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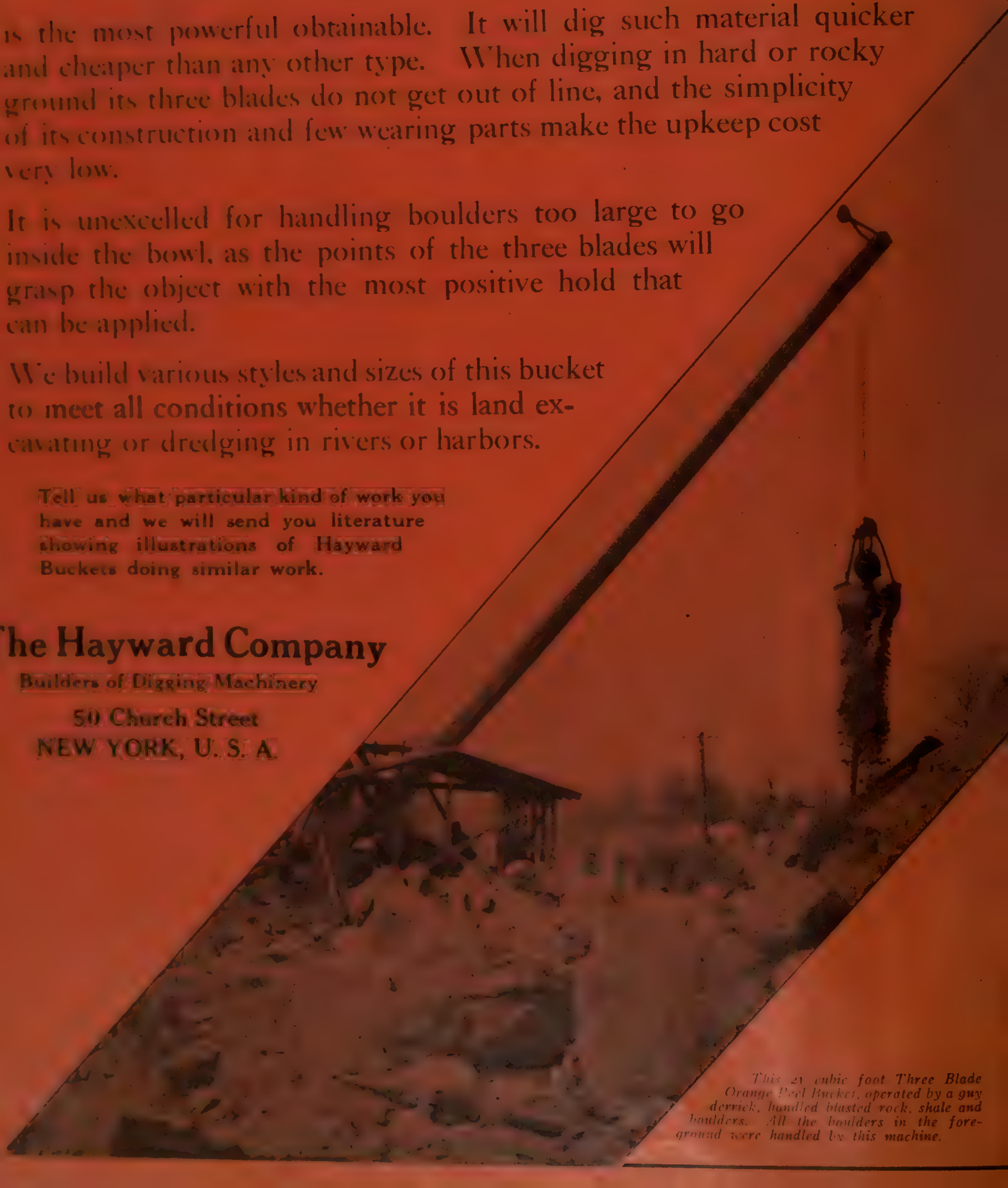
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Educating the Public

EDUCATION of the public to the importance of engineering work should be a part of any plan for engineering publicity—in fact is the ultimate end of all such publicity. Appreciation of a work will lead surely to appreciation of the worker. For that reason the plan of advertising to the public the merits of a new pavement, as explained on page 10 of this issue, is to be highly commended. The idea is not new, though its infrequent use shows conclusively that its value is not appreciated. Here and there engineers have marked test roads, and in New York signs on the contractors' structures along the line of a new subway tell of which route the particular section is a part, the name of the contractor and of the body, the Public Service Commission, in charge of the work. The education of the public in matters engineering, even if in so fragmentary a way, cannot but have favorable results. The scheme has endless possibilities limited only by the ingenuity of those in charge.

Municipal Bond Market

THAT municipalities with good credit have every reason for being encouraged at the present condition of the money market is apparent from the success of recent large bond sales. On Tuesday of this week New York City received bids for $71,000,000 in 4½ per cent issues, of which $46,000,000 was in fifty-year bonds to finance revenue-producing improvements and $25,000,000 in fifteen-year serial corporate stock, to pay for non-revenue producing improvements. The issue was over-subscribed three times, the bids totaling $320,000,000. The fifty-year bonds went at an average price of 101.253 and the fifteen-year bonds at 101.306. Contrasted with these prices is the average of 100.137 for the last sale of New York City's 4½'s in 1913. It is apparent; therefore, that money can readily be obtained for municipal improvements, though at an advanced rate, and that that phase of our activity is being less influenced by the war than is private enterprise.

Convention Returns

TO LEARN of the latest kinks and to get in touch with the "live wires" of the field are arguments with which many waterworks superintendents every year have to ply their superiors to permit them to attend the meetings of the large associations. Will it pay us to have you attend this convention, and in what way, is the usual opposing rejoinder. It was, therefore, with some degree of satisfaction that one superintendent was able to save his company much more than his convention expenses by listening to a discussion at the meeting of the American Waterworks Association on "Arsenic in Alum," a subject which many present felt should be taboo. A manufacturing company near a filter plant found that a shipment of alum contained more arsenic than was permissible in preparing medicinal glycerine. From calculations based on the figures given at the convention the superintendent found that one would have to drink 40 gal. of water, each gallon treated with 6 grains of alum, to get a medicinal dose of arsenic. This assumed that all of the arsenic would remain in the filtered water, which is not the case. Furthermore, arsenic is not a cumulative poison and little if any of the water from this plant is used for human consumption. Thus with the data fresh in mind the superintendent was able to seize the opportunity to get the discarded alum at a material reduction over the market price and still feel that the occasional careless workman who drank the water would not be injured. Far be it from this journal to promote the use of alum containing a high arsenic content, but, as noted at the time of the convention, the data are good stock in trade. The waterworks official wants to know more about every detail in the manufacture of his product than any one outside the department. He can get much information at waterworks conventions, but unfortunately the direct financial return from ideas picked up there is not always as easily traceable as in the instance cited above.

Testing Materials Convention

IT HAS been the pleasure of this journal from year to year to record the remarkable progress of the American Society for Testing Materials and to voice the appreciation by those in attendance of its efficient management and invaluable contributions to the engineering profession and the industries which serve it. Less in the public and professional eye than other engineering societies, because it holds but one meeting a year, it goes its way quietly, though meanwhile its committees, through their activities, are measuring off professional mile-stones, of which we become aware only when the yearly cycle exhibits the fruition of their work at the annual meeting. As has been pointed out previously in these columns the scope of the society is steadily widening and, perforce, its influence is being felt in ever broadening circles. During the last year, for example, new committees were formed on hollow building tile, on gypsum, on textile materials and on revision of pipe threads. Meanwhile the older committees have been expanding their work by the organization of new sub-committees and attacking hitherto unstudied problems in their fields. The committee on concrete and concrete aggregate, for example, though a comparatively new one, has laid out a most elaborate program (printed on page 14 of this issue). While that program is more than ordinarily ambitious it is, in its general spirit, characteristic of the thoroughness with which the society is studying the problems set before it. Needless to say the society by reason of its excellent work merits the heartiest support of engineers and manufacturers. Its work has been of great benefit to both, and with increased membership and strict adherence to the ideals which have made for it a unique place among American technical organizations, it faces a future of even greater usefulness.

Evidence of Influence

REFERENCE was made in the preceding note to the widening influence of the American Society for Testing Materials. Increasing use of the standard specifications was to be expected on the part of private interests whose engineers, chemists and manufacturing experts are members of the association. The executive committee pointed out in its report, however, that Federal, State and municipal authorities in increasing numbers were turning to the standards of the society, thus indicating that among engineers generally and those in charge of important enterprises the standing of the society is keenly appreciated. The report stated that the purchases for the Panama Canal have been largely made under the society's standards, twenty-seven of the specifications being used by the purchasing department of the canal. Furthermore, the material for the United States postal cars is purchased under those standards, while nine of the specifications have been adopted, in some cases with slight modification, in connection with the boiler code recently prepared by a committee of the American Society of Mechanical Engineers. Similarly in the current revision of the building code of the city of New York, seven standards of the society are used. It needs only more general knowledge of the work of the society to have the adoption of its specifications carried still further, and with the efforts which will be made during the coming year to increase the membership of the society, the increase in influence should be very gratifying indeed.

Responsibility of Power

IN SETTING forth in its annual report evidence of the widening influence of the society, the executive committee of the American Society for Testing Materials

emphasized that the wider the confidence placed in the work of the society, the greater the reciprocal obligation upon the organization to justify that confidence in connection with everything to which its name is attached. Fortunately, the character of the work of the various committees shows clearly that this serious responsibility is keenly appreciated. But there was further evidence of appreciation of this responsibility. On motion of the executive committee, the annual meeting approved and passed on to letter ballot an amendment to the by-laws which, if accepted, will make the work of the society still more conservative and further safeguard against too hasty adoption of standards. Heretofore, it has not been unusual in one annual meeting and a letter ballot immediately following thereafter to place a new specification in the society's year book as a standard. That might still be done under the proposed amendment, though it is expressly stipulated that such action is to be taken only for exceptional reasons and then only if a nine-tenths vote of those voting at an annual meeting approve the course. Normally, under the newly proposed plan, specifications proposed for the first time and amendments of existing standards shall be published in the year book for one year as "tentative standards," on which written discussions addressed to the appropriate committee shall be invited. This plan would place still another step in the process of raising a proposed draft to the dignity of a standard. With the exception of those special cases above referred to, all proposals would therefore be held up for the invited criticism of the society for an entire year, giving ample time to discuss them, to experiment with their requirements if desirable, and to be certain that haste has not prevented the discovery of valid objections thereto. With this disposition evident in the society, combined with the progressive spirit of the committee work, no fear need be entertained that the society will fail to live up to the responsibility which its widening influence imposes upon it.

Street-Lighting Developments

INTERESTING developments in street lighting are coming on apace as the contest between the gas-filled incandescent lamp and the high efficiency arc grows more acute. Cities desiring to utilize the most modern equipment in renewing their street-lighting contracts will do well to investigate the designs now available in a thorough fashion before deciding upon any particular type of apparatus. There is a lot more to the problem than a good many municipal officials have realized.

Just now there is a close balance between the gas-filled lamp and the low-powered arc for the illumination of subordinate streets. It would not take much of a change in prices to shift the scales either way. As one goes into the larger units, the high efficiency arc lamp still seems to be more than holding its own. Really wonderful effects are being attained by the use of the prismatic refractor and improved electrodes, even when the units are spaced as far as 600 ft. apart and carried 25 ft. above the roadway. Half way between two such lamps of the 6.6-ampere size one can read the second hand of a watch. Few cities have as yet awakened to the increased effectiveness of illumination made commercially possible by these two factors alone, but the perennial demand of more light for less money is sure to find out these developments sooner or later. Central stations are not to be blamed for introducing one improvement at a time, considering the frequent short life of street-lighting contracts.

Before long we are likely to see changes in the direction of better fixtures for service based on gas-filled incandescents, coupled with some sort of discrimination between the lighting requirements of classified streets. Unless politics prevents, the time is not far distant when several different types of lighting units and different sizes of the same unit may be effectively employed in the same town. The practice of replacing old and inefficient lamps by new and better units in exactly the same locations will give way to improved engineering treatment of neighborhood requirements. If the lessons of Continental Europe mean anything, more attractive fixtures for outdoor service are surely coming. Before long, also, we shall be in possession of more complete life records of gas-filled lamps for series service. The uncertain factors are being narrowed down, and one may confidently expect general improvement in the lighting of streets in American cities during the next few years.

Operation of Imhoff Tanks

IMHOFF tanks for sewage treatment have been such a comparatively recent development in the United States that most of the information concerning them has related to design and construction rather than to operation. Among the pioneer plants in this country were the three at Atlanta, completed in 1912. Sufficient time has now elapsed to warrant an analysis of their operation and the article dealing with the Proctor Creek works, on page 4 of this issue, by Charles C. Hommon, chemist and bacteriologist in charge, is of particular value because it sets forth in detail for the first time the operating methods and results obtained at a large municipal plant of this type. The installation comprises, in addition to the two-story settling tanks, grit chambers and sprinkling filters.

In the early days at Atlanta some trouble was caused by "foaming" at the gas vents of the settling tanks. The increase in the height of the vents did not improve matters, and it was finally discovered that the foaming was caused by the sludge reaching too high a level in the digestion chambers. When the sludge from the filled compartment was withdrawn the foaming ceased. This discovery naturally set the interval for sludge discharge. It is interesting to note, also, that the tank effluent has been so clear that use of the revolving screen between the tanks and the filters was discontinued after the first few weeks of service. The screen was installed as an insurance against the clogging of the sprinkling-filter nozzles, but such good results were obtained without it that it was decided to save the expense of its operation.

The operating costs of the whole plant, exclusive of interest on investment and depreciation, have averaged $3.93 per million gallons. The first sludge was withdrawn five months after the tanks were placed in service and was of good quality. The aim in operating the tanks is to remove enough sludge during the summer and fall to carry each unit through the winter months without emptying. Mr. Hommon's figures show that the plant is effecting a satisfactory degree of nitrification and is doing well the work for which it was designed.

American Sanitary Engineers in Servia

ON MAY 15 a party of sanitary engineers and physicians left New York for Servia to serve under Dr. Strong of the American Red Cross Society in the Sanitary Commission. They arrived in Athens on June 5 and by this time are in the field. The party was in charge of Mr. Edward Stuart, a graduate of the Massachusetts Institute of Technology, who had had experience as a State sanitary engineer in Oklahoma and had been engaged in engineering work in Brazil. The assistant sanitary engineers were recruited from graduates of the Massachusetts Institute of Technology and the School of Engineering of Harvard University. The School for Health Officers furnished two physicians who had just been awarded the certificate in public health. Two of the men were assistant engineers in the Massachusetts State Department of Health. The party was, therefore, composed of young men who were unusually well qualified for their task.

Their work is to clean up Servia in order to prevent the spread of typhus fever and cholera, which dread diseases have already made terrible ravages among the inhabitants, many of whom have been driven from their homes and are living under most insanitary conditions. What problems will have to be met cannot be well forecast, but two of them are known. Clean water must be provided and war must be waged on the body louse, which is the agent by which typhus fever is transmitted. There are few large cities in Servia and the problem in general will be that of camp sanitation.

The undertaking will be a hazardous one for the young sanitarians. As preventive measures each one was vaccinated against typhoid fever before leaving this country, and the new vaccination treatment against typhus fever was taken by them during the voyage across the Atlantic.

In this way, thanks to the American Red Cross Society and the Rockefeller Foundation, American engineers are not only helping to save life in Servia but are acting as an outer line of defense for the people of the United States. The first principle of modern sanitary strategy is to destroy the germs of disease at their foci and not allow

them to spread. The work of the Servian Sanitary Commission will make easier the work of the U. S. Quarantine Service. This is but the beginning of a very important movement aimed at such diseases as typhus fever, cholera, the plague, typhoid fever, and the like, which in past generations have followed the lines of trade and made an aftermath of death for every great war.

Engineering Advice in Public Utility Cases

IN AN ADDRESS by former Mayor James Logan, of Worcester, Mass., upon "The Public Service Corporation and the Municipality," printed in the current "Journal" of the Boston Society of Civil Engineers, the disadvantages to municipalities of inadequate engineering advice on large public questions are admirably set forth. It is a question if the public as a whole has the faintest realization of the odds against it in conducting cases before State commissions and legislative committees. Certainly many boards of aldermen and of selectmen still look upon an outlay for expert advice in such proceedings as an extravagance. The lack of this advice is hampering many municipalities seriously in their dealings with public utilities and with State authorities; it is throwing a great burden of additional work upon public service commissioners, and its omission in important cases is a grave mistake.

The need of expert advice in no sense impugns the ability of the permanent engineering staff of a municipality, nor does it justify attacks on the public utilities for their successful work before the public tribunals. Improper methods have within late years largely disappeared, and the real cause of failure on the part of a city to obtain its reasonable desires from State authorities is usually the superior preparation of its adversaries. Too often it happens that owing to changes in the personnel of a city government, complex questions have to be wrestled with by new men who have practically no knowledge of the past conditions, while opposed to them are organizations which have had a continuous management for years, with a fixed, persistent, well-defined policy. The utility's side of the case is conducted by the ablest talent money can buy, by men who may have been present at the birth of the problems under discussion, and who have been familiar with every stage of their development. Moreover, the city's plan or request may not have general support from the citizens and to this broken front the utility is able to present a solid defense, thoroughly intrenched and protected, manned by men who know every move the city has made or is about to make. Without the slightest trace of corruption, these well-organized forces develop a case which is hard to beat, and over and over again, only the wisdom and experience of the public authorities have saved the day for communities which have made out a showing which would have failed utterly in the courts, but which none the less had merits entitling its advocates to concessions or to a favorable decision. Furthermore none can criticize the utility for its careful preparation. It is its right, and its duty to its stockholders, to present its side of the case as strongly as possible and to marshal to its support all the legitimate corroborative data obtainable.

The city or town which follows the policy of presenting such cases without expert assistance, when the amounts involved are considerable, cannot expect, in legislative committees at least, the results to which it is often entitled. In a grade-crossing situation, for example, the municipality may have a good city engineer, but the problem may be the first important one of the kind that has come to him, and on the other side will be a body of engineers who have fought to a finish probably scores or perhaps hundreds of grade-crossing cases, who know precisely what they want, how to impress the committee with the facts bearing on their side and who can draw from outside, in support of their contentions, a mass of data beyond the reach of anyone but a specialist. The retention of such an expert by a city, even at a cost of a good many thousands of dollars, puts it in a place to fight its case on an even basis with its highly prepared antagonists, and wonderfully unifies the public contention.

Cracking of Brick Pavements

IT IS the common belief that in many of the cases where cement-grouted brick pavements have cracked to quite an extent the trouble is due to the repeated rise and fall of the pavement, on account of temperature expansion across the entire width of the street or road. Of course, settlement of the base and the washing away of the cushion rightfully come in for their share of the blame. The arching theory is held to be substantiated by the rumble heard when a wagon goes over the pavement, indicating, so proponents of the theory claim, a large hollow area. For somewhat over a year Mr. Mont Schuyler, engineer in charge of the testing laboratory of the city of St. Louis, has been making a special study of this subject and has reached the conclusion, which seems indisputably borne out by examination, that the rise of the pavement, or rather the existence of a space between the cushion and the bottom of the block, is confined to comparatively small isolated areas. These areas may be separated by narrow solid areas, so that the continuous rumble is due to the length of wheel base, which spans the solid spaces, leaving either front or rear wheels or both on the unsupported spot.

These conclusions have been reached after sounding pavements with a hammer. The hollow spots are readily and unmistakably located. If the method be tried on a pavement which is cracked and apparently has spots that have settled due to the breaking of the cement-grout bond, it will be found that the blocks which are now acting as isolated units have settled back on their beds. Surrounding them are bricks carried as cantilevers, with a space below. The bond, however, is still intact, though it may be beginning to show signs of distress. Beyond these are blocks with a solid bearing on the cushion. Other hollow spots will be found where the bond is entirely intact and without any settled bricks in the center, and this will be the condition in a newly laid pavement. Mr. Schuyler believes that it can be safely predicted that it is in these spots that the pavement will begin to fail, a conviction borne out by the limited number of observations which he has been able to follow through since the theory was first formulated. On a pavement laid in St. Louis last year he made a careful "hammer survey," and indicated the spots where this disintegration was to be expected. Troubles where they have developed are invariably in the spots designated.

The facts established, one seeks naturally for the explanation. Mr. Schuyler believes that it is due to the unequal shrinkage of the cushion, which is traceable to the unequal moisture content. It is well known that even small changes, 2 to 4 per cent, in moisture content of sand makes as much as 10 to 15 per cent change in volume, and this change in volume, affecting cushions of even uniform thickness in isolated spots, would be sufficient to account for the support of certain areas and the space below others. Variations in amount of moisture in the cushion are accounted for by conditions in the sand bank, where the moisture frequently varies from zero to 5 per cent within a radius of a few feet.

In support of his theory Mr. Schuyler points to a brick-paved street in St. Louis, in which limestone screenings were used for the cushion. Tests have shown that moisture has, relatively to sand, little effect on the volume of these screenings. Though the cushion is 2 in. thick the street after several years of service shows no cracks, in striking contrast with those with sand cushions.

With reference to the theory that there is arching from curb to curb, Mr. Schuyler states that in no case has he been able to find any disturbance or compression in the so-called expansion joints at the curbs. He terms them, rather, lubricating joints, allowing the pavement to settle as the cushion loses its moisture. Furthermore, where pavements have been run up to the curb and the joint grouted there is frequently a crack in the bricks near the curb, indicating that they have been prevented from settling with the remainder of the pavement.

The theory propounded, if accepted, leads to an inquiry for a type of cushion which is not affected by moisture. The mortar type now being used in several cities would seem to offer a satisfactory solution, for while there is some change in volume of mortar with varying changes of moisture content, the change is negligible. This would be a still further argument for this type of cushion, or bedding. Its other advantages lie in holding the brick more firmly and in preventing the displacement of the support, which may happen where plain sand is employed.

The subject warrants further investigation and holds surprises to those who are willing to sally forth, hammer in hand, to search out the ailments of their brick roads.

Operating Records of Atlanta Sewage Treatment Plant Show Adequate Degree of Purification

Troubles with Scum in Tanks and Foaming in Gas Vents Are Overcome at Proctor Creek Works, One of the Pioneer Imhoff-Tank Installations in the United States—Fine Screening Abandoned

By CHARLES C. HOMMON

Chemist and Bacteriologist in Charge of Sewage Treatment Plants, Atlanta

OPERATING records of one of the pioneer Imhoff-tank sewage treatment works in the United States, the Proctor Creek plant at Atlanta, Ga., which was placed in service Aug. 8, 1912, and comprises grit chambers, Imhoff tanks, a revolving fine screen, sprinkling filters and sludge-drying beds, have now extended over a period sufficiently long to justify the definite conclusion that the works have fulfilled the function for which they were designed—the elimination of nuisances in the form of foul odors, floating débris, and sludge accumulations in the stream bed. In fact, there is no longer any evidence of sewage in the creek at any time of the year, for the plant effluent has a high relative stability figure and contains a large amount of free oxygen. In the maintenance of the works, particular attention has been given to the Imhoff tanks, where measures are taken to remove scum, prevent foaming in the gas vents, and draw off sludge at the proper intervals. Very little trouble from clogging of the sprinkler nozzles at the filters has been experienced, in spite of the fact that the operation of the fine screen was discontinued soon after the plant had been placed in service. Costs of operation have been kept and average $3.93 per million gallons, exclusive of interest on investment and depreciation.

The Proctor Creek plant is one of Atlanta's three sewage treatment works, the others being located on Intrenchment Creek and Peachtree Creek. They are all of the same general type and the Peachtree Creek plant was described in detail in the Engineering Record of Dec. 31, 1910, page 769. The sewerage improvements in Atlanta were undertaken by the advice of Capt. R. M. Clayton, and the designs of the treatment plants were prepared by the firm of Hering & Fuller, consulting engineers, of New York City.

The Proctor Creek works have been in service longer than any of the others, and it is with the operation of this plant that this article deals.

INDUSTRIAL WASTES IN SEWAGE

The principal industrial wastes received are from the Atlanta gas works, the Prest-o-lite Gas Company, and the American Tin Can works. None caused any trouble at the plant except the wastes from the gas works, which contained tar. The company, however, installed tanks especially designed to remove the tar and oil, and no serious trouble has resulted from the sewage from these works.

The waste from the Prest-o-lite Gas Company consists principally of spent calcium carbide, $Ca(OH)_2$. It forms a heavy flocculent precipitate in the sewage, and except for increasing the sludge and causing the sewage to appear white it does not cause any trouble. It is discharged into the sewer two or three times a day, and the white color is very noticeable at the plant for a period of 30 min. after each discharge.

The trade waste from the American Tin Can works is discharged into the sewer only on Saturday afternoons. It consists mostly of weak pickling liquors, largely sulphuric acid that is used for removing scale from the tin and iron. Before the pickling liquors are discharged they are diluted with sufficient water to prevent any action by the acid on the sewers. These pickling liquors contain an appreciable amount of ferrous iron in solution, which forms hydroxides with the alkaline sewage and causes the sewage to have a brown color, which can easily be detected when it reaches the sewage treatment works. The iron wastes are probably an advantage, as the flocs that are formed assist in removing the suspended matter in the Imhoff tanks. The iron that is in solution and does not settle in the Imhoff tanks is oxidized in the sprinkling filters and only a small portion of the iron reaches the outlet.

EQUIPMENT AND METHOD OF OPERATION

The intercepting sewer to the Proctor Creek plant terminates in a rectangular chamber 8 ft. long, 4 ft. wide and 7 ft. deep and has a 12-in. connection to the stream. This basin was designed to remove the coarser sand that is carried along the bottom of the sewers and has a detention period of about 1 min. From three to four times a day the valve on the 12-in. connection to the creek is opened and the accumulated sand is flushed out. This has been found to be a very economical method of removing the coarser sand, and by careful manipulation only a very small amount of untreated sewage is discharged into the creek.

After passing through this preliminary grit chamber, or sand-trap, the sewage passes through a screen made of ⅜-in. bars, spaced 2 in. center to center, and is laid at an angle of 45 deg. downstream. This screen removes pieces of wood, dead animals, rags and other débris which find their way into the sewers at all times and in large quantities during storm flow. The screenings removed average about 30 lb., wet, per million gallons of sewage, and they are disposed of by burying.

GRIT CHAMBERS

There are three grit chambers for removing the finer sand that is not deposited in the first grit chamber, or sand-trap. They are operated so that there is always one ready for use, one draining and one in operation. The velocity of the sewage while passing through the grit chamber is about 1 ft. per second, and tests have shown that at this velocity practically all of the sand is deposited, and that little organic matter settles out. A part of the sand is used for resurfacing the sludge bed and the excess is hauled away to a dump. When piled up it does not create a nuisance, and after a short time the sand throughout the pile becomes dry. The quantity of sand deposited in the grit chambers amounts to about 0.3 cu. yd. per million gallons of sewage treated. It costs about 16 cents per cubic yard to remove the sand from the grit chambers and haul it 100 ft. to a dump.

IMHOFF TANKS

There are twelve Imhoff sedimentation tanks arranged in series of three, that receive the sewage from the grit chamber. There is provided what is called a cross-over channel so that the sewage can be admitted to the tanks from either end and thus get an even distribution of sludge over the bottom of each tank. In practice the sewage is applied to one end of each series of the tanks for a definite period of time and then the flow is reversed and the sewage passed through the tanks from the opposite end for a definite period. This method has given very good results and approximately equal amounts of sludge are removed from each section of the series. The direction of flow is reversed about once every month.

TANKS SKIMMED OFTEN

Great care is taken to keep the surface water of the settling compartments of the tanks free from floating material. This is done by frequently skimming. The floating material is driven to one side of the tanks by means of water from a garden hose and then removed with a large skimmer. The skimmings consist mostly of small particles of grease, corks, matches, etc. The skimmings amount to about 33 lb. per million gallons of sewage treated, figured on a wet basis, or just as the material is removed from the tanks. They are carted off and buried.

The sloping walls that separate the sludge well from the settling compartment of the Imhoff tanks are scrubbed on an average twice a week. This is done by means of a 12-in. wire street-sweeping broom fastened to the end of a 20-ft., ¾-in. pole. An arrangement of this sort can be handled with ease and is very effective, and the time required for scrubbing the sloping walls is about one hour per tank per week.

SCUM FORMS IN GAS VENTS

During the first three months of operation little material collected in any of the gas vents. At the end of three months, however, a scum began to form in the outside gas vents of each tank, while the central vent remained comparatively clean. The water beneath was black and odorless. The scum gradually became thicker until at the end of six months it was 15 in. thick. The upper surface was quite dry and firm, some of the material being packed in tight enough to hold up the weight of a man. It was thought that this might interfere with the escape of gas so all of the gas vents were cleaned of this solid material. They remained clean only for a short time, how-

ever, and at the end of six months they were in the same condition, and had to be cleaned again. They have been cleaned four times since the plant has been in service.

The central gas vents have caused little trouble. They were cleaned once and after that the material that rose to the surface floated for awhile and sank again to the bottom. There is a small amount of floating material on the surface of the central vents all of the time, but it never forms a thick scum, and as it does not interfere with the escape of gas it has never been removed after the first time.

After the Imhoff tanks had been in service about five months the gas vents began to give trouble by foaming or boiling over. The gas bubbles as they arose from the sludge well seemed to be covered with a soapy or greasy film that did not break on reaching the surface of the tanks, but continued to build up on top of one another until they overran the sides of the gas vents. The gas bubbles did not carry over enough suspended material to lower the efficiency of the tanks materially, but they did make the tanks look very unsightly.

Several methods were tried to prevent the gas from bubbling over, one of which was to build the gas vents up higher. One vent was built up 6 ft. and the bubbles ran over this, and to all appearances would have gone higher so the idea was abandoned. The next method was to spray water into the gas vents, but this only produced a temporary relief and had to be applied several times a day in order to keep the bubbles within the vents. Finally sludge was drawn from one of the tanks that had been causing trouble from foaming and as soon as the sludge was removed the gas bubbles that rose from the sludge well broke on reaching the surface of the water. It has been observed since then that as soon as the sludge well is almost filled with sludge the gas bubbles do not break on reaching the surface and the gas vents begin to foam.

The explanation of this phenomenon seems to be that when the sludge reaches a certain point in the sludge compartment, near the slots, the gas rising from the sludge carries enough particles with grease to cause the film holding the gas bubbles to become elastic and tough, while the gas bubbles rising from the greater depths through the sewage are washed free from the particles of grease and consequently break on reaching the surface. The general plan now is to draw sludge from the tanks as soon as they start foaming, and there is no longer any trouble from the gas vents foaming or boiling over.

SLUDGE REMOVAL

The Imhoff tanks were in service from Aug. 8, 1912, to Jan. 9, 1913, before any sludge was drawn out, thus making an initial ripening period of five months. The first sludge drawn was of a good quality, and it has been of a good quality ever since. It is black in color and has a slight tarry odor when held close to the nose. When the sludge is distributed on the sludge bed not over 6 in. deep it dries into spadable material in from seven to nine days, depending on the weather conditions. When first drawn from the tanks it contains from 80 to 85 per cent water. Care is taken not to draw out any more sludge than is necessary during the winter months, because of the unfavorable drying conditions. During the summer months small amounts of sludge are drawn from each tank every ten days or two weeks, rather than larger amounts at longer intervals. It has been found to be better practice to put sludge on the drying bed about 6 in. deep and remove it quickly, than to put it on thicker and take the risk of getting it wet by rain.

The aim is to have all of the digested sludge out of the tanks before winter sets in so as to have enough storage capacity to carry each tank through the winter.

For reasons of economy only a small part of the sludge has been dried on the sludge beds. The city owns 20 acres of land, just below the sludge beds, that were to be used as a dumping ground for the dried sludge. This area is about 2 ft. below the level of the bed, thus making it very easy to let the sludge run directly onto the bottom land and dry out. This saves the expense of removing it from the sludge drying beds and carting it away in cars. By this means of disposal it is impossible to get any accurate data as to amount of sludge deposited in the tanks. It costs about 20 cents per cubic yard to dry and remove sludge from the artificial beds and haul it 100 yd.

GASES OF DECOMPOSITION

Most of the gas formed in the sludge well escapes through the center vents, and it is most active in those tanks receiving the largest quantity of sludge—that is, the inlet section of the series of three tanks. There is no odor of hydrogen sulphide noticeable when standing near the vents, even when the ebullition is most active. The largest quantity of gas is produced during the warmer months, the quantity gradually decreasing as the sewage becomes cold, but at no time does it disappear entirely.

TABLE 1.—ANALYSIS, IN PERCENTAGES, OF GASES COLLECTED FROM VENTS OF IMHOFF TANKS

Sample	Carbon Dioxide	Oxygen	Hydrogen Sulphide	Methane	Hydrogen	Nitrogen
1	4.7	0.3	0.0	85.3	9.7	0.0
2	5.2	0.5	0.0	82.8	8.2	3.3
3	4.4	0.6	0.0	84.2	7.9	2.9
4	4.2	0.4	0.0			
Average	4.6	0.4	0.0	84.1	8.6	3.1

EFFICIENCY OF IMHOFF TANKS

As will be noticed by referring to Table 2, the Imhoff tanks are doing very satisfactory work. While these determinations, made by the Imhoff settling glass, do not cover a very long period they show with fair accuracy the amount of settleable material in this particular sewage on the above dates. A two-hour settling period was used in making these tests and the theoretical settling period in the Imhoff tanks is three hours. These results would tend to show that the tanks could be operated with a shorter storage period and still give good results, but in the tests the sewage in the settling glasses remained quiescent for two hours, while there was a forward movement in the tanks tending to keep the lighter suspended particles from settling as quickly there as in the settling glasses. Furthermore, it is impossible to obtain complete displacement in the tanks, so that the actual storage period is less than the theoretical, and the tanks are probably operating at the shortest storage period possible consistent with the high per cent of removal now obtained. Settling experiments on the tank effluent have been made from time to time with the Imhoff conical glasses, and there has never been any settleable material noted. The suspended matter in the tank effluent that is recorded in Table 3 consists mostly of colloidal material, which would never settle out by its own weight.

REVOLVING SCREEN DISCONTINUED

The sewage, after passing through the Imhoff tanks, goes to a Weand revolving cylindrical screen. This screen was installed for the purpose of screening out of the tank effluent any large particles that



THE ATLANTA PLANT, PLACED IN SERVICE IN AUGUST, 1912, IS ONE OF AMERICA'S PIONEER IMHOFF-TANK INSTALLATIONS

TABLE 2.—RESULTS OF EXPERIMENT TO SHOW AMOUNT OF SETTLEABLE MATERIAL IN CRUDE SEWAGE AND EFFLUENT FROM IMHOFF TANKS

Sample	Time Collected	Settling Period, Hours	Cu. Cm. Settleable Material per Liter Crude Sewage	Cu. Cm. Settleable Material per Liter Effluent Imhoff Tanks
	March 6, 1913			
1	9.30 a. m.	2	3.5	0.0
2	10.30 a. m.	2	6.0	0.0
3	11.30 a. m.	2	16.0	0.0
4	12.30 p. m.	2	17.0	0.0
5	1.30 p. m.	2	6.0	0.0
6	2.30 p. m.	2	1.7	0.0
7	3.30 p. m.	2	1.7	0.0
8	4.30 p. m.	2	3.5	0.0
	March 7, 1913			
1	8.00 a. m.	2	9.7	0.0
2	9.00 a. m.	2	10.0	0.0
3	10.00 a. m.	2	13.0	0.0
4	11.00 a. m.	2	4.7	0.0
5	12.00 m.	2	11.0	0.0
6	1.00 p. m.	2	7.5	0.0
7	2.00 p. m.	2	10.0	0.0
8	3.00 p. m.	2	3.5	0.0
9	4.00 p. m.	2	3.8	0.0
	March 8, 1913			
1	11.00 a. m.	2	45.0	0.0

would tend to clog the nozzles of the sprinkling filters. The cloth on this screen has thirty-six meshes to the linear inch and has a screening area of 150 sq. ft. It is operated by a 3-hp. motor and cleaned by water under pressure.

The screen was operated for about two weeks when the plant was first put into service, but it was found that there was not enough clogging material in the tank effluent which the screen would catch to justify the expense and trouble of running it. There was collected only about 0.7 lb. of screenings per million gallons of sewage screened.

FILTER BEDS

The filter beds are in two units, one of 1 acre in area and one of 0.5 acre. The beds are filled to a depth of 6 ft. with crushed granite, ranging in size from stones 1½ to 2½ in. The underdrains are of half-tile set in concrete.

The sewage is applied to the filter beds by two 24-in. Miller automatic siphons. The time between two consecutive doses averages fifteen minutes; the time the nozzles are discharging each dose is about three minutes and the rest period between doses is about twelve minutes. The rate at which the sewage is treated during the dosing period is 10,000,000 gal. per acre per twenty-four hours and the net rate per twenty-four hours is 2,000,000 gal. per acre per twenty-four hours. The filters are operated continuously except for the rest period between the discharges of the siphons, and the number of discharges of the siphons depends on the volume of sewage flowing at any particular time.

There has been but very little trouble due to the clogging of nozzles. A small amount of grease collects in the risers and occasionally this forms little balls which throw the spray to one side of the nozzle, but trouble from this cause is negligible and one man can take care of all the beds in fifteen minutes each day.

CLOGGING OF FILTERING MATERIAL

As will be noted by referring to the suspended matter in Table 3, during the first twenty months of operation there was no noticeable unloading of the filtering material. During the months of January and February and the first part of March, 1914, both filter units were badly clogged. In places the water stood ½ in. deep on the surface. During the latter part of March both units began to unload and by the first part of April the filter effluent looked much worse physically than the tank effluent and contained large quantities of suspended matter, the highest quantity being 139 parts per million. The filters continued to unload until May, when the suspended matter in the effluent gradually became less. The improvement continued until operation was normal and the voids in the filtering material had become practically free from accumulated suspended matter. After unloading, the beds were practically as clean as when they were filled with the stone except for the upper 6 or 8 in. which has a slight accumulation that has been formed since the bed stopped unloading.

Since the plant is not equipped with final settling basins all of the clogging material that was washed from the filter beds had to pass directly into the creek with the filter effluent. However, at no time during the interval the beds were unloading did the creek water below the plant become offensive.

TABLE 4.—ANALYSIS OF MATERIAL COLLECTED FROM WEAND SCREEN

Material	Per Cent
Water	24.2
Solids (dry)	75.8
Volatile matter (on dry basis)	88.5
Fixed matter (on dry basis)	11.5
Nitrogen (on dry basis)	1.1
Ether soluble matter (on dry basis)	55.4

TABLE 5.—ANALYSIS OF SLUDGE REMOVED FROM IMHOFF TANKS

Specific Gravity	Per Cent Moisture	Per Cent Vol.	Per Cent Fixed	Per Cent Nitrogen	Per Cent Fat
....	88.7	45.0	55.0	1.16	9.76
....	88.3	33.3	66.7	1.26	6.92
....	79.3	28.0	72.0	....	7.34
1.02	87.8	38.6	61.4	1.44	6.84
1.05	84.2	42.2	57.8	1.28	6.42
1.02	87.6	39.9	60.1	1.28	5.84
1.03	87.7	35.5	64.5	1.12	4.0
1.03	90.2	37.9	62.1	1.2	7.14
1.02	86.2	38.5	61.5	1.28	11.12
....	86.3	39.7	60.3	1.28	10.0
1.0	87.7	42.5	57.5	....	....
1.01	90.0	37.1	62.9	....	....
1.0	87.0	45.0	55.0	1.28	8.5
....	87.7	44.0	56.0	....	....
9.18	1,218.7	547.2	852.8	12.58	67.23
Average:					
1.02	87.05	39.1	60.9	1.25	6.11

With the coming of warm weather in the spring of 1913 and 1914 there appeared on the under surface of the stones the larvæ of a fly that later developed into a small gray white fly, belonging to the genus psychoda. During May and June there were great numbers of these flies but they did not migrate very far from the filter beds except when driven by the wind. They remained until the middle of July, when there began to appear in the stones numerous small spiders. With the coming of the spiders the flies gradually disappeared, and it is thought the spiders fed upon them. The filter beds became thoroughly alive with the spiders and no flies were to be found.

The unloading of the filters began about the time the larvæ of the fly were first noticed, and it is quite possible that the movement of these little worms working in the deposit on the stones had some material effect in causing suspended matter to pass from the filters.

VENTILATORS IN FILTER BEDS

No special studies were made to determine the effect of the ventilators (see illus-

TABLE 3.—PROCTOR CREEK SEWAGE TREATMENT PLANT, MONTHLY AVERAGE ANALYTICAL RESULTS

	Crude Sewage — Parts per Million										Imhoff Tank Effluent — Parts per Million										Sprinkling Filter Effluent — Parts per Million										
		Nitrogen as					Suspended Matter					Nitrogen as					Suspended Matter					Nitrogen as					Suspended Matter				
Date	Temperature of	Organic	Free Ammonia	Nitrites	Nitrates	Oxygen Consumed	Total	Volatile	Fixed	Dissolved Oxygen	Temperature of	Organic	Free Ammonia	Nitrites	Nitrates	Oxygen Consumed	Total	Volatile	Fixed	Dissolved Oxygen	Temperature of	Organic	Free Ammonia	Nitrites	Nitrates	Oxygen Consumed	Total	Volatile	Fixed	Dissolved Oxygen	Relative Stability
1913																														
Jan.	62	14.4	18.6	0.1	2.0	....	317	154	163	44	60	13.2	21.3	0.1	1.9	....	89	50	39	33	56	3.9	12.2	0.8	6.4	....	60	31	28	76	98
Feb.	61	14.6	19.3	0.1	2.6	....	230	98	112	47	58	11.4	21.3	0.2	3.1	....	90	42	41	41	55	3.1	14.2	0.7	7.2	....	55	26	28	68	96
Mar.	63	13.4	16.9	0.1	3.0	78.3	222	....	....	33	61	7.1	16.8	0.2	2.8	60.0	77	..	..	39	59	2.7	8.4	0.5	9.4	25.0	58	..	..	66	97
Apr.	65	11.1	14.6		2.7	89.3	266	....	....	22	64	6.5	18.6	....	2.1	59.2	60	..	..	26	62	2.8	6.2	....	9.7	23.6	42	..	..	65	99
May	70	14.9	18.0		2.3		291	....	....	24	70	7.2	19.1	....	2.1	....	60	..	..	22	70	2.6	6.8	....	8.7	....	33	..	..	59	..
June	71	11.3	19.6	..	1.6	....	266	....	....	18	72	6.7	20.9	....	1.2	....	65	..	..	24	74	3.8	8.6	....	7.9	....	51	..	..	52	88
July	77	11.6	14.5	..	1.4	....	290	....	....	11	76	7.1	19.0	....	1.1	....	58	..	..	21	78	3.8	8.2	....	5.8	....	56	..	..	52	94
Aug.	75									12	78	....	....	....	....	....	..	..	..	28	79	....	....	....	....	....	..	..	..	65	99
Sept.	74						....	....	....	26	75	....	....	....	....	....	..	..	..	38	74	....	....	....	....	....	..	..	..	71	99
Oct.	71	13.8	21.8	....	2.6		371	....	....	29	70	10.6	21.9	....	2.4	....	55	..	..	39	68	5.6	11.4	....	11.3	....	48	..	..	62	99
Nov.	68	15.6	20.3	....	2.2	[illegible]	296	....	....	38	66	10.7	19.9	....	2.3	53.1	68	..	..	41	61	4.2	10.7	....	8.9	24.2	42	..	..	69	99
Dec.	65	14.1	18.9	..	2.1	100.0	302	....	....	41	63	9.2	21.1	....	2.3	68.0	56	..	..	43	57	3.3	12.7	....	7.0	32.1	44	..	..	63	99
Average	70	13.3	18.8	0.1	2.2	90.6	285	126	138	28	68	9.0	20.0	0.2	2.1	60.1	68	46	..	33	66	3.8	9.9	0.7	8.2	28.2	49	28	28	64	89
Max.	77	15.6	21.8	0.1	3.0	100.0	371	154	163	47	78	13.2	21.9	0.2	3.1	68.0	90	50	..	41	79	5.6	14.2	0.8	11.3	32.1	60	31	28	76	99
Min.	61	10.4	16.5	0.1	1.4	78.3	222	98	112	11	58	6.5	16.8	0.1	1.1	53.1	35	42	..	21	55	2.6	6.2	0.5	5.8	23.6	33	26	28	52	88
1914																														
Jan.	62	15.2	20.5	....	1.7	....	279	....	....	42	60	9.2	21.7	....	1.9	....	64	..	..	48	55	5.7	14.6	....	5.2	....	40	..	..	62	99
Feb.	60	15.3	19.1		2.2	....	302	....	....	48	58	9.2	18.0	....	2.0	....	60	..	..	46	57	6.1	12.5	....	4.5	....	41	..	..	58	96
Mar.	61	16.2	20.3		1.6	....	431	....	....	34	59	10.3	27.6	....	1.8	....	73	..	..	46	55	8.5	19.5	....	3.6	....	71	..	..	55	89
Apr.	67	14.5	20.3		2.0	....	360	....	....	12	66	9.0	28.8	....	1.5	....	68	..	..	41	64	6.0	20.7	....	6.1	....	106	..	..	58	90
May	72	12.4	23.4		2.3	....	385	....	....	22	71	7.1	30.0	....	1.7	....	73	..	..	35	71	4.5	17.4	....	9.1	....	82	..	..	79	98
June	74	19.2	29.9	....	2.0	....	391	....	....	22	77	4.7	30.3	....	1.8	....	67	..	..	34	77	4.8	13.1	....	10.7	....	51	..	..	76	99
July	[illegible]	12.6	24.9	....	2.0	....	393	....	....	..	..	4.1	25.0	....	2.0	....	49	..	..	..	..	4.4	8.8	....	11.2	....	42	..	..	..	..
Average	66	13.4	27.1	....	2.0	....	351	....	....	30	65	7.7	25.9	....	1.8	....	65	..	..	42	63	5.7	15.2	....	7.2	....	62	..	..	65	95
Max.	74	16.9	23.4	....	2.3	....	431	....	....	48	77	10.3	30.3	....	2.0	....	73	..	..	48	77	8.5	20.7	....	11.2	....	106	..	..	79	99
Min.	60	9.5	18.1	....	1.6	....	279	....	....	12	59	4.1	18.0	....	1.5	....	49	..	..	34	55	4.4	8.8	....	3.6	....	40	..	..	55	89

tration on front cover) in causing air to circulate through the filters. It has been observed, however, that there is a downward draft of air through the ventilators when the wind is blowing and an upward draft when there is no wind. From the chemical analysis it will be seen that the nitrification has been uniformly good. The dissolved oxygen results, while not showing saturation, have been normal at all times in samples freshly taken from the beds, and the fact that there was oxidation going on so actively in the filters accounts for the difference in the results found and the required amount of oxygen for saturation.

COST OF OPERATION

From the time the Proctor Creek plant was put into operation the cost of treating the sewage per million gallons has been $3.93. This includes salaries, expenses of operation, such as repairs, renewals, water and electricity, but does not taken into account interest on investment or depreciation.

CONCLUSION

When the sewage treatment plants for Atlanta were under discussion the designing engineer's plans were to carry the purification of the sewage to such a degree that the final effluent would be free from all objectionable floating material and equal in quality to the stream into which it was discharged. As will be noted by referring to Table 3, the final effluent has a high relative stability figure and contains a large amount of free oxygen.

Before the sewage treatment plant was put into service Proctor Creek, which carried the raw sewage away from the outskirts of the city, was in a very bad condition. There were sludge banks, rags and other débris from sewage and the bed of the creek was black. The odors were offensive during the summer months and there was a general dissatisfaction among the people living along the stream. Since the plants have been in operation the water in the creek has become clear and there are no complaints from nearby residents. The sludge banks have disappeared, the bed of the creek is no longer black and there is no evidence of sewage in the creek at any time of the year.

The writer wishes to acknowledge the hearty co-operation and generous support of Capt. R. M. Clayton, chief of construction; W. A. Hansell, Jr., former assistant chief of construction, and H. N. Hurt, the present assistant chief of construction, in all things connected with the successful operation of the Atlanta sewage treatment works.

Split Road on Curve Forces Autoists to Keep to Right

SEPARATION of a concrete road into two parts on a moderately sharp curve lying on a 5 per cent grade is a "safety first" innovation in road construction in Minnesota. The object of the split road, states John Mullen, deputy State engineer, is to prevent possible accidents due to the tendency of drivers to hug the inside of the curve regardless of the direction in which they are going. As illustrated by the accompanying photograph, the road at the turn consists of two strips 8 ft. wide, separated by a crescent-shaped opening. On tangents the concrete slabs are 16 ft. wide.



SPLIT ROAD PREVENTS LEFT-HANDED CROWDING OF INSIDE OF CURVE

The divided roadway was not considered especially successful at first, as the 8-ft. width of each track was found insufficient. One of the divisions has since been increased to a 10-ft. width, and with this additional width Mr. Mullen is of the opinion that such construction is an extremely good insurance against accidents on sharp curves where the road can be seen only a short distance ahead.

WATER METERS IN LONDON, ONTARIO, numbered 2562 Jan. 1, 1915, an increase of 486 during the previous year. Only 17 per cent of services are metered, although 24 per cent of the water consumed passes through meters and furnishes 40 per cent of the revenue. Each inhabitant of this town of 56,000 population consumes on the average 81 Imperial gallons per day and the cost of supplying water is $34.15 per 1,000,000 gal.

Five 4-Foot Water Mains Underpinned After Break

Large Yardage of Excavation Rapidly Removed by Hand and Street Car Tracks Supported While Girders Are Built to Carry New York Pipe Lines

TEARING up an entire city block in New York City to repair five large cast-iron mains, in one of which a break occurred June 3, involves an unusual problem simply in getting rid of and then replacing the dirt. Conditions were further complicated at Manhattan Avenue between 109th and 110th Streets where all of the mains had settled, by the necessity for maintaining double-track street car traffic over the excavation. A description of the break in one of these mains, which feed the Central Park reservoir from the Croton supply, will be found on page 757 of the Engineering Record of June 12.

Where a break of this kind occurs the important thing is to restore conditions in the shortest possible time consistent with doing a good job. There is no time to set up plant or deck the street. The first step taken on this work was to tear up the pavement and put timber stringers under the car-tracks in place of the supports which had been damaged by the break. These supports had been built down to the old rock fill, over which was a blanket of clay in which the mains were laid.

When traffic over the car tracks had been provided for, the whole street was excavated to the bottom of the mains as rapidly as possible by hand. The street surface had been undermined until it was unsafe for teams, so carts were driven on the sidewalks beside the excavation after plank had been laid to protect the surface. Material was stored on adjacent streets for backfill by building walls of the broken concrete pavement base and dumping the carts between them.

CONCRETE GIRDERS TO SUPPORT PIPE

It was found that enough of the clay around the mains had been washed out to allow them to settle from the south curb of 109th Street to the center of 110th Street. Reinforced-concrete cross girders on 6-ft. centers have been placed under the pipes for this distance, and are carried on concrete footings excavated down to the old rock fill, which, contrary to first conjectures, has proved to be very solid. About forty of these bents were required.

The next step after excavating to the bottom of the mains was to dig under the pipes at the site of alternate girders, or on 12-ft. centers, and lay blocks on which jacks were set, one on each side of the main. Each pair of jacks carried a long timber under the main, and each main was picked up a few inches at a time at each joint till no joint was more than ¼ in. out of plumb in its height. With the 7-in. bells with which this pipe is fitted, ¾ in. in 4 ft. is allowable. The joints were then calked by driving up the old lead. The water was turned off each main while it was raised and calked. The final calking on one main, however, was done successfully under pressure. The east main was raised 14 in. for about 70 ft. and the next main to it was raised 10 in. The others were raised less, except the one next to the west main, which broke. At the break the pipe had dropped 2 ft.

Where the break occurred, a new double-bell casting had to be set. After the ends

which fitted into this casting were ready, a small derrick was set up on the car tracks at night to handle the section. The whole performance stopped traffic only two hours. While the raising proceeded the first girder trenches were dug on 12-ft. centers, alternating with the blocking. Pits from 3 to 5½ ft. deep were sunk below these trenches to the rock fill. Enough concrete to bring these pits to within about 2½ ft. of the underside girder was dumped in each hole, on top of which a ready-made box form was set and concreted. Forms for the girders were then set and poured. Concrete was mixed by hand, as materials in small lots could be delivered by team very close to the point of use. There was no chance for continuous pouring and volumes were small. Therefore a mixer brought on the job was not used.

Blocks were poured on top of the girders under each pipe, leaving a clear space of 1 to 4 in. It was thought dangerous to rest the lines directly on concrete, and hardwood wedging blocks were used for this purpose. After the lines were wedged up on the alternate beams first placed, the blocking was removed and the remaining concrete bents placed. The timber bents first set under the car tracks will next be replaced with permanent I-beams and concrete piers by the street railway forces before the street is backfilled and the paving replaced.

The concrete girder design was varied on the south side of 109th Street by two brick sewers converging into a manhole in the center of the street intersection. As the manhole drops 30 ft. or more to a trunk sewer located just over bed rock and running north under Manhattan Street, only the branches are in the way of the underpinning work. The piers were, of course, sunk to miss these branches. Where girders cross the branches there was room for a section 1 ft. deep in all but one place, where the shallow depth made it necessary to use 6-in. I-beams.

Shoring the dirt under the sidewalks proved easy, as the street car tracks furnished longitudinal ties for the 8 x 8-in. crossbracing from curb to curb. The hard clay stood very well and required no sheeting either at the sides of the main excavation or in the foundation pits.

The work is being done on force account by the Beaver Engineering Company. The Department of Water Supply, Gas & Electricity, of which Col. Merritt H. Smith is chief engineer and William W. Brush, deputy chief engineer, is furnishing all materials. Henry B. Machen, borough engineer for Manhattan, is in immediate charge of the repair work.

Constructive Work Leading to Better Rail Specifications Urgently Needed

A. W. Gibbs Reminds American Society for Testing Materials that Little Advance Has Been Made Recently and Suggests Lines of Investigation

FEELING that there has been little progress made during the last seven or eight years in the way of securing better rails, and that the American Society for Testing Materials has failed to produce a satisfactory rail specification, A. W. Gibbs, outgoing president of the society, and chief mechanical engineer of the Pennsylvania Railroad, in his presidential address at the annual convention in Atlantic City last week, made an urgent plea for constructive committee work to meet the situation. In his estimation the specifications of both the American Society for Testing Materials and the American Railway Engineering Association are defective, but those of the former association he deems more so. He believes the chemistry of the finished rail itself, and not that of the ladle test ingot, should be the basis for determining the acceptability of the rail. He thinks it a pernicious practice to accept material if a second and third test piece pass after the first fail. He also decries the acceptance as "specials" of rails represented by unsound test pieces, and thinks the only sure way to keep them out of important service is to prevent their shipment from the mill. He is inclined to believe the time has come for a considerable increase in the weights of sections. While more or less radical changes in mill practice have been proposed, he points out that the mills cannot be expected to disrupt their sequence of operations without proof of the value of the changes sought, and to this end he suggests a small experimental mill, run by the co-operative efforts of the parties interested.

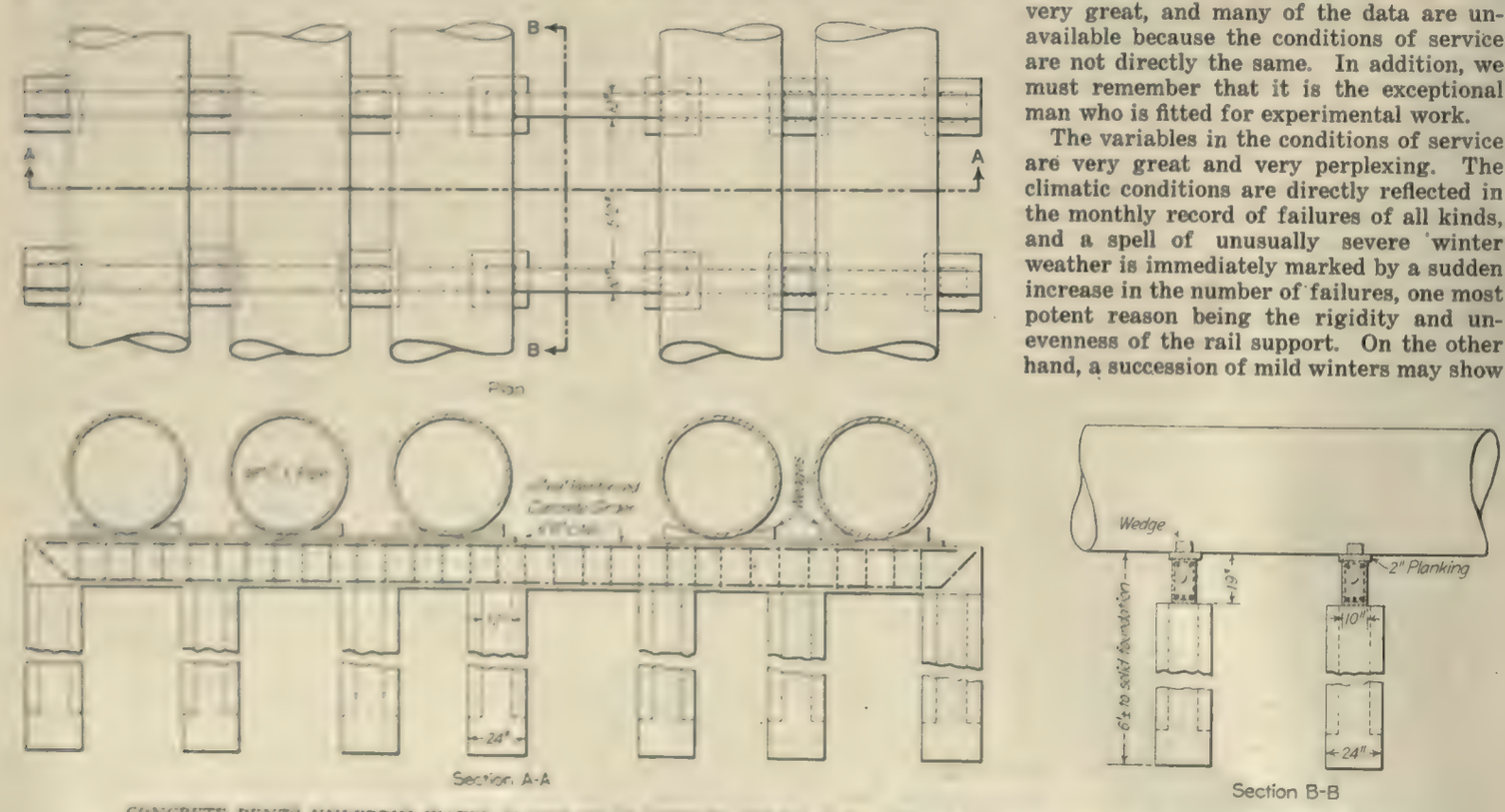
Mr. Gibbs introduced his subject by pointing out the ever-growing expenses of the railroads, which had been met by larger units, and consequently heavier loads. He saw no possibility of turning back from this course, hence the great importance of the rail problem. He then continued as follows:

In this country we are using heavier concentrated loads than are carried elsewhere. Much has been written to show the relative increases of the weights of rail and of loads carried, and conclusions have been drawn that one or the other has unduly increased. The flaw in this argument is that the contemporaneous comparisons have been of the heaviest rail and the heaviest load, forgetting the fact that the heaviest loads are few in number, and that the prevailing rail section over which they run is not the heaviest.

STATISTICS AND SERVICE CONDITIONS

Definite conclusions as to the performance of different lots of rail are difficult to draw. Statistics of actual service worthy of confidence are still young and far from complete. The labor of following the location and service of different trial orders is very great, and many of the data are unavailable because the conditions of service are not directly the same. In addition, we must remember that it is the exceptional man who is fitted for experimental work.

The variables in the conditions of service are very great and very perplexing. The climatic conditions are directly reflected in the monthly record of failures of all kinds, and a spell of unusually severe winter weather is immediately marked by a sudden increase in the number of failures, one most potent reason being the rigidity and unevenness of the rail support. On the other hand, a succession of mild winters may show



CONCRETE BENTS UNDERPIN WATER MAINS THAT SETTLED WHEN SLOW LEAKS WASHED OUT CLAY SOIL BENEATH THEM

such a comparative immunity from failures as to delude us into the belief that at last we are making definite progress.

The number of rails which fail annually, as compared with the total number in service, is very small when reduced to percentages. In many materials it could be ignored as purely an economic loss, and not very large at that. The enormous preponderance of those laid are removed because they are worn out. It is because the rail is part of a chain that its occasional failure assumes such importance.

PROGRESS DISAPPOINTING

With the above points in mind, it must be said that the available data do not show that progress in performance which we have a right to expect. It is true that certain classes of failures have greatly diminished, but these are directly traceable to improvements in design rather than in quality, and, taking the records altogether, the progress is very disappointing.

That the real answer to this great problem has not been reached is proved by the continued unrest in our specifications, and by the everlasting changes in sections.

What answer can we make?

First, as users, we can and should lessen as far as possible unnecessary punishment of the rail by improvements in the mechanical design and maintenance of our equipment.

We can be expected to improve our structure under the rail as our loads increase, and this change is in progress. It is but fair to say that bad conditions, both as to equipment and track structure, have contributed to rail failures. It is probable that this condition has always existed, and in times of business depression maintenance standards may have been lowered, but, altogether, the conditions of use are not worse. It is not probable that perfect track will ever be constructed or maintained, as the means for doing this are necessarily too crude.

That the large number of failures of rails has attracted no more attention is because of the vigilance of the track inspection. In the very great majority of cases the rails are removed before any serious results ensue, but we must not take too much comfort from this fact, for each case offers the possibility of most serious consequences, and this is fully recognized.

Against these unsatisfactory conditions we have several possible solutions: Better steel, in the sense of more uniform steel; better steel in connection with more rational sections; materially heavier sections; or retrogression in loads and speeds.

To date, a combination of the first and second has been chosen. There has been a very general change to open-hearth steel, at an increased cost.

CHEMISTRY OF RAIL ITSELF NEEDED

Committees of this and sister societies have worked almost continuously on the subject of specifications. To-day, after our fourth revision in a period of eight years, our specification is almost identical with that of the American Railway Engineering Association, but the seemingly small differences are really very important. Both specifications are identical in chemical requirements; both provide that the chemistry furnished by the producer shall be that of the drillings from the ladle test ingot; but both ignore the fact that the chemistry of the actual rails, at least of part of them, is apt to differ widely from the ladle analysis. In the case of the open-hearth specifications there is at least the merit of an analysis for each heat. In the case of the Bessemer rail the chemistry other than carbon is averaged from two complete analyses per 24 hours, to determine the quality. It is difficult to see how a specification could be made more absurd, and yet this clause in one form or another has been and still is part of many specifications, and it did not originate with our committee.

Neither the American Society for Testing Materials nor the American Railway Engineering Association specification really protects the buyer as to chemistry. Neither puts any limit on the amount of segregation permitted, and it is well known that this ranges over wider limits than would be permitted in the ladle analysis.

In investigating the causes of the failures of individual rails many analyses have shown such startling discrepancies between the composition of the failed rail and the analysis purporting to represent the heat that it was difficult to believe that they could represent the same material. Either the ladle analysis is an unreliable index of the quality of the material in the rail, or there is a great need for chemical reform. We know by experience that when put to it, the chemists of the producers and the consumers can tally within very reasonable limits. This is a serious matter for the consumer. In one of the railroad wrecks due to a failed rail, the Government representatives analyzed the rail and discovered that the composition did not at all agree with that called for in the specification, and severely scored the road for not enforcing its own specifications. How far the difference between chemists is due to difference in methods I do not know, but possibly the methods by which the chemistry is determined may have to be agreed upon and made a part of our specifications. Dr. C. B. Dudley, who did much work on standardizing methods of chemical analysis, would in his specifications not only state the composition required, but also the methods by which the determination was to be made.

UNSATISFACTORY MATERIAL ACCEPTED

From the physical standpoint both specifications are defective, as both contain the provision that if the test piece meets the requirements the material will be accepted; but in the event of the failure of the first test piece, two more tests are made, and if both pass, the material is accepted. We hold that this is a pernicious practice, in that the consumer has positive proof that some of the accepted material does not meet the requirements. How this clause ever crept into the specifications, we do not know. We do know that it is nothing new. If meeting a single test means acceptance of a definite quantity of material, failure to do so should mean a definite rejection, and in a number of our other specifications this is the case.

"SPECIAL" RAILS

Our own American Society for Testing Materials specification includes all the machinery for detecting physically unsound material by nicking and breaking, and then provides that the rails represented by these unsound test pieces shall be accepted as "special" rails. Presumably they are to be used in some unimportant location. This is another very bad practice. It is not always possible to find unimportant places. Designating marks in the way of paint or punch marks become illegible in time. The only sure way to keep such material out of important service is not to ship it from the mill. The total additional cost per ton for eliminating both of these objectionable physical clauses is quite well known and is not large. In some specifications both are cut out, but we hold that a buyer should not have to pay an additional price to avoid taking material which does not fairly meet the prescribed tests.

Summed up, the rail specification of our Society does not put a proper premium on the selection of the better part of the ingot for one of the most exacting services for which steel is used. Where our specification differs from that of the American Railway Engineering Association it is not so good.

Our committee is composed of able men. Among them are some of the ablest metallurgists in the country, and we should look to them for that constructive work which would make our specification beyond criticism. The purpose of our Society is to make specifications and have them used. If year after year we retain provisions that lessen the incentive to improve the product, we cannot wonder if other specifications are preferred.

FEW IMPROVEMENTS IN METHODS

If we consider all the steps in our rail industry, we find very few improvements in methods other than those which lend themselves to increased output or reduced cost. There are some notable exceptions to this, three in particular: namely, the electric furnace, for producing better steel; the sinkhead process for casting ingots, for producing better ingots; and the deseaming process, for producing better rails, by mechanically removing some surface defects which would later develop into seams. All of these processes are represented by rails actually in track under observation, but it is yet too soon to justify an opinion as to their value, nor have any of these methods been generally adopted.

In this connection, it may be mentioned that, in addition to the sinkhead-process steel rail made in this country by American methods, we have, also, a small supply of ingots made in Sheffield by the Hadfield patented process, which will shortly be rolled into rail and put in service.

Heat treatment, although not yet on a commercial scale, has been attempted, and such rails are actually in service under severe conditions. So far as non-service tests go, the results are promising.

HOPE IN LARGE-SCALE EXPERIMENTS NOW IN PROGRESS

It is to be hoped that some of the large-scale experiments now in progress will show what is to be looked for from a more uniform product. One of these includes the requirement that the chemistry shall be from the rail, instead of from the ladle test ingot, and the segregation must be within reasonable limits. This experiment will, at least, give a quantity of fairly uniform material, so far as any practical method of representative testing will insure it. Let us hope that it will give some definite light as to how far we should go toward more uniform material.

Should it develop from the test of service that by means of more uniform steel, namely, by analysis from the finished rail, with limits of permissible segregation, we eliminate enough of our serious failures to

make it worth while, we will have to face the question of how such provisions shall be carried out. It is certain that few railroad organizations have the chemists to make the determinations on the spot, so that by the time the rail is ready for shipment the makers will have advice from the chemists that the steel is acceptable. It is very desirable that this complication be avoided, but, if uniform steel proves to be the remedy, the consumers must know that they are getting it.

Aside from these, and some experiments on too small a scale to deserve special notice, the rail situation remains very much as it was seven or eight years ago. Any deviation from the beaten path is immediately met by an increase in the price asked, the reasonableness of which the purchaser has no means of determining. In at least one case of which I have knowledge, the actual expense of every kind, so far as it could be ascertained, due to rail breakage on a certain system was less than one-fifth of the annual increase in the cost of rail due to the introduction of a proposed new specification designed to secure the quality of rail desired. The year taken was not an abnormal one in any way. One serious wreck would, however, entirely have changed this showing. It requires a lot of courage and a strong sense of duty to justify such an expenditure when the direct return is problematical.

HEAVIER RAIL

There are many who believe that we cannot hope for relief by the use of more uniform steel. They make the point that, if this is the solution, it can be obtained by a discard larger than the ordinary. They cite the records of the carriers to show that the failures, especially the breakages, are fairly well distributed throughout the ingot, so that no practicable discard would eliminate the trouble. They also call attention to the many examinations of broken rail which reveal no defect that we can recognize as such. From these conditions they argue that the only remedy is to use more steel—that is, heavier sections—without any change in the specifications as to quality. Possibly this is correct, but we would call attention to the fact that post-mortems on rail sometimes give negative results, because we have not before us all the related evidence. The rail may have been damaged by unfair usage, of which there is no evidence. If due to defective support, the evidence is lost when the track is repaired. Damage from defective wheels, etc., leaves no permanent mark. There is a growing belief that the straightening press, by straining the material beyond the elastic limit, is responsible for many otherwise unexplainable failures, and it would also explain why rails from the lower part of the ingot figure so prominently in the breakage record.

As to the quality, we cannot ignore the fact of the difference between rails from different mills. There have been some notoriously bad rollings, as shown by the records of various roads, and these mills have subsequently turned out an excellent product. If all of the rail was as good as the best, we would have very little room for complaint.

The present line of progress includes a general increase in the weight of sections throughout the country. The 100-lb. mark, or that neighborhood, seems to be one of the halting spots, but some sections go considerably beyond this figure. A careful study has been made of the sections, and the new ones, especially of the heavier weights, are believed to be better adapted to secure good mill results, as well as better performance in the track.

Personally, I believe that the time has arrived for a considerable increase in the weight of sections, and I am not so certain that a change of quality is required at the same time. One reason that appeals is the presence within recent years of that class of failures known as "transverse fissures." So far, there seems to be no satisfactory explanation. It seems surprising, if this class of breakage develops in the rail, that it should not also do so in the tire, which is subject to the same intensity of pressure. The tire, however, has an immensely greater section than the head of the rail, and it is not until from one-third to one-half of the original area has been removed by wear and turning that it becomes necessary to remove the tire from service. If the mere fact of the relatively large area or section of the tire contributes immunity from this class of failure, it is fair to assume that somewhat the same result could be looked for in the case of the rail head.

Certain practices, such as the present system of straightening, have long called for improvement. Nearly all rail passes through the gagging press. The rail specifications are possibly too exacting in requiring that all rails shall be "smooth, straight in line and surface, and without any twists, waves, or kinks." It is a question whether this is not asking too much for the good of the rail and whether it would not be well to make the greatest possible tolerance in the way of accepting rail with such variations from straightness as can be reasonably eliminated in laying.

MILL METHODS

In the search for a remedy for our troubles, some have proposed to improve the product by more or less radical changes in the mill practice. It must be remembered, however, that a modern steel mill, like the railroad, can only exist by being operated on a large scale. It is designed in advance with a view to a certain sequence of operations, and if proper provision has been made for each, smooth operation follows. The mill, however, is only balanced when it performs these operations in the prearranged order, and to make a radical change—as, for instance, slow rolling, cold rolling, more passes, or one of the many other innovations suggested, may seriously unbalance the whole operation. It is not to be expected that a mill will be willing to make changes in its practice until after experimental work has demonstrated that the proposed practice is practicable and valuable. This does not mean that the mere assertion that the proposed changes are impracticable absolves us from doing anything further; on the contrary, the steel mills should be willing to go as far as possible in the direction of proving or disproving these theories.

Many of the questions could be settled by a small mill, in connection with a large one, at which experiments could be made without affecting the regular operations of the works. It may be feasible to provide such a mill by some form of co-operation, through which the expenses and the benefits may be distributed among subscribing companies.

In conclusion, I must repeat that the rail situation, as we see it, is disappointing. To add to the complexity of the situation, the Government, through some of its bureaus, is taking a hand and investigating every serious failure, apportioning blame and suggesting remedies. This will probably increase rather than diminish, and may some day be very awkward for the producer as well as for the user.

The function of our society is to prescribe specifications and tests, which, if enforced, will prevent improper material from getting into service. This calls for constructive work in committee; but it has been accomplished with other products—why not with rail?

Merits of Philadelphia Pavement Explained by Placards

IN CONNECTION with the completion of the granite-block pavement laid in Germantown Avenue, Philadelphia, the engineer in charge, William H. Connell, chief of the Bureau of Highways and Street Cleaning, has taken steps to call the attention of the public to the pavement as a desirable one for a business street. A number of attractive frames have been erected at important corners along the avenue, and behind a glass front is a large poster card headed as follows:

Improved Type of

GRANITE BLOCK PAVEMENT

On Six-Inch Concrete Base

Germantown Avenue

The construction of this pavement presents:

- The latest and best practice in granite-block pavement work.
- A type designed to withstand the extremely heavy traffic on this street.
- A surface which will be smooth riding for automobiles and will afford a good foothold for horses drawing heavy loads.

Foundation Course:

The pavement is laid on a six- (6) inch concrete base mixed in the proportions of one part Portland cement, three parts sand and six parts stone.

Cushion Course:

Between the concrete foundation and the block surface there is a one-inch sand cushion.

Surface Course:

The improved granite blocks are from eight to twelve inches long, three and one-half to four and one-half inches wide, and from five to five and one-half inches deep, accurately dressed. The heads are so cut that they have no more than three-eighths of an inch depression from a straight edge laid in any direction across the head and held parallel to the general surface of the block. The joints are not more than one-half inch wide at the top and for a depth of one inch, and not more than one inch wide in any other part of the joint. They are filled with a grout of Portland cement and sand in the proportion of one part of cement to one part of sand.

For further information, apply to

Chief Bureau of Highways and Street Cleaning
Room 232, City Hall Philadelphia

MORE THAN $3,000,000 will be spent for public works this year in British Columbia, it is announced. Of this sum $2,500,000 is for improving existing highways and for maintenance of existing bridges and roads. About $600,000 will be spent in extending and preparing for the construction of public buildings in the Province.



WEST SIDE OF NEW STRUCTURE ON APRIL 16—OCEAN IS ON THE RIGHT

Note the three wings, each extending farther from the main building than the preceding in order to give a maximum number of rooms with ocean view.

Largest Fireproof Resort Hotel in the World Completed at Atlantic City

Hotel Traymore Adds Eighteen-Story Reinforced-Concrete Structure Containing Large Domes, Cantilever Beams and Many Offset Columns

THE NEW Hotel Traymore at Atlantic City, N. J., which was opened for guests on June 1, consists of the addition of an eighteen-story structure to the older twelve-story reinforced-concrete building, finished about five years ago, which was altered to insure structural unity of the two buildings. The new structure is 238 ft. high from grade to top of the new large domes, and in addition to being the largest resort hotel in the world, is also the highest reinforced-concrete structure, with one exception—the tower on the recently completed Robert Gair warehouse in Brooklyn, which is 258 ft. above the sidewalk, and nearly 100 ft. above the main twelve-story building. The new hotel building is marked by several special features and by an unusual variety in the types of construction used. Among the features which will be described in some detail the more important are the tests of piles in sand foundations, the several types of floors and columns used, the many offset columns, the construction of heavy reinforced-concrete cantilever girders, and the large domes and connecting gallery at the roof.

The new complete structure covers an area 140 x 520 ft. Above the fourth floor, which is the first sleeping floor, the main building is about 54 ft. wide, and three wings are carried successively two, three and four bays out from the main building in order to insure a maximum number of rooms with an ocean view. One of the accompanying photographs shows the general appearance of the new structure on April 16. Above the eleventh floor the building reduces in plan at each floor until it is finally capped off with the two large central domes and a smaller dome over the fire tower. This reduction in plan resulted in many offset columns requiring heavy supporting girders, and the domes and galleries further added to the complication in form work. In spite of the difficulties of construction, however, the building was erected in record time, only nine months being required to complete the new work.

As an indication of the number of offsets and resulting structural problems it can be stated that in addition to the 179 columns resting upon the foundations there are 132 columns starting from girders on the various floors. Of the forty-one columns at the springing lines of the domes only nine continue down to their own foundations, the other thirty-two being supported by girders at various floors. One of the photographs shows many offset columns above the twelfth floor.

SPECIAL FOUNDATIONS ON SAND

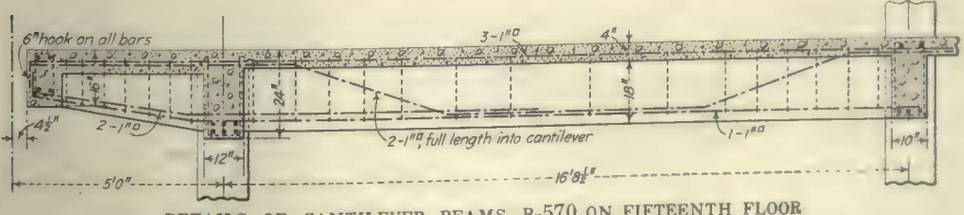
The foundations on sand were constructed of reinforced-concrete mattresses on timber piles. The piles averaged 18 ft. long and were jetted into place, then tapped with a steam hammer to practical refusal. In designing these foundations it was necessary to take into consideration the variable heights. During erection some piles were fully loaded far in advance of adjacent piles; in fact, there were times when piles in one cluster had five times the load of those in an adjacent cluster. Therefore, to overcome the tendency to unequal settlement, the rather low unit load of 15 tons per pile was used, considerably less than that adopted in the original building, which was not subjected to this condition.

The results of a series of tests on piles in the sands of an adjacent plot were secured to aid in determining the allowable load per pile. It was found by these tests that a long 32-ft. pile was little more effective than a short pile about 16 ft. long, and also that a pile by itself developed a greater unit resistance than piles arranged in a cluster about 2 ft. 6 in. center to center. The basement walls were reinforced to resist water pressure, assuming a slight reduction on account of the retardation due to seepage through sand. Where retaining walls and secondary tanks rest directly on the sand, 2 tons per square foot was allowed.

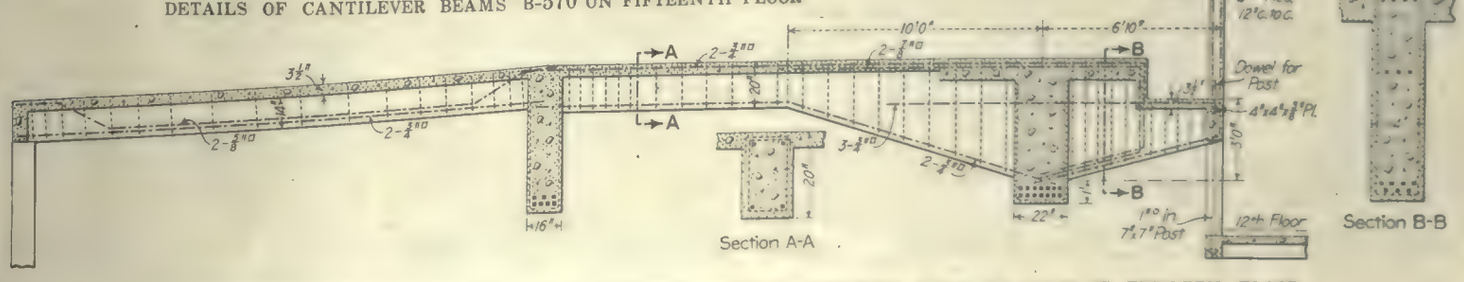
LIVE LOADS AND DESIGN STRESSES

The design was made to conform to the Atlantic City building laws, and the usual allowable unit stresses were used. In a few special cases, where beams supported offset columns with live load from several floors, the unit stress in steel was increased to 20,000 lb. The live loads per square foot were: Roof, 30 lb.; sleeping floors, 60 lb.; laundry floors, 150 lb, and special machinery concentration; kitchen and main exchange floor, 100 lb.; garden and slab construction, 200 lb. The live load on the girders was reduced 10 per cent when 100 sq. ft. or more of live load was carried, and 2 per cent additional for each additional 100 sq. ft. The live load on the columns was reduced to 5 per cent per floor (except for roof, top floor and exchange floor) until 50 per cent was reached, when such reduced load was used throughout the remaining floors.

The mushroom-slab floor with four-way reinforcement was designed for a moment of $WL/24$ at the center of diagonal bands



DETAILS OF CANTILEVER BEAMS B-570 ON FIFTEENTH FLOOR



CROSS-SECTIONS OF 44-FOOT GIRDERS, AND ELEVATION OF CANTILEVER BEAM AT ROOF OF TWELFTH FLOOR

and WL 12 at the center of the straight bands. All rods were carried to the quarter points of the adjacent panel, which doubled the reinforcing steel over the columns where the rods were bent up to within 1 in. of the top of the slab. The column caps were made one-fourth of the span in diameter and designed for the bending produced by unequal loading. Three types of columns were used—square or rectangular concrete columns at 500 lb. per square inch, reinforced with 1½ per cent of vertical rods tied with ¼-in. rounds 12 in. on centers; hooped columns of 1000 lb. per square inch on the concrete inside the hooping, with vertical rods and hooping designed by the Considère formula; and structural steel cores at about 15,000 lb. per square inch with fireproofing concrete casing counted only as increasing the radius of gyration of the column.

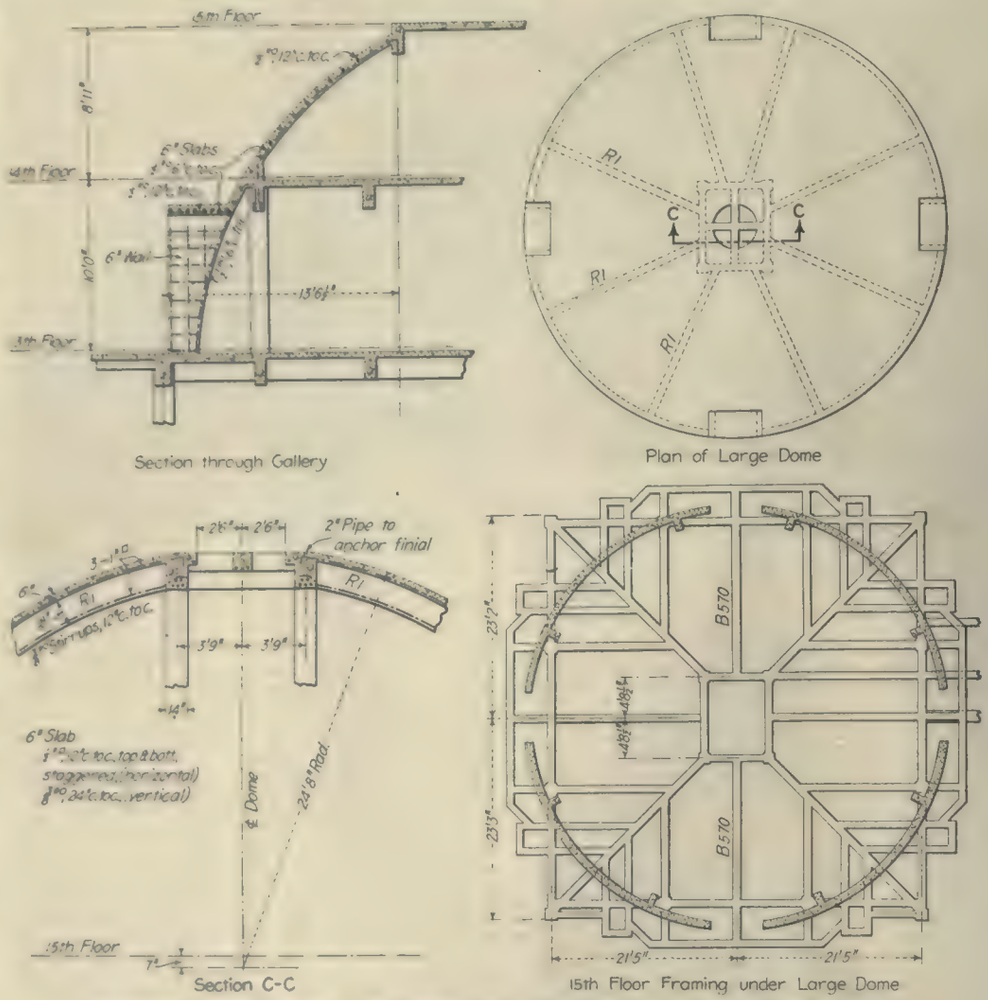
The domes were designed for true dome action, the horizontal reinforcing bands completely around the domes being assumed to resist the thrust from the part of the dome above the ring designed. Ribs were used as arched beams on the interior of the shell. Where openings were cut in the domes secondary members were incorporated above and below to take up the stress.

FLOOR AND COLUMN DETAILS

The main exchange floor is of the mushroom-slab type and forms the ceiling of the grill room in the basement. In the center intersecting reinforced-concrete beams support the glass bottom of a pool to enable the guests of the grill room to see the fish in the pond in the ceiling. Around the pond is an earth garden which this mushroom system supports. The mezzanine and first floor are mainly long-span tile-and-concrete slabs on reinforced-concrete beams forming panels which conform to the architectural features. A number of columns are offset on this first floor, and steel beams fireproofed with stone concrete are used for their support. On the central wing of the second floor large steel girders were used to support the columns coming upon them from the thirteenth floor, thus eliminating central columns from the dining room. Above the second floor typical reinforced-concrete beam-and-slab construction is used.

All offset reinforced-concrete columns were doweled to their supporting girders by the use of four ¾-in. round dowel rods 3 ft. long extending 18 in. into the columns. When steel girders were used these dowels were placed in punched holes in the top flanges, and where reinforced-concrete beams were used they were properly set before pouring the beams. From the eleventh floor up the reduction in size of building results in many of these offset columns, as seen in one of the photographs. The fourteenth and fifteenth floors contain many cantilever beams supporting the large brick buttresses extending 35 ft. below the dome and projecting outward a maximum distance of 13 ft. from the columns.

Bay windows of both slab-and-beam type and balconies supported on reinforced-concrete brackets were used at various floors, as can be seen in the view below the heavy cantilever girders at the roof of the twelfth floor. A balcony was added to the old building and supported on steel brackets stone bolted into the existing reinforced-concrete columns. A test load of 120 lb. per square foot, or twice the live load, was applied to this balcony without measurable deflection, proving the value of stone bolts when properly used. One of the detail drawings shows a typical reinforced-concrete column bracket to support steel beams at the twelfth floor. When steel columns were used bracket angles were furnished to support the reinforced-concrete beams which were poured with the concrete casing of the columns.



SECTIONS OF GALLERY AND DOME, AND PART PLAN OF FIFTEENTH FLOOR

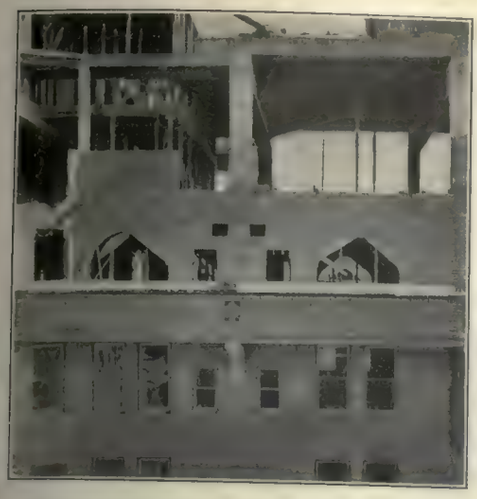
SPECIAL CANTILEVER GIRDERS

Unusually heavy reinforced-concrete girders of 44-ft. span in the roof above the twelfth floor are shown in the illustrations, the special cantilever beams supported by them being shown in elevation on page 11. These cantilever beams support at their overhanging ends the adjacent thir-





MANY OFFSET COLUMNS ABOVE TWELFTH FLOOR COMPLICATE THE CONSTRUCTION—GALLERY AT THIRTEENTH FLOOR FROM EXTERIOR



HEAVY GIRDERS AND CANTILEVER BEAMS

Adjacent portions of twelfth and thirteenth floors are supported below and above left hand ends of cantilevers.

teenth-floor loads on reinforced-concrete columns and the twelfth-floor loads by steel hangers and anchor plates. The steel reinforcing in these cantilever beams and the heavy supporting girders should be noted, especially the manner of bending the rods in the cantilever ends.

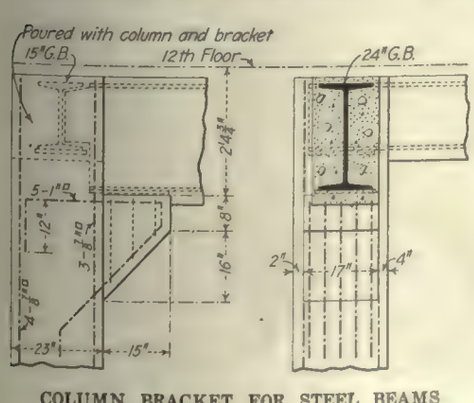
The usual type of reinforcing used in the many cantilever beams in this building is indicated by the detail drawing, page 11, of one of these beams in the fifteenth floor. At this floor many cantilever beams are necessary. The ample provision for shear stress, the bent rods for negative bending moments and the typical cross-sections of the supporting reinforced-concrete beams are all shown on the drawing.

MAIN DOMES AND GALLERIES

The two main central domes are about 48 ft. in diameter and are constructed of spherical reinforced-concrete slabs with eight arched ribs as shown in the accompanying section and plan. Horizontal circular rods ½-in. square on 12-in. centers staggered top and bottom are used in the 6-in. domes, to take the thrust as already explained. The central columns were introduced after the first design was completed. Part of the fifteenth-floor framing plan shows the complicated nature of form work required for the beams of this floor, and the supports for one dome. Each dome weighs 240 tons, two-thirds of which is carried by concrete girders or beams as shown.

A cross-section of the connecting gallery at the thirteenth floor is also shown, and a photograph of the exterior portion with a view of the dormer windows for which the reinforcement is given on the drawing.

Considering the great variety of problems involved, it is probable that the structure as a whole is one of the most complex ever constructed of reinforced concrete. The architects were Price & McLanahan, the structural features were designed by Otto H. Gentner, Jr., and F. Dickinson Shaw, and the contractors were Cramp & Company, all of Philadelphia.



COLUMN BRACKET FOR STEEL BEAMS

Waterworks Analysis Contains Data from 5185 Towns

THE STATISTICAL summary of American and Canadian waterworks plants, contained in the accompanying table, is from the recently published *McGraw Waterworks Directory*. It presents in condensed form records from 5185 towns, of which 3301 are municipally owned and 1403 privately owned. In addition to the analysis of ownership there are columns showing the use of pumping equipment other than steam. Of the towns listed 517 employ electric equipment and 343 are dependent on water power. An interesting feature of the analysis is the evidence of the extent to which light and waterworks plants are combined. In 1044 towns, or roughly 20 per cent of the total, this consolidation of the two principal utilities is in effect. The figures in the column "Plants Using Water Power" have been revised since the first edition of the directory appeared.

THE PNEUMATIC METHOD OF PLACING CONCRETE was used successfully for conveying the mix 2805 ft. through a 6-in. pipe on the Mile Rock tunnel work at San Francisco. The compressor capacity installed was 1200 cu. ft. per minute and the receiver pressure was kept at about 115 lb. per square inch. This is regarded as a record for long-distance work of this character.

STATISTICAL SUMMARY OF AMERICAN WATERWORKS

State, territory or province	Number of towns listed	Municipally owned	Privately owned	Mixed ownership	Supplied from other towns	Combined light and waterworks	Using electrical equipment	Plants using waterpower
United States								
Alabama	71	47	16	1	7	22	11	2
Alaska	7	..	7	..	..	3	..	..
Arizona	26	7	16	..	3	1	10	..
Arkansas	61	27	31	..	3	17	12	1
California	250	81	136	11	22	17	109	..
Colorado	90	74	13	..	3	4	7	1
Connecticut	127	18	62	5	42	2	11	3
Delaware	11	7	4	..	..	3	7	..
Dist. of Columbia	1	1	..	..	..	..	..	..
Florida	48	31	16	..	1	38	27	..
Georgia	116	110	6	..	..	..	1	4
Hawaii	1	1	..	..	..	..	..	..
Idaho	49	23	25	..	1	6	20	1
Illinois	312	247	53	1	11	12	70	..
Indiana	146	90	54	..	2	40	28	..
Iowa	248	228	20	..	..	4	75	2
Kansas	170	154	15	..	1	20	49	1
Kentucky	53	22	31	..	..	4	8	1
Louisiana	35	29	6	..	..	13	5	..
Maine	103	17	65	1	20	4	7	3
Maryland	48	23	25	..	..	3	3	..
Massachusetts	209	145	51	1	12	..	27	2
Minnesota	182	175	7	..	..	32	36	4
Michigan	118	95	19	..	4	9	33	11
Mississippi	66	59	7	..	..	17	15	..
Missouri	82	55	27	..	..	23	37	1
Montana	33	18	14	..	1	6	8	1
Nebraska	98	95	1	..	2	8	26	..
Nevada	29	11	14	..	4	4	3	3
New Hampshire	43	26	17	..	..	..	4	2
New Jersey	261	71	90	5	95	8	30	6
New Mexico	15	6	8	..	1	3	3	..
New York	273	167	73	7	26	8	48	4
No. Carolina	66	57	8	..	1	9	28	..
No. Dakota	27	24	3	..	..	3	3	..
Ohio	196	156	34	..	6	12	24	3
Oklahoma	94	87	6	..	1	30	30	..
Oregon	55	35	19	..	1	8	11	2
Pennsylvania	418	92	176	3	147	4	27	8
Porto Rico	7	7	..	..	..	1	..	..
Philippine Islands	3	1	2	..	..	..	..	..
Rhode Island	14	3	7	1	3	..	..	1
So. Carolina	32	22	9	..	1	6	16	2
So. Dakota	48	45	3	..	..	1	6	..
Tennessee	49	35	14	..	..	22	9	..
Texas	147	75	67	..	5	29	33	2
Utah	21	18	3	..	..	..	1	..
Vermont	53	35	18	..	..	3	4	2
Virginia	45	25	14	..	6	4	9	1
Washington	48	45	3	..	..	1	8	3
West Virginia	45	21	22	..	2	8	8	..
Wisconsin	101	83	17	1	..	20	19	2
Wyoming	21	19	1	..	1	..	3	..
Totals for United States	4,872	3,045	1,355	37	435	493	969	80
Canada								
Alberta	18	16	2	..	..	2	4	..
British Columbia	27	19	8	..	..	4	3	..
Manitoba	11	9	2	..	..	..	4	..
New Brunswick	17	15	1	..	1	..	..	..
Nova Scotia	31	27	3	..	1	2	3	1
Ontario	129	114	13	2	..	13	41	17
Prince Edward Island	2	2	..	..	..	..	..	..
Quebec	62	38	19	2	3	3	14	4
Saskatchewan	15	15	..	..	..	..	4	..
Newfoundland								
Newfoundland	1	1	..	..	..	..	..	..
Totals for Canada and Newfoundland	313	256	48	4	5	24	75	26
Grand totals	5,185	3,301	1,403	41	440	517	1,044	106

Committee on Concrete Tests Outlines Work in Progress

Many Series of Tests Have Been Distributed to College and Commercial Laboratories by American Society for Testing Materials

IN ITS REPORT presented to the American Society for Testing Materials at the annual meeting in Atlantic City, N. J., June 22-26, committee C-9, on standard tests of concrete and concrete aggregates, outlines the procedure which is being followed in most of its investigations. The practice is to distribute series of tests to various commercial and college laboratories, with very complete instructions. These tests are arranged so that each series is duplicated several times, and are designed to separate the individual variables in order to determine, one by one, the specifications for each function. The committee's report was received and ordered printed.

Co-operative Investigation

The committee has been fortunate in having for preliminary use the results of the investigations carried on by the committee on specifications and methods of tests for concrete materials, of the American Concrete Institute, published in their *Journal* for October and November, 1914. At the first meeting of the committee it was voted that the work of these two committees be co-ordinated and that they act as a combined committee in making the researches and tests.

The work of committee C-9 has been divided among nine sub-committees. Sub-committee 1 is in charge of the finances of the work. An outline of the work of the others follows:

Sub-Committee 2 on Laboratory Tests for Concrete and Laws of Mechanical Mixtures.—This sub-committee has outlined certain tests on concrete and mortars with the view of establishing the best practice in making and testing concrete specimens in the laboratory, and to determine the effect of variations in the gradation of sizes of the aggregates on the strength and properties of the concrete.

Laboratory Tests Outlined

The following series of tests have been outlined as a part of the necessary investigations:

1. Comparison of metal and wood forms for standard laboratory tests of concrete.
2. Variations in strength and properties of concrete throughout the batch.
3. Effect of different methods of tamping and compacting.
4. Effect of condition of storage of specimens for standard compression test of concrete.
5. Method of capping test specimens preparatory to testing.
6. Effect of gradation of sand.
7. Effect of varying ratio of fine to coarse aggregates.
8. Effect of varying sizes of fine to coarse aggregates.
9. Strength of mortar as affected by the form of the test specimens.

Sub-Committee 3 on Sampling and Testing Field Concrete.—In laying out the work for this sub-committee it was found that on a number of the larger concrete jobs field tests are being made, but there seems to be no uniformity of practice in making, storing, and testing the specimens. It was deemed wise, therefore, that this sub-committee select tentatively a method which seems to have the most merit, and recommend that wherever possible such tests be made.

Field Tests

The following tests have been outlined:

1. Comparison of four methods of storage during first two days after molding.
2. Comparison of methods of storage subsequent to first two days.
3. Study of the cold-weather effect on field specimens.
4. Comparison of prisms made in the field and in the laboratory with prisms cut from work.
5. It is considered within the realm of possibility that a portable core drill can be made to use in cutting test specimens from concrete already in place in the form of 6 by 12 or 8 by 16-in. cylinders.

Sub-Committee 4 on Relative Values of Various Strength Tests.—In the field to be covered by this sub-committee there are certain fundamental problems which it is felt should be investigated as soon as possible. These may be stated as follows:

1. To establish the relative reliability of mortar strength tests for determining the suitability of sand for use in concrete.
2. A determination of the most desirable size and shape of mortar test specimens and the relation of tension to compression.
3. A determination of the most desirable size and shape of concrete test specimens.

Sub-Committee 5 on Impurities Affecting Fine Aggregates.—The work of this sub-committee is as follows:

1. In securing samples of fine aggregates which have shown abnormal results when used for concrete.
2. To make tests on the samples secured with the view of determining the cause of the peculiar action noted.
3. To find, if possible, an economical corrective for such peculiarities.

Samples Obtained

In order to secure samples for this investigation, letters were addressed to a large number of persons throughout the United States and Canada, who it was thought might be able to assist in supplying samples of sand which would be of economic importance if the impurities could be removed. Considerable information has been collected concerning sands of this kind. Several samples have been received and are now being subjected to preliminary tests. The tensile and compressive strengths of mortars made from each of these sands will be compared with mortar from standard Ottawa sands, using various brands of Portland cement. Chemical analyses will be conducted on the foreign material in the sands, and an effort made to discover some method of treatment which will remove the defects. In searching for a corrective, the commercial aspect of the problem will be kept constantly in mind so that the method of correcting used for each sand will be practical and the most economical one available.

Owing to the extremely technical nature of the tests involved in this investigation, a chemist has been employed by the committee to carry out the chemical work under the direct supervision of one of the members of this sub-committee.

Sub-Committee 6 on Methods of Tests for Voids, Weights, Density, Specific Gravity and Consistency.—In the standardization of certain of these tests the committee is co-operating with other committees of the society in order to arrive at specifications which will apply to all classes of work. The first series of tests laid out has been with reference to methods of determining weights and voids.

Variables to be Standardized

The variables to be standardized are (*a*) size of measure; (*b*) method of filling; (*c*) condition of sand.

(*a*) Four sizes of measures are being tried of the following capacities: 100 cu. cm., 1000 cu. cm., ¼ cu. ft., and 1 cu. ft., in order to find out whether it is necessary to make weight determinations on a large sample, such as ¼ cu. ft. or more. If smaller measures, such as 100 cu. cm., or 1000 cu. cm., give equally concordant results, they will be more easily used in the laboratory. The two larger sizes of measures are being tried in cylindrical and cubical shapes.

(*b*) Seven more or less different methods of filling the measures are being tried out. Each method as outlined has been in use by laboratories testing sand and each gives results differing more or less from the others.

(*c*) Two sets of determinations on condition of sand are being made; one with the sand dried at room temperature, the other with damp sand. Samples of two kinds of sand have been furnished by the committee to those performing these tests.

Sub-Committee 7 on Methods of Tests of Coarse Aggregates.—The work of this sub-committee is the investigation of methods of tests to determine the suitability of coarse aggregates for concrete to be used under varying conditions.

Sub-Committee 8 on Available Aggregates for Concrete.—The work of this sub-committee is the compilation of localities throughout the United States where concrete aggregates are available. The co-operation of geologists of the United States government in the various States will be solicited and also the assistance of engineers. The efforts of the committee will first be devoted to States in which there are few deposits of available aggregates.

Sub-Committee 9 on Definitions.—The work of this sub-committee is as follows:

1. To collect as many of the definitions as it can secure which are pertinent to the work of committee C-9.
2. To endeavor to secure the co-operation of all committees pertaining to concrete or correlated subjects of the various engineering societies in this country, with a view toward standardizing definitions pertaining to the testing of concrete and concrete aggregates.

GROSS OPERATING REVENUES FOR APRIL on the large steam railroads of the United States, according to a bulletin issued by the Bureau of Railway Economics, were $1010 per mile, showing a decrease of $28 or 2.7 per cent as compared with 1914. Operating expenses were $722, a decrease of $60 or 7.7 per cent. Net operating revenues, therefore, were $288—an increase of $32 or 12.3 per cent, and operating income was $239—an increase of $33 or 16.2 per cent. The operating ratio was 71.5 per cent, as compared with 75.3 per cent in April, 1914. Considering the three main districts, the respective ratios for April, 1915, and April, 1914, were as follows: Eastern district, 71.0 and 76.4; Southern, 70.9 and 75.2; Western, 72.3 and 74.2.



UNOILED SECTION IN FOREGROUND IS MUDDY; OILED PORTION BEYOND IS FIRM AND HARD

Iowa Experiments with Oil on Dirt Roads

Benefits, Limitations and Costs Applicable to Rural Communities Given by Engineers of State Highway Commission

OILING dirt roads in Iowa is practised as a cheap way to eliminate mud and dust. Pictures of oiled and plain roads in Ames after a protracted rainy period shown in the *Service Bulletin* of the State Highway Commission, from which the following notes are taken, indicate that oiling is well worth while. However, the following warning is given:

"Any town or community that places its faith in an oiled earth road as a substitute for a strictly hard surface road is doomed to disappointment. No combination of oil and ordinary Iowa earth has yet been found which will serve as a substitute for gravel, concrete, wood blocks, or brick. No such combination can approach the road crusts commonly known as sheet asphalt and asphaltic concrete. The oiled road will not stand up under hard or heavy traffic for a very long period in dry weather. It will not stand up under prolonged wet seasons if subjected to severe usage. While the oiled road is not even a cheap substitute for the higher class of surfacing materials, it has an important field as a dust and mud preventive or palliative. Small towns with oiled streets can get out of the mud and dust except in extreme conditions and at slight expenditure compared with putting down pavements. The oiled earth road has its place just as much as the cheap automobile. It may not stand the wear and tear of the higher priced article, but like the automobile, it will give a very satisfactory service."

Elgin, a town of less than 1000 people, has been oiling its main business street for five successive years. The fact that it has continued the oiling from year to year is evidence that the people are satisfied with the results they obtain. De Witt, West Union, Estherville, Monona, Postville, Castalia, Ayrshire and many other towns of the State are now resorting to the same practice.

Ames made its first experiment with oil during 1914. The oil was applied about the middle of the summer on several sections of two or three blocks each in various parts of the town. Two or three of these sections were so located that they took a great share of a heavy Chautauqua travel. Shortly following this a long rainy period set in and these and all the other oiled sections, by reason of their good condition, took a great deal more than their ordinary share of the city traffic.

OIL'S FUNCTION TO PREVENT DUST

The chief value of oil on earth roads is as a dust and mud preventive. Its effectiveness in both cases depends upon two things, the character of the soil and the body and stickiness of the oil used. The oil has little or no resistance to wear. Its function is merely to hold the particles of earth together in a more or less solid and waterproof body. The moment the particles become torn apart either by horses' hoofs, or wheels of vehicles, there is dust in dry weather and mud in wet weather. In wet seasons the water-shedding character of the oil performs a valuable function in addition to waterproofing the road surface.

A very little sand will help out an oiled road surface greatly. Road-builders who have had experience with oiled roads urge that if possible a light coating of sand be thrown over the oiled surface as quickly as possible after putting on the oil. The oil, sand and dirt particles together greatly improve the surface over the straight oil and earth surface. The sand thrown over the freshly oiled surface prevents a large per cent of the oil being carried off the road by travel when the road is thrown open to traffic.

To the depth of penetration of the oil body which varies from 1 in. for a single application to 5 or 6 in. where the treatment has been continued for several applications spread over a series of years, depends in a large measure the success of the oiled surface as a waterproof road covering. The deeper the penetration of the oil the better the oiled surface will protect the earth below and the harder it will be to break up the road crust.

WHEN TO APPLY OIL

Oiling gives best results when used on thoroughly compacted grade, with perfectly smooth surface and as near the standard cross-section as it is possible to have it. Good results cannot be secured from a road surface that is freshly and loosely graded or that is full of pockets for water to stand in. It is a useless expenditure of money to oil a flat ungraded road and expect it to stand up at all under wet weather conditions. The oil should be put on after the grade has been properly shaped and side drainage amply provided for. The surface should be caught following a rainy



BECAUSE OF ITS BETTER CONDITION THE OILED STREET AT THE RIGHT CARRIED MORE THAN ITS SHARE OF TRAFFIC

period, when it is thoroughly dried out but before it has begun to rut or before any appreciable quantity of dust has been formed. If there is any quantity of dust on the road it should be scraped off. Naturally the conditions in the late spring or early summer afford the best opportunity on the average for oiling.

It is highly important to secure the best results that the oil should be applied hot. The best heat is approximately 180 deg. The heat can best be applied by steam, piped into the body of the oil tank. A convenient arrangement is to use a steam tractor to haul the tank and to draw the supply of steam from the tractor boiler. Far better penetration is secured by heating, the hot oil going deeper into the road surface and more perfectly permeating the surface than when applied cold, and there is less waste.

It requires about ½ gal. of oil per square yard per season to properly oil a dirt surface. The petroleum oils used cost about 4 cents per gallon delivered in the central part of the State. The cost of applying the oil will approximate on the average the cost of the oil. A 15-ft. roadway entering a town or in a country community would therefore cost $2 for each 60-ft. lot.

Chain "Anchorage" Holds Transit Steady in High Winds

IN the construction of the Yolo Causeway for the California Highway Commission near Stockton, Cal., it was found advisable to keep two transits on the job most of the time for spotting the concrete piles as they were placed for the driver. The causeway is in a location exposed to the winds and no shelter is available for the instrument men. As more than thirty concrete piles are often driven in 8 hours it is necessary for the transitmen to remain on the work in all kinds of weather, and they are often required to spot piles quickly in high winds.

Under these conditions it has been necessary to find some means for steadying or "anchoring" the transits, and this problem has been solved by simply taking short sections of the heavy chains used on the work, and substituting this weight for the plumb bob, as shown in the accompanying illustration, after the instrument has been set up at the desired point. The weight is suspended from a wire passing over the tripod head so that no injury is done to the plumb-bob hook.



TRANSIT HELD STEADY IN WIND BY CHAIN ANCHORAGE

New Methods of Odor Elimination at Garbage Plants Indicated by New York Tests

Irwin S. Osborn Finds That Furnace Heat Alone Is Not a Deodorizer of Insoluble Digester Gases—Final Washing Necessary

OFFENSIVE odors from New York City's garbage and dead animal disposal plants on Barren Island are to be eliminated by measures proposed by Irwin S. Osborn, of Toronto, and embodied in a report to the Board of Estimate and Apportionment which was commented on in the editorial columns of the Engineering Record of June 26. A number of changes in design and in operating methods are suggested and a radical departure from present practice is advocated for treating the insoluble gases from the digester tanks of the reduction plant. These gases, after passing through condensers, have been discharged into the boiler furnaces and passed thence to the stack. Mr. Osborn's investigations, which are claimed to be the most complete of their kind ever undertaken, show that this heat treatment, instead of acting as a deodorizer, actually makes the gases more offensive. It does, however, render them soluble so that the final process of treatment should be washing. Special attention also should be given, according to the report, to keeping all garbage digester tanks free from leaks and to the installation and operation of condensers with an adequate water supply.

THREE PLANTS AT BARREN ISLAND

There are three so-called disposal plants at Barren Island, all privately operated but under the general supervision of the Department of Street Cleaning. The largest is the garbage reduction plant of the New York Disposal Corporation. A fertilizer plant, where garbage tankage is dried, is operated by the Thomas F. White Company, and at a rendering plant dead animals are treated by the Products Manufacturing Company.

Garbage is delivered at the plant of the New York Disposal Corporation, the largest of its kind in the world, by scows, from which it is unloaded by grab buckets and discharged into scraper conveyors. Connecting the conveyors with digesters are swivel spouts which discharge the garbage directly into the digester tanks. The digesters are housed in two buildings, known as the New York building and the Brooklyn building. The New York digester building contains 68 digesters and the Brooklyn building 104 digesters. The digesters are approximately 6 ft. in diameter and 18 ft. long, constructed with a cone bottom, which is connected to a receiving tank by a large gate-valve and nozzle on the bottom of each digester. The garbage when cooked is discharged into the receiving tank, from which it is passed through a roller press, steam press, or hydraulic press, for extracting the free water and grease.

OPERATION OF DIGESTERS

The digesters when filled are sealed by tightly closing the charging hole at the top, after which live steam is admitted at the bottom. The steam, entering the bottom, circulates up through the mass submerging it at from 60 to 80 lb. pressure. After application of the steam from 6 to 10 hr., the garbage cells are broken down and material thoroughly sterilized and digested. The top of each digester has a 2-in. vent line for relieving the pressure on the digester after the material has been digested. The 2-in. vent line is closed off by a valve during the cooking period and the gases allowed to escape through a ⅜-in. by-pass. The digesters in the Brooklyn building are arranged similar to those in the New York building and vented in the same way through 6-in. main vent lines. The two 6-in. vent lines are carried to the end of the building, where they discharge into the digester vent tank.

Six-inch jet condensers are connected to the digester vent tank for condensing the steam and soluble gases. The discharge line from the condensers is connected to a blow-off tank, where the insoluble gases are trapped and the water overflows to the sewer. The blow-off tank is vented by means of a 4-in. line, which carries the insoluble gases and discharges them into the rear of the boiler furnaces, and thence with the combustion gases from the boilers to the chimney.

The garbage when cooked is discharged from the digesters into receiving tanks underneath, from which it is in turn passed through either roller, steam or hydraulic presses. Water and free grease are pressed out, flowing through a conduit to grease-separating catch basins. The solids are delivered by conveyors to the drying building, the whole operation being carried on in closed apparatus.

GASES FROM DRYERS

The solids from the presses carried to the dryer building are fed into the primary direct heat dryers, which consist of a large circular shell with furnace at the feed end. The material is fed into the dryer and as the dryer revolves the material cascades, coming in contact with the combustion gases from the dryer furnace, thus evaporating the moisture in the material. The dried material is discharged at the rear of the dryer into conveyors, which carry it to the percolating building. The vapors and gases coming from the dryers enter a large continuous chamber at the rear, which is connected to a flue leading to the chimney. The chimney, which is constructed of concrete, is 17 ft. in diameter and 225 ft. high, and not only takes care of the gases from the dryers, but also serves the majority of the boilers of the boiler plant. The dryer gases before entering the chimney are passed through a steel two-compartment scrubber, where the gases are passed through water spray to condense and take up the soluble gases. The scrubber was installed and placed in operation the latter part of 1914.

The dried material delivered to the percolating building is placed in extractors, and the grease left in the material extracted by means of a solvent. After treatment in the percolating building, it is carried by conveyors to the dryer building and passed through the secondary dryers, which are similar to the primary dryers, and the gases given off pass through a common flue to both sets of dryers, which in turn are connected to the scrubber. The dried material

from the secondary dryers is taken by conveyors and industrial cars to tankage storage building, ready for shipment.

The boiler house contains ten 200-hp. and twelve 150-hp. horizontal tubular boilers, which are connected by a flue to the concrete stack. In addition to the above boilers there are four water-tube boilers of 380 hp. each and connected to separate steel chimneys. The water-tube boilers were installed in 1914. The total rated horsepower of boilers amounts to 5320 hp., the steam generated being used in cooking, pressing, percolating and operating steam engines and pumps.

REQUIREMENTS FOR ODORLESS PLANTS

The type of equipment installed in the plants on Barren Island is similar to that found in the majority of reduction plants. In few plants has the required attention been given to eliminate the undesirable features. Odors from rendering or reduction plants have been due largely to improper equipment and apparatus or to careless operation.

To eliminate odors the following essential features must be considered: 1. The type of equipment used should be such as to produce a minimum amount of gas-carrying odors. 2. The equipment and apparatus used should be designed and installed so as to confine all odorous gases. 3. Proper and sufficient means must be provided to deodorize the gases produced. 4. The equipment and apparatus installed must be operated properly and efficiently.

Proper attention from a sanitary or free-from-nuisance standpoint cannot be expected when sufficient control as to the manner in which the work is to be conducted is not obtained by the municipality. When contracts are awarded in competition for short terms it usually results in the plants being constructed with less attention being paid to details and permanent construction. It is an evident fact that when contracts are obtained it is necessary to charge off the larger part of the first cost of the plant during the life of the contract, and that the cost of operation will be increased when it is necessary to consider sanitation and freedom from nuisance as the first object. It is only natural to expect the commercial side to be foremost, unless proper control is exercised by the municipality, whether the work is conducted by contract or by the municipality.

THREE SOURCES OF NUISANCE

The odors given off by the garbage reduction plant, causing nuisance to the surrounding territory, come principally from three sources—the gases vented from the digesters, gases escaping from the apparatus, and the off gases from the dryers.

The gases carrying odors are treated at the reduction plant so as to eliminate a larger part of the odors, although they are not adequately or sufficiently treated. As previously described the gases vented from the digesters are passed through condensers where the steam is condensed and a large part of the gases are absorbed by the water. The insoluble gases are trapped in a hot well or vent tank and then vented through a pipe line to the boiler furnaces, so as to raise their temperature sufficiently to deodorize them. *From the tests made during this investigation it was demonstrated that by heating the gas to 2000 deg. Fahr. the odors were not eliminated but became more irritating as the temperature was increased, due to a change in the sulphur compounds to sulphur dioxide.*

INSOLUBLE GASES MUST BE WASHED AFTER HEATING

The practice of discharging the insoluble digester gases into the boiler furnaces has been universal in nearly all reduction plants. Mr. Osborn made tests in 1911 on deodorizing gases by heating to a high temperature, demonstrating that the gases could be completely deodorized. In conducting the tests water was used in producing suction on the test line leading to the high temperature furnace, so that after heating the gases were washed. The water was used only for siphoning the gases through the combustion chamber, the tests being made and a conclusion reached from the results obtained at various temperatures, while in reality, as demonstrated by the tests made during the Barren Island investigation, heating changes the sulphur compounds, producing a gas which becomes soluble in water.

The changes recommended call for abandonment of the present practice of discharging the insoluble gases into the boiler furnace, as, on being heated, they are given off with the odor caused by the chemical change.

The greatest source of the odors in the plant of the New York Disposal Corporation is the direct heat dryers used in drying the tankage. From determinations made approximately 175,000 cu. ft. of dryer gas per minute was given off. This gas, previous to the fall of 1914, was carried direct to the chimney and discharged to the atmosphere.

WASHING DRYER GASES

In 1914 the company installed a scrubber for washing the gases, so that the odors would be absorbed before entering the chimney. Tests were made which showed that the odors in the gases from the dryers were absorbed by water, but that the scrubber now installed was not as efficient as it should be, due to its design and the manner in which it was operated. The velocity of gas, in passing through the scrubber, should be reduced to obtain effective results, and the application of the water should be such as to insure the passing of the gases through sufficient curtains of sprays, to reduce the temperature and thoroughly wash them. To obtain satisfactory results the temperature of the gas should be reduced to 100 or 110 deg. Fahr. and the velocity should be at the rate of 300 to 350 ft. per minute, the quantity of water required depending on the quantity and temperature of the gases to be scrubbed.

The water should be applied so as to require all gases to pass through the curtains of water. The velocity of gas should not permit the water to be carried back or to short circuit, so as to prevent sufficient contact. The pressure on the spray nozzles should be such as not to offer too great resistance to the gas, and when using low pressure on the nozzles they should be spaced sufficiently near each other to give the desired curtains of water.

Estimates of the cost of carrying out the work as recommended have not been worked out in detail. An approximate figure for eliminating the public nuisance is as follows: For the New York Disposal Corporation, $100,000; the Thomas F. White Company plant, $7,000; and the Products Manufacturing Company, $25,000. These amounts might be somewhat reduced after a detail study of design and application.

No attempt has been made by Mr. Osborn to state in detail what steps should be taken, and in just what way the work should be done, as it was the object of the investigation only to determine in what way it could be done and whether it was feasible.

RECOMMENDATIONS

As a result of the studies and investigations covered in this report the following recommendations are made for the New York Disposal Corporation plant:

1. That immediate changes be made in the treatment of the insoluble gases vented from digesters through condensers, so as entirely to deodorize them, as the present practice of discharging into the boiler furnace does not deodorize the gases.

2. That special attention be given to keeping all tanks containing digested garbage, or garbage in the process of digestion, free from leaks, and that equipment not absolutely free from leaks when under pressure be kept out of service until repairs are made.

3. That gases shall not be permitted to escape at the time of opening digesters.

4. That special attention be given to all condensers to insure sufficient water being used, and at a temperature that will condense all the steam and take up all soluble gases.

5. That the present dryer plant be so constructed or changed as to prevent leakage, and reduce the amount of gases to be treated.

6. That all gases given off from the dryers shall be thoroughly scrubbed and deodorized before being allowed to escape to the atmosphere.

7. That the scrubber now installed be replaced or reconstructed, to enable the volume of gas passing through it to be thoroughly washed or scrubbed.

8. That the water supply at the plant be increased and, where necessary, pumps to be duplicated to insure sufficient water for condensing and scrubbing of gases at all times.

9. That the pumps be of a type that will assure the required amount of water being delivered and fitted with meters to show the amount used.

10. That the works and grounds at all times be kept in a clean condition.

11. That the city at all times have inspections made to determine the manner in which the work is being done.

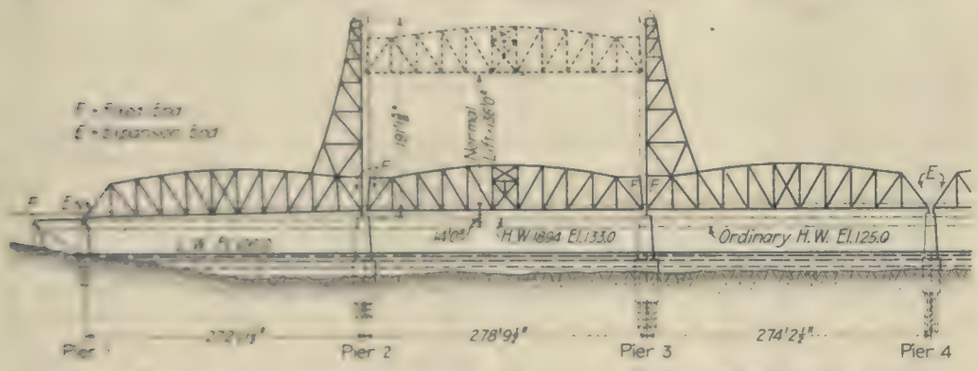
The report is followed by a detailed account of investigations made at the Barren Island plants by the city's Central Testing Laboratory, under the direction of Otto H. Klein.

A NEW STEEL PLANT IN AUSTRALIA began operations about the middle of March by the "blowing in" of a 350-ton blast furnace. One blast furnace, three open-hearth furnaces and a combination structural steel and rail mill have been completed, and sixty by-product coke ovens are under construction, all at Newcastle, New South Wales. The plant is owned and operated by the Broken Hill Proprietary Company, Ltd., of Australia, which company controls large iron-ore deposits in South Australia. The expert steel workers have been brought from various steel centers in the United States, and are, in general, under a three-year contract.

Special Pier and Floor Design Feature Pacific Highway Interstate Bridge

Riveted Steel Spans and One Lift Span Over Columbia River to Connect Vancouver, Washington, with Portland, Oregon—Curved I-Beams Used in Floor

UNUSUAL design of piers and floor system characterized the new Interstate Bridge to be constructed over the Columbia River valley, at a cost of about $1,500,000. This bridge with its approaches will extend for a distance of about 3¼ miles between the city limits of Vancouver, Wash., and the city limits of Portland, Ore. It forms one of the most expensive sections of the series of highways, included under the term "Pacific Highway," which is to extend from Vancouver, B. C., to San Diego, Cal. The distinctive features of the steel structure, which is fireproof in every particular, are the concrete piers supported on very long timber piles and constructed of two cylindrical shafts connected by a 30-in. cross wall, the curved I-beams which support the reinforced-concrete slab floor and the two-gage double-track trolley lines, and the results of comparative designs and alternative bids on draw-span versus lift-span construction for the required clear opening.



LIFT SPAN AND TYPICAL SIMPLE SPANS OF MAIN CROSSING, 3531½ FEET LONG

The Vancouver end is shown. To the right of pier 4 are ten spans each about 265 ft. long.

The main channel of the Columbia River at the site is 3500 ft. wide, with a maximum depth of 30 ft. at extreme low water and with variations from extreme low to extreme high water of 33 ft. The water rises each spring about 20 ft. and generally once in four years about 25 ft. It has reached 33 ft. only once in known history. The bed of the river consists of sand with a small amount of gravel, extending to a great depth. At the North shore very compact cemented gravel is found a few feet from the surface, dropping off to 100 ft. below about 700 ft. from the North shore. Over the remainder of the river only sand, with some gravel, was found to depths of more than 100 ft. The average elevation of the ground across the river valley is from 12 to 15 ft. above low water, so that much of it is inundated at every high-water period.

The Oregon Slough forms an important secondary channel, particularly for flood conditions. It is about 1000 ft. wide and 25 ft. deep, and is separated from the main river by an island about 1500 ft. wide. The Columbia Slough provides some drainage near the Oregon side of the valley, and is about 300 ft. wide and 20 ft. deep at low water. The bottom is of clay and sand, and hard compact gravel is found about 80 ft. below low water.

About 5000 lin. ft. of steel bridge structure and 12,000 ft. of embankment, with a secondary approach on the Oregon side for which about 6000 ft. of embankment will be built at the present time, will be used to form the crossings. The main crossing over the Columbia River consists of a series of through riveted truss spans with curved top chords, three spans 275 ft. long and ten spans 265 ft. long, together with a small deck girder span at the Vancouver end, making a total length of 3531½ ft. between end shoes.

Provision for navigation on the river is made by a vertical lift span. The central of the three 275-ft. spans is arranged to lift between towers on the other two spans so as to afford a channel 250 ft. wide at right angles to the current of the river, and 150 ft. high above ordinary high water, as shown on one of the accompanying drawings. The trusses are spaced 41 ft. center to center, with a 38-ft. roadway between them, and one sidewalk supported on brackets on one truss.

Special Pier Design

The river at the site of the bridge is subject to a certain amount of scour, but inspection of the soundings taken for many years past fails to disclose any indication of scour to extreme or unusual depth, although the river both for some distance upstream and about 3 miles downstream is deeper than at the site. The exceptional facilities for securing piles of great length at a very reasonable cost was a considerable factor in determining upon the exact type of piers to be used.

The piers are to be constructed of concrete, containing and resting on piles sunk by means of water jets to a depth of about 105 ft. below low water. Open cribs of timber, braced transversely and forming permanent parts of the pier bases, will be sunk to a depth of 20 or 25 ft. below the river bed, and the piles will be jetted down inside the cribs, averaging about one pile to 10 sq. ft. area. The details are indicated on one of the drawings.

Concrete will be deposited through the water in sufficient quantities to seal the bottom of the crib, and after this concrete has hardened the crib will be pumped out, the piles cut off a short distance below low water, and the remainder of the concrete for the pier placed in the open. The piles used will thus be about 120 ft. long, 10 or 12 in. in diameter at the top and 22 in. at the butt. Piles of this length can be purchased at the bridge site for about 12 cents per linear foot. In the typical piers under the 265-ft. spans there are ninety piles spaced about 3 ft. on centers as shown.

The upper ends of these piles are embedded from 15 to 20 ft. in the concrete of the base of the piers so that the pile forms a definite part of the pier. It is evident that even though some unusual scour should extend below the bottom of the base, the pier would still be perfectly stable. The occurrence of ice on the Columbia River is very rare, so that the concrete piers need no special protection of steel or stone facing. The shafts of the piers above the base are composed of two cylindrical battered concrete columns, one placed under each pair of bridge shoes. These columns are joined by a vertical cross wall and by a horizontal coping at the top, both of which are reinforced with steel. There is thus afforded a considerable saving of weight upon the supporting piles and the elimination of a large amount of unnecessary concrete.

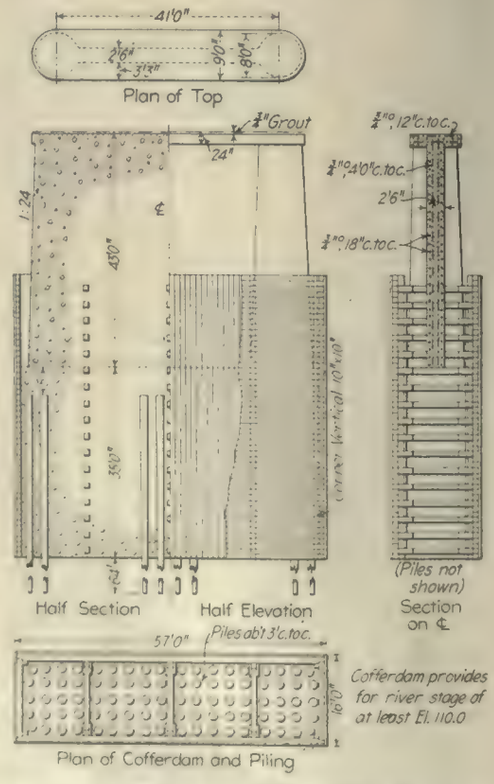
Loads and Impact Allowance

The live loads for which the structure is designed are as follows: For the floor system, 50-ton cars on both tracks, 12-ton motor trucks (with special provision for a 24-ton machinery truck) and class A uniform loading on the roadway, 120 lb. per square foot on the sidewalks; for impact allowance 50 per cent added to all the above loads except for the sidewalks; for the trusses and girders 40-ton cars on both tracks and class B uniform loading on the roadway, with impact allowances according to the following formulas:

Street car loading, $I = 230/(NL + 300)$

Roadway loading, $I = 180/(NL + 30)$

in which L is length of load producing maximum stress and N the number of loaded tracks or of lines of traffic. In no case shall impact be greater than 50 per



TYPICAL PIER 4 SHOWING CROSS WALL AND PERMANENT COFFERDAM CONSTRUCTION

cent. Class A and class B uniform loads vary with the length of truss or girder considered.

The working stresses conform to the regular specifications of the consulting engineers, which are practically the same as the A. R. E. A. standard specifications. The large number of duplicate spans and the complete detailed plans furnished to the contractors contributed toward securing low unit prices from the steel contractors. Erection without the use of falsework is planned by the erectors, who will erect, rivet and paint the spans on a dock at the shore, transfer them to barges and float them to position on the piers.

FLOOR WITH CURVED I-BEAMS

The reinforced-concrete slab floor is supported upon curved 8-in. I-beams bent to conform to the crown of the roadway and spaced about 33 in. apart. These beams extend entirely across the roadway and rest on longitudinal I-beam stringers spaced about 9 ft. apart as shown in the cross-sections, which show the floor and sidewalk details for both the truss spans and the short plate girder spans. Six 7-in. rails for the two-gage double-track street car lines are supported directly on the top flanges of the curved cross beams, to which they are fastened by standard Carnegie steel-tie clips. It is seen that the surfacing is a special 2-in. bituminous concrete which, with the 5-in. slabs, makes up the 7-in. height of rail. To afford access to the rails without injury to the roadway slab, a 5-in. space on each side of each rail is filled with concrete, as shown, and a flangeway provided by curving the top of this concrete.

It is proposed to bend the cross beams by shimming up the hot beds upon which the I-beams are run at the mill, and allowing them to form to the proper curve while cooling. The expansion joints are made by the usual type of checkered plates supported on angles upon which they slide. For the rail splices at the expansion ends manganese steel castings are placed beside the webs and one side of the rail head is planed off. Two fixed ends and two expansion ends are placed adjacent in order to reduce the number of expansion joints to a minimum. Owing to the lateral stiffness of the floor the lower laterals are lighter than would otherwise be required. Drainage intakes with downspouts are placed at 50-ft. intervals along each curb.

DETAILS OF LIFT SPAN

The 275-ft. lift span is suspended from each of its four corners by sixteen plow-steel 2-in. wire ropes which pass over cast-steel sheaves, 12 ft. in diameter, supported on the steel towers as shown and attached by a group of equalizing levers to concrete counterweights built around a steel frame. The towers are of simple riveted construction arranged so that the outer columns support all the load and the other members framing upon the adjacent trusses act as bracing only. The span is guided by cast-steel jaws which engage tracks on the tower columns. At one end these jaws guide both laterally and longitudinally and at the other end laterally only, thus allowing for expansion and contraction and for any slight variation in the relative position of the towers.

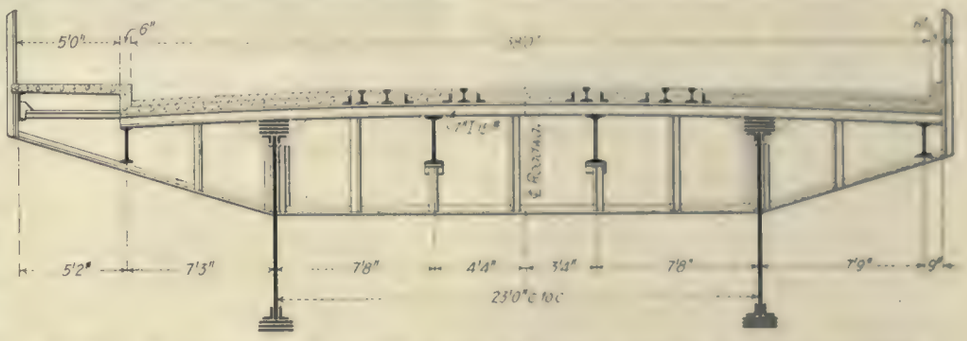
Operation is effected by means of tables, of which there are two pairs at each corner of the span. The operating machinery, which is placed on the span at its center just above the roadway clearance, consists of four spirally grooved drums connected by a train of gears to an electric motor. Each of these drums controls the operating rope for one corner of the spans. All of the drums are connected so that when they are operated in one direction ropes leading to the tops of the towers are wound upon the drums, and those leading to the bottom of the towers are played off, lifting the span by the force exerted upon the corner sheaves. The machinery for operation is thus exceedingly simple—one transverse shaft extending across the span, one pair of reduction gears in a frame inside of the house and the back gears on the motor. An indicator and a limit switch are provided, by which the current is automatically cut off and solenoid brakes are applied to the motors near the upper and near the lower limits of the run of the spans.

EMERGENCY OPERATION

To provide for emergency operation the span is equipped with a small gasoline engine connected through a speed reducer to the machinery, so that in case of failure of electric current the operator will be able to move the span at slow speed without having to seek outside assistance. There is a manually operated lock at each end of the span in connection with a centering device, so that the span may be locked down. The solenoid brakes in connection with the down haul rope also serve as a lock.

When the span is at its upper limit the counterweights are 2 ft. from the floor level, and special provision for the trolley wires under the counterweights must be made. A swinging frame on which the trolley wires are fastened is pushed down by the counterweights and returned to position by means of a small counterbalance. The rail connections at the ends of the movable span are simple scarfed joints so that the span lifts away from the fixed rails and returns to them without any movable devices.

At the ends of the fixed span adjacent to the movable spans there are provided roadway gates of substantial design to make an effective barrier across the roadway, and these are connected to the derailing switches in the street-car tracks so that when the gate is closed across the roadway, the derail is thrown. These gates will be manually operated, and a small steel and concrete cabin is provided at each for the gate tender.

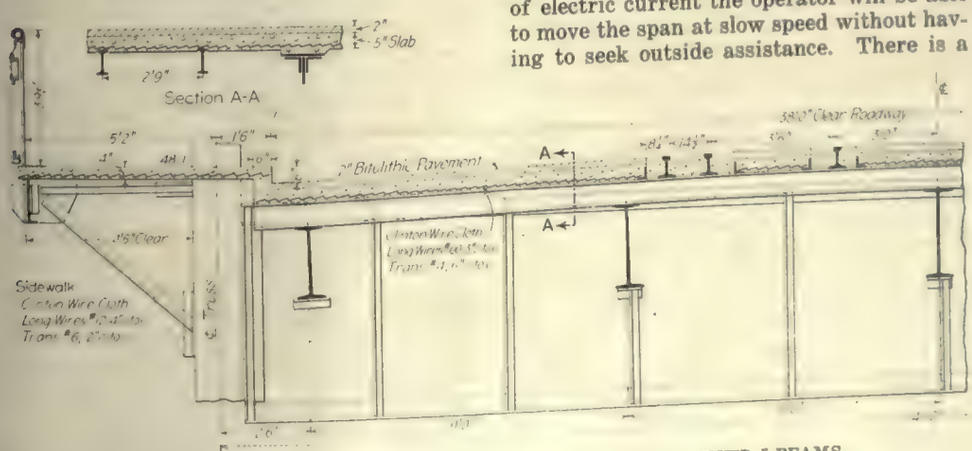


SECTION OF ROADWAY FOR GIRDER SPANS—BRACKETS SUPPORT OUTSIDE STRINGERS

RELATIVE COST OF LIFT AND DRAW SPANS

Several types of movable spans to provide the necessary channel opening for river navigation were considered, and the matter was narrowed to the selection of either a swing span or a vertical lift span. Alternate plans were prepared for the structure, one for each of these two types of movable spans, and designs made according to the same specifications and as nearly duplicate in character as possible. Application was made to the War Department and tentative approval was received for either type of movable span, provided the swing span should have two channels 200 ft. wide, and the lift span should provide one channel 250 ft. wide, with a vertical clearance of 150 ft. above normal high water.

Bids were received on both types of structure, and it developed that the lowest bid for the bridge with lift span was $70,000 less than for that with swing span. The lift span as above described was therefore adopted, not only for the advantage of the lower first cost, but also because, judging from experience in operating bridges of both types, there will be continued advantage in lower cost of operation and maintenance. It is likewise advantageous for river navigation, in that it provides a channel 250 ft. instead of 200 ft. wide, not hampered by the long draw protection required for the swing span. As the main channel is close to the Vancouver shore, the draw protection, about 500 ft. long, would have been a serious detriment to the dock frontage adjacent to the bridge.



HALF SECTION OF ROADWAY AT TRUSSES, SHOWING CURVED I-BEAMS

The construction of the bridge is the result of a popular movement originated by the commercial clubs of Vancouver and of Portland. An attempt was made to have the structure built by the two States, but when this was not successful the two counties provided funds by issuing general county bonds, after an election voting them almost unanimously. Multnomah County, Oregon, issued bonds for $1,250,000, and Clarke County, Washington, for $500,000. The contracts covering the total construction were let for $230,000 less than the money available.

The bridge is being constructed under the direction of the Columbia River Interstate Bridge Commission, comprising the bridge commissioners of Clarke County, Washington, and of Multnomah County, Oregon, with the Governor of Oregon acting in some cases. The consulting engineers, Harrington, Howard & Ash, of Kansas City, prepared complete detailed plans covering every feature of the structure and complete and definite specifications for every part. E. E. Howard, one of the consulting engineers, furnished the information for this article. Bids were called for on the unit basis, and applied to the approximate quantities of the various materials as given in the specifications. In order to secure the best possible competition, the total contract was divided into twelve units and into such divisions as seemed naturally applicable.

The contract for the superstructure of the main Columbia River Bridge was let to the U. S. Steel Products Company. The steelwork for the girder spans of the Slough bridges is furnished by the Northwest Steel Company, of Portland, Ore. The erection and painting will be done by Porter Brothers, contractors, of Portland. The substructure contract went to the Pacific Bridge Company, of Portland. The concrete floor will be placed and the pavement laid by the Warren Construction Company, also of Portland. It is expected that the bridge will be in service late in the fall of the year 1916.

Complete Railway Aids Construction of Welland Ship Canal

A DOUBLE-TRACK railway, built with stone ballast and 60-lb. rail, has been built by the Canadian Government in connection with the construction of the Welland Ship Canal.

The railway extends from a point just north of the town of Thoroid to Lake Ontario, a distance of seven miles, and its construction is for the purpose of handling excavated material from the canal prism to two long dumps in the lake forming the new Lake Ontario entrance to the canal, and for the handling of crushed stone excavated from the site of the flight locks in Thoroid to the other lock sections of the canal to be used as aggregate for concrete. A large crushing plant has been erected with a capacity of 4000 tons per day, and both this plant and the railway are now in active operation.

Since it is expected that during the summer, when all contracts are under way, there will be a train every five minutes, the entire line has been equipped with a block signal system.

The construction of the road was in charge of J. F. Pringle, railway engineer, under the direction of J. L. Weller, engineer-in-charge, Welland Ship Canal.



READY TO OPEN VALVES TO FILL SECTION WITH WATER AND SINK IT

7000-Foot Pipe Line Floated to Place in Lake Ontario in Long Sections

Lowered and Placed from Pile Bucks and Connected with Special Submarine Joints by a Diver—Terminus of Line in Large Timber Crib

By N. ADELBERT BROWN
Special Assistant Engineer, Rochester, N. Y.

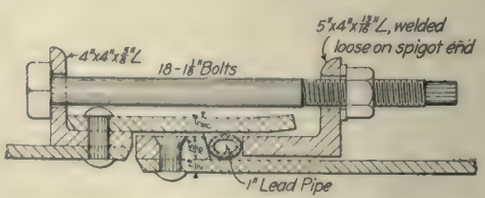
A SIXTY-SIX-INCH steel pipe line was recently laid in the bed of Lake Ontario for the discharge from the Rochester sewage-disposal plant by floating it into place in long sections, filling the sections with water, lowering them from pile bucks and connecting them with a special submarine joint. The discharge line extends from the end of the plant to the shore of Lake Ontario, a distance of 1900 ft., in open trench. From this point the pipe is submerged and laid in a dredged trench, terminating in a timber crib 7000 ft. from shore.

The straight sections of the pipe are of the lock-bar type, 66 in. in diameter, made of ½-in. steel plate in 30-ft. tapered sections. The pipe for the land section was unloaded on the site of the work. That for the lake section was delivered at a yard on the river, 2 miles away. A shallow beach and a main-line railroad track made the launching of long sections of pipe at the work practically impossible. At the yard the pipe was riveted into lengths of 120 and 160 ft. The shorter lengths were used at the outer end, where the piles would not bear the heavier loading, and near shore, where the wave action would not permit dredging long trenches.

SUBMARINE JOINT SIMPLE AND FLEXIBLE

At the ends of these pieces submarine joints, similar to those used on the intake pipe, at Erie, Pa., were placed. The joint consists of a welded angle and papered ring riveted to one end of the pipe to form the bell, and a flat ring riveted to the other end, with a lead gasket and a loose angle-ring follower to form the spigot. Bolts through the angle rings draw the gasket between the flat ring and the sides and hub of the bell. This gives a tight and slightly flexible joint. A slip joint to take up expansion was provided where the land and lake sections of the line join.

The line ends in a three-way tee, having one 66-in. and two 38-in. outlets. This tee is placed in a crib to protect it from anchors and raise the discharge above the bottom of the lake. The crib is 46 ft. square and 24 ft. high. It is built of 12 x 12-in. timbers, and divided into twenty-five pockets. These were filled with stone, except where occupied by the pipe, and the crib was surrounded with riprap. The sills of the crib are 4 ft. below the bottom of



JOINT EASY TO CONNECT UNDER WATER

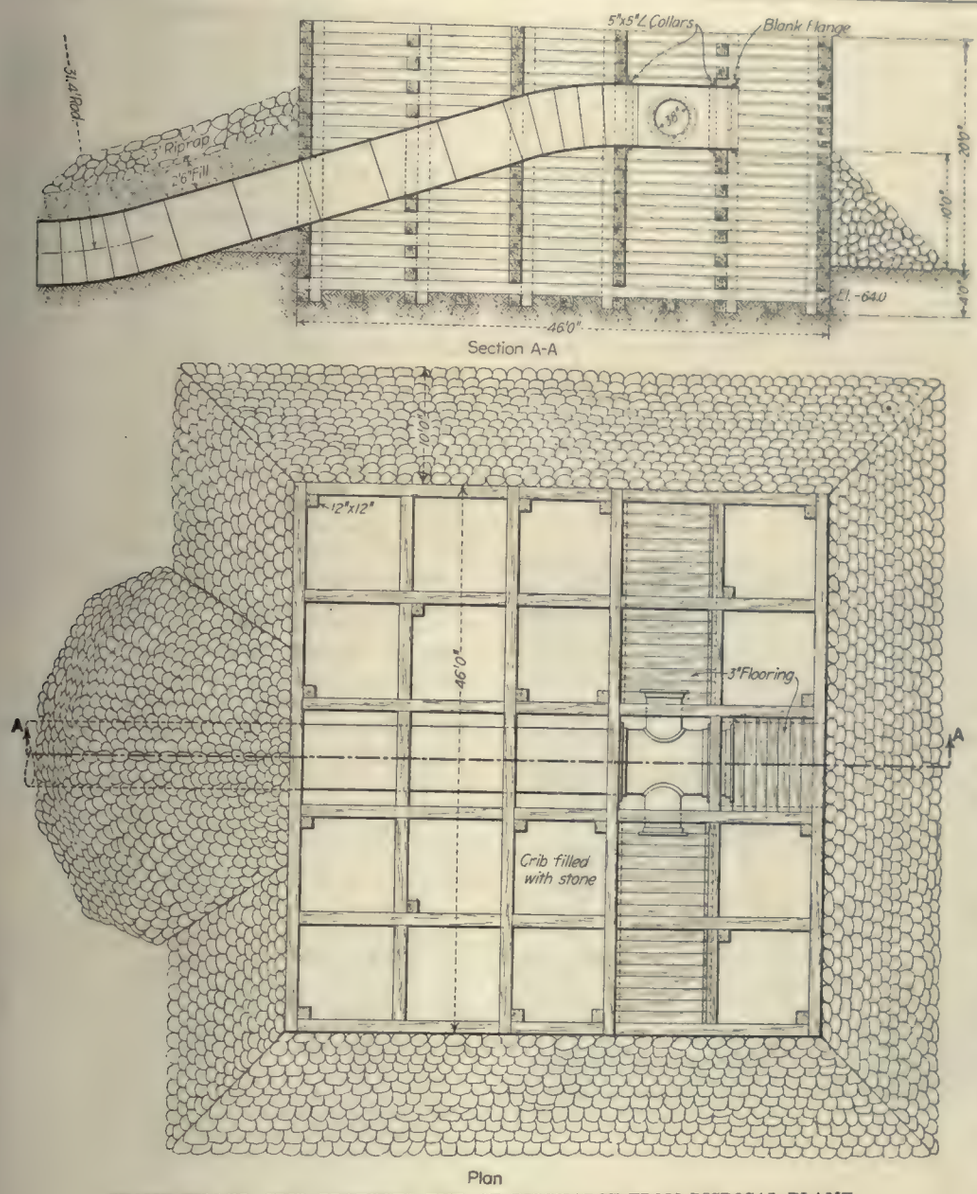
the lake and the top is 26 ft. below low water.

HYDRAULIC DREDGE DIGS TRENCH

An 8-ft. trench was excavated by a hydraulic dredge to allow 2½ ft. of cover over the pipe. No attempt was made to excavate holes for the joints, as it was found to be more satisfactory to do this with a jet as the pipe was laid. In the excavation it was found that the fine sand would stand on a 1:1 slope. Where clay was mixed with the sand the slope was 4:1.

Work started at the crib and progressed toward shore. After the excavation was made the location of the crib was marked on three sides with piles. The crib was towed to position and suspended by cables from two derrick scows, and the pockets were filled with stone. It was then gradually lowered to place.

To lay a section of pipe a buck of four piles was driven at each end of the section.



STONE-FILLED CRIB PROTECTS END OF DISCHARGE FROM DISPOSAL PLANT

These piles were built up of three 5 x 12-in. timbers, were driven 10 or 12 ft. in the ground and extended 10 ft. above water. They were driven on 14-ft. centers and the tops were drawn to 10-ft. caps to give stiffness. They were capped across the pipe line with round timbers, and the two bents were tied together along the line with 2 x 8-in. plank, on which other plank were laid to form a working platform. On the caps another round timber was set, parallel with and over the line of the pipe. A set of Manila rope falls was hung from the upper cap on a U-bolt. When the rigging was in place a pipe section, which had been bulkheaded and launched at the yard, was towed to position between the piles, and cables were placed around each end of it and shackled to the lower block of the falls. Valves in the bulkheads were then opened and the pipe was filled with water, after which the tackles were slacked off by hand and the pipe was lowered to place. When near grade a diver descended, removed the bulkheads and directed the work from below. A line from the middle of the pipe extending to the forward pile buck, was held taut as the pipe descended, swinging the pipe endways away from the bell already on the bottom. When at grade this line was slacked and the spigot slipped into the bell. The bolts were entered by the diver, but the nuts were drawn up by men at the surface with a tackle attached to a ratchet wrench.

To permit the removal of all tackle before backfilling, a cable was passed under the free end of each section of pipe and drawn up to the caps with eyebolts. After the backfill had settled these cables were removed and the piles pulled.

The work was done by the T. A. Gillespie Company and completed in fourteen months. The contract price, which included furnishing and laying both the land and lake sections, was $250,000.

PANAMA CANAL TOLL EARNINGS reached the $4,000,000 mark Sunday, June 6. The earnings during May were $547,054.60.

Compares Losses in Concrete and Mortar Lined Canals

Reclamation Engineer Concludes from Experiments That Concrete Made with Clean Sand and Gravel Is Superior to Mortar

WATER LOSSES in concrete and mortar lined canals have been observed for some time by H. D. Newell, project manager of the Umatilla reclamation project in Oregon. In the June "Reclamation Record" he gives the following data, which include losses due to seepage and evaporation:

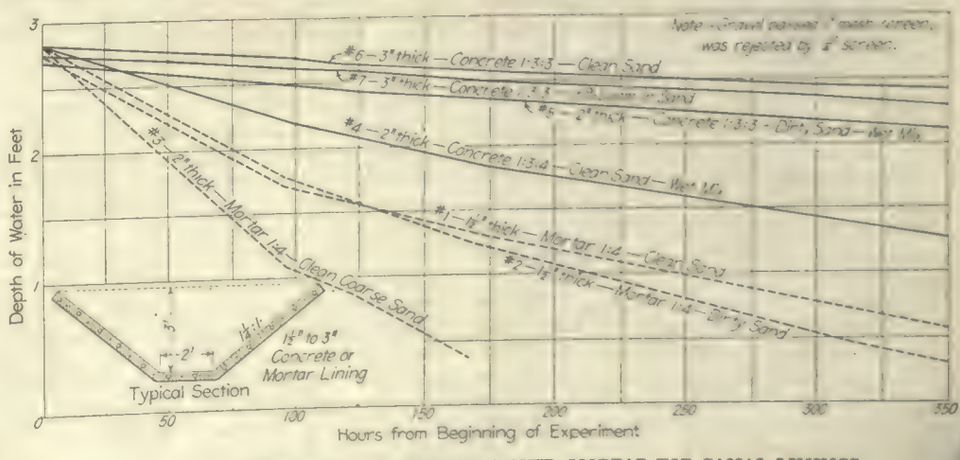
In 1910 a section of canal about 1000 ft. long, located in a sandy fill, was lined with a 1-in. thickness of mortar composed of 1 part of cement to 4 parts of sand. This section has a bottom width of 3 ft., a depth of 2 ft., and 1½:1 side slopes. Dams were placed at either end, and observations indicated a loss of 0.2 ft. vertically in twenty-four hours. The lining passed through several winters without injurious effects from frost.

In 1911 another canal was lined with a 1½-in. thickness of 1:4 mortar. This section has a bottom width of 4 ft., a depth of 4 ft., and 1¼:1 side slopes. The lining was somewhat damaged by frost. Obaervations made the following summer indicated that the losses on the 2.2-mile length of canal were less than the probable error of the measuring instruments.

In 1913 a section of small lined canal was constructed in a sandy formation for experimental purposes. It was divided into seven sections, each 8 ft. long in the clear, by concrete walls 4 in. thick. When these basins were first filled with water the seepage losses were quite large. After one or two preliminary wettings all the basins were filled, and observations continued for fifteen days. The results are shown graphically in the accompanying diagram.

REDUCED RATE OF LOSS AS DEPTH OF WATER DECREASES

A noteworthy point indicated by the diagram is the reduced rate of loss as the depth of water decreased, as indicated by the slope of the lines. This tendency is less marked for sections 5, 6 and 7, which probably indicates that these losses are principally the results of evaporation, which is independent of the depth, as is further shown by the records of evaporation from the Cold Springs reservoir on this project. The latter showed a loss by evaporation of about 0.03 ft. in twenty-four hours, and it is probable that the loss from the canal section was greater than this, as it was located on the south slope of a sand pit.



CURVES SHOW SUPERIORITY OF CONCRETE OVER MORTAR FOR CANAL LININGS

Inverted Bridge Which Should Have Failed Carries Heavy Load

THE BRIDGE of 45-ft. clear span, shown in the accompanying photograph, has supported three 15-ton dinkies at one time, in spite of predictions that it would collapse when thus loaded. The rails forming its compression members are practically unsupported laterally from end to end. If the sticks forming the "tension members" were free to deflect, as a line of pin-connected eye-bars would be, a concentrated load of 6 tons on the middle of the bridge would crumple both rails.

The two logs, depending on their soundness, would support a concentrated load of 10 to 16 tons at the center of the span without breaking. They undoubtedly deserve full credit for the fact that the bridge did not collapse, although they are said to be old white pine "glance booms," or floating fenders, that have been water soaked for years and later thoroughly dried out.

If the rails had been put underneath, as could have been done by raising the grade of the track, thus inverting the structure, they would easily have supported a concentrated load at the center of the span more than equal to the three 15-ton dinkies, and that without putting the logs in any danger from compression.



THIS BRIDGE IS SAID TO HAVE SUPPORTED TWO 15-TON DINKIES

REDUCING ROAD TRANSPORTATION COST in Kansas by only 2 cents per ton-mile, according to the State highway commission in its latest biennial report, would mean a saving to the consumer or an increase to the farmer of nearly $1,500,000 per year. The cost of transportation by water is about ¼ cent and by rail about 4/5 cent per ton-mile. On a well-improved public highway the cost of hauling is from 5 to 12 cents per ton-mile, and on an ordinary road from 20 to 50 cents per ton-mile. The average cost of hauling farm products in the United States is 23 cents per ton-mile. A careful investigation in Kansas has shown that the weight of the average load of farm products is 2960 lb., the average length of haul to market is 5.5 miles, the average time required to make a round trip is 4.5 hours, and the average cost of hiring a driver and a two-horse team and wagon for a 10-hour day is $3.50. This gives an average of 21.5 cents per ton-mile, or about thirty times as much as by rail.

Prolonged Stress and Corrosion Crack Copper Alloys

Tests by Ernst Jonson Indicate That 20,000 Pounds per Square Inch Is Practical Ultimate Strength for This Group of Materials

LONG-TIME tension tests of copper alloys, exposed to ammonia for the purpose of providing conditions of accelerated corrosion, have disclosed the fact that cracks are liable to occur when the stress exceeds 20,000 lb. per square inch. This is the conclusion reached by Ernst Jonson, engineer-inspector in charge of the testing laboratory of the New York Board of Water Supply, in a paper, "Fatigue of Copper Alloys," presented before the American Society for Testing Materials at its annual meeting in Atlantic City, N. J., June 22-26. Mr. Jonson discussed the same subject in an article, "The Cracking of Drawn Brass," in the Engineering Record of April 11, 1914, page 415.

From the results of his investigations, Mr. Jonson concluded that the ordinary ultimate strength of brass is developed only when the metal is broken so quickly that cracks do not have time to develop, and that when a stress exceeding the yield point is applied for a considerable time the metal will fail by cracking. The working hypothesis formed for the purpose of co-ordinating these facts and to guide further investigations is as follows:

CORROSION WEAKENS FLAWS

In copper alloys there are microscopic flaws. When the tensile stress approaches the yield point these flaws are opened sufficiently to admit corrosion. This corrosion weakens the edges of the flaws and causes them to increase under the continued action of the stress, and thus a continuous crack is formed which gradually increases in depth. When the crack has so reduced the cross-section that the stress on the remaining solid portion exceeds the ultimate strength, the rod breaks.

In order to determine more definitely the magnitude of the stress at which cracking begins another series of tests has been started. Each test was made as follows: A tension test specimen of 1 in. diameter and 8 in. length, with a reduced diameter of 0.8 in. and 6-in. gage length, was placed in the testing machine. A sheet steel cup with a 1-in. hole in its bottom was put on top of the lower grip so that the end of the test specimen passed through it, and the cup was filled with strong ammonia. Some absorbent cotton was tied to the test specimen so as to keep it wet by capillarity, and the cup and test specimen were covered by a conical paper hood so as to confine the ammonia fumes. A stress of 10,000 to 17,000 lb. per square inch, increased by increments of about 3000 lb. per square inch at intervals of a day or more, was applied to the test specimen. Under the higher stresses the test specimen continued to stretch for a considerable length of time, and in such cases this time was added to the interval between the additions of load.

The test specimen was examined before each increment of load was applied. When the first crack was seen the test was concluded, because experience has shown that a crack once started will increase in extent until the test specimen fails, even if the load is not increased. The cracks were similar to season cracks; the largest was generally found where the test specimen emerged from the liquid. In some cases this crack was the only one present; in others there were quite a number of cracks distributed over the length of the test specimen.

In order to discover what alloys are subject to failure by cracking all the usual copper alloys will be tested.

The stresses at cracking are as follows:

STRESSES OF COPPER ALLOYS AT CRACKING

Kind of metal	Stress at cracking, lb. per sq. in.
No. 1. Manganese bronze, plain extruded..	27,000
No. 2. Manganese bronze, plain extruded..	23,000
No. 3. Manganese bronze, plain extruded..	23,000
No. 4. Naval brass, plain extruded.....	20,000
No. 5. Muntz metal, plain extruded.....	23,000
No. 6. Gun metal, cast 88 Cu, 10 Sn, 2 Zn..	23,000

It appears that the stress at which cracking occurs bears some relation to the elastic limit, but this relation has not yet been definitely established. Present results indicate that the metal is liable to cracking when the stress exceeds the elastic limit by 5000 lb. per square inch.

EFFECT OF RED LEAD

Four specimens of manganese bronze have been under excessive stress for many months but have been protected from corrosion. These specimens have not cracked. Some manganese-bronze studs which were found cracked in valves in the Catskill Aqueduct were made up with red lead. One test bolt, therefore, was embedded in red-lead paste and drawn up to a stress in excess of the initial yield point. In the part of the bolt where the red lead remained liquid the surface of the metal was stained and cracks appeared.

Two specimens of plain-extruded manganese bronze were corroded, one in ammonia, the other in a mixture of ferric chloride and hydrochloric acid, and then broken in the testing machine. The specimens gave ultimate strengths of 65,300 and 60,000 lb. per square inch, and elongations of 43 and 42 per cent respectively. These results, which are quite normal, indicate that corrosion does not generally injure brass when it is not under stress while being corroded.

The results thus far obtained may be summed up as follows:

1. Prolonged excessive stress does not injure the metal when it is protected from corrosion while under stress.

2. Corrosion does not generally injure the metal when not accompanied by excessive stress.

3. Corrosion accompanied by prolonged stress less than 20,000 lb. per square inch does not generally injure the metal.

4. Corrosion by ammonia accompanied by a prolonged stress of 20,000 lb. per square inch or more causes cracking similar to season cracking.

5. The foregoing results apply to manganese bronze, naval brass, Muntz metal and gun metal.

6. No copper alloy has as yet been found to which these results do not apply. It is possible, however, that such exceptions exist, either on account of higher elastic limit or greater resistance to corrosion.

CONCLUSION

Practical experience with season cracking indicates that ammonia is not the only corrosive agent which causes cracking in overstressed copper alloys, but that the corrosion which results from the common conditions of exposure also produces cracking. Ammonia, therefore, may be regarded as a representative corrosive agent, although it attacks these alloys more quickly than the average exposure. The test with ammonia may be regarded as an accelerated test which in a few hours produces results which ordinarily would require days, weeks or months to develop, but which do not differ in kind from the results of the more common forms of exposure. Since all copper alloys in practical use are exposed to various corrosive agents it is probable that sooner or later all metal in use will be affected by corrosion, just as much as the test specimens in the tests here reported. Therefore, it follows that the results obtained from these tests may be expected wherever copper alloys are permanently stressed over 20,000 lb. per square inch.

It seems, therefore, that we are justified in drawing the conclusion that forgible brass and gun metal, and probably copper alloys in general, should never be stressed in practice to 20,000 lb. per square inch. In other words, 20,000 lb. per square inch should be regarded as the practical ultimate strength of this group of materials. The working stress should therefore be taken as a safe fraction of this stress, say 5000 lb. per square inch.

An important corollary of this conclusion is that the process of manufacturing rods of copper alloys must be so planned that no appreciable initial tensile stress is left in the surface of the rod, and that the proper inspection of drawn rods must include strain measurements. Another important corollary is that copper alloys cannot be depended on where the stress is indeterminate, for in such cases it may or may not exceed the safe stress. These alloys, therefore, should not be used for important bolts when there is the least occasion for drawing them up very tight.

Letters to the Editor

Comment on matters of interest to engineers and contractors will be welcomed

Military Preparedness an Insurance for Peace

SIR:—I want to express my appreciation of the inclusion in the Engineering Record of June 19, page 768, of General Wood's article on "Military Preparedness an Insurance for Peace."

I do not know why any engineering journal should not point out just this kind of thing. It seems to me quite appropriate that the Engineering Record should give space to General Wood's excellent remarks on the hopelessness of unpreparedness. As engineers, we have a duty to perform in educating the public up to the fact that war is an engineering business, and that engineers are a very large factor in war, and that we cannot hope to have successful war without preparation.

I congratulate you on the spirit of the Record, which can take up patriotic questions of this kind.

JOHN W. ALVORD.

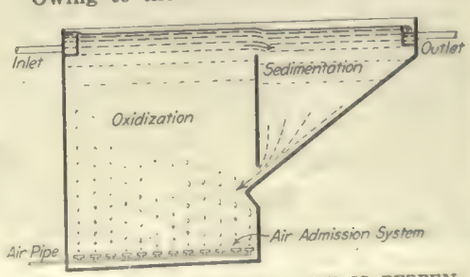
Chicago.

Activated Sludge and the Baltimore Sewage Experiments

SIR:—In operating the converted Imhoff tanks at Baltimore sewage treatment plant for the activated sludge experiments on a continuous flow basis there is danger of short circuiting, that is, that particles of raw sewage, due to the air agitation, will reach the outlet before the proper time of oxidation and reduce the degree of purification desired in the effluent. Indeed, short circuiting may prevail to such an extent as to defeat the whole object of the experiments. Both Mr. Schoonmaker and myself had this in mind two months ago.

It seems to me that a proper oxidation period will more nearly obtain when the flow of sewage through the oxidation and agitation chamber is perpendicular to the direction of the agitating air bubbles. In our experiments as laid out to fit the existing tanks the sewage flow is parallel to the direction of the air bubbles, that is, directly upward. I have noticed in our laboratory bottle experiments, where the air is admitted through a tube at the bottom of the bottles, that the liquid is displaced much more in a vertical than in a horizontal direction, or that the cycle of any particle of liquid has the shape of an oval or ellipse with its major axis vertical. This would seem to show that in a tank designed for horizontal flow all particles of sewage have a better chance of remaining in the oxidation chamber for the proper period than in a tank designed for vertical flow.

Owing to the lack of definite knowledge of the subject at the present time it is rather difficult to state how a horizontal-flow, activated-sludge tank should be designed. Experiments must be made and data collected upon the necessary oxidation and sedimentation periods, possible degrees of purification, quantity of air needed and length of time it will take the activated sludge to go back to its ordinary condition after aeration is discontinued.



SKETCH OF TANK WHERE FLOW IS PERPENDICULAR TO COURSE OF AIR

It may be possible to design a horizontal, continuous-flow, activated-sludge tank according to the accompanying sketch. If it is impossible to design the tank with the sedimentation compartment having a bottom steep enough to cause the sludge deposits to settle back into the oxidation chamber, then power-driven squeegees, endless chain-scrapers or false floor plates made to tip-tilt, perhaps would answer the purpose. In such a tank care should be taken to provide weirs or baffles to insure an even distribution of the inflowing sewage across the width of the tank.

GUSTAV J. REQUARDT,
Acting Division Engineer, Baltimore Sewerage Commission.

Baltimore.

Technical Literature Classification

SIR:—The Joint Committee on Classification of Technical Literature, 29 West Thirty-ninth Street, New York City, is extremely desirous of obtaining the assistance of your readers in making a collection of classifications of applied science which have been developed independently in the offices of manufacturing plants or engineering firms, especially those which exist in manuscript form, and have been used for filing or indexing data.

The committee would especially like to have copies of any extensions of present systems to cover any special industry or branch of engineering not now fully covered by the published classifications.

W. P. CUTTER,
Secretary.

New York City.

Examinations Held After Positions Are Temporarily Filled

SIR: On page 753 of your issue of June 12 appears a letter from W. R. Robinson, secretary, Illinois State Civil Service Commission, animadverting an article on page 695 of your issue of May 29.

Mr. Robinson says "the bars are not 'let down for three of the positions,' as stated." He says further that the examination for these three positions "does not include a written test on technical matters." It consists of an inquiry into education, training, experience, personality and reputation, supplemented by an oral interview "which will afford an opportunity to judge the personality of the applicant."

May I inquire through your columns if it is not a fact that the three positions to be filled under this proposed examination are already held by "temporary" employees?

ROBERT ISHAM RANDOLPH.

Chicago.

[A copy of Mr. Randolph's letter was sent to the Illinois Civil Service Commission. In reply W. R. Robinson, secretary, states that with the exception of assistant chief utilities engineer, all of the positions under the Public Utilities Commission are now filled temporarily, pending the results of the examinations which have recently been announced.—EDITOR.]

HINTS FOR THE CONTRACTOR

Details Which Save Time and Labor on Construction Work

Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

[Contributions to this section are solicited, and if found available will be paid for. They must be SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

"Dirt Bucker" Used in Idaho for Making Fills Over Marshy Ground

FOR MAKING fills across marshy ground in connection with Idaho State road work, the device shown in the accompanying photograph, called a "dirt bucker," is used. It consists of an ordinary Fresno scraper fitted to the forward end of a frame supported on two wheels in the rear, similar to that of a "hay bucker" such as used on western ranches for moving hay from the field to a stacker. The material is pushed ahead of the team by the frame in making fills across wet, marshy places too soft to hold up the horses. The dirt is first dumped at the end of the fill and the "bucker" is simply used for pushing it ahead, taking the place of dump men. According to Edward S. Smith, Idaho State highway engineer, it has proved very effective and economical.



WITH THIS TOOL TEAM WORKS ON SOLID FILL TO SPREAD SPOIL IN SWAMP

Frame Enables Slanting Holes to Be Bored Under Water

A TIMBER frame, hung at correct line and grade from two guide-planks, was used to bore slanting holes in the piles under water for anchor rods on the Municipal Pier at Chicago. This pier was described on page 778 of the Engineering Record for June 19, 1915. The augers used were driven with compressed air. Operators are shown in the photograph standing on the frame to bore the holes, but this was not always done in rough weather. Above the guide blocks the long auger shanks are fitted with a universal joint, so that men could stand on an oscillating raft and keep the machines going even when the waves were quite high. The rods were inserted by men in rubber suits standing on a submerged raft. This was easy because of the accurate boring possible with the frame.



FRAME LINES SLANTING AUGER HOLES BORED WITH UNIVERSAL JOINT DRIVE

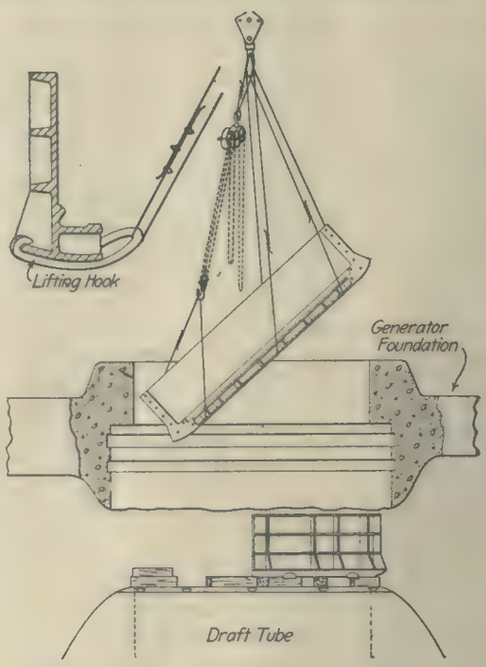
Unusual Rigging Used to Set Heavy Turbine Parts in Close Quarters

By F. M. BIERSACH
Erection Superintendent, Allis-Chalmers Manufacturing Company

IT was necessary to lower four half-ring castings, each half of one ring weighing 7 tons, and each half of the other, 9¼ tons, through an opening of less diameter than the rings in erecting the turbines for the Coon Rapids power plant of the Northern Mississippi River Power Company. The two halves of the base ring were each lowered to the top of the draft tube, or foundation, in three slings which hung them at an angle with the horizontal, allowing them to pass through the hole in the station floor which formed the generator foundation. Chain blocks were inserted in the longest sling to level up the casting after it had passed through this hole. The slings were kept from slipping by lugs on the castings.

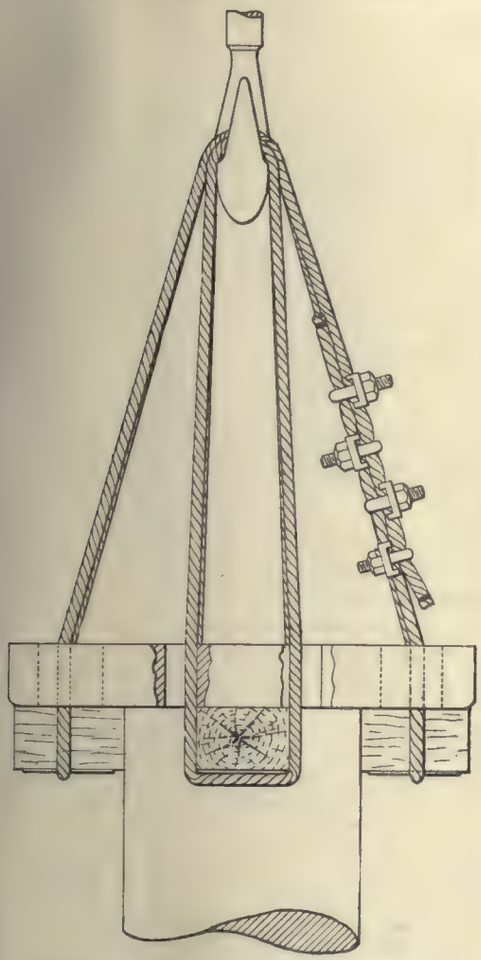
The bottom ring was assembled, aligned and leveled on jacks, and grouted into the top of the draft tube. The top ring was then lowered in the same way and assembled on blocking on the bottom ring. Four lifting hooks, shown in the sketch, were then slipped under the assembled ring and used to lift it into the recess left for it in the generator foundation above. Here it was blocked up while the distance bolts, spacing it from the base casting, were screwed into nuts grouted in with the lower casting. The upper ring was then lowered onto these bolts, which held it to proper elevation. The adjustment for line was made with four jacks set between the outside of the ring and the concrete, and the ring was grouted in.

The first of the five turbines was ready



CHAIN BLOCK HITCH ON HALF OF RING

Ring was assembled, bolted together and raised to position with four lifting hooks.



SLING OF SINGLE LENGTH OF WIRE ROPE HOISTED 38-TON RUNNER

for installing the 38-ton solid cast-iron runner before the eye-bolt which was to be screwed into the shaft of each runner in turn to raise it had arrived on the job. The runner was successfully hoisted, however, by the flanged coupling at the top of the shaft. This coupling had eight bolt holes, through which a single length of ¾-in. steel cable was rove and clamped as indicated in the sketch. Wood blocks were inserted in each loop below the coupling to protect the cable from the sharp edges of the boltholes and equalize strains on the coupling, and the loops above the coupling equalized over the crane hook. This was done very carefully, and would have been impossible if four separate slings had been used. It enabled the runner to be suspended absolutely level.

This erection was carried out by the writer for the Allis-Chalmers Manufacturing Company.



DISTANCE BOLTS SPACE TOP-PIT RING FROM RING IN DRAFT TUBE

Subway Undercrossing Walls Concreted from the Top Down

THICK concrete supporting walls are being placed from the top down in constructing the crossing of the Canal Street subway under the recently completed Center Street loop in New York City.

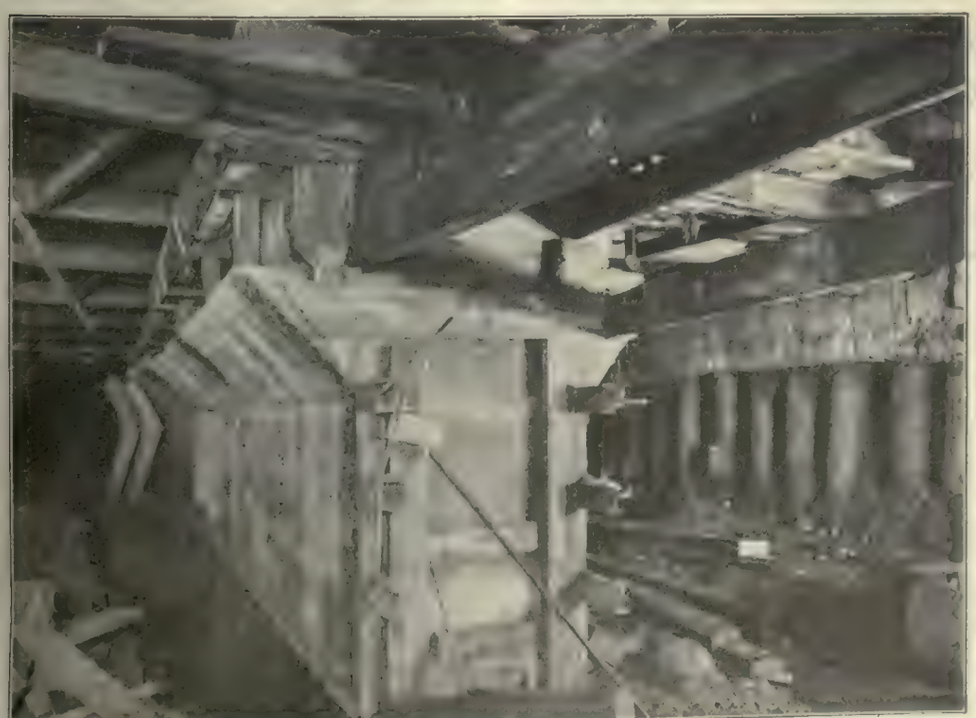
The weight of the Center Street subway is carried on rows of closely spaced metal pipe piles filled with concrete. These piles were spaced so as to clear the tracks and passageways of the new subway and to be entirely enclosed in walls of this latter work when completed. They were driven at the time the Center Street subway was built with the present Canal Street construction in view. The process of building the walls of this new subway not only gave additional weight to be supported but also destroyed partially the carrying value of the piles by exposing them and destroying skin friction and lateral support. It was necessary, therefore, to construct these walls in such a way as practically to underpin the overhead Center Street subway during the process.

The new subway passing below the present subways on Lafayette and Center Streets will connect the express tracks of the new Brooklyn rapid transit subway on Broadway with the Manhattan bridge. The contract is known as section 2 of route 20. As may be seen from the drawing on page 26 the Canal Street subway at this point consists of two tubes for express tracks and two footways, the latter connecting the stations of the three subways. The floor system of the Center Street subway is designed to span the two passageways and the two tubes and is supported by five concrete-encased transverse box girders. These were underpinned at the time they were built with two rows of piles each. These piles reach well below the subgrade of the new cut.

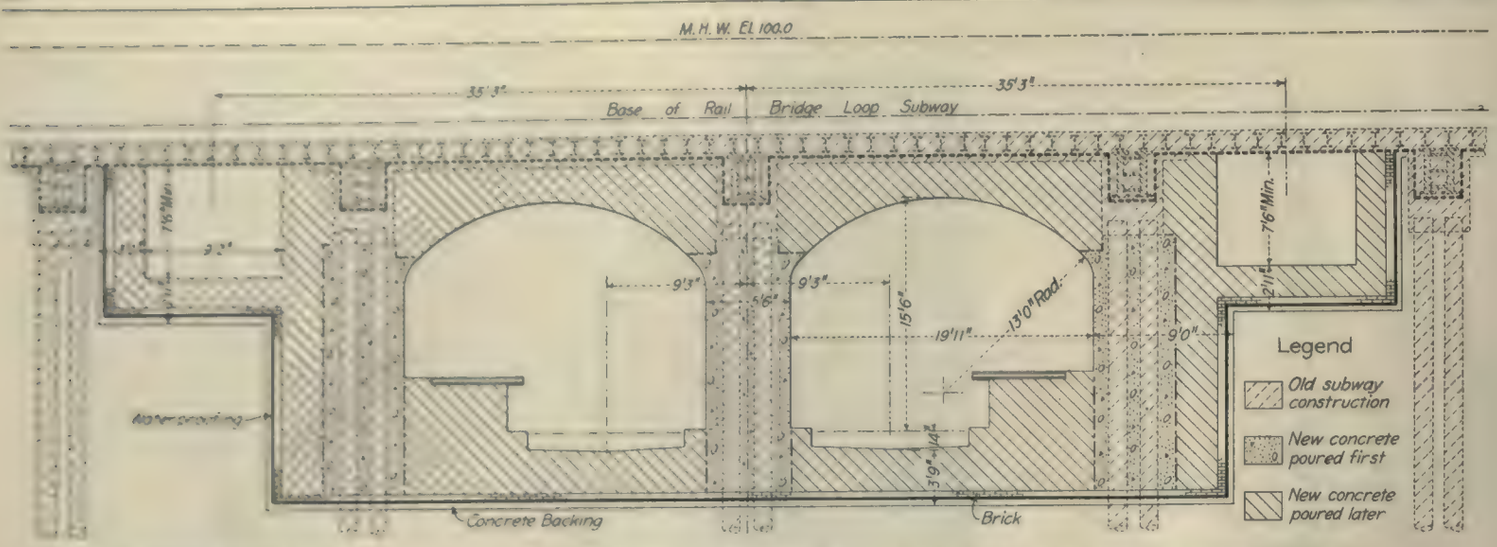
CONSTRUCTION METHODS

The construction method of the new work was to drive headings immediately under the floor of the present subway, exposing the girder capping the piles and about 6 ft. of the piles themselves. Forms were set up reaching above the spring of the arch and were poured from this shoulder. At first in a portion of this work the piles and cap were exposed for a considerable distance for the purpose of examination, and the walls were concreted in 20-ft. lengths. In the remaining portion of the first, or upper section only one piece of 20 ft. of wall was concreted at a time, and the piles were only exposed immediately in advance of this concreting. In this way only a small group of piles was robbed of lateral support and skin friction, and this group was immediately surrounded by a heavy concrete wall which not only supported the piles laterally but also had a firm bearing on the soil below, thus aiding in carrying the direct load.

While this concrete was setting up the



TOP SECTION OF MIDDLE WALL UNDER CANAL STREET SUBWAY CONCRETED FIRST—PILES EXPOSED AT RIGHT WERE LATER INCLOSED IN CONCRETE OF SIDE WALL



CENTER STREET SUBWAY SUPPORTED ON PILES PREVIOUSLY DRIVEN WHILE WALLS OF UNDERCROSSING WERE CONCRETED

balance of the necessary excavation between the walls was completed down to its base. Forms were then stripped and trenches were dug under these walls and around the piles, making the excavation deep enough to give working head-room and keeping above the level at which the ground water was held by the pumps. Forms were then set up in the trench and the concrete was poured through a shoulder at the top of this second form, which had to be chipped off later. This second section of wall was also concreted in 20 ft. panels and the trenching was only carried ahead fast enough to keep out of the way so all walls at all times had a firm bearing on the soil below except the 20 ft. panel then under construction. While this concrete was setting up the general excavation was carried down to its base. The forms will now be stripped and in the same general way trenches will be dug and the third section put in, taking the wall to subgrade. The arch and invert will be concreted last. The waterproofing is placed directly against the board lagging on the outside of the outside trenches and the walls concreted directly against it.

The present Center Street subway is in no way disturbed during these operations, the roof carrying several feet of backfill with the pipe lines, conduits, surface car tracks, etc. Concrete retaining walls, above the walls of the existing structure, on each side of Center Street, were poured in trenches and carefully backfilled before the main excavation began. This method avoided the necessity of decking Center Street and providing for overhead pipe crossings.

The Underpinning & Foundation Company is the contractor for this section. John B. Goldsborough is chief engineer of the company and W. T. McKibben is superintendent for this contract. For the Public Service Commission J. O. Shipman is division engineer for the first division, and A. J. Mayell is assistant division engineer, with B. A. Hodgdon section engineer.

Hydrochloric Bath Removes Rusty Scale from Reinforcing Bars

A BATH for rusty reinforcing rods has been obtained by the Chicago, Rock Island & Pacific track elevation engineers after much experimenting and is now being used in cleaning tons of rusty, scaly rods in connection with Chicago track elevation. The bath is composed of three parts of hydrochloric acid and one part of water. Two wooden troughs about 35 ft. long, 18 in. wide and 12 in. deep are used, one for the hydrochloric bath and the other for water only. The more badly rusted rods are left in the bath about 20 minutes, depending on the amount of rust. They are then washed in running water in the water box. Using one dollar's worth of acid, two



WATER WASHES ACID OFF CLEANED RODS

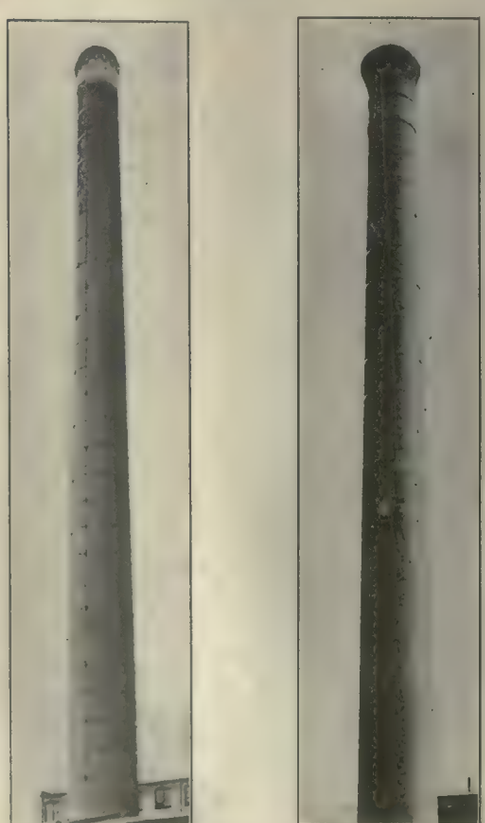
men cleaned in an eight-hour day 1826 ⅞-in. and 1550 ½-in. rods, average length 30 ft.

Tall Brick Stacks Repaired Rapidly Under Difficulties

WHAT is claimed to be the largest smokestack banding and repairing job while the chimney was in use has recently been completed for the Simmons Manufacturing Company, Kenosha, Wis. The top 12 ft. of the stack was torn down and rebuilt in three days. Several years ago the smokestack was struck by lightning and although the cracks that resulted had never proved serious, it was decided to be on the safe side and repair the stack.

Peter Drolshagen, Chicago, the contractor, put on thirty-two 4 x 12-in. wrought-iron bands, 6 ft. apart, the height banded extending 190 ft. up from the breeching. By means of a cable rigging carried from band to band he was able to reach the top, where he found the stack in poor condition. As a result he had to take down 12 ft. of the stack and rebuild it, putting on a hood. The company shut down its plant and drew its fires on Thursday night and on Monday morning the contractor turned the stack over in time for work. As Friday was a holiday the company did not suffer any appreciable time loss. The work was carried on in a thick fog.

Another chimney banding job, in which Mr. Drolshagen had to start his banding from the top, was recently completed for the Baltimore & Ohio Railroad at Chicago. In this case to get his tackle and rigging to the top he shot a line up through the chimney from the bottom. The line, coiled around the mortar from which it was shot, had a weight on the end. This was shot several hundred feet in the air, and fell over the top of the stack. Stouter cable was pulled up and over, and a man sent up, who fastened the tackle at the top. Then working from the top down, the bands were placed on the tall patient. In order to get the tackle and ropes down when the work was finished, a large hook was hung on the lip of the chimney. On this hook a smaller hook was hung, with a pole about 3 ft. long attached. By juggling the rope the pole caught in the large hook, pulling the smaller hook out and dropping ropes and tackle to the ground.



TWO STACKS REPAIRED UNDER SERVICE

The top 12 ft. of the stack on the left was rebuilt in three days.

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

Miami Conservancy District of Ohio Is Organized

On June 28 the Miami Conservancy Court authorized the organization of the Miami Conservancy District of Ohio by a vote of five to four. The court had previously convened at Dayton on June 24 to consider the petition for organization, and on motion of the petitioners to amend their original petition to exclude Logan County and part of Shelby County the court of ten judges voted in favor of the amendment, and the judge from Logan County was excluded. The court unanimously appointed Edward A. Deeds of Dayton, director for the seven-year term, Henry M. Allen of Troy, director for the five-year term and Gordon S. Rentschler of Hamilton, director for the three-year term.

Creation of New York State Engineering Department Urged

Nelson P. Lewis, chief engineer of the Board of Estimate and Apportionment of New York City, and E. P. Goodrich, consulting engineer to the president of the borough of Manhattan, appeared in Albany, N. Y., June 25 to urge before the Committee on Canals of the Constitutional Convention and the Governor and other State officers, the adoption of a proposal for creating a State department of engineering. They represented a committee of engineers made up of delegates from the New York City Engineers' Club, the American Society of Civil Engineers, the American Institute of Electrical Engineers, the American Society of Mechanical Engineers, the American Institute of Consulting Engineers and the Municipal Engineers of the City of New York.

The plan is to create a department headed by three commissioners appointed for twelve-year terms, which will gather under one control the offices of State engineer, highway commissioner, Canal Board, Department of Public Works, and other minor State engineering offices. The measure looks toward eliminating politics from the engineering work of the State, and relating all the engineering services required by the State in an efficient group under the control of a central body, which will be in office long enough to plan and carry out effective construction.

The movement has the unanimous and hearty support of all of the engineering bodies throughout the State.

Bills for Lake Erie and Ohio River Canal Become Law

The Lake Erie and Ohio River canal bills passed by the last Pennsylvania Legislature have been signed by Governor Brumbaugh. The bills provide for the continuance of the canal commission of five members, with a somewhat different distribution of authority, and permit the counties interested to vote on bond issues to help pay for the canal.

Irrigation System Unharmed by Imperial Valley Quake

Brick Buildings Suffer Most—Waterworks Systems Were Not Injured and the Few Fires Started Were Easily Controlled

A dozen or more tremors which occurred in the Imperial Valley region of Southern California June 22 and 23 caused some loss of life and a heavy property damage, but left the extensive irrigation system unharmed. Six persons killed, all of whom were on the Mexican side of the boundary line, and perhaps two score injured, is the extent of the casualties reported, while the property loss is variously estimated at from $500,000 to $1,250,000.

The first of the series of shocks that rocked the valley came at 8.05 p. m. June 23, others followed at 8.55, 9.30 and 10 p. m. and during the remainder of the night there were occasional shocks of lessening violence. The buildings in the various towns of the Imperial Valley are chiefly of light construction, and these suffered heavy damage. That there was not a far greater loss of life is due primarily to the fact that the heavy destructive shocks were preceded by a slight warning quake which caused practically the entire population to rush into the streets in time to escape the falling walls later.



DAMAGE TO RECENTLY LAID BRICKWORK WHERE MORTAR SHOWED NO BOND



BRICK COLUMN, 2 BY 3 FEET, SHEARED



FRAME HOUSE MOVED OFF ITS FOUNDATION, BUT APPARENTLY UNINJURED

About 100 buildings were wrecked or seriously damaged. El Centro suffered the greatest loss and Calexico next, while Heber, Holtville, Imperial and Brawley were less seriously damaged. Niland and Calipatria in the northern part of the valley were unharmed. A few serious fires started, but these were checked before they became general conflagrations that could endanger the wrecked towns. That more extensive fire loss did not occur is due, undoubtedly, to the quick action of the operator in the Holton Power Company's plant in El Centro, who cut off the power immediately when the first shock was felt.

Nature of Quake

The force of the earthquake was exerted in an east and west direction, and in both El Centro and Calexico the walls that faced east or west were damaged most; in fact, very few of them were left intact in either of these two towns. Many buildings moved east or west on their foundations. No "fault line" has been discovered, and the earthquake is thought to be in some way related to volcanic disturbances south of the boundary line in Mexico. It is reported that evidences of such disturbance have been frequent of late in the vicinity of Volcano Lake in spurting jets of steam and hot water.

Practically all structures in the Imperial Valley were deserted after the earthquake; business has been suspended altogether, and families are camping on their lawns until the buildings can be repaired or declared safe. A temporary outdoor telephone exchange has been established and telegraphic connections have been maintained continuously since the first quake. On the morning after the earthquake a meeting of the city trustees of El Centro was called by the chairman of the board, and a resolution was passed instructing Frank Harris, city architect, to start an immediate inspection of the buildings of the city. Those damaged are to be rebuilt or condemned at once. Practically all the commercial enterprises will be promptly rehabilitated, it is reported.

That the delivery of water in the canal system was not even interrupted is the cause of general rejoicing in the Valley where the crops of the season are dependent entirely upon a regular water supply. Neither the levees nor the canal were seriously injured. There was a small landslide in the Alamo waste channel which can be repaired for about $2,000, but beyond this there is no indication that the structures of the system have been subject to the racking strains of an earthquake. At Sharp's heading the ground cracked and settled badly, but the concrete structure which is the key to the major part of the system stood firm, as did the high New River flume upon which all the West Side water users are dependent.

Damage to Buildings

Brick work appears to have suffered most, though many of the buildings of this class demolished were evidently constructed with a poor grade of mortar. Many of the bricks came out clean, with no mortar adhering to them, and breaks usually followed the joints. It is well known that lime mortar does not develop full strength for many years, and all of these buildings had been constructed in the last eight years. Several reinforced-concrete buildings escaped undamaged, including the new plant of the Holton Power Company at El Centro. The old brick plant of this company was damaged where the walls were not supported by tie rods, although its roof trusses remain standing, and one of its generator units is still in operation. The Hotel Barbara Worth at El Centro was a reinforced-concrete frame building with brick walls and partitions. The brick work cracked, suffering most on the interior of the building, but the reinforced-concrete frame appears to be uninjured. The El Centro water system, including a brick and tile pumping station and a 75-ft. steel tower tank, was not injured.

American Society for Testing Materials Holds Annual Meeting in Atlantic City

Considers Measures Governing the Adoption of Standards and Ways of Increasing the Financial Strength of the Society

Chief among the happenings of general interest, at the meeting of the American Society for Testing Materials in Atlantic City last week, were the approval by those in attendance of measures to insure a still more thorough consideration of proposed specifications before final approval and the strengthening of the financial position of the society by increasing the dues. The general impressions gained from the meeting are recorded editorially on page 1 of this issue. Only such reports and papers are referred to below as are of interest to civil engineers and contractors.

Government and Finances

The meeting approved and passed on to letter ballot an amendment which would provide that all proposed new standards or proposed amendments of existing standards should on two-thirds vote of those voting be printed in the year book as "tentative standards," on which written discussions addressed to the appropriate committee should be invited. At the next annual meeting these proposed new standards or proposed amendments would be subject to amendment by a two-thirds vote of those voting and to reference by a like vote to letter ballot of the society. A two-thirds vote of those voting would then be required for adoption. This requirement, it is provided however, may be set aside by nine-tenths vote of those voting at the annual meeting and the proposals be sent at once to letter ballot. The same procedure would apply to proposals regarding "recommended practice" as to standards.

The report of the executive committee discussed at length the present financial status of the society and put forth various suggestions as to methods of increasing the revenues and decreasing the expenditures. By a unanimous vote, the first session voiced the sentiment that there should be no curtailment in the present policies of the society, but that a solution of the financial situation be found in raising further revenue. Following the meeting at which this resolution was passed, the executive committee considered the various plans and brought in a recommendation that the dues of members be raised from $10 to $15 a year and those of junior members from $5 to $7.50 per year. This recommendation was unanimously approved and passed on to letter ballot of the society. All other recommendations as to increasing revenues and curtailing expenses, as discussed in the report of the executive committee, were discarded.

The present membership of the society was announced as 1842.

The committee on papers and publications announced that for this meeting all of the papers and committee reports were preprinted, the total amounting to 968 pages. As has been done for the last two years, complete sets of pre-prints were handed to each member upon registration, so that every one in attendance was provided with all of the material coming before the meeting for discussion. As in the past this plan was highly commended by those in attendance.

The officers elected for the ensuing year were announced in the last issue of this journal, while the annual address of the president on "Rail Specifications" will be found on page 8 of this issue. A paper by Ernst Jonson on "Fatigue of Copper Alloys," which aroused considerable discussion, is also printed in this issue, page 22.

Steel

The committee on standard specifications for steel brought in an extensive report recommending some proposed standard specifications, certain revisions in present standards and a number of proposed tentative specifications. Most of these, however, appeal to specialists in other lines and not to civil engineers and contractors. Of the proposed standards passed to letter ballot and of interest to civil engineers were those for quenched high-carbon-steel splice bars, quenched carbon-steel track bolts and quenched alloy-steel track bolts. New matters to be taken up during the coming year by the committee through appropriate sub-committees are specifications for screw spikes, tieplates and ties and standard holders for 2-in. tension test specimens. An appendix to the report of the committee gave an outline of the studies and conclusions of a subcommittee which has been studying the finishing temperatures of rails. This committee summarized its conclusions as follows:

"In all of the information as to actual tests which we are able to obtain there is lacking anything which points to such decided differences in the quality of rails rolled at varying temperatures, as theoretical considerations have led some of us to expect. The differences are so slight that it seems hardly justifiable to go to any great expense in determining finishing temperatures any more accurately than is possible with the shrinkage clause, which on account of its easy application is by far the most convenient means of checking the finishing temperature."

The report of the committee on standard methods and a paper on "Elastic Limits," by T. D. Lynch, brought out a spirited discussion on the proper form of contact for extensometers. While at the beginning of the discussion a two-point instrument seemed to be favored, the three-point contact seemed to have the indorsement of most of those present. The chief conclusions drawn in Mr. Lynch's paper were that commercial accuracy can be had with a two-point contact instrument reading to 0.0001 in. per inch of gage length with a testing machine running continuously up to the yield point; that it is practicable to use an extensometer in commercial testing as well as in research, and that the society should establish practical methods of making extensometer tests in commercial laboratories, so that common conclusions can be reached by those making tests. As a result of the discussion it was voted that the recommendations of the committee on standard methods of testing with reference to determination of elastic limit, proportional limit and yield point be printed for another year in the year book.

At the session devoted to testing apparatus, papers on the failure of materials under repeated stress, by H. F. Moore and F. B. Seeley, and on "A Laboratory Method of Determining Pressures on Walls and Bins," by J. Hammond Smith, were very well received. The apparatus designed by Mr. Smith was especially commended, and the view expressed that it might result in adding considerably to our information on pressures on retaining and bin walls.

Cement and Concrete

The committee on standard specifications for cement reported that it had received the report of the joint conference, composed of representatives of the American Society for Testing Materials, the American Society of Civil Engineers and the United States Government, and that it had voted that the report be referred to subcommittees of its own committee for study and report. It further announced that the committee had voted to request the executive committee of the American Society for Testing Materials to ask the governing bodies of the other interests represented in the joint conference to refrain from publishing the data in the conference report until they could be more thoroughly studied. The committee

also reported that its subcommittee on the autoclave test had concluded that this test should not for the present be adopted, because the investigations do not as yet show that the method is superior to the present test for soundness. It was also reported that a subcommittee had reached the conclusion that the Chapman method for determining consistency was not as yet reliable, and that further investigations should be made.

The report of the committee on standard tests of concrete and concrete aggregates reported its program for the coming year, which is reprinted on page 14 of this issue.

A paper on the "Micro-Structure of Concrete," by Nathan C. Johnson, was received with much interest and carefully discussed. Henry S. Spackman and P. H. Bates disagreed with Mr. Johnson that there were relatively large groups of unhydrated particles of cement to be found in concrete. They believed that the groups so termed by Mr. Johnson were really particles of clinker. Furthermore, they did not believe that the cracks running through concrete, which Mr. Johnson explained as being due to the expansive forces of salt crystallizing in initial pores, were really formed in that manner. They were of the opinion that these cracks were due to shrinkage.

Ceramics and Lime

Standard specifications for paving brick, proposed by the brick committee, were approved by the meeting and sent to letter ballot. Similar action was taken on standard specifications for quicklime and hydrated lime, which had been offered as tentative specifications last year and had been printed for one year in the year book.

Much discussion followed the paper by Edward Orton, Jr., on "The Legal Interpretation of the Word Vitrified as Applied to Ceramic Products." It was felt that the subject was of much importance, and since it concerns all committees dealing with ceramic material, it was voted to refer the paper to the committee on brick with instructions that the committee confer with committees studying other clay products.

The report of the committee on standard specifications and tests for clay and cement sewer pipe brought in proposed tentative "recommended practice" for the laying of sewer pipe. This specification was brought in with the clear understanding that engineering practice of this sort is outside of the province of the American Society for Testing Materials, in the belief that this was a very special case. It was decided to send the proposal to letter ballot to be adopted as purely tentative, with the understanding that the entire subject of the extent to which the society should go into matters of practice should be taken up by the executive committee, the committee on drain tile and the committee on sewer pipe for a broad discussion of the entire question. It is the expectation of the executive committee that a full report on this most important subject will be brought in at the next annual meeting. Sentiment in the session was strongly in favor of continuing the present limitation of the society's activities—to specifications for materials only, leaving engineering practice to other organizations.

Proposed standard definitions of terms relating to sewer pipe, proposed by the same committee, were sent to letter ballot.

The committee on gypsum and gypsum products, recently organized, reported that it had appointed subcommittees on gypsum for various uses, on gypsum plasters, on structural gypsum products, on testing methods and on nomenclature.

Timber and Road Materials

The committee on standard specifications for timber brought in a proposed revision in the standard classification of structural timber, abandoning the longleaf and shortleaf classification and substituting therefor the grades of dense Southern yellow pine and sound Southern yellow pine. The former calls for six rings to the inch, showing at least one-third summer wood, or else one-half summer wood for wide-ringed material. Proposed revisions were also brought in for the standard specifications for yellow pine bridge and trestle timber, and while objection was made to the wording of both of these revisions they were ultimately passed to letter ballot. Proposed tentative specifications for Southern yellow-pine piles and poles to be creosoted, for other Southern yellow-pine timber to be creosoted, and for the sampling and analysis of creosote oil, were brought in and ordered printed in the year book for one year.

Certain proposed revised definitions brought in by the committee on standard tests for road materials were passed to letter ballot, while some nine definitions on non-bituminous materials were referred to a conference committee representing both the road committee and the committee on concrete and concrete aggregates. Certain other definitions were referred back to the committee on road materials for reconsideration. Proposed standard definitions reported by the joint committee representing committees D-4, C-9 and D-8 were passed to letter ballot. A proposed tentative method for the determination of the penetration of bituminous materials, offered by this committee, was ordered printed in the year book.

Dr. Newell Urges Co-operative Engineering Publicity

A recent proposal of Dr. F. H. Newell, former director of the U. S. Reclamation Service, looking to the creation of a central agency for co-operative publicity regarding engineering achievement, was the subject of discussion at an informal meeting of engineers at Buffalo, June 24. The meeting was called by Dr. Newell during the week of the spring meeting of the American Society of Mechanical Engineers.

His suggestion has for its prime object the advancement of the material welfare of engineers. To accomplish this end he has proposed systematically and intelligently to educate the public, through the press and otherwise, to a proper appreciation and understanding of the work done by engineers, and the service which the engineer is prepared to render in civic affairs. The widespread desire for a better understanding of the engineer by the public was reflected at the meeting, and the time was thought to be opportune for beginning a movement with this purpose in view.

From the many written opinions received by Dr. Newell, and also from the discussion at the meeting, it was evident that there is a general feeling that the machinery for doing this work already exists in the several engineering societies, once it is thoroughly organized and directed toward the common end. Several of these societies, particularly the local societies, are now co-operating with the local press in producing articles of popular interest concerning engineering work. In many cases these articles prove to be of more than local interest, and could be more widely utilized through a central organization. The publicity work being done by the engineering societies of several of the large cities was discussed at some length. The opinion seemed to prevail that much useless repetition and waste of effort is already going on among the various organizations, through the lack of means for diffusing the experience of each society among the others.

Several other benefits which might accrue from the proposed co-operation were also discussed. The advantages of what might be termed a National employment service, affording a local society an opportunity to keep in touch with the supply and demand elsewhere, were brought out. In this way one society, finding difficulty in placing all of its unemployed locally, might take advantage of outside demands. The possibilities of securing better legislation through co-operation between the different societies was also pointed out.

A later conference was suggested at the meeting, to which representatives from many of the societies interested will be invited with a view of perfecting an organization for launching the work proposed by Dr. Newell.

Railroad Takes Lead in Planning Flood Prevention

The Union Pacific Railroad has made at its own expense a survey of the Kaw River watershed in Kansas, Nebraska and Colorado, which is considered by the officials of the road detailed enough to warrant the assertion that the disastrous floods frequently experienced in this district could be controlled by twenty-six earth dams. The reservoirs behind these dams would occupy a little more than 100,000 acres, and would be located on the tributary streams of the Kaw. This, it is said, would be much less expensive than to locate reservoir sites in main valleys, which are all under cultivation, and in which are railway lines that would have to be relocated. The estimated cost of $11,500,000 is only about five times the sum already spent to safeguard Kansas City, Kan., from the Kaw River. The interest and maintenance on this reservoir system is estimated at a little less than $600,000 yearly. This sum, the railway officials believe, would be much more than earned in eliminating the serious yearly damage to crops on the watershed. As was pointed out by engineers who made an investigation of this scheme for the U. S. War Department some years ago, these dams could not be counted on to develop power which might be sold to pay the interest on their construction. To be effective, the reservoirs would, of course, have to be empty at the beginning of the season when heavy rains may be expected.

Besides damaging crops, floods on this watershed have caused large direct losses to the railroads by washing out tracks. No figures have been given out, but it is well known that every recent flood on this watershed has seriously interrupted traffic on the Kansas division of the Union Pacific system.

A. M. Mohler, president of the Union Pacific Railroad, hopes to interest the public officials of the three States mentioned in this plan, which would require State aid for its realization.

Engineers Condemn Power Development Scheme in Missouri

The Associated Engineering Societies of St. Louis recently adopted a committee report which characterized as impracticable a power canal now being urged before the Missouri Legislature. The proposed plan is to develop hydroelectric power to supply the city of St. Louis by constructing a canal from the Missouri River to the Meramec River. The sponsors of the scheme would use a supposed fall from the Missouri to the Meramec to develop 200,000 hp. The committee report referred to states that at certain stages of water, which occur frequently during the year, the flow in such a canal would actually be reversed, and that there is no continuous difference in the elevation of the two rivers which could possibly be used to develop electric power commercially.

Los Angeles Engineering Societies Unite in New Organization

The Los Angeles Chapters of Seven Technical Societies held a banquet in that city on June 15, at which a new organization, to be known as the United Technical Societies of Los Angeles, was founded. Brief addresses were made by William Mulholland, Samuel Storrow and James A. B. Scherer, president of Throop College of Technology, the subject of the evening being "The Service of the Technical Man to the Community." It was announced that Gen. George W. Goethals, Governor of the Panama Canal Zone, would be invited as guest

of honor and principal speaker at the next meeting to be held early in September. The societies represented in the new organization are the American Society of Mechanical Engineers, the American Society of Civil Engineers, the American Institute of Electrical Engineers, the American Institute of Mining Engineers, the American Chemical Society, The Engineers' and Architects' Society, and the Institute of Architects.

Structural Society Condemns Shopping for Steelwork

The dulness in domestic structural-steel construction which has continued for some time seems to have brought out a practice which, it is claimed, has been very bad for the steel contractors and fabricators. After advertising for bids on the steelwork, and using the lowest received to secure a general contract, it is said that some firms have taken advantage of the present condition of the market to obtain lower prices by disregarding the original low bidder and peddling the steelwork around still further. To correct this condition the Bridge Builders and Structural Society has adopted a resolution condemning the practice and terminating as follows:

"Be it further resolved: That on and after July 1, 1915, the members of the Bridge Builders and Structural Society will endeavor to induce, as a matter of fairness and justice, all owners and architects to receive prior to or simultaneously with bids of general contractors a separate and distinct bid on the structural-steel requirements where the aggregate is in excess of 250 tons, such bid to be publicly opened, with the understanding that the most favorable bid will be accepted, or recommended for acceptance if the general contract is let."

State to Construct Ocean-to-Yuma Highway Route

The State of California has decided to construct the last link in the Ocean-to-Yuma highway lying between the San Bernardino County line and Yuma. This decision was made on the advice of the Highway Advisory Board at Sacramento after two bills, each carrying an appropriation for $100,000, had been passed by the State Legislature for building two roads over this territory. There had been great rivalry in the matter of choosing the road through Imperial County, which resulted in the passage of the two bills.

Governor Johnson refused to sign both of these and called a conference of the Advisory Board with the result that funds will be supplied from the motor and vehicle tax and convict labor from the State penitentiary will be used on the construction. This will enable the road to be built without the delay necessary if funds from the new $15,000,000 bond issue were to be used.

Riverside and San Bernardino Counties are to contribute $500,000 jointly toward the new road, and Imperial County is to build all the bridges and culverts at an estimated cost of $50,000.

Alaskan Timber Reserve No. 1, 200 Miles Long, Established

In order to prevent the timber needed for the construction of the Government railroad and its branches in Alaska from falling into private hands and necessitating repurchase by the Government, President Wilson has signed an order establishing an extensive timber reserve, approximately 200 miles long and from 5 to 10 miles wide. The reserve follows the route of the railroad along Knik Arm and Cook Inlet and up the Susitna valley to Broad Pass, and also includes the proposed branch line to the Matanuska coal fields. Only the timber, not the land itself, is reserved, states a bulletin from the U. S. Department of the Interior, and it is not the intention of the Government to make any unnecessary restrictions which will tend to retard development along the line of the railroad. When it shall be determined that no more timber is needed within a locality, the lands within that locality will be eliminated from the reserve.

Engineers Must Get Together

In the course of a recent talk before the San Francisco Association of Members of the American Society of Civil Engineers, Charles Warren Hunt made an appeal for more united action in other than technical matters on the part of the engineering fraternity. The following is quoted verbatim from his address:

"The time has come when engineers must realize the necessity for united action in all matters which affect the profession. There is no need of additional professional societies. What we need is united effort and the cultivation of a spirit of compromise which will subordinate narrow, individual views and foster and expand human and social elements in the profession. Why should not engineers of all kinds and types get together, and in so doing advertise in a perfectly proper and legitimate way, by educating the public to a better realization of what the profession accomplishes and what its services are worth?

"In the five national societies of civil, mining, mechanical, electrical and naval engineers there are approximately 30,000 trained minds, most of them pulling in different directions. Why should these able and keen-minded men allow other professions to outstrip theirs in matters which are not purely technical? Why should we not realize that in addition to being technically proficient we must be men of affairs, club men, civic men, broad men, whose influence in the body politic shall be recognized by all our fellow citizens?

"There are already signs of an awakening in this direction. We are working together for the coming International Engineering Congress; for eight or ten years the National Societies have been united in the annual award of the John Fritz medal; the Engineering Foundation for research work has been started by a fund of $200,000 donated by an engineer, and which is to be administered by representatives of all branches of engineering. These and other plans, which are likely to develop in the near future, indicate a general realization of the necessity for concerted action, and emphasize the fact that this necessity is apparent to those who have given thought to present conditions."

Building Data League Organized

The Building Data League, Inc., has been organized as a corporate association of consumers, for the purpose of securing through co-operation exact and reliable information as to the quality and economic value of the vast number of materials, methods and devices offered for use in the construction and equipment of buildings.

The league's purpose is to establish market standards in the building industry, in order that demand may find definite expression. Through the work of the league the consumer may readily secure accurate information and a working knowledge of available materials, methods and devices. Reciprocally, the league will focus upon the producer the demand of the consuming class for the attainment and maintenance of high standards and honorable methods in the manufacture and marketing of his product.

The league will accept such standards of quality as are established by recognized authorities, but where such standards are lacking, the league will establish them for its use through co-operative research, investigations and examinations. The products will be given a market rating with regard to their value measured by such standards.

Since a considerable amount of time will be necessary in order to make the needed investigation, an agreement has been made by the league with the Building Data Company, Inc., to do the necessary work. This company has been especially formed for the purpose of rendering technical service to the league.

As an indication of the diversity of subjects covered, committees have been formed on non-ferreous metal products, fireproofing and fire protection, electrical devices and equipment, sanitary equipment, building stones and structural methods. There are in all seventeen technical committees.

The incorporators and first directors are engineers and architects from, principally, New York City and vicinity, though Boston and Chicago are included in the first list of directors. Among the incorporators are, Gustav Lindenthal, consulting engineer, New York, and Prof. James C. Macgregor of Columbia University. Among the directors for the first year are: Frederick A. Burdett, Job R. Furman, Prof. Charles. W. Killam and Mr. Lindenthal, all members of the American Society of Civil Engineers. Among the directors of the Building Data Company, Inc., is William A. Aiken.

Offices of the league are at 105 West Fortieth Street, New York City.

After Four Years Chicago Smoke Committee to Talk

The committee of the Chicago Association of Commerce on smoke abatement and electrification, nearing the completion of its comprehensive investigation of Chicago's smoke problem, plans to make in the near future a series of preliminary reports comprising various phases of its extensive inquiries.

The work of this committee has continued nearly four years under the direction of a chief engineer and a technical staff of between fifty and one hundred engineers, inspectors and other assistants. The data which the committee has selected for its report fill several thousand pages.

All American Countries Invited to Road Conference

Under the auspices of the American Highway Association, the American Road Builders' Association and the Tri-State Good Roads Association, a Pan-American Road Conference will be held in Oakland, Cal., Sept. 13-17, 1915. A program is being prepared which it is believed will thoroughly cover the subject of road building and street improvement. The papers presented will be prepared by men who are prominent in their respective fields.

Invitations to attend and to appoint delegates have been sent to the Governors of each State, the Lieutenant Governors of the Canadian Provinces, and to the Presidents of the South American Republics.

News of Engineering Societies

The Cleveland Engineering Society went to Buffalo June 24 in a body on a special steamer to attend the meeting of the American Society of Mechanical Engineers.

The Albany Society of Civil Engineers held a meeting at Keeler's Maiden Lane Hotel, June 22, at which Harold E. Hilts, representative of the American Portland Cement Manufacturers of Philadelphia, spoke on "Concrete Roads."

The American Institute of Consulting Engineers found it necessary to postpone the meeting schedule for June 29 at the Engineers' Club, New York City. At the next meeting, which will be held in the fall, important business will come up for decision.

The Society for the Promotion of Engineering Education held its annual convention at the Iowa State College, Ames, Iowa, June 22. Anson Marston, dean of the engineering division of Iowa State College, and president of the society, presided over the session.

The Pacific Northwest Society of Engineers held its thirteenth annual convention in Se-

attle, June 17-18. Oscar S. Bowen, principal assistant engineer of the Great Northern Railway, delivered an illustrated lecture on the snow-sheds near Scenic, Wash. Marvin Chase, president of the society, delivered the annual address. Jesse A. Jackson is secretary and M. H. Strouse assistant secretary of the society.

The National Paving Brick Manufcturers' Association will hold its annual meeting in Dayton, Ohio, Oct. 11 and 12. This arrangement will enable its members to attend the meeting of the American Society of Municipal Improvements which will also hold its annual meeting in that city Oct. 12-14, and will give engineers of Ohio, Indiana, Kentucky and other States, who have not hitherto been members of the latter society, an opportunity to become acquainted with its purposes.

The Engineers' Club of Baltimore, at its annual meeting held recently, elected Oscar F. Lackey president. The other officers elected were: W. Watters Pagon, vice-president; John M. Mackall, chairman of the house committee; R. Keith Compton, W. W. Crosby and Ezra B. Whitman, members of the board of directors. At the organization meeting of the board of directors held later, William D. Janney was re-elected secretary-treasurer. The next meeting of the club will be held the first Thursday in September.

The Western Society of Engineers, bridge and structural section, held a postponed meeting June 24, at which C. N. Bainbridge, office engineer of the Chicago, Milwaukee & St. Paul Railway, presented a paper on grade-crossing elimination in cities. Data from this paper were presented in the Engineering Record of June 19, page 770, and it was there stated that the paper was presented as scheduled June 14. After the abstract referred to had gone to press it was learned that on account of the Chicago street-car strike the meeting was postponed.

Personal Notes

A. K. Nicolaysen, appointed assistant city engineer of San Antonio, Tex., to design special bridge work for the city, has resigned with the completion of this work.

Paul Nash has been reappointed city engineer of Stamford, Conn., for a term of four years. Mr. Nash has been city engineer of Stamford for the last fourteen years.

William N. Jones, special engineer in charge of the construction of the new filters for the city of Minneapolis, left the city's service on July 1, following the completion of the plant.

Benjamin E. Winslow, consulting architectural engineer, of Chicago, has been appointed architectural engineer for the Chicago Building Department to succeed J. Norman Jensen.

Frank E. Davidson, architect and engineer, of Chicago, has been elected president of the Illinois Society of Architects. Mr. Davidson is also a trustee of the Western Society of Engineers.

W. G. Hare has been appointed resident engineer on the construction of a pier and pumping plant for the Scripps Institution for Biological Research of the University of California, at La Jollá, Cal.

R. McA. Beemfield, recently superintendent of construction on the $500,000 State armory just completed at San Francisco, has taken charge of the construction of the State Normal School being erected at Los Angeles.

George E. Goodwin, assistant engineer, with the United States Government, has gone to Fort Klamath, Ore., to take charge of the construction of roads and bridges to be built this summer in the Crater Lake National Park.

F. C. Dreyfus has been appointed county engineer for Lake County, Florida. Mr. Dreyfus has recently been in charge of special highway work at Tyler, Tex., and was formerly county engineer of Covington County, Alabama.

Louis Mitchell, assistant professor of civil engineering at Syracuse University, who has been on a year's leave of absence to take graduate work at the Massachusetts Institute of Technology, completed his work there and was awarded the degree of Master of Science, June 8.

H. E. Bilger has been given the degree of master of science by Bucknell University. Mr. Bilger is road engineer of the Illinois State Highway Department. He was formerly senior highway engineer with the United States Government, and has had a large experience in road building and railway work.

B. G. Slining has severed his connection with the Southwestern Engineering Company of San Antonio, Tex., of which he has been vice-president for the last three and a half years. After a trip to Chicago, Mr. Slining will return to San Antonio to take up the investigation of several hydraulic developments.

Frank R. Farnham has joined the staff of Walter B. Snow, publicity engineer and advertising agent, Boston. Mr. Farnham was previously with the McGraw Publishing Company, in charge of copy service department for Engineering Record, *Electrical World, Electric Railway Journal,* and *Metallurgical and Chemical Engineering.*

William A. Smith, formerly in charge of grade-crossing elimination work on the New York Central & Hudson River Railroad in the vicinity of New York City, has been appointed village engineer of Tuckahoe and town engineer of Eastchester, N. Y. He will also maintain an office for the purpose of practising as consulting engineer at Tuckahoe.

Maj. Wildurr Willing, Corps of Engineers, U. S. A., has been detailed to superintend the construction and repair of aids to navigation in the Fifteenth Lighthouse District, relieving of this duty Col. Curtis McD. Townsend, Corps of Engineers, U. S. A., division engineer of the Western Division. Major Willing was formerly under the immediate orders of the St. Louis district engineer office.

Sutton Van Pelt has engaged in consulting work, including engineering construction, with an office at La Porte, Ind. Mr. Van Pelt has been connected with the U. S. War Department in the design and construction of locks, dams and canals in Alabama and Michigan. He has also been engineer and manager on many important construction projects in the Central States.

Lieut.-Col. Jay J. Morrow, Corps of Engineers, U. S. A., will go to Panama early in August to assist Lieut.-Col. Chester Harding, who, it is understood, is to take the place next November of Gen. George W. Goethals as Governor of the Canal Zone. Colonel Morrow will then succeed Colonel Harding as engineer of maintenance of the canal. Colonel Morrow is now in charge of the First Portland (Ore.) District of the Northern Pacific Division. Under this district are the Government improvements to the Columbia, Willamette, Coquille and Coos Rivers, including the Dalles-Celilo Canal.

Thomas L. Fountain, of the Fountain-Shaw Engineering Company of Dallas, Tex., has been appointed engineer of sewers for the city of Dallas. He was graduated from Cornell University in 1905. As assistant engineer for Alexander Potter, consulting engineer, of New York City, he was in charge of the drafting room and the design of sewer works. He supervised the construction of additions to the West Orange (N. J.) water system. In 1907 he made surveys and plans for a water development and a 1000 hp. hydroelectric plant for the Giraux Consolidated Mines Company of New York City. In 1908 he was appointed assistant resident engineer on the construction of the McKeesport (Pa.) water-purification plant. He became a member of the Fountain-Shaw Company in January, 1909.

R. H. Howard, formerly general manager of the New Orleans Great Northern Railroad, has been appointed chief engineer maintenance-of-way of the Wabash Railroad, with headquarters at St. Louis. Mr. Howard, who was born at Zanesville, Ohio, entered railroad service in 1889 as draftsman for the Cincinnati & Muskingum Valley Railroad. He was subsequently assistant on engineer corps, and chief clerk to the engineer maintenance-of-way. In 1902 he went to the Vandalia Railroad as assistant engineer, and three years later was made principal assistant engineer of the Chicago & Eastern Illinois Railroad. Within a few months he became engineer maintenance-of-way, remaining at this post until 1910. Then for a few months he was on special railroad work for private interests, and early in 1911 he went to Jackson, Miss., as chief engineer of the Great Southern Lumber Company and engineer maintenance-of-way of the New Orleans Great Northern Railroad. He was advanced to general manager of the railroad in June of the same year.

Obituary Notes

Arthur Marshall Morgan, a Chicago hydraulic electrical and sanitary consulting engineer, died in that city June 28. Mr. Morgan for more than twenty years was a member of the Chicago firm of G. C. Morgan, consulting hydraulic engineers. He was a member of the Western Society of Engineers.

William McKenzie Hughes, a consulting structural engineer of Chicago, died in that city June 25. Mr. Hughes was born in Utica, N. Y. in 1848 and graduated from Cornell University. He came to Chicago as engineer of construction at the world's fair. He was city bridge engineer in 1893 and 1894. He had also held a similar position in Cleveland and Cincinnati. He was engineer during the construction of a number of the Chicago elevated roads. For several years prior to 1899 he was bridge engineer for the Sanitary District. Since that date he has been in consulting practice for himself. He has been for many years a member of the American Society of Civil Engineers and Western Society of Engineers.

Civil Service Examinations

United States.—The Civil Service Commission announces that examinations will be held this fall at the usual cities throughout the country for the positions enumerated below.

September 15.

AID, COAST AND GEODETIC SURVEY.
COMPUTER COAST AND GEODETIC SURVEY.
DRAFTSMAN:
Copyist topographic, departmental service.
Junior engineer, Engineer Department.
Topographic, departmental service.

October 13.

AID, BUREAU OF STANDARDS.
CIVIL ENGINEER AND DRAFTSMAN.
DRAFTSMAN:
Topographic, Panama Canal Service.
Ship, Navy Department.
ENGINEER, INDIAN SERVICE.

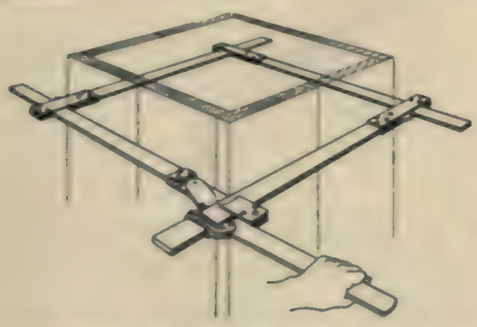
Application forms and full information may be obtained by addressing the U. S. Civil Service Commission, Washington, D. C., or the secretary of the Board of Examiners at the following named places: Post office, Boston, Mass.; Philadelphia, Pa.; Atlanta, Ga.; Cincinnati, Ohio; Chicago, Ill.; St. Paul, Minn.; Seattle, Wash.; San Francisco, Cal.; Customhouse, New York, N. Y.; New Orleans, La.; Old Customhouse, St. Louis, Mo.

New York State.—An examination for assistant engineer, water-power, storage and drainage, Conservation Commission, salary $3,000 a year, will be held July 31 at various cities throughout the State. Applicants must be 21 years of age, citizens of the United States and trained civil engineers with experience in all three lines mentioned in the title of the position. Application blanks must be received in the office of the State Civil Service Commission on or before July 21. No application blanks will be sent out by mail after July 19. For further information, apply to the State Civil Service Commission, Albany.

Concrete Form Appliances That Will Interest Contractors

Designed to take the place of wooden shores and clamps in concrete form work, cut the labor cost of erection, wrecking and rebuilding, and save on the lumber required, a series of adjustable metal form supports have just been placed on the market.

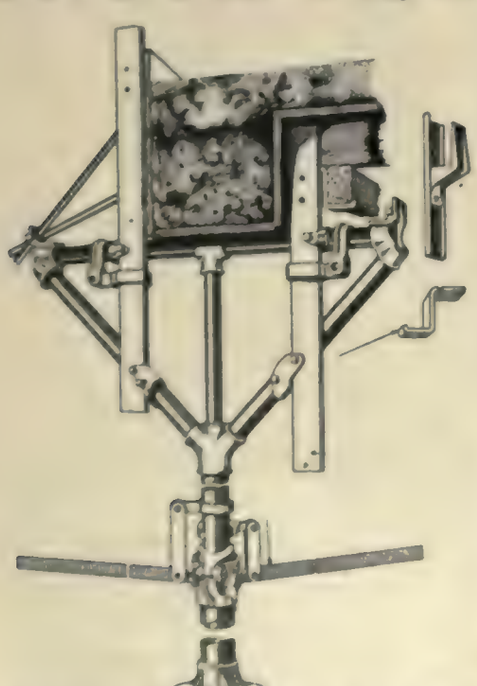
The adjustable metal shore and clamp combination illustrated herewith has a horizontal member at the top which supports the beam bottom. Two vertically and horizontally adjustable arms are supported by hooks and links which carry the weight. Adjustable collars slide on the pipes of which the support is made. They are capable of being securely fastened in any position, to hold the beam sides in place. The upper ends of these beam-side clamps are provided with a bracket to support the joists. So secured to this bracket that it may be detached is a stirrup which supports a timber running from bracket to bracket and carrying the ends of intermediate joists. In this way all joists are adjusted to the proper height from one bearing. By the vertical adjustment of these clamps, together with this joist-supporting timber, the entire floor is adjustable as a unit.



FORM CLAMP SQUARES COLUMNS SO THAT ALL CRACKS ARE CLOSED

The work of wrecking is simple. For ordinary adjustment only one lever is required, and therefore a single-lever shore for temporary work has also been devised. These shores have an adjustment of 3 ft. 6 in. The closed height is 9 ft., and the extended height 12 ft. 6 in.

A feature of the metal column clamp is that it can be adjusted very closely. When a set of them are in place, they automatically square the column, and can be tightened from all sides so as to close all cracks. The clamps will be opened very quickly. The clamp is made of heavy steel bars with one end provided with a toothed locking-dog, pivoted between two plates, which are riveted to opposite sides of the bar. Sufficient space is allowed to enable the bar to slide freely when the locking-dog is not engaged. For octagonal column clamps, four additional bars are used. The clamps, which will accommodate any usual size of column, and the shores are manufactured by the Gemco Manufacturing Company of Milwaukee.



ADJUSTABLE PIPE BEAM SUPPORT WITH BRACKET TO HOLD THE JOISTS

Two-Speed Gear Change Said to Prolong Life of Brush Sweeper

A feature of the latest model revolving brush sweeper to be placed on the market is the addition of a two-gear change which it is claimed allows the sweeper to work at maximum capacity until the brush is entirely worn down. The broom is thrown into high or low speed by a lever at the driver's right as on an automobile. As a result the surface speed of the broom can be increased when its diameter is reduced, thus keeping up the cleaning efficiency when the broom is worn. The team is driven at the regular rate with the broom at high speed.

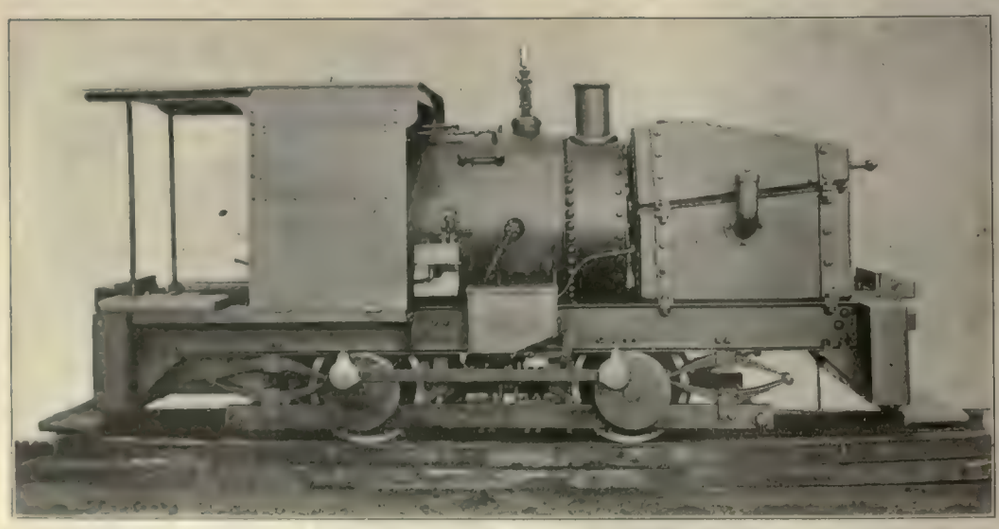
From a galvanized iron tank, holding 200 gal., mounted on top of the wagon platform, water is sprayed just ahead of the broom through either, or both, of two perforated pipes. Two valves controlling the spray are at the extreme right of the driver. If the streets are cleaned at the proper intervals, the spray on this machine will apply enough water to make the dirt mealy. The outfit is compact and of light draft, with no load on the horses' necks. The broom is reversible, revolves in ball and socket joints and is hung from an equalizer bar fitted with adjustable weights. The machine is manufactured by the Austin-Western Road Machinery Company, Chicago.

Oil-Burning Contractor's Locomotive Develops High Traction

Burning oil, or other liquid fuel, a new construction locomotive made by the H. K. Porter Company, of Pittsburgh, is run by an engine geared 2 to 1 to the driving wheels. This arrangement gives a much more even torque on the drivers than can be had with a direct drive. This results, it is claimed, in easier and quicker acceleration, and in eliminating swaying at full speed. The engine itself has roller bearings, and is built with much more care and accuracy than is the usual practice with direct-connected engines. This, it is claimed, makes a high speed possible without undue wear, giving this locomotive very nearly the same track speed as is obtained by other dinkies.

This engine is equipped with a new type of horizontal boiler having a large number of ½-in. copper flues about 16 in. long. The boiler and smoke box on the 5-ton size measure only 37 in. over all. This type of boiler is said to raise a full head of steam with oil firing in fifteen minutes. The wheels are rigidly connected to the subframe, which supports the main frame on elliptical springs. The pull is taken through these springs, assisted by a set of angle bars mounted between the two frames. Strength, flexibility and ease of repair are claimed for this arrangement.

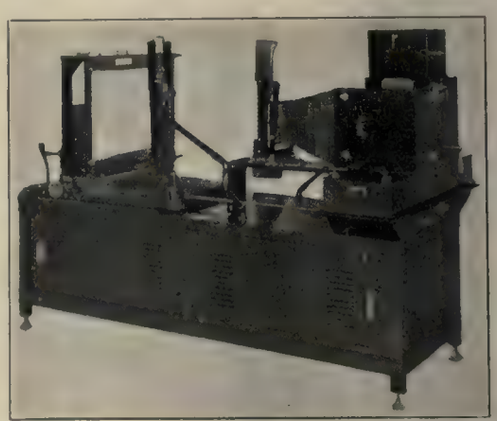
Locomotives are furnished in from two to twelve ton sizes, of any gage. With gasoline for fuel, they may be used in tunnel work. They may be operated in the open with kerosene or any fuel oil.



GEARED OIL-BURNING LOCOMOTIVE EQUIPPED WITH A NEW TYPE OF HORIZONTAL BOILER RAISES STEAM IN FIFTEEN MINUTES

Machine Reproduces, Develops and Prints all in Itself

Facsimile reproductions of blueprints, maps, drawings, specifications or, in fact, any printed or written matter that the contractor or engineer desires to reproduce, may be obtained by means of the "Cameragraph," manufactured by the Cameragraph Company, Kansas City, Mo., a photographic appliance which exposes, develops and fixes the prints entirely within the machine, without the use of a dark room, plate or film. It is compact and its mechanism is simple, requiring no expert knowledge on the part of the operator. Through one lens and at one exposure either the two facing pages of a book or the opposite sides of the same page may be photographed direct on paper sensitized on both sides. If it is desired to use only one side, paper sensitized on one side only can be obtained. Where paper coated on both sides is used, 100 per cent more print surface is secured at 50 per cent additional cost.



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Engineering Record

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DIGGING

The Modern Way

One of the most indispensable of modern labor-saving and work-speeding machines provided for the use of the contractor is the

HAYWARD BUCKET

Obstacles which continually confront contractors—hard, rock-filled soil, boulders, swampy land, tree stumps; almost everything except solid rock, can be handled quickly and cheaply by means of a Hayward Bucket designed for the purpose.

The illustration shows a 1 cu. yd. Hayward Orange Peel Bucket overcoming unusually hard digging conditions. The site being an old reservoir, the material dug and handled was overburdened with clay, rolled earth and cobblestones and also a form of cemented gravel.

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Tunkhannock Viaduct

IT MUST be with much satisfaction that the engineers of the Lackawanna Railroad witness the last steps in the construction of the great Tunkhannock Viaduct on the Clark's Summit cut-off, just above Scranton. When epoch-making structures of this sort are proposed the engineer, figuratively, doffs his hat to those with the courage to project them, but thereafter, accustomed as he is to handling new problems, quickly loses appreciation of the courage and ability which these structures typify. Nevertheless, the difficulties in a monumental work such as the Tunkhannock Viaduct, the Quebec Bridge, or the Hell Gate Arch are not by any means over when the decision is made to adopt the general design. New problems, never occurring in the smaller structures, constantly come up for solution, and the ability and courage which brought the first design into being must be matched throughout the work in order to handle properly the innumerable details upon which the success of the whole is dependent. Such has been the case in connection with the Tunkhannock structure, and a word of appreciation as it draws to a close is, therefore, in order. The chief engineer, G. J. Ray, his assistants in the drawing room and in the field, and, finally, the contractors deserve to be congratulated on the successful outcome of their work.

Funds for Road Maintenance

THE RECENT legislation in Pennsylvania calling for the registration and taxation of tractors and trailers, as noted elsewhere in these columns, is but one manifestation of an appreciation on the part of the State Highway Department of the importance of maintaining the roads which the Commonwealth has been building. A more recent index of the importance with which the maintenance problem is regarded is furnished by the department's apportionment of State-aid funds among the counties for the years 1915 and 1916, the results of which have just been announced. The feature of this distribution of money is that a definite sum is allotted to each county expressly for maintenance work. In accordance with the policy formulated by Commissioner Cunningham and Chief Engineer Uhler, the maintenance division of the department has estimated the amount of money necessary for the maintenance for two years of previously constructed State-aid highways in each county and this amount has been deducted from the sum available for State-aid construction. This policy is by far the most economical in the long run. In some States the funds are so managed that the necessary amounts are reserved for maintenance, but by making the county allotment known and deducting it from the total of the county's share of State-aid funds, the importance of maintenance is very strongly impressed on the local authorities.

Alloy Steel for Long Spans

TWO DEFINITE features distinguished the design and specifications for the new bridge over the Ohio River at Metropolis, Ill., on the Paducah & Illinois Railroad. The main trusses, as described on page 53 of this issue, are to be built of silicon-steel compression members and nickel-steel eyebars and to provide for Cooper's E90 loading. Although the new 1500-ft. continuous trusses of the Sciotoville Bridge, described in the issue of June 26, page 799, are to be of carbon steel, because it was found that at present prices a nickel-steel design cost about the same, the use of alloy steel for long-span trusses under heavy loading, especially for the suspended trusses of cantilever bridges, as in the Quebec Bridge, generally results in economy. This will be the first example of the application of high-silicon steel to bridge construction, and its action in withstanding shop manipulation and the ultimate cost of production will be watched with interest. The 668-ft. simple truss span of the Municipal Bridge at St. Louis, which now holds the record for span length, was built of nickel steel but it is understood that no saving over the carbon-steel design was realized. The tendency toward large increase in specified live loading which characterizes the design of recent bridges is notable. President Gibbs, in his address before the American Society for Testing Materials, upon his retirement at the recent annual meeting, emphasized the fact that economy in railroad operation pointed toward continual increase in engine power and weight. He could see no limit to the concentrations which rails and structures must be designed to support. When it is remembered that nearly all bridges which were built 20 to 25 years ago have either had to be replaced or reinforced to carry present loadings, the wisdom of the designers of expensive long-span bridges in providing for very heavy live loading is apparent.

Promoting Engineering Work

OBJECTION was made early this year to the free engineering service being offered to small communities by the extension divisions of State universities. The topic was the central one at the meetings of both the Iowa and the Minnesota societies of engineers. The Engineering Record believes that there was good ground for the objection, for if the practice is allowed to grow the field of the consulting engineer, and consequently the incentive for acquiring competence and experience, will be curtailed. This would be a serious blow to the profession and would, in the end, be detrimental to the interests of owners and builders of engineering works. The Extension Division of the University of Wisconsin has appreciated very clearly the danger of usurping the functions of the consulting engineer. It has, therefore, shaped its advisory work, planned for the benefit of the smaller communities of the State, so that in every respect it may be free from the criticism voiced at the Iowa and Minnesota meetings last January. Just how the Wisconsin department proceeds is told in an article on page 47 of this issue. Without a doubt there is a broad field for an activity of this sort, and, when conducted in the sensible way obtaining in Wisconsin, it is a benefit not only to the smaller communities but to all connected with or dependent upon engineering work. For one feature the Wisconsin department deserves special commendation. It has been appreciated that one of the critical difficulties is to advise the community when it puts the question, "Whom shall we employ as engineer?" It is at this point that the advisory department is most likely to get into difficulties and antagonize those whose support and co-operation it needs. Mr. Bascom's solution is to give the town authorities the names of the waterworks superintendents in the State, in order that they may ask for the names and some particulars about the services of engineers employed by these plants. In this way the extension division could not be accused of favoritism. The authorities at Madison are to be congratulated on their skillful handling of a service beset with difficulties.

Popularizing Our Geology

THE U. S. Geological Survey has just embarked upon a very noteworthy departure in its work and one that deserves hearty commendation. Realizing the stimulus given to travel in this country by reason of the locking of European doors and the expositions on the Pacific Coast, it has prepared a series of four guidebooks, covering four of the older railroad routes between the Mississippi and the Coast. Part A will be devoted to a description of the Northern Pacific route, with a side trip to Yellowstone Park; Part B, to the Overland route, with a side trip to Yellowstone; Part C, to the Santa Fe route, with a side trip to the Grand Canyon of the Colorado, and Part D, to the Shasta route and Coast line. The second of the series, Part B, has just been issued as Bulletin 612 of the Geological Survey. As explained in the preface of the first volumes to appear, the books are educational in purpose, but the method adopted is to entertain the traveler by making more interesting what he sees

from the car window. The plan is to present authoritative data regarding the country traversed, to explain the geologic features in language readily understood by the layman and to point out the economic features of the various sections along the line. A careful perusal of one of these books while passing from the Mississippi Valley to the Pacific will give one a most excellent comprehension of the economic future of the country traversed, something that the average traveler never gets. To him a trip to the Coast means, at its end, only a jumble of impressive scenery and big deserts, with here and there some unusual feature, generally scenic, standing out from the mass and making a permanent impression on his memory. Those with a serious interest need now not be uninformed as to the features and opportunities of the country they will traverse on the way to the Coast. The first volume, Bulletin 612, is a 244-page book, of 6 x 9-in. page, containing twenty-five 7 x 8-in. topographic maps, each showing a small section along the railroad line, to a scale of 8 in. to the mile and with 200-ft. contour intervals. The text is further illustrated by wood cuts and numerous halftone illustrations of scenic features along the way. The volume should prove very popular indeed with those contemplating a coast trip this year.

Importance of Biological Studies of Stream Pollution

THE ETERNAL cycle of change of matter from the mineral to the vegetable kingdom, from vegetable to animal and from animal back to mineral again is of never ending interest. From time to time one phase after another has been taken up and studied by scientists. Agriculturalists have studied the changes in the nitrogen in the soil from manure to nitrates and from nitrates to the growing crops. Sewage disposal experts have long been familiar with the four conditions of nitrogen —which, in the language of the water analyst, are termed albuminoid ammonia, free ammonia, nitrites and nitrates. Bacteriologists have given attention to the bacteria which help to bring about these changes. At intervals biologists interested in the higher forms of microscopic life have studied the inter-relations of the different forms one to the other. Most of the studies have been fragmentary and have not been pursued far enough to yield practical results.

In his study of the biology of the Genesee River at Rochester, Prof. George C. Whipple, of Harvard, showed the existence of biological zones corresponding to different states of pollution and self-purification. Immediately below the sewer outfalls was found a zone where bacteria were enormously abundant. Next came a zone of protozoa, then rotifers and crustacea, then fish. Each kind of organism thrived upon the preceding, until finally the fish were caught and taken to Rochester to serve as food for human beings, thus completing the chain. This phenomenon is not unique, but universal. It remains, however, to pursue this study in a more detailed and quantitative manner and on a more extended scale. This problem is being taken up in several places, and it bids fair to occupy a prominent place in the thoughts of sanitary engineers for some years to come. Of particular interest are the studies being made at Brockton, Mass., by the biological research department of the Massachusetts Institute of Technology, in the small stream which receives the effluent from the sewage disposal works. Prof. Robert Spurr Weston is in charge of this work. Important researches have also been made by Dr. Forbes and his co-workers in the waters of the Illinois River.

At first thought one would suppose that the pollution of streams by trade wastes would be essentially a problem for the chemist, but the effect of the addition of trade wastes to streams upon the animals and plants in the water and on the shores is often very pronounced. Sometimes their growth is stimulated; sometimes the organisms are killed outright.

The opportunities for similar studies elsewhere are very great and it is hoped that not only trained sanitarians but amateur microscopists will take advantage of the coming summer season to engage in this fascinating and very important field of biology. To be of greatest use the studies should include not only microscopical examination but bacteriological and chemical tests, and the organisms growing upon the shores should be studied as well as those in the water. Only by such extensive and intensive studies will the problem of the self-purification of streams ever be solved.

Dirigible versus Aeroplane

FROM the standpoint of the engineer the performance of aerial craft in the present war is most interesting, especially in view of the widely heralded destructive powers of the Zeppelin, which was, in popular imagination, "a dreadnought of the air," spreading unimaginable destruction along its path. In particular it has been promised for a good many months past that London was to be reduced to a flaming wreck by a fleet of Zeppelins sweeping resistlessly across from the German coast. A considerable number of the illustrated papers have indulged in pictorial forecasts of the impending catastrophe.

The raid on London was made in May, and the first report of it, other than the brief and elaborately censored dispatches, is now at hand. As nearly as can be determined it proved as futile as the previous incursions upon the British coast which furnished practice in bombarding fishermen's huts and sea-shore boarding houses. It is not yet clearly known whether the raid was by one Zeppelin or several. Reports state, however, that about ninety bombs were dropped, in part explosive, but generally incendiary, with the net result of killing outright four persons and injuring about seventy others, a few of them dangerously. A large percentage of the bombs fell on unoccupied land or in vacant streets. Something like a dozen fires were started, of which only a very few required the services of the fire department, and that is about the complete record aside from a very moderate degree of damage to buildings from explosion. The raider was flying high and in the very early morning; its crew was unable to see well the features of the city below, and nearly all of the bombs dropped in the suburbs or poorer quarters of the city.

It is, on the whole, a rather surprising record, after the promises of wholesale destruction that had been made. A few days later another Zeppelin, returning from a raid on the English Coast, was destroyed in Belgium by a bomb thrown from a British monoplane, and if any really keen watch had been kept in the London territory it is more likely that the hostile Zeppelin would have shared a similar fate before she could have flown out of the country.

The truth seems to be that, splendid as the Zeppelin is for long scouting expeditions, it is quite too good a target to risk flying low or in broad daylight, and at night, flying over a darkened city, the chances for effective bomb throwing are greatly diminished. So far as the contest has now gone the honors are decidedly with the aeroplanes as weapons of offence. Their small size, great speed, and extreme facility in maneuvering, make them vastly more dangerous than the dirigibles, particularly when one realizes that dozens of them can be sent out for the cost of a single Zeppelin. The big dirigible is a wonderful feat of engineering and immensely spectacular, but it seems to bear about the same relation to waging war that the huge 25-knot liner does to the world's work of cargo carrying.

Pennsylvania Law for the Taxation of Tractors and Trailers

THOUGH vigorously opposed, a law taxing tractors and trailers was passed by the last Pennsylvania Legislature and has been signed by the Governor. While the taxation of pleasure vehicles and motor trucks is now generally accepted without opposition, traction engines and trailers have heretofore been free in most States. However, the principle being established, it was inevitable that sooner or later they would be brought in under the same general ruling. Probably there will for years be dispute as to the proper amount of tax, which, theoretically, should be based on the relative destructiveness of various vehicles. The manufacturers of heavy vehicles contend that because of the wider tires and the lower speeds the destructiveness of the heavier vehicles is not as great as that of the fast-moving pleasure cars. There is much force to their argument, though, of course, with pavement of deficient thickness, the reverse would hold. The Pennsylvania law attacks the problem from various standpoints and its details will therefore be of interest to highway engineers.

For the purposes of regulation the new measure divides the heavy vehicles into two general classes—those used exclusively for agricultural purposes, road-grading, and

the transportation of the machinery which, when at rest, they operate with their own power, and those used for freighting. The registration fees in the first class are $5 and in the second class $20 annually. For trailers weighing less than 10,000 lb., including load, the charge is $3 per year, and for trailer weights in excess of 10,000 lb., but under no circumstances more than 24,000 lb., the fee is $5.

Limiting weights also are prescribed for tractors of both classes—for the first class, 28,000 lb. and for the second, or freight-hauling traffic type, 32,000 lb. Cleats are allowed on the drivers of all traction engines, but their width must be at least 2½ in. and their height not more than 1½ in. In the case of the trailers the tires must be smooth and no load exceeding 750 lb. per inch width of tire is allowed.

These are, in brief, the main provisions of the law in so far as it relates to weights, widths of wheels and type of cleats. But as a further safeguard to the highway system the State highway commissioner is vested with authority to designate allowable hauling routes. Applications, setting forth the roads to be used and the weights of the tractors, must be made in advance, and the commissioner may use his discretion as to the granting of permits. This is an important point, for, even if a tractor fulfilled all of the requirements previously outlined, its owner might elect to operate it at a time when the roads were soft. As a result there would be serious damage to the surfacing. With the powers granted to him, however, the commissioner may allow heavy vehicles to operate only when the routes are in a condition to carry heavy loads.

There is but little doubt that taxes and restrictions of these general types are to be expected in other states in the near future. The tendency is to make those pay who most directly benefit by an improvement and to apply reasonable safeguards for the protection of the surfacing. Opposition there will be, but the energy had better be expended on keeping the restrictions and taxes reasonable than in opposing the principle in toto.

Common Sense Regarding Academic Freedom

JUST at present comment is rife in Philadelphia and among graduates of the University of Pennsylvania over the refusal of the trustees of that institution to renew a contract with a member of the economics faculty. It is stated by those agitating for his re-employment that his virtual dismissal is due to the disagreement of the trustees with certain economic opinions advocated by him. They declare that "academic freedom," the right of members of the faculty to pursue unhampered their investigations and publish their results, has been curtailed. This journal is not informed as to the facts in the Pennsylvania case, but because of its importance the Engineering Record takes advantage of the opportunity afforded by the incident to discuss the general subject of academic freedom. Its abuse is such that every educated man needs to do some vigorous thinking on the subject.

It is contended in the university world that the university cannot fulfill its functions as the leader of thought unless members of the faculty are free to pursue their investigations wherever they may lead and to publish without restraint or supervision their conclusions. With this contention, in the abstract, this journal has no quarrel. It does believe, however, that the doctrine of academic freedom has been pushed to absurd conclusions.

This journal cannot believe that the wide and unqualified endorsement by educated men of the doctrine of unhampered academic liberty has been given after full consideration of all that the doctrine involves. American men, in the mass, especially educated Americans, think sanely. They discover quickly theories that lead to absurd results and are not slow in expressing their opinions.

To hold that there should be no restrictions on academic freedom is to concede that, no matter how false the theory or how destructive its conclusions, every immature instructor or radical professor shall have the privilege of teaching it to American young men and women at the most impressionable period of their lives. The man who advocates unhampered freedom of speech in university circles would protest most loudly if a member of the faculty were allowed to teach immoral doctrine, immoral in the sense in which we usually use that term. Yet, broadly speaking, it is just as immoral, just as much a violation of the fundamentals of ethics, to teach, for example, under the guise of a new economic theory, that race suicide is justifiable or that theft is legitimate. The latter doctrine certainly has been taught in at least one of our institutions, for a teacher in the economics faculty advocated the right of the Government to take private property without compensation. Socialism is another of the vagaries, taught not with a view to examining into its principles, as one would into any other economic doctrine, but advocated and preached from the professional chair. Fathers of youths now in American universities can multiply with ease the list of false doctrines to which their sons and daughters are obliged to listen.

Unquestionably we must permit freedom in investigation and research. For the sake of the ultimate good we must bear with half-baked theories, silly doctrines and perverted conclusions, but that does not necessarily imply that these same theories and conclusions are to be taken into the classrooms and to be taught as true to those not yet mature enough or sufficiently familiar with the subject to discover the error. The place for those theories and conclusions is the forum afforded by the meetings and journals of the learned societies, where they come for examination before a body of specialists. Unfortunately, however, this is just what these immature minds do not want. While professing to seek the truth they are in reality seeking the truth as they want it to be, and the last thing they care to do is to put their theories before those fully competent to analyze them.

Necessarily, if academic liberty is to be restricted, there must be some body or authority which shall set the limitations. For this we must look to boards of trustees and heads of departments. When, however, they exercise their proper functions —when they stand between our young men and women and a faculty member who is teaching error—the local press, members of the faculty and graduates immediately go up in arms over the restriction of "free speech." An instructor, so limited by higher authority, immediately becomes the recipient of the martyr's crown, his popularity increases many fold over night and protests deluge the trustees or whatever authority has taken the action. It is a sad commentary upon the quality of our education that so many university graduates should be found in this unreasoning throng.

As a result of experiences of this kind, boards of trustees have learned how difficult it is to handle such cases of needed discipline, and, without a doubt, have been deterred in many cases from taking what they believed to be desirable action. Methods of quiet elimination have undoubtedly been tried rather than face the storm of protest sure to be aroused if "straight-from-the-shoulder" action were taken. Radical and immature members of the faculty appreciate this, too, and therefore do not hesitate to abuse the privilege of academic freedom, confident that in case of discipline the masses will be with them.

It need hardly be added that a faculty member taking advantage of his board of trustees or his department head in this way can only be described by the word despicable. If he could stand alone, isolating himself from his university, but little harm would be done. But the press takes delight in calling the merest tyro on the faculty "professor" and in linking his name with the institution, so that his doctrines, no matter how radical or erroneous, go forth with the weight of university authority back of them. The instructor or professor cannot speak in his private capacity, even if he would. When, therefore, in defiance of what he knows to be the attitude of his superiors, he insists upon giving vent to his unsound doctrines, he acts as a mountebank, forcing his own personal views upon an unsuspecting public under the guise of university backing.

Considering these points, therefore, the Engineering Record cannot believe that the championship of unhampered academic liberty by university men has been the result of mature thought. Free speech may consistently be advocated without holding that faculty members should be allowed to impose their doctrines on unsuspecting and immature youths. If parents have a duty to protect their sons and daughters from immoral influences, that duty is just as binding with reference to economic and other fallacies as with reference to those we generally describe by the word immoral. And the duty imposed on the parent is necessarily transferred to the boards of trustees and other authorities, to whom the education of his children is entrusted.

Why Drainage of Irrigated Lands Is Necessary, and How the Problem Is Handled

Leakage from Canals and Excessive Use of Water for Crops Cause Saturation of Subsoil and Depositing of Alkali on Ground Surface—Remedy Lies in Intercepting and Relief Drains

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A QUESTION frequently asked, especially by those not fully acquainted with farming operations in the arid regions, is why there should be a requirement for drainage on lands to which water is supplied by irrigation. Why, if water is supplied artificially to the lands, should more be applied than is necessary to keep the soil in a condition for growing crops; or, in other words, why should there be any excess waters in the soil to be drained out? It must be admitted that if no more water reached the land than that which could be taken up and used by growing crops no excess would be found in the soils, and no drainage would be necessary. This condition is the ultimate goal of perfection in irrigation practice. It cannot be regarded as impossible of being attained, but can be reached only after long experience in the construction and painstaking care in the operation and use of irrigation works. It is apparent to the careful observer that the need of drainage during the past ten years or more has been increasing rather than decreasing—and this despite the better methods of irrigation that are constantly being adopted.

In order to get a clear understanding of why drainage is required on irrigated lands it is necessary to consider the various phases of irrigation, from the taking of water from the source of supply to its application to the soil. To explain the increasing need of drainage it is necessary also to consider the development of irrigation and its effect upon ground-water conditions over largely increased irrigated areas.

WHERE IRRIGATION WATER GOES

During the past ten years the growth of irrigation, over the greater part of the arid regions, has been rapid. New enterprises have been developed on large and comprehensive plans, and the older ones have been enlarged and extended so as to reach more nearly the limits of available lands and water supply. The conserving of all streams, or the greater part of them, by means of storage works, and the supplying of extensive canal systems have made possible the irrigation of large individual areas. Valleys or plains miles in extent have been covered by networks of canals, into which water has been turned. From these canals water has been diverted to the surface of the ground in varying amounts, depending on the smoothness of the surface, the character of the soil and the individual ideas of the irrigator applying it.

A part of the water carried by the canals and laterals is lost by seepage from them before it reaches the irrigator. A part of that delivered to him is wasted from the surface and absorbed by adjacent areas where possibly it is not needed; a part is lost underground because more is applied to the surface soils than they can retain and use in the growing of crops. The result is, water is supplied not only to the surface soils, but a part is lost into the subsoils, which gradually become filled if the underground losses are not removed. A large part of the water lost in the subsoils is carried away through natural channels through the slow process of underground percolation. In many instances, especially on areas of limited extent, and where the subsoils are of a uniform, porous nature, the natural underground drainage is sufficient to carry away the excess water and prevent the subsoils becoming saturated. But on large areas, or even on small ones, where the underlying materials are more or less impervious and irregular, natural drainage is generally not sufficient to carry away the underground losses. In such cases the subsoils become filled, and the ground water is raised in many cases to the surface of the ground.

CONSTRUCTION TO PREVENT LEAKS FROM CANALS EXPENSIVE

The principal sources of ground water on irrigated lands, as above stated, are losses from canals and laterals, and underground waste due to excess application to the land. Losses from canals and laterals can be avoided only by lining the waterway or constructing the canals of watertight materials such as concrete or other forms of masonry. The cost of such work is high, and in many irrigated sections is regarded as prohibitive on this account. Losses due to excess irrigation are largely the result of applying to the soils at a single irrigation more water than they can retain and give up to the growing plants. The excess sinks into the subsoils and contributes to the raising of the ground-water table.

As is well known, the amount of water necessary to render the soil moist to the depth required for plant growth varies with the character and fineness of the soil, and also the character of crop being grown. The amount or depth of water that should be applied at one irrigation, under varying conditions of soil and crop, is difficult to determine. Even though this be definitely known, the uniform application of the required amount and no more over the land presents in many cases even greater difficulty. Some soils, especially before they have been thoroughly broken up by cultivation and growth of plant roots, absorb water slowly, and it must be held on them for a relatively long period of time to allow it to penetrate to the required depth. Other soils, such as porous sands and gravels, absorb water so rapidly that it is difficult to carry it for even a few hundred feet over them without excessive underground wastes. Economic irrigation, or the application of just the right quantity of water to the soils, requires careful preparation of lands and care and skill on the part of the irrigator.

MORE WATER USED THAN NECESSARY IN IRRIGATION

Observations of the effects of varying quantities of water applied to growing crops, and also measurements of the underground losses, both show that ordinarily more water than is necessary is used in irrigation. The result of this is the filling of the subsoils and the raising of the ground-water table.

Another contributing factor to ground waters, although far less frequent than those above mentioned, are underground percolations from natural streams or from precipitation on higher areas. Even in the semi-arid regions, and where irrigation has not been practised, examples are found where the ground water is but a few feet below the surface. In such cases the ground waters have generally traveled down slopes, possibly some distance below the surface, and have been stopped by a more or less impervious formation at or near the foot of the slopes. High ground-water areas are also found frequently in porous beds of sand or gravel which are overlaid and possibly surrounded by dikes of clay or other impervious materials.

Whenever the underground losses on a given area due to seepage from canals and streams and waste from excess irrigation are greater than the natural drainage from that area can carry away, the subsoils gradually become filled and the ground-water table rises. Examples of this kind have



SUBSURFACE CONDITIONS DETERMINED BY USE OF ORDINARY SOIL AUGER

been found where the water table has risen from 50 to 100 ft. within a period of ten years or less. On large irrigated areas the ground waters must ordinarily travel greater distances than on small ones. There is consequently greater danger of the subsoils becoming filled and the water table being brought to the surface on them.

EFFECTS OF HIGH WATER TABLE

The effects of a high water table are first, to render the soil unfit for growing crops on account of its interstices being filled with water, or, as it is generally termed, becoming saturated; and, second, to cause a deposit of alkali upon the surface, the result of capillary action and evaporation. In order that plants may survive and produce proper growth in a soil, it must be moist, but not saturated. To accomplish this, the water table must be kept below the zone of plant growth.



DITCH LOCATED TO SKIM OFF TOP LAYER OF WATER IN WATERLOGGED SOIL

In most sections of the arid or semi-arid regions the soils contain more or less alkali salts, many of which when sufficiently concentrated are harmful to plant growth. These salts, which are soluble, are dissolved by the ground waters, and when the water table is high enough to permit the water being brought up and evaporated, the salts are left on the surface, as the result of such action. This in a short time causes a sufficient concentration of salts on the surface to render the lands unfit for cultivation and the growing of crops. In order to prevent the concentration of salts near the surface it is essential that the water table be kept low enough to prevent capillary action bringing excess quantities of ground water to the surface.

PURPOSE OF DRAINAGE

The fundamental purpose of drainage works is to control the ground-water table and prevent its rising high enough to impair the irrigability of the soil, either through saturation or through the accumulation of alkali. Ground waters are not stationary, but are slowly moving through the minute spaces of the subsoils from lower to higher areas. In this movement they are affected by the character of the subsoil formation. Where this formation is uniform as to porosity and thickness, ground waters may travel at a relatively uniform rate and distance below the surface. Where the porous subsoils are broken by dikes or barriers of less pervious materials, the underground flow or percolation is retarded and the waters are forced to the surface. As a result of this condition the rise of ground waters is seldom, if ever, uniform over any considerable area.

Ordinarily seepage, or the rise of ground water to the surface, begins at isolated points. These may be either along or at the foot of slopes, or even on a level area if it be underlaid by a pervious bed of sand or gravel. In the latter case the seepage first appears where the top soils are thinnest or where they offer the least resistance to the upward movement of the water. From the points of starting seepage gradually spreads, the direction and rate of spreading being dependent on the amount of flow and resistance offered by the top soils to water penetrating them.

Drainage works must be so located and constructed that they will be effective in skimming off or disposing of the top portion of the ground waters over those areas where there is a tendency for them to reach the surface. These high water areas may be relieved in some cases by intercepting and carrying away the flow at the foot of the slopes, or at points where water is forced to the surface by the presence of impervious barriers. In some cases it is necessary to tap large reservoirs of porous sands or gravel, and by drawing the water out of these, effect a general lowering of the water table over the entire adjacent area.

TWO CLASSES OF DRAINS

The conditions above mentioned have given rise in drainage work to two quite distinct classes of drains, known as intercepting drains and relief drains. The first class applies to drains by means of which water is intercepted and carried away before it reaches lower areas which might be injured by it. The second class applies to those which tap, as it were, underground reservoirs in porous materials and effect a general lowering of the water table over them.

It is sometimes impossible to dispose of water by means of intercepting drains constructed along or at the foot of slopes, on account of the great depth to the pervious material through which it is traveling. It is also frequently difficult to remove ground waters from relatively flat areas by means of drains constructed in them. The porous materials through which the waters actually come to these areas may be found at depths so great as to make it impracticable to tap them by means of drains. In such cases the water in the lower subsoils is usually found to exist under pressure which in time is sufficient to force it through the heavy layer or blanket of top soil to the surface. Relief to such areas can frequently be given by means of wells sunk from the bottom of drains into the porous water-bearing materials.

To determine the location, type and depth of drains to be used are questions to which no general answer can be given. They depend on local conditions in each particular case and can be determined only after careful investigations and study of the character of the subsoils and the ground-water movement through them.

LOCATION AND DEPTH OF DRAIN

To be effective drains must first of all be located so that they will tap the underground water in porous materials in order to produce a flow into them. They should also carry the water so collected to some natural waterway without allowing it to be lost in the subsoils and become a source of waterlogging on other lands. The depth of drains must be sufficient to lower and hold the water table below the zone of plant growth, and also below the depth of excessive capillary action to the surface. Both of these vary largely. The depth to which the roots of ordinary field crops penetrate the soil ranges roughly from a few inches to about 4 ft. This maximum is, however, in many cases greatly exceeded. The minimum depth to water for crop requirements, consequently, depends largely on the nature of the crop, whether deep or shallow rooted. In determining the depths of drains, consideration should be given to the protection of the deepest rooted plants to be grown.

The height that water will be raised by capillary action varies greatly with the texture and condition of the soil. It ordinarily ranges from about 18 in. to 3½ ft. for any appreciable quantity of water being brought to the surface. In some instances a perceptible capillary action has been observed to a height of 7 ft. This is exceptional, however, and it is believed that the quantity of water ordinarily raised more than about 3½ ft. is too small to impair the lands seriously by the bringing up of alkali. The condition of the surface of a soil is an important factor in determining the amount of water which rises to and is evaporated from it. A well mulched surface reduces capillary action and consequent evaporation.

The depth to which drains must be constructed frequently depends on the depth to various water-bearing materials. In many cases it is necessary to go to greater depths than soil or crop conditions would require in order to reach materials sufficiently porous to allow water to pass readily through

them. The determination of proper locations and depth of drains requires a knowledge of the surface topography, elevation and slope of the ground-water table and the water-bearing properties of the subsoils through which these waters must pass.

Investigations and Surveys

One of the important factors in the location and planning of drainage works is the collecting and putting in convenient form for use the necessary information relative to ground-water and subsoil conditions. Surface topography necessary for determining the slopes available and the location of main outlets can be readily determined by means of surveys, or in many cases from existing contour maps. Data relative to underground conditions are more difficult to obtain, and the most thorough investigations that can be made reveal only partly the conditions governing the movements of ground waters.

Instances are sometimes found where the subsoils are uniform in character, and where the ground water in them maintains relatively uniform slopes. These conditions can be determined by means of relatively few borings or test pits. Generally, however, the subsoils lack uniformity both as to character and thickness and the slopes and direction of percolation in them are very erratic. Conditions of this sort require the collection of a large amount of field data and a systematic arrangement of these data in order to give the necessary information for laying out a drainage system. Miscellaneous data relating to depths, to ground water and to character of underlying materials are of little value in showing the source of ground-water supply, or where it can best be reached by means of drains.

Plan Devised for Determining Underground Conditions

The most satisfactory plan so far devised by the writer for determining the underground conditions is by means of subsurface cross-sections or profiles. The sections are usually taken at, or nearly at, right angles to the natural slope of the country. They are prepared by first running accurate surface profiles by means of chain and level or other suitable means. These are platted on a scale of from 500 to 1000 ft. to the inch horizontal and 10 ft. to the inch vertical. This large vertical scale permits showing the details as to character of subsoils and elevation of water table. The small horizontal scale is convenient for showing in a compact form the conditions over a large area.

The elevations of ground water and the character of the underlying materials are indicated on the sections by means of convenient symbols. Wherever possible the sections are taken on parallel lines and are platted one above the other from the lower to the upper part of the area. All are referred to the same straight line so that the location of any point on a section can be readily determined on the ground. When the sections can be taken on east-and-west or north-and-south lines, as is usually the case, they are referred to rectangular coordinates. Distances are usually given in miles and fractions of a mile. Such a series of sections when platted represent a sort of relief map of the area covered by them.

The elevation of water table and the character of the underlying materials are determined by means of borings or test pits. The latter are used in heavy gravels or other materials through which the auger cannot be made to penetrate. For making borings an ordinary hand soil auger about 2 in. in diameter is commonly used. With this form of auger borings have been made and the materials determined to depths of 30 ft. or more. Where borings are made in sand or silty materials which cave readily the wells are kept open by means of light iron casings. This is generally necessary, also, where a series of readings is to be taken for the purpose of determining the elevation of the water table.

The interval at which sections are taken depends on the surface topography, the nature of the subsoil formation and the variations in elevation of ground water. It usually ranges roughly from ½ mile as a maximum to about 200 ft. as a minimum. Similarly, the distances between borings or test pits in a section are made to suit each particular case. They must be near enough to each other to give a reasonably accurate profile of the top of the ground water and also to show variations in the underground formation. The depths to porous strata and the pinching out of these strata are factors which must be carefully determined. These in some instances require borings at intervals of 50 ft. or less.

Use of Sections in Locating Drains

The primary purposes of subsurface sections is to show the grades and direction of flow of ground waters, and the locations of the various classes of materials which affect this flow. They show also the locations of high ground-water areas and where these areas may be tapped to lower the water table over them.

The points at which a drain should cross the various sections gives a preliminary location which can be quickly determined and marked on the ground. The final location is made by connecting these preliminary points by the most feasible lines. Except over very rough areas, and even there if the sections are taken close together, reasonably accurate profiles of any proposed line can be prepared from them and the available slopes determined. The depths to which drains must be constructed in order to reach porous water-bearing materials is shown by the position of such materials on the subsurface sections.

Flat-Slab Bridges at Denver Combine Permanency and Good Appearance

Four Such Structures Built Across Cherry Creek Were Specially Designed to Withstand Such Floods as Wrought Havoc in 1912

By WALTER H. WHEELER
With C. A. P. Turner, Minneapolis

IMMEDIATELY after the disastrous cloudburst and Cherry Creek flood which occurred at Denver July 14, 1912, it became necessary for the city, in connection with the repair work which followed the flood, to consider the construction of four new bridges spanning the channel of the creek. For most of its course through the city the channel is confined by reinforced-concrete retaining walls and varies from 80 to 100 ft. in width, the depth ranging from 10 to 15 ft. The grade of the creek bed is quite steep, causing the water to flow, in times of flood, at a high speed, and there is frequently considerable débris brought down.

To meet these conditions the city desired to construct bridges which would be as nearly permanent as possible and at the same time be ornamental and provide the greatest area of clear waterway for a given elevation of roadway. It was decided to use reinforced-concrete construction and competitive designs and bids were called for on the Market and Larimer Street bridges, situated on opposite sides of the city hall. Designs were submitted for two-span and single-span bridges of the girder, arch and flat-slab types and contract was let for flat-slab bridges of the "mushroom" type. The design gave a clear waterway 10 per cent in excess of the other designs submitted. Later the city let a contract for a bridge at Downing Street and for one at Curtis Street, in both of which the same system was specified.

The new bridges give more clearance underneath than the old steel bridges they replace, and the bottoms of the slabs are smooth and do not offer any opportunity for driftwood to catch in passing under and form a dam, as did the steel bridges.

The Downing Street bridge is 80 ft. wide by 106 ft. long over all. The spans between piers, center to center, are 45 ft. longitudinally by 34 ft. transversely. The roadway is 56 ft., with a double-track street-car line in the middle, and 12-ft. sidewalks at each side of the roadway. This bridge crosses somewhat obliquely, so that the longitudinal lines of pier centers intersect the transverse lines of centers at about 70 deg., making the perpendicular distance between longitudinal lines about 32 ft. For purposes of computation the spans will consequently be taken as 45 ft. and 32 ft. The bridge is designed to carry a working live load of 150 lb. per square foot over the full area and provides for a moving load of one 75-ton car and one 18-ton road roller on each panel, plus ordinary vehicle and foot traffic. The rails of the car tracks are carried on Carnegie 5½-in. steel ties embedded in the concrete of the slab. The roadway is paved with 3½-in. 16-lb. creosoted wood blocks, manufacturers' standard specification, laid on a 1-in. sand cushion. The slab is 20 in. thick at the gutter, 25 in. thick at center of roadway, 31 in. at inside edge of sidewalk, and 32 in. at outside edge of sidewalk. There are three rows of three columns or piers each crossing the stream, a middle column of each row in midstream. The center midstream pier is 36 in. square; the two outside midstream piers are built oblong in section and are 3 ft. wide by 9 ft. 6 in. long, the idea being to bring the piers out flush with the edge of the bridge and give the spans, when viewed from the side, the appearance of a flat arch. The six end piers are 42 in. square.

All piers are carried down to bedrock and anchored thereon with four 1⅜-in. round rods extending 4 ft. into the rock and

grouted. Bedrock at Downing Street averaged about 5 ft. below the Creek bed, at Market Street about 15 ft. The bedrock is shale and the footings of the piers are proportioned for a bearing on the rock of about 8 tons per square foot when the bridge is fully loaded. Embedded in each sidewalk 24 in. above the bottom of the slab are 7 lines of 4 x 12-in. hollow tile, spaced 18 in. on centers, for wire conduits. At each end of the bridge a thin wall is carried down flush with the edge of the bridge to the top of the retaining wall to carry out the flat-arch effect.

REINFORCING

The reinforcing in the slab consists of belts of rods running in four directions, between piers, with 16-ft. laps in every belt at each mushroom head. The belts are 16 ft. in width, which is the width of the "mushroom" heads on the piers. These heads are made exceptionally stiff, having twice the usual number of radial and ring rods. The outer edges of the slab are carried as a cantilever and reinforced with supplementary rods running longitudinally near the edges of the slab. There is also supplementary reinforcing in the sidewalk near the surface. The columns or piers are reinforced with vertical rods and spiral hooping. All steel is plain round bars, manufacturers' standard specifications for structural grade.

The wearing surface of the sidewalks is floated smooth and blocked off in squares. The hand railing and lamp posts are of ornamental cast stone manufactured by the National Stone Manufacturing Company of Minneapolis, and are laid up in cement mortar.

The writer is not aware that any tests have been made on the bridge since its completion, but it has been in actual service about two years. The construction work was done during the winter with the thermometer registering as low as 20 deg. below zero at times. Artificial means were employed to prevent the concrete from freezing. The water used in mixing, as also the aggregate, was warmed, and salamanders were kept fired under the slab for a period of about three weeks after casting.

STRESSES

Referring to Dr. Henry T. Eddy's book, recently published, entitled "The Theory of the Flexure and Strength of Rectangular Flat Plates, Applied to Reinforced-Concrete Floor Slabs," and applying his formula, it will be noted that the width of the belts of rods in the slab of the Downing Street Bridge should be such in the mushroom system as to make them



DOWNING STREET BRIDGE OVER CHERRY CREEK, DENVER

cover practically the entire area of the slab, which is found to be the case in this design, although, by reason of the obliquity of the bridge, this width is some 10 in. less than 7 $(L_1 + L_2)/32$, which would have been required in case of rectangular panels for the "mushroom" system, where L_1 equals longitudinal span and L_2 transverse span. Applying his formula and assuming a dead load for the slab of 350 lb. per square foot and a live load of 150 lb. per square foot distributed over the full area of one panel, which equals a total load of 720,000 lb. evenly distributed, we find f_s, the stress on the steel, is about 8300 lb. per square inch, and under a test load of double the working load f_s equals about 10,800 lb. per square inch at the middle of the 45-ft. span.

The number and length of the laps over the columns reduce the unit stresses in the steel over the edge of the caps below that at midspan. Were four times the live load placed upon the bridge, the greatest unit stress in the steel would be only 15,800 lb. The factor of safety may, consequently, be taken as more than 4.

Again applying his formula for the deflection at the center of the panel, we find, under a test load of 300 lb. per square foot evenly distributed over the full area of a panel, the deflection at the center would not exceed 0.18 in., which is less than 1/3000 of the span. But this formula is one derived to compute actual deflections for heavy loads only where the unit stresses in the steel are 20,000 lb. or more, and give results much in excess for small loads. On this account and owing to stiff sidewalks over 30 in. deep, longitudinal car rails, and pavement, it is probable that no deflection could be detected under test load.

Assuming the neutral axis to be at the bottom of the slab at the edge of the pier the maximum stress on the concrete on the center of the slab, computations show that caps is everywhere less than 700 lb. per square inch, the allowable working stress.

From the above it will be seen the stress values for concrete and steel used in designing the slab of this bridge are very conservative. It will also be noted that the formulæ used in obtaining the above values for stress in steel and concrete are applicable only where the stiff column heads of the "mushroom" system are used.

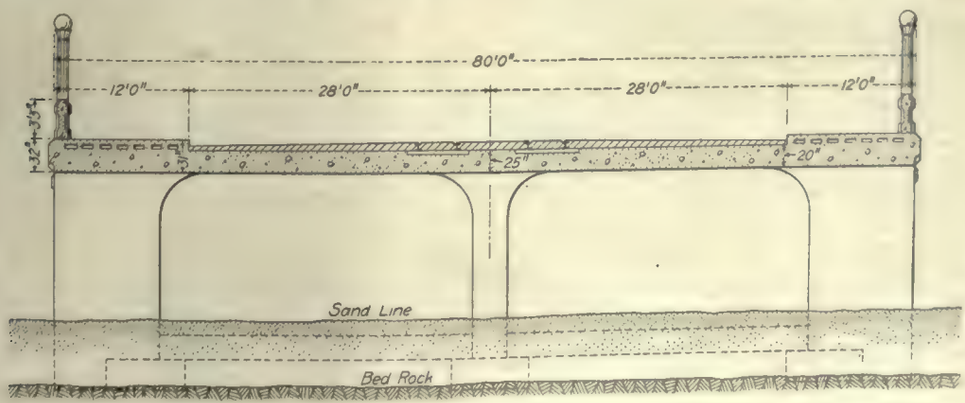
The Downing Street bridge was constructed by the C. P. Allen Contracting Company of Denver. The concrete for all piers was cast up to the sand line before the centering for the slab and the remainder of the piers were erected. The balance of the bridge was cast in one operation, but not continuous, the slab being divided into panels, so that one panel with its piers could be completed in a day's run, all joints in the slab being made at the centers of spans, using temporary wooden bulkheads to secure smooth vertical joints. The concrete was all machine mixed and placed with two-wheeled carts.

CENTERING

The centering for the slabs consisted of 6 x 12-in. posts spaced about 8 ft. 3 in. on centers both ways, carried on 12 x 14-in. mud sills and sway-braced both ways with 3 x 6-in. bracing. Stringers 12 x 12 in., of Oregon pine, were laid directly on the posts, and 2 x 12-in. Oregon pine joists laid over the stringers 12 in. on centers, with 1-in. sheeting over the joists. Very little cutting of the form lumber was necessary because of the flat slab without beams, and the salvage on it to the contractor was therefore exceptionally large.

Mud sills were used instead of piling, as ordinarily Cherry Creek carried very little water in the winter time, and it was expected the work would be completed before the usual spring freshets. The specifications provided that the slab centering should remain in place for not less than sixty days. The work was delayed somewhat in starting, which brought the casting of the slab later in the spring than was expected, and about thirty days after casting an unusually early freshet cut away the sand under the mud sills, allowing the forms to settle several inches. As far as could be observed, however, there was no settlement in the slab. This practical test clearly shows that the concrete when properly cured is far from overstressed, as it is now probably three times as strong in compression as it was thirty days after casting, and should carry five times the full working live load as easily as it then carried its own dead load.

The contract price for the bridge, plus



CROSS-SECTION SHOWING MAIN DIMENSIONS OF ONE OF THE BRIDGES

the cost to the city of reinforcing diagrams, steel and artificial stone, was about $17,400. This did not include the track work, which was a separate item and paid for by the Denver City Tramway Company. As the bridge is constructed it is absolutely independent of any end abutments or retaining walls, and approaches and retaining walls could be entirely washed away and the bed of the creek scoured down to bedrock without injury to the bridge. In the event of a flood passing over the top the railing and lamp standards might be injured, but could be easily and comparatively cheaply replaced. The stone railings might wash away if submerged by a flood and leave only the relatively thin slab impeding the flow of the water, which would tend to cause only slight overflow. The weight of the bridge itself adds greatly to its permanency.

The total contract price for the Market Street bridge was $17,150; for Larimer Street bridge $17,850. The contract price of the Curtis Street bridge plus cost to city of reinforcing diagrams, steel and artificial stone was $12,300. On all four bridges the writer acted as engineering agent for C. A. P. Turner of Minneapolis, designing and furnishing the reinforcing steel and artificial stone.

Standard Grades and Cross-Sections for Colorado Roads

MAXIMUM road grades adopted by the Colorado State Highway Commission are 6 per cent, and most of the lines laid out over the Continental Divide are within this limit, with the exception of a few short stretches. The standard width of road is 28 ft. from ditch to ditch, with a rise in the center of the road of 20 in. from the bottom of the ditch. The section was designed, states J. E. Maloney, State highway engineer, with the idea that blade machines and teams could be used to do the crowning. For sidehill work the width from a 2-ft. ditch to the outside of the road is 18 ft. The slope toward the hill is ½ in. per foot. For embankments a width of 24 ft. has been adopted, with a rise of 1½ in. to the foot.

First 2400-Volt Third-Rail Line Is Built

Electric Road in Michigan, Linking Grand Rapids, Kalamazoo and Battle Creek, Is Designed for Heavy Loads and High Speeds

A 2400-VOLT third-rail electric railroad—the first ever built to use such a high voltage with the third rail—has just been completed in Southern Michigan. The line is owned by the Commonwealth Power, Railway & Light Company of Grand Rapids, and has just been turned over to the Michigan Railway, the operating company. It consists of a new line 50 miles long from Kalamazoo to Grand Rapids, and branches to Battle Creek and Allegan, obtained by buying and electrifying a 44½-mile branch of the Michigan Central Railroad connecting these two points. The Battle Creek-Allegan line crosses the new line at Monteith Junction, 18 miles from Kalamazoo and 30 miles from Battle Creek. The Kalamazoo-Grand Rapids section represents the highest type of modern electric-railway construction, being designed for heavy loads and speeds up to 90 miles per hour. Some of the trains are scheduled to run the 50 miles in seventy minutes.

General Features

The territory traversed between Grand Rapids and Kalamazoo is slightly rolling, some rather heavy cuts and fills being necessary. Except in the city streets of Kalamazoo, and on a section of private right-of-way in Grand Rapids, the maximum curvature is 3 deg. and the maximum grade 1 per cent. The roadbed is 18 ft. wide on fill and 24 ft. wide in cuts, 1½:1 slopes being used in each case. The total amount of grading for the 50 miles was about 1,000,000 cu. yd., the heaviest being 20 ft. deep and 2000 ft. long, and involving 85,000 cu. yd. The maximum fill contained 60,000 cu. yd. and was 30 ft. deep. In general, the right of way is 100 ft. wide. Through Grand Rapids there is a section of private right-of-way several miles long, wide enough for a second track. All right-of-way is fenced.

All waterways and under or over crossings are concrete or concrete and steel combined. For the smaller openings reinforced-concrete pipe was used, furnished under contract by the Chicago Reinforced Concrete Pipe Company. This pipe was made on the right-of-way with a portable concrete mixing plant which was moved along the line to minimize the haul of the completed pipe.



BOARD EACH SIDE PROTECTS THIRD RAIL

Bridges

All bridges and viaducts except those to carry foreign roads were designed for Cooper's E-40 loading, which is approximately equivalent to a 100-ton car. For overhead highway crossings the ordinary three-span type of bridge was generally used.

Two bridges of unusual size were constructed over the Grand River in Grand Rapids. The lower Grand River bridge consists of seven 88-ft. deck girders resting on concrete piers, the two central spans of which rest on a circular pier and are designed as a draw span. Double-track approaches of this bridge from each side close into gauntlet tracks over the bridge. This structure, with its two 59-ft. towers, giving a 210-ft. feeder span, is shown in one of the accompanying illustrations.

The upper Grand River crossing is a double-track reinforced-concrete bridge. The Grand Rapids passenger terminal is at one end of the structure and a freight yard and repair shops are at the other end. The bridge is of the Luten type, with four 96-ft. spans and one slightly longer.

All track, including main track and sidings, is laid with 80-lb. A. S. C. E. rail on 8-ft. cedar ties, twenty to a 33-ft. rail. Every sixth tie is 10 ft. long and furnishes support for the third rail. Main-line turnouts are built with No. 12 frogs, 18-ft. switch points and 90½-ft. leads. Passing sidings are approximately 1000 ft. long, built according to main-line standards, except that the third rail is lighter. All turnouts were finished by the Cleveland Frog & Crossing Company, as were the manganese-steel crossings at all grade intersections with foreign roads. All grade crossings of other railroads are interlocked.

Third Rail

Along the main line the third rail is an 80-lb. A. S. C. E. low-carbon rail rolled especially for this road; on industrial sidings and passing tracks 52-lb. relayer is used instead. The center of the third rail is 32 in. from the nearest gage and the top is 8 15/32 in. above the surface of the track



LOWER GRAND RIVER BRIDGE AT GRAND RAPIDS HAS DRAW SPAN, NECESSITATING HIGH TOWERS FOR FEEDER-LINE CROSSING

rail. The type of protection is shown clearly in one of the photographs.

In the cities and elsewhere where the overhead trolley replaces the third rail, three types of catenary suspension have been used. Where there are two tracks they are spanned at 300-ft. intervals by double-track special galvanized-steel bridges with the legs set in concrete. The legs are 32 ft. 1 in. long and set 5 ft. in concrete, and give a trolley clearance of 9 ft. above the top of rail. The single-track overhead construction is suspended from special galvanized, hot-riveted, steel latticed poles set in concrete. Wooden poles are used for the side tracks.

SERVICE

As the road handles package freight and express traffic as well as passengers, facilities have been provided therefor. At Grand Rapids the freight facilities are on the opposite side of the Grand River from the passenger terminal, and include a 50 x 185 ft. freight house and a team yard, as well as a repair plant. At Kalamazoo a combination passenger and freight terminal has been provided. To meet the traffic demands in the best manner, three classes of service have been inaugurated—local trains, limited trains and flyers. The flyers are single cars from Kalamazoo and Battle Creek to Monteith Junction, where they are coupled together and run to Grand Rapids as two-car trains. The shorter run, that from Kalamazoo to Grand Rapids, a distance of 50 miles, is made in 1 hour and 10 minutes. The limited train takes slightly longer, and the local trains require 1 hour and 45 minutes and 2 hours and 25 minutes respectively from Kalamazoo to Grand Rapids and from Battle Creek to Grand Rapids.

The work of building the new line, and electrifying the steam road running to Battle Creek and Allegan, was under the immediate supervision of George L. Erwin, president and general manager of the Michigan Engineering Company, and G. J. Wagner, superintendent of construction. During the construction period the Michigan Railway was represented by the late W. A. Foote, vice-president, who promoted the line and was responsible for many of its unusual features.

STATE-AID ROAD-IMPROVEMENT SURVEYS made by the Wisconsin Highway Commission from July 1, 1911, to July 1, 1914, cost $27,165 for a total of 2567 miles, an average of $10.58 per mile. In addition 182 miles of surveys were made by representatives of the counties, which were not paid for by the commission, making a total of 2749 miles of State-aid road surveys. During the past winter the commission made surveys and plans for 500 miles of road, at approximately $7000.

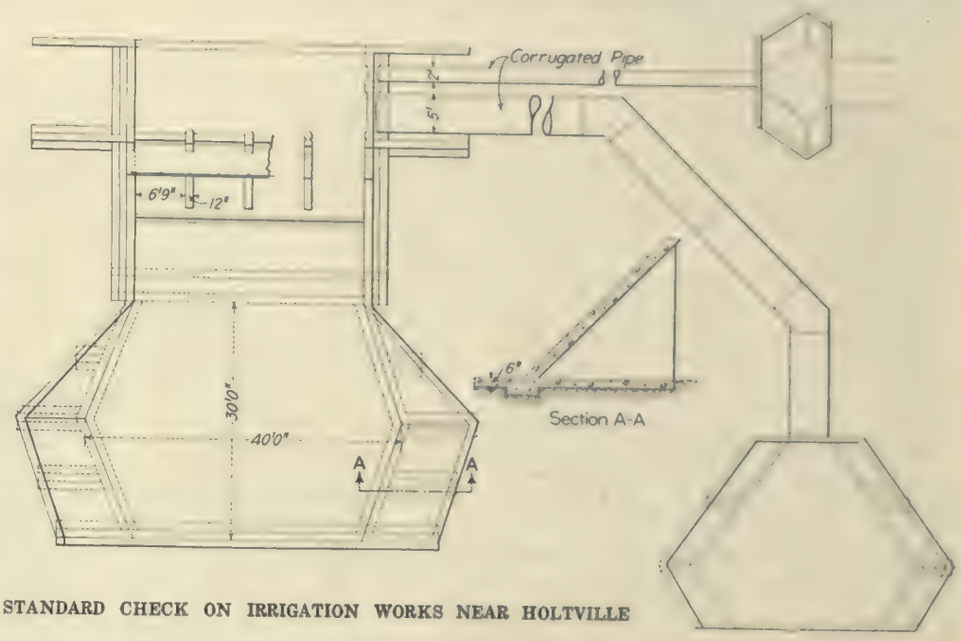
Bowl Outlets Reduce Velocities at Pipe-Line Ends

Enlarged Concrete Sections Used at Entrance Ends of Main and Diversion Channels of Irrigation Project in California

DIVERSION of water from the main canal of Imperial Water Company No. 5, near Holtville, Cal., is accomplished at three points by concrete checks from which the water is led in metal pipes some 20 ft. away from the main structure to prevent the possibility of erosion and back-cutting from the discharge. In one case two American ingot-iron corrugated pipes of 5-ft. and 2-ft. diameter respectively had their intake ends embedded in the side wall of the check, while the outlet ends discharged into a concrete bowl, 4 ft. deep and 28 and 10 ft. in diameter, designed to reduce the velocity so as to prevent erosion of the unlined canal earth banks beyond the bowl. The 5-ft. pipe feeds a side main paralleling the supply canal. To make the necessary turn two 45-deg. elbows, placed 20 ft. apart, were employed. All joints made in the field were riveted and soldered, substantial mud-sills were placed under the pipe and earth was puddled carefully around it. Control of the outlet flow is attained by wooden gates moving in iron channels embedded in the concrete walls of the check and operated by lift screws. The engineer states that the structures are watertight and satisfactory in operation.

In this district several corrugated-iron inverted siphons for the purpose of carrying storm water and waste irrigation water under a low-line main have been used. The intakes and discharges consist of vertical walls of reinforced concrete or of treated Oregon pine. With concrete the pipe is simply embedded in the walls, but with wood the pipe is let into the wood and the joint calked with oakum. Pipe has been selected where the concrete materials run high in cost.

Roger Laurence is chief engineer of Imperial Water Company No. 5 and has immediate charge of all construction work, which is carried out by force account.



STANDARD CHECK ON IRRIGATION WORKS NEAR HOLTVILLE

Boulevard Will Overlook Entrance to San Francisco Harbor

A SCENIC boulevard starting at the Panama-Pacific International Exposition and skirting the tops of the cliffs overlooking the entrance to San Francisco harbor is now under construction, the major part of the work being undertaken by the city of San Francisco. The roadway is 80 ft. wide with a paved center, parking and sidewalks. Part of the route is through the Presidio military reservation and is being constructed by the Government. Private owners have donated parts of the right of way and the exposition company has appropriated $64,000 toward the work.

WATER consumption in Albany, N. Y., during 1914 amounted to 219 gal. per capita daily as compared with 211 gal. in 1913 and 235 gal. in 1912. The population in 1914 was 108,692 and the number of meters installed 6519.



CONCRETE CHECK WITH METAL PIPE OUTLETS



END OF PIPE LEADING INTO CONCRETE BOWL

Tunkhannock Viaduct Nearing Completion

Last Steps Include Concreting Arch Ribs and Spandrel Walls Through Upper Panels of Central Cableway Tower

THE MAIN RIBS for the center arch of the Tunkhannock viaduct, which have just been concreted, were built through two bays of the central double cableway tower without stopping operation of the cableway. This tower rises more than 320 ft. above the creek bed, and supports four cableways, two on each side. The viaduct, 2375 ft. long and 240 ft. high from the creek level to the parapet, is now nearing completion, only 6000 of its 162,000 cu. yd. of concrete masonry remaining to be placed. It consists of ten 180-ft. and two 100-ft. arch spans, and is the largest structure of its kind in existence. The viaduct is part of the 43-mile Nicholson cut-off of the Delaware, Lackawanna & Western Railroad in northeastern Pennsylvania. Its construction, including special features of the foundation work, the arch centering and the twin double-span cableways, erected for handling centering and concrete, have been described in the issues of the Engineering Record of May 3, 1913, page 484, and Nov. 29, 1913, page 594.

The central cableway tower is of timber on concrete pedestals midway between piers 5 and 6. The timber tower consists of three bents, parallel to the bridge, of three posts each. The faces of the tower perpendicular to the bridge are battered, while those parallel to the bridge are vertical. The central bent is located between the main arch ribs, which are in pairs for each span, while the outside bents are entirely clear of the concrete construction.

CENTERING FOR LAST ARCH SPAN SET

As will be remembered from the former articles, each arch center is in four sections. The four sections next to the piers for the two sets of centering are entirely clear of the tower, and were set first. The four middle sections were then erected by temporarily removing one panel of X-bracing on each face of the tower and replacing it through the framework of the centering after the latter had been set. The X-bracing in the panel above was then removed to allow the rib concrete to be poured.

Between each of the batter faces of the tower and the three center posts on a line at right angles to the viaduct comes a spandrel wall. To concrete these two walls the X-bracing is removed in one panel between the three posts of the bent between the arch ribs. In concreting the floor of the viaduct three small square holes will be left for the three posts of the center bent. The concrete clears the cableway tower at all other points.

This construction was all planned at the time the cableway was designed. When the last arch centers had been set, the last remaining clear hoistways through which the cableways could reach the ground were blocked. Provision had to be made, therefore, for raising concrete buckets from the tracks on the floor of the valley to the bridge deck and transferring them to the cableways. This is done by four derricks, two on top of pier 6 and two on pier 4. Pier 5 was not used, as it was not quite finished at the time the last arch centers were set. Because of the smaller hoists used, it takes 90 seconds to hoist a bucket with a derrick as against 30 seconds with the cableway. Buckets can be handled right to the face of the tower, and dumped into hoppers, the concrete being spouted the short distance remaining to the center of the arch. Two yards has been the standard concrete unit handled on the job, and 30 cu. yd. per hour, or better, have been placed for each cableway span in service.

The cableway tower construction was planned by Lincoln Bush and engineers of the Lidgerwood Manufacturing Company. Flickwir & Bush are the contractors for the viaduct, and F. M. Talbot is general manager of the company. The design and construction of the viaduct has been under the direction of G. J. Ray, chief engineer of the Delaware, Lackawanna & Western Railroad. F. L. Wheaton is engineer of construction in charge of the entire cut-off work, and A. B. Cohen, concrete engineer, handled the design of the viaduct.



CLOSE VIEW SHOWS ATTRACTIVE PROPORTIONS OF STRUCTURE AND GIVES AN IDEA OF ITS MAGNITUDE







TUNKHANNOCK CREEK VIADUCT ON LACKAWANNA RAILROAD ENTERS LAST STAGE OF CONSTRUCTION

With its length of 2375 ft. and its height of 240 ft. above creek level, this structure is conceded to be the most remarkable concrete viaduct in the world.

Driving and Lining Carried On Simultaneously at Snoqualmie Tunnel Saved Timbering

Drift Driven Along One Wall from "Shafts" Sunk in Bench in East Heading Allowed Most of the Bench Excavation to Be Trapped Into Cars at Subgrade

By R. W. RAE
Chief Engineer, Cascade Irrigation District, Ellensburg, Wash.

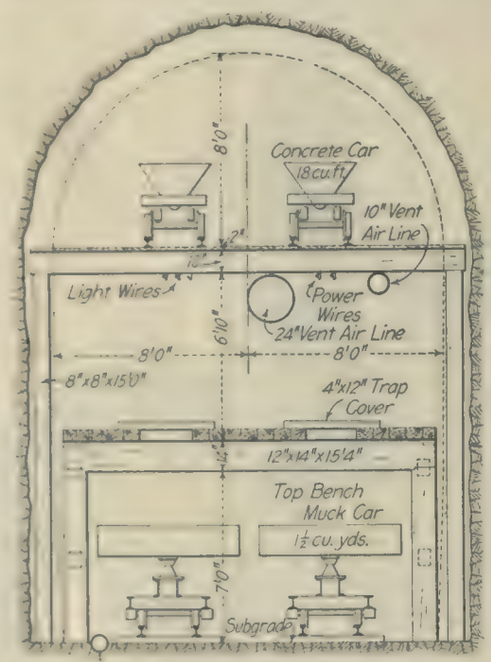
TO SAVE TIMBERING concrete lining was placed as excavation progressed in the arch of the top heading at the east end of the Snoqualmie tunnel, sixty miles east of Seattle, which was opened for traffic early this year. Concrete and muck were handled simultaneously by a dinky at the level of the top of the bench. Meanwhile a heading in the bench along one side was driven from "shafts" sunk in the bench and used to operate a low-level railway into which the bulk of the bench excavation was trapped. From the west end the bottom-heading method was used with economy and speed. Concrete was handled here on an 8000-ft. cable-car line in trains of cars provided with grips. The fact that the new line was 443.5 ft. lower than the old location was turned to good advantage in laying out concrete plants at either end of the 11,902-ft. tunnel. The work was done entirely by the railway company's own forces.

On Jan. 24, 1915, the first regular train passed through the tunnel. Although work on this tunnel was authorized in July, 1910, little was done until March, 1913, and the bulk of the construction has been accomplished since that time. During this period work was prosecuted day and night with a force of from 500 to 2000 men. Some idea of the saving in distance, grade and curvature effected by the relocation may be gained by referring to the article in the Engineering Record of Feb. 13, 1915, page 193.

BOTTOM HEADING PREFERRED FOR WEST PORTAL

The tunnel was driven entirely from the two ends. At the west end a bottom heading 7 x 13 ft. was first driven. This was winged out to the full width and timbered. Upraises to the crown of the arch were then driven 150 ft. apart, after which stopes were driven in both directions from each upraise until they met, all muck being handled by gravity, through traps, into 1½-yd. side-dump cars.

In ordinary ground 8-ft. rounds were drilled in the stopes, consisting of approximately twenty holes. The rock encountered was mainly a hard black slate, although short sections of granite and extremely hard quartzite were also found. The irregularity of the rock formation was the most difficult feature in the driving of the tunnel. In many heading rounds the rock on one side was so much harder than that on the other that two machines would be through drilling several hours in advance of the other two, making it necessary to crowd all the machines on one side of the bar to complete the drilling on the hard side. The uncertainty of the ground made it impossible to judge with any accuracy just when a shot could be put off. The time necessary for drilling an 8-ft. round varied from 3 to 20 hr.



MUCK AND CONCRETE EQUIPMENT FOR BOTTOM HEADING

DEEP PORTAL CUT NECESSITATES TOP HEADING AT EAST END

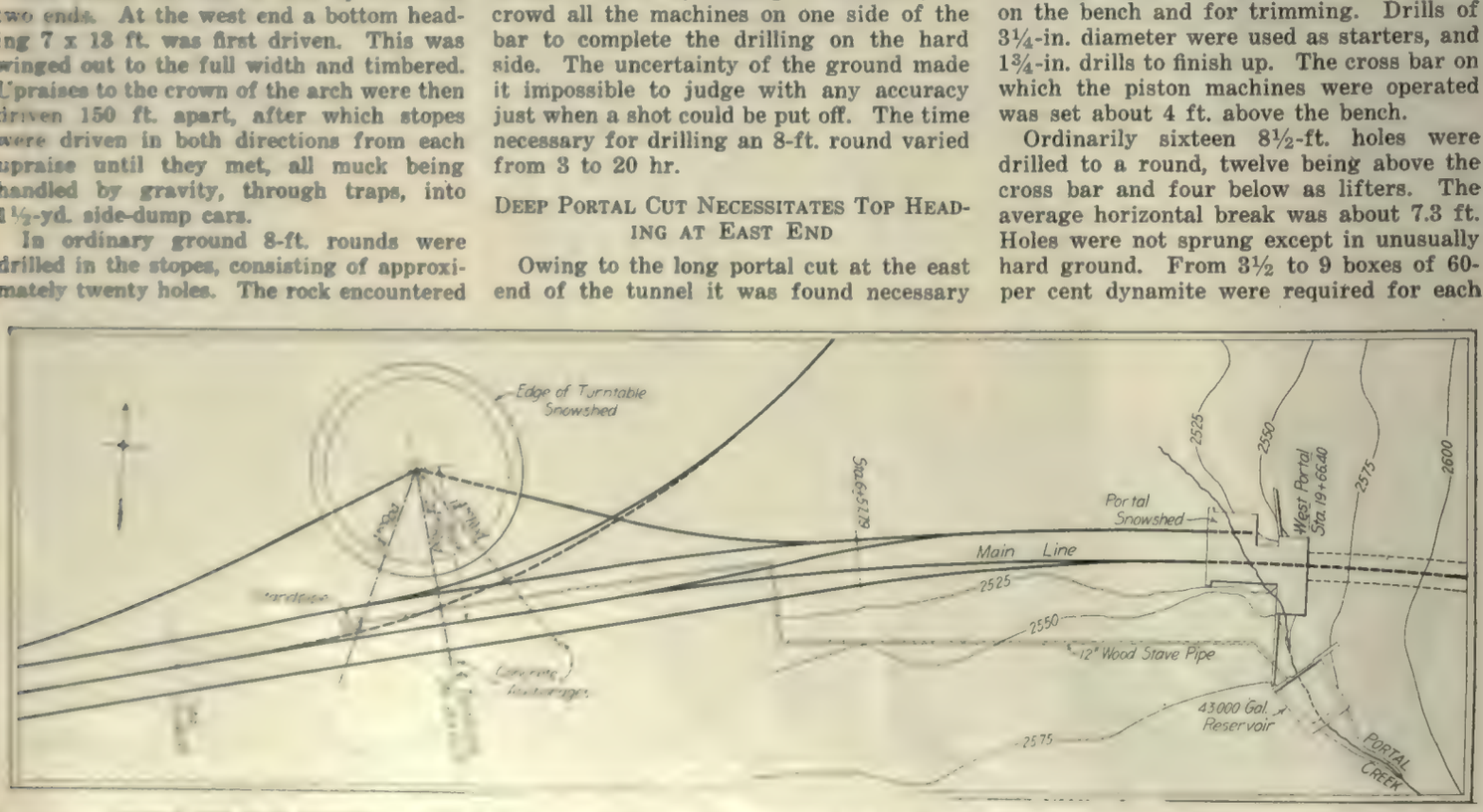
Owing to the long portal cut at the east end of the tunnel it was found necessary to adopt the top-heading plan of driving to avoid waiting an additional three months for the excavation of the approach. The top heading, 7 x 13 ft. in size, was driven at the crown of the arch and later winged out to the full width of 18 ft. The floor line of the heading was taken out to 1 ft. above the spring line of the arch, so as to reduce as much as practicable the amount of muck to be handled at the higher level. For taking out the bench a drift of 7 ft. high by 9 ft. wide was driven along the south wall and timbered with square sets. Everything above the timbering was trapped, the rectangular section of the bench left at subgrade being broken up and hand-mucked after the trap timbers were removed. In order that this bottom drift might be kept well in advance of the trapping forces shafts were sunk at intervals of approximately 800 ft. from the heading to subgrade, and drifts worked either way from each shaft. The muck from these shafts and drifts was handled in 1-yd. steel rocker cars, which were hoisted to the heading grade on a cage operated by a steam hoist using air.

In the east end of the tunnel, the ground was uniformly softer than that encountered in the west end, making it necessary to put in considerable timber. The first 1500 ft. was timbered with permanent, non-removable sets. Later, owing to the high cost of this class of work and the decision to concrete the entire tunnel, much of the arch lining was placed as the top heading progressed, thus avoiding considerable waste of timbering. All material in the top heading was handled by a 3-ton Goodman electric trolley locomotive. Cars in the drift at subgrade were handled by 7-ton steam dinkies fired with coke.

DRILLING OPERATIONS AND EQUIPMENT

Air was used at a pressure of from 90 to 150 lb. per square inch and was taken to the heading in a 6-in. pipe line. Ingersoll-Rand piston-type drills, mounted on a horizontal bar, were used in the heading, and a great many jackhammers were used on the bench and for trimming. Drills of 3¼-in. diameter were used as starters, and 1¾-in. drills to finish up. The cross bar on which the piston machines were operated was set about 4 ft. above the bench.

Ordinarily sixteen 8½-ft. holes were drilled to a round, twelve being above the cross bar and four below as lifters. The average horizontal break was about 7.3 ft. Holes were not sprung except in unusually hard ground. From 3½ to 9 boxes of 60-per cent dynamite were required for each



CREEK BED WAS CARRIED ACROSS WEST PORTAL STRUCTURE AND THE WATER WAS STORED FOR USE OF LOCOMOTIVES

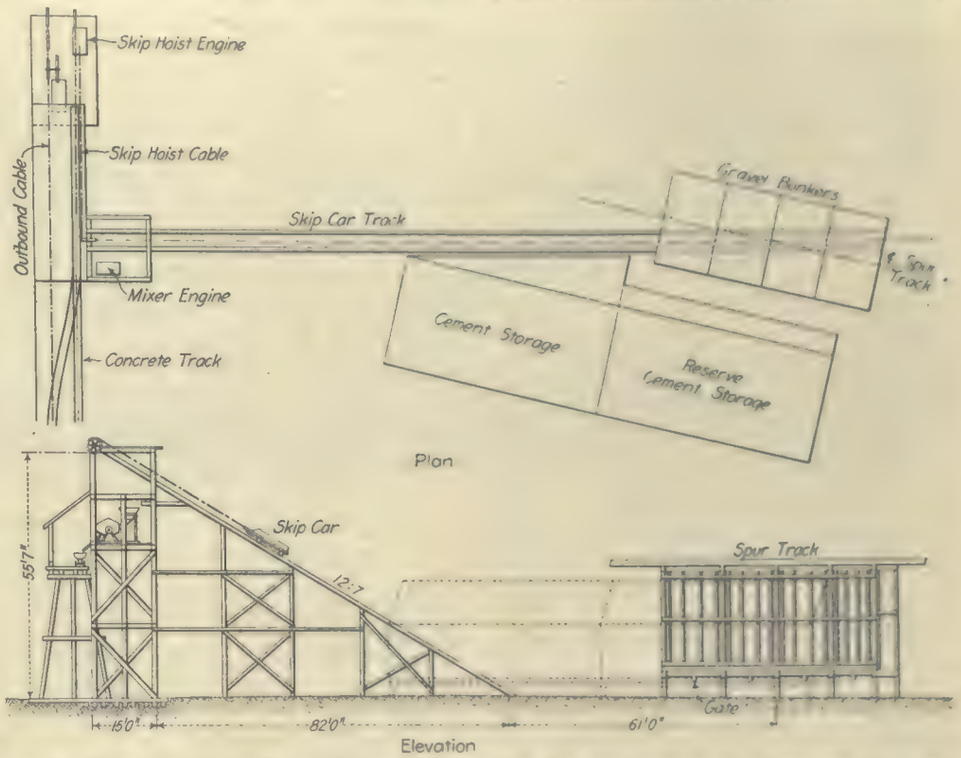
round of sixteen holes. Fuses were used throughout the work. An average of 8 lb. of powder was required for each cubic yard of material removed. All muck was shot upon steel sheets to facilitate shoveling. The best progress made in the east heading was 433 ft. in one month, and as much as 500 ft. of the bench in this heading was removed in one month. The trap to the east heading was maintained as its original high level throughout the work, being supported on 8 x 12-in. timbers placed 5 ft. apart at the spring line of the arch and posted to subgrade.

CABLE CARS CARRY CONCRETE AT WEST END

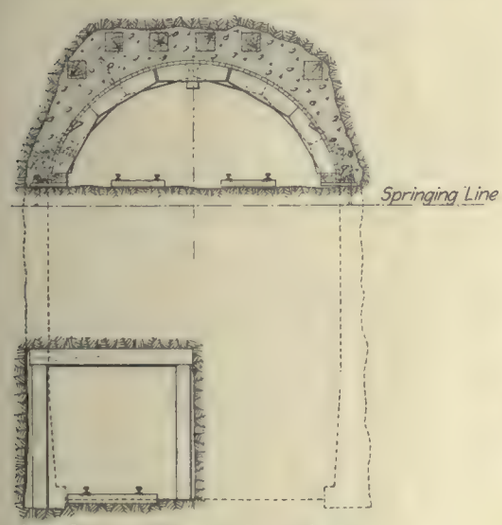
The aggregate for the concrete used in lining the tunnel was obtained from a gravel bank on the right-of-way of the railroad 15 miles from the west portal. It was sluiced into cars at a cost of about 4 cents per yard, and one train load was delivered to each end of the tunnel every day while concreting was going on. The difference in grade between the old main line and the tunnel portal was taken advantage of in locating the spur at the west end for the delivery of gravel so that the cars dumped directly into storage bins over the mixer. The gravel storage consisted of four bins with a total capacity of 350 cu. yd. The cement shed at the west end had a capacity of 4000 bbl. The gravel was handled by one man, and the cement by two men.

Concrete materials were hauled from the bunkers and cement shed in a mine skip running on an incline and dumping directly into the ¾-yd. Smith mixer. Concrete was handled from the mixer in 18-cu. ft. dump cars over a high line built at the level of the top of the bottom heading. As all muck at this end was handled at the level of the tunnel floor, this track did not interfere with the muck cars, and was only used for concrete. The cars were operated by a ¾-in. endless wire rope traveling at a speed of 4 miles per hour. Each train was attached to the cable by a grip which was released at the desired point by a trip. The slack was taken out of this cable by a counterweight adjusted outside the tunnel. This counterweight was hung to a carriage holding a sheave around which the track cable passed. The carriage was free to move up and down an inclined track. The main cable was operated by a 75-hp. hoisting engine.

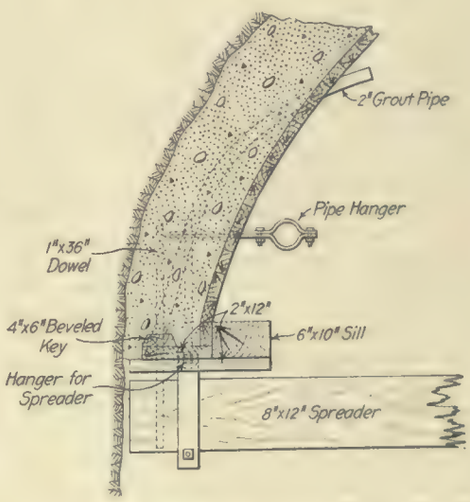
From six to ten trains were used in hauling concrete, depending on the distance from the portal at which concrete was being poured. The material was dumped directly into the side walls, and into a box between the tracks, from which it was shoveled into the arch forms. The limit of cable haulage was 8000 ft. Twelve hundred linear feet of tunnel were lined from one end in a month with this layout. Ground pipes inserted every 12 ft. in the roof were used to complete the concreting of the arch. From 15 to 600 cu. ft. of mortar was forced through each of these ground pipes.



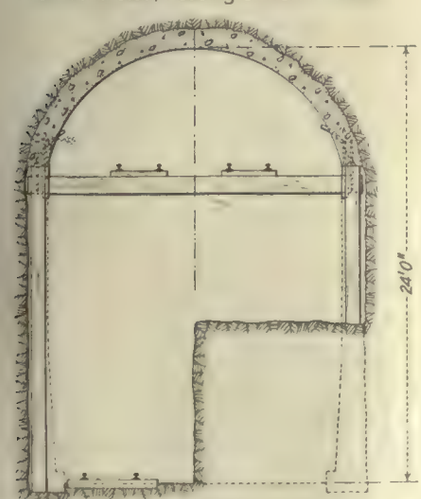
LOW DELIVERY OF MATERIAL AND HIGH ENTRANCE TO HEADING ARCH GOVERNED LAYOUT OF CONCRETE PLANT AT WEST PORTAL



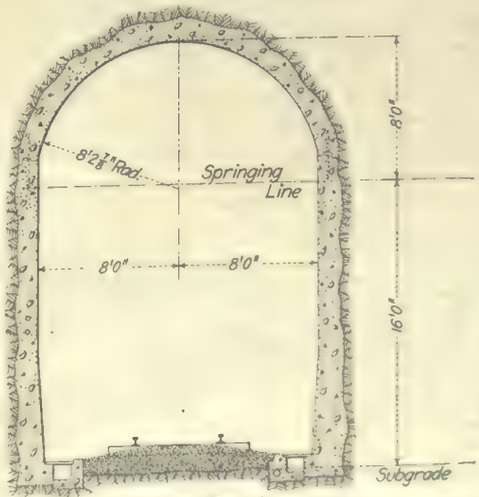
Arch Concreted, Heading Driven in Bench



Detail of Key and Grout Pipe



Bench Partly Removed



Completed Tunnel

ADVANTAGES OF TRAPPING LARGE PART OF EXCAVATED MATERIAL RETAINED EVEN WITH TOP HEADING METHOD ON EAST END

EAST PORTAL NEARLY HALF A MILE FROM OLD MAIN LINE

The east portal was 2000 ft. away from the nearest point of the old main line and 200 ft. lower in elevation. To avoid building a long standard-gage track for materials at this end the storage bins were located 900 ft. from the main line, and an inclined track of 3-ft. gage was run from the east end to the mixer, where a small gravel storage was provided. Two V-body dump cars of 2 cu. yd. capacity each were used on this inclined railway. A gasoline-driven hoist was installed at its upper end. A second ¾-yd. Smith mixer located under the bins at the portal dumped into hopper-bottom cars running on the highline track. The electric locomotive on this track pushed empty muck cars ahead of it and pulled concrete cars, eight at a time, behind

it. While the concrete was being dumped the locomotive took the empty cars to the heading and returned with a load, and while the concrete cars were being filled at the portal the locomotive took the muck cars to the dump.

This arrangement made lining operations somewhat slower than at the west end of the tunnel. As soon as the heading excavation at the east end was well started, the arch was concreted in advance of excavating the bench. In order to avoid a possible settlement when the bench was taken out, the bottom of the concrete on each side of the arch was reinforced with six ½-in. square bars. As the bench was excavated 8 x 10-in. posts were set under the concrete at intervals of 8 ft. A longitudinal key was formed out of the bottom edge of the arch concrete on each wall, and into the top of this key on 8-ft. centers were concreted 2-in. ground pipes. The side walls were concreted up in the usual way, and the closure was made by forcing ground into the key through these pipes.

PORTAL CARRIES CREEK BED

The portal structures are of reinforced concrete, that at the east end being of the usual design. As the portal at the west end, however, was located directly under a mountain stream carrying, at some seasons, great quantities of water, the portal opening was extended 60 ft. and a double conduit built overhead to carry the creek water.

The power plants at either end of the tunnel were unusual in construction work, in that fuel oil was burned exclusively in the boilers. This oil was delivered in railway tank cars and stored in four tanks, those at the west portal holding 15,000 gal. each and those at the east portal 20,000 gal. each. The latter tanks were on a siding 2700 ft. from the portal, and oil was piped from them to the boilers. These plants, which had a capacity of 450 and 375 hp. respectively, burned an average of 120 bbl. of oil apiece each 24 hours.

COST, ORGANIZATION AND WAGES

The cost per foot of tunnel complete with track and ballast was $166. This cost is made up of $112 per foot for excavation, $44 for concrete lining and $10 for track and ballast. The quantities corresponding to these figures were: Excavation, 15.5 cu. yd. per foot, place measurement, increased to 17.5 cu. yd. actual measurement by the overbreak; and 6 cu. yd. of concrete lining per foot. These figures include all charges made against the work.

The work was in charge of J. I. Horrocks, engineer and superintendent of the tunnel, reporting to B. O. Reeder, assistant chief engineer, at Seattle, who in turn reported to C. F. Loweth, chief engineer. The office force consisted of two clerks, two head timekeepers and four assistant timekeepers. One draftsman, one paymaster and one stenographer were also attached to the office at the west portal. One engineer, assisted by an instrumentman and two chainmen for each heading, looked after all location and inspection work. The camp and commissary departments were taken over by a contractor. The working force was organized with one general foreman at the west end, and two walking bosses on tunnel work and two on concrete work. The walking boss on concrete work at each portal also handled the outside layout. One master mechanic looked after the entire job.

Outside labor received 20 cents per hour, concrete men from 25 to 30 cents per hour, muckers 25 to 27½ cents, machine runners 45 cents, helpers 30 cents, shift bosses 60 cents and carpenters 35 cents. Outside foremen received 35 and 40 cents per hour.

Old Storage Used for Oversize in Enlarged Rock-Crushing Plant on Detroit River

Since Reconstruction Large Crushers Do Not Have to Wait for Small Crushers to Catch Up on Oversize, while Oversize Can Be Sold or Crushed as Needed

IN ORDER to obtain increased capacity, continuity of operation and flexibility of production to meet the demands of the trade which require varying kinds and quantities of stone day by day, a large Michigan rock-crushing firm has recently reconstructed its plant. Stone crushed in this plant is the result of dredging operations in the Detroit River, and arrives at the plant on large deck scows. As the above operations are carried on by very heavy equipment, some of the limestone blocks received are of unusually large size, pieces with dimensions of 3 x 6 x 6 ft. not being at all uncommon.

The original plant was served by a slip at the crusher side. In order to ship finished products by water the newly constructed portion of the plant, containing additional screens, storage capacity and crushing rolls, is located on a parallel slip and connected with the old plant by two 24-in. belt conveyors.

Stone is unloaded from the scows by a dragline outfit, which swings in a full circle on its base and operates a large flat scoop-like bucket that slides along the top of the scow filling like an ordinary scraper. The bucket is then hoisted, swung over and dumped into the receiving crusher.

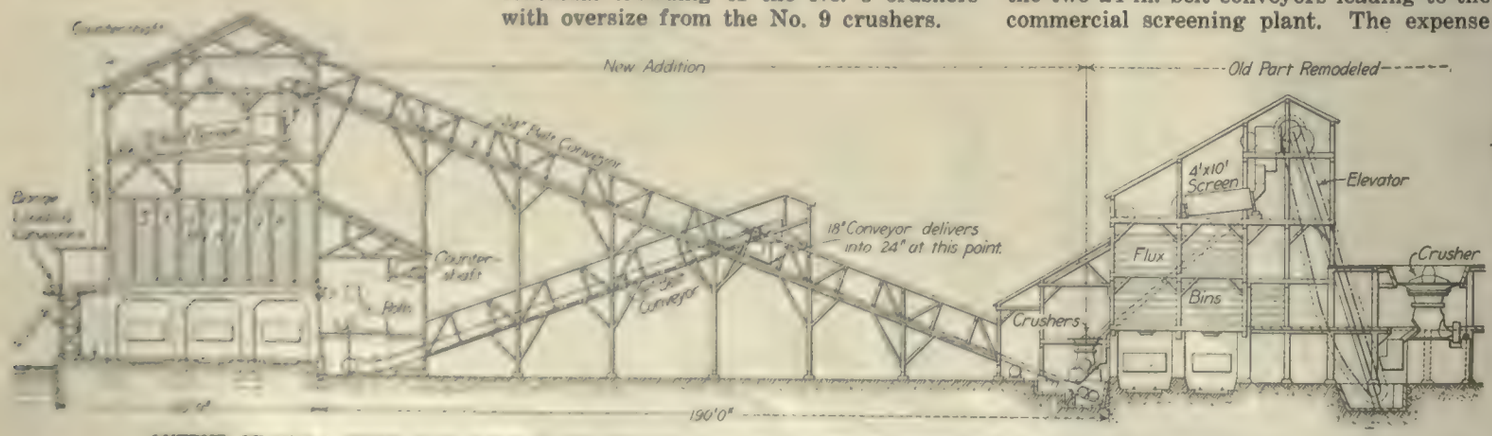
The original plant consisted of a No. 9 crusher and elevator, two 48 x 10-ft. screens, two 32 x 20-ft. screens and two No. 5 crushers for rejections, the stone passing through the several machines in the order named. The finished sizes of stone fell into a set of bins of small capacity below the screens. The plant was cramped for space and inaccessible in nearly every part, making operation difficult, but the most serious trouble was the lack of flexibility and the continual crowding of the No. 5 crushers with oversize from the No. 9 crushers.

The lower screens at the head of the No. 9 elevator in the old plant were removed, the screen floor was lowered so as to get a proper discharge from the No. 9 elevator, and the 48 x 10-ft. screens were set on this new floor and equipped with perforated coverings having 3½-in. round holes. At the same time the side walls of the old bins were raised, increasing the storage at this point.

OPERATION AFTER REMODELING

The stone is now broken in the No. 9 crusher to about 5-in. size and spouted direct to the No. 9 elevator. This raises it to the head of the plant, from which point it is spouted to the two 48 x 10-ft. screens. The spouts are so arranged that in case either screen has to be stopped for any reason the entire product may be sent through the other screen by operating the gate. The oversize from these screens is known as "flux stone," for which there is now a separate market. It falls directly to the old storage bins below, while the undersize chutes to two 24-in. belt conveyors leading to the new screening plant for commercial stone. This arrangement permits the operation of the No. 9 crusher independently of the rejection crushers, and the No. 9 crusher is never delayed by having to wait for the rejection crushers to catch up. The changes were accomplished with few alterations of the existing buildings, and at little cost.

The two No. 5 crushers were placed side by side directly in front of the flux bins, so that they would be fed automatically from chutes in the sides of the bins and would discharge their product directly upon the two 24-in. belt conveyors leading to the commercial screening plant. The expense



OUTPUT OF OLD LAYOUT WAS HELD DOWN TO CAPACITY OF OVERSIZE CRUSHERS, WHICH COULD NOT KEEP UP

Oversize now accumulates in old bins, and is crushed or sold according to demand.



PLANT HAS RAIL AND WATER DELIVERY, AND STORAGE FOR ALL SIZES, AND CAN RE-CRUSH CHEAPLY TO SUIT MARKET

of this change amounted to new foundations for the No. 5 crushers and a new light frame building over them.

This arrangement of the rejection crushers makes them independent of the No. 9 crusher and permits their constant operation so long as stone remains in the flux bins. They can be run to maximum at all times; in case of accident, or if repairs to one crusher become necessary, the flux-bin gate is closed and the other crusher kept at work, the oversize in the meanwhile accumulating in the flux bin. Again, in case of an extra demand for commercial stone and a light demand for flux, the No. 5 crushers can be run overtime, and at night if necessary, recrushing all of the rejections down to commercial stone, while the No. 9 end of the plant is closed down.

The 24-in. belt conveyors leading from the No. 5 crushers are inclined from the horizontal, thus elevating while conveying the stone. Each discharges at its upper end into a 48 x 28-ft. revolving screen provided with dust jackets and sections perforated to give the various sizes of stone called for by the Detroit market. The undersize from the dust jacket of each screen falls to the floor below to a 36 x 90-in. shaking screen, which separates the screenings from the fine stone. Interposed between the revolving and shaking screens is a pneumatic device which takes the fine dust out of the stone and delivers it to a separate section of the bins, thus cleaning the screenings and at the same time making this objectionable dust a valuable by-product.

Economical Construction

Sized stone from the screens falls below to the storage bins, which have a capacity of 1750 cu. yd. and are of combined concrete and timber, specially designed for construction economy. The footings, columns and floors of these bins are of reinforced concrete, while the bin walls consist of heavy timber posts sheathed with 3-in. planks and cross-stayed with heavy tie rods. By this scheme of construction the bins were built with only about 300 cu. yd. of concrete and 50,000 ft. of lumber. The lower posts and floor, which are subject to rot, were replaced with concrete, and the bin walls, which would be expensive to build of concrete because of the amount of form work required, are made of timber.

A belt conveyor under the bins delivers commercial stone directly to scows in the slip, or, running in the reverse direction if necessary, delivers oversize and material to be recrushed to electrically driven roll crushers located to the right of the bin. The product from these rolls is carried by an inclined 18-in. conveyor to the 24-in. conveyor, thence to the top of the screening plant.

Three loading tracks run directly through under the bins and suitable gates are provided in the floor of each bin for loading railroad cars. The new plant was designed and its construction supervised by the J. C. Buckbee & Company, consulting engineers, of Chicago.

University Promotes Engineering Work without Displacing Consulting Engineer

Extension Division, in Fact, Creates New Work for Consultants by Urging Needed Measures on Smaller Communities

By GEORGE R. BASCOM

In Charge of Municipal and Sanitary Engineering Department, Extension Division, University of Wisconsin

THERE are few engineers in private practice who will not admit that there is very often a great need of some system of educating the public to the necessity of making certain public improvements. The problem of popularizing the engineering features of any public improvement and getting the public opinion aroused to action is a matter of promotion rather than engineering, a matter of salesmanship rather than design, and a problem in publicity in its final analysis.

If it is true that the cities, villages and communities quite generally need improvements which have a direct bearing on the health, economics, and general welfare of these places, would it not be a matter of economy and efficiency to create some system by which this engineering promotion or this education could be systematically and impartially carried on? There is little doubt that most engineers in private practice will agree with this, providing the work is carried on impartially and providing the service given is limited in such a manner that the legitimate business of the engineer in private practice is not taken over by the new agency. Of this the writer has been reassured by a great many opinions which were solicited prior to beginning the work in Wisconsin and have been sought at every opportunity since. It is quite interesting to note that in not a single case did the engineers consulted disapprove of the service when so limited. In many cases we have met with hearty approval and offers of co-operation that have been an inspiration in our work, which is truly pioneering.

The following account will show how the services of the Extension Division of the University of Wisconsin are offered in promotion work.

Water Situation at Bloomington

About a year ago the division held a three-day Community Institute at Bloomington, a town in Grant County, which lies in the extreme southwest corner of the State. In many respects Bloomington is a very remarkable village. There are less than 1000 inhabitants and yet the bank deposits are almost a million dollars! The town is located about 15 miles from the nearest railroad station. Nevertheless the stores are very much better than the average for towns of much larger size.

In spite of the fact that Bloomington is such a thrifty, businesslike little city, the people were never able to get together on the waterworks problem, which truly has been a problem with them for at least 15 years. Conditions there were such that the private well supplies were in constant danger of pollution from the privies, which, as usual, were located close to the wells. The fire losses were large and frequent. One recent fire cost the village and insurance companies more than twice the price of the proposed waterworks system. Prior to the last fire and since 1896 the fire losses in Bloomington have been more than $50,000.

Service Rendered

Probably the fact that Bloomington had voted a very large bond issue to be used as a bonus in securing a railroad outlet and had thus limited the public funds to practically $10,000 has been the main reason for delaying the installation of a public water supply. Add to this the fact that a con-

siderable portion of the village is made up of retired farmers, who opposed the idea, and we have the situation pictured about as it was when the Extension Division took hold of the problem. There was, however, a group of live-wire business men who were willing to take every means to get the much-needed supply, and to these workers we must give credit for valuable co-operation and assistance.

At the Community Institute the writer made a plea for a waterworks system, and explained to the general audience that the Extension Division of the university would make a study of the local problem, outline a plan, and furnish an estimate which would serve as a guide in deciding the bond issue. After the meeting a group of business men discussed the details of the plan, and as a result the Extension Division was asked to make the study and present a report at the earliest date possible. This action was also formally taken at a later date by the Village Board.

BOND ISSUE VOTED

An engineer made a trip to Bloomington to gather the data for a report and an estimate of cost. The expense of travel for this trip was borne by the village of Bloomington, according to our usual practice, the services of the expert being free to any community in the State.

After receiving the report the Village Board called an election on the question of voting bonds for the waterworks. The question carried 110 to 45. Oscar Knapp, president of the board, gives the Extension Division the credit for promoting the work. It was the unanimous opinion of the board that we had accomplished what seemed impossible and had engineered a project which had met defeat at the polls several times before.

A second trip was made at the suggestion of Mr. Knapp and at that time the board was urged to secure the services of an engineer in private practice to prepare detailed plans and specifications and to take charge of the work and carry it through to completion.

SELECTION OF ENGINEER

Then came the question of selecting an engineer, and we had to devise some means of assisting Bloomington in securing a competent engineer without suggesting any names. We were asked outright to recommend a man for the place, but the writer was of the opinion, and still is, that the surest way to put an end to this service was for the department to suggest the engineer for the work. We, therefore, adopted a simple plan which has worked out entirely to our satisfaction, since it has relieved the department of all responsibility of indicating the choice of an engineer. We furnished the Bloomington board a list of all the waterworks systems in the State and advised them to write any or all of the places for detailed information regarding the engineers who had charge of work, what the results were, and for any other information leading to the selection of a competent engineer.

Shortly thereafter Louis P. Wolff, M. Am. Soc. C. E., was retained as the board's selection, and as a result of his independent investigation plans and specifications were prepared in detail. The original outline plan as covered by the Extension Division's report has been followed except for a few minor changes. Our report gave only a "ground-floor" plan of the system with no detailed plans or specifications, and hence was of value only in suggesting a method and in promoting the work.

ONLY PROMOTION SERVICE OFFERED

It can thus be seen that in this service we are advising, guiding and inspiring rather than serving in an engineering capacity in its fullest sense. We believe that we are filling a real need, for the work has thus far clearly demonstrated the fact that communities will take the impartial advice of the university departments where the overtures made by individuals in the promotion of public improvements may be viewed with suspicion. In this work we are trying to advise against unnecessary expense as well as encourage new improvements, and since we neither sell material nor collect fees our advice is effective with the average layman. Bloomington stands out as a striking illustration of this fact, for we were able in one year to accomplish what the community at Bloomington was unable to do for more than 15 years, and in spite of the fact that a competent engineer previously had made a report on the waterworks problem.

It is the writer's firm conviction that with the proper support this work will be the means of promoting better sanitary conditions in the State in a most effective and direct way, and at the same time in a manner which will create added business for the engineer in private practice.

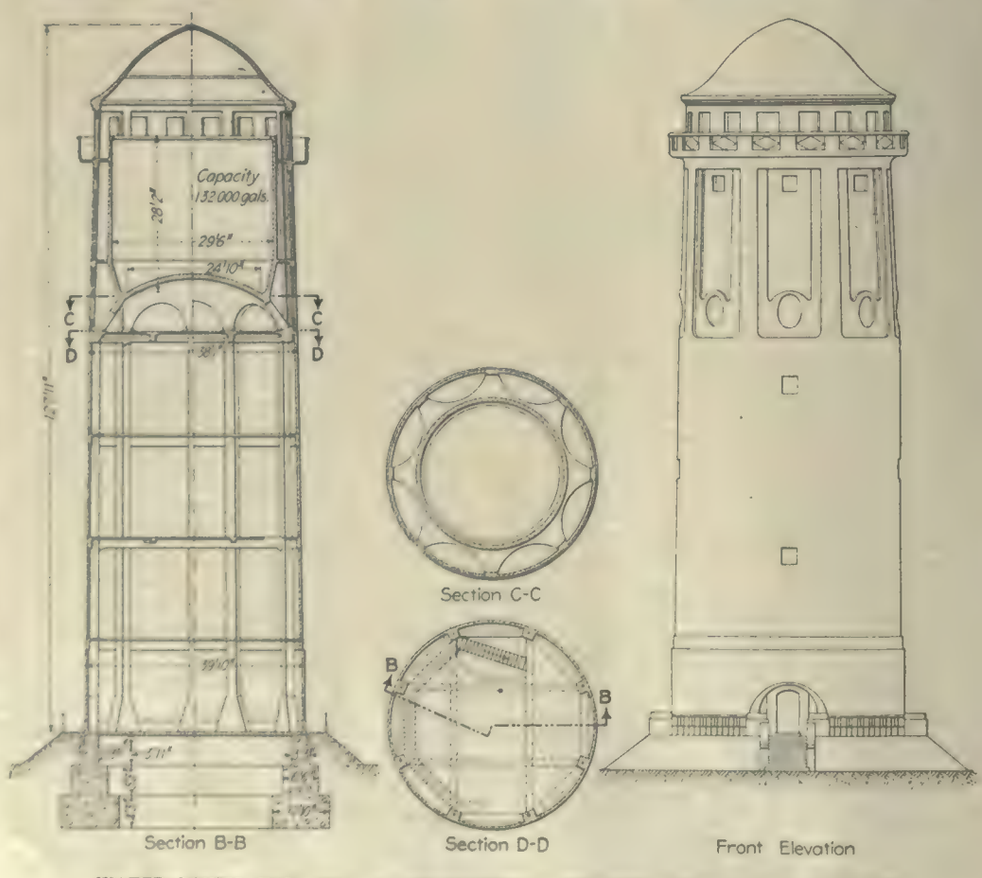
The waterworks problem is only one of the branches of municipal and sanitary engineering in which this department of the Extension Division is offering assistance and advice. Such problems as sewage disposal, pavements, garbage disposal, etc., are also covered and many requests for service in these lines have been received. In giving assistance in this service the best advice which can be obtained is given, and we *always* urge the people to secure a competent engineer where the work requires such services. In this connection it should be understood that the engineers engaged in this work are not engaged in private engineering practice; hence are in no way benefiting personally from the business created.

Appearance Considered in German Water Towers

Great Weight Given to Architectural Features of Reinforced-Concrete Tanks—Circular or Octagonal Supporting Structures Used

ARCHITECTURALLY pleasing results have been attained in recent developments in the design of water towers for the support of tanks in the vicinity of various cities in Germany. In the March issue of "Armierter Beton" is an article by Diploma-Engineer Spangenberg, director of the firm of Dykerhoff & Widmann, of Dresden, describing several types of water towers constructed under the supervision of the author and located at Edingen, Hockenheim, Strassburg, Stromeyersdorf, and Karlsruhe. The accompanying illustrations of two of these towers illustrate types of construction which are claimed to be economical and wholly satisfactory. All of these towers support circular reinforced-concrete tanks of a design which has become fairly well standardized in German practice.

The water tower designed for the city of Hockenheim to support a tank of 132,000-gal. capacity was selected from many other competitive designs, and the decision in its favor was influenced largely by its architectural features. The general dimensions and structural treatment of the reinforced-concrete supports are shown in the sections herewith. Of particular interest is the arched or domed construction by which the tank is supported on top of the eight rectangular main columns without the use of any beams and without bending the



WATER TOWER FOR CITY OF HOCKENHEIM SELECTED FROM MANY DESIGNS

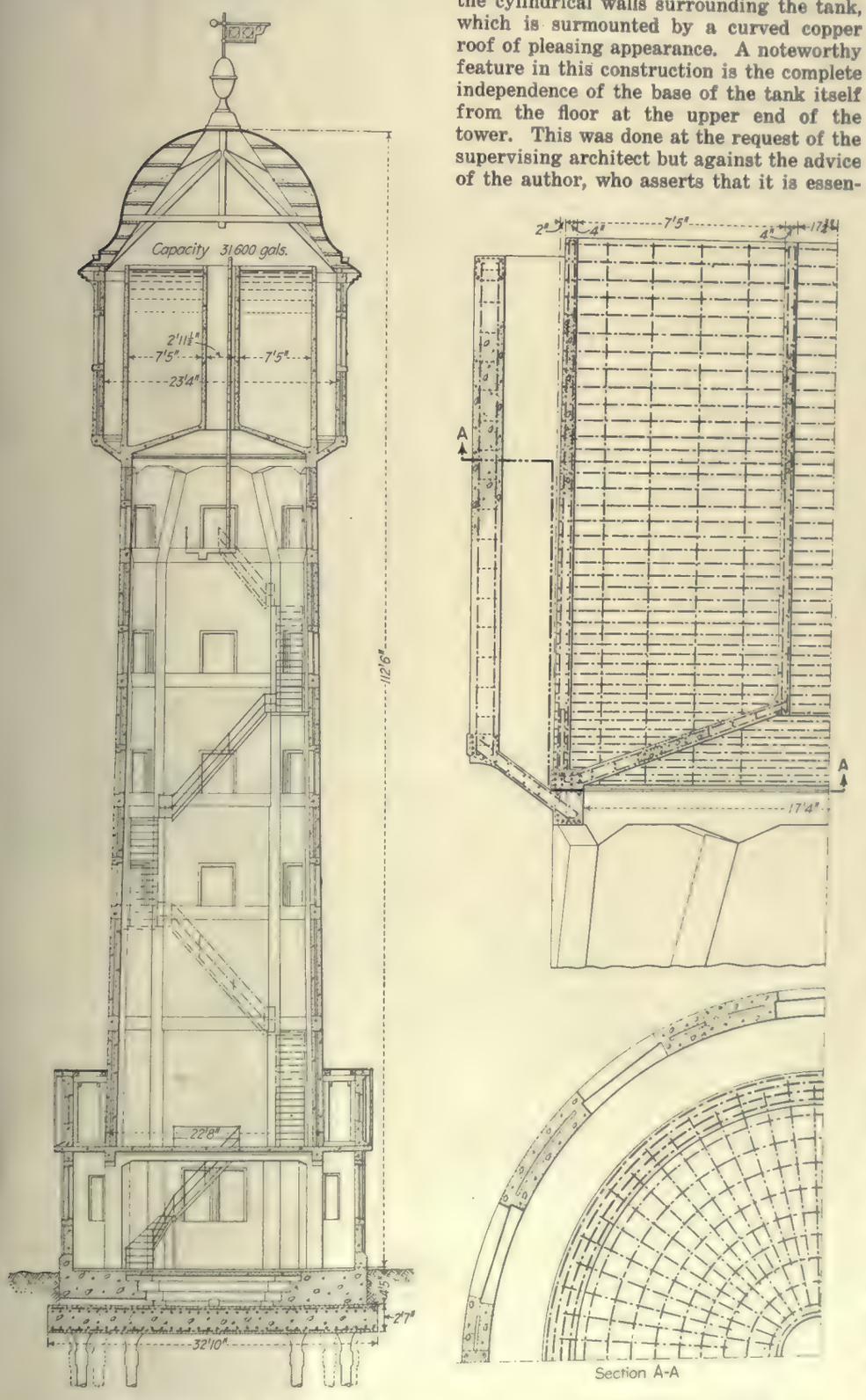
columns, the outward thrust being resisted by the reinforced-concrete beams and floor at the top of the columns as shown.

Entrance to the outer gallery at the top is furnished by circular stairs above this floor and in the insulating space between the tank and the surrounding wall. The architectural effects were obtained mainly by the use of the curved roof, the outside gallery and balustrade, decorative panels finished in color, and the treatment of stairs and entrance at the base.

TOWER AT STROMEYERSDORF

The type shown in the accompanying section of the tower at Stromeyersdorf is used when access to the upper part of the tank cannot conveniently be obtained through the air space provided between tank and inclosing wall used for insulating purposes. It is then necessary to use a vertical ladder, as shown, passing through a cylindrical opening through the center of the tank, the capacity of which is thus decreased. The tank here shown is of about 31,000-gal. capacity. The general dimensions of both tank and tower are given, and the sections indicate the position of the reinforcement in the sides and bottom of the tank.

The tower foundation had to be made of a square reinforced-concrete footing on piles, as shown, due to the very low supporting power of the soil. The octagonal construction and interior stairs are indicated by the main section, which also shows the small machinery house at the base which acts as part of the tower itself. The insulating space at the top is provided by the cylindrical walls surrounding the tank, which is surmounted by a curved copper roof of pleasing appearance. A noteworthy feature in this construction is the complete independence of the base of the tank itself from the floor at the upper end of the tower. This was done at the request of the supervising architect but against the advice of the author, who asserts that it is essentially irrational and uneconomical thus to separate the circular tank base from the floor at the top of the tower. The latter could be used to furnish the required resistance to outward thrust, as in the case of the design previously described, without the necessity for providing heavy circular reinforcement at the base as shown in this design.



STROMEYERSDORF WATER TOWER BUILT ABOVE SMALL MACHINERY HOUSE

Diver Repairs Parted Intake Line at Evanston

Pipe Laid in Lake Michigan Floated by Air or Shifted by Storm Sufficiently to Allow Spigot to Separate from Bell

LAST FALL the 36-in. intake through which the pumping station at Evanston, Ill., obtains water parted about 100 ft. from the dock line, in 12 ft. of water. At this point the sand cover ends and for the remainder of the 5000 ft. the line is uncovered and rests on a clay bottom.

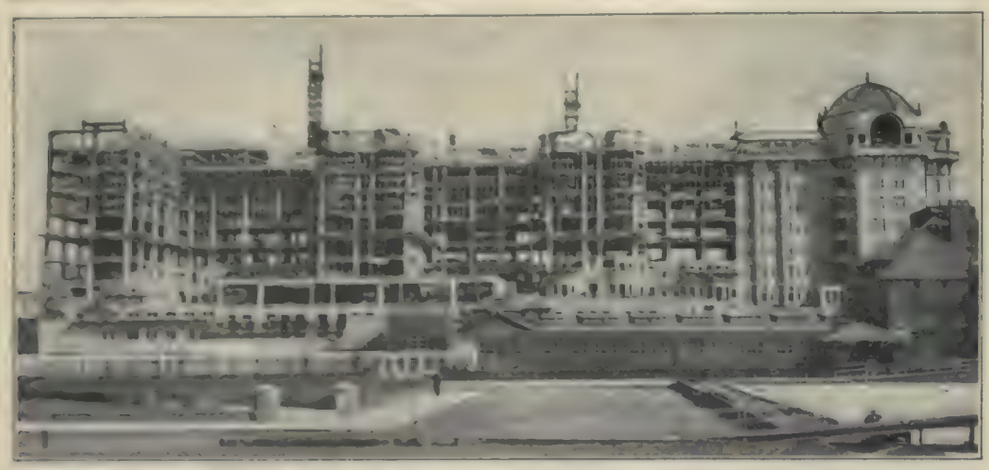
In repairing the break it was impossible to get the spigot back into the bell, so the latter was cut off after taking the length of pipe to shore. The cut was made far enough back of the bell to leave about 4 in. between the ends at the original break when the opposite end was pulled home in its bell. It was necessary to pull one or two lengths in each direction back into line. A sleeve 3 in. larger in diameter than the outside of the inner pipe was slipped over the pipe before replacing it. The 1½-in. annular ring was calked with cypress wedges and to prevent any further shifting five sets of 18-ft. piles were driven at alternate joints. Holes below the tops of the pipes were bored through the piles by a Chicago Pneumatic tool under water. Instead of inserting a band or long bolt, a chain with short lengths of 1½-in. bolts was passed over the pipe. Tightening the chain tended to bed the pipe more firmly on the bottom of the lake.

Sand found for 48 ft. in each direction from the break was removed by means of a 2½-in. water jet operating under 225-lb. pressure. The end of the jet pipe had a return bend so that the diver could push it in front of him and clear the pipe as he groped his way into the line.

CAUSE OF ACCIDENT

Opinion differs as to the cause of the accident, but the one advanced by J. G. Falcon, the diver who repaired the line, is as follows: When the filter plant was erected the overflow from the elevated wash-water tank was connected with the intake line. Air is drawn into this overflow when it operates, and occasionally air bubbles have been observed escaping from the break. Mr. Falcon believes that the pipe at some time has been floated by this air, perhaps aided by a heavy storm. He could see no other way in which the line could be parted, because the spigot end of one pipe had been pulled out of the 6-in. bell of the adjacent line and the ends were found lying adjacent to each other as though the pipe had been raised until the spigot parted from the bell and then fell back upon the lake bed again.

The waterworks officials state, however, that the pipe as parted had been drawn back nearly into line by the city diver who attempted to make temporary repairs before Mr. Falcon started work. It is their belief that the displacement may not have been caused by air.



LARGE SPREAD OF CANVAS USED TO PROTECT FLOORS POURED DURING COLD WEATHER

Reinforced-Concrete Frame of Hotel Traymore Erected at Rate of a Floor a Week

18,000 Cubic Yards of Concrete Require 1,500,000 Feet of Lumber for Forms, the Erection of Which, on Schedule, Employs 160 Carpenters

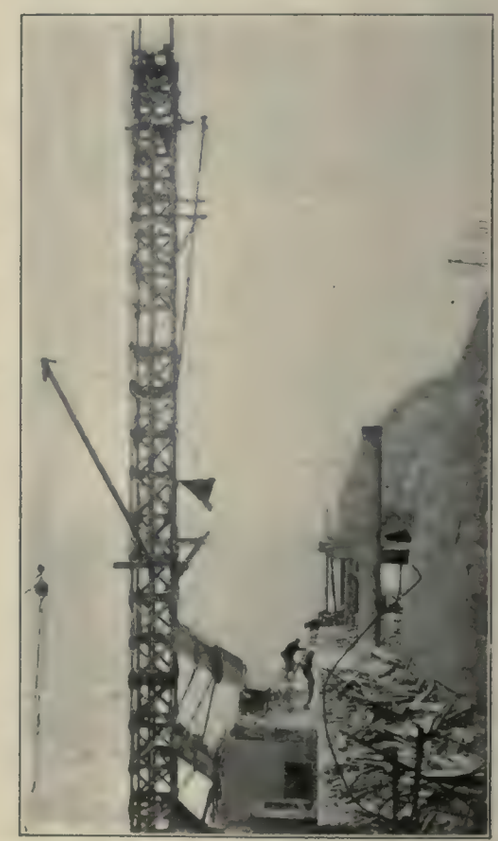
THE REINFORCED-CONCRETE frame of the eighteen-story addition to the Hotel Traymore at Atlantic City, N. J., which contains 18,000 cu. yd. of concrete, and has a total floor area of 470,000 sq. ft., was built in less than four months. This was accomplished by Cramp & Company, contractors, between Dec. 27, 1914, and April 24, 1915. At the same time the brick wall trim and tile partition work were brought almost to the top of the building, and a large share of the interior finish was completed. The construction of the frame averaged a floor a week for the four months.

The work also involved the use of two concrete towers 256 ft. high, which is probably itself a record. In addition to the new construction the contractor, in remodeling the old reinforced-concrete wing of the hotel to match the new building, cut out two floors and replaced them with three new ones.

Work on wrecking the wooden part of the old hotel began Sept. 1, 1914. The heavy pile footings for the new structure were completed by Dec. 27, last, on which date the construction of the frame for the new building was begun. The hotel was opened to the public June 1, and the structural work and practically all of the interior finish had been completed by that date. The whole building would have been ready for occupancy but for a delay in the delivery of some of the ornamental terra cotta.

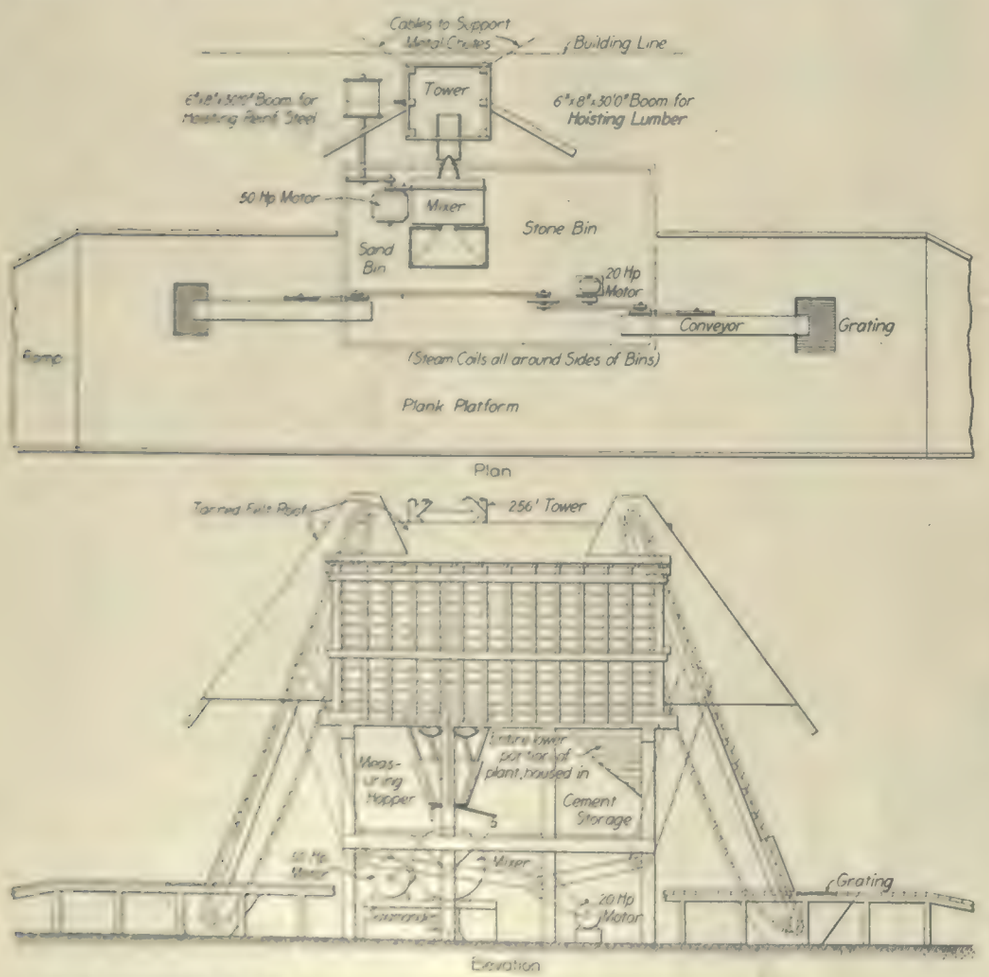
WORK ORGANIZED FOR RAPID PROGRESS

As will be recalled from the article in the Engineering Record of last week, page 11, the reinforced-concrete construction involved a variety of complicated form work. Only five floors of the building resembled each other sufficiently to allow forms to be used over without rebuilding. No less than 1,500,000 ft. of lumber were required for this item alone. Also, 1400 tons of reinforcing steel had to be handled and placed. Without a large and well-organized carpenter force this form work could never have been built at such a rapid rate. From 100 to 140 men were employed in the day gang, and from thirty to forty at night. Forms for the columns, beams and girders were erected in the day time, and the night crew was used simply for decking the floors. The local labor organization further handicapped this end of the job by refusing to work at night, and the night crew had to be transferred to the day shift with some loss in its effectiveness.

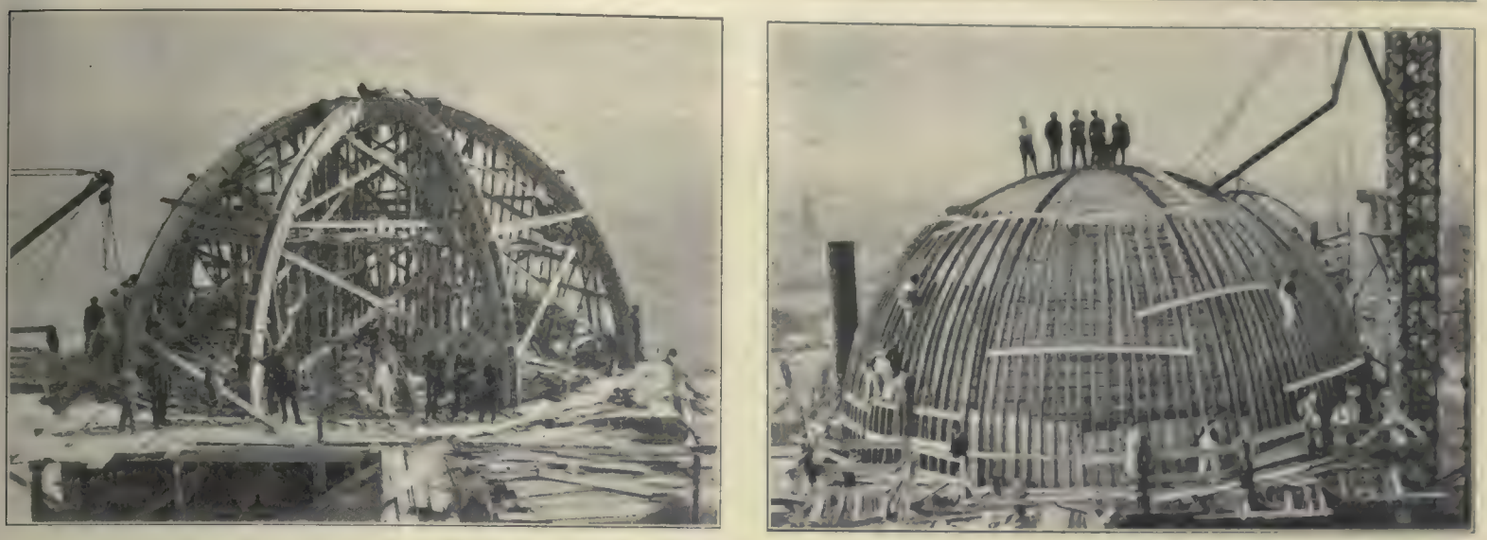


WOOD CHUTES ON TOWER HANDLING CEMENT FLOOR FINISH

Forms were poured as fast as they could be built, and this was followed closely with the trim and partition work and cement floor finish. From sixty to seventy laborers on the day shift handled the concrete and the materials, aided by a night crew of twenty men. On the brick and tile work 130 masons were used. As bricklaying could not well be carried out except in daylight, the night shift was utilized to stock the floors with a supply of tile, brick



MAIN CONCRETE PLANT HANDLED TRUCK-DELIVERED MATERIALS MECHANICALLY, AND MIXED HOT CONCRETE FOR WINTER WORK



AT LEFT, BRACING AND RIB CENTERING OF SOUTH DOME IN PLACE—AT RIGHT, NORTH DOME FORM ALMOST COMPLETE

and materials for mixing mortar for the next day.

For handling these materials an electric elevator with a speed of 800 ft. per minute was used. A fourth tower, erected between this and the south tower toward the end of the job, was used to hoist material for the plasterers. Form lumber and reinforcing were handled by booms mounted on the two concrete towers which, with the material elevator, were located on the north side of the building. These concrete towers were built to the unusual height of 256 ft., and were braced from the building.

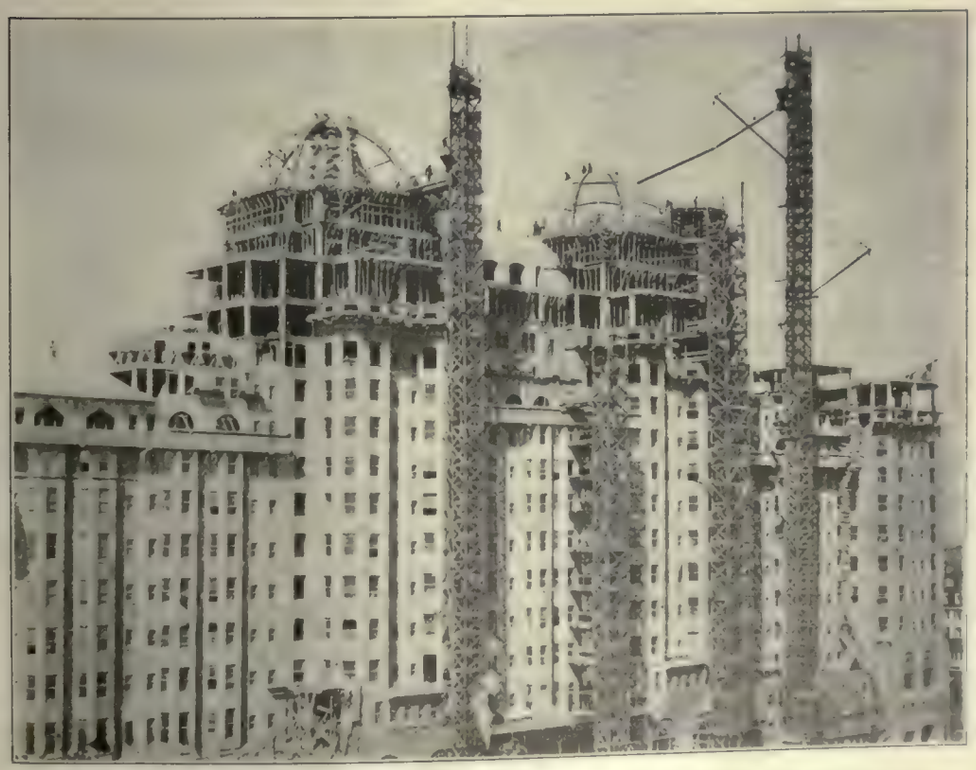
HANDLING AND PLACING CONCRETE

The plant for mixing the structural concrete is illustrated in the accompanying drawing. It was located at the tower farthest from the beach. Material was delivered to it in the bottom-dump wagons, emptied into pits in the street, and raised to the bins by light bucket elevators. The plant at the tower next to the beach mixed the cement floor finish, and helped out the main plant when necessary, placing reinforced floor concrete amounting to less than 15 per cent of the total yardage. Both plants were equipped with 1-yd. mixers, but that for the floor finish was fed by wheelbarrows dumped into a hopper elevator.

The concrete on some of the lower floors was spouted directly into the forms for a distance of 200 ft. from the towers, but on the upper floors, due to the difficulty of carrying the spouting, the concrete was spouted only a distance of 75 ft. from the tower into hoppers, and distributed from the hoppers by concrete carts. The floor finish was distributed by carts from hoppers located above the floors on which work was going on. The two domes were poured by direct spouting.

Most of the concrete and building materials were stored on vacant property at the railway siding half mile from the job, and hauled to the site by motor trucks as wanted. Cement was stored at the job in small quantities. A large cement storage was provided at the railroad siding.

Canvas covers around the outside of freshly poured floors, and numerous salamanders, were used to prevent the concrete from freezing. Steam coils were put in the bins of the main mixing plant, and the water was also heated. These precautions were entirely effective. No delays from failure of the concrete to set were experienced.



FOUR TOWERS REQUIRED TO HANDLE CONCRETE AND FINISHING MATERIALS

COLUMNS BRACED WHILE FLOORS ARE REMOVED

The first two floors of the reinforced-concrete wing of the old hotel were cut out and replaced with three floors to match the new structure. The interior columns, when the adjacent floors were removed, had to be braced in four directions each by timber struts set below each ceiling before the floor was cut out. For this purpose 12 x 12-in. timbers, wedged at the ends, were used. The old floors were both cut out, and forms were built and the new floors poured as in a new building. The columns were then strengthened with reinforced-concrete rings where they had pierced the old floors. After these rings had set the horizontal shores were removed and the interior was refinished.

The construction was in charge of F. V. Warren, general superintendent for Cramp & Company, of Philadelphia. Price & McLanahan of Philadelphia, were the architects for the building. The structural design was carried out by O. H. Gentner and F. Dickinson Shaw, associated consulting engineers, also of Philadelphia.

A WATER-WASTE PREVENTION CAMPAIGN, which will eventually result in the installation of meters on all services in Chicago, has been begun, starting with a water-waste meeting, June 9, at the City Club. The committee on water waste, E. W. Bemis, Ray Palmer and H. W. Clausen, all engineers, presented a report outlining the situation in Chicago where 40 gal. per capita go to frontage consumers, 47 gal. to meter consumers, 10 gal. to parks and other free users, 5 gal. slip through meters unregistered, 40 gal. are lost through leaky plumbing fixtures and 61 gal. through willful wastage, defective mains and service pipes. With 50 per cent of the water lost through leaks the department finds it impossible to increase the head so that fourth-floor residents can obtain water at periods of maximum consumption. Ineffectual appeals to the finance committee of City Council for aid in reducing waste have been ignored and the City Club will undoubtedly take steps now to bring the matter of metering forcibly to the attention of the city fathers.

Garbage Collection Studies in Chicago Justify Continued Use of Horses

Data Assembled for Gasoline and Electric Trucks Warrant Their Adoption Only for Hauling, After Horse-Drawn Carts Have Done the Collecting

HANDLING garbage by motor trucks was studied some time ago by the efficiency division of the Chicago Civil Service Commission, with the conclusion that the saving does not warrant the change to motors. The studies were made particularly with reference to handling garbage from the different wards to the reduction plant at Thirty-ninth and Iron Streets, or to the different loading stations, the distances varying from 1½ to 5 miles.

Garbage is collected from alleys, less than 6 per cent of which are paved. To use trucks in the alleys would mean a large number of stops, which are not economical considering the extra daily cost of the truck over horse-drawn vehicles; therefore, the report from which this material is taken is based on collections by wagon and transfer of the tank to the motor truck for hauling. The conclusions follow:

CONCLUSIONS

At the present prevailing cost of team hire the saving in the use of electric motor trucks for hauling garbage in such wards as have a considerable haul would amount to 5.1 per cent. If the cost of teams were increased to $6 per day the total estimated saving by using motor trucks for hauling would be about $15,775 per year, or 12.3 per cent of the total estimated cost of teams at $6 per day. These estimates are computed on the eight-hour-day basis. It has been very apparent that the present working period of garbage teams rarely amounts to eight hours per day, and that often it is as low as six hours.

In the investigation it has been found that either the gasoline or the electric power truck can handle the hauling of garbage with comparable ease. The more economical truck has been found to be the electric. This is governed in large measure by the low rate of cost of electrical energy from the Sanitary District to the city for night power, and by the fact that the collected data on the electric truck have shown lower percentage rates for depreciation, maintenance, repairs and insurance than for the gasoline truck.

The haul below which an electric truck carrying 3 tons would not be economical, when measured against a $5.50 per day team, is found to be 1.8 miles, and when measured against a $6 per day team the distance is 0.8 miles. The 3-ton gasoline truck at present cost price would not haul as economically, when traveling in the city at the economical rate of speed, as would the horse-drawn vehicle at either $5.50 or $6 per day.

The advantages of motor trucks over horse-drawn vehicles are: (a) Improved personnel of drivers, as they would be placed under civil service and would be subject to discharge for inefficiency; (b) more rapid transit of garbage from the different districts to the reduction plant or loading station, thereby causing less nuisance to the public; (c) elimination of the necessity of holding partly filled tanks in alleys, and so of such nuisance as this would cause; (d) greater mileage per day.

In comparing the costs of the two kinds of power trucks the investigators recognized that either motive power is capable of giving full service, but the factor determining the most efficient truck is measured by the cost per ton-mile for operation. Data were collected from many sources. From Marshall Field & Company were obtained statements that for average 4-ton trucks 1 gal. of lubricating oil was required per 100 miles; for electrics 1064 watt-hours were consumed per mile. Gasoline cars of this size went 4 miles on a gallon of gasoline. Depreciation, including obsolescence, were 25 and 12½ per cent for gasoline trucks and electrics respectively. In this connection the report points out that it must not be overlooked that the average run for the gasoline trucks is from 25 to 30 per cent greater than for the electrics; also that this advantage is due to fewer stops and greater speed possible on the kind of haul assigned to the respective cars.

GASOLINE VS. ELECTRIC TRUCKS

The basis of the comparative estimates of gasoline and electric trucks was as follows:

Interest at 4 per cent on truck value, assuming that money can be obtained at 5 per cent and will draw an average of 1 per cent on total sum when placed in bank as depreciation accrues.

Insurance (fire and liability)—gasoline 3 per cent plus $70 per annum, electric 3 per cent plus $63 per annum.

Garage rates, varying from $15 to $35 per month, depending on locality—average rate of $25 per month used.

Drivers at $80 per month (union scale $3 per day for 3-ton truck).

Depreciation on trucks minus tires, life figured at 75,000 miles for a gasoline truck and 100,000 miles for an electric truck.

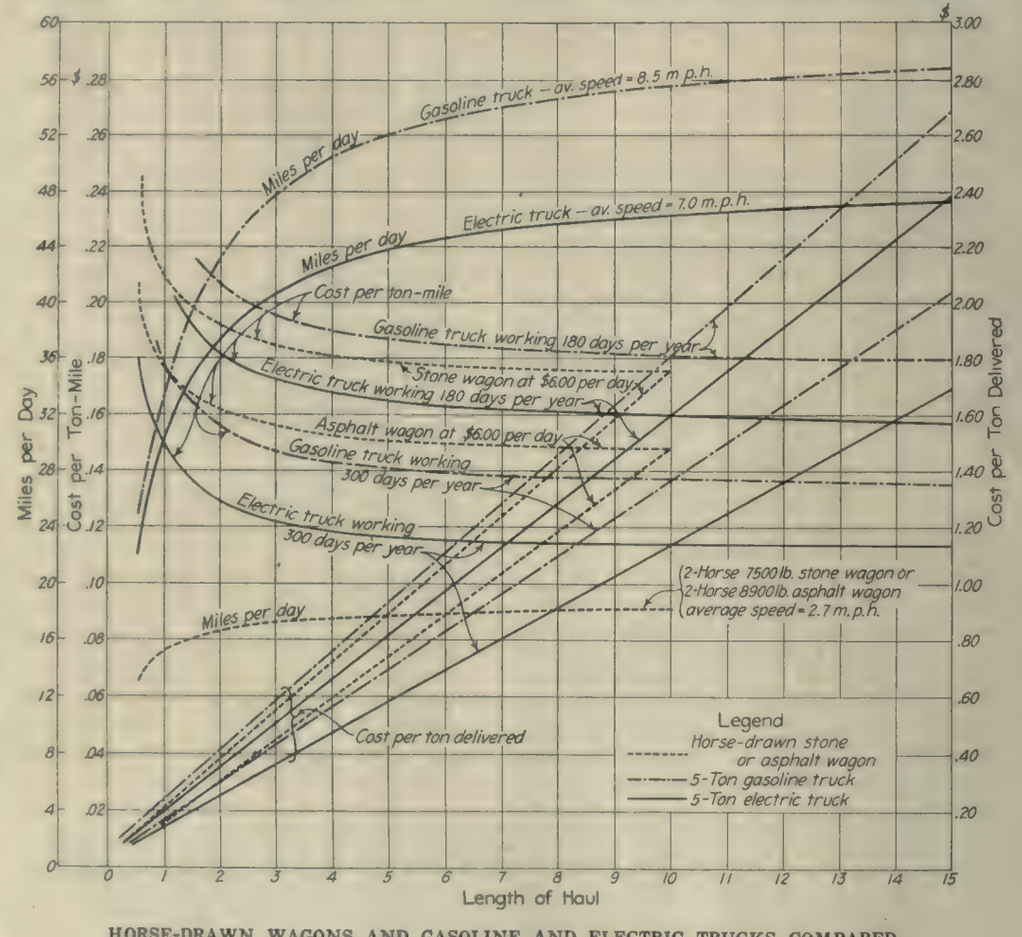
Tire cost, based on a guarantee of 8000 miles—6, 6½, 7 and 8 cents per mile for 3, 4, 5 and 6-ton trucks respectively.

Maintenance and repairs based on experiments of Massachusetts Institute of Technology and operating costs of Marshall Field & Company and the Texas Oil Company.

Lubricating oil and grease, 0.005 cent per mile for 3-ton truck.

Gasoline at 13½ cents per gallon in carload lots (quoted price).

Electricity at ½ cent per kilowatt-hour, present cost to the city for night power from Sanitary District.



HORSE-DRAWN WAGONS AND GASOLINE AND ELECTRIC TRUCKS COMPARED

Operating values, shown in Table 1—taken from actual figures given from fourteen Standard Oil gasoline trucks, more than one hundred Marshall Field & Company electrics and Massachusetts Institute of Technology experimental values.

TABLE 1—OPERATING VALUES FOR GASOLINE AND ELECTRIC TRUCKS

Size of Truck	Miles Per Gallon for Gasoline Cars	Kilowatt-hours Per Mile for Electrics
2-ton	5.00	0.741
3-ton	3.92	0.903
4-ton	3.20	1.064
5-ton	2.70	1.225

Contingencies, covering interest on general operating stores, repair materials, general superintendence, etc., 2 per cent of first cost.

Obsolescence, figured as a fixed charge, it being a factor which decreases the value of the car due to improved methods in the science of construction, 5 per cent.

License, State license only, paid by city —$4 per year for 3-ton truck.

Table 2 shows the estimates for fixed and mileage charges for the two types of truck or tractor when handling a garbage tank of 3-ton capacity.

TABLE 2—FIXED AND MILEAGE CHARGES FOR GASOLINE AND ELECTRIC TRUCKS

	Gasoline	Electric
First cost of three-ton truck or tractor	$4,000	$4,000
Fixed charges per year:		
Interest at 4 per cent	160	160
Garage	300	300
Insurance (fire and liability)	190	183
State license	4	4
Driver	960	960
Obsolescence	200	200
Contingencies	80	80
Total fixed charges per year	$1,894	$1,887
Total per day, 1/300 year	6.31	6.29
Variable expenses per mile:		
Depreciation	$0.0473	$0.0340
Tires	0.0600	0.0600
Maintenance and repairs	0.0300	0.0300
Lubricating oil and grease	0.0050	0.0050
Energy (electricity or gasoline)	0.0344	0.0050
	$0.1767	$0.1340

The costs for hauling with horses (Table 3) are computed on both the present contract price and a possible future price of $6 per day for teams and drivers, and are based on an average rate of travel shown by twenty-three observations on garbage wagons in the city of Chicago. The average rate of travel for garbage wagons loaded is 2.93 miles per hour, and empty 3.11 miles per hour. This value for trucks has been assumed as 10 miles per hour, it being 1 mile per hour less than that recommended as the most economical speed for rated capacity of 3 tons by the National Association of Automobile Manufacturers.

TABLE 3—COSTS FOR HAULING WITH HORSES

Daily Expenses	Teams Costing Per Day	
	$5.50	$6.00
Fixed charges for equipment	$0.021	$0.021
Horses and driver	5.500	6.000
Wagon depreciation, life 22,000 miles	0.084	0.084
Maintenance and repair at 5 per cent	0.021	0.021
Total daily expenses	$5.626	$5.126

In determining the length of haul at which the efficiency of motor trucks begins to increase over the horse-drawn vehicle, it was also necessary to learn about the time of loading and unloading. Experiments showed the average length of time required at the unloading station to be 20 min. and the time required to transfer the tank from the collecting wagon to the truck, 6 min.

In the diagram presented the curves apply to garbage only, and, as the report states, cannot be used directly for any other kind of haul without corrections covering loading and unloading time. Applying figures taken from the curves shown to the hauling of garbage in the different wards of the city with the different quantities hauled different distances, as worked out for the budget report, there is a saving of but $5,950 per year under present contracts of $5.50 per day for teams, or $15,775 if $6 per day is paid. The figures are based on 8-hr. days. The actual value to the city of working teams on this basis would mean a considerable saving, because at present the working period has been found to vary from less than 6 to 8 hr. per day.

The lack of advantage of the truck service is due, in a great measure, to the fact that one truck-load of garbage has been taken as the unit of handling garbage, although if it were possible for the trucks to haul two tanks at a time the economy over the horse-drawn vehicle would be very apparent.

Longest Simple Truss Span in World to Be Erected Over Ohio River at Metropolis

Bridge to Contain Trusses Built of Silicon-Steel Main Members and Nickel-Steel Eyebars—Steelwork in Crossing More Than One Mile Long

SILICON-STEEL main members and nickel-steel eyebars were adopted for the main truss spans of the new bridge to be constructed over the Ohio River at Metropolis, Ill., by the Paducah & Illinois Railroad, a subsidiary of the Chicago, Burlington & Quincy Railroad. This structure will contain the longest simple truss span in the world—about 720 ft. center to center of end pins. The total length of the steelwork will be more than one mile and the total cost is estimated at about $3,500,000. The bridge is to be a double-track structure designed for unusually heavy live loading—Cooper's E90 engines followed by 7500 lb. per foot of track. For the design of the trusses, however, both tracks are not assumed to be loaded with engines, as is customary, but only the uniform loading is specified for the far track. Rather unusual specifications for impact have been used, the impact factor being independent of the loaded length. The physical and chemical requirements for the special steels will be given.



PADUCAH & ILLINOIS RAILROAD BRIDGE TO BE ERECTED OVER OHIO RIVER AT METROPOLIS, ILL.

GENERAL DIMENSIONS AND SUBSTRUCTURE

The total length of the steelwork in the new structure will be about 5487 ft., consisting of the six through-truss spans and one deck-truss span shown on the accompanying elevation, and viaduct approaches on each side in which fifteen 30-ft. towers supporting girders of various lengths from 62 ft. to 90½ ft. will be used. The floor of these approaches will be of the solid ballasted type, constructed on 0.2 and 0.3 per cent grades as shown, while the main truss floors are of the usual open deck construction. The underclearance required above high water is 53 ft. with a 700-ft. maximum clear opening. The maximum span is thus seen to be about 720 ft. long, which will be the longest simple truss span in the world. All the trusses, except those in the shorter spans at each end, are of the through curved-chord pin-connected type with subpanels throughout, using subdiagonals in compression as shown.

The piers are being constructed by the use of pneumatic caissons which vary in size from 47 x 80 ft. for pier 1 near the Illinois shore to 60 x 110 ft. for pier 6 and 60 x 100 ft. for pier 7 at the end of the longest span. The fixed and expansion ends alternate as shown on the elevation, the Illinois end of each span being fixed. Piles are used under the concrete piers on the approaches.

SPECIFIED LOADING AND IMPACT

The dead-load weight of ties, rails, etc., for the floor of the truss spans is assumed at 500 lb. per foot per track. The concrete deck on the approach spans is taken at 3350 lb. per foot per track, including ballast, rails, ties, etc. The specified live load for the approaches consists of two Cooper's E90 engines followed by a uniform live load of 7500 lb. per foot of track. The live load for the design of the main truss members consists of two Cooper's E90 engines followed by 7500 lb. per foot of track for the near track and the uniform load of 7500 lb. per foot for the far track. The floor system, hangers, and subdiagonals are designed for two Cooper's E90 engines on each track.

The impact on the approaches is to be provided for by the addition of 22,500 lb. to each of four drivers on one rail of each track on the engine which will cause the greatest stress. All members in the truss spans are designed for impact of 10 per cent of the live load, except the hangers and subdiagonals and the web members of the 250-ft. and 300-ft. spans. For the latter web members an impact of 20 per cent is required, and for the floor, hangers and subdiagonals 50 per cent of the live load for one track is added for the near track only.

The wind loads for the truss spans are assumed as moving loads at 30 lb. per square foot on the floor and train, taken to cover an area 20 ft. high, and on the area of truss members for two trusses not covered by this 20-ft. height. The top laterals of the through spans and bottom laterals of the deck spans are designed for wind at 50 lb. per square foot on the exposed area of two trusses, treated as a moving load. The viaduct towers are designed for the usual wind pressure and empty-car assumptions. Longitudinal force is assumed at 20 per cent of the live load applied at the top of the rail for one track only.

ALLOWABLE UNIT STRESSES FOR SPECIAL STEELS

The material in the deck plate girders and towers of the approaches is medium

steel. In the trusses all main members except the eyebars are to consist of silicon steel, eyebars and pins of nickel steel, and all other material, including all lacing, is to be medium steel. The allowable unit stresses for total dead, live and impact stress are as follows, in pounds per square inch: For tension, or for compression when reduced by Gordon's formula—30,000 for silicon steel, 20,000 for medium carbon steel, and 35,000 for nickel-steel eyebars; shear and bearing on nickel-steel pins—20,000 and 35,000 respectively; bending fiber stress on plates and shapes—30,000 for silicon steel, 20,000 for medium carbon steel and 35,000 for nickel-steel pins.

For wind stresses the medium steel value of 20,000 is raised to 24,000. For members having alternate stress the gross and net sections required for compression and tension stresses respectively have been determined and one-half of the smaller has been added to the larger section; where tension is the governing stress, the net section is used for the above combination, and where compression is the governing stress, the gross section is used. Pin plates are to be proportioned for the sum of both stresses, except where governed by the sections required at pin holes.

Physical and Chemical Requirements

All steel is to be made by the open-hearth process. As determined by standard test specimens, the silicon steel is to have an ultimate strength between 80,000 and 95,000 lb. per square inch and a yield point of 45,000. Nickel steel must have an ultimate strength between 95,000 and 110,000, with a yield point of 55,000. The usual requirements of from 55,000 to 65,000, with a yield point of 30,000 are given for structural carbon steel. The drop of the beam is to be carefully observed and the yield point thereby determined taken as the elastic limit of these test specimens. Full-size tests of the nickel-steel eyebars must show an ultimate strength of 80,000 minimum and yield point of 48,000 minimum, with a minimum elongation in 18 ft. of 10 per cent, and a reduction of area of 25 per cent. The per cent elongation of silicon-steel specimens must be 1,600,000/ultimate, with special reduction for material more than 1 in. thick. The accompanying table gives the chemical requirements for the special silicon and nckel steels.

Chemical Requirements of Special Steels in Per Cent

	Max. phosphorus		Sulphur max	Carbon, max	Manganese		Silicon, min.	Nickel
	Basic	Acid			Max	Min.		
Silicon steel	0 04	0 05	0 05	0 40	1 00		0 25	
Nickel steel	0 04	0 05	0 05	0 45	0 80	0 50		3 25

The design and preparation of all drawings, now in progress, are under the supervision of C. H. Cartlidge, chief engineer of the Chicago, Burlington & Quincy Railroad. Ralph Modjeski, Chicago, is the consulting engineer. The total cost is estimated at $3,500,000, and work has been resumed after some months' delay during the stringency in the money market. The contract for the substructure has been let to the Union Bridge & Construction Company of Kansas City, Mo. The superstructure contract went to the American Bridge Company of New York City.

Brick Road Built Monolithic at Paris, Ill.

Paving Blocks Were Laid Directly on Green Concrete Base, Thereby Eliminating Necessity for Sand Cushion

By W. T. BLACKBURN
Consulting Engineer, Dunn Wire-Cut-Lug Brick Company, Paris, Ill.

IT HAS BEEN the writer's experience that the excess of sand cushion has been one of the elements of uncertainty in the construction of a cement-filled brick pavement, and for many years he has made an effort to reduce the depth of this sand cushion to the minimum, realizing that the only function of this bed of sand was to compensate for the irregularities of the surface of the concrete base and the depth of the paving block. Since tile floors and, in a few instances, paving brick have been successfully laid on a rigid base, there would seem to be no reason why country roads should not be more economically constructed by laying the bricks directly on the green mortar base and eliminating the necessity of either a stone or concrete edging. A road recently built at Paris, Ill., was so laid.



DOUBLE TEMPLATE IS HAULED FORWARD BY MIXER OUTFIT

The roadway was first excavated to the proper grade and the sub-grade thoroughly compacted by repeated rolling with a 5-ton self-propelling tandem roller. Steel forms, specially designed for this type of work, of convenient length and 8 in. in depth, were set true to line and grade. The depth of the concrete was 4 in. and the depth of brick the same, making an 8-in. monolithic pavement. Two types of forms have been used, the Heltzel and the Blaw.

Laying the Base

The concrete was mixed in proportions of one part of cement and six parts of the combined aggregate of sand and gravel, in a batch mixer, and spread over the subgrade, to a depth a little over that required by a light wood template resting on the forms.

A steel template, consisting of an I-beam and channel-iron placed 2 ft. apart, supported by rollers carrying the weight of the template on the forms, was drawn over the concrete base, the I-beam cutting the concrete to grade. In between the two members was kept a mixture of dry sand and cement in proportions of 1 to 5, which was mixed dry and deposited in front of the rear member. As the template was drawn forward the concrete base was covered with a thin film of dry sand and cement, filling all of the irregularities of the surface, and leaving a minimum layer of this dry mixture 3/16 in. deep. This mixture immediately took up the moisture from the wet base, leaving an ideal surface upon which to lay the brick.

The steel template referred to is one of the essentials in securing accurate results in this type of construction, and credit is due J. C. Gordon for the development of the template and carrier used. Mr. Gordon is foreman for Allen Jay Parrish, the contractor, and to Mr. Parrish and Mr. Gordon credit is due for working out the details and carrying into successful execution the construction of this type of roadway.

Laying the Brick

The carriers were instructed not to carry in defective brick, and were required to place the brick on the pallets so that when delivered to the setter the brick could be easily laid in the roadway with the best face up and the lugs in one direction. The batting was kept close up to the laying, and, in fact, the pavement was finished, except the grouting, at all times within 25 ft. of the depositing of the concrete base.

Immediately after the brick were laid the surface was rolled with a hand roller 30 in. in length and 24 in. in diameter, filled with water, making it weigh something over 600 lb. I would suggest that this roller should be 30 in. in diameter and made in two sections, giving it additional weight, but still leaving it very easy to operate. This roller seemed to iron out the surface perfectly and gave it the appearance of tile laid on a floor, rather than of a brick surface rolled in the ordinary manner. The brick in no instance were creeled or embedded in the base but were merely made smooth, leaving the joints entirely open. Wire-cut-lug brick were used, leaving perfect separations for the filler.

The filler was applied by an improved method, one part of sand and one part of cement having been mixed dry in a small batch mixer and then conveyed in small quantities to the grout box on the pavement. Sufficient water was added and thoroughly mixed, making the grout of a consistency that would readily flow into the joints after being removed from the box with scoop shovels.

The surface was finally finished with a squeegee, leaving the joints entirely filled and the surface smooth. After the filler had sufficiently set up, the forms were removed.

After sufficient time had elapsed so that there would be no danger of disturbing the pavement with the grading, the side berms were constructed and the earth road graded and thoroughly compacted. The paved portion was a little to one side of the right-of-way, leaving room for a 10-ft. earth road.

A city pavement at Paris, Ill., was constructed in a similar manner, excepting that the gutter was used in place of the side forms, the template riding on the gutter. The base was 6 in. deep.

ADVANTAGES OF NEW TYPE

Some of the advantages of the new type may be summarized as follows:

1. By omitting the sand cushion, the construction will not be injured at any time by the interruption of rainstorms, as the pavement, with the exception of the filler, is complete at all times. The filler is never allowed to be left out more than 6 hours after the laying of the brick. However, should storms intervene, no damage would be done by delay if traffic were kept off and the surface kept clean. There is no sand cushion to become saturated, and the worry about rolling the brick surface is eliminated.

2. The certainty of having a 4-in. depth, or the full depth of the block, for the cement filler cannot be ignored.

3. The support of the individual paving block on the rigid base cannot be questioned, as it relieves the condition of suspension where the bricks are solidly cemented together and the sand shrinks away from any portion of the under surface.

4. In the country road especially this type is more easily and cheaply constructed.



SMALL HAND ROLLER BEDS BLOCKS



ON COUNTRY ROAD TEMPLATE RIDES ON SIDE FORMS

5. Every element entering into its construction is positive.

6. A true and uniform surface can be more easily obtained.

7. It eliminates the necessity of the edging, thus reducing the cost of the roadway.

Both the city pavement and the country highway, during the progress of construction, have been examined by many engineers and city and highway officials, and have been pronounced by all a success.

It is my opinion that this type of construction will make a more durable and more economical brick pavement and will provide for the successful use not only of 4-in., but also of 3 and 3½-in. block.

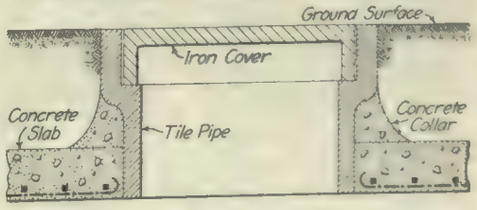
The country highway described was built under the direction of W. W. Marr, State highway engineer of Illinois, and the city pavement referred to was under the direction of C. P. Lycan of Paris, Ill.

The writer advised the contractor on the work and worked with him personally on perfection of the details, and in certain experiment leading up to the type of pavement here described.

Tile Manholes for Sewage Plants

By H. S. McGEE
Assistant State Sanitary Engineer, Michigan

FOR residential sewage treatment plants and for locations where great depth and structural strength to resist heavy loads are not required, a large vitrified bell and spigot pipe laid bell end up, makes a cheap and satisfactory manhole, a cover being laid



TILE FORMS EFFECTIVE MANHOLE LINING

in the bell end. Cracked pipe and seconds, provided they are circular and the bell is not seriously injured, are as good as firsts and may be strengthened and held in shape by a concrete collar.

Forest Service Proposes Grading Rule for Southern Yellow Pine

Density Requirement for No. 1 Grade Is Based on Number of Annual Rings to Inch and Percentage of Summerwood

A SPECIFICATION for Southern yellow-pine timbers, Grade No. 1, has been proposed by the U. S. Forest Service. It follows in the main the recent trend toward a ring specification, which has been discussed in this journal in reference to the rules recommended by a committee of the Yellow Pine Manufacturers' Association on May 5, 1914, and printed in this journal May 23, 1914, page 579. The rule proposed by the Forest Service is as follows:

REQUIREMENTS FOR DENSITY AND RATE OF GROWTH

1. Shall contain only sound wood.

2. Shall show on the cross-section an average of not less than one-third summer wood in timber with six or more annual growth rings to the inch; or one-half summerwood in timber with less than six rings to the inch. The inspection for summerwood and rings shall be made on a radial line from the pith as follows:

I. When the pith is present or can be accurately located.
   (a) Radial line of 5 in. present:
      1. Apply inspection over third, fourth and fifth inches from pith.
   (b) Radial line of 5 in. not present.
      1. Apply inspection to the second inch on 2 by 3, 2 by 4, 2 by 6, 3 by 3, 3 by 4, 4 by 4 in., or any other dimension material that has less than 16 sq. in. on the cross-section.
      2. In larger material apply inspection to the three inches farthest from the pith.

II. When the pith is not present or can not be accurately located:
   (a) When material is over 3 in. thick apply inspection to three inches nearest the pith.
   (b) In dimension material 3 in. or less in thickness apply inspection to second inch from the edge nearest the pith.

III. The radial line chosen shall be representative with respect to rate of growth and percentage of summerwood. In case of disagreement between purchaser and seller the figures obtained by averaging the number of annual rings and percentage of summerwood on the two chosen inspection lines shall be used.

3. Contrast in color between summerwood and springwood shall be sharp and the summerwood shall be dark in color.

4. It is sufficient if either end passes the inspection.

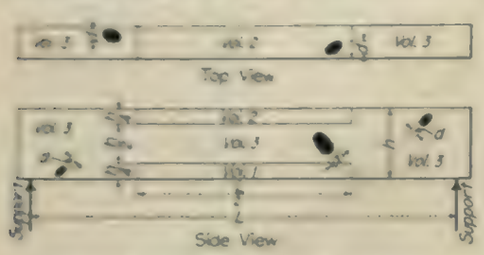
RESTRICTIONS ON KNOTS IN BEAMS

5. Shall not have in Volume 1 (see figure) sound knots with a diameter greater than 1½ in. or one-fourth the width of the face on which they appear—or knots over ½ in. in diameter which are insecurely attached to the surrounding wood. Shall not have in Volume 2 sound knots with a diameter greater than 3 in. or one-half the width of the face on which they appear—or insecurely attached knots with a diameter

greater than 1½ in. or one-fourth the width of the face on which they appear.

The aggregate diameter of all knots within the center half of the length of any face shall not exceed the width of that face.

The diameter of a knot on the narrow or horizontal face of a beam is to be taken as



VOLUME RESTRICTIONS FOR DEFECTS

its projection on a line perpendicular to the edge of the timber. On the wide or vertical face, the smallest dimension of a knot is to be taken as its diameter (see figure).

Restrictions on Knots in Columns

6. Shall not have sound knots whose diameters are greater than 4 in. or one-third the least width of the column, or knots over ½ in. in diameter which are insecurely attached to the surrounding wood.

The diameter of a knot is to be taken as its projection on a line perpendicular to the edge of the column—as on the narrow edge of a beam (see figure).

Restrictions on Shakes and Checks in Beams

7. Ring-shakes shall not occupy, at either end of a timber, more than one-fourth the width of green material, nor more than one-third the width for seasoned material.

Any combination of checks and shakes which would reduce the strength to a greater extent than the allowable ring-shakes will not be permitted. Shakes shall not show on the faces of either green or seasoned timber.

Restrictions on Cross-Grain in Beams

8. Shall not have in Volume 1 diagonal grain with slope greater than one in twenty.

Notes on Proposed Rules

The Forest Service makes the following explanation of the proposed rules:

1. The greater part of the Southern yellow pine structural timber is now sold under grade classifications adopted by associations of lumber manufacturers. These classifications differ somewhat and are described in rules published by the several associations. The rules here proposed embody the principles which should guide in the selection of high-grade structural timbers. Their use will result in securing timbers of higher average strength and greater uniformity than can be obtained by the use of any of the existing commercial rules. They are intended to apply to structural timbers only and not to material to be used where factors other than strength are of prime importance. In specifying material the advantages connected with the use of commercial grades should be considered and the commercial grades adhered to as long as it is certain that material selected under such rules will meet the requirements.

2. Contrast in the color of summerwood and springwood may be classified as sharp, medium, and poor. Sticks with medium or poor contrast should not be admitted in Grade No. 1 material, except when the proportion of summerwood is considerably in excess of the minimum requirement.

Importance of Shakes and Checks

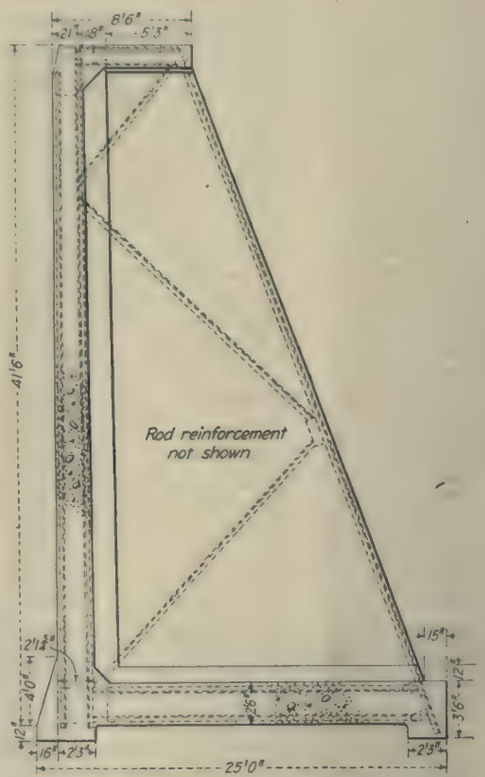
3. The importance of shakes and checks in the middle half of the height of a beam is dependent upon the magnitude of the horizontal shearing stress. The specification given is for beams in which the allowable shearing stress is developed. In beams whose length is more than fifteen times their height the allowable shearing stress is not usually developed and as the ratio of length to height increases, the importance of these shakes and checks decreases proportionately. Ring-shakes showing on an end should be considered as extending to the center. Checks and radial or star-shakes are not usually continuous in the direction of the length of the timber but should not be allowed if, in the judgment of the inspector, their weakening effect is greater than that of the allowable ring-shakes.

Allowable conditions for both green and seasoned material are given because checks are formed and shakes further developed during seasoning. The maximum amount of shakes and checks should not be allowed unless it is practically certain from the appearance of the timber, or from a knowledge of the seasoning conditions, or length of time elapsed since cutting, that it is thoroughly seasoned. For purposes of this rule, it will be considered that at least 1½ months per inch of thickness is required for material to become thoroughly seasoned.

4. In dry interior construction a working stress of 1600 lb. per sq. in. may be used with beams which meet the requirements of the proposed rules.

Light Frames Support Reinforcement for High Retaining Wall

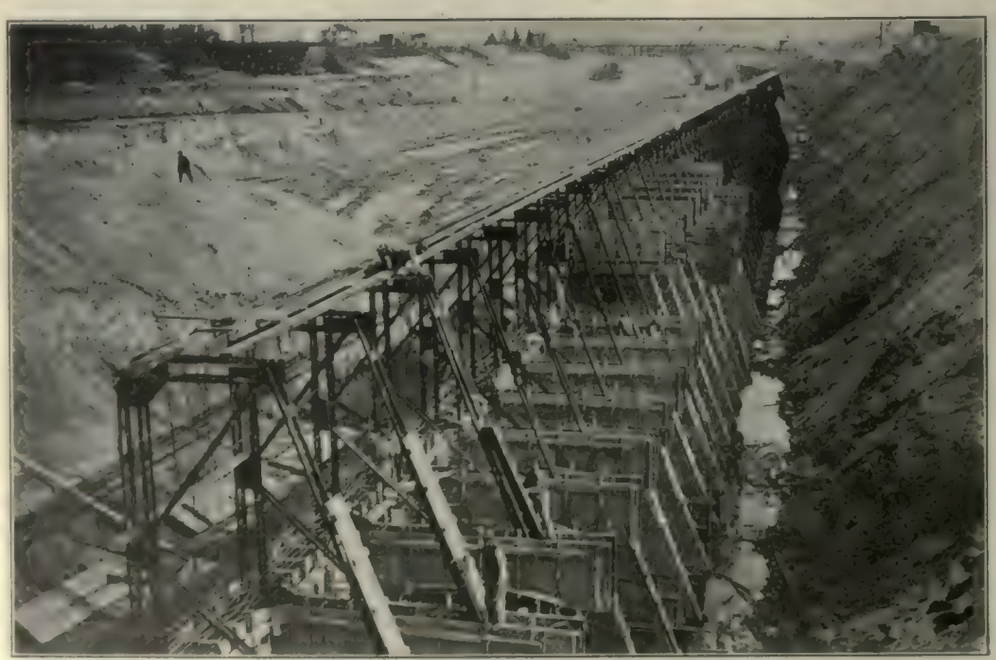
ON the Welland Ship Canal the entrance walls for lock 1, which is nearest Lake Ontario, are 41½ ft. high. In order to support the reinforcing steel, consisting of round rods, light steel frames were designed. Only the angles in the back of the counterfort are counted upon to take any of the stresses in the finished wall. There is a frame in each counterfort. The material for the main members, consisting of uprights in the face of the wall, inclined angles paralleling the back of the counterforts and horizontal members in the base are 3 x 2½ x ¼-in. angles. In the face of the wall and in the base four of these are disposed at the corners of a square and are tied together by gusset plates of ¼-in. material. In the back of the counterfort there are only two of these angles. The gracing running from the angles in the face to those in the counterfort are of 2½ x 2½ x¼-in. material.



RELATION OF FRAMES TO CROSS-SECTION

The angles in the face and in the base are punched for the proper spacing and the horizontal reinforcing bars are placed in the holes. Each frame complete, ready for setting in the wall, weighs 2739 lb.

The work on which these frames are used is under the direction of J. L. Weller, engineer-in-charge, Welland Ship Canal.



STEEL FRAMES SUPPORT RETAINING WALL REINFORCEMENT

Concrete was deposited from cars run on top of frame.

HINTS FOR THE CONTRACTOR

Details Which Save Time and Labor on Construction Work

Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

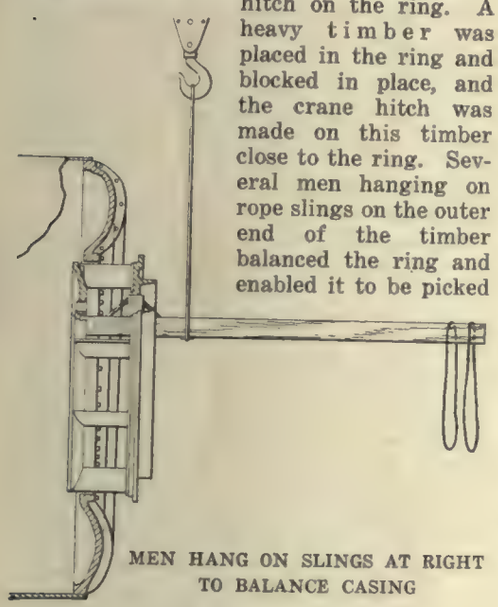
[*Contributions to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

Cantilever Timber Raises Ring When Casing Prevents Hitch

By F. M. BIERSACH

Erection Superintendent, Allis-Chalmers Manufacturing Company

THE accompanying drawing shows a method used by the writer in erecting a 6-ton speed ring for a horizontal turbine where the casing prevented making a direct hitch on the ring. A heavy timber was placed in the ring and blocked in place, and the crane hitch was made on this timber close to the ring. Several men hanging on rope slings on the outer end of the timber balanced the ring and enabled it to be picked



MEN HANG ON SLINGS AT RIGHT TO BALANCE CASING

up level by the crane and inserted in the casing. This occurred on a rush job of overhauling the Malade station of the Beaver River Power Company, near Bliss, Idaho.

Thirty-Six Inch Water Main Lowered While in Service

WITHOUT shutting off the water a 36-in. main 1000 ft. long, part of the system of Waterbury, Conn., was lowered 6 ft. as part of the program of regrading Thomaston Avenue. The work, as described by R. A. Cairns, city engineer, in his annual report for 1914, consisted of excavating a trench alongside the pipe, cutting away under each length, but leaving earth piers at each joint. Then, while surveyors kept track of the levels, the piers were weakened until the weight of the pipe line caused little settlement. Working up and down the line in this way the pipe gradually came down to the bed blocks, which had been set to the exact elevations.

Owing to the pressure of about 100 lb. per square inch on this main and the proximity of two railroad tracks the operation was attended with some risk and required close attention. Under the constant supervision of Charles W. Eddy, assistant engineer, and with John F. Keating, foreman, in charge of the labor, the work went on regularly and systematically and was completed without accident. After driving up the lead joints the line was as tight as ever, according to Mr. Cairns. All material and labor was furnished by the bureau of water.

Steel Support of Decking Gives Large Clear Space for Subway Work

THE SUPPORT of the street decking on Seventh Avenue, on Sections 4 and 5 of Routes 4 and 38 of the new Seventh Avenue subway, New York City, now under construction, has been so designed as to give maximum working space in the trench extending from Greenwich Avenue and West Eleventh Street, the present southerly end of Seventh Avenue, to Thirtieth Street. It has been found especially necessary to devise some scheme for a large working space at headings through solid rock, so that in using maximum safe charge of powder, that is, a charge which will not cause a concussion endangering adjacent buildings, the fragments of rock from the blast do not displace the posts supporting the decking. This problem seems to have been economically solved in the design used.

The method of street support is clearly shown in the accompanying drawing. While the weight of steel required exceeds in value the quantity of timber saved, the advantage of the larger working space permits of more economical methods of shooting and mucking, and a consequent saving in cost of rock excavation. The advantage of economical mucking can be claimed when all earth is encountered. The saving in the cost of handling concrete and final steel erection must also be considered, due to fewer posts, struts and braces to hinder handling and placing of these materials.

A 24-in. I-beam placed transversely to the street, extends from the net lines of the subway excavation to a little beyond the first rail under the car tracks, on both sides

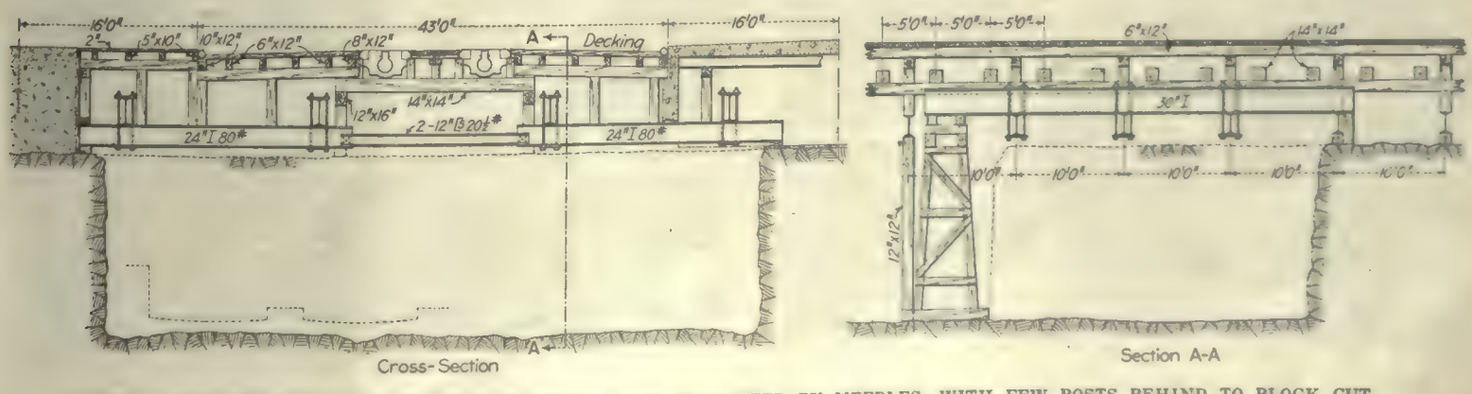


TRAVELER MAKES FIRST EXCAVATION FOR PLACING STEEL HAMMER

of the street, and two 12-in. channels underneath the car tracks hold the beams together. These beams transfer street loads to four or, at most, six posts to sub-grade, and are about 10 ft. below the street level.

In view of the large number of pipes in Seventh Avenue and on account of the fact that rock between Twenty-second and Twenty-fifth Streets is practically found at the street level, much of the pipe being in rock trenches, special permission was granted by the Public Service Commission to do this work by open cut. Even then the closeness of the rock to the pipes required careful blasting to avoid breaking the pipes. A section, taking in half of the avenue and about 30 ft. in length, was opened up and excavated to a depth of about 10 ft. A traveling derrick was used to handle the excavated material and load it on trucks. The 24-in. beams were then placed and the posts carrying decking were set on the beams. The "heading" was thus practically completed and the rock in the "bench" was removed under cover.

This latter process was a simple one. A



FULL HEIGHT OPEN AT WORKING FACE UNDER DECK SUPPORTED BY NEEDLES, WITH FEW POSTS BEHIND TO BLOCK CUT

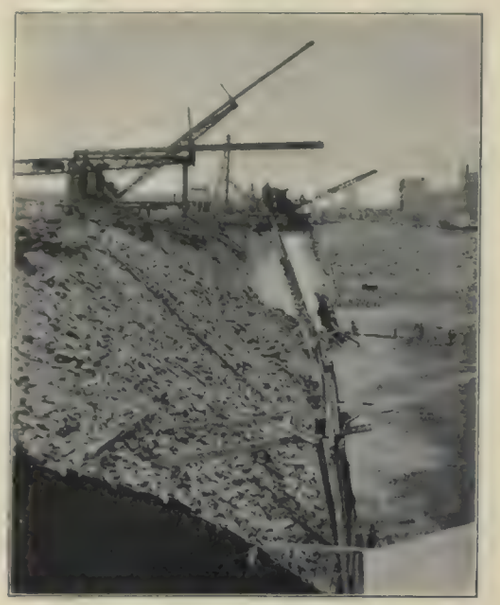
30-in. I-beam was used as a needle, was above and supported three of the transverse 24-in. beams. One end of the needle was supported on the bench, a safe distance beyond the top edge, and the other end had a bearing on a timber tower. The transverse beams, underneath the needle beam, were carried by rods, a special type of steel saddle having been designed to transfer load of beams to the rods. This scheme gave a working area from 20 to 30 ft. high and about 30 ft. long. The needles were placed above the transverse beams, so that no extra work in trenching out rock ahead of the excavation was necessary, the transverse beams having been set about 10 ft. deep and below all pipes, as stated above.

On other parts of the Seventh Avenue and on the contractor's Broadway work, Section 2, Routes 4 and 36, where the traveling derrick was not used, the placing of the 24-in. beams was not so easy. The caps, stringers and planking of the decking were first placed, and then a 10-ft. depth "heading" was excavated under cover or mined out from below. Then openings were made in the deck and the 24-in. beams placed.

The United States Realty and Improvement Company is the contractor, for which C. H. Stengel is chief engineer and E. A. Little, general superintendent. F. W. Carpenter and J. H. Meyers are division engineers over Sections 4 and 5 respectively on Seventh Avenue, and the Broadway work is under the office of J. O. Shipman, engineer of the first division. All of this work is under the supervision of the Public Service Commission for the First District, Robert Ridgway, engineer of subway construction.

Trussed Timbers Extend Reach of Cranes at New York Pier

TO SET the first bent of each of six crane and dinky tracks across the site of the Forty-sixth Street pier, New York City, it was necessary to lengthen the booms of the locomotive cranes employed. The timbers used were trussed on top instead of on the bottom, as is the usual practice, with a timber pin-connected boom. This, of course, is the correct rigging, as the boomfall of the crane is attached at a point under the middle of the stick. The sticks are acting



EXTENDED BOOMS TRUSSED ON TOP

as cantilevers, and deflect downward on the outer end under a load. The long outside bents for the first timber tower under each track were framed in halves, which were assembled on top of the cofferdam and set as units by the cranes. The work is being done by the Holbrook, Cabot & Rollins Corporation, for which D. A. Hughes is superintendent.

Small Crew Moves 3000 Yards of Dirt in Week with Dynamite

By GEORGE B. SHAFFER
Civil Engineer, Edwardsville, Ill.

A TON of dynamite and seven days time was all that was required to dig a 3400-ft. ditch in Mississippi County, Arkansas. Another ditch 2640 ft. long in the same section in sandy and stumpy soil, was excavated with the same quantity of dynamite in nine days. The grade and shape of these ditches is brought out in the accompanying photographs, taken just after the charges were fired on the second ditch.

The entire list of tools and materials used on each job comprised a level, a transit, a rod, two axes, five punch bars, stakes, chalk line and 2000 lb. of DuPont 50 per cent dynamite. Stakes were driven along the center line at 25-ft. intervals, and a chalk line at convenient height above the grade of the ditch was stretched on them. The graduated punch bars were used to make holes in the ground every foot to subgrade. The charge in these holes had to be judged by the weight of dirt to be moved, and the nature of the soil. That this can be done accurately is shown by the excellent sections in the photographs. Loose sand and dry soil require heavier charges than compact or saturated ground. Soil containing stumps was, of course, harder to blast than ditch sections in the open. The ditches were each fired in several sections after all preparations were completed.

The first ditch lay along a chain of small swamps, and was from 3 to 5½ ft. deep, and from 5 to 16 ft. wide on top. It emptied into a drainage canal. Water ran the entire length of the ditch without obstruction as soon as the shots were fired. About 200 acres of land were reclaimed by this operation.

The second ditch was dug at the side of the property drained, after a topographical survey of the tract had indicated the advisability of this location. It intercepted a ditch which had no outlet, and traversed much sandy and stumpy soil. It varied in depth from 3 to 7 ft., with a top width of 7 to 16 ft. A good ditch was obtained with the first shot, but sand beds crossed by the ditch absorbed all the flow, so that none reached the mouth of the ditch until the next rains.

The work was done by the writer for Burroughs Brothers, of Edwardsville, Ill.

GRAVEL is about the only hard-surfacing road material Iowa has, and an experimental two-course water-bound road 1¼ miles long of that material will be built this year in Webster County just east of Fort Dodge. The road is for the purpose of testing out the gravel along modern lines to meet hard-surfacing conditions. It is to be a joint affair participated in by the city, county, State Highway Commission and good roads section of the Engineering Experiment Station at Iowa State College. The road will be 16 ft. wide, 8 in. thick in the center and 6 in. at the sides. Frequent tests will insure the proper proportions of gravel and clay binder. A coat of oil will probably be applied one or two months after construction has been completed.





MOUTH OF 2600-FOOT DITCH DUG WITH DYNAMITE IN NINE DAYS, BEFORE AND AFTER FINAL BLAST—TOOLS AND CREW AT LEFT

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

Hollow Tile vs. Cinder Concrete Fight in New York Settled

The Board of Aldermen of New York City, on July 6, passed three of the more important articles in the current revision of the building code—article 13 on masonry construction, article 16 on reinforced-concrete construction, and article 17 on fireproof construction, all to take effect three months from date of adoption. These articles were passed with no opposing vote, and finally settle the long-continued deadlock in the Board of Aldermen between the hollow-tile and the cinder-concrete interests. This fight has been waged since 1908, and previous attempts to revise the regulations governing such construction in 1909, 1911 and 1913 met with total failure.

The new articles have been prepared to give all types of construction fair consideration. The success of the present committee of the board was brought about largely through the expert advice and guidance of Rudolph P. Miller, consulting engineer of the committee in reconciling conflicting interests by the method of mutual concession, preliminary hearings and many conferences.

The work of revision of the thirty-one articles of the code under the jurisdiction of this committee is now at least 75 per cent completed, as the revised articles most difficult to pass have now been adopted by the board. In addition to the three articles thus passed, the following have been revised and adopted as part of the new code: Article 2, on materials; article 3, on working stresses and loads; article 4, on classification of buildings; article 5, on restricted areas; article 11, on partitions, fences and walls; article 12, on excavations and foundations; article 14, on wood construction; article 15, on iron and steel construction; and article 29, on plumbing and other systems. The articles which yet remain to be revised are, in general, of minor importance.

Live in Illinois? Structural Engineer? Get Your License

The Illinois structural engineer's license bill, the measure which has been fought so fiercely by the organized architects, was signed July 5 by Governor Dunne. The Attorney General gave his opinion that the bill was constitutional and in good form. There is some uncertainty as to when the bill will become a law and court action is likely. The point to be raised is that, July 1 having passed prior to the executive action, the new law cannot become effective until July 1, 1916. Prominent Chicago engineers are of the opinion that the profession will rapidly adjust itself to the new measure and will aid it to get into working order as vigorously as they worked to have the law passed.

Train Crashes Through Damaged Trestle Killing Three

Three persons were killed and sixteen injured when a Chicago, Milwaukee & St. Paul passenger train from Seattle to Hoquiam crashed through a trestle near Rainier, Wash., July 3, falling down 40 ft. on to a Northern Pacific freight train that was crossing underneath. Investigation disclosed the fact that a bent had been ripped out of the structure by the steel arm of a crane that was being carried on one of the freight cars, which had become loose and, swinging about, had caught one of the diagonal cross-stringers of the trestle.

Hydraulic Appropriation Measures Vetoed in Pennsylvania

The Governor of Pennsylvania, believing that the State treasury would be unequal to the demands, has vetoed a great number of appropriation bills, among them two bills for water survey projects. He also reduced the appropriation for stream gaging work to $10,000, thus practically putting a stop to the great work which the Commonwealth has had in hand. As a result of previous appropriations, however, a very elaborate report on the water resources of the State, running to 1500 pages, quarto size, is now in the hands of the State printer.

The Governor also vetoed a measure which would have appropriated $300,000 per year for five years, beginning in 1917, for the Pymatuning Reservoir project, a matter previously discussed in this journal. An appropriation of $65,000 for this project, left over from a previous $100,000 appropriation, however, was allowed to remain.

General Goethals Has Made No Plans for Future

Press reports that Major-Gen. George W. Goethals had made arrangements to take up a general engineering and construction practice in conjunction with his son, Capt. George R. Goethals, S. B. Williamson, at present chief of construction of the U. S. Reclamation Service, and C. A. McIlvaine, upon his retirement from the U. S. Army, have aroused considerable interest among the engineering profession. The Engineering Record learns by cable from General Goethals that he has made no plans for the future.

Hydraulic Engineers of Pennsylvania Commission Lose Positions

Owing to lack of appropriation the engineering employees of one department of the Water Supply Commission of Pennsylvania will be dispensed with during July. They include division and assistant engineers, field and office assistants, at salaries from $75 to $250 per month. Their experience covers waterworks, water power development, flood investigation, river improvement and hydrography. Farley Gannett, the commission's chief engineer, is endeavoring to find positions, outside of the State service, for those members of his staff who are to be dropped.

Urge Adoption of Metric System

The Spokane, Wash., Engineering and Technical Association on June 11 appointed a committee to place a request with federal officials and congressmen that they co-operate with the United States bureau of standards in the urging the adoption of the metric system as the standard of measurements throughout the United States.

Date Set for New York's Street Cleaning Exhibit

The New York Department of Street Cleaning will hold its second annual exhibition of street cleaning apparatus and appliances in the First Regiment Field Artillery armory, Sixty-eighth Street and Broadway, during the week beginning Monday, Oct. 11. Its object is to awaken public interest to the importance of this feature of city work and to exhibit the latest machinery and appliances in this field. Commissioner John T. Fetherston will have general charge of the arrangements.

Committees Will Study Many Phases of Engineering Education

The annual convention of the Society for the Promotion of Engineering Education at Ames, Iowa, was notable for the large number of representatives who attended from distant parts of the country. The location proved to be exceptionally attractive and the facilities and courtesies extended by the Iowa State College were everything that could be desired. The general characteristic of the convention was the presentation by committees and individuals of new ideas in methods of teaching. The convention devoted itself more to methods than to material and to the characteristics of the students rather than to text books. Of especial interest was the report of the joint committee on engineering education by Dean Anthony.

Detailed discussion of the work to date followed the report of the committee on committees appointed at the Princeton meeting in 1914. This committee divided the work of the society into twenty groups. The work for each committee was outlined and specific tasks were assigned each committee for the ensuing year. Some of their duties are: Administration committee—occupation of engineering teachers during the summer vacation; mathematics committee—to what extent does co-ordination exist among mathematics, physics and mechanics; English committee—present status of the teaching of English to engineering students; mechanics and hydraulics committee—experiments made in methods of teaching mechanics and means used to test these experiments; committee on statistics—record of attendance and mortality of students, location and occupation of alumni kept by each institution and other work along the line of statistical studies being made at institutions; nomenclature committee—recommendations regarding the use of symbols in mechanics and hydraulics. It is expected that this method of making definite assignments will result in much valuable data.

The enthusiasm of the institutional delegates was notable. It became evident that through the institutional delegates the results obtained by the society will be made more available for the different educational institutions.

The following officers were elected: President, H. S. Jacoby, Corneli University; vice-president and chairman of committee on institution delegates, D. R. Chatburn, University of Nebraska; vice-president and chairman of committee on administration, F. H. Constant, Princeton University; secretary, F. L. Bishop, University of Pittsburgh; assistant secretary, L. H. Harris, University of Pittsburgh, and treasurer, W. O. Wiley.

Special Train Will Carry Delegates to Pan-American Road Congress

The executive committee of the Pan-American Road Congress, at a meeting held in New York City, June 7, decided to run a special train to Oakland, Cal., to accommodate the delegates who proposed to attend the meeting durig the week of Sept. 13. The route will be selected so as to afford the delegates an opportunity of inspecting road work at the principal cities across the continent.

The executive committee of the Congress will appoint local representatives or chairmen in all the principal cities in the United States and Canada. Each local representative will look after the interests of delegates from his section and help to arouse interest in the meeting.

Reinforced-Concrete Stood Up Well in Imperial Valley Quake

Further reports from El Centro indicate that reinforced-concrete stood the test in several instances during the earthquake in Imperial Valley, Cal., June 22 and 23, which was described in this journal, July 3. Light buildings of wooden frames with galvanized-iron roofs and sides, with the exception of one warehouse building, also did well. Over half of the taller chimneys, of brick, tile and cement blocks, gave way. Brick buildings laid with cement mortar held together in nearly all instances, while the walls of tile buildings were partially demolished. Frame buildings were moved from their foundations, which were of tile or brick and to which they were not well anchored. In very few instances were they damaged otherwise.

Brick buildings, with the exception of those anchored, failed, in most instances, at the roof line. One moved out of plumb an inch on both walls, about 3 ft. above the foundation and running the full length of the structure. Another, built about a year ago, had a wall move out 6 in. at one corner for a short distance above the foundation, but the wall held together very well. Columns failed usually about 4 ft. from the base and some broke near the top. Walls that failed were mostly on the east and west sides. The Fifth Street Grammar School in El Centro, constructed of red brick and covered with cement plaster in 1914 was badly damaged, the walls on the north and west face showing diagonal cracks both ways, opening more than half an inch. The concrete columns at the entrance are apparently intact.

Pennsylvania Companies Will Donate Cement for 12-Mile Concrete Road

The cement industries of Eastern Pennsylvania and public-spirited citizens in Lehigh and Northampton counties have entered into an agreement with the State Highway Department to furnish sufficient cement to build a road twelve miles in length, running from Allentown to Bethlehem and continuing from Bethlehem to Easton. According to the estimates of the State Highway Department, this will require about 40,000 bbl. of cement. Plans are under way also to have these citizens furnish, in addition, the amount of stone which will be necessary to construct this improved highway.

A conference was held in the office of State Highway Commissioner Cunningham, June 14 at which Col. H. E. Trexler, Congressman H. J. Steele, H. R. Fehr, president of the Lehigh Valley Transit Company, G. S. Brown, president of the Alpha Portland Cement Company, William B. Myers, representing the Bethlehem Steel Company and Senator Horace W. Schantz presented the offer of the Associated Cement Companies and the citizens of that district.

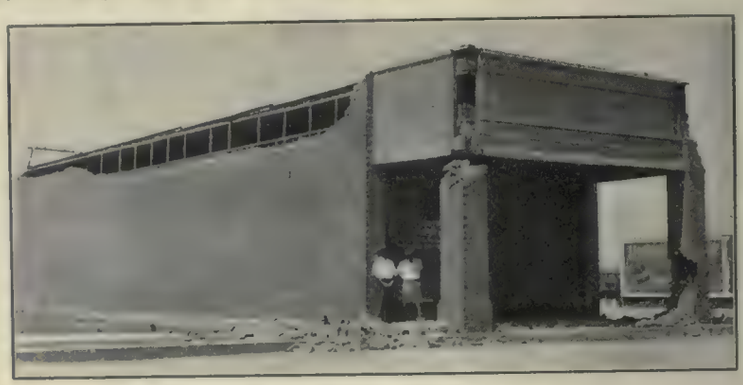
The proposition was made that the State Highway Department do the necessary grading and pay the expenses of such engineering changes as might be necessary and build the road. A letter was drawn up to the commissioner pledging the cement industries to furnish 40,000 bbl. of cement, or such part thereof as might be needed for use on the road. Another letter was drawn up pledging the Lehigh Valley Transit Company to furnish $1,000 worth of transportation for the freighting of the cement. Colonel Trexler and the other members of the delegation agreed to take up the project of furnishing the necessary stone and promised to advise Commissioner Cunningham of this at an early date.

National Drainage Congress to Meet at San Francisco

The National Drainage Congress will hold its sixth session in San Francisco Sept. 17 to 21. Under its auspices at the same time there will be held an International Drainage and Flood Control Congress. The object of the congress is to secure the backing of public opinion throughout the country for the enactment of the Clark-Williams bill now pending before the House of Representatives. This bill contains a constructive program looking to the reclamation of 80,000,000 acres of swamp land in the United States, and the establishing of a rational system of flood protection and river regulation throughout the country. Delegates will be sent by various engineering societies, colleges and universities, chambers of commerce, and boards of trade throughout the country.



GRAMMAR SCHOOL WALLS CRACKED IN MANY DIRECTIONS



BRICK BUILDINGS FAILED IN MOST CASES AT ROOF LINE

Inspection Trips Planned for International Engineering Congress

In order to afford the members of the International Engineering Congress, to be held at San Francisco Sept. 16 to 25, an opportunity of viewing the important engineering works of the West, a number of excursions have been arranged. The annual convention of the American Society of Civil Engineers is scheduled for Sept. 16 and 17, and the intervening days before the International Congress opens will be given over to the following excursions:

1. Sept. 18, the San Francisco high-pressure fire system and the Potrero gas works and electric station A of the Pacific Gas & Electric Company.

2. Sept. 18, Green Valley Waterworks Company on east side of San Francisco Bay.

3. Sept. 19, Spring Valley Waterworks, Storage reservoirs and pumping stations, located on the San Francisco Peninsula.

4. Sept. 19, the Delta lands of the Sacramento and San Joaquin Rivers.

5. Sept. 17 and 18, Great Western Power Company's hydroelectric development on the Feather River and dredging at Oroville.

6. Sept. 18 and 19, Pacific Gas & Electric Company's hydroelectric development at Lake Spaulding and Drum power house at the gold mines at Grand Valley.

7. Sept. 17 to 19, oil fields at Coalinga.

San Francisco Wins Hetch Hetchy Construction Point

A party of Congressmen and other representatives of the Government from Washington met San Francisco officials June 17 at the site of the proposed Hetch Hetchy dam to consider the proposed construction plans. In the Congressional party were S. T. Mather, assistant secretary of the interior; A. P. Davis, chief engineer of the U. S. Reclamation Service; Mark Daniels, superintendent of national parks, and James J. Fitzgerald of New York. San Francisco was represented by M. M. O'Shaughnessy, city engineer, and Percy V. Long, city attorney.

The meeting at the site was planned primarily to settle the question of flooding the floor of the valley during construction, to which there is opposition on the part of "nature lovers" who have appealed to Secretary Lane. Mr. O'Shaughnessy proposes to build a temporary diversion dam, which will raise the water on the floor of the valley to a depth of about 30 ft. and submerge between 600 and 700 acres of land. The object of this dam will be to change the course of the Tuolumne River and turn it into a by-pass tunnel about 20 ft. in diameter, on the south side of the stream, so that flood waters may be passed while the excavation is made for the main dam across the river.

In commenting on the results of the conference Representative Borland said, "We came to a substantial agreement that clears the way for the City of San Francisco to go ahead with its work. I am more than ever convinced that San Francisco needs Hetch Hetchy and that no mistake was made when Congress voted the valley into the city's hands. The formation of the lake will not detract from the beauty of the valley, and the erection of the temporary dam will facilitate the work."

Department of Labor Inaugurates Many Employment Bureaus

The United States Government, through the Department of Labor, has inaugurated as a part of the Division of Information a country-wide employment bureau. It is the belief of those connected with the work that it will go far toward improving business conditions in the United States. The underlying principle of the work is expressed by the Secretary of Labor in the folowing words:

"The Department of Labor and Docks has established distribution branches throughout the country for the purpose, on the one hand, of developing the welfare of the wage-earners of the United States and improving their opportunities for profitable employment, and, on the other hand, of affording to employers a method whereby they may make application for such help as they need and have their wants supplied through the distribution branches."

Comparative statistics show that there has been in some portions in the United States a surplus of labor, while in other portion a deficiency. It is believed that this condition will be almost eliminated by this work. The United States has been divided into eighteen sections, or "distribution zones," as they are called, and in each of these zones an employment office has been opened. These zones in nearly every case

have been subdivided, and branch offices opened under the jurisdiction of the controlling office. This means that a large number of employment offices have been opened by the United States Government. The employer who needs help of any kind can secure what he wants by calling or writing the distribution office in his section. No fee is accepted by the Government from those seeking employment. Every postmaster in the United States is a representative of this employment bureau. At every postoffice in the United States will be found, on application to the Postmaster, blanks for the use of employers in need of help and for the use of persons seeking employment. These blanks, upon being handed to the Postmaster, are transmitted by him, free of charge, to the proper zone office, where both kinds of blanks are properly registered. Proper help is selected for the employer either from applicants residing in the city in which the office is located or from applications on file. A copy of the employer's application is also sent to the Division of Information at Washington, D. C. At frequent intervals these applications are assembled and published in the form of bulletins, and sent to all the distribution offices, thereby making it possible for each office to know where help of any description is in demand. It is the purpose of the bureau to have the best interests of the employer kept in mind by the distribution offices, so that only persons competent to fill the vacant positions of which the department is notified will be recommended.

Illinois to Have State Bureau of Sanitary Engineering

A state bureau of sanitary engineering will be established in Illinois at the earliest possible date, writes C. St. Clair Drake, M. D., secretary and executive officer of the State Board of Health. The new bureau has been made possible as a result of the Governor's signature to the bureau appropriation bill. All positions will be filled through the legal channel, the Civil Service Commission, as soon as the necessary examinations can be held and the successful candidates determined. The position of state sanitary engineer will pay $3,600 for the first two years.

New Edition of Engineer's Book on Yellowstone Park

As a result of his sojourn in 1891 in Yellowstone Park, where, as a member of the Corps of Engineers, U. S. A., he was engaged in the construction of the highway system, Gen. H. M. Chittenden, U. S. A., retired, now of Seattle, Wash., wrote a guide to the park. This was revised in 1903 and now Stewart & Kidd, the Cincinnati publishers, have brought out a revised and enlarged edition. It is a 5½ x 8-in. volume of 350 pages, replete with graphic descriptions of the lore and wonders of the park. The historical section is no less interesting than that which deals with the geologic marvels that have made Yellowstone famous. An interesting chapter is devoted to the road system. The book is of general interest. To those having the good fortune to visit the park it is invaluable.

Personal Notes

E. J. Holland has resigned from the office of city engineer of Guelph, Ont.

Walter W. Kraft has been appointed superintendent of streets of Evanston, Ill.

William R. Holway has been appointed bridge inspector by the Rhode Island Company of Providence, R. I.

Louis J. Larson has been appointed to an engineering position in connection with drainage work at Redwood Falls, Minn.

Samuel J. Mott, civil and sanitary engineer of Saratoga Springs, N. Y., has been appointed city engineer of that city.

W. R. Butler, for the last eighteen years professor of civil engineering in the Royal Military College at Kingston, Ont., has retired from active service.

George A. Reed, formerly city engineer of Barre, Vt., has been appointed city engineer of Montpelier, Vt. He was appointed city engineer of Barre in 1907.

F. L. Brinkman, formerly assistant engineer for the city of St. Thomas, Ont., has been appointed assistant resident engineer in the Department of Public Works at Fort William, Ont.

George M. Rice has been appointed chief engineer of the Puget Sound & Willapa Harbor Railway, succeeding Charles H. Byers, whose resignation is noted elsewhere in these columns.

H. L. Butler, formerly a resident engineer of the State Highway Commission of Illinois, has been appointed instrumentman by the Interstate Commerce Commission, Division of Valuation.

Walter H. Oliver, formerly division engineer for the Atchison, Topeka & Santa Fé Railway at Needles, Cal., has been appointed division engineer for the same company at San Bernardino, Cal.

J. K. Hilton, formerly assistant county engineer of Sac County, Iowa, has resigned from that office to engage in drainage work in Green County, Iowa, under the direction of S. J. Melson.

David Salkind & Company, painting contractors on bridges and structural steel work, of Philadelphia, have moved their offices from Fourth and Market Streets to 151 North Fourth Street.

Capt. James F. Bell, Corps of Engineers, U. S. A., has been promoted to the rank of major to fill the vacancy caused by the death of Maj. A. B. Putnam, which was noted in this journal, June 19.

J. O. James, for the past year holder of the McGraw Fellowship in Civil Engineering at Cornell University and a graduate student in experimental hydraulics at that institution, has been appointed assistant professor of hydraulics at the University of Kansas.

Eugene Couch, formerly engineer of street paving of the city of Houston, Tex., and previous to that, principal assistant city engineer of Dallas, Tex., has been appointed engineer for the Klein Brothers Company, contractors for all kinds of concrete construction, of Dallas, Tex.

F. J. Stimson, formerly engineer of maintenance of way of the Grand Rapids & Indiana Railway, has been appointed superintendent of the Zanesville division of the Pennsylvania Railroad Lines west of Pittsburgh, succeeding Paul Jones, who has been appointed superintendent of the Toledo division.

Frank O. Lee, formerly assistant engineer with F. O. Sinclair, consulting engineer of Burlington, Vt., has been appointed city engineer and superintendent of the water department of Barre, Vt., succeeding George A. Reed, whose appointment to a similar position at Montpelier is noted elsewhere in these columns.

Nathan C. Johnson, consulting concrete engineer, author of the series of articles on the use of the microscope in the study of concrete which appeared in this journal early in the year, and joint author, with Cloyd M. Chapman, of the series on sand testing which appeared recently, has taken offices in the Singer Building, New York City.

F. Le Cocq, formerly assistant engineer in the city engineer's department of Aberdeen, S. D., has been appointed city engineer of that city. He was graduated from Purdue University in 1911 and entered the city service at Aberdeen in 1912. In addition to his duties as city engineer he will have charge of the water and sewer departments.

D. B. Duncan, formerly connected with the L. W. Dumas, Jr., Construction Company, has been appointed superintendent of construction for the W. D. Lewis Company, contractors, of New York City, on a five-story reinforced-concrete warehouse that the company is constructing for the Des Moines & Southern Railway at Fort Dodge, Iowa.

Hurlbut S. Jacoby, formerly chief engineer of the Standard Steel Construction Company of Welland, Ont., whose appointment as instructor in civil engineering at Pennsylvania State College was noted in these columns, April 10, has been retained as associate engineer for summer work by the Samuel Austin & Son Company, industrial engineers and builders, of Cleveland, Ohio.

G. R. G. Conway has resigned as chief engineer of the British Columbia Electric Railway to enter consulting engineering practice in the East. He was honored at an elaborate farewell banquet at the Hotel Vancouver, June 28, tendered by the company, and highly complimented in a cablegram from the board of directors in London, England. He will continue relations with the company as its consulting engineer.

D. D. Howe, formerly an assistant to J. M. Baldwin, consulting engineer, of Atlanta, Ga., has been appointed a transitman with the DuPont Powder Company on the construction of the new plant covering several thousand acres which is being built for manufacture of gun cotton at City Point, Va. The work is a rush job, involving day and night work, and requiring a working force of 12,000 men, located in a town that one year ago had only 450 inhabitants.

Prof. Charles M. Spofford, of the firm of Fay, Spofford & Thorndike, consulting engineers of Boston, and head of the department of civil and sanitary engineering of the Massachusetts Institute of Technology, has been appointed a member of the commission constituted by a recent legislative act to investigate the subject of terminal facilities and the improvement of facilities for the transportation of freight in the Boston Metropolitan District by the Governor of Massachusetts.

John F. Trumbull, formerly chief clerk to the chief engineer of the New York, New Haven & Hartford Railroad, has been appointed chief engineer of the Public Utilities Commission of Connecticut, succeeding C. C. Elwell, who resigned to become a member of the commission. He was graduated from Sheffield Scientific School, Yale University, in 1902, and has engaged continuously since that time in railroad work on the forces of the International Railroad of Mexico, those of the Connecticut Company and the New York, New Haven & Hartford.

Charles H. Byers has resigned from the office of chief engineer of the Puget Sound & Willapa Harbor Railroad to accept an appointment as assistant engineer of the Pacific District of the Interstate Commerce Commission, Division of Valuation, with headquarters at San Francisco. He was graduated from Oskaloosa College in 1881 and was employed on the forces of the Cedar Rapids, Oskaloosa & Southwestern Railway, the Chicago, Burlington & Pacific, the Marion & Manchester and the Burlington & Western from then until 1886, when he was appointed, successively, instrumentman for a private engineering firm, transitman for the Chicago, Milwaukee & St. Paul, and division engineer on the Atchison, Topeka & Santa Fé. Later he entered the service of the Missouri Pacific and remained in it until 1905, attaining the grade of division engineer, maintenance of way. From this service he went to the Chicago, Milwaukee & Puget Sound as district engineer and, from 1909 to 1912, as assistant engineer on special work, did considerable work in connection with railway valuation.

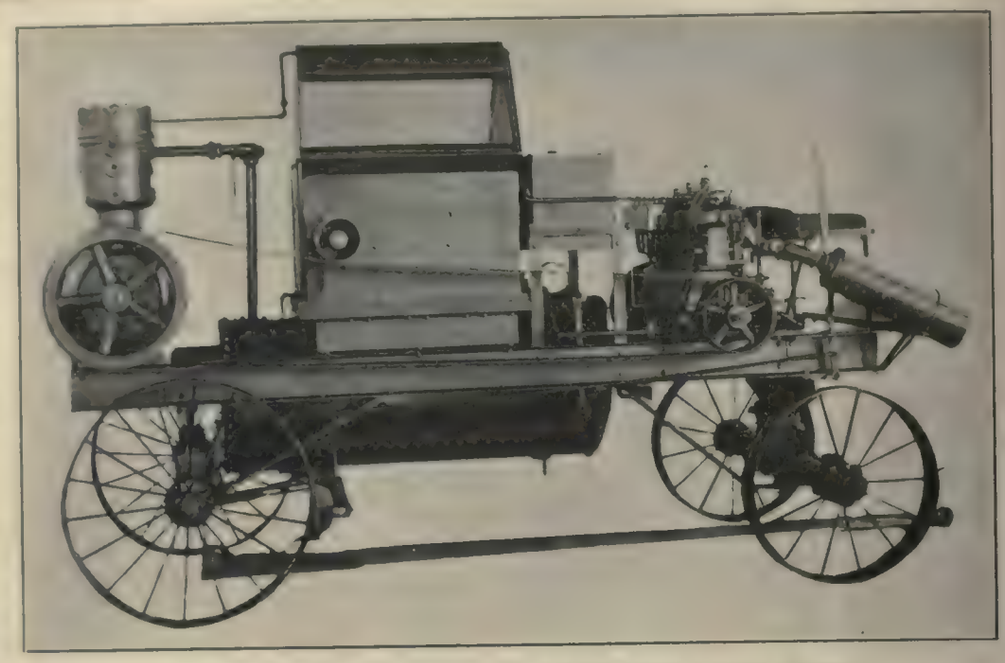
Obituary Note

Leonard D. Croshaw, a Chicago contractor, died at his home in that city July 5.

Light Weight a Feature of Latest Model Air Compressor

Material reduction of weight, due to the use of a four-cylinder, high speed marine engine in place of one of the usual heavy duty single-cylinder type, is a feature of a new model portable air compressor. The machine is said to be particularly adapted for structural steel erection where air is used for pneumatic hammers. It is also designed for the use of contractors when air is necessary for caulking water mains and on jobs where compressed air is used in relatively small quantities.

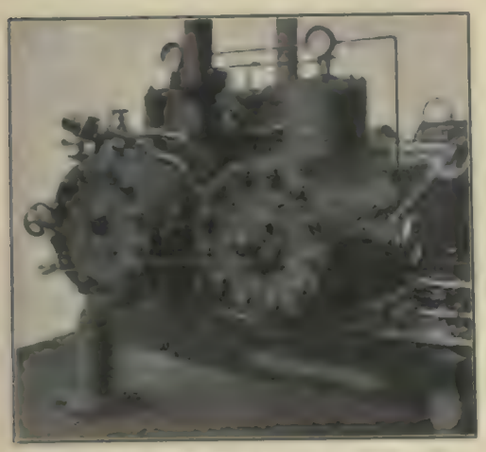
The machine, which is manufactured by the Gardner-Governor Company, Quincy, Ill., is made in 80, 105, 140 and 218 cu. ft. capacities, 125 lb. pressure.



NEW PORTABLE AIR COMPRESSOR USES HIGH SPEED MARINE ENGINE

Compressor Not Needed for Fuel Injection in New Oil Engine

To meet the demand for an oil engine that combines the economy of the Diesel type, yet is not so cumbersome and complicated, the Nordberg Manufacturing Company, of Milwaukee, Wis., is manufacturing a 200-hp., two-cycle engine that makes use of the Diesel principle of ignition, but does not require an air-



OIL ENGINE FOR SMALL PLANTS

compressor for injecting the fuel, as this is done mechanically. Other features are the absence of valves and valve gear subjected to pressure, the only valve being a simple piston valve controlling the scavenging air.

Business Notes

The Maher & Byrne Company of Chicago, of which C. L. Arson is president, has been made the Chicago representative of the Kingsford Foundry & Machine Works, manufacturers of heavy centrifugal pumping equipment of Oswego, N. Y.

The Marion Steam Shovel Company and the Marion-Osgood Company of Marion, Ohio, state that the litigation that has been carried on for the past several years by them has been satisfactorily and amicably adjusted. The settlement covers all machinery heretofore shipped by the Marion-Osgood Company and grants it shop rights to continue the use of those patents held by the Marion Steam Shovel Company which are involved in the Marion-Osgood Company's machines as at present constructed.

Trade Publications

J. H. Burnett Iron Works, Inc., Fresno, Cal., and Pittsburgh, Pa. Catalog, 4 x 7 in., 12 pages, illustrated. Describes the patented lock nut, "Johnny Bolt," and illustrates its use and application.

Weber Chimney Company, McCormick Building, Chicago. Catalog, 5 x 9 in., 48 pages, illustrated. Concrete coniform and cylindrical chimneys recently constructed by this organization.

Watson Wagon Company, Canastota, N. Y. Folder, 8 x 11 in., 4 pages, illustrated. A talk on the Watson bottom dump truck, with its special distinctions of front drive and even distribution of load.

Troy Wagon Works Company, Troy, Ohio. Catalog, 5 x 7 in., 30 pages, illustrated. Describes in detail the general features of Troy wagons, then explains each type briefly, illustrating its special use.

Troy Wagon Works Company, Troy, Ohio. Leaflet, four pages, 9 x 12 in. Of interest on account of showing variety of uses of heavy motor trucks—for hauling road materials and in industrial-plant use.

Chicago Pneumatic Tool Company, Fisher Building, Chicago. Bulletin 34-X, 6 x 9 in., 8 pages, illustrated. Relates to class A-G "Giant" gas and gasoline engines, ranging in horsepower from 16 to 130.

Automatic Concrete Mixer Company, Providence, R. I. Catalog, 6 x 9 in., 32 pages, illustrated. Explains the principle on which the Automatic mixer operates and shows pictures of numerous big jobs where it has been used.

Garford Motor Truck Company, Lima, Ohio. Booklet, 6 x 9 in., 16 pages, illustrated. A treatise by S. M. Williams on roads and their influence on economic and social conditions, showing the muddy road, the dirt road and the improved road, and discussing their effect upon the community.

Gemco Manufacturing Company, Milwaukee, Wis. Catalog, 5¾ x 8½ in., 12 pages, illustrated. Deals with appliances and devices for concrete work, such as column and wall clamps, and adjustable joist and beam shores for wooden forms, and a patented wire twister and cutter for tying rod reinforcement.

Armstrong Manufacturing Company, Waterloo, Iowa. Catalog B-I, 7¾ x 10¾ in., 64 pages, illustrated. Covers in detail Armstrong gasoline portable cable-drilling machines designed primarily for drilling blast holes, and adapted especially for quarry requirements, or others where there are large stone or earth displacements.

P. D. Skahen, Syracuse, N. Y. Leaflet, 7¾ x 10¾ in., 8 pages, illustrated. Skahen steel adjustable concrete forms, the special advantages of which, it is claimed, are that they may be adjusted to any length or height, and that they will save much time and labor, as they are constructed simply of steel framework and wall sheets that are attached without any complex devices.

Fairbanks-Morse & Company, Chicago. Catalog, 6 x 9 in., 40 pages, illustrated. Pictures the uses to which Fairbanks-Morse pumping machinery has recently been put for irrigation purposes. Shows types of machinery ranging from a 2-hp. Jack of All Trades engine delivering 350 gal. of water per minute to a 200-hp. multi-cylinder oil engine furnishing power to three pumping stations, the output of which aggregates from 9000 to 12,000 gal. per minute.

National Tube Company, Pittsburgh, Pa., Catalog J, leather, 5 x 8 in., 394 pages, illustrated. An unusually elaborate and expensive book listing and describing the material manufactured at the Kewanee works of the company, including "National" pipe for steam, gas, water and air, cast-iron, malleable iron and brass fittings, "Kewanee" unions and specialties, brass and iron body valves and cocks, radiators and coils, drive well points and well supplies. From cover to cover it is attractive to the eye. The data are presented in clear, compact tables. Almost every heading is illustrated and the illustrations are especially good, particularly those dealing with the "Kewanee" combination brass and iron unions, which are shown in color.

American Sheet & Tin Plate Company, Frick Building, Pittsburgh. Booklet, 10 x 7 in., 32 pages, illustrated. An article by D. M. Buck, metallurgical engineer for this company, discussing the action of corrosion on sheet metal as observed on a series of tests carried on in the Pennsylvania coke regions. The results of Keystone copper bearing steel in comparison with other metal sheeting are given. Tables showing relative losses on exposed test pieces are also included. Catalog, 9¼ x 6¼ in., 32 pages, illustrated. Describes Apollo Best Bloom galvanized sheets and culverts. The illustrations show the product and its adaptation to many uses such as railroad and road culverts, tanks and silos, roofing, warehouses, elevators and other structures that need fireproofing construction. Catalog, 9 x 6 in., 64 pages, illustrated. Provides information relative to formed metal roofing and siding material for buildings, giving in detail descriptions and instructions of the uses to which sheet metal may be put. Booklet, 3½ x 6¼ in., 44 pages, illustrated. Contains a general description of Copper Bearing open hearth steel for roofing tin, and a list of standard sizes of sheeting with prices, weight, size, etc.

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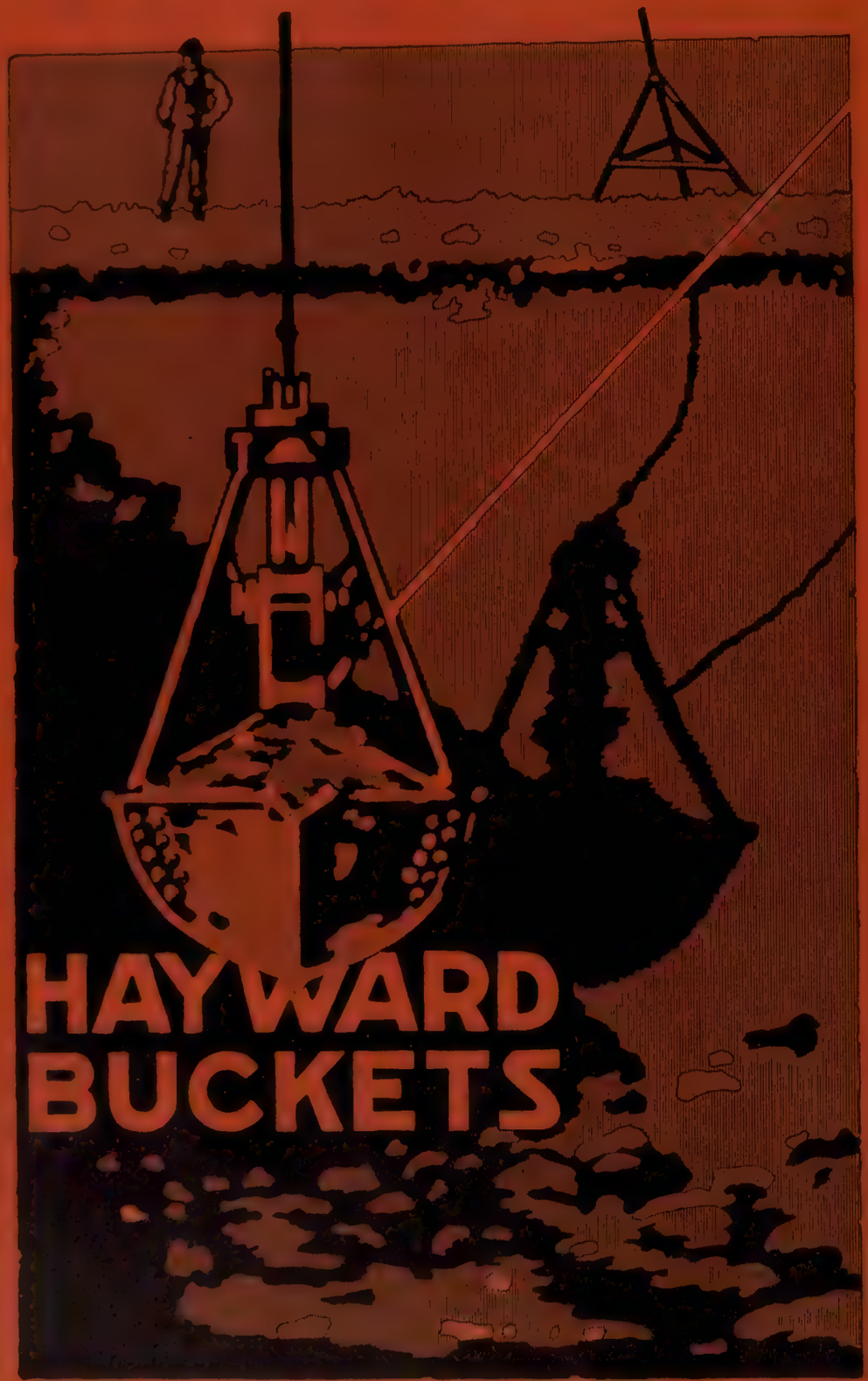
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Engineering Record

A Weekly Journal Devoted to Civil Engineering and Contracting

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Illinois Licensing Law

A LAW for licensing structural engineers in Illinois is now on the statute books. Without a doubt it could be bettered—one would certainly think so, judging by both the friendly and inimical criticism which has come to this journal—but it accomplishes its main object, that of removing the engineer from the restraining yoke of the architects' licensing bill. Many there were who felt that the best procedure for the engineering profession would have been to have secured the repeal of the architects' licensing law. This being impossible of accomplishment the only alternative was to license structural engineers and give them the rights which they have been so long denied. The Engineering Record trusts that the passage of the measure, abstracted on page 71, will not encourage other States to go recklessly into the licensing of engineers. The Illinois conditions were exceptional.

The State and Liability Insurance

THE first annual statement of the New York State fund created under the Workmen's Compensation Act, which went into effect July 1, 1914, should interest contractors, as well as insurance men. The premiums charged on policies written under this act were 20 per cent lower than those charged by private companies. Yet the State fund has earned a 20 per cent dividend, after paying all losses and setting up large reserve funds. It is likely that the State will prove to have a great advantage over any insurace company, in that it is more free from demands for ridiculously large damages. In many instances the damages awarded by juries against private companies have been out of all reason, being many times the sum the injured could have earned if he had lived to be a hundred. To award damages in excess of earning power is, to the reckless or worthless employee, an invitation to get hurt. The lesson of this State insurance fund is that the country can adequately take care of those injured in industrial and public work at much less expense than has been the rule under the damage suit system. This lesson should be driven home to all those having to do with framing and enforcing liability laws.

Fostering Interest in Conventions

THERE has been a decided change, of late, in the methods which local committees of engineering societies are adopting to foster interest in annual conventions. One of the things to be desired at such meetings is a large and representative attendance, but with few exceptions, the measures employed heretofore to achieve this result have indicated a lack of appreciation of how to go about the work. The reason is that committees in charge have failed to realize the value of intelligent advertising and have proceeded on the assumption that by merely mailing a printed program their duty has been performed. Different tactics are being followed this year by the New England Waterworks Association, which will hold its annual convention in New York, Sept. 7 to 9 inclusive. As a forerunner of other announcements there has been mailed to each member a picture postal card showing in an ingenious cross-sectional view the spectacular work of laying a 36-in. flexible joint pipe line across New York Harbor, a million dollar job of the Catskill aqueduct work, which will be inspected during the convention. Other postals, dealing with different phases of the meeting, are to follow, so that the members of the association will be reminded of the event, not once, but at regular intervals from now until September. The scheme is nothing more than the "follow-up" system which has been used in other fields to arouse curiosity and create interest, but it indicates on the part of a technical society an appreciation of business methods and the value of publicity properly applied.

Patented Materials in Public Work

IT is clear to those who read carefully Mr. Whinery's article on page 73, advocating certain changes in the relations of State, contractor, and patentee of processes or materials employed in highway or other forms of construction, that the point at issue is not the relative merits of patented and unpatented materials or methods in themselves, but rather the abuses which have attended the award of contracts in which patented materials have been involved. In other words, a road in which patented processes or materials are used may give as good, or better, service under traffic as some other type of construction not controlled by commercial interests, but in the use of patented materials on public works difficulties and complications have arisen which can only be solved by a frank discussion of the trouble and its remedy. In the case of a State or city highway contract, where a patented pavement is admitted under the specifications, it is common practice to require the patentee to quote a price at which his material will be delivered to contractors submitting bids. This opens the way for a "favored contractor" to receive, surreptiously, a cut-rate price, thereby giving him an advantage which his competitors, who are bidding upon the figures openly published, do not enjoy. Thus, in spite of the fact that the favored contractor's bids on all the other items of the work may be high, it is still possible for him to secure the contract as low bidder. If, however, the other bidders could have availed themselves of the reduced price on the patented products, the favored concontractor would cease to exist, and the State or city would be able to save an appreciable amount in construction costs. This, in brief, is the malady which Mr. Whinery would cure by eliminating dealings between contractor and patentee and having the State or city pay the royalty directly. Highway officials will do well to give to the proposed changes very careful consideration, for they point to economies in the cost of work and a square deal for contractors who submit bids in good faith.

Time by the Forelock

IN business and in industry there is a growing appreciation of the value of standard practice instructions. They allow the best experience in the organization to be used, even when the most competent men are away. Another advantage is that methods are never so severely analyzed as when they are put down on paper and passed around for the scrutiny of the staff. The errors in methods are then quickly discovered, while every effort is made to find the best possible solution for every difficulty. The experience of a staff, or of a group of men, can thus be more quickly focused than in almost any other way. An excellent example of standard practice instructions, drawn up so that the counsel of the best men in the organization may be at hand in every emergency, is afforded by Mr. Allner's article on ice fighting at the Holtwood plant, on page 66 of this issue. The precautionary measures adopted at the very beginning of the critical season in removing the screens in front of one of the intake openings of each unit, the close watch kept upon the exciter and change in the forebay, to give the very first indication of danger, the warming of chambers of units which had been shut down and of the exciter kept in reserve, and the minuteness of instructions as to procedure when a run of ice is certain, form a campaign of defense that is truly admirable. One can readily appreciate, even if one is without experience in the operation of a hydroelectric plant, that great importance must be attached to continuity of operation. The industries dependent upon this plant for their power would be seriously crippled if the power should suddenly fail and the reserve stations were not prepared to take up the load. Of course, one of the precautionary steps is to warn the reserve steam stations in ample time and if all of the defensive measures should prove unavailing, the only loss would be that occasioned by the cost of steam operation in place of

the hydroelectric. To show how successful these measures have been Mr. Allner, in next week's issue, will tell in detail how a heavy run of ice in January of this year was successfully fought.

Monolithic Brick Pavements

A DISTINCT advance in the construction of brick pavements is marked by the type at Paris, Ill., described by W. T. Blackburn on page 54 of last week's issue of this journal. Practice, undoubtedly, has been drifting in the direction of a firm support for both wood block and brick pavement surfaces, and there is no special reason why, if a rigid base proves entirely satisfactory for these types, the same construction should not be used for stone block. Mr. Blackburn and A. J. Parrish, the contractor, have, however, developed a method whereby their entire pavement is laid practically at one time, thus insuring the maximum of bond possible between the base and the lower side of the vitrified blocks.

The chief advantage that should be expected from this type of pavement is the elimination of the hollow spots, explanation for which was offered in the theory of Mont Schuyler discussed at length in this journal July 3, page 3. Mr. Blackburn, in summarizing the advantages of the type of pavement he describes, referred to this point. If further study of Mr. Schuyler's theory should prove it to be correct—and from examinations this journal has been able to make, it seems to be tenable—there can be no question that this type will very rapidly supersede that in which a sand cushion is used. Already a number of cities have adopted the lean mortar cushion, placed, however, after the concrete base has set. While undoubtedly this cushion must act to some extent as a bond between the base and the brick, one cannot expect as good results as when the Paris method is adopted.

This type of construction naturally raises the question as to the strength of the bond between the base and the comparatively smooth surface of the vitrified brick. Upon it depends the extent of the beam action brought into play in spreading the load over a considerable area. Tests to determine the bond strength would be of interest, for should they prove to be high, so that considerable resistance could be expected to the horizontal shearing forces, the adoption of a quite thin reinforced concrete base would be possible. In fact, one city is now considering the advisability of attempting the Paris type with a base thickness of only 8 in., figuring that with the grouted block and monolithic action through a slab depth of 7 in. there will be ample strength for all except the very heaviest load.

It will be objected that this type of pavement will be very difficult to open up for sub-surface repair and construction work. It will be difficult, of course, but the Engineering Record has no patience with an argument which leads to the condemnation of a type of construction, otherwise entirely satisfactory, merely because of increased difficulty of disturbing a small percentage of the surface. Those who attach great weight to that argument put themselves in the false position of selecting inferior construction for 90 per cent or more of the pavements in order that they may be entitled to tear up the remaining 10 per cent at the slightest provocation.

The inherent advantages of the Paris type of pavement are such as should result in its speedy adoption elsewhere. It represents the farthest step in a development which has been pretty clearly sensed for some time.

Engineering Administration Courses at Massachusetts Institute

WITH the graduation exercises the past month, the Massachusetts Institute of Technology completed its first year of the new course in engineering administration. It is naturally much too early to make a full statement as to its real value, for, as one of the professors said, it is not easy to judge of the success of any line of education until the young men who are instructed have had a chance to try it out in real life. But with this consideration set aside the course gives evidence of success. It is an option beginning in the second year, and only sophomores undertook the work the past year. In 1915-16 there will be second and third-year students taking the course, while in 1916-17 students will have taken the full course.

The philosophy of the combination of technical engineering studies and those of business administration is self-evident. Till recently the heads of engineering corporations have been either men who began at the bench and learned the business in the office, or else men who were in the office and learned engineering in that inefficient school, the efficient shop. It is the institute's plan to furnish parallel and correlated studies which shall teach business and engineering together. There is no intention of making skilled accountants in any sense of the word, but to furnish the fundamentals of accounting to men who wish to accept financial responsibility. The student will learn the terminology of bookkeeping, the meaning of assets, liabilities, good-will, franchises, of the profit and loss account, the theory of accounts in general and of depreciation. Cost accounting, bonds, sinking funds, amortization, etc., are included in the studies, as are the functions of the stock and other exchanges, the broker, and similar agencies in the marketing of securities and stocks. Transportation and industrial organization will be taken up in the same analytical way.

Not only is the course adapted to business in connection with engineering generally, but options are provided which correlate the special work to civil, mechanical, electrical and chemical engineering, each of which is taken up from the point of view of the specialty, different in some related details from the other options.

From the opening of the course its numerical success was assured. Fifty-two students enrolled in September, 1914, as against about an equal enrollment in electrical engineering and from eighty to ninety in the mechanical and civil engineering courses. It may be that some of the students imagined that the course was to be an easy one and the Technology degree was to be gained by a cut comparatively short. It is unnecessary to say that such hopes were without foundation.

From the students' point of view the new course has been satisfactory, and certain of the lectures really popular. The accounting, which has been open to those not registered for the full course, has attracted eighty-seven men, 70 per cent more than the course proper, while the lectures on banking and finance have been taken by 125 students. It is further true that these numbers would have been larger, but for the difficulty in arranging for the courses in an already well-filled schedule.

One of the interesting features in connection with the establishment of the course was the thorough consideration and digestion of it in advance of adoption by trained and successful business men. It had its origin in the alumni association of the institute. It is the habit of this body to take up important questions at the association's meetings and at the meetings of its council, and subject them to the scrutiny of committees which report in regular engineering fashion. It is along the lines of the report of a committee of this kind that the course was established. It is the first of its kind in the country, but it seems to fill the bill so well that it is likely to be a pattern for similar work in other institutions.

Revenue from Sewage

WHILE sanitary engineers have long realized the inherent possibilities of sewage sludge as a fertilizer, very few plants, in this country at least, can boast of deriving any revenue from the sale of the waste material. In fact, works operators generally feel satisfied if they can remove sludge from the tanks and dispose of it inoffensively, without considering the matter of profit and loss. At Baltimore, however, the Sewerage Commission, which controls the operation of the Back River disposal plant, comprising settling and sludge digestion tanks as well as sprinkling filters, has been able to sell a portion of the plant's sludge to farmers, who use it in developing their crops. For a year past, according to Calvin W. Hendrick, chief engineer, the receipts from the sale of sludge, at the price of 35 cents a load, which the farmers pay, have amounted to about $5000. From the digestion tanks a gravity flow pipe leads to the road so that the matter of loading into tank carts is merely a matter of opening up a valve. It is interesting to note that the sludge is taken not only from the tanks directly but also from the drying beds, and that the preference for the material from the two sources is about equally divided. Mr. Hendrick's policy is to adopt every measure which will help to make the works pay their operating costs, and the sale of sludge

is only one of these measures. All of the power for lighting, pumping and other mechanical uses is generated by passing the sewage effluent through a small hydro-electric plant, and there is being developed a plan for the recovery of grease at the influent end of the works. In fact, there are at the Sewerage Commission's offices two bars of soap made as a sewage plant by-product. In the light of present sanitary knowledge prospects for the recovery of sewage works wastes on a large scale which will be commercially attractive have never been considered bright, but the fact that Baltimore is deriving some revenue from its sludge and is taking up the problem of grease recovery suggests that the operators of plants in other cities, after they have developed the technical end of the maintenance routine, may well devote some thought to the matter of getting from their works something more than chemical and bacterial analyses.

Why One Contractor Will Bid Higher the Next Time

"WHEN the mixer starts, Hell breaks loose. The engineers take delight in standing by until we are ready and then in finding something to delay the work while the mixer crew waits." Such is part of a superintendent's report, explaining his bitter disappointment to his contractor employer for placing less than 400 cu. yd. of concrete in two months on a Government contract that could easily be pushed several times as fast. The superintendent further explained that it mattered not how true or how well forms and steel were placed, the work was never done correctly unless it was done the engineer's way. His way always cost more and there was no arguing with him that another method would produce equal results. Surely a remarkable report coming as it did from one of the oldest employees of a firm of contractors noted for fairness and ability to do good work. If the contractors were not well acquainted with their superintendent they would be inclined to think he was partly to blame, but difficulties of this kind have never risen before in the twelve years of his employment, and careful investigation on the job showed that the report was not exaggerated.

A few notations on the form sketch sent in by the superintendent indicate the needless care with which the structure had to be built. Concrete in side walls, only 11 ft. high, could not be poured from the top but had to be deposited in several layers, the upper panels of the forms being left off for that purpose, thus causing much delay. All forms were required to be set within ⅛ in. error and bars within ¼ in. The forms were complicated beyond possibility of description here.

The superintendent wound up his letter resignedly with the characteristic attitude of his company, "We will do the best we can." The contractors state that they instructed the superintendent to get the job done the engineer's way. But they added that this is the reason why work for this particular department of the Government costs so much more than private work. If this firm can again be induced to bid for work in this department, the prices will be considerably higher than those of the present contract. Of course, the occasional isolated case like the above gets more publicity than half a hundred regulation contracts where give-and-take, fair-and-square methods of procedure obtain. While anathemas are heaped on the unreasonable engineer, this is not the end of the story, for irreparable damage is done to the whole profession and to the particular organization with which he is connected. The news of his unreasonableness is sure to spread among contractors, and his attitude will be imputed to the department which he represents.

Catskill Water for New York City in 1916

THE statement in the 1914 annual report of the Board of Water Supply of the City of New York—which was issued this week—to the effect that the Catskill aqueduct, for the delivery of the first installment of 250,000,000 gal. daily, was 93 per cent completed on Jan. 1 of this year and will be ready for service in 1916 is a reassuring reminder that the grave danger of a water famine, which appeared to be so imminent only a few years ago, is now effectively removed. Only two links in the 126-mile line connecting the Ashokan reservoir in the Catskills with the Silver Lake reservoir in Staten Island, the southerly terminal of the waterway, remain unfinished. Of these the first is a 900-ft. stretch of tunnel to replace a section of the Moodna siphon, where leakage developed, while the other is the Narrows siphon, the flexible-joint submarine pipe line which will carry the aqueduct flow under New York Harbor to the borough of Richmond. Pending unforeseen requirements, which may be indicated by service tests, the contracts for these two pieces of work constitute all construction essential to the delivery of Catskill water from the Esopus watershed to the five boroughs of New York. The remainder of the aqueduct is practically ready for service.

With its many miles of conduit in open cut, its huge dams, deep rock tunnels, submarine pipe lines and other equally spectacular features, the work which has been directed so effectively by J. Waldo Smith as chief engineer is on such a huge scale and is so well known to the profession—for scores of engineering societies have made it a feature of inspection trips during annual conventions—that the official figures of progress, as given in the report for 1914, will impress upon the thousands of engineers who have tramped over the line that the aqueduct which they saw in the making is now about ready to carry water.

As to the reservoirs, the Ashokan, at the north end of the line, is finished and water was impounded in it throughout the year. At the Kensico dam 806,000 cu. yd. of masonry, of the total amount of 872,000 cu. yd., have been placed and, incidentally, a masonry placing record of 84,450 cu. yd. a month was established. Excavation and embankment for the Hill View reservoir have been finished and the concrete lining was well along toward completion at the end of the year. Forty per cent of the work on the Silver Lake reservoir, the terminal basin of the system, had been done by the end of 1914. The aqueduct proper has been tested, and the work within the city limits necessary to deliver Catskill water to the five boroughs of New York was 98 per cent finished. The only further operations necessary are the installation of some of the valves and the construction of valve chambers for the distribution connections. Practically nothing further remains to be done on the pipe lines in the boroughs of Brooklyn, Queens and Richmond, except the Narrows siphon.

No less impressive than the technical details of the work are the figures of its finances. Disbursements during the year for all purposes were about $14,000,000, bringing the total cash amount disbursed for the purposes of the Board of Water Supply since its organization on June 9, 1905, to $123,000,000. The registered liabilities to Jan. 1, 1915, were $11,000,000 and the total obligations $134,000,000. The amounts of contracts finished and now in progress aggregate $99,000,000, of which $11,000,000 were done during 1914.

But the work of the Board of Water Supply is by no means finished. The additional water supply plans contemplate the development of Schoharie Creek, north of the Esopus watershed, and from this source 200,000,000 gal. per day will be added to the Esopus yield. In fact, borings have already been made to determine a location for the Schoharie dam. Thus, while the closing chapters are being written for the first and more important part of the project—the delivery of 250,000,000 gal. daily—work is ready to begin on the second installment for the ultimate capacity of about 500,000,000 gal. daily.

The news that New York will soon be receiving Catskill water is an announcement which means much to the engineering profession at large. It will impress upon a skeptical public that municipal work on a scale never before attempted can be prosecuted expeditiously and without scandal if properly qualified engineers are allowed to exercise authority unhampered by political interference. It is an argument, also, for long tenure of office for responsible department heads. With a few exceptions—and these due principally to the fact that their work was finished—the men who are directing the final operations on the aqueduct are those who were in office when the preliminary borings were being made and the plans and specifications drawn up. Organization is everything on a project such as the Catskill aqueduct, and the City of New York is now ready to reap the benefits of a policy which allowed the chief engineer of the Board of Water Supply to conduct the work in the way that his judgment dictated and to choose as members of his staff lieutenants qualified by training and experience to perform the duties expected of them.

Ice Fighting Is Systematized at Holtwood Hydroelectric Plant

Permanent Instructions to Operating Force Show Detailed Procedure to Prevent Shutdown of Main and Exciter Units When Frazil and Anchor Ice Are Running—Steam Used for Warming Turbine Chambers

By F. A. ALLNER

General Superintendent, Pennsylvania Water & Power Company, Baltimore, Md.

ICE FLOODS on the Susquehanna River are usual occurrences every year. In some years more than one ice flood is recorded in the lower course of the river, when the first high-water peak following the breaking up of the frozen river and its tributaries is not sufficient to carry out the bulk of the ice beyond the shallow reaches of the river. The up-river ice grounds then along the river stretch from Columbia down to York Furnace, where the river channel is very wide and shallow and intersected by a number of projecting islands. For a period of several weeks shifting ice jams form and break in the short space of a few hours until a temporary channel on the surface or below the ice is formed.

SECOND ICE FLOOD

The second ice flood then occurs toward spring when another high-water peak, produced by warm rains and thaws, washes down the residue of the first ice jam, plus the ice that has collected in the headwaters and tributaries subsequent to the first ice flood.

In some years the first high-water peak in January carries out all the up-river ice and the second ice flood brings down only such ice as has formed after the passing of the first ice jam, particularly when there has been a continued cold spell in February.

FIELD ICE DOES NOT AFFECT PLANT

None of the above ice phenomena have ever interfered with the operation of the principal hydraulic development on the river, the Holtwood plant of the Pennsylvania Water & Power Company, at McCall's Ferry, beyond a temporary reduction of head due to backwater in the tailrace, accompanied by a corresponding small reduction of station capacity. This is illustrated on the accompanying diagram giving station loads, forebay and tailrace elevation on Jan. 9, 1915, when the forebay rose almost 5 ft. in less than 30 min., the tailrace going up over 7 ft. in the same time. The largest reduction of station capacity during the passing of this ice jam did not exceed 8 per cent of the turbine rating.



ICE FENDERS GUARD POWER HOUSE

No operating precautions of any kind need to be taken at the Holtwood plant against ice floods, thanks to the excellent protection given to the plant by the natural formation of the river channel and by the layout of the plant. The current of the river always carries the bulk of the ice toward the York County shore, away from the power house. When the pond has been filled with ice over the whole width of the dam, the submerged intake arches, the floating booms between the ice piers and the rock fill on the up-stream side of the forebay have prevented any of the ice from entering the forebay. This has been true during the past five winters that the plant has been in operation.

FRAZIL AND ANCHOR ICE

There are, however, two types of ice formation that are apt to interfere more seriously with the normal operation of the plant if proper precautions are not taken upon the first sign of trouble. The reference is to frazil and anchor ice, which are of common occurrence at hydraulic plants in northern climates, but less frequent at plants in moderate climates. The Holtwood plant has been very successful in overcoming the difficulties from these sources. This is principally due to the careful planning and standardization of the precautionary measures to be taken by the operating force and in the working out of ice-handling devices that facilitate a quick diagnosis of and remedy for the trouble.

Some of the methods described in the following instructions had been in use for two or three winter seasons, but the complete standardization as given below was adopted only previous to last winter. Its beneficial effect is particularly noticeable in the handling of a very severe ice attack that occurred in January of this year.

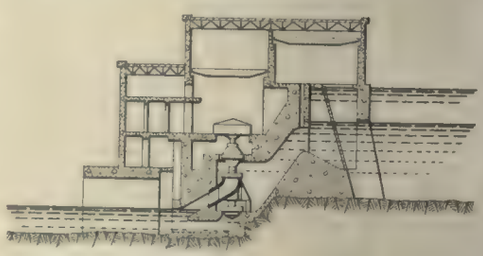
The instructions, in full, are as follows:

DIAGNOSIS

Apart from the possibility of trouble due to floating cake ice the operation of the generating plant may be interfered with by frazil and anchor ice. It is essential that the operator should have a knowledge of the conditions of formation and effects of these latter forms of ice in order properly to provide against trouble from them.

Frazil Ice.—Frazil ice is formed during cold weather and high winds in the absence of any protective ice coating on the lake. Under such conditions the water becomes chilled to a temperature a few thousandths of a degree below freezing point. Ice needles then appear, and by sticking to the racks or turbine parts choke off the water from the turbines or prevent the operation of the turbine gates. Ice thus formed persists in the lake until a rise in temperature, generally with the rising sun, and a decrease in the wind results in melting the ice needles or allowing them to form a surface sheet of ice. Dull and windy days with little prospect of the sun's rays piercing through the cloudy sky aggravate the difficulties a great deal.

Anchor Ice.—Ground ice is formed when there is no ice covering on the lake, or only a thin sheet of clear ice, when there is a cold night with clear sky. Anchor ice then forms on the bed of the river and is detached therefrom in huge masses of slush-like material when the temperature of the water is slightly raised, usually a little after sunrise. There are, therefore, certain definite weather conditions when frazil or anchor ice may be expected to form, and when these conditions occur the operator should be on the lookout for such troubles. Ordinarily trouble from such ice develops so quickly that it is essential to be prepared for it well in advance of the actual appearance of the ice. Instructions and drill on this subject must be rehearsed yearly.



TRANSVERSE SECTION OF POWER HOUSE

DIAGNOSIS OF POSSIBLE ICE DANGER

Frazil or anchor ice cannot form until the water reaches freezing temperature; nevertheless, the operator should not be deceived by the gatehouse water thermometer showing a temperature a few degrees higher than freezing, since the water temperature in the lake may not be identical with the temperature of the water in the gatehouse. When frazil ice is possible, half-hourly examinations of a chain immersed in the flowing water of the forebay should be made for evidences of the ice needles.

It is also advisable on suspicious days to operate the No. 1 turbine-driven hand-control pump continuously at a fixed valve opening and observe its speed at short intervals. A decrease in speed, not explainable by external load conditions, sometimes accompanied by a rumbling noise in the turbine casing, will be one of the first indications of imminent ice trouble, and the morning hours preceding the peak load are often a favorite time for such ice trouble to begin. The responsibility for diagnosing imminent ice trouble in due time to prevent serious interference with service rests solely upon the switchboard operator, who



HEAVY ICE PILES HIGH IN WINTER ABOVE HOLTWOOD DAM ON THE SUSQUEHANNA RIVER

must be at all times alert to the danger and fully familiar with the precautions to be taken and methods outlined below for protecting the service.

PRECAUTIONS

Beginning Nov. 15 of each year (or earlier, if freezing weather sets in before that date) and until March 15, a set of four screens must be removed from a single intake of each main unit and its respective head-gate lowered to the closed position to prevent trash from entering the wheel-pits during normal operating conditions. [Each main unit at Holtwood has four intakes, controlled by head-gates. In front of each intake the water has to pass through an inclined screen area, built up in five sections, so that each main unit has twenty screen sections.]

The rack area of the whole power house should have been examined previously by a diver and all debris at that time collected on the racks should have been removed. It is always possible that floating trash may enter the intakes after the removal of the screens and particularly is it to be expected during ground-ice trouble, the effect of the ground ice being to gather up and float logs and stones from the river bed. The operator should look out for unusual noises in the turbines during such operation period and be prepared to take the proper action in case of fouling of the turbine gate rigging by trash.

During the open-winter season the gatehouse is to be maintained at a warm temperature by heat from the generator room and the gatehouse windows are to be kept closed. Particularly during ice troubles the operator should take special care in maintaining the highest possible temperature in the gatehouse.

PRECAUTION WITH EXCITERS

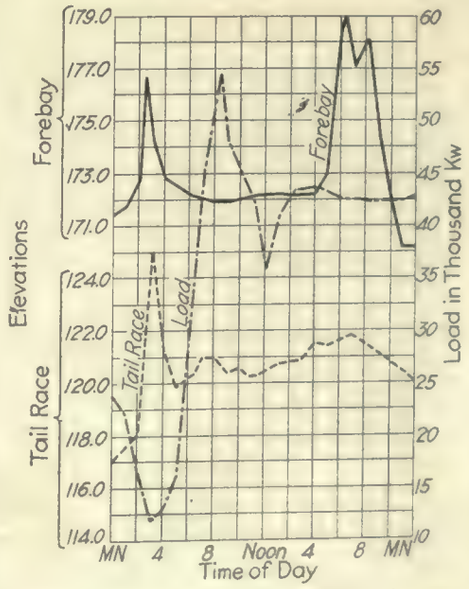
During the whole open-winter season one of the turbine exciters should have three of the screens removed. Ordinarily, only the motor-driven exciter and the turbine that has the intake protected by screens should be used. Direct-current station load and auxiliaries should be transferred or replaced as far as possible by alternating-current service. The battery always should be maintained in fully charged condition.

The dinkey fire during the open winter season should not be allowed to be withdrawn unless the river is completely frozen over from shore to shore and within a short distance from the crest of the dam. A convenient steam-hose connection should be held in readiness to feed steam from the dinkey when standing on the lower power-house track into the 1-in. compressed-air header on the downstream side of the pump tunnel.

FIGHTING IMMINENT ICE TROUBLE

In the event of imminent ice trouble the closed head-gates to each main unit are to be raised. As soon as other operating work of immediate urgency will permit, three or four top screens of another intake for each unit are to be removed or raised, and left in this position until the river is completely frozen over or all danger from ice trouble is passed. The operator wants to bear in mind that the ice, forming on the screens unexpectedly, may obstruct very quickly the flow of water to the turbines, so that there is hardly any water flowing into the pit. This condition is also accompanied by the danger of the screens crushing under the hydrostatic pressure when the difference of the water elevation in front and back of the screens exceeds 15 ft. The closed head-gate to each main unit must be raised immediately to insure that each main unit can carry approximately 50 per cent load should the screens of the other three intakes form a complete obstruction to the water entering the wheel pits. The subsequent raising of the screens on another intake will increase the capacity then to full load.

It is most important during occasions of actual ice flow that the wheel-pit, while the unit is running, be kept completely filled with water to avoid the possibility of the gate mechanism being frozen to the turbine casing, which condition will develop should the wheel-pit be partly or completely drained, allowing the outside air to enter the pit from the gatehouse. With the gate mechanism frozen it is impossible to move it by admitting pressure to the operating cylinder, and thereby the control of the unit is lost. A full wheel-pit is indicated by the pressure gages mounted on each turbine near the floor, which ordinarily indicate 14 or 15 lb. pressure. A full wheel-pit can be maintained during such conditions only by adjusting the gate opening on the turbine to a point approximately where the pit pressure attains a constant maximum pressure or permits the flow through the turbine to equal the flow into the wheel-pit. The above conditions must never be overlooked, as it is of prime importance that the unit be always under complete control, and delivering its highest feasible load while the station is operating under a reduced capacity.



LARGEST REDUCTION OF HEAD DURING PASSAGE OF ICE JAM JAN. 9 ONLY 8 PER CENT

FREEING MAIN UNIT FROM ICE

In the event of a main unit becoming inoperative due to ice on the operating mechanism or turbine passages, the head-gates of the unit affected are to be lowered and the pits drained. If load conditions permit, a speedy inspection of the wheel-pit is also advisable. Live steam is then to be admitted to the wheel-pits through the 1-in. air line from the dinkey. The object of this is to increase the air temperature in the pit, and thereby raise the temperature of the metal parts of the turbine and the concrete surfaces of the wheel-pit sufficiently to allow the adhering ice to be cleared away. It will be possible then to run the unit again until the flowing water has time to abstract the heat from the surfaces sufficiently to cause the ice crystals to adhere once more.

In general, however, it is expected that the main unit turbines will be less interfered with by ice than the exciters, since it would take longer to cool the more massive portions of the main turbines. Also, since the passages of these units are very large they would not become choked so quickly with adhering ice as the exciter turbines. It is advisable to keep the gate mechanism moving slowly so that the ice has no opportunity to freeze solidly around the numerous links, vanes, etc., and then all at once offer an excessive resistance to the moving of the gate mechanism.

Although serious danger of a complete choking up of the main units exists only during a long protracted run of frazil ice, it is nevertheless a possibility and the operator should endeavor to keep one main unit with its guide vanes closed, running on leakage and synchronized with the bus, without carrying any load. Such unit should be considered a spare, ready to be put into service so that another unit can be cut out and its wheel-pit thawed out. If enough steam can be spared from the dinkey, aside from the requirements for thawing out the exciter turbines, it is advisable to let steam also enter the water-filled pit of this reserve main unit, through the 1-in. air connection in the pump tunnel.

The filling of the turbine passages with ice can be evidenced by the decreased carrying capacity of the unit in proportion to its gate opening. The operator should, therefore, maintain a continuous observation of this feature through the floorman, so that he can quickly change over to the reserve unit and dispatch the thawing out of the ice-troubled turbines. He wants to bear in mind that it takes a comparatively shorter time to thaw out a unit with little ice obstructions than a unit that has the passages almost completely choked up. Consideration of an expected increase or decrease in the load curve, preparedness of the customers to take over a portion of their load by steam, will be the guiding factors for taking certain risks temporarily or of avoiding such chances. As a general rule, however, the operator should try to keep ahead with his station capacity over the load requirements by a safety margin of about 10,000 kw., until all ice danger has been removed.

The customers are to be notified of ice conditions upon the first indications of frazil or anchor ice and are to be kept informed at short intervals of the situation, so that they may be prepared to take over a portion of their load by steam, if necessary. Constant and the most accurate possible communication with customers is an important feature in the successful handling of the ice situation as a whole, and the operator's attention is to be called particularly to this point because a neglect in this respect has aggravated to a vast extent every occurrence of ice difficulties in the past.

FIGHTING IMMINENT ICE TROUBLE — EXCITER UNITS

The undisturbed operation of exciters during ice flow occasions is a most vital requisite for the continuity of the service. Although the battery can be relied on to supply, in an emergency, the entire excitation and direct-current station service for a limited period (from 10 to 50 min. depending on load conditions), the operator should never rely on this reserve for maintaining continuous service. The following method of operating exciters when ice trouble is imminent will usually bring the best results:

1. During the open-winter season the screens on one exciter are removed. At the times of imminent ice trouble the screens on the other turbine exciter should also be raised. If possible, however, neither waterwheel exciter should be in service and only the motor-driven unit is to be used. It is desirable that the head-gates on exciters Nos. 1 and 3 be open, but the guide vanes are to be closed, and the units run on leakage. Live steam is to be admitted from the 1-in. air line to at least one of the exciter wheel-pits, thus insuring that this unit can be relied upon as a reserve excitation supply.

In the event of No. 2 exciter alone not being sufficient to supply the direct-current demands of the station, one of the exciters, No. 1 or 3, is to be paralleled, with such a division of load that the water-driven unit has the guide vanes wide open up to the limit of the electrical capacity of the machine. In the meantime, of course, the other waterwheel exciter will be kept warm by live steam and if the good condition of this unit as spare has been insured, and also additional steam can be spared from the dinkey boiler, live steam should also be admitted to the 1-in. air line into the wheel-pit of the turbine exciter on the load. Constant watch is to be kept on the exciter turbines carrying the load for the slightest indication of a capacity reduction caused by ice troubles. Immediately then its load should be transferred to the reserve turbine and all thawing out efforts in the station must be concentrated on the keeping clear of the threatened exciter turbine.

[An article in the next issue, also prepared by Mr. Allner, will tell in detail how a severe run of ice in January of this year was successfully fought.]

4½ Miles of Concrete Fence Flank Transit Route

Solid Slab 4½ Feet High on Sea Beach Line Improvement in Brooklyn Is Built in Place—Dovetailed Grooves for Expansion

THERE has recently been completed on the Sea Beach Line rapid transit improvement in Brooklyn, N. Y., about 4½ miles of reinforced-concrete fence built in place. This fence continues on both sides of the cut between Fort Hamilton Avenue and Eighty-sixth Street. The accompanying photograph shows the Twenty-second Avenue Station and the fence on top of each retaining wall.

This fence is 4 ft. 6 in. high, supported on reinforced-concrete posts 7 x 7 in. by 4 ft. 10 in. high, with alternate 7 x 9-in. posts for expansion, spaced 8 ft. 4 in. center to center. The latter posts were built with 1¾ x 3-in. grooves, dove-tailed to allow the expansion of the panels. The posts are reinforced by two ¾-in. twisted steel rods and four ¼-in. rods, one at each corner, and the panels by six ¼-in horizontal rods running through the posts and eleven ¼-in. vertical rods to each panel. All the rods are tied together by Curry tiers, so as to keep them in position and at proper spacing, as shown in one of the photographs.



PANEL REINFORCING RUNS THROUGH POSTS, AND IS HELD IN PLACE BY TIES

The posts were constructed first. The ¾-in. anchor rods extending into the retaining wall 12 in. are set in grout and are 5 ft. 6 in. long. Several days after the posts were cast the panels were built by the use of forms of good spruce lumber covered on the face with sheets of galvanized iron. The frames were made very rigid and thoroughly braced so that they could be used several times.

The concrete consisted of one part Portland cement, two parts sand and four parts grit (small pebbles) and was mixed by hand, as only a few yards were required to run 200 to 300 lin. ft. of fence in a day. Between March 15 and May 30, 1915, over 12,000 lin. ft. of fence were built, the balance having been finished the fall of 1914.

George W. McNulty, Inc., was the gen-



CONCRETE FENCES CAST IN PLACE, POSTS FIRST, PANELS AFTERWARD

eral contractor for the Sea Beach improvement, and the D. Cuozzo Construction Company, Inc., was the contractor for the fence.

Subaqueous Pipe Taken Up and Replaced 3 Feet Lower

Improvements on Neponset River Work Near Boston Involved Use of Dipper Dredge to Raise Flexible Joint Line

By EDMUND M. BLAKE
Engineer in Charge, Massachusetts Board of Health

AMONG the problems encountered in widening and deepening the channel of the Neponset River near Boston was the removal of a 10-in. flexible joint cast-iron water pipe laid across and on the bed bed of the river in 1896 opposite the pumping station of the old Hyde Park Water Company below Readville. The pipe was relaid at a grade about 3 ft. lower than its original location. The Massachusetts State Board of Health had supervision over the work for which the Barge Canal Construction Company of New York secured the contract.

The land between the pumping station and the river is low and swampy and the water pipe runs from the station across that land, under the river and up toward the Readville district with the purpose of furnishing better fire protection to that district and to the car shops of the New York, New Haven & Hartford Railroad. The land on the other side of the river was originally low, but when the grade crossings at Readville were eliminated all of that area was filled in to quite a depth. This fill comes down very close to the river bank to allow for the laying of as many tracks as possible in the Readville freight yard, so that the pipe, after crossing the river, runs into a steep embankment with a heavy fill. There is a 10-in. gate near the old pumping station and another one on the opposite side of the river near the bank, but covered with about 12 ft. of fill. The gate box for this latter gate is set between two ties on the outer freight yard track. Furthermore, this 10-in. pipe crossing is located at a very sharp bend in the river with the railroad embankment on one side and a row of very large oak and elm trees on the pumping station side.

PIPE PROFILE PLOTTED

The water pipe was originally about 3 ft. above the bottom grade which it was necessary to obtain at this bend in the river for the new channel, and consequently it had to be lowered. No information was available as to the condition of the flexible joint pipe. A very careful cross-section of the old river channel was taken and the profile of the pipe was accurately plotted from soundings. This pipe is in continuous service for the supplying of drinking water as well as for fire protection, although a second 10-in. crossing about ½ mile downstream made it possible to remove this pipe without serious interference with the service, provided a large conflagration did not occur during the work. This latter emergency was fortunately not met with, but, as the river is very much polluted with the discharge from mills and tanneries above this point, it was necessary to do the work so that none of the river water could in any way remain in the relaid pipe or get into the system through the open ends of the old pipe during the work.

Several plans for the new crossing were carefully studied. It was finally decided to locate a new 10-in. gate on the pumping station side of the river near the bank and to place a 10 x 4-in. tee on the opposite side near the bank, running a 4-in. blowoff discharge pipe from that tee about 20 ft. downstream into the river at an elevation below the low water stage. The new 10-in. gate and the old one near the outer freight track, in connection with the 4-in. blowoff, would make it possible to clean out the pipe crossing thoroughly after relaying it and before putting it back into regular service. The space taken up by the new 10-in. gate and the 4-in. blowoff connection would make it possible to dispense with at least one flexible joint. It had been decided to use the old pipe again provided it was found to be in good condition, which was the case.

DIPPER DREDGE LIFTS LINE

A big dipper dredge was at work in this section, but the river was high, due to the spring floods, so that relaying the pipe under those conditions would be both difficult and costly. The Department of Public Works of the city of Boston then unexpectedly granted permission to remove the pipe without relaying it, as it had been decided by them at that time to put a new river crossing in at a point lower downstream where access to it would be easier.

Having one flexible joint to spare, it was therefore decided to arrange with the dredging contractor to pull out the old 10-in. pipe by the use of the dipper dredge, which was equipped with steel teeth extending beyond the lip of the dipper. Both gates on either side of the river were shut tight before starting to pull out the old pipe. Pits were also dug over the pipe on both sides of the river at the bank lines to release the earth pressure on the pipe. On the morning of March 21, 1913, the dipper dredge was brought into position, the dipper was carefully maneuvered until the teeth caught under the 10-in. pipe about in midstream and was then very slowly lifted. After several trials, the midstream joint was brought above the surface of the water, the lifting was continued slowly and the two adjoining flexible joints under water were opened fully, separated from the rest of the line and the two lengths were then pulled out and deposited on the banks. This was done without opening up the flexible joint first exposed. Chains, attached to the dipper and the pipe, were then used in pulling out the balance of the pipe, and in the whole operation only one flexible joint was broken and that only in a small section of the bell. The lead was all saved. Seven lengths, or about 84 ft. of pipe, were thus removed and placed on the bank on the pumping station side of the river, where they could be easily handled for cleaning, cutting and removal of lead.

Late in May, 1913, the city of Boston gave notice that it had abandoned its original plan of putting in a new crossing lower down and requested that we relay the old 10-in. pipe in its original location, except as to grade, as soon as possible. Plans were perfected rapidly, and on June 10, 1913, three bids were received for doing the work, all pipe and special castings and gates to be furnished by the State, as follows: T. H. Corrigan, Hyde Park, $1,490; Charles N. Taylor, Wellesley, $1,150; Crandall Engineering Company, Boston, $790.

The contract was awarded to the Crandall Engineering Company, which was required to furnish a bond in the sum of $500, and work was started under this contract on June 20, 1913. In dredging out the river bottom at the pipe crossing, it was impossible to deposit any material on the side of the railroad embankment. This necessitated placing it on the other side, and in the course of that work some of the pipe lengths removed from the river were partly covered up. These were uncovered by force account work in preparation for the work of relaying.

PIPE RELAID

A very careful cross-section was again taken of the dredged bottom of the river and the profile plotted to a large scale, showing the exact location and elevation of the two ends of the old pipe on both sides of the river. The contractor first erected a scaffolding on a double row of 4 x 4-in. posts, 5 ft. apart on 12-ft. centers, across the river on the line of the crossing. Sheeted bulkheads were put in at either side from which the water was later pumped to expose the ends of the old pipe to which the submerged section was to be connected. After thoroughly cleaning the old flexible joint pipe both inside and at the bell and spigot ends, it was suspended from the scaffolding to the true profile of the bottom of the river where it was to rest. The joints were then run and calked while the pipe was thus suspended, making it possible to obtain perfect joints.

The cross pieces on the scaffolding were then removed and the six lengths of 10-in. flexible joint pipe suspended therefrom, with the joints all calked, were lowered slowly and evenly by means of ropes at eight points slung around the barrels of the various lengths of pipe and passing through falls. In this manner the pipe was placed on the bottom with practically no motion at the flexible joints. A diver then went down for about an hour and a half for inspection and to properly bed all of the pipe lengths. Everything was found in satisfactory condition.

By the use of the bulkheads it was a relatively simple matter to make the connections at the two ends, place the new 10-in. gate and the 4-in. blowoff and its connections. A special 10-in. bend was placed in the line to take up the grade on the pumping station side where a 10-in. sleeve was also used to close in. There was some slight delay in making these end connections on account of the high stage of water in the river and the consequent difficulty in keeping the pits pumped out.

After the crossing had been completed, the new 10-in. gate was closed tight as well as the 4-in. gate on the blowoff branch and a ½-in. tap was made in the 10-in. pipe beyond the 10 x 4-in. tee and between that tee and the old gate near the freight track. On July 8, 1913, two air pumps were connected to this tap and 40-lb. pressure was maintained for 28 min. after stopping the air pumps without the slightest drop in pressure and without any evidence of leakage. This test, although under a relatively small pressure, was pronounced satisfactory by the inspector from the Department of Public Works of Boston.

Later during that day the crossing was blown out through the 4-in. pipe for 20 min. after opening the new 10-in. gate on the pumping station side of the river, the water running clear after about 5 min. Then, closing the new 10-in. gate and opening the old 10-in. gate near the freight

track, it was blown out again from that side for 15 min., the water running clear almost from the start. The 4-in. blowoff gate was then closed and both of the 10-in. gates opened and the crossing put back into regular service. Samples of the water were taken and analyzed both from the crossing and from a tap in a house some distance beyond the pumping station, both analyses showing the water to be up to the metropolitan standard constituting this supply.

The entire cost to the State of removing and replacing the 10-in. flexible joint cast-iron water pipe was as given in the table:

COST OF REMOVING AND REPLACING TEN-INCH FLEXIBLE JOINT MAIN

First cost of removal of pipe by dipper dredge	$75.00
Additional to dredging contractor for extra excavation at pipe crossing to secure level desired and to open up at both ends, 2.2 cu. yd., at 42 cents	97.44
One 10-in. gate, one 4-in. gate, 2 gate boxes	43.48
One 10 x 10 x 4-in. tee, one 10-in. quarter bend, one 10-in. sleeve	53.75
Hauling 10-in. gate and freight on same	2.31
20 ft. of 4-in. pipe, one 4-in. one-eighth bend, one length 10-in. pipe bored out at bell to fit spigot end of the flexible joint pipe	42.60
Crandall Engineering Co., contract price for removal	790.00
Crandall Engineering Co., extra work, separating the flexible joint pipe lengths, cutting and additional excavation on both banks	46.00
Total cost to State	$1,150.58

The total length of the crossing was approximately 102 ft., making the cost per foot of removal and replacing about $11.28. As the first two and the last items above are chargeable to the removal of the old pipe, the total cost of removal was $218.44, or $2.14 per foot of total crossing length. The total cost of replacing was $932.14, or $9.14 per foot of total crossing length.

This work was under the supervision of X. H. Goodnough, chief engineer of the State Board of Health, with the writer as engineer in charge in the field. The making and calking of the lead joints was under the inspection of Newton L. Hammond, assistant engineer.

MONTHLY MEETINGS FOR ALL MUNICIPAL EMPLOYEES is recommended in a report of the San Diego waterworks superintendent, Herbert R. Fay. The water department has found monthly meetings so beneficial to the individual and so conducive of good to the department that the idea is to be taken up by all officials. A better understanding and better working conditions between departments is sought, to the end that loyalty, efficiency and harmony may prevail, and better results be obtained in city work.



HOLLOW TILE IS USED THROUGHOUT FOR THE EXTERIOR WALLS

Jersey Central Service Buildings at Jersey City Have Several Novel Features

Reinforced-Concrete Substructures Rest on 70-Foot Wooden Piles and, Being Below High Tide, Are Reinforced Against Upward Pressure

ALTHOUGH apparently built along simple lines, the 500-ft. string of one and two-story passenger-car-service buildings of the Central Railroad of New Jersey present features of design not usual in the construction of such commonplace utility buildings. Such features are the driving of wooden piles to a depth of 70 ft., the reinforcing of basement floors and walls against hydraulic pressure, and the construction of a cantilever sidewalk and pipe brackets integral with the floor system. These buildings are just outside of the terminal station at Jersey City, and include one-story toilet and lamp houses, a one-story and basement oil house, and a two-story repair shop, Pullman storehouse, general storehouse and rest house. The rest house and repair shop are steel-frame structures with reinforced-concrete floors. All other buildings have reinforced-concrete frames. The exterior walls are of hollow tile, as shown in the photograph.

FOUNDATION

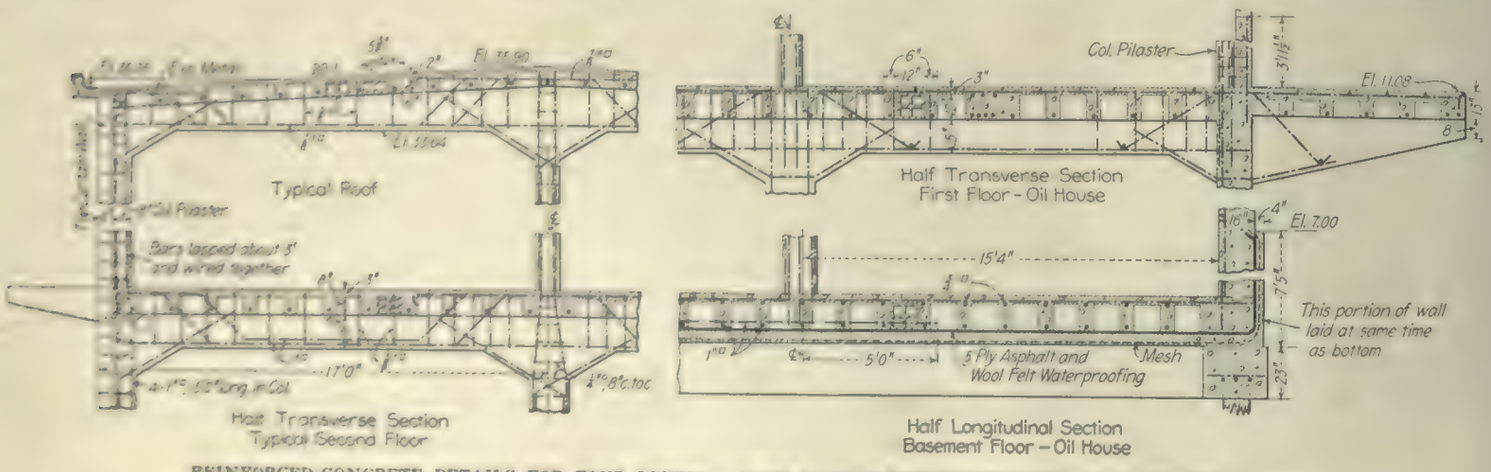
The soil underlying these buildings is composed of silt and fine sand, so that it was deemed necessary to provide piles to support the footings. The yellow-pine piles are driven to an average depth of 70 ft., where bedrock was found, in groups of four, five and six, according to the loading, and capped with reinforced concrete, upon which concrete piers are built. The piers furnish bearings for the columns and for a system of continuous reinforced-concrete girders.

The oil house has a basement story, the floor of which is below mean high water, making it necessary to provide reinforcement in the floor against upward as well as downward pressures. A 6-in. concrete slab, just strong enough to support the dead weight of the floor system, is laid directly on the soil, but bearing on concrete girders; over it is spread asphalt and wool-felt waterproofing. Upon this rests the floor of the beam and hollow-tile type, as shown in one of the drawings. These beams are reinforced both top and bottom, the top reinforcing acting in bending against the water pressure below, and the bottom reinforcing being provided as ordinarily for superimposed loads. This reinforcement is continuous with that of the walls, which are also reinforced for water pressure. The waterproofing in the floor is continued up the side walls to a level about 1 ft. above the ground.

FLOOR SYSTEM

The floors are divided transversely into panels of 16 and 20-ft. widths by continuous girders, running crosswise of the buildings, supported on intermediate and wall columns. The floors are of the beam and hollow-tile type.

Integral with the first-floor girders, on the south side of the buildings are cantilever brackets carrying the sidewalk, or



REINFORCED-CONCRETE DETAILS FOR FOUR LEVELS—NOTE DOUBLE REINFORCEMENT OF BASEMENT FLOOR

car platform, which is also of reinforced concrete. On the north side, the second-floor girders are continued outside the building to form brackets for supporting several lines of pipe which run the length of the buildings. To prevent any horizontal thrust being transmitted through these brackets to the building by the expansion of the long lines of pipe, a special device allows play for this movement. Steel channels are bolted to the brackets with the flanges up. To prevent lateral motion of the pipes notches of a proper radius are cut in the flanges of the channels for the reception of the pipes. The pipes rest on steel rollers which lie loose on the web of the channels.

CURTAIN WALLS

In order to lighten the loads on the foundation as much as possible and save material in the continuous girders supporting the walls, vitrified hollow-tile blocks were used to form a 6-in. curtain wall. The tile walls start from the top of an 8-in. concrete wall which is carried around all buildings to a height of 6 ft. The steel or concrete frames of all buildings are totally inside the curtain walls, the curtain walls being carried up from the first-floor level and tied into the columns at frequent intervals with wire binding.

The lintels and sills are made of reinforced concrete. The lines of blocks forming the sides of windows and doorways are filled with concrete and a vertical steel rod is inserted, thus reinforcing the wall to take the spandrel loads. All doors have steel channel jambs, and are of white pine, metal covered, the larger doors being furnished with steel sash. Most of the windows have Fenestra steel sash. All flashing and leaders are of copper. The roof is finished with tar and gravel.

The work was designed and carried on under the general direction of Joseph O. Osgood, chief engineer, and was erected by Westinghouse Church Kerr & Company.

Concrete Scow Has Withstood 4½ Years' Hard Service

APROPOS of the experiences with concrete barges on the Panama Canal, detailed in the Engineering Record of May 29, 1915, page 684, it is worth noting that a concrete barge has been in service on the Welland Canal for four and one-half years and during that time has been subjected to severe service. It is used in canal maintenance work and at times riprap, in loading, has been dropped on its deck from a height of 12 ft.

The scow, which was built in November, 1910, is 80 ft. long, of 24-ft. beam and has sides 7 ft. high. The hull is divided into eight compartments by one longitudinal and three cross bulkheads. There are 2 x 2½-ft. openings through the cross bulkheads. The deck, bottom, sides and bulkheads are 2½ in. thick, reinforced in both directions by ¼-in. round rods on 2-in. centers. Beams 6 in. square on bulkhead lines, reinforced with heavier steel, as required, and braced by reinforced-concrete posts, care for the principal stresses. The concrete is a 1:4 mix, using small gravel.

The boat was designed and built under the supervision of J. L. Weller, then superintending engineer of the Welland Canal, and now engineer-in-charge, Welland Ship Canal.

Illinois Law Requires Licenses for Engineers

Act as Prepared by Western Society of Engineers Provides for Examination and Licensing of Structural Engineers

THE passage of the law requiring structural engineers in Illinois to obtain State licenses, as noted last week on page 59, records the successful outcome of the efforts of the engineers in that State to remedy the situation brought about by the architects' license law, which was so worded that practically every structural engineer practising in Illinois was violating the law, unless working as an employee of an architect. The law as drafted by the legislative committee of the Western Society of Engineers, the essential features of which are abstracted below, was passed by the Legislature after certain minor amendments, made to overcome the opposition of the architects, had been incorporated.

STATE BOARD OF EXAMINERS

The Governor of the State shall appoint a State board of examiners of structural engineers, to be composed of five members, one of whom shall be a professor in the civil engineering department of the University of Illinois, and the others shall be structural engineers of recognized standing with not less than ten years' practical experience, then practising as structural engineers in the State. The regular term of office shall be four years.

Each applicant for a license shall pay a fee of $20 and present his affidavit that he is 21 years of age or above. He shall sustain a satisfactory examination in the design and construction of buildings and structures according to scientific principles. The examination shall include the strength and properties of various building materials, the principles of theoretical and applied mechanics, and the application of this knowledge to the ordinary requirements of structural engineering in such manner as to fairly and thoroughly test the competency of the applicants.

Each applicant shall show (a) that at the time of the taking effect of this act he was actually engaged in the practice of structural engineering in this State, and did not apply for license under Section 5 of this act, in which case he is entitled to examination without regard to number of years he has practised, or, (b) that within ten years prior to his application he has practised structural engineering in some State or territory of the United States, or in some foreign country for not less than six years, during at least two full years of which he shall have been in responsible charge of work as the principal or assistant, or, (c) that within ten years he has pursued a course of study and training in the theory and practice of structural engineering for the period of not less than six years in the employ or under the supervision of one or more practising structural engineers, during at least two full years of which he has been in charge of work.

Applicants who have graduated from a college or school of engineering considered by the board to be in good standing requiring a course of study not less than four years, during at least thirty weeks in each year, shall be credited to two years upon the six-year period required above. If the result of the examination be satisfactory to a majority of the board under its rules, the secretary shall, upon payment by the applicant of $30, issue a license to practise structural engineering in this State.

EXEMPTION FROM EXAMINATION

Section 5 states that any person who shall by affidavit or other proof show to the satisfaction of the State Board of Examiners that he was a resident of and engaged in the practice of structural engineering in this State on the date of the taking effect of this act, shall be entitled to a license without examination, provided such application shall be made within six months after the taking effect of this act. The secretary of the board shall, upon the payment to him by the applicant of a fee of $50, issue to the person named in said affidavit a license to practise structural engineering. A license, without examination, upon payment of a fee of $50, may be issued to a structural engineer licensed under the laws of any other State or territory of the United States, or any foreign country, provided it appears to the board that in such State or country the license requirements were equal to those prescribed in this State.

No corporation shall be licensed to practise structural engineering, but it shall be lawful for them to furnish to others engineering plans, drawings and specifications for supervision of the construction of buildings and structures, provided the chief executive officer or managing agent in Illinois shall be a structural engineer licensed under this act. It shall be lawful for one or more licensed structural engineers to enter co-partnership with one or more architects licensed under the laws of this State, for the practise of their profession.

DEFINITION OF STRUCTURAL ENGINEER

Any person engaged in the designing, or supervision of the construction, enlargement or alteration of buildings and structures, as hereinafter defined, or any part thereof, for others, and to be constructed by persons other than himself, is to be regarded as practising structural engineering within the meaning of this act, and shall be held to comply with the same.

Buildings and structures within the meaning of this act shall be construed to mean buildings and structures having as essential features, foundations, columns, girders, trusses, arches and beams, or some of them, and in which safe design and construction require that loads and stresses must be computed and the sizes and strength of parts must be determined by mathematical calculations based on scientific principles and engineering data.

THREE CLASSES EXEMPT

This act shall not be regarded as applying to draftsmen, students, clerks of work, superintendents and other employees of structural engineers, so long as they work and act under the instructions, control, direction and supervision of their licensed employers; superintendents of construction of buildings and structures employed and paid by the owners, provided they act under the supervision and control of a licensed structural engineer; persons licensed to practise architecture in this State. Nothing contained in this act shall be construed to prevent any person from making plans and specifications for any building or structure that is to be constructed by himself or his employees, and for his own use.

It shall be the duty of the State building commissioner, or the building commissioner

of any city, town or village, to issue permits for building construction to any owner or his agents upon filing of a true copy of the plans, drawings and specifications for the construction, and a certificate signed by the licensed structural engineer who executed them certifying under his seal that said plans and drawings are in accordance with the State building code, or the building code of such city, town or village, as the case may be. Every licensed structural engineer in this State shall pay an annual fee of $10.

REVOCATION AND REINSTATEMENT

Any license may be revoked by a four-fifths vote of the State Board of Examiners for gross incompetency; or recklessness in the construction of buildings or other structures; or for fraudulently affixing his seal to plans or specifications; or for any dishonest practice or practices on the part of the order thereof; or for fraud in obtaining his license; or practising without payment of the annual license renewal fee.

The board shall have power to entertain and grant for good cause petitions to vacate its orders revoking licenses and reinstate such petitioner to practise in this State, and to adopt rules and regulations governing the requirement and hearing of such petitions, provided that at least one year shall intervene between the date of the entry of the order revoking a license and the filing of such petitions in cases involving gross incompetency, recklessness, dishonest practices or fraud. Every petitioner shall pay a fee of $10 in advance. A majority vote of the board shall be sufficient to reinstate such petitioners to practice.

Earth Pressures Determined by Laboratory Apparatus

Prof. J. H. Smith Before American Society for Testing Materials Describes Method for Finding Resultant Force and Reports Tests

A SERIES of experiments has been started in the laboratories of the University of Pittsburgh to determine the position, magnitude and direction of the resultant earth pressure on either vertical or sloping sides of a specially devised model for variable heights from one to four feet. In a paper presented June 24 before the annual meeting of the American Society for Testing Materials, J. H. Smith, professor of civil engineering, University of Pittsburgh, described the apparatus used in these experiments, and reported the results of tests of river sand and gravel on vertical walls. These tests are still in progress and, aside from the statement that the pressure increases with the thickness of the fill, and that moist or wet material gives a higher resultant pressure than dry material, and packed material gives the highest pressure of all conditions tried, with the center of pressure in many cases above the center of the retaining surface, no definite conclusions or comparisons with usual assumptions were given. The following abstract describes the apparatus used and the method of computing the location, direction and intensity of the resultant pressure.

PRESSURES ON VERTICAL WALLS

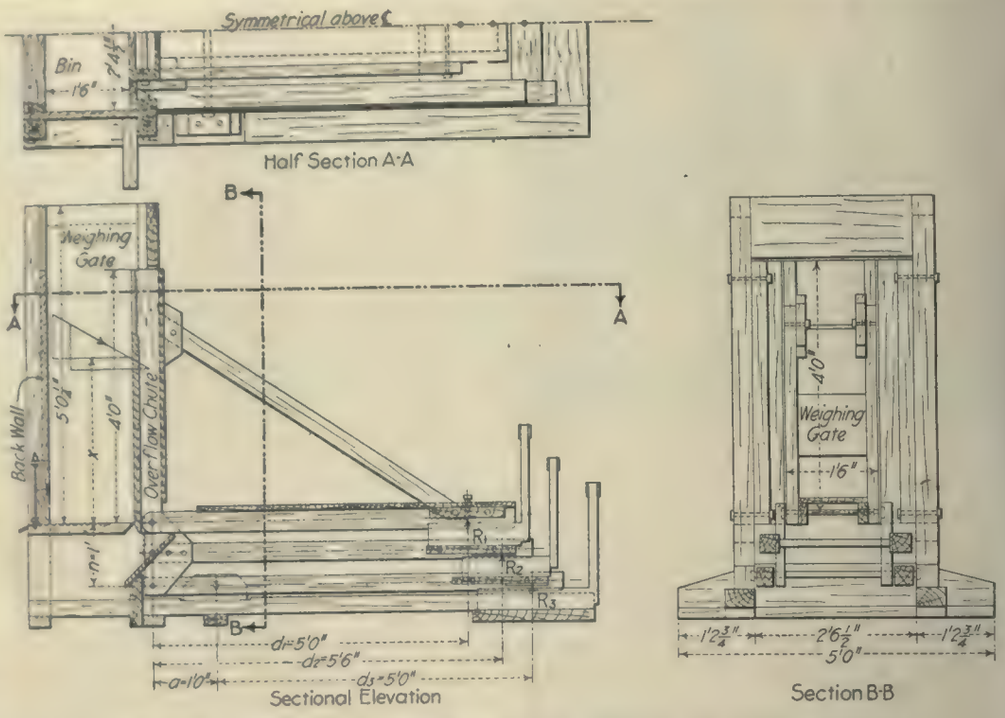
The special machine shown in the accompanying drawing was designed upon the principle that if the moments of the pressure about three different axes could be determined, the three unknowns could be found. These unknowns were taken to be X, the height of center of pressure above axis 1, V and H, the vertical and horizontal components, respectively, of the resultant pressure R. The other notation used is given on the drawing. Writing the three moment equations about axes 1, 2 and 3 and solving, there is found:

$$H = (R_2 d_2 - R_1 d_1)/n$$
$$V = (R_2 d_2 - R_3 d_3)/a$$
$$X = R_1 d_1\ n/H$$

When the values of a, d and n used in the apparatus are substituted, these equations reduce to:

$$H = 5\ (1.1\ R_2 - R_1)$$
$$V = 5\ (1.1\ R_2 - R_3)$$
$$X = 5R_1/H + V/4H$$

The additional term, $V/4H$, in the last equation is introduced because the vertical weighing surface is 3 in. back of the vertical plane through axis 1. By use of the above equations, H, V and X may readily be determined when R_1, R_2 and R_3 have been measured by experiment.



APPARATUS GAGES CENTER, DIRECTION AND AMOUNT OF EARTH PRESSURE

PRINCIPLE OF APPARATUS

The figure shows three sectional views of the apparatus as designed and built for practical laboratory tests. The weighing gate, or front retaining surface, has a width of 18 in. and a height, G1, of 4 ft. The weighing gate occupies only the central portion of the front face of the bin, the adjustable ledges at the sides of the gate being attached to the main frame. The weighing gate has two walls, the inner wall forms the retaining surface, while the outer wall is intended to catch any of the filling material which may run over the inner wall, and return it to the space beneath the bin. The height of the inner wall is adjustable by means of removable sections. Therefore a fill of given depth with its angle of repose may be obtained readily by filling the bin until the excess material runs over the inner wall of the gate. The clearance space between the gate and side ledges and bottom is covered with loosely fitting strips of muslin, glued to the inner surface of the bin.

The bin has vertical side and back walls, is 28½ in. wide inside, and 5 ft. high above its floor. The back-wall is made adjustable, so that the thickness of fill between back wall and weighing gate may be varied. This ranges from 6 to 18 in. when the weighing gate is in a vertical position. The back-wall is suspended on an adjustable rod at the top, which allows it to swing outward at the bottom when the fill is to be discharged from the bin, and has removable sections to facilitate the filling of the bin.

As it was not practicable to use knife-edge bearings for axes 1, 2 and 3, 1¼-in. cold rolled shafting with heavy ball-bearings at each end was used. There was some question as to the friction and exact position of the center in the ball bearings used, therefore a special device was constructed for the testing of these bearings. The results showed that the centers of the bearings were quite true, and that they were practically frictionless, even under heavy loads.

The apparatus can easily be modified for measuring pressures on inclined walls. The equations for such cases are worked out in full, but tests have not yet been made.

Mortar Cushion for Granite Block Paving in New York

IN the borough of Manhattan, New York City, the use of a sand cushion for granite blocks has been abandoned, according to information received from Eugene W. Stern, engineer of highways. Under the 1915 specifications a mortar bed is used consisting of one part Portland cement to three parts sand, mixed almost dry. The blocks, it is said, are brought to a proper surface by ramming just as readily as when the old sand cushion was used. The mortar hardens in a few weeks even under traffic.. The great advantage of the mortar bed over the sand cushion, Mr. Stern states, is that surface water leaking through the joints of the blocks does not cause depressions in the surface, which was the case with the sand cushion, and the cost of maintenance is considerably reduced thereby.

State Should Deal Directly with Patentees of Processes and Materials in Public Work

Plan to Prevent Collusion Between Contractor and Patentee Suggests that Highway Departments Assume Payment of Royalties

By S. WHINERY
Consulting Engineer, New York City

THE question of the propriety of using patented materials, devices and processes upon public work has been discussed for a long time; but it has of late attracted renewed attention in connection with the construction of roads and pavements.

There undoubtedly exists in the minds of the public and of public officials a pronounced prejudice against the use of patented articles or processes upon the streets and roads. This prejudice is difficult to account for upon sound principles. So far as it can be analyzed it seems to be mainly based upon the assumption that a patent does, or may, create a monopoly, a word that is particularly obnoxious to people just now. But in addition to this there is prevalent a feeling that many patented articles have, as a rule, little merit and are often exploited under exaggerated claims of value.

PATENTS AND MONOPOLIES

While the courts have quite uniformly held that a patent does not create a monopoly in the true and legal meaning of the word it does confer upon the patentee that kind of a monopoly inherent in the ownership of private property. An invention protected by a patent is as much the private property of the patentee as his real estate or his chattels. Neither his neighbors nor the public may deprive him of such property, nor can State or municipal governments (herein, for brevity, called the State) appropriate or use the patented invention without his consent or by due process of law. But while a patent does not itself constitute a legal monopoly, it may be, and often is, especially in connection with public work, employed by its owner or his agents (who will, in this article, be referred to as the patentee), to create or enforce a true monopoly by extending the protection it offers to materials and methods not covered by it, and in this way to exacting excessive prices and profits. The practices resorted to for this purpose are too well known to need description here.

In ordinary commercial business prejudice against patented articles does not exist to the same extent. The public daily buys thousands of patented articles, presumably for the simple reason that they are better or cheaper than the unpatented articles available. At first thought there would seem to be no sound reason why public officials should not follow the same simple rule with equally satisfactory results. If a patented road or pavement offers better value for the same cost, or equal value for a lower cost than others available, it would seem not only proper but the clear duty of State and municipal officials to secure the benefits offered thereby, provided that these benefits are not offset by possible difficulties and complications connected with its use. Unfortunately, such difficulties and complications are frequently encountered under the methods of procedure now common.

In so far as the prejudice against patents and patented articles is based upon their frequent lack of utility, or upon questionable methods of promotion, including fraudulent or exaggerated representations, it is not without substantial justification. The facts are too well known to need recounting. Experience has taught most of us that only a very small percentage of the patents brought to our attention are of any practical utility, and that even where they possess merit not a few of them are promoted and sold under exaggerated claims or by methods that are at least questionable.

The lesson that such experience clearly teaches is that no patented articles, devices or processes relating to roads and pavements should be adopted or used, except on a very small scale for experimental purposes, until their utility and economy has been well established by experience under conditions similar to those to be met in each individual case. Many careful and prudent officials have learned this lesson, and their disinclination to take up newly patented schemes is the result of wise conservatism rather than of prejudice.

THE CASE OF THE NEW YORK STATE HIGHWAYS

As a text for the discussion of the practical side of the subject, we may consider the action of the State of New York in attempting to regulate the adoption and use upon the State highways of patented articles and processes. In framing the present Highway Law of the State the Legislature obviously sought to apply competition to the solution of the troublesome question of patents. The law provides that:

"In the construction, maintenance and repair of State or county highways no patented material or article or any other material or article shall be specified, contracted for or purchased except under such circumstances that there can be fair and reasonable opportunity for competition, the conditions to secure which shall be prescribed by the Commissioner of Highways."

It will be observed that, contrary to a common impression, this law does not prohibit the use of patented articles or processes. On the contrary, it places them upon an equal footing with unpatented articles, the condition for each being that there shall be opportunity for free and reasonable competition. The law thus skillfully avoids the appearance of discrimination against one class of property; but it shifts the whole responsibility for carrying out its obvious purpose upon the Commissioner of Highways.

That official, in an attempt to comply with the law in the case of one patented pavement, issued the following order:

"Upon the Commissioner of Highways determining that any pavement in any city or village on any county or State highway in the State of New York shall be constructed of ——— pavement, the owners of said patent, within five days thereafter, shall file with the State Highway Department at their office in the city of Albany, New York, a price at which they will deliver said material to contractors in connection with said work to be constructed or improved, said price to be available for any contractor desiring to bid upon said work and the provisions of the offer of said company to be approved by the State Department of Highways."

A similar provision had been inserted earlier in the specifications of a number of cities where it had been desired to admit the use of patented pavements, materials or devices, and the commissioner evidently followed the precedents thus set, adding thereto the provision, not found in most city specifications, that the terms offered by the patentee must be approved by the State Department of Highways. But even with this prudent addition the scheme, as a whole, is very inadequate, and unless supplemented by a number of other provisions, apparently not contemplated, leaves the door wide open for troublesome difficulties and complications.

There is no provision for, and apparently it is not intended that the patentee shall become a legal party to, any contract entered into for work, or that he shall subscribe to or be required to comply with the specifications. He will be under no contract or bond to do so. On the other hand the contractor himself could not fairly, even if he could legally, be held responsible for the quality of a material thus designated and tacitly accepted by the State and supplied by parties over whom he presumably would have no control, since, in theory at least, he must be supposed to have no contractual relation to the patentee.

OPPORTUNITY FOR FAVORED CONTRACTOR

The requirement that the terms submitted by the patentee shall be approved by the highway department implies that that department shall be competent and able to estimate correctly in each case the actual cost of the patented work, and to determine a fair and reasonable royalty for the compensation of the patentee. Otherwise the terms named by the patentee and approved by the department might be excessive and monopolistic and the object of the law defeated. For the patentee might be able to name to a favored contractor such more liberal terms as would enable him to underbid all "outside" competitors and, while naming excessive prices, still be safely the lowest bidder. It has been openly charged in one State that certain favored contractors, through such collusive methods with a patentee, have been able to monopolize large contracts at exorbitant prices, to the serious loss of the State. In another case, where all the facts were obtained and verified, the owner of a patented pavement submitted to the municipal authorities an excessive price at which the patented surface of the pavement would be supplied to all bidders, but he privately made a much lower price to one favored contractor, who was thus able to secure the contract, though his unit prices for all items other than the patented surface were much higher than any of his competitors. Had the "outside" contractors been given the same prices on the patented surface as the favored one the city might have saved many thousands of dollars, for the contract was a very large one.

TERMS OF PROPOSED CONTRACT

To make the plan adopted by the State Commissioner of Highways effective and

to safeguard the interests both of the State and the contractor, a comprehensive formal agreement or contract with the patentee would be necessary in the case of each individual road contract, since varying conditions of location, cost of delivery, etc., would affect the fair compensation to the patentee as well as to the contractor. Such a contract with the patentee should embrace:

A. The contractual provisions and specifications of the primary contract in so far as they relate to the patented part of the work. Otherwise the patentee might supply inferior material or work not in accordance with the specifications, in which event the State would apparently have no recourse upon him, and the contractor could not justly be held responsible.

B. A provision that the patentee shall not quote to any prospective bidder prices lower than those publicly announced, and that he shall not accept from any contractor to whom the work may be awarded any lower rate of compensation, either directly or indirectly.

C. The time, place, manner and conditions of deliveries of material by the patentee to the contractor should be provided for and clearly defined.

D. A provision for the adjustment of any differences or disputes that may arise between the contractor and the patentee, in so far, at least, as they may affect the interests of the State.

E. A provision that the patentee shall supply the materials that may be required for the *maintenance* of the road for a stated period of years at a stipulated price, and whenever required.

F. Performance with the terms of the agreement to be secured by a sufficient bond in the usual form.

Other provisions might be necessary to meet special conditions, but even with an adequate contract between the State and the patentee the plan might not work out satisfactorily. Among the three parties in interest there would be opportunities for divided authority and troublesome complications that might result in serious delays to the work, if not in litigation, to the serious detriment of the interests of the State.

STATE SHOULD PAY ROYALTY

These considerations lead to the question: Cannot a better scheme be devised for regulating the use of patents in street and pavement work and controlling the relations between the State, the contractor and the patentee? The writer believes it to be not only possible but comparatively simple and feasible. The plan suggested is not new, but seems not to have been applied heretofore to road and pavement work. Briefly, it is that the State shall agree with the patentee to pay him a stated royalty per unit of the work in which the patent is used, throughout the whole State or municipality, for a period of years. Under such an agreement, wherever the State considered it advisable to utilize patented elements in the proposed work, the character, quality, and name of the materials to be used and the method of their fabrication would be fully set out in the specifications. Bidders would be notified that the State would assume and pay any royalties that might become due upon the patented work specified, or, if legal requirements prevented this, a stated royalty per unit of work must be included in their proposal. But whatever the exact procedure, the royalties should be paid to the patentee by the State and, if necessary, charged against the contractor's account upon the final estimate. A prime object of the plan is to prevent direct dealings, with the possibility of collusive or corrupt arrangements, between contractor and patentee.

ADVANTAGES OF PLAN

The advantages of the general plan here outlined may be briefly stated:

1. It would insure the fair and reasonable opportunity for competition stipulated in the New York law, which is the real end sought after in all like attempted legislative or contractual action.

2. It would prevent, by removing the motive for, collusion and monopolistic agreements between contractor and patentee, which is the most frequent source of crooked and questionable practices in the use of patented roads and pavements.

3. It would prevent divided or uncertain responsibility. It would concentrate the whole responsibility for the character and quality of the work upon one party—the contractor.

4. It would permit the patentee, if he so desired, to bid upon the work upon exactly the same footing as other contractors. It is often the case that the patentee, being the one most interested in the success of his patent, and therefore anxious that the work shall be done in the best manner, prefers to do the whole work himself. For the same reason it is advantageous to the State that he should be permitted to do so. But he would not be able by reason of his patent on one or two items, to exact excessive prices on the unpatented parts of the work.

5. It would be fair and just to the patentee. He is entitled to a reasonable and even liberal compensation for the benefit that his patent may bring to the public, but he is not entitled to use his patent as a club to exact excessive profit on parts of the work not covered by or relating to his patent. The question of the rate or amount of the royalty to be paid to him would be a matter of mutual agreement between himself and the State, either party being free to accept or reject the offers of the other. This is said upon the assumption that a patent is not quasi-public property. If the courts should hold otherwise the State might, by appraisal of value and legal process, regulate the rate of compensation.

6. It would relieve the State and municipal officials of possible trouble and complications arising out of questions or differences between the contractor and the patentee. The arrangement, applying as it would to the whole State for a definite period of time, would simplify and standardize procedure with reference to the patent involved. Contracts under it would be open, daylight transactions, and it would thus tend to remove any ground or pretext for charges of complicity or duplicity on the part of the officials.

7. The great majority of the patents relating to roads and pavements, that are, or are likely to be, useful, relate to or cover processes or special combinations of materials, but not the materials themselves, which are usually procurable in the open market. With the right to use the patent as here proposed the contractor could buy the materials and combine and manipulate them as the specifications require and thus be able to do all the work himself, wholly independent of the patentee, though, if he found it to his interest to do so, he would be free to employ the patentee to do any part of it, but the responsibility to the State for the character and quality of the completed work would remain wholly upon the contractor.

These advantages would seem to commend this general plan to all State and municipal officials. The only objection that can be urged against it is that existing laws and ordinances may not authorize or permit the necessary procedure. If so, they should be suitably amended. Since the plan would be clearly in the interest of the State it should not be difficult to secure such amendments as might be found necessary.

Proposes Definition of the Word "Vitrified"

DEAN Edward Orton, Jr., of the college of engineering of Ohio State University, in a paper entitled "The Legal Interpretation of the Word 'Vitrified' as Applied to Ceramic Products," presented at the annual meeting of the American Society for Testing Materials on June 25, proposed the following definition:

"Where the word 'vitrified' is used in a contract or agreement in describing the properties of a clay product, and is not further defined in the contract, it shall mean that the product shall have attained in the firing process such a degree of compactness that its mean absorption does not exceed 3 per cent of its own initial weight of pure water, when subjected to complete immersion in cold water for 48 hr., or boiling water for 3 hr. Not less than three tests shall be made in determining the mean absorption, and no single test may exceed the mean by more than 0.5 per cent. Neither the possession of the visual properties or appearance of a glass, nor any definite degree of physical strength, hardness, color, or specific gravity shall be implied as an attribute of vitrification."

This definition was referred to the committees on clay products for conference and recommendation, with especial reference to its use in all specifications which contain no definition of the term.

In justification of this definition, Dean Orton stated that color, texture, hardness, strength and specific gravity are all affected in the heat treatment of clay, and that all may to some extent act as rough gages or modes of measuring the progress of vitrification. Color goes through a progressive series of changes, the texture becomes finer and closer, the hardness, the strength and the specific gravity all increase, but exact measures of color, texture, hardness, strength or specific gravity are all impossible or costly, and cannot be correlated exactly with the progress of vitrification. On the other hand it appears that compactness is the one property which most clearly typifies the vitrification process, and that the absorption test makes an excellent and easily applied method of determining it. The absolute degree of compactness of a product is indicated by a single test. By a series of determinations made upon test pieces drawn at different temperatures, the progress of the vitrification process in a burn can be studied equally well by this simple method.

RAILROAD WAGES constituted 45.07 per cent of gross earnings in 1914, as compared with 40.33 per cent in 1905, according to figures recently compiled by the Bureau of Railway Economics.

Severe Tests Show Chicago Municipal Pier to Be Sound in Construction

Attacks on Structural Details Refuted by Committee of Consulting Engineers and by Loading in Excess of Usual Requirements

GROWING out of controversies between the building commissioner of Chicago and the Harbor and Subway Commission were charges that the concrete floors in the city pier would hold up their own weight only, that is, if figured strictly according to the provisions of the building code. Several other charges of violations were made by the building department officials, the most serious being with reference to pile cut-offs above city datum. The more serious charges of instability of the structures, which were described in the Engineering Record of June 19, page 778, have been looked into by boards of reputable consulting engineers,



CEMENT PILED TWENTY SACKS HIGH OVER PILE PIER PRODUCED SETTLEMENT OF 0.17 INCHES ONLY

who have in every case given the pier a clean bill of health. The latest accusation, that the floors, floorbeams and piers would not carry designated loads, have been refuted by tests carried out by Robert W. Hunt & Company, June 1 to 9 inclusive. Data on these tests are given because of the remarkably good results obtained.

FLOOR LOAD TESTS

The tests were made for the purpose of determining the amount of deflection and settlement which would occur in the floor, girders and pier foundations under a live load of 750 lb. per square foot, or three times the designed load. The building ordinance requires the equivalent of twice the live plus the dead load or 680 lb. in this case. Cement in bags was uniformly distributed over two 16½ x 20-ft. interior floor panels located in the freight shed. The bags were closely piled up fifteen courses high for the floor and girder tests and twenty courses high for the column footings.

Observations of deflections were taken immediately after each increment of load had been applied and were read by means of a level on scales graduated to twentieths of an inch. These scales were located on each of the six columns, and also on target stakes located at the center point of each girder and floor panel, thus giving a total of fifteen observation stations. Observations were also taken after the full live load of 769.2 lb. per square foot had been carried by the floor panels for 24 hr. The

SETTLEMENT IN INCHES AFTER LOAD HAD BEEN APPLIED FOR 24 HOURS

Column	Load on	Load off
1	0.050	0.015
3	0.070	0.035
7	0.110	0.085
9	0.115	0.055
13	0.055	0.015
15	0.030	0.010

settlements after 24 hr. under load are for columns, as shown in the above table.

The net deflection of girder 2 was 0.030 in., of girder 8, 0.092 in., and of girder 14, 0.057 in. The net deflection of floor 5 was 0.114 in. and that of floor 11 was 0.125 in. To be contrasted with these low figures is the allowable deflection of the girders of 0.300 in., and of the floors, 0.247 in.

In considering the settlement of the piers it is believed by the Harbor and Subway Commission that it was due mostly to end compression of the piles.

PIER TEST

The total load on foundation pier L-12 was 185.6 tons, an average per pile of 46.4 tons. A settlement of only 0.170 in. occurred in 64 hr. The dead load was 117,500 lb. Cement was piled around the column on an area equal to one floor panel, 330 sq. ft., until 1025.7 lb. per square foot had been placed. Of the total amount shown in the photograph only 75 per cent was considered as carried by the column under test.

The foundation piles under the head house support a heavier load per pile (22 tons) than any others on the pier. They have been thoroughly tested for several months with the full load from the 60,000-gal. tanks filled with water. So far no settlement at all has been observed.

PILE CUT-OFF CONTROVERSY

Great stress was laid by the building commissioner on the fact that the piles were not sawed off to a uniform level at least 1 ft. below Chicago datum after being driven. A committee of three engineers, consisting of Col. W. V. Judson, Corps of Engineers, U. S. A., C. W. Cartlidge and R. W. Patterson, made a thorough examination after one-third of the piling had been covered with concrete. The committee reported it did not consider it necessary to recommend any change in the plans in this respect. The comment by the committee on the pile cut-off provision in the building ordinance is as follows:

"When it is considered that this ordinance must provide for safe construction of buildings all over the city and subject to widely varying soil conditions, the wisdom of this provision is evident, but it is not evident that it is necessary, from an engineering standpoint, to conform to this provision if conditions of soil, exposure, etc., are such that piles cut off above the prescribed plans will not be subject to decay in a specific case such as the one we are considering.

"Of course, it is the general rule in such cases that timber will decay unless always dry, or always wet, although protection from air currents (or lack of it) is an important factor.

"The plans for the municipal pier provide that the piles be cut off at heights varying from 9 in. below datum under the head house to from 1 ft. 9 in. to 5 ft. 3 in. above datum under the sheds proper, the bottom of the concrete footings being in all cases 9 in. below the cut-offs. They will be, in all probability, continually moist, and surrounded by moist clay or sand and protected by the inclosing dock walls and the reinforced-concrete floor from circulation of air. The nearness of the water, the permeability of the walls retaining the pier, the sealing of the earth fill by a concrete floor and the circumstance that the fill is largely hydraulic and thus may not be expected to settle away from the pile tops are all conditions favorable to the life of the pile tops when cut off at elevations shown on the plans. It is true that conformance with the building ordinance would have provided insurance against the remote probability of the decay of the tops of these pilings, but on the other hand the cost would have been materially increased and the increase would have been excessive as insurance.

"We must also consider what would be the consequence if some decay of the tops of these pilings should take place. It is the committee's opinion that while this is possible, it is a remote contingency, but if it should occur the damage would be slight and not such as to endanger either the structure as a whole or the lives of its occupants, and would be easily and cheaply repaired.

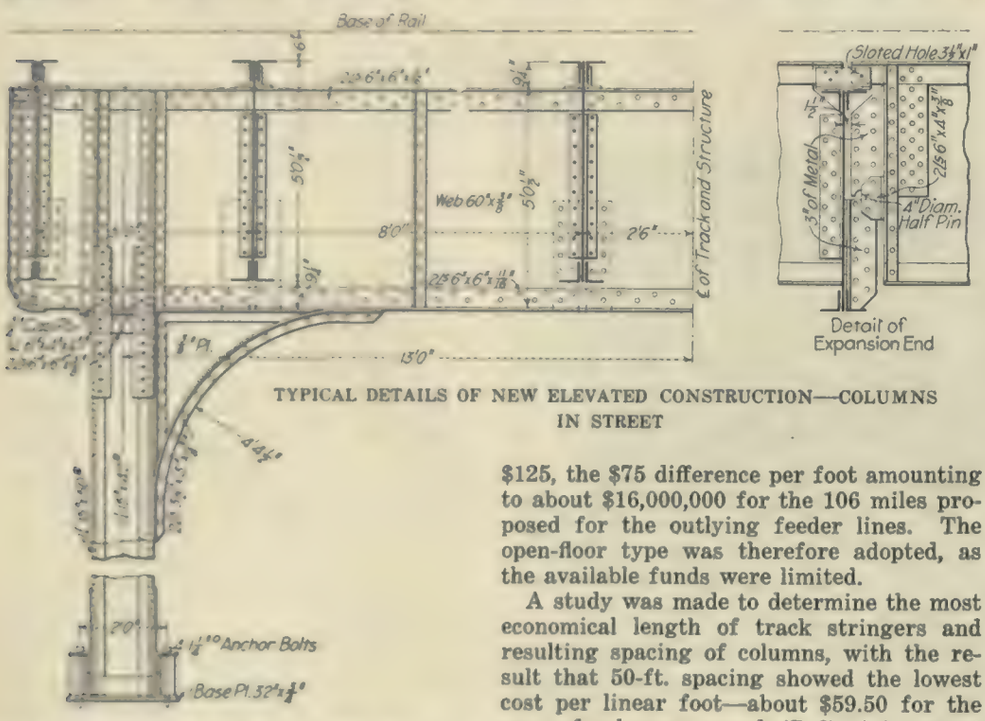
"The harbor commissioners have abundant precedent for their adoption of this feature and have been more conservative in this respect than the designers of the piers at Portland, Ore., and Boston, where the piles were cut off 19 ft. and 9 ft. above low tide, respectively."

A STRIKING COMPARISON for translating engineering quantities into terms for the layman appears in the Reclamation Record with reference to the 380,260 cu. yd. of masonry placed in the Elephant Butte dam for the year ended Feb. 28. This amount would have covered a 300 x 600-ft. city block 57 ft. deep, or to the height of a five-story building.

Typical and Special Construction Used on Queens Extension to New York Elevated

Reasons for Adoption of Open-Deck Floor, and for Column Spacings—Special Details at Three-Level Crossing of Long Island Railroad

THE NEW Queens extension of the New York Elevated Railway, a part of the dual-system of rapid transit over which there was so much dissension in 1910 and 1911, contains several unusual features of elevated construction, and is now rapidly nearing completion. Elevated trains operated by the Interborough Rapid Transit Company on the Second Avenue line will cross the Queensboro Bridge over the East River. Trains on the Steinway Tunnel line connecting with the present subway in Forty-second Street and the New York Municipal trains from the new Broadway subway will run through the Steinway Tunnel under the East River. This tunnel, which was completed in 1907, has just been opened for traffic. The connections between bridge and tunnel and the new Queens Plaza express station at the eastern end of the Queensboro Bridge are now under construction. Beyond this station the lines branch in the form of a Y, one three-track line turning north to Astoria and the other continuing eastward over the Pennsylvania Railroad yards, along the new Queens Boulevard, and curving to the northwest to Woodside and Corona, the present terminal.



TYPICAL DETAILS OF NEW ELEVATED CONSTRUCTION—COLUMNS IN STREET

Difficult problems were encountered at the Queens Plaza express station, where many tracks with varying grades and curves had to be provided, and also at the Woodside Station, where the elevated line crosses the Long Island Railroad, which itself is there carried over Roosevelt Avenue as an overhead crossing. Unusual construction is used along the Queens Boulevard, where for architectural appearance a reinforced-concrete arch structure on columns, and concrete-covered steel frame stations, were adopted. The features to be here described include general details of typical steel construction, with reasons for the adoption of the principal sections and dimensions, the typical form of expansion joints used, and the special construction, including heavy cantilever cross girders, adopted in Roosevelt Avenue for the three-level crossing at Woodside station.

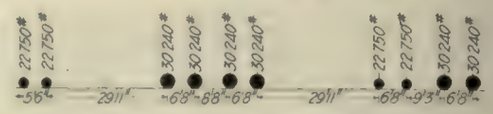
Open Floor and Deck Girders

Although solid-floor construction on these elevated lines was preferred, because of the decrease in maintenance cost and in the amount of noise from passing trains, it was estimated that such construction would cost $200 per linear foot and open floor only $125, the $75 difference per foot amounting to about $16,000,000 for the 106 miles proposed for the outlying feeder lines. The open-floor type was therefore adopted, as the available funds were limited.

A study was made to determine the most economical length of track stringers and resulting spacing of columns, with the result that 50-ft. spacing showed the lowest cost per linear foot—about $59.50 for the case of columns spaced 47 ft. 4 in. apart under 6-ft. cross girders, and $52.50 when the columns were spaced 26 ft. transversely. The 50-ft. spacing was therefore adopted, although at street intersections 60 ft. or more often had to be used, and the odd lengths of blocks caused unavoidable variations.

Assumed Loads and Impact

The dead load of track, etc., is assumed at 400 lb. per linear foot in addition to the steel itself. The specified live load for one track is shown in the accompanying diagram. Wind pressure at 30 lb. per square foot from the top of the train to the bottom of the structure, centrifugal force on curves and traction force at 10 per cent of the live load, assuming for a three-track line that only two tracks will be subject to tractive force at the same time in the same direction, have all been provided for.



LIVE LOADING USED IN DESIGN

The impact, in per cent, is given by the formula

$$I = 125 - \sqrt{2000\ L - L^2}/8$$

in which L is the length in feet of loaded track which produces maximum stress. For 50-ft. stringers $I = 86$ per cent; for cross girders in which maximum stress is produced with one track loaded, $L = 100$ and $I = 70$ per cent, while if three tracks are loaded $L = 300$ and $I = 36$ per cent.

The typical construction between the stations consists of six track stringers of the solid-web girder type framing into cross girders supported by two columns, the stringers being spaced 5 ft. apart so that the crossties resting on them are not subjected to bending stress.

Transverse Spacing of Columns

The transverse spacing of the columns was fixed at 26 ft. for columns located in the street. This is the minimum allowable for two lines of trolley tracks below the elevated structure, assuming tracks on 10-ft. centers, and 7 ft. 4 in. clearance to steel. With 13-ft. spacing of tracks on the elevated the center of columns is below the center of outside tracks. The cross girders therefore cantilever about 3 ft. at each end, and are curved and connected to the supporting columns as indicated by the accompanying typical detail drawing. All columns in 100-ft. streets, which have 60-ft. roadways, are spaced 26 ft. apart.

For 80-ft. streets the roadway is 44 ft. wide and there is not enough space between columns and curb for the 16 ft. required to allow two vehicles to pass. Therefore the columns are placed on the sidewalk, 1 ft. 8 in. from the curb, this distance being sufficient to allow for the protection of their bases from passing traffic, and making their spacing 47 ft. 4 in.

Economic Stringer Design

The economic depth of the 50-ft. stringers was found to be 5 ft., and this was



SPECIAL CONSTRUCTION USED AT WOODSIDE ELEVATED STATION

View taken from grade of Long Island six-track crossing over Roosevelt Avenue.



HEAVY DOUBLE-WEB CROSS GIRDER

Carries upper columns and mezzanine floorbeams above Long Island platform below, Woodside Station.

adopted for all spans except those of 70 ft. or more. To avoid cover plates and thicknesses of flange angles exceeding ⅞ in., which would require the holes to be drilled from the solid, the longer girders were made 6 ft. or 6½ ft. deep.

To prevent excessive deflection for all cases in which the length exceeded twelve times the depth, the usual allowable stress of 20,000 lb. per square inch was reduced by multiplying by the ratio of depth in inches to length in feet. The relatively high unit stress of 20,000 allowed for direct tension and bending fiber stress is justified by the high impact stresses used.

EXPANSION JOINTS

At the stations a through-girder type of construction was used to lower the track level over the mezzanine entrances and reduce the climb from street to platforms to a minimum. Near Woodside Station a typical viaduct tower construction has been used, with bracing in every other bay down to the 14-ft. clearance line above the street for all columns over 30 ft. long. Expansion joints in the stringers were provided at every other bent, provision being made for 1½-in. contraction or expansion from the normal. The typical expansion joint, as shown in the accompanying detail, consists of a 4-in. half-round pin bearing on pin plates on the stringer and sliding on a seat of angles and plates on the cross girder. Small guide angles hold the pin in place and keep the stringer in line. The absence of all seat angles for the erection of stringers, and the riveting of the end connection angles direct to the cross-girder web without fillers, are unique features which it is asserted made a saving of about $1 per linear foot of the structure.

The top flanges of the stringers are braced by the usual type of stringer bracing, which is provided in all spans for the two outside tracks. Similar bracing is provided between the inside track stringers only in the spans containing expansion joints, for the purpose of transferring the tractive force from the center track to the columns without bending the cross girder. Stringer cross frames are provided at intervals varying from 12½ to 20 ft. For the case where long cross girders are used with columns placed at the curb, the outside stringers at a cross frame are connected by deep struts to the columns.

COLUMN DESIGN

In designing the main column sections direct stress and bending stress due to both wind and tractive forces had to be considered. The formula used for direct stress alone was

$$f = 20{,}000/(1 + l^2/8000\,r^2)$$

with a maximum of 14,000. When direct stress and bending stress in one direction only were combined, 20,000 was allowed in the extreme fiber. When bending in both directions was used in the combination, the allowable stress in the extreme fiber was increased to 25,000. The latter value was justified on the ground of the infrequency in the occurrence of such maximum conditions.

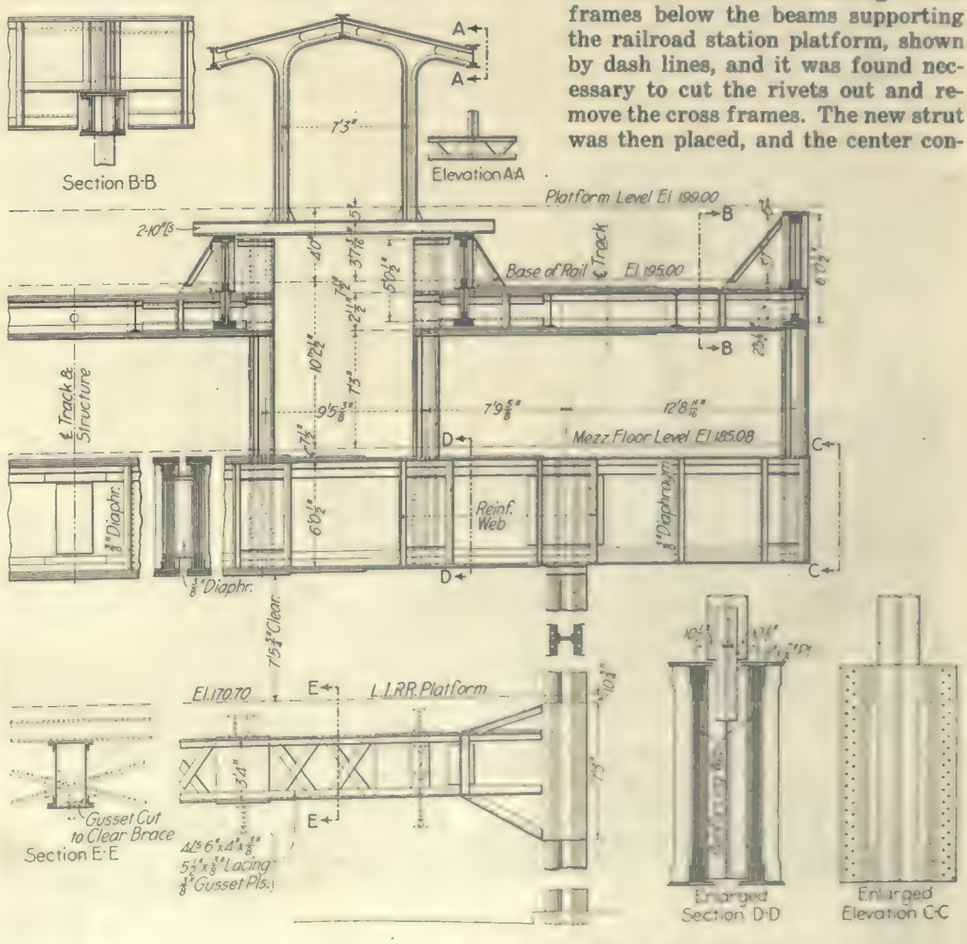
The most effective type of section for columns subjected to bending stresses in both directions is the two-channel and I-beam type, when all sections of the box type are ruled out because of not permitting inspection and painting. This type was adopted, using 15-in. channels, 15-in. I-beams and 15-in. cover plates on the channels where necessary. Some difficulty has developed from the distortion of the I-beams, which come from the rolling mill slightly warped, the two flanges not being exactly parallel. A built I-section has been proposed to replace the rolled I-beam for future designs, although it is less economical.

SPECIAL CONSTRUCTION AT WOODSIDE STATION

Where the elevated railway which is carried along Roosevelt Avenue crosses the Long Island Railroad at Woodside station, it was necessary to design special construction to avoid interference with the existing through-girder spans and columns of the Long Island Railroad overhead crossing. This was accomplished by the use of heavy columns and cross girders, details of which are shown.

This drawing shows a cross-section at the columns which pass directly through the Long Island Railroad station platform. The connections between columns and cross girders are seen to be complicated by the type of column used, which is composed of two interior channels and two heavy outside built I-sections. The double-web cross girder, also seen in one of the photographs, straddles these columns and is riveted directly to the main angles. It is high enough to give sufficient overhead clearance above the platform and yet allow clearance between the mezzanine floor and the longitudinal girders above. The through type of floor construction at the upper level and platform and canopy details are typical of the elevated stations. One of the photographs shows the Woodside station, not yet completed, and the new Long Island Railroad six-track span.

In order to reduce the unsupported length of the columns which pass through the Long Island station platform, a long four-angle strut was used, laced on four sides and connected to the columns with heavy gusset plates as shown. This strut interfered with the existing cross frames below the beams supporting the railroad station platform, shown by dash lines, and it was found necessary to cut the rivets out and remove the cross frames. The new strut was then placed, and the center con-



DETAILS OF SPECIAL CONSTRUCTION AT WOODSIDE STATION

The mezzanine floorbeams and connections are not shown. See photograph.

nection plates of the old cross frames were cut at the corners to clear, as shown on the detail drawing, and the angles threaded through and again riveted up. The manner of connecting the upper built I-section columns to the cross girders by diaphragm plates and angles is shown in the sections and end view of the girder.

The work on these city-built lines has been done under the direction of the engineering staff of the New York Public Service Commission, First District. Alfred Craven is chief engineer, Sverre Dahm principal assistant engineer, and A. I. Raisman senior designing engineer. Maurice E. Griest, assistant designing engineer, has had immediate supervision of the design of the details here described. The steelwork at Woodside was furnished by the American Bridge Company, and the general contractor was the E. E. Smith Contracting Company.

What Kansas Roads Cost

GRAVEL ROADS in Kansas cost from 20 to 60 cents per square yard, averaging about $2,500 per mile for a 10-in. surface 16 ft. wide, where the haul does not exceed 2 miles, according to the latest annual report of W. S. Gearhart, State engineer. Oiled earth roads cost from 10 to 20 cents per square yard, averaging about 15 cents. Waterbound macadam roads vary in cost from 45 to 60 cents per square yard; a waterbound macadam road 16 ft. wide, and with a surface 8 in. thick after rolling, will cost approximately $5,000 per mile under normal conditions. An oiled or bituminous macadam road costs from 10 to 25 cents per square yard more than waterbound macadam. Concrete paving costs from $1 to $1.30 per square yard. Brick roads cost from $1.50 to $2.25 per square yard, averaging about $1.75 where the haul is short. Sand-clay roads cost from $300 to $1,500 per mile for a 12-in. clay surface 16 ft. wide, the average cost being $800 per mile.

Seventy-Nine-Ton Derrick Car Lowers Itself 50 Feet in Twenty-Five Minutes

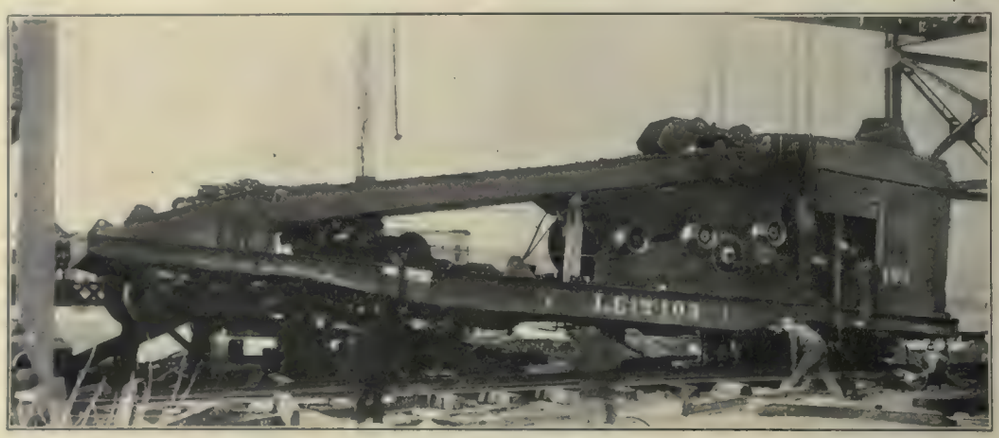
Three Sets of Falls Hung from Bents Lead to Hoist—Operator Rides Car and Turns Engine Over Backward with Frictions in During Descent

By A. S. BEALE

Resident Engineer, Lucius Engineering Company, Woodside, Long Island

ON COMPLETING the erection of 2 miles of three-track elevated railroad from Corona to Woodside, L. I., a 79-ton derrick car was situated 50 ft. above ground with its usefulness in this position at an end. Physical conditions made impracticable the employment of an inclined plane for the removal of the car, and it was therefore lowered vertically by its own engine, the descent occupying 25 min.

From its position on the middle or express track the derrick was skidded laterally until it rested directly above the opening between the express track and the westbound local track of the structure, being supported in this position by twelve 8 x 16-in. timbers, six under each truck. A timber gallows-frame was then erected over each end of the car and guyed. From the forward frame one set of falls was attached to the front end of the car, using a sling about the car body. From the rear frame two sets of falls, one on each side of the car, were hung. The front set of falls contained ten parts of ⅞-in. steel hoisting rope rove through two four-sheave blocks and one single block. The rear tackles consisted of eight parts each of ⅞-in. wire rope passed through a pair of triple blocks and a pair of single blocks, leading to the front of the car and thence to the engine, which was a three-drum hoist.



REAR END REACHED GROUND FIRST AS FRONT FALLS CONTAINED MOST PARTS

Notice lead of lines from rear falls to front of car and back to hoist through single blocks. Boom was unshipped for descent.



BENTS WERE ERECTED AFTER CAR WAS SLID OVER SPACE BETWEEN GIRDERS

ENGINE TURNS BACKWARD TO LOWER CAR

By throwing in the frictions of all three drums they could, of course, be operated in unison. Although he does not appear in the photographs, the engineer stood at the operating levers, directly in front of the boiler, during the descent. With all three frictions in, the car was picked up and the timbers under it removed so that lowering could begin. The brakes, which had been set while the timbers were taken out, were then released, allowing the drums to pay out in unison, lowering the car and turning the engine over backwards. In this way the descent could be checked or stopped by opening the throttle slightly. It will be seen from the views that during the descent the car left the horizontal. Since the rear falls consisted of eight parts each, while the front set was made up of ten parts, it is apparent that the back end of the car would descend 10 ft. while the front was being lowered 8 ft. To correct this condition the derrick car was halted in mid-descent, and the drums feeding the front falls dogged and held at a standstill while the rear of the car was picked up level. An equal number of parts in all three sets of falls would have permitted the car to re-

main horizontal during the descent. The reaving of the tackle, however, was regulated according to the loading.

STRESSES IN RIGGING ANALYSED

Of the total load of 79 tons, 31 tons were carried by the front falls. The rear sets of falls carried 24 tons each. The hoisting rope used had a working load of 5.8 tons. When the car was suspended at a standstill, each part of the front falls carried a load of 3.1 tons, and each part of the rear falls a load of 3 tons. Each part was then stressed to approximately 50 per cent of its working load. Additional cable stresses were introduced during the descent of the car by jarring due to the cable slipping on itself as it left the drum. While this occurred but twice, it produced visible drops each time, and caused temporary increases of stress of 100 per cent from impact. Also, the load-distribution on the parts of falls in action is materially different from the load-distribution of the same at rest. Tackle at rest has the load equally divided between each of the various parts. The stresses in a tackle in action pass from a maximum in one part to a minimum in another. In the present case the load was being lowered. Therefore, the standing part, clamped to the becket and farthest from the drum, had the maximum stress. This condition is due to the retarding effect of friction of the sheaves in the blocks, and to the work required in bending the steel rope around the sheaves. The determination of the amount of increased stress in the standing part over that in the leadline was a matter of estimate, since up to the present nothing on the subject has been published. For the conditions of rigging under consideration the estimate of the increase of stress in the standing part of the forward set of falls was placed at 40 per cent over the stress in the same at rest. Adding, then, to the three-ton stress of the standing part at rest, the impact increase of 100 per cent and the second increase of 40 per cent, there results a maximum stress of 7.2 tons. This was the maximum cable stress in the rigging. It exceeded the working stress by 1.4 tons. This encroachment on the factor of safety, however, was of short duration, and could hardly have been serious.

The gallows-frames used were made up of 12 x 12-in. posts and legs, with 12 x 16-in. caps. After lowering the car, the boom was lowered from the same frame work.

The method of lowering the car was devised by Albert Lucius, and the work was done under the direction of F. B. McEwen of the Lucius Engineering Company of Pittsburgh, erectors for the general contractors, the E. E. Smith Contracting Company of New York City.

High Duty Obtained from Small Booster Pumps

Turbo-Centrifugal Pumps in a Large Central Station Economically Replace Plunger Pumps in Isolated Station

TWO newly installed booster pumps in the Roseland Avenue station, Chicago, exceeded the required duty under test by 8.95 and 5.97 per cent. The pumps boost water to supply the high levels in Washington Heights under a varying suction pressure of from 50 to 60 lb. The pumps replace plunger pumps in a small isolated station and do not require additional labor for their operation. The minimum head of 62 ft. and the maximum head of 85 ft. are the amounts that the suction head has to be boosted, representing the work required. The units are 14-in. Worthington special horizontal turbo-centrifugal pumps direct connected to 115-hp., 2750-r.p.m. Kerr Economy steam turbines. The pumps are of the single-stage, double-suction, screw-impeller type having volute casing. The turbines are of the multi-stage and impulse type with parallel steam flow in the direction of the turbine shaft. The first stage nozzles discharge steam onto the buckets of the first stage wheel, after which further expansion takes place through the second stage nozzles and buckets, and so on through the turbine.

The conditions of the duty guarantee required the accurate determination of the quantity of water pumped, the total head, and the steam consumption, together with a determination of its quality and initial pressure. Each pumping unit was subjected to a separate test of twelve hours' duration.

TESTS DIVIDED INTO RUNS

Each test was divided into runs, one of 4 hours at as near the guaranteed capacity as possible, and four other runs of 2 hours each at capacities above and below the guaranteed capacity, so selected as to give points on a characteristic curve distributed over as great a range as operation conditions would permit. In the case of the west pump, two 1-hr. runs were made in place of one 2-hr. run, in order to get another point on the characteristic curve.

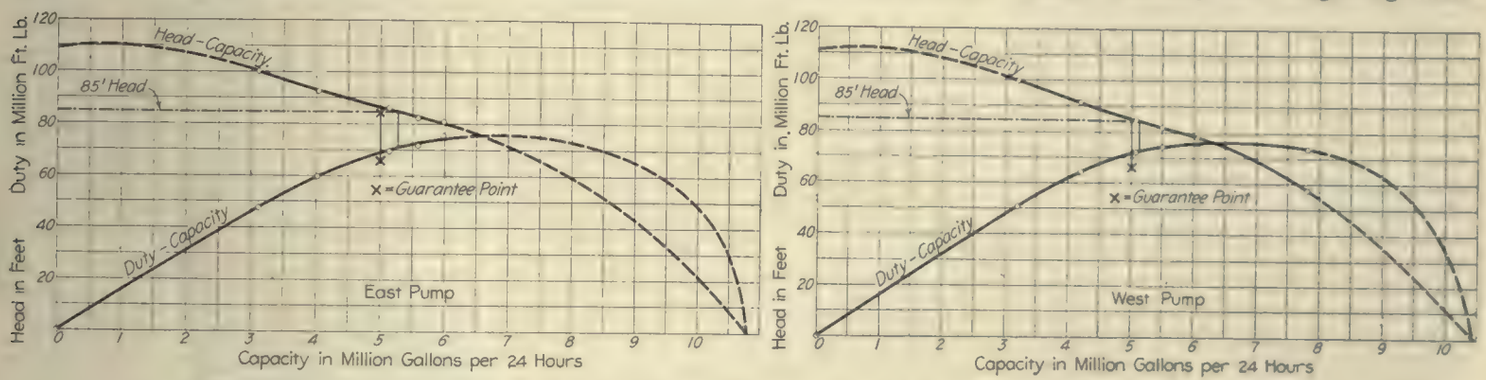
From the characteristic curves and corresponding curves of duty, the capacities and duties at the test head of 85 ft. were obtained. In order to vary the capacity and maintain the same constant during each run, the discharge piping system was isolated from the Washington Heights high-pressure system and the water returned to the low-pressure system through cross-over valves controlling the rate of flow. A pitometer was installed about 1 mile west of the station at a point convenient to the valves mentioned which were manipulated as necessary to get the desired rate of flow as indicated by the pitometer.

The above method of regulating the capacity permitted very constant rates of flow to be maintained, and the temporary isolation of the discharge from the service lines gave the desirable freedom from surges otherwise present.

During the tests the Fisher governor, ordinarily maintaining a constant discharge pressure, was disconnected as otherwise constant conditions of speed, capacity, and head, could not have been maintained.

MEASURING QUANTITY PUMPED

As the suction pressure of the booster pumps was fixed by its maintenance in the low-pressure distributing system of the city, and did not come within the range of 50 to 60 lb., no attempt was made to keep the discharge pressure of the booster pumps at 200 ft. as specified. The quantity of water pumped during the tests was measured by a 30-in. Venturi meter which, with its mercury manometer and combined indicating, recording and integrating instru-



CHARACTERISTIC AND DUTY CURVES FOR THE BOOSTER PUMPS OF THE ROSELAND AVENUE STATION IN CHICAGO

ment, is a part of the permanent equipment of the pumping station. Since the amount of water discharged from each pump was considerably below the normal capacity of the meter the mercury manometer furnished with the meter showed only about 1 in. of deflection at rated capacity of each pump. In order to obtain more legible readings, a temporary inverted water manometer, giving 12.58 times as much deflection as the mercury manometer, was employed for determining the rates of discharge that were used in computing the duty.

Inasmuch as the suction pressure is subject to pulsations due to the low pressure pumps which would cause corresponding pulsations to be set up in both the suction and discharge mercury columns if connected independently thereby causing difficulty in reading, it was decided by the experts conducting the test to lead the suction and discharge connections to a common mercury U-tube, thereby neutralizing the pulsations.

CONCLUSIONS

The test of the west pump, when pumping against the specified head of 85 ft. showed an official duty of 73,000,000 ft.-lb. per 1000 lb. of steam corrected to an initial pressure of 170 lb. gage and 98 per cent dryness and a capacity of 5,120,000 gal. per 24 hours, thereby exceeding the guaranteed performance of 8.95 per cent in duty and 2.40 per cent in capacity.

The east pump under similar conditions showed a duty of 71,000,000 ft.-lb. and a capacity of 5,280,000 gal. per 24 hours, thereby exceeding the guaranteed perform-

ance by 5.97 per cent in duty and 5.60 per cent in capacity.

The tests were carried out by W. A. Nelson, representing the city, by R. W. Allerton, representing W. A. Pope, contractor, and by C. J. Bacon. The pumps were installed under the general direction of John Ericson, city engineer, and H. S. Baker, assistant city engineer. Henry W. Allen is mechanical engineer of the water department in charge of pumping stations.

British Engineers Advised as to Uniform Charges

Institution of Civil Engineers Formulates General Policy to Govern Fees for Professional Services

CHARGES for professional engineering services in Great Britain, involving design and superintendence of construction, ordinarily amount to 5 per cent of the cost of the work, but the diversity of conditions involved in different undertakings makes impossible any rigid standard. Nevertheless the Institution of Civil Engineers, through its council, has endeavored to put into effect a plan whereby its members will adopt a more or less uniform policy as to charges. To this end it has issued a statement, the substance of which is given below:

In the case of undertakings where the services rendered by the engineer are large relatively to the extent and cost of the work, or in the case of undertakings involving a considerable amount of intricate and detail work, the commission of 5 per cent may be increased. On the other hand, in the case of exceptionally large undertakings, the commission may be reduced by agreement.

The preparation of bills of quantities, payments to resident engineers and inspectors, and also personal traveling expenses are matters for arrangement, depending upon the nature of the work and the circumstances under which it is carried out, and may be included or not included in the engineer's remuneration according to the extent and difficulty of the works and the amount of detail work involved in the preparation of the plans, drawings, specifications and bills of quantities, and also the amount of superintendence by the engineer's staff necessitated by the character of the work.

Where the works are designed in sufficient detail to enable a contract for their execution to be made or to enable the local government board to hold an inquiry into the propriety of allowing an authority to borrow money for the purposes of the works, but where the carrying out of such works is deferred indefinitely or abandoned, the fee for services up to this stage is one-half of the ordinary commission.

The council is advised that plans and specifications prepared by an engineer belong, as chattels, to the client, after payment of the agreed fees; but the copyright in all original matter contained in such plans and specifications remains vested in the engineer. Neither the client nor any other person is entitled to multiply copies of plans and specifications so far as the original matter therein contained is concerned, and, further, if such original matter has "an artistic character or design" the plans can only be used for the purpose of the particular structure for which they were prepared by the engineer, or for such other purpose as he may authorize. Original matter in specifications is defined by counsel to be a composition or arrangement of the author—something which has grown up in his mind, and would, if applied to patent rights, be called invention.

Charges for reports on engineering proposals must necessarily be largely dependent upon the extent of the inquiry and research upon which the reports are based, and upon the professional standing of the engineer employed, and cannot, therefore, be dealt with in any scale of fees.

Remuneration for services in preparing for and giving evidence before Parliamentary committees or other tribunals generally consists of a preliminary fee, and a charge per diem while engaged upon the preparatory work and during the hearing of the inquiry, as well as all out-of-pocket expenses.

Handling Hydraulic Fill on Piute Dam

Joseph Jenson, Consulting Engineer, Gives Kinks in Trestle Construction and Unit Costs on 95-Foot Earth Dam in Utah

STEEL-LINED hydraulic flumes on steel trestles and special tangent construction on curves were features in the building of the hydraulic fill earth dam for the Piute irrigation dam on the Sevier River near Marysville, Utah. The manner in which hydraulic nozzles were used for excavation and pumps for removing spoil in the core trench was described in the Engineering Record of Nov. 8, 1913, page 522. A full report on the construction and cost of the project has recently been made to W. D. Beers, State engineer, by Joseph Jenson, consulting engineer. From the report the following information has been taken:

Hydraulicking in the material for this 95-ft. earth dam required four seasons, the work being finally completed in 1914. Before the hydraulicking was started, the upstream toe was built up 53 ft. by hauling with wagons and dump boards in the usual manner from a deposit of fine material lying in a ravine too low to be available for sluicing.

HANGERS HOLD BOX BOTTOMS TO SIDES

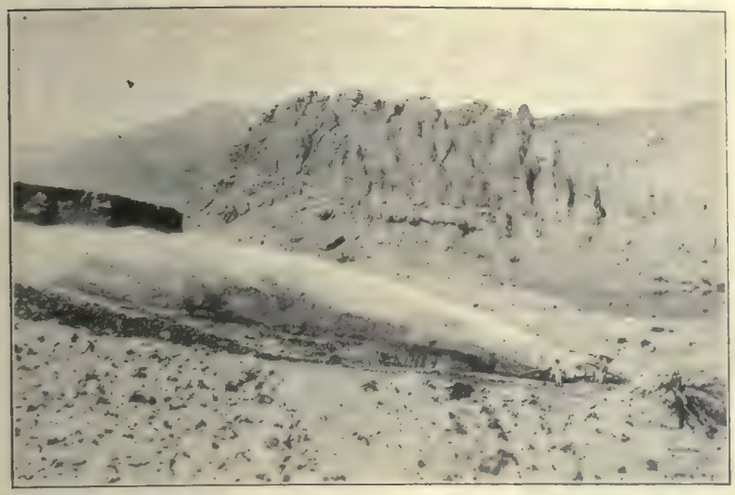
For hydraulicking a high trestle was built extending from near the solid rock ledge on the west with an upgrade of 4 per cent, to the hill on the east side. This first trestle was built midway between the axis of the dam and the downstream toe, that is, 100 ft. inside the dam area. Branch trestles were built laterally from the main line, at first all extending outward. On these trestles was built a steel-lined sluice box 15 in. wide and 12 in. deep inside. The steel lining consisted of a bottom plate ¼ in. x. 15 in. x 14 ft., the side plates were ¼ in. x. 10 in. x 14 ft., all being hard steel containing 0.4 to 0.5 per cent carbon. Special nails with conical heads were used to fit the countersunk plate holes. The box, itself, was made up out of 2 x 12-in. plank. The boxes were made of Oregon fir in 14-ft. lengths. The butt joints between the sections were lapped by steel plates, and so arranged that each section could be handled as a unit without knocking it down. It was soon found that this scheme of sluice box construction was not entirely satisfactory. In spite of very close and heavy nailing, the heavy, rough material rolling on the bottom of the sluice boxes would, in a comparatively short time, pound the bottoms loose from the side boards, which resulted in a large percentage of loss of sluicing water, and a more than proportionate loss of mov-



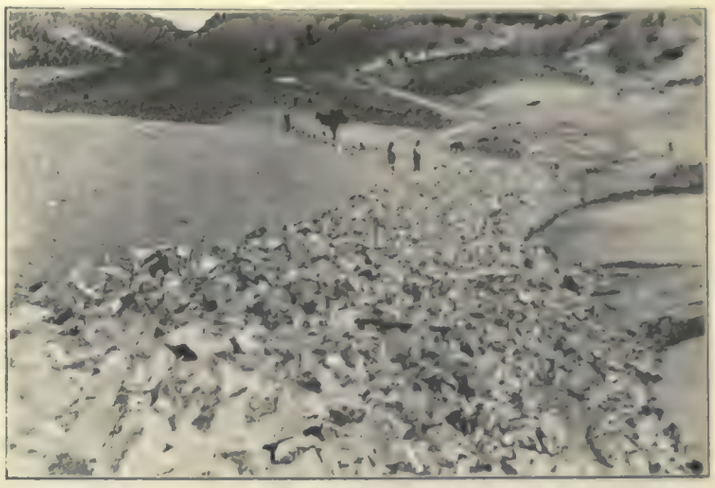
PIUTE HYDRAULIC FILL DAM IS 95 FEET HIGH



BOULDERS IN SLUICE BANK HINDER WORK OF GIANT



GIANTS DO BEST WORK WHEN SET 50 TO 150 FEET FROM BANK



UPSTREAM TOE OF DAM WAS HEAVILY RIPRAPPED WITH STONE

ing power. This condition was overcome by placing a halter on the box.

As the fill proceeded, all side and cross-braces were taken off and only the posts and caps of the trestle remained standing in the fill. After the fill was brought up to the top of the first line of trestles, this sluice box line was laid out along the center of the dam, and the form of trestle and sluice box construction, shown in the drawing, was used. The lifts, by stages, were from 10 to 12 ft. This was found to be more economical both in timber used and time required for construction than the higher and more complicated trestle construction.

HANDLING THE RETAINING BANKS

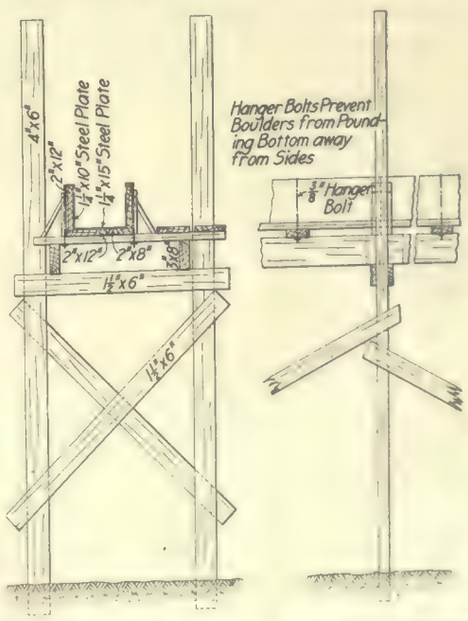
When the sluicing operations began, a bank of dirt had been scraped up along the lower toe of the dam about 6 ft. high. As the fill proceeded this bank was kept built up about 4 ft. higher than the surface of the settling pond. During the first year of sluicing operations, no dry material was hauled in to keep up this bank. The wet material sluiced in was scraped in from the inside of the dam area to form the lower slope. As already stated, a high bank had already been hauled in forming the upper toe, so that nothing was done during the first season on this slope. The material on the lower toe was so deposited as to form the regular 1 on 2 slope, but as weight was added, the saturated and plastic material forming the dam squashed out so as to make a steeper slope than was contemplated, in the final slope up to the 45 ft. elevation, at the end of the season's run. This added width was taken advantage of later to build the dam up to the 95 ft. elevation instead of to only 90 ft., as originally designed, which step increased the capacity of the reservoir from 78,400 to 92,600 acre-feet.

During the second season, and until the completion of the dam, a heavy dry bank was hauled in along each edge and the regular slope maintained. In September, 1913, all the material available for sluicing on the east side, whence all material up to that time for the fill had been obtained, was exhausted. A deposit of first class material was found to exist just back of the high ledges on the west side. This was obtainable by cutting through several reefs of solid rock, the cuts varying from 5 to 21 ft. in depth, and by building high trestles between. The last 5 ft. of fill forming the crest of the dam was hauled in dry.

The flow of water used for sluicing varied from 4 to 6 cu. ft. per second, depending on the elevation and consequent pressure at the giant nozzle. The giants used were No. 1 Hendy giants with 4-in. diameter nozzle tips. Best results were obtained when the sluice bank was distant from the giant setting from 50 to 150 ft. At nearer settings it was found more difficult to regulate the amount of earth carried down to the sluice flume in such a manner as to utilize the full carrying power of the water, and to keep the sluice boxes from clogging. At greater distances the eroding power of the jet was lessened, and the system, therefore, operated under light load. It was found advantageous to keep a boosting jet near the head of the sluice boxes. This was obtained by attaching a length of 3½-in. fire hose to the pipe line back of the giant, with a fire nozzle attached and fastened immediately over the sluice box, with the jet directed slightly downward and along the direction of the sluice box. This was found particularly efficient in giving the very coarse material a rolling rather than a sliding motion along the sluice box bottom. By this device it was possible to handle rocks weighing 50 to 60 lb. without difficulty.

TANGENTS BETTER THAN A SMOOTH CURVE

Another item which proved rather interesting was the manner in which turns in the sluice box should be made. It was at first assumed that these turns ought to consist of long smooth curves. These, however, gave considerable trouble, even when the grade was made somewhat steeper, by the rougher material slowing up and thereby causing the boxes to clog. Careful observation showed that this was due to the added friction caused by pressure against the side of the box. It was also observed that when this rough material was allowed to impinge against a vertical surface set obliquely to the direction of the motion that the larger rocks would rebound from the surface, then return to the side with a series of decreasing impacts and velocities before they finally assumed their altered direction with an accelerating motion. When the turns were made with a series of tangents 14 ft. long, each one making an angle of about 150 deg., i. e., a 30 deg. offset with the preceding, the clogging tendencies were almost entirely overcome.



HANGER BOLTS PREVENT BOULDERS FROM POUNDING BOTTOM AWAY FROM SIDES

The sluice banks on the east side contained a large amount of rocks and boulders. These would eventually cover the borrow pit area to such an extent that it would become impossible to penetrate the surface with the stream from the giant. It was, therefore, necessary to keep a force of men and teams at work clearing away these rocks and boulders which were dumped on the downstream slope of the dam and were later hand laid, thus forming a very efficient riprap and serving as a protection of this slope against weather erosion as well as from the tramping of sheep and cattle.

COSTS

The 257,600 cu. yd. of hydraulic fill cost 20.9 cents per yard, estimating 100 per cent depreciation of plant. This figure would be reduced to 18.7 cents if a depreciation of 50 per cent were charged off. The dry fill of 186,500 cu. yd. cost 47.8 cents per yard. Riprap on the upstream slope, 8540 cu. yd., cost $1.905 per yard, and the 3177 cu. yd. on the downstream slope cost 72.9 cents per yard. The total cost of the dam and contiguous work was $322,311.96. The unit cost of the total fill, 444,100 cu. yd., based on 50 per cent depreciation, amounted to 30.9 cents per yard.

SAND-CLAY ROAD MAINTENANCE in Colorado costs from $50 to $100 per mile per year. The same figures hold for gravel roads. Dirt roads cost $20 per mile per year.



NEW PIER GRILLAGE PLACED—CANTILEVER ERECTION OF 525-FT. SPAN

New stringers used on falsework to support floor and temporary anchor span by blocking.

Longest Riveted Simple Trusses Erected Around Old Bridge by Cantilever Method

Half Spans from Back Channel Used as Anchors for 525-Foot Main Channel Spans During Reconstruction of Ohio Connecting Bridge

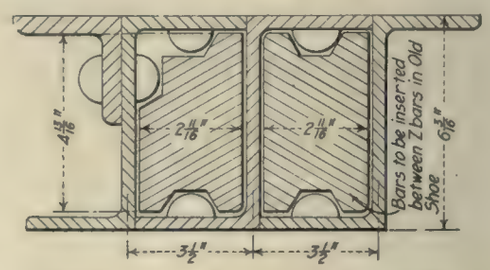
THE ERECTION of the longest riveted simple truss span in the country has recently been completed at Pittsburgh by a unique cantilever method involving the use of anchor arms temporarily adapted from another span used in the same crossing. The Ohio connecting bridge of the Pennsylvania Lines West of Pittsburgh over the Ohio River, an old single-track structure about 4545 ft. long, built in 1890, is being replaced by a modern double-track bridge supported on the same piers, which were originally built wide enough for this purpose. The original single-track crossing consisted of one span 525 ft. long over the main channel and a series of eleven deck truss spans, each about 175 ft. long, across Brunot's Island, and a 416-ft. span over the back channel. The long steel single-track viaduct approaches consist of about 636 ft. on a curve and 660 ft. on tangent and one 140-ft. deck truss span at one end and two deck truss spans at the other end.

The reconstruction work included the replacement, practically without interruption of traffic, of the old 525-ft. single-track span, which was about 65 ft. deep at the center, by the double-track riveted truss span shown in the accompanying elevation, about 91 ft. deep at the center and 50 ft. at the ends. The cantilever erection of this span was accomplished by using half trusses from the 416-ft. back-channel span. The approach viaduct was also changed to a double-track structure, and the grade decreased from 0.56 per cent to 0.3 per cent. The 140-ft. span shown by dash lines on the elevation was originally designed to support two tracks, one track to Pittsburgh branching off from the main line. It was first shifted to one side while the falsework and anchor span were used for erecting the 525-ft. span, and then replaced in its new position on the piers.

The deck trusses across Brunot's Island are replaced on the same piers by double-track triangular trusses of the type shown on the drawing. The old 416-ft. pin-connected Pettit trusses, which were 60 ft. deep, are being replaced by the riveted trusses shown in the diagram, 75 ft. deep at the center, after they have served as temporary anchor spans as above mentioned. The deck truss spans at the end, shown by dash lines, have been retained in the new structure, as they originally supported two tracks.

CUTTING DOWN OLD PIERS UNDER TRAFFIC

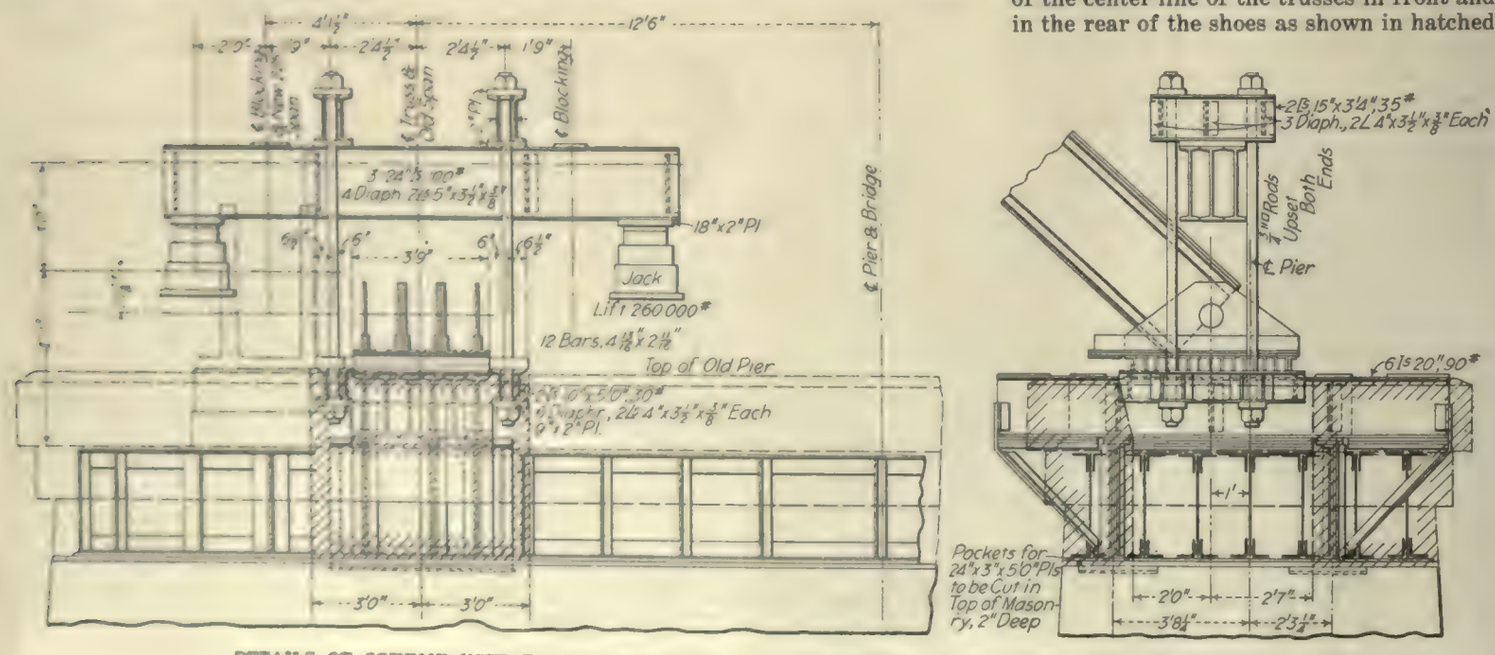
One of the most difficult problems was the removal of several courses of the masonry from the tops of the old piers to allow the placing of seven heavy plate girders acting as pier grillages for the purpose of distributing the heavy loads over the piers and making room for much deeper and heavier shoes than were used in the old structure.



SPECIAL BARS TO SUPPORT OLD SHOES

One of the accompanying drawings shows the details of the scheme adopted. Since traffic had to be maintained, it was necessary to use a method which would insure a minimum interruption of trains while the old trusses were suspended. This was accomplished by the use of outside temporary girder supports resting on the piers and carrying six 20-in. I-beams as shown.

The order of operations for both the piers was the same. First, the old shoe plates, grillage and rollers were burned through with a flame, to reduce the width of the old shoes to 3 ft. 9 in. The masonry of the pier was then removed for 3 ft. on each side of the center line of the trusses in front and in the rear of the shoes as shown in hatched



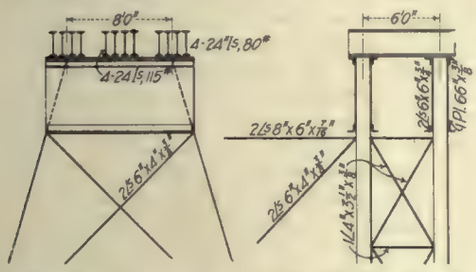
DETAILS OF SCHEME USED TO CUT DOWN TOP OF MASONRY PIER AND PLACE GIRDER GRILLAGE



OHIO CONNECTING BRIDGE OF THE PENNSYLVANIA LINES WEST OF PITTSBURGH—BRUNOT'S ISLAND IN CENTER

outline to allow the two above-mentioned supporting girders to be placed. These girders rest on the 24 x 3-in. bearing plates grouted into the pier as noted. Enough of the top course of masonry was taken out to permit the double-channel beam to be inserted. These 10-in. channel beams support twelve special bars, 4 13/16 by 2 11/16 in. in size, inserted in the old Z-bar grillage. The details of these bars, which are shaped to clear the rivet heads, are given on the accompanying large-scale drawing.

Jacking girders of three 24-in. I-beams 14 ft. long were then placed and the 3¼-in. square rods erected. Traffic was stopped and the span load lifted from the shoe by the two jacks. The top course of masonry



MATERIAL AT TOP OF TEMPORARY BENTS

immediately under the shoe was removed and six 20-in. I-beams were placed under it and on top of the supporting girders, and connected to the brackets as shown. The span was then jacked down until the shoes rested on these beams and girders, when traffic was allowed to pass.

The jacks and jacking girders were then removed, and the masonry was cut down to the final level below the bottom of the new pier girders. A concrete fill was poured on top of the old course of masonry to give the proper level for the plates under the pier girders. The four inside pier girders were placed in position, one at a time, and the I-beams supporting the shoes were wedged up from the pier girders until the load was released from the outside girders and brackets, which were then removed. The remainder of the pier girders were then set. During the removal of the masonry courses, the end stringers and the temporary girders for the adjacent span were followed up with blocking to take care of the traffic.

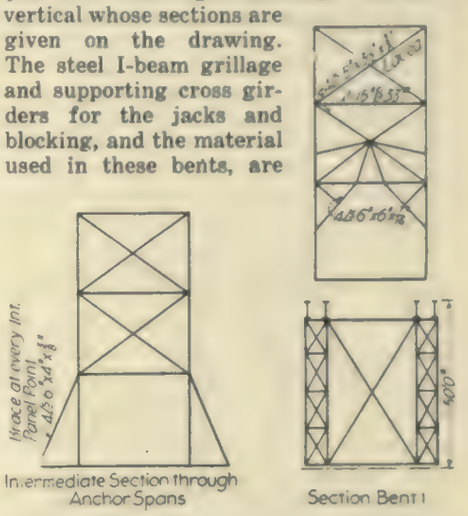
The general scheme used in the erection of the heavy main channel span is illustrated. Partly owing to the necessity for preserving a clear channel during erection and hence for adopting the cantilever method, and partly owing to the desire for rigidity and stiffness in the new structure, these trusses were designed of stiff members with riveted joints, making them the longest of this type yet constructed. The novel method of providing anchor spans by the use of the new material for the 416-ft. back-channel span with the addition of a few members to support platforms weighted down by stringers, floorbeams and steel rails to develop the desired resistance to uplift is indicated by the drawing.

The anchor spans were erected on timber falsework, using the special supporting girders for the end shoes as shown in one of the accompanying photographs, which also indicates the method of blocking up under the panel points and under the floor on the new steel stringers, temporarily used below the trusses. The new main trusses were erected by the large two-boom travelers shown, the material being delivered on barges in the river below and hoisted into place. The heavy built-up erection ties of twelve plates and two angles carried the traveler loads on the blocking seen in the photograph, being supported by temporary posts above the piers. The erection and wind stresses in some of the members of the anchor spans are very high; in the end post the total is 3,000,000 lb., which is about the same as its total normal design stress.

BRACING AND STEEL BENTS

The lower chords of the anchor trusses could not be braced laterally on the inside without interference with the floor and traffic. The outside horizontal triangular trusses shown in the plan view were therefore designed to keep these chords in line. Diagonal braces to the vertical posts, as shown in the cross-section, were used outside of the anchor trusses to support the horizontal trusses. As the new 416-ft. trusses used in these anchor spans are spaced 32 ft. apart, and the main 525-ft. trusses are 33 ft. 3 in. apart, the upper diagonal bracing and the swaybracing had to be lengthened for this erection condition by the addition of ½-in. lateral plates.

The cross-sections at the steel erection bents 1 and 2 given on the drawing indicate the erection material which had to be supplied for bracing at these points, all members being of the stiff latticed type. It is seen that one bent was placed six panels from the left main pier, while the other is seven panels from the right main pier to avoid interference with the existing piers shown. The only added truss members required were the right end diagonal and half vertical whose sections are given on the drawing. The steel I-beam grillage and supporting cross girders for the jacks and blocking, and the material used in these bents, are

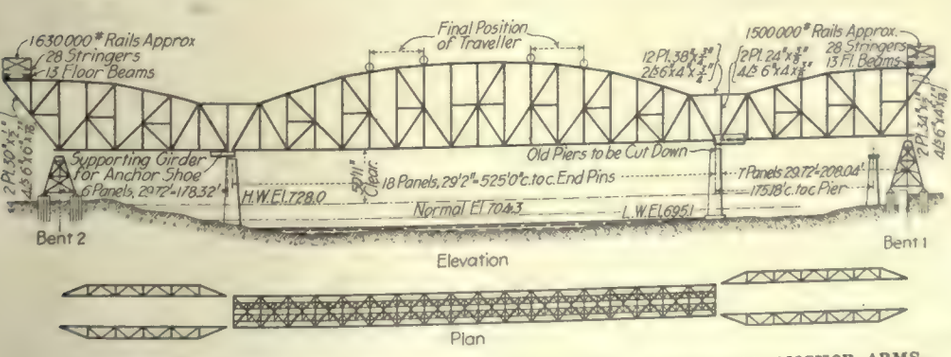


SECTIONS SHOWING BRACING OF TEMPORARY ANCHOR SPAN AND BENT 1

shown on the details. The bents were supported on piles capped by steel I-beam grillages.

RAPID PLACING OF NEW FLOOR

The new floor system was riveted up on barges and raised into a position below the old floor and temporarily supported by long hanger plates below the main panel points. One of the photographs shows a panel being raised from the barge into position below the truss. The drawing on page 84 shows



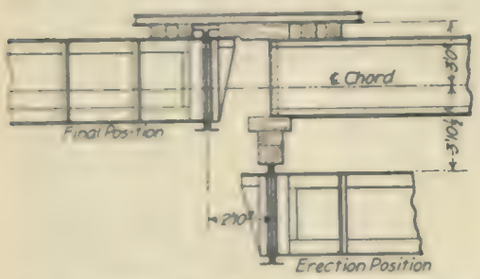
CANTILEVER ERECTION OF 525-FT. SPAN, USING 416-FT. TRUSSES AS ANCHOR ARMS



RAISING PANEL OF FLOOR FROM BARGE

that two floorbeams are used at each panel point, and indicates the scheme adopted for the erection of the floor. It is seen that the new floor panels were first erected in a position about 6 ft. below their final position in the completed bridge. This was for the purpose of supporting the old trusses and floor before their removal. The old trusses were spaced 25 ft. apart and the new trusses 33 ft. 3 in. apart, the two interior lines of new stringers being the same distance apart as the two lines of old stringers. It was therefore possible to block up the old stringers on the new. Since the old trusses consisted of twenty panels at 26 ft. 1¾ in. each the panel points did not match, and it was necessary to cut the old stringers to permit raising the new panels one at a time.

After the new floor system was placed in its temporary position, the old trusses and floor were blocked up and the trusses razed. The old stringers were cut through with a flame above one of the new floorbeams in each panel and four stiffener angles and temporary cross frames riveted to them. This was done throughout the span before any of the panels of the new floor system were raised to their final position. The taking out of the old floor system and raising



TWO FLOORBEAMS AT EACH PANEL POINT

The new floor was first erected about 6 ft. below the final location.

the new to its final position was accomplished without holding up trains more than an average of 40 min. per panel. The record time for one panel was 28 min., and the two center panels, which were changed in one operation, required one hour.

The placing of the pier girders on the piers at the ends of the main 525-ft. span was started Aug. 31, 1914, and finished on Sept. 18. Erection of steelwork of the anchor spans was begun Sept. 23 and completed by Jan. 11, 1915. The erection of the main trusses then proceeded until they were finally swung on Feb. 18 by jacking up from the end steel bents sufficiently to make the center connections and relieve the erection ties. Blocking up the old span on the floor of the new started Feb. 20 and between Feb. 26 and March 18 the old span was completely razed. The new 525-ft. span was practically completed by March 19, 1915.

These truss spans were fabricated and erected by the American Bridge Company for the Pennsylvania Lines West of Pittsburgh. J. C. Bland is engineer of bridges of the railroad. Richard Khuen, Jr., and later L. H. Shoemaker, were in charge of the construction, and H. A. Green, division erection manager of the American Bridge Company, was in charge of erection.

STREET TRAFFIC ACCIDENTS in San Francisco have been reduced, it is stated, since the adoption of "safety crossings" indicated by white bands painted on the pavement, and upon which automobiles are not allowed to encroach until the traffic policeman signals by whistle.

Literature

For the Civil Engineer and Contractor

New Publications

REPORT OF THE BUREAU OF BUILDINGS OF THE BOROUGH OF MANHATTAN, NEW YORK. 1914. Cloth; 7 x 10 in.; 99 pages, illustrated.

EXPERIENCES IN EFFICIENCY. By Benjamin A. Franklin. Cloth, 5¼ x 7½ in.; 167 pages. New York, the Engineering Magazine Company. $1 net.

ONE YEAR OF CITY MANAGEMENT IN DAYTON, OHIO. By Lent D. Upson, director. Paper; 6 x 9 in.; 7 pages. Dayton, Ohio, Bureau of Municipal Research.

THE BUDGET OF THE CITY OF DAYTON, 1915. As Enacted by the City Commission. Paper; 6 x 9 in.; 52 pages. Dayton, Ohio, Bureau of Municipal Research.

SANITATION IN PANAMA. By William Crawford Gorgas, surgeon general, U. S. Army. Cloth; 6 x 9 in.; 298 pages, illustrated. New York, D. Appleton & Company. $2 net.

STANDARD CLASSIFICATION OF ACCOUNTS for the use of the city and county of Denver. By Thomas R. Lill. Paper; 6 x 9 in.; 57 pages. Denver, the Colorado Taxpayers' Protective League.

SOME TYPES OF CITY GOVERNMENT. By Lent D. Upson, director, Bureau of Municipal Research of Dayton. Paper; 6 x 9 in.; 8 pages, diagrams. Dayton, Ohio, Bureau of Municipal Research.

YEAR BOOK OF THE DEPARTMENT OF AGRICULTURE FOR 1914. Cloth, 6 x 9 in., 715 pages, illustrated. Of principal interest to the engineer are the chapters on "State Management of Public Roads," by J. E. Pennybacker, and "The Preparation of Fertilizer from Municipal Waste," by J. W. Turrentine.

U. S. GEOLOGICAL SURVEY—Washington, D. C. Superintendent of Documents. Paper; 6 x 9 in. WATER SUPPLY PAPER 340K—Stream Gaging Stations and Publication Relating to Water Resources, 1885-1913. Part XI, Pacific Coast Basins in California. Compiled by R. D. Wood. 15 pages, with list of other reports. WATER SUPPLY PAPER 358—Water Resources of the Rio Grande Basin, 1888-1913. By Robert Fallansbee and H. J. Dean. 725 pages, illustrated.

ROAD MODELS—Bulletin 220, U. S. Department of Agriculture. Prepared by the Office of Public Roads, Logan Waller Page, director. Paper, 6 x 8 in.; 24 pages; illustrated. Washington, Government Printing Office. This bulletin contains illustrations and descriptions of the models in miniature of roads, bridges and culverts and of road machinery exhibited by the Office of Public Roads at expositions and fairs and on railroads. Methods of construction are discussed.

LIMESTONE ROAD MATERIALS OF WISCONSIN. By W. O. Hotchkiss and Edward Steidtmann. Bulletin 34, Economic Series 16. Cloth; 7 x 10 in.; 136 pages; illustrated; tables and diagrams. Madison, Wis., State Printing Office. A publication intended to aid in conserving highway expenditures for stone, which, delivered on the road, usually represents two-thirds or more of the total cost of the road. The report contains chapters on the general characteristics of Wisconsin road materials and descriptions of tests on hardness, toughness, per cent of wear, specific gravity and weight per cubic foot, and absorption.

BULLETIN OF THE PACIFIC HIGHWAY ASSOCIATION issued June 8, 1915. Paper; 6 x 9 in.; 20 pages. H. L. Bowlby, executive offices, Chamber of Commerce Building, Portland, Ore. Official announcement of the incorporation of the Pacific Highway Association on April 19, 1915, the objects of the organization and its rules and by-laws. Ten pages are devoted to a report on the conditions of the Pacific Highway between Seattle, Wash., and San Francisco, Cal., the report having been written by Mr. Bowlby, ex-State highway engineer of Oregon, as a record of a round trip made by automobile over this highway during the month of May. The report notes distances and running time between all stops and comments in detail on the conditions of the road along the entire route.

Books Reviewed

Manual del Ingeniero

Spanish translation of Trautwine's Engineer's Pocket Book. Translator; Alberto Smith, professor of the Central University of Caracas. Cloth, 4½ x 7 in.; 1273 pages; illustrated; diagrams and tables. Paris, France, Garnier Brothers. On sale by A. Smith, 45 Broadway, New York. $5 net.

Only one who has mingled with engineers of the Spanish-speaking countries sufficiently long to have obtained a fair understanding of their ways of thinking and of the language they speak can thoroughly appreciate the value and the difficulties of the translation this author has made. Of recent years a great many of these Spanish-speaking engineers have obtained their education in the United States and have done most of their important work either under the supervision of or in association with Americans, yet the American engineer does not occupy the pre-eminent position he should in the southern countries nor are his standards of practice generally adopted there. The reason is simple—the Spanish-speaking engineer has had to look to others, particularly to the French, to obtain his technical information in a form that is understandable to him and, naturally, with this information he has adopted their methods of procedure. This work will do much to combat this tendency and will serve a very useful purpose. The Spanish is excellent and practical, not the stilted, precise attempt at the pure *castellano* that is, unfortunately, generally the case in American translations of this class, but the easy, understandable Spanish that those for whom it is written speak. It will doubtless be heartily welcomed, particularly by those Spanish-speaking engineers who have been educated in this country. It is complete even to the use of the metric system in tables and formulas, instead of the English system of feet and inches or decimals. In contents the work is identical with the original, so that a reader who understands either of the languages may lay the original and the translation side by side and easily acquaint himself with the terminology of the other.

Irrigation in America

Author, A. D. Lewis, M.A., circle engineer, Irrigation Department, Union of South Africa. Cloth; 8½ x 11 in.; 258 pages, illustrated. Pretoria, South Africa, Government Printing and Stationery Office.

The object of the author in writing this book is avowedly to spread information of the rapid strides made in America in recent years in the irrigation of arid lands and methods of inducing settlement thereon. Many valuable examples of engineering methods in constructing high masonry and earthen dams are given, and even more valuable lessons are derived from the results of settlement. Seventeen of the more modern irrigation schemes which the author inspected during a trip in the United States in 1913 are described and well illustrated. Each scheme is described separately in all of its aspects and with special reference to the results achieved in settlement, which is, as the author states, the measure of the success of irrigation and depends on conditions which vary with each scheme. Failures have resulted not so much from bad engineering as from lack of proper understanding of agricultural conditions and the human element involved.

A uniform method of description has been followed so that information on any one aspect of irrigation can be conveniently found and brought together. One chapter describes some useful crop experiments in Utah and two chapters are de-

voted to settlement and irrigation law. The book describes the following schemes of development: Bellefourche in South Dakota, Huntley in Montana, Shoshone in Wyoming, Boise in Idaho, Minidoka and Twin Falls on Snake River, Oakley and Salmon River, Truckee-Carson in Nevada, Modesto-Turlock, Fresno, Redlands, Imperial Valley and Yuma in California, Salt River in Arizona, and the Rio Grande in New Mexico. A summary of important points and general comparisons closes the volume.

Guidebook of the Western United States

Part B. The Overland Route from Missouri River to the Pacific Coast, with a side trip to Yellowstone Park. Authors, Willis T. Lee, Ralph W. Stone, Hoyt S. Gale, and others. U. S. Geological Survey Bulletin 612. Paper; 6 x 9 in.; 244 pages, illustrated. Washington, D. C., Superintendent of Documents, $1.

Every traveler may now enjoy the luxury of being "personally conducted" on a transcontinental journey which will afford an intimate acquaintance with the country through which he passes. This volume, the first of four which will appear in rapid succession, covers the route from the Missouri River to the Pacific Coast. The next to come, that covering the Northern Pacific route, so closely identified with the Lewis and Clark Expedition of 1803-1806, will be published in a few days; and those describing the Santa Fé route and the Shasta and Coast route will follow soon.

The value of these guides to travelers interested in this country cannot be measured. The route is followed from station to station, and human history, geologic history, agricultural and mining values—everything, in short, that can make a car-window landscape vital and interesting is succinctly and rapidly sketched.

The guide books are full of items of general interest that will answer such questions as the average intelligent traveler is continually asking. In a broad way the story of the West is a unit, and the aim of this description of the western United States is to meet the needs of the American citizen who desires to understand what he sees. In the preparation of the book on the overland route much information already in the possession of the Geological Survey has been utilized, but to supplement this material three geologists last year made a field examination of the entire route, where special topographic surveys for the accompanying maps were made by survey engineers. The route is covered by a series of twenty-nine complete and accurate maps, which are so arranged that the reader can unfold them one by one and keep each map in view while he is reading the text relating to the portion of the route it represents.

The book is, as a whole, distinctly popular in character, and is freely illustrated with half-tone plates of some of the most striking views and objects to be seen on the journey and with pictures of prehistoric animals that inhabited the West in ages past, when Nebraska and Colorado, for instance, were huge swamps frequented by strange beasts whose fossil remains are now found in the rocks formed from the sand and the mud of the ancient swamps, which have since been elevated thousands of feet.

The book should prove a distinct boon to any traveler, and its low price makes it available to all.

Letters to the Editor

Comment on matters of interest to engineers and contractors will be welcomed

Florida's Sand-Asphalt Roads

SIR: Your journal is quoted in this State to discourage sand-asphalt construction of our roads. Please do the facts the justice to state with regard to the Eustis sand-asphalt road (see Engineering Record, May 15) that it was laid upon sand, the old clay road having been excavated to permit of proper grading for the sand-asphalt surfacing. That is the fact, and this is the third summer the road has been in continual use and not a cent's expense has been involved in its repair, and it is as good as new.

Secondly, there is no truth in your information that an inch of sand is kept spread upon this sand-asphalt road to protect it from sun or traffic. Connected with this road is a stretch of sand-asphalt surfacing laid upon 15 in. of fresh sand in and around the New Ocklawoha Hotel garages. This surfacing is perfect, and requires a heavy adz to separate it.

We have just let a contract for 20 miles of this sand-asphalt, 15 ft. wide, on 4 in. of new clay, the total cost being 66 2/3 cents per square yard. Do you suppose we will waste our bond money on a material that has for 3 years in our midst withstood not only the destructive agencies of heavy traffic, but the malicious misrepresentations of this cheapest, best and most practical road material in this sandy, "hot" State of Florida?

CLARENCE E. WOODS,
Editor "Eustis Lake Region."
Eustis, Florida.

Propriety of Government Surveys for Local Use

SIR: The engineering profession must accept as a fact the existence of serious competition by certain Government bureaus. This conclusion was not only arrived at through consideration of statements by the director of the U. S. Geological Survey appearing in the Engineering Record of May 29, page 682, but rests also on additional evidence which has been supplied the writer by engineers in various parts of the country—engineers of high standing—many of them members of the American Society of Civil Engineers. These cases cover the various fields of hydroelectric, drainage, road and water supply engineering. One correspondent, referring to a recent case in which the Government is now doing drainage work, and for which he did missionary work, says:

"This is by no means the first instance in which I have suffered. If I read the signs of the times correctly, it will be impossible for an engineer to remain in general practice of engineering, in a very few years, if the Government bureaus continue to expand."

The director of the Geological Survey, in his statement in the Engineering Record, makes no denial that his bureau entered into competition with fourteen private engineers or engineering firms in the Harris County, Texas, case, but attempts to justify that action on the ground of mutual benefits to both the Federal Government and to the locality. The statements that the Harris County co-operation follows precedents in form, and is a mutual benefit to both contracting parties, are open to challenge. With regard to the various co-operative surveys named by the director as being precedents for the Harris County work, the official records of his bureau show that without exception these surveys were *State* co-operation undertakings, legally provided for under some act of a State legislature, and participated in by some *State* official. The Harris County survey is not in any sense a State undertaking, nor are the county officials who are party to the contract under which the Geological Survey is doing the work in any sense *State* officials.

In the year 1910 a pamphlet was issued by the U. S. Geological Survey exploiting its policy of co-operation. In that pamphlet it is stated (page 4) that "The object of the State in these agreements was to direct and promote topographic mapping, geologic investigations, etc." Further on we find that "the director is willing to enter into co-operative agreements only when the interests of the country as a whole will be benefited." The Harris County survey is distinctly a local survey for purely local benefits, and the engineers of the country will do well to note that it is the *first* (in so far as I can learn) purely local survey to be made by the U. S. Geological Survey in direct co-operation with distinctly local officials. It is also of pertinent interest to note that the request for co-operation did not originate with the county officials, but with the local Chamber of Commerce. This is but another departure from a so-called precedent in co-operative work, the director claiming that in all cases the request for co-operative surveys must originate with the co-operating officials. In another case it is known that co-operation was sought by the U. S. Geological Survey officials.

In challenging the director's statement that the Harris County work is one of mutual benefit it is necessary to investigate only along the lines of his published statement that the policy of co-operative surveys was undertaken in order to *hasten* the progress of making the topographic map of the United States, a project now about 40 per cent complete. It is admitted that State co-operative surveys which have to do with the production of maps on standard scale do hasten that progress and are of mutual benefit to State and nation, but the same is not true of co-operation on detail surveys of a scale materially larger than the standard. By departing from its legal function of making foundation topographic surveys and undertaking detail surveys for local engineering projects the Geological Survey not only does not hasten the progress on the topographic map of the United States, but that progress is thereby materially retarded.

The employment of a Government topographer on detail surveys naturally takes him away from his legitimate work, and as a consequence he maps in a given season only about one-fifth as much territory as he would ordinarily have done. This ratio

of one-fifth is believed to be near the truth in the Harris County survey, though if we accept the statement that the contributed sum of $5,000 is not a bonus, but represents the Geological Survey's interest in that county survey, a survey costing some $90,000, the ratio should be one-seventeenth. It being an established fact, recognized by the director of the Geological Survey, that the time and cost of topographic mapping is almost in direct proportion to the scale of the mapping, the sum of $85,000 must represent the additional work to be done in Harris County by Government topographers due to the special needs of that county. In any event, it must be clear that the U. S. Geological Survey would have to undertake only a few surveys similar to the Harris County survey to tie up a good part of its trained force on detail surveys, thus materially decreasing the area which it annually maps, and thereby postponing for an indefinitely long period the completion of the topographic map of the United States, one of the prime duties with which Congress has charged this bureau.

The benefit of this survey to the county must also be questioned. The director states that the Geological Survey is not engaged in the making of drainage plans. Will a survey planned by them meet the needs of Harris County as well as a survey planned by engineers of long experience in drainage and detail topographic work? It was the opinion of well known drainage engineers interested in the Harris County work that the clause in the county engineer's specifications on which bids were made, calling for 1-ft. contours on the topographic map, was a proper one and was needed for the making of complete drainage plans for the county. This is also in accordance with the best engineering practice. Despite this, the Geological Survey proposes to make a map with the 5-ft. contours located and the intermediate contours sketched (?) in. This map is to be used as a basis for complete drainage report and plans for Harris County, a very level section of coastal plain, with large prairie areas having slopes of as little as 2 ft. to the mile. Only time and the completion of work based on plans so prepared can tell if the county has really made a start at securing successful and adequate drainage, but the engineering public will, I believe, admit that the odds are against any such plans being successful.

In his letter to the Engineering Record the director of the Geological Survey enunciates the following policy for his bureau: ". . . This Survey feels not only warranted but compelled by a broad public policy, in large undertakings similar to the mapping of Harris County, an area of nearly 1700 sq. miles, to give all the assistance possible when so large a public interest is involved."

It is desired to call the attention of the engineers of the country to this stated policy. It concerns every one of them, if not now, then at some not far distant day. If the U. S. Geological Survey is to be permitted to establish a policy whereby it can undertake detail surveys at will—if, after thirty years of co-operation with the various States it now feels authorized to undertake county work—what assurance have we that precinct and small drainage surveys may not also be undertaken by this bureau? The trend is surely in that direction, and *now* is the accepted time to voice a protest and to insist on proper remedial action. In the hands of the engineer lies the remedy—publicity and legislation. To each and every engineer—to you who have felt the weight of Government competition and to you who have yet to feel it—I say seek publicity and legislation. Publish in your journals and before your societies what you know of this matter, and in this way a competent collection of facts will be gathered and an honest public opinion developed, and when the proper time comes legislative action will be assured compelling attention and fair and complete remedial measures.

W. N. BROWN,
Of Brown & Clarkson,
Civil and Mining Engineers.
Washington, D. C.

New Theory of Cast-Iron Water Main Breaks

SIR: I have read with much interest the editorial in the Engineering Record of May 8, page 574, under the heading of "New Theory of Water Main Breaks." They invite suggestions as to the best way of laying cast-iron water mains, especially sizes from 12 in. upward, so that there would be no maintenance expense or broken mains caused by settling, expansion, contraction, or radius extension. The latter might be caused from internal pressure that would increase the curvature of the pipe line if laid without bends.

In order to take care of a certain amount of expansion which we had theoretically estimated for a 12-in. line crossing a river and supported on the brackets of a concrete bridge, we cut out ⅛-in. cloth-inserted sheet-rubber rings and placed them between the shoulder of the socket and the spigot end of the pipe. This we estimated would crush if the pipe increased in length any, whereas the regular allowable expansion is taken care of when the pipe shortens by the compression of the jute which is usually put in the joint in advance of the lead. We used this method because the pipe had to be laid upon very short notice, and we did not have time to purchase an expansion joint, which we understand would have overcome any theoretical as well as practical troubles from expansion on this line.

On work where the mains are laid around a curve or deflected from a straight line in any direction without using bends, we have always been afraid to lay the joints off a straight line if the taper of the lead which is run into the joint would be more than ⅜ in. per foot, which is really too much for any size pipe under 12 in. Our reason for this is that if there is any material amount of taper the lead has a tendency to slip or work out of the socket or bell of the pipe, especially on the outside of the curve. The inner side, being compressed at the mouth of the bell, forms what might be termed an inverted wedge and would have a tendency to drive it toward the bottom of the bell or shoulder of the socket.

An offhand conclusion on the Cincinnati trouble, noted on page 588 of your issue of May 8, is that the spigot end of the pipe must have been bearing very heavily against the side of the socket or bell, this pressure having been increased probably by reason of the excavation which, made near the pipe line, caused it to shift slightly. It is possible, also, that the radius of the pipe was increased by internal water pressure, or probably some water hammer caused from irregular action of the pumping station, or perhaps from some very unusual opening and closing of valves or hydrants.

We understand very readily that the manufacturer contends that cast-iron water pipes are designed to withstand certain heads or pressure, and when laid in a trench they are to be in a straight line, and if any irregularity is to be made in this line exceeding 6 to 9 deg. per 100 ft., they advise the use of bends. On the other hand, we believe that large pipe of any size from 12 in. upward should be carefully laid. Where there is a reasonably firm earth the trench should be carefully dug so as to provide a proper bearing for at least two-thirds of the length of a 12-ft. pipe. Then there should be some good tamping of the earth on each side of the pipe.

We do not believe in the method that is very often pursued in digging a trench to irregular depths and then just blocking up the pipe at each end and dragging the loose earth back into the trench with a scraper. This method invariably allows the pipe to settle down before the earth really becomes set and packed around the under side of the pipe. Where the earth is not sufficiently firm to offer good support for the pipe, we would have it set on piling or concrete piers.

While these methods may bring about high first construction cost we believe that eventually they will be a justifiable expenditure in waterworks construction.

H. J. WEIERHAUSER,
San Antonio Water Supply Company.
San Antonio, Texas.

Remodeling Old Septic Tanks

SIR: I note with interest the editorial "Remodeling of Old Septic Tanks" in your issue of June 12, page 731, and would say that last year I constructed an Imhoff tank at the inlet end of an old so-called "septic tank" which had been pretty much of a failure. There was built also a covered nitrification bed provided with aerators, with the result that a most excellent effluent is being obtained and one without odor whatever, either at the discharge from the old tank or at the discharge from the nitrification bed. The plant referred to is now in successful operation at the Crippled Children's Home near Elgin, Ill., serving seventy-five persons.

The sewage treatment and plant at the Cook County Infirmary, Oak Forest, formerly comprised two so-called "septic tanks" and four contact beds. This plant was remodeled by adding a detritus chamber, an Imhoff tank, hypochlorite plant and four additional contact beds with the result that, so far as physical examination goes, a most excellent effluent is being obtained and has completely set aside the nuisance which the former plant was producing along the farms through which the sewage flows in an open ditch for several miles and empties into the Little Calumet River. This plant is designed to care for 5000 people. The hypo plant in this case is interposed between the new Imhoff tank and one of the old septic tanks, which is now converted into a settling tank. From this settling tank the discharge is made directly into the control chambers of the contact beds.

BURTON J. ASHLEY,
Consulting Engineer.
Chicago.

LEVEE DISTRICTS in Louisiana number seventeen. All but two of them—the North Bossier and Cat Island districts—are in operation.

HINTS FOR THE CONTRACTOR

Details Which Save Time and Labor on Construction Work

Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

[*Contributions to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

Keep Traffic Off Newly Grouted Granite Block Paving

IN HIS REPORT for 1914 R. A. Cairns, city engineer of Waterbury, Conn., emphasizes the importance of excluding traffic from freshly grouted granite block paving. The success of this class of pavement, he states, depends largely on accurate cutting of the blocks, and on thorough grouting. To secure well cut blocks they should be bought direct by the city and inspected at the quarry before shipment. After the street is torn up and the public is impatiently demanding that the work be hastened, there is little opportunity for rejection of blocks which are not quite up to standard. Thorough grouting requires close attention to every detail, and even when properly executed will be a failure unless travel can be absolutely excluded and all disturbances prevented until the cement has become well hardened.

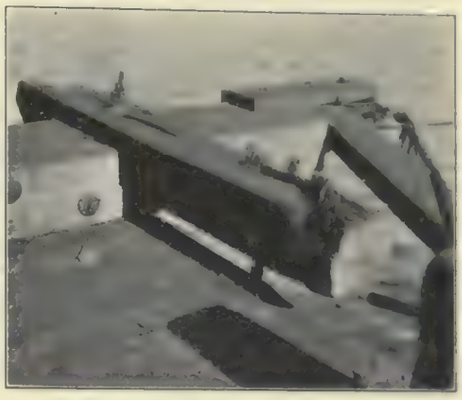
The experience at Waterbury is that this usually requires from two to three weeks, and that when sooner opened to travel the blocks are loosened, the grouting chips out of the joints, and the pavement never can have the smooth surface which is so desirable. There are places in the pavement laid recently where the work was well done, but the grouting was ruined by teamsters deliberately removing the barriers and driving over the work in spite of the protests of inspectors and contractors.

Floating Driver Places Seventy-five Piles a Shift

A FLOATING driver being used on the construction of the Hunt's Point bulkhead in New York City by the Jarrett-Chambers Company, Inc., regularly places from 60 to 75 piles each 8-hour shift. Many of these piles are driven at a 60-deg. angle.



DRIVING PILES AT A 60-DEG. ANGLE



TOGGLE SLIDES OUT TO CATCH LEADS

The driver is of the "moonbeam" type. The leads are pivoted near the top of the ladder, and swing to one side beyond the edge of the hull in driving batter piles. They are secured in this position by a toggle block framed into the moonbeam timbers, and sliding on a bolt through a slot in the timber. The leads are pulled to either side of the boat by lines running to nigger-heads on the hoist. Of course, the hammer is pulled to the top of the leads before they are swung over. A No. 1 Vulcan steam hammer is used, and 40 to 55-ft. piles are driven. The average penetration is 15 ft. in compact sand and gravel. No jet is used.

Large Number of Light Needles Hold 606-Ton Brick Wall

THE brick party wall between Nos. 1128 and 1130 Broadway, near Twenty-eighth Street, New York City, now supported on needles, weighs 606 tons. This is said to be the heaviest load yet underpinned in building the new subways. This wall is 8 ft. thick at the building line and 6 ft. thick at the back of the cut made to underpin it. The building at No. 1128 is seven stories high, and that at No. 1130 is eleven stories high. The street face of the latter building is supported entirely by the two side walls.

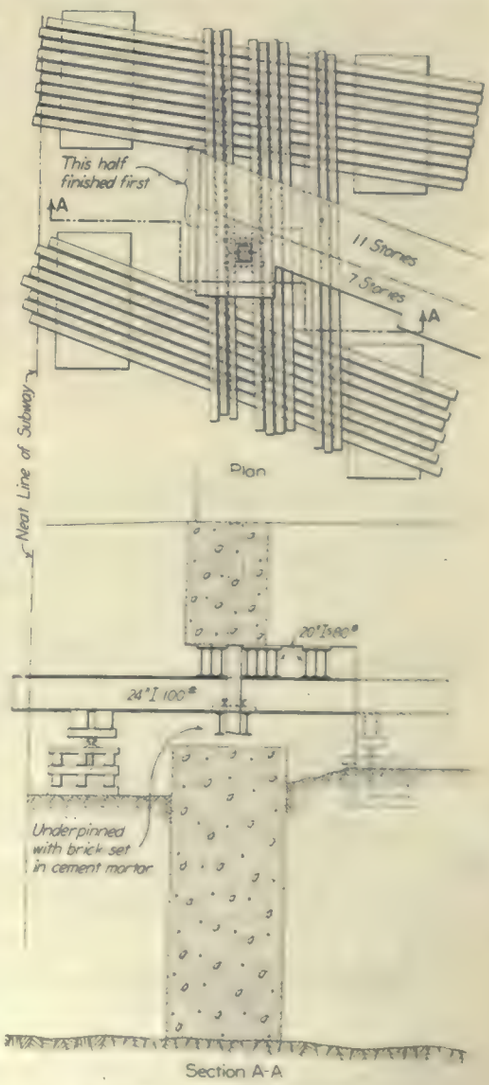
Three sets of needles were run through the wall, the center set being placed first and the side sets later, all supported on two banks of I-beams, one at each end of the mean top needles. These, in turn, rest on stringers of timber or I-beams under which fifty-six 3-in. screw-jacks are set on the four separate timber cribs. These jacks have a combined capacity of 1120 tons. The four main cribs load the soil to 2 tons per square foot. The soil was first tested and found good for 4 tons. The bearing between the top needles and the wall is made of 3-in. plank set in cement mortar.

As soon as the first set of needles was placed through the wall, a strain was taken on the jacks. To tell when the weight of the wall had been lifted, the brick work was tapped with an 8-lb. maul above and below the cut, a difference in the sounds of the blows showing very accurately when the wall had been picked up. The same method showed when it was necessary to take up on the jacks to keep the wall lifted as the holes for the remaining needles were cut.

A small cast column was found in the wall, which did not come up when the wall was raised, and therefore had to be picked sepnrately. What this column carried is not shown on the building plans on file. Three 2-in. pins were run through it, bearing on short I-beams which in turn bear on beams parallel to the upper needles and are supported on cribs on the ground beneath the main bearing needles.

With the wall lifted, the north half of the 7 x 9-ft. underpinning pier was sunk to rock and concreted before sinking the south half. This procedure made a smaller open hole in the ground, and thus minimized the danger to the cribbing from a broken water main or other accident. Wood sheeting was used, being driven by hand to hardpan, as quarters were too close for an air hammer, and under cut and tapped down through the hard pan to rock.

After the pier is concreted it will be built up between the main carrying needles and the upper bearing needles, using brick laid in cement mortar. The joints between this brick work and the old wall will be filled with cement mortar wedged in with slate. When this has set, the wood over one set of bearing needles at a time will be chiseled out, the needle beams withdrawn



NEEDLES SUPPORTED ON I-BEAMS

and the holes they occupied bricked up and wedged. This will be repeated with each set of upper needles. The brick are, of course, laid from the center out, and wedged up a course a time.

The work is being done by the Friestedt Underpinning Company, sub-contractors of the E. E. Smith Contracting Company, for the Public Service Commission, of which Alfred Craven is chief engineer and Robert Ridgway engineer of subway construction. For the commission Charles P. Madden is section engineer, J. O. Shipman, engineer of the first division, and A. J. Mayell, assistant division engineer.

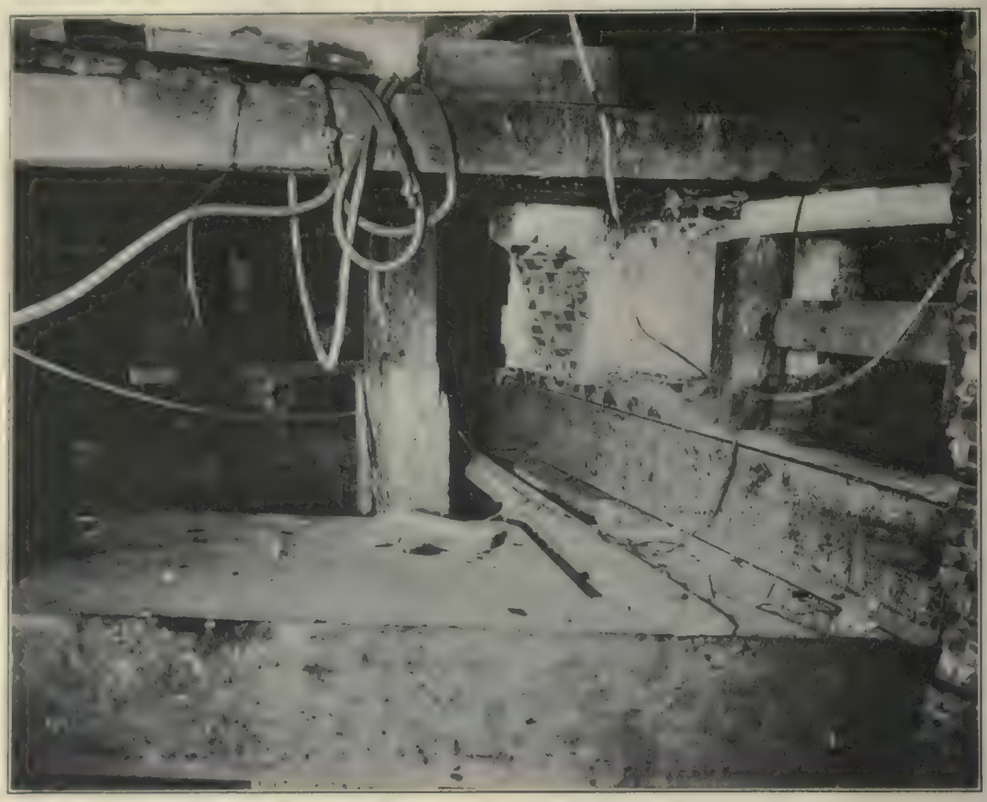
Steel Billets Needle Bridge Shoe in Quarters Too Close for Beams

By T. J. WILKERSON
Division Engineer, Division of Bridges, Pittsburgh

TWO SETS of special steel billets were used to pick up a bridge shoe in Pittsburgh in order to replace the roller nest under it, in which the segmental rollers had turned over. When the north 531-ft. steel span of this structure, the North Side Point bridge, was erected, the segmental rollers were set that they would be in proper position when the entire dead-load was on the span. As the roadway paving and reinforced concrete sidewalk slabs were not in place at the time of the extreme cold weather during the winter of 1913 and 1914, the temperature contraction in addition to the lack of elongation in the bottom chord, due to the paving loads not being in place, caused the rollers to pass the safety point and tip over.

Owing to the crowded condition of the roller shoes on the pier, it became necessary to devise a very compact strong frame for lifting the shoes. The load to be lifted was about 630 tons. The city requested several responsible parties to bid on the work, asking each bidder to submit with his bid a plan showing how he proposed to lift the shoe. The plan submitted by the successful bidder was checked by the writer and found satisfactory, excepting a few minor details which in no way affected its strength, and this plan is shown herewith.

The framing consisted of four 6 x 13 in. special steel billets, two of which passed through between the ribs of the shoe and took bearing on the I-bar heads with an intervening brass plate, while the other two took bearing on the pin ends by means of large square nuts which replaced the regular pin nuts. These four billets were carried by two other special steel billets 10 x 14 in. in size, one placed in front and one at the rear of the shoe. Each of these billets rested directly on two 300-ton jacks. The jacks were carried on two distributing beams, each composed of three 15-in. 60-lb. I-beams, which rested directly on the heavy grillage girders in the pier.



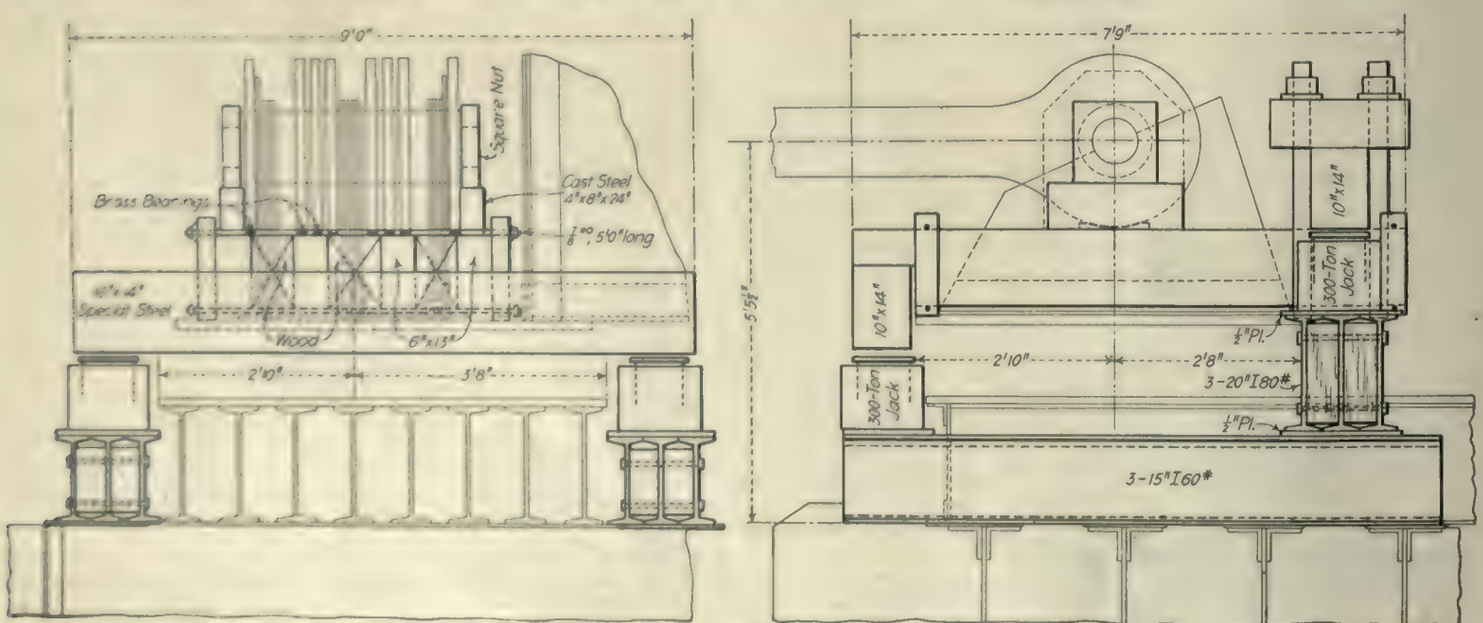
NEEDLES THROUGH PIER REST ON TWO BANKS OF 24-INCH BEAMS

The equipment was placed and a slight load put on the jacks to see that everything was in working order before noon. Work was resumed at 1 p. m., the span raised, the rollers set up and the span lowered on them at 5 o'clock in the afternoon. When the shoe was lifted the top bolts connecting the side-bars to the rollers were found to be sheared off, which necessitated raising and adjusting each roller separately, and caused some delay in the work.

The billets used were of chrome nickel steel, the test of which showed an elastic limit of 68,400 lb. per square inch, and an ultimate tensile strength of 111,600 lb. per square inch.

Each pair of the four 300-ton capacity jacks was connected by an equalizer to one pump. In addition to these jacks, one 125-ton hydraulic jack was placed under the end floor beam to relieve the shoe of the deadload from this beam. The work was executed by the Pittsburgh Construction Company, under the personal direction of their chief engineer and general superintendent, and was done for the Bureau of Engineering of the City of Pittsburgh, N. S. Sprague, superintendent, and directly under the personal supervision of the writer.

WISCONSIN BUILT 1350 MILES OF ROAD in 1914, in 71 counties, at a total cost of $3,929,718.



STEEL BILLETS OF EXTRA STRENGTH REQUIRED TO RAISE BRIDGE SHOE IN CLOSE QUARTERS TO RESET ROLLER NEST

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

Specifications Submitted for Hollow Building Tile

First Meeting of Manufacturers' Association Suggests Building Code Requirements and Discusses Promotion Work

Specifications for hollow building tile, for incorporation in municipal building codes until the American Society for Testing Materials shall draw up specifications for this material, were submitted July 13 at the first semi-annual meeting, in Indianapolis, of the Hollow Building Tile Manufacturers' Association. The specifications were originally reported in May, revised in June, and submitted in final form at the Indianapolis meeting this week. It was voted to publish the specifications with an explanation that they are based on tests and studies of three successive building commissioners in Cleveland and the Osborn Engineering Company of that city. Copies of the specifications may be secured from the secretary of the association, whose address is 824 Engineers Building, Cleveland, Ohio.

The principal requirements of the specifications are as follows: Maximum absorption, 12 per cent; average ultimate crushing strength, 2500 lb. per square inch of net web area tested; maximum permissible load, 200 lb. per square inch of vertical web. Within fire limits the wall thickness must be the same as for brick construction.

The Indianapolis meeting was devoted chiefly to a consideration of the future activities of the society in publicity and promotion work. The principal addresses were made by H. Tolles, of the Chicago Association of Commerce; E. J. Mehren, editor of the Engineering Record, and E. C. Zorn, of the *Brick and Clay Record.*

Construction Commences on Canadian Government Observatory

The contract for the construction of the structure to house the 73-in. reflecting telescope which is being built for the Canadian Government, and which is to be installed at Victoria, B. C., was awarded to the McAlpine, Robertson Company of Vancouver, B. C., on June 12. Preliminary work was at once commenced, and the mountings for the telescope are to be ready by next October. The contract price was $75,000.

The observatory building surmounted by a dome 60 ft. in diameter, will be located at an elevation of 700 ft. above sea level on Little Saanich Mountain near the city. A description of the astronomical equipment appeared in the Engineering Record of June 6, 1914, page 656.

Cincinnati Storm Does Million Dollar Damage

Roofs Blown from Buildings—Church Steeples Fall—Railroad Cars Swept from Tracks by Wind

By J. W. ELLMS
Consulting Engineer, Cincinnati

A severe storm of wind and rain passed over Cincinnati, Ohio, about 9 p. m., July 7. For about half an hour before its full violence broke lightning and thunder gave warning of its approach. The velocity of the wind rapidly increased, reaching a speed of 62 miles an hour in the business district and as high as 50 miles per hour on the hill tops in the residential section. Both of these wind velocities are from the official records of the Weather Bureau at their observation stations. The rainfall amounted to 1.01 in. and of this amount 0.66 in. fell in 9 minutes, commencing at 9.24 p. m. The highest rate of precipitation was 0.55 in. in a period of 5 minutes. The storm occurred in connection with the eastward movement of a low pressure area, which passed from northwestern Iowa on July 7 to northeastern Ohio on July 8.

The loss of life in Cincinnati and vicinity and the damage to property exceeds anything that has ever visited this locality. It is known that 81 persons were killed, and it is



ROOF OF CINCINNATI STORE FALLS INTO STREET



WORKERS REMOVE DEBRIS OF COLLAPSED STRUCTURE



STORM DAMAGE AT EIGHTH AND CUTLER STREETS



MANY BODIES WERE REMOVED FROM THIS WRECKAGE

possible that as many as 50 persons lost their lives, as about a score of persons are missing. It will probably never be known how many people were drowned during the storm. Search for the dead and missing was in progress for 48 hours after the storm had passed. Many people were injured by flying debris and from the caving in of buildings.

It is believed that property losses will amount to over $1,000,000 for Cincinnati and Hamilton County alone. The property losses in the Kentucky cities opposite Cincinnati will reach many thousands of dollars, but no lives were lost, so far as known, although some persons were injured.

Buildings Lose Roofs

The losses in the business district are confined largely to the dropping of signs, and to a heavy loss from broken glass windows. Many houses in the basin of the city were unroofed or badly damaged, and several were demolished. In the collapse of these buildings occurred the greatest loss of life. Two church spires were blown down during the storm in Cincinnati, and one in Covington, Ky., while another in the latter city is so badly damaged that it will have to be taken down.

In the suburban and residence district on the hilltops thousands of shade trees, many of them very large, were either uprooted bodily or broken off by the force of the wind. The damage to crops in the immediate vicinity of Cincinnati is estimated at $500,000, and results from the leveling of the corn, wheat, oats and grass crops, and the destruction of fruit trees.

The steam railroads suffered some losses. Debris which lodged on their tracks occasioned some slight delay in the movement of trains, but this condition was quickly remedied. The Pennsylvania Railroad had a bad accident to one of its trains in the outskirts of the city. One car of the train was blown off the track, pulling another with it. Three men were killed and nineteen injured in the wreck.

The city street car lines were able to give good service by prompt attention to broken wires and poles. The interurban electric car lines were, on the other hand, put temporarily out of business. A line coming in on the western side of the city only suffered a 4-hour interruption of traffic. Practically all of the lines entering the city on the eastern side did not resume service for nearly 36 hours after the storm. The car lines entering the city from the south—that is, from the Kentucky cities—were out of service for 24 hours.

The telephone service of the city and suburbs was crippled in those districts over which the storm passed. The same was true of the electric lighting service both in Cincinnati and in the Kentucky cities opposite Cincinnati.

New York City to Place Largest Municipal Rail Order

Taking advantage of the low prices prevailing in the steel and iron industries, the city of New York, through the Public Service Commission, is going into the market for the largest order of ties, ballast and rails and other track accessories for the new subway and elevated lines of the dual system that has ever been placed by an American municipality.

Some idea of the magnitude of these contracts is obtained by the fact that the orders cover about 35,000 tons of 100-lb. open hearth rail; about 3,000 tons of rolled manganese rail; over 1,000,000 tie plates; about 356,000 cu. yd. of broken stone ballast and about 30,000,000 ft. of ties and timber. The material now about to be purchased, if placed on the New York Central Railroad would be sufficient to lay a continuous single track from the Grand Central Terminal to Utica.

Besides the saving in cost to the city by placing the orders at the prevailing low prices, it is expected that considerable saving will be made in the handling of the material, in that the supply contractor is required to deliver the material directly to the contractors who will lay the track, thus eliminating any necessity for a city store yard. In order to avail itself of this very desirable condition the commission has provided in its forms of contracts that the material be delivered in installments, from time to time, as ordered, for a period of about eighteen months.

The new materials are needed for the track-laying on all lines of the dual system except the Fourth Avenue subway in Brooklyn and the Centre Street Loop subway in Manhattan, which have been already equipped, and the New Utrecht Avenue elevated line in Brooklyn, for which the materials have been ordered. On the new lines of this system, to be owned by the city, there will be approximately 260 miles of single track railroad. In the Fourth Avenue subway and the Centre Street Loop there are approximately 30 miles of single track, and as these tracks have already been laid there remains to be equipped about 230 miles upon other lines. These include the Lexington Avenue, the Seventh Avenue, Broadway, Canal Street, William Street and Nassau Street subways in Manhattan; the Jerome Avenue, the White Plains Road and the Southern Boulevard extensions in The Bronx; the Eastern Parkway, Nostrand Avenue, Flatbush Avenue, Eastern District, New Utrecht Avenue, Gravesend Avenue and Livonia Avenue lines in Brooklyn, the three new tunnel lines under the East River, the Astoria and Corona elevated lines and the Queensboro subway extensions in Queens.

Texas Paper Appreciates Engineer

In commenting in very favorable language upon the report rendered by E. E. Sands, city engineer, of Houston, Texas, on the development of the ship canal and Houston Harbor, the *Houston Chronicle* had the following to say regarding the engineer:

"This city is entering upon a great epoch. For the moment its destiny is in the hands of engineers—more particularly its own engineer. And right here let it be remarked how important the engineer is becoming, and how little recognition his services have received. He is the man who does things..... He is the man with whose work we come in contact on every avenue of life, and upon whose skill and cunning rests in large measure the growth and prosperity of this country.

"If somebody writes a trashy book or paints a smutty picture, we rave, call it art, and vote to put a new statute in the hall of fame, but the engineer we still consider as rather commonplace, rather tiresome and prosaic."

"Lord Baltimore" Makes Dramatic Test of City's Sewage Plant

Calvin W. Hendrick, chief engineer of the Baltimore Sewerage Commission, has such implicit confidence in the efficiency of the settling tanks and sprinkling filters which comprise the Back River sewage treatment plant that he always makes a particular effort to convince visitors that the effluent from the works is adequately purified by the process. A moving picture concern recently made plans for a feature film showing the return of Lord Baltimore to the city which bears his name. The idea was to have His Lordship tour the city as it is to-day and express his amazement at the changes which time has wrought in the way of tall buildings and monumental civic works.

A trip to the sewage treatment plant was arranged and "Lord Baltimore," in all the splendor of grease paint and Colonial costume, was conducted by Mr. Hendrick from one end of the works to the other, while the moving picture operator reeled off hundreds of feet of film. The climax of the film was arranged to show "Lord Baltimore" collect a glassful of the effluent and drink it as proof of the harmless nature of the purified sewage. The actor apparently thought that when he had secured his sample of the effluent the picture machine would be stopped long enough to allow him to substitute a glass of real water. In fact, he tried to do so, but Mr. Hendrick insisted that there be no "fake" about the picture and refused to allow the reel to be finished unless the sewage treatment plant were put to an actual test. It took a long time to convince "Lord Baltimore" that the educational value of such an act would be worth while, but Mr. Hendrick stood his ground and finally the glassful of effluent was gulped down while the picture operator "filmed" His Lordship in this act of martyrdom to the cause of sanitary engineering.

Personal Notes

B. H. Klyce has been appointed city engineer of Miami, Fla.

G. H. Yocco has been appointed city engineer of Los Gatos, Cal.

S. L. Tolman has been appointed a junior assistant on the engineering forces of the New York State Public Service Commission, First District.

William Wells, irrigation engineer, of Woodland, Cal., has been retained by officials of the proposed Southern Lassen Irrigation District to prepare reports and plans.

C. C. Gillespie, assistant city engineer of Sacramento, Cal., has been appointed chief engineer of the State Sanitary Engineering Bureau by the California State Board of Health.

T. H. Johnson, formerly assistant city engineer of Sioux City, Iowa, has been appointed city engineer, succeeding Fred C. Smith, whose resignation is noted elsewhere in these columns.

The W. J. Sherman Company, consulting engineers, of Toledo, Ohio, have been retained by the city of Menominee, Mich., to prepare detailed cost estimates of a proposed municipal waterworks system.

The Solomon-Norcross Company of Atlanta, Ga., has been appointed consulting engineer for the city of Lexington, Ky., to prepare report and preliminary plans for the proposed sewerage system, prior to a bond issue.

T. W. Norcross, assistant chief engineer of the United States Forest Bureau, Washington, D. C., has been touring the West and inspecting various existing and projected power developments on the Pacific Coast and in other western States.

A. L. Upham, formerly resident engineer with the Massachusetts highway commission, has been appointed paving inspector for the city of Woonsocket, R. I., on the granite block paving in that city, contracts for which were recently awarded.

Henry Floy, consulting engineer of New York City, has been retained by the U. S. Department of the Interior to visit, inspect and report on the plant and property of the Mt. Whitney Power & Electric Company in the Legnoia National Park, Cal.

H. J. Bennet, formerly instructor in mathematics at the Derry (Pa.) High School and previous to that transitman for the Buffalo, Rochester & Pittsburgh Railway at Du Bois, Pa., has been appointed a computer in the Washington (D. C.) office of the Interstate Commerce Commission, Division of Valuation.

Ray D. Armstrong, U. S. transitman, who was associated with I. W. Stoddard, U. S. surveyor, on the survey of railroad grant lands in Arizona during the winter months, has been transferred to Idaho, where he is in charge of a double party engaged in the survey of railroad grant lands in the Clearwater country.

R. C. Limerick, formerly transitman in the engineering department of the Atchison, Topeka & Santa Fé Railway at Los Vegas, N. M., has been appointed assistant engineer to W. G. Kirkpatrick, consulting municipal and hydraulic engineer, of Birmingham, Ala., and

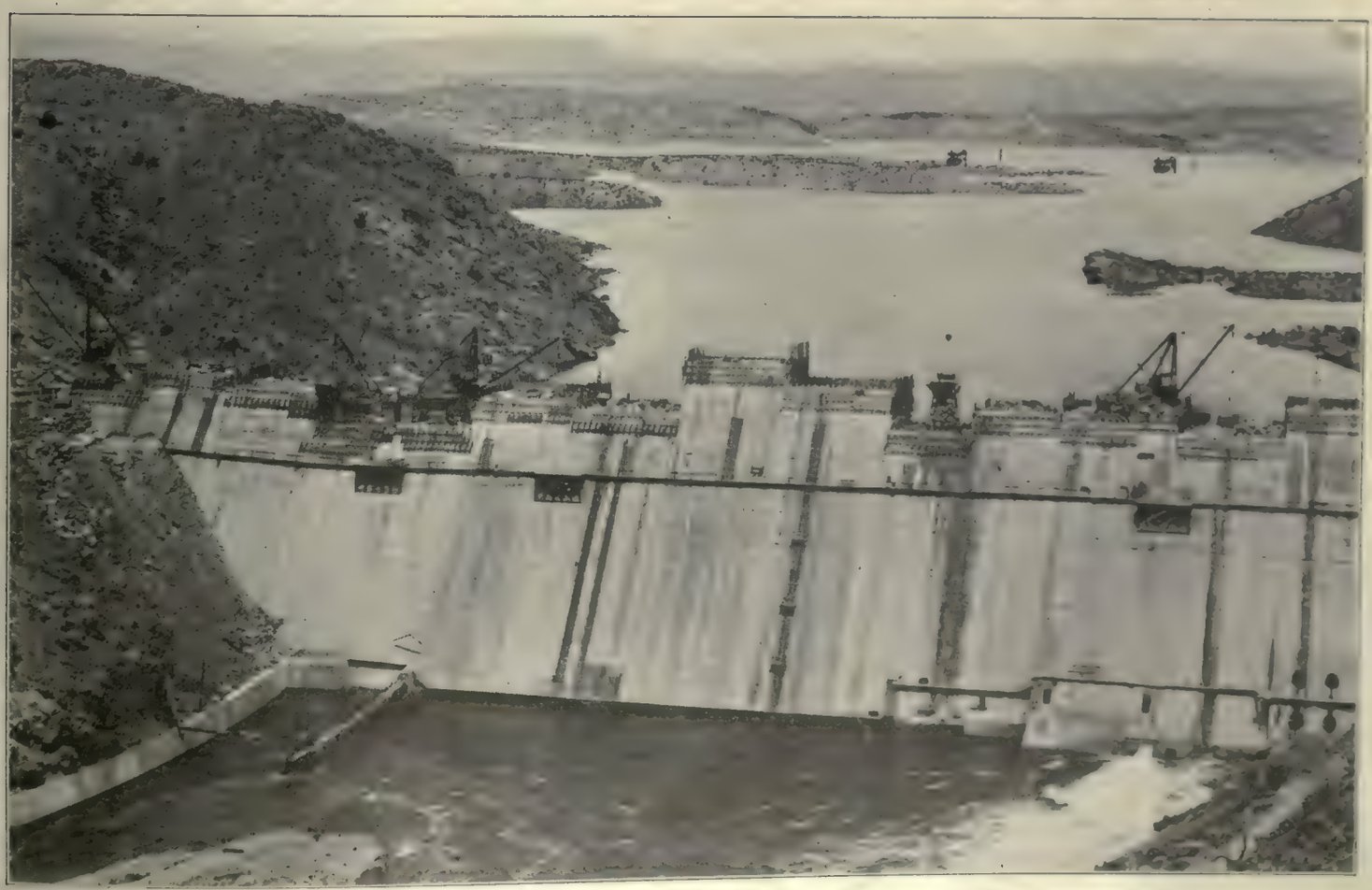
Construction on Elephant Butte Dam for Reclamation Service in New Mexico Nears Completion



DAM DURING EARLY CONSTRUCTION STAGES



STRUCTURE AS IT APPEARED ON APRIL 28, 1915



A RECENT VIEW INDICATING THAT THE CONCRETING WORK IS N EARING THE ELEVATION OF THE FINISHED CREST

is at present in charge of the preliminary work on a sewer system for Cleveland, Tenn.

E. F. Saxton, formerly acting supervising engineer of the permit bureau of the Bureau of Highways of Philadelphia, has been appointed assistant director of wharves, docks and ferries of that city. He is a graduate of Lehigh University and has served on the engineering forces of the New York Central Railroad, the Chicago & Northwestern and the Mexican Central.

J. H. Moore, commissioner of public works and city engineer of Evanston, Ill., tendered his resignation July 1, same to be effective Sept. 1. He has occupied the office continuously for sixteen years. At the meeting of the City Council, July 6, at which the resignation was acted upon, his services were highly commended and it was unanimously voted that he be given a leave of absence of thirty days, with full pay, as a token of appreciation. He retires to accept another position.

H. M. Montgomery, chairman of the Chicago section of the American Society of Mechanical Engineers, has been elected vice-president and director of the Powdered Coal Engineering and Equipment Company of Chicago. The company is preparing plans for the construction and equipment of a large demonstration plant and research laboratory in Chicago, where working demonstrations of the adaptation of powdered coal to all forms of furnace heat production will be carried on under engineering observation.

Allen F. Sherzer, assistant in hydraulic machinery at the University of Michigan, is doing summer work as construction engineer for the National Gas & Electric Company of Detroit, in charge of the construction of a steam electric plant at Bucyrus, Ohio. The plant when completed will contain a 600-kw., 4-stage, General Electric Company turbine and boilers of the Wicks vertical type, equipped with Foster superheaters. It will replace the old gas engine plant now in use. A dam is under construction in the Sandusky River to divert water for condensing purposes.

Fred C. Smith has resigned from the office of city engineer of Sioux City, Iowa, to become consulting engineer for the Philip Carey Company of Cincinnati. His first engineering experience was in the city engineer's office at Sioux City, where he served from 1887 to 1895. He was assistant on the survey of the State line between Nebraska and South Dakota during the two years succeeding, and returned to Sioux City in 1898 as assistant city engineer. He served in the latter office until 1909, when he resigned to become a member of the engineering firm of Smith & Finley. He was appointed city engineer of Sioux Falls in 1911.

Edgar A. Kingsley, consulting engineer, of Temple, Tex., formerly supervising engineer of the Bell County (Tex.) highway system, and previous to that State highway engineer of Arkansas, has been appointed paving engineer of San Antonio, Tex. He was graduated from Purdue University in 1893 and from then until 1904, when he was appointed superintendent of public works of Little Rock, Ark., was engaged principally in railroad work. He entered private practice as consulting engineer in 1911, acting also as consulting engineer for the Pulaski County (Ark.) road division. He was appointed highway engineer of the State in 1913.

Irving C. Brower, division engineer of the Chicago & Alton Railroad at Bloomington, Ill., was named by Mayor Pearsons of Evanston, Ill., as commissioner of public works and city engineer, to succeed J. H. Moore, whose resignation is noted elsewhere in these columns, at the meeting of the City Council held July 6. Mr. Brower was graduated from Cornell University in 1901 and had two years' experience in municipal work in Philadelphia previous to taking up railroad work in 1903. Since then he has been engaged principally in the latter class of work with the Philadelphia, Baltimore & Washington, the Norfolk & Western, William Wharton, Jr., & Company of Philadelphia, the Kansas City, Mexico & Orient, the Mexican International, the Missouri Pacific and the Chicago & Alton.

Isaac W. Geer, formerly superintendent of the Cleveland & Pittsburgh division of the Pennsylvania Lines West of Pittsburgh, has been appointed general superintendent of the Central system, with headquarters at Toledo. He was graduated from Yale University in 1895 and entered railway service as rodman on the Pennsylvania in the fall of that year. In 1898 he was appointed assistant engineer in the maintenance-of-way department of the Erie and Ashtabula division and engineer of maintenance of way in 1900. He attained the grade of superintendent of the Terre Haute & Logansport and the Logansport & Toledo railways in 1904.

Benjamin F. Cresson, Jr., formerly chief engineer of the New Jersey Harbor Commission, was appointed chief engineer of the Board of Commerce and Navigation of the State of New Jersey at its organization meeting, July 1. He received his professional education at Lehigh University and the University of Pennsylvania and served on the engineering forces of the Lehigh Valley Railroad from 1894 to 1897, successively as chainman, rodman, draftsman and instrument man. In 1897 he was appointed transitman on the construction of the Reading subway in Philadelphia and, in 1900, assistant engineer in the office of Jacobs & Davies, consulting engineers, of New York City, on preparation of plans, specifications and estimates for the proposed tunnels for the Long Island Railroad under the East River, New York City. He was appointed first deputy commissioner of docks and ferries of New York City in 1910 and resigned from that position in 1913 to become chief engineer of the New Jersey Harbor Commission.

Joachim G. Giaver, who for the past seventeen years has been chief engineer of structural design and foundations for D. H. Burnham & Company, announces that he has left that concern and opened offices for the practice of consulting engineering at 751 Railway Exchange Building, Chicago, where he intends to specialize in structural design, foundations and building engineering. He is a graduate of the Tecknical College at Trondjheim, Norway. He came to America in 1882. One of his early jobs in the new country, while chief engineer, from 1883 to 1890, of the Shiffler Bridge Company of Pittsburgh, was the iron supporting frame for the Statue of Liberty on Bedloe's Island, New York Harbor. When assistant chief engineer of the World's Columbian Exposition in 1892, he designed the three-hinge arch in the Manufacturers and Liberal Arts Building which is still the largest building arch in the world. Mr. Giaver's latest work has been in connection with the new forty-story Equitable Life Building in New York City.

L. R. Jorgensen, the inventor and patentee of the constant angle multiple radius dam, who has been associated for the past eight years with the engineering firm of F. G. Baum & Company of San Francisco has resigned to engage in a general electric and hydraulic engineering practice, specializing in the design of arch dams, with office in the Chronicle Building, San Francisco. He was graduated from Technikum Mittweida, Germany, in 1900 and, after a few months spent in special studies, engaged as draftsman and calculator on electric railroad systems in that country. He came to the United States in 1901 and served a few months as draftsman with H. G. Layng, consulting engineer, of New York City, after which he entered the employ of the General Electric Company at Schenectady, N. Y. In 1903 he was appointed construction engineer on power plant installations for the Edison Electric Company at Los Angeles, Cal., in which capacity he served until 1905, when he was engaged by the Abner Doble Water Wheel Company of San Francisco. He left this service to accept a position with the California Gas & Electric Corporation on hydro-electric work. He became associated with F. C. Baum & Company in 1907, in which capacity he developed the constant angle multiple radius dam which was used in the design of the Lake Spaulding Dam, described in the Engineering Record, Aug. 9, 1913, page 150.

Henry D. Dewell, formerly connected with Galloway & Markwart, consulting engineers, of San Francisco, and, for the past three years, chief structural engineer of the Panama-Pacific International Exposition, has opened offices in the Holbrook Building, San Francisco, for the practice of civil engineering. He was graduated from the University of California in 1906, and was engaged from then until 1909 with Howard & Galloway, architects and engineers, of San Francisco, as draftsman on steel frames and foundations for various buildings, including four for the Alaska-Yukon-Pacific Exposition, as assistant to J. D. Galloway, on designs and estimates for pipe lines, reservoirs, flumes, power-houses and dams, as head draftsman of the engineering department and resident engineer. In the latter capacity he had charge of the design of steel frame buildings aggregating in cost $3,000,000, and a $350,000, 400-ft. draw-span bridge at Sacramento for the Northern Electric Railway Company. He also served as assistant in general hydroelectric work, including investigations of various power propositions.

Edward F. Vincent, formerly assistant chief engineer of the Colorado & Southern Railway, has been appointed chief engineer with headquarters at Denver. He was graduated from the State University of Iowa in 1884 and entered railway service as draftsman and field assistant on the forces of the Union Pacific in 1886. In 1887 he was appointed engineer of construction on the State Capitol Building at Denver. He occupied this office for about three months, then returned to the Union Pacific. In 1889 he was engaged for a short period with the U. S. Geological Survey, after which he was appointed principal assistant engineer for the Board of Public Works of the city of Denver. He was resident engineer for the Fort Worth & Denver City Railway from 1900 to 1903 and assistant chief engineer of the Wyoming State Railway and its successor, the Chicago & North Western, in 1904. From 1905 to 1906 he was with the Missouri Pacific as assistant engineer on surveys and later as engineer of construction in the general office at St. Louis. He was appointed assistant chief engineer of the Colorado & Southern in 1906.

Obituary Notes

Frank Amherst Bowen, vice-president of the Concannon Engineering Company, San Francisco, died recently at his home at Oakland, Cal.

William L. Criglar of the San Francisco city engineering department died of heart trouble, July 1. For many years Mr. Criglar was superintendent of the Fulton Iron Works of San Francisco, which position he left just after the fire in 1906 to enter the engineering department of the city. He had personal charge of the installation of the high pressure water system and pumping stations and carried much of the responsibility in the construction of the Municipal Street Railway extension for handling the exposition traffic.

Joseph A. Holmes, director of the U. S. Bureau of Mines, died in Denver, Col., July 13. He entered the government service in 1904 when appointed by President Roosevelt to take charge of the U. S. Geological Survey laboratories for the testing of fuels and structural materials at St. Louis and Pittsburgh. Previous to that he was professor of geology at the University of South Carolina and also State geologist of that State. He took a deep interest in the good roads movement in Georgia and was instrumental in the passing of a law by which the counties could have the work of their own convicts for road construction and repairs.

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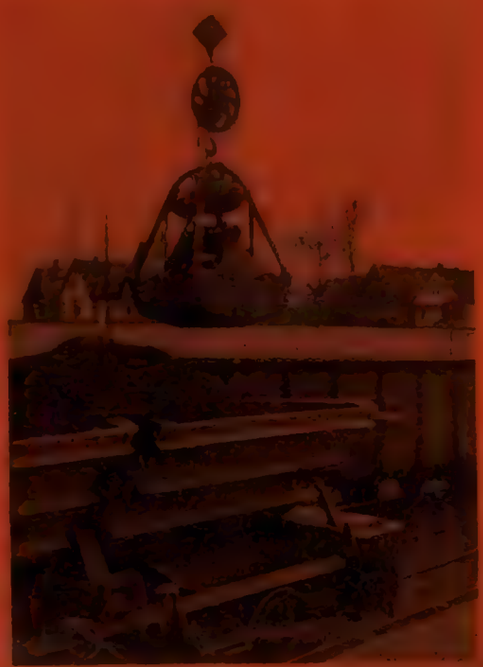
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Leaving the Lawyers Out

ABSENCE of lawyers from a recent conference between city officials of Chicago and the Chicago & Northwestern Railway is said to be accountable primarily for a speedy agreement on the adjustment of costs of the Franklin Street bridge improvements. William R. Morehouse, commissioner of public works, debarred lawyers and called in the president of the road, two aldermen and the engineers of the city and railroad. Forty-five minutes' time only was consumed, truly a good record. The president, backed by his engineers, knew what was a fair bargain, and the adjustment, therefore, came quickly without the quibbling and technical legal persiflage with which the lawyers are wont to clothe negotiations. Many another engineering problem would be well on the way toward solution were the opposing engineers left to agree upon the facts and adjust differences of opinion between themselves instead of intrusting the negotiations to lawyers with little appreciation of the engineering features of the problem.

Signs for Road Detours

ANY one who has had the disagreeable experience of coming to a line of carpenter's horses across a road, indicating that new work or repairs were in progress, without finding any directions as to the combination of roads by which to regain the main highway beyond the construction work, will say a hearty "Amen" to the suggestion that highway engineers make it their business to explain combinations of detour roads clearly. It would not be much of an effort to have a suitable sign painted, showing both by diagram and description just how one should proceed. When there are alternative routes, their length and conditions should be noted. So far as this journal knows very few of the States make it a practice to thus designate detour routes. Unfortunately the guide books usually carried by automobilists give comparatively little information about the side roads, which must, as a rule, be followed to avoid construction work. The highway engineer's business, as this journal sees it, is not only to take care of the technical problems of road work, but, in general, to provide for the movement of traffic as cheaply and as comfortably as is consistent with the financial limitations imposed by the volume and type of traffic and the financial condition of the community. It is, therefore, entirely within his scope—and, in fact, part of his duty—to render the use of the trafficways he builds as satisfactory as possible even from the standpoint of directing those who use the roads. A little thoughtfulness in this connection will go a long way toward making fast friends; and wide popular support is a type of approval which no highway official can afford to ignore.

Smoke Prevention at Boston

CONTROL of smoke emission appears to be making excellent progress at Boston, according to the latest annual report of the Massachusetts Gas and Electric Light Commission. Last year 41,680 recorded observations were made, against 35,424 in 1913, and while the respective numbers of violations noted were 1334 and 1225, the increasing strictness of the inspection no less than the proportional decrease in excessive emissions indicate the success of this supervision. Locomotive stacks at roundhouses appear to be giving the board some concern, but improvements in this direction are anticipated. As an incidental feature of the work, the inspectors of the board have been able to aid fuel users materially in the direction of securing more efficient as well as smokeless combustion, and a gratifying co-operation has been evident among all parties in interest. Economical and smokeless firing go close together, and nothing better indicates the success of thorough inspection, combined with intelligent study of firing conditions, than the fact that only one of the stacks visited by the chief of the department remained an offender at the close of the year. Two fines were imposed by the courts during the year for continued violation; but in the great majority of cases, fuel users are showing themselves heartily anxious to co-operate with the board in this important service.

The Rail Problem

EMPHASIS is again laid on the seriousness of the rail problem by the recent discussion of the subject before the New York Railroad Club, abstracted on page 106 of this issue. The revolutionary proposal of Mr. Lindenthal to experiment with U-shaped double-webbed rails, with a view to their possible adoption, did not meet with the approval of the other engineers who joined in the discussion. Yet it is a deplorable condition, as Mr. Lindenthal pointed out and all agreed, that so essential a part of the railroad structure can fail utterly in service, without warning or seeming provocation, and that eternal vigilance on the part of track men must be depended on to prevent daily disaster. Whether the ultimate solution of the problem will be a radical change in the size and shape of the rail section, its chemistry, the mechanical processes of rolling, or a combination of all these, must be determined by those who are making the problem a life study. Even these experts, however, cannot make much progress without money for experimental purposes. It is unfortunate that the American Railway Association, dissatisfied with results, has withdrawn its financial support from the rail committee of the American Railway Engineering Association. It behooves the members of the latter organization, as well as all others cognizant of the technical seriousness of the situation, to use their influence to the utmost to convince the railroad managers that the rail problem must be solved and that it can only be solved by continued, costly and, to a large extent, unproductive experimentation.

Successful Ice Fighting

LAST WEEK Mr. Allner, superintendent of the Pennsylvania Water & Power Company, detailed the instructions which have been prepared to guide the operators of the Holtwood hydroelectric plant in their endeavors to keep the plant in operation when its continuance in service is threatened by frazil ice. The natural inquiry, following a reading of such instructions, is as to the success of the procedure laid down. This inquiry is answered fully in a second article by Mr. Allner, printed on page 113 of this issue. His frank discussion of the difficulties encountered and of the improvements which will be adopted next year make the article of unusual value to operators—and designers, too—of hydroelectric plants. It must be expected that in working out a procedure such as this some details of standard equipment, put to a new use, will have to be changed. Of special interest are the means for detecting the first sign of frazil. The outstanding feature, however, is that the plant was kept in operation and that the rules promulgated have proved adequate to meet the situation. It must not be gathered from the length of the instructions and the amount of detailed information given by Mr. Allner that frazil ice disturbances are frequent or to be regarded as unusually alarming. Such is not the case. A close reading of the article in this issue shows that frazil ice runs are rather infrequent. The attention given to methods of fighting them is merely an evidence of the care with which the operation of the plant has been worked out and of the determination of the company to leave nothing undone to help attain the desideratum—uninterrupted operation.

Safety First in Bridge Building

IT IS significant to note that in the largest of modern bridge-erection problems, the safety and convenience of the workmen are recognized as essential for efficiency. Attention has already been called to the

riveting stages and pin-driving bridges being used by the American Bridge Company in the erection of the Hell Gate arch. It will be recognized, moreover, from the description of erection methods on the Quebec Bridge, on page 96 of this issue, that the St. Lawrence Bridge Company is second to no erection organization in caring for the safety and efficiency of men engaged in what must always be considered a dangerous class of work. This tendency means that the human factor in construction is beginning to receive some of the attention it deserves. Have a care for the men's safety, free them from the anxiety of working in needlessly exposed places, make it easy for them to get to their work, and convenient for them to do it, and long steps have been taken toward winning their loyalty and arousing pride in their work that cuts both ways. The men earn more for the contractor and more for themselves, the while doing far better work. Aside from this significant tendency, and from the fact that the Quebec Bridge will be the largest ever built, both in length of span and in weight of metal in the main spans, the new erection problems, created largely by the extraordinary distances between pin points in the main trusses, and the skill shown in solving them, for which the engineers connected with the bridge deserve the highest credit, will be of great interest to erection engineers and contractors. There is no doubt that the erection of this bridge is the most novel and interesting feat of its kind attempted since the Forth bridge was completed.

Home Rule in Road Work

"WHAT we want is home rule," oratorically declared an Illinois country politician recently, when, by taking advantage of a small legislative attendance, he blocked the passage of a bill appropriating the unexpended balance in the State road fund for the construction of hard roads until the Senate should pass a bill giving county officials more authority. He and other legislators of his type might do well to heed the experience of other States in which the small local official has been given the chance to express his views or exercise his authority.

Special effort was made in Wisconsin to obtain suggestions from town chairmen as to plans submitted for road work, but the response was extremely meager. The State Highway Commission states that with plans for a total of 2527 miles of roads submitted to the town chairmen, with an urgent request for suggestions and criticisms, not more than fifty such suggestions were received. Most of the town chairmen either do not take the trouble to look over the plans and the road to be improved, or are satisfied with the plans. Some of them prefer to register their objections to the construction after it is finished rather than to make helpful suggestions in time to prevent mistakes.

Kansas has "home rule" in its road building; in fact too much, as is evidenced by the following statement by W. S. Gearhart, State engineer: "The lack of an adequate system of road management largely accounts for the waste of public funds. Kansas has entirely too many inexperienced, incompetent, inefficient road officials. There are four county officials for each of the 105 counties and an average of about seven township road officials for each of the 1492 townships, which makes a total of about 10,900 road officials to superintend the construction and maintenance of 108,500 miles of highways, or about one for each 10 miles of road. One-third this number of officials could manage the work much more economically and much more satisfactorily from every standpoint."

A centralized body like a State highway commission, from its very nature, acts as a clearing house for the collection of information and impressions as to improved methods of doing work and is in a position to take a broad view, to sift the wheat from the chaff and pass on to the local authorities the experiences not only of other counties but also of other States. There must always be some measure of local control of the minor highways. In fact it is well that it should be so, in order that the people may, by direct participation, have a concern for their road work and its cost. But more and more every feature of road work needs to be brought under the advisory influence, at least, of competent engineers. State-aid now plays an important part in the highway activities of counties, with the salutary influence on the county officials due to contact with the State's engineering corps. Likewise some measure of county control, in a technical way, would be of immense benefit to the township highway systems. In too many States the township road supervisors follow their own crude theories of road construction and maintenance, much to the detriment of the resulting highways.

Standards for Drinking Water

NOT long ago the U. S. Treasury Department issued an order prescribing certain standards of purity, or, to be more exact, certain limits of permissible impurity, for drinking water furnished by interstate carriers. These regulations were adopted after long deliberation, but they have already been criticized by water experts as being too drastic, and it must be admitted that there are some public water supplies generally regarded as reasonably safe for general use which will fail to meet the requirements. It is even true that some filtered water supplies cannot always comply with the tests demanded. Doubtless the opposition to these standards will grow as their application becomes wider.

Without attempting to comment on the stringency or leniency of the requirements for bacterial purity, it seems proper to point out the great difficulty inherent in the application of any fixed standard. If one studies the bacteriological analyses of the effluent of any well-designed and well-operated filtration plant it will be evident that the numbers of bacteria present are not uniform. Most of them will hover around a certain median figure, but a few will be higher and occasionally one will be very high, due either to a temporary lapse in the efficiency of the filter or to some error of observation. To fix a standard high enough to include these occasional samples would make it too lax; to fix it too close to the median would be too strict. The proper standard would be one which was not exceeded except by a small percentage of the samples. What should be this percentage, one, or five, or ten, or what figure? At present no one can give an answer based on adequate data.

Having decided upon a standard, it is obvious that it cannot be applied to a single sample of water, because this sample may perchance be one of the erratic ones which fall within the small allowable percentage of excesses. The use of the standard is, therefore, a matter of judgment. No water should be condemned on the results of a single sample. The U. S. Treasury standard, therefore, should not be considered as unfair until the manner in which it is used by the authorities has been shown. It is admittedly a tentative standard and subject to change, and is intended to be applied to drinking water only. Water analysts will do well to study carefully the mathematics of these important bacteriological tests.

Another phase of the subject of standards of purity of water supplies should be considered—the influence of custom or local prejudice. The permissible limit of color in water is sometimes said to be 10 or 15 or 20, or thereabouts. Is this arbitrary or local? In regions where colored waters are common it is well known that consumers do not object to water with a fairly high color, to a color that would not be tolerated in some other region. And in the same way consumers who are accustomed to a very soft water object strenuously to even a slight increase in hardness.

To what extent should the standards for water served by interstate carriers be independent of local standards? To require a soft water in a hard-water country would be so difficult as to be practically impossible and, from the standpoint of a drinking water, unnecessary, so far as local travelers are concerned. Yet to subject cross-country travelers alternately to very hard and very soft waters is undesirable.

The more one studies the subject of standards the more difficult it appears to be. The general principle, however, would seem to be axiomatic, that the wider the geographical application of a standard the more lenient it should be. Possibly the outcome will be the adoption of certain general standards of wide application supplemented by local standards appropriate to local conditions.

The Jitney's Wane and Influence

AS was predicted in this journal early this year the jitney craze seems to have passed its height. The downward trend was clearly noticeable on the Pacific Coast as far back as March, but reports from other sections of the country indicate that the experience is being repeated quite generally. It was contended, in the early days

of the jitney movement less than a year ago, that large companies would enter the field and with their more efficient management prove a formidable competitor to the street railways. This journal conceded that there was a chance for success with the 5-cent conveyance provided the traffic were dense and the haul only about a mile. Later events, however, lead one to wonder whether, even under this favorable condition, there is likely to be a success sufficiently marked to keep capital in the enterprise.

Recently a well organized company in Washington which had been operating six eighteen-passenger buses of good design over a route from Fifteenth Street and Pennsylvania Avenue, a departmental, business and hotel center, to Sixteenth and U Streets, traversing one of the best residential districts of the city, went into the hands of a receiver. The maximum haul for a 5-cent or a six-for-a-quarter fare was 1½ miles. The traffic has amounted to as many as 65,000 passengers a month, but the line could not be made to pay even with the most economical, not to say parsimonious, management. It is simply a case of trying to give a service for less than cost, cost in this case meaning proper allowances not only for operating expenses, but also for interest, depreciation, maintenance and a fair return on the capital. In this case the failure is all the more noteworthy because the enterprise was well backed financially and had a particularly good route. A similar experience, though the conditions were not quite so favorable, was recorded at Los Angeles some months ago when a bus company that had been in operation for three years went into the hands of a receiver.

Nevertheless, during its short but very active career, the jitney has made inroads upon the electric railway industry aside from the hole due to it in the financial account. Street railway operators have been wondering whether it would not be advisable to build a light, small-capacity car, which could be run with one man and at frequent intervals. This suggestion was made editorially in this journal, April 24, page 513. It has very manifest advantages, because of the smaller number of stops (a matter directly related to the passenger-carrying capacity) and the shorter time taken in starting and stopping. Even beyond this proposal, which in itself is a far step, since the tendency in street-railway car design has been toward longer and heavier units, the proposal has been seriously made that the zone system be adopted, offering a lower fare for the short haul traffic in a central business zone. In fact, this method is now being used by the British Columbia Electric Railway. While for its ordinary service a 5-cent fare is charged, a special non-transfer ticket is sold at the rate of eight for 25 cents, good only within the city limits of Vancouver and of Victoria. At Milwaukee the zone system has also been proposed in order that, with a reduced rate, the number of passengers may be increased, thus setting up competition with the jitney and encouraging those to ride who now walk for short distances.

Considering the attention being given to these two possible means of competing with jitney service one need not be surprised at developments in either direction in the near future. The jitney would then not have been without service even to the electric railway industry itself.

Recent Progress in the Development of Power

POWER plant engineering maintains a steady advance toward more efficient installations. Progress is being made along many lines, assumed to be thoroughly standardized by persons not intimately associated with this field of work, as even the casual reader of this year's report of the National Electric Light Association's committee on prime movers will discover. Noteworthy developments are under way in all departments of power production, but at present chief interest attaches to the boiler plant, to auxiliary equipment long considered settled in design, and to refinements in hydraulic measurement.

Improvements in automatic-stoker design have lately been realized which mean more convenient installations from the space standpoint, besides greater assurance of smokeless combustion and exceedingly efficient utilization of fuels of varying grades. The increasing size of boilers justifies many refinements of design and measurement which would hardly be warranted in small plants, and scientific management is coming to be the order of the day in the best boiler rooms. With large units goes a complete equipment of indicating and recording instruments which ultimately will put the "steam end" of an installation on a far higher plane of service than has previously been realized.

By the subdivision of economizers in certain cases, so that each boiler has its own section, feed water temperatures have been increased advantageously and many of the difficulties associated with single economizers of large size eliminated. Exactly how far to push feed-water heating by economizers depends on investment cost, depreciation, operating expense, space requirements and the economy obtained, each case being a separate engineering problem.

With the present tendency to increase the operating pressure of boilers, it is evident that some change of materials away from cast-iron will have to be made in economizer construction, since the feed-line pressure is rapidly approaching 300 lb. per square inch in advanced installations. Special attention must also be given to the study of ash fusibility, to the effect of slags on furnace linings, to improvements in the methods of sampling flue gases for analysis, and to the prevention of damage to boilers from water-treating compounds containing carbonate of soda. It is anticipated that a bulletin on the last topic will soon be issued by the Engineering Experiment Station of the University of Illinois, in view of an investigation of these troubles conducted by Dr. W. F. M. Goss.

The most notable point in steam-turbine development of late is the large size of units which have been installed. No revolutionary changes in design have lately been brought out, but it is notable that the economy of turbines has been improved from 10 to 20 per cent in the past three years, and that the service of even the largest machines is proving most satisfactory. The tendency in station design where the loads suffice is to provide very large units for handling the bulk of the service, carrying the shorter duration peaks on the older and less efficient apparatus. Turbines of 30,000-kw. rating are proving as reliable as much smaller units. The amount of power involved in these immense machines justifies the utmost refinement of design, not only in relation to turbines and generators, but to auxiliaries, and particularly to condensing equipment.

Many high-class steam plants are still equipped with condensing apparatus which on the builders' rating cannot yield a vacuum within 0.5 in. as high as is easily possible with a properly designed condenser, and this loss amounts to hundreds of thousands of dollars annually. Condenser manufacturers are now fortunately prepared to deliver equipment in which the loss of pressure of the steam in passing through the tubes is greatly reduced, and the advances in detailed design in this long-standardized apparatus are most encouraging to the seeker of high over-all plant efficiency. Pumps are also coming to the front in efficiency studies, and at last the immense importance of saving heat units in the station basement is receiving due recognition.

The omission of regular measurements in any important department of power-station service is likely before long to be a thing of the past in all well conducted plants. Whether for tests or routine operation, engineers are no longer content to let large quantities of water, steam, fuel and oil pass through cycles of service without commercially accurate measurements, either of the recording or of the indicating type. The measurement of condenser-tube leakage by an electrical resistance method, the use of chemical analyses to determine the amount of water discharged by wheels in hydroelectric stations, renewed appreciation of the better known means of checking the costly quantities which may be looked upon as the raw material of power production, and the adaptation of special recorders and regulators to draft measurement and control, all indicate the interest prevalent in securing all possible data regarding power production. As for prime movers, the steam turbine and the reciprocating engine are to-day far ahead of the gas engine in development, and the advance of the crude-oil engine appears to be rapid in the small-power field where independent service is required. The steam turbine bids fair to be the most conspicuous prime mover for some years, and with the development of still larger plants for wide-area service, interesting data as to economy of production on a great scale will become available.

New Methods Evolved in Building World's Largest Bridge

Quebec Erection Takes Care of Members Spliced Between Panel Points by "Flying Falsework" and Erection Trusses—Travelers Unique for Size and Central Operating Control

REMARKABLE erection problems solved by unique and effective methods characterize at every turn the greatest bridge-building undertaking that has ever been attempted. The main members of the Quebec Bridge are so huge that most of them have to be spliced between panel points, and these spliced halves further split lengthwise into two and even four parts for shipment and erection. The field work of fitting these parts together was only made possible by shop work of unprecedented accuracy. This splicing also made necessary extraordinary means of support between panel points for many of these members during erection.

A vertical hoisting range of 320 ft. was required of the erection tools, within which height 90-ton members must not only be handled, but handled in pairs, and with speed and accuracy. The size and weight of the trusses made it desirable to have erection progress on both sides of the bridge exactly simultaneous. This condition has been met and turned to positive advantage.

To deliver material to the piers at the river's edge for simultaneous erection of the anchor and channel arms would have required expensive trestles and a double outlay for erection plant. On the other hand, to erect the anchor arms first has required heavy falsework, some of which at least must remain in place until the river work is well along, since the top chords of the bridge are tension members, and the stress in them could not be reversed without going to great expense in their construction.

Order of Erection on Anchor Arm

An account of the erection of the north anchor arm, describing the traveler tracks, and the erection provision for deformation camber, was published in the Engineering Record of Jan. 16, 1915, page 80, and this erection will only be outlined here. The floor system of the north anchor arm was erected on interior falsework consisting of steel towers, topped by heavy plate girders on which the floorbeams of the bridge rest directly. The traveler, running on outside tracks on this floor system, completed this operation from abutment to pier. It then moved back, setting steel columns at each panel point under each truss and erecting the bottom chord as it went. It next traveled back to the pier, the move being made in a few hours, and began erecting each truss to the subpanel points above the floor system. The floorbeams were then connected to the trusses and no longer required the support of the first set of staging. The traveler then erected the upper part of the trusses, completing the span as it moved out for the last time. The falsework that had carried the floor system was removed behind it. This was promptly shipped across the river and re-erected under the south traveler, which had just been set on the south abutment.

The bank on the south side is higher than that under the north anchor arm, but the steel towers of the falsework were designed so that a section unbolted and removed from each left them the proper length for their new positions. This interior falsework weighs 2500 tons, while the outer towers under the panel points, which must remain in place until the river arm is erected, and which alone had to be duplicated for the south anchor arm, weigh but 500 tons.

Tower Travelers Equipped with Cranes and Booms

The 1000-ton travelers that are handling this erection are themselves without precedent in design and operation. The main bridge tracks are left clear for steel delivery, and additional girders outside them carry the traveler tracks. A square steel tower, comparable in height and weight of members to the frame of a fifteen-story building, is surmounted by a trussed bridge, overhanging either side of the tower parallel to the main trusses. On top of this bridge are two traveling cranes, each crane carrying two hoisting machines. These main hoists are mounted back to back on the crane girders, and each operates a ten-part fall. In order to keep the heavy machines as near the center of the bridge as possible, the hoisting cables are led over sheaves mounted on trolleys connected to the main hoists and moving with them. An auxiliary crane is mounted on the outer end of each of the main cranes. These auxiliaries are moved by hand power, but are provided with power hoists. They handle pin-driving cages, riveting platforms and light loads.

In addition a steel boom is mounted half way up each corner post, each boom swinging by power through 270 deg. The four hoists controlling these booms are banked on the operating deck, over the tracks, on the land side of the traveler. Just under them is the transformer house —for the sole power used for all the erection is electricity from neighboring power developments. At the front of the operating deck is a bridge from which all sides of the traveler are visible. Here are the controls for operating the cranes on top. The motors for the hoisting and traveling motions, however, are mounted on the cranes above, and draw current from a multiple-unit contact system on the deck of the top bridge. A man is stationed at each hoist, with a telephone to the control deck at his elbow, in case of accident. An electric elevator connects the crane deck with the operating deck. The traveler is mounted on four trucks provided with eight wheels each, and is moved by two sets of wire-rope falls, to which two of the derrick falls are luffed for pulling.

With this traveler it is possible to set the corresponding members of each cantilever truss at one operation. The members are loaded each on two short, heavy lorry cars, and pushed out to the bridge head side by side on the main tracks by dinkeys. The front crane is spotted, and its trolleys are run in to the sides of the traveler.

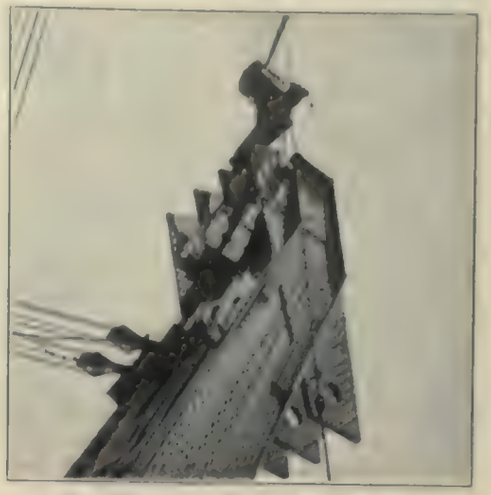
A two-part fleeting tackle is hooked into two open-sheave blocks on the inside of the lifting beams on each set of falls from this forward crane. This fleeting tackle draws in the opposite blocks of the crane to the main tracks. The open-sheave blocks are mounted on a center strap, and the fleeting tackle, consisting of a single long sling of wire



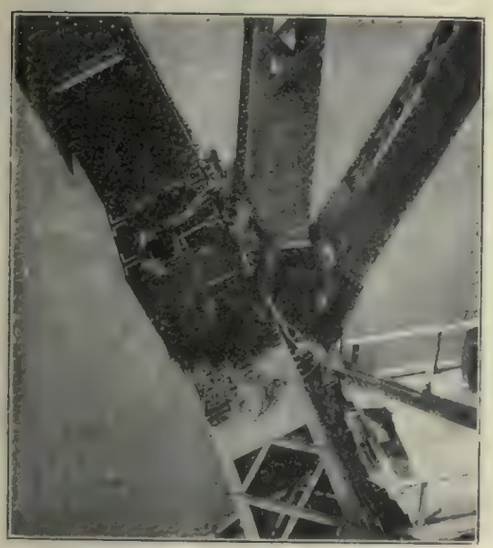
APPROACHING THE BRIDGE BY ROAD, ONE SEES SPREAD OUT BELOW HIM THE STEEL YARD, SERVED BY AN OVERHEAD CRANE



LIGHT EXTERIOR FALSEWORK SUPPORTS ANCHOR ARM



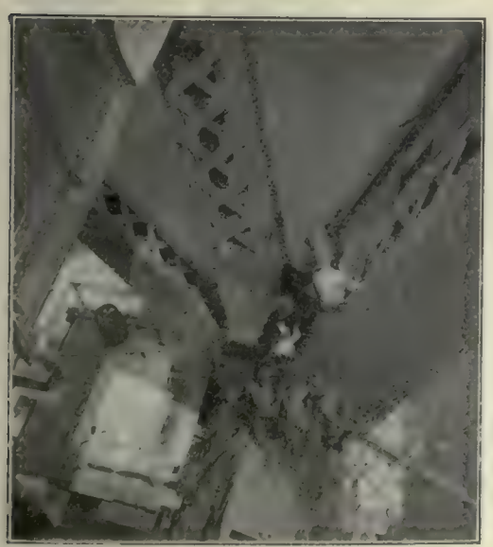
LIFTING-PIN BUSHED IN LARGE HOLE



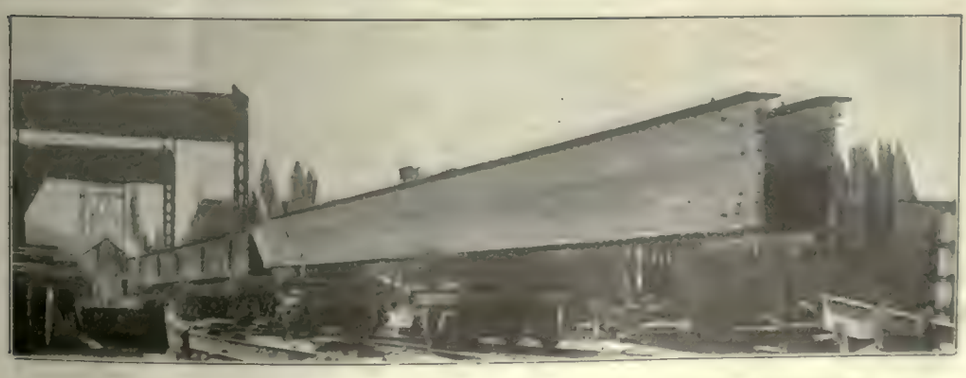
READY TO SET LAST HALF OF DIAGONAL



STARTING OUT OVER RIVER—NOTICE RIVETING PLATFORMS ON TOP CHORD



GUIDING HALF OF DIAGONAL INTO PLACE



THESE TWO MEMBERS, SHOWN IN PLACE ABOVE, WERE SET IN 40 MINUTES



ONE TRUCK OF 1000-TON TRAVELER

rope, needs only to have the bights of each part thrown behind the sheaves to engage the blocks. The two ends of the sling, which are on top, are then picked up by one of the forward booms, drawing the main falls in over the track until they can be hooked up to the forward ends of the members to be set. The ends of these members are then raised, and the crane which has hold of them is moved forward.

Meanwhile the derrick holding the fleeting tackle booms out and picks up its load, and the dinkeys push out the rear ends of the two members, which still rest on the rear lorry cars. When the back hitching point of these members comes in front of the traveler tower, where the rear crane can reach it, the falls of this crane are fleeted in by the other forward boom and attached. The members are then raised clear and the cranes run out in position to set them, one raising its ends as the other lowers until the members reach the proper inclination for entering. The fleeting tackles are slacked as soon as the members are in the clear, and are cast off by four men, one of whom rides each lifting beam, by throwing the bights of the slings out of the open sheaves. The members are then lowered or raised to place and connected. With the centralized control of the traveler it is possible to move the cranes and booms together as if they were interlocked, with little signaling and a minimum expense of lung power. The two 73-ton inner halves of the upper half of the lower subdiagonal in the cantilever panel next the north pier were set in this manner inside of 40 min., the operation being timed by a representative of this journal.

Two general types of lifting hitch are used. They are identical, except that in one the lifting pin is bushed in a large pin-hole of a member, while in the other the lifting pin passes through holes in special lifting angles bolted to the back of the member. The first type is shown in the upper right corner of page 97, which photograph also shows the open-sheave block for the fleeting tackle at the right of the lifting beam.

"FLYING FALSEWORK"

The vertical tension members from the subpanel points to the bottom chord are erected after all the diagonals for the panel are in place. To make the pins in these posts, as well as to support the bottom-chord members until they are placed, some kind of falsework from which to jack was practically necessary. Such falsework was also required for another reason. The four parts of each bottom-chord section, spliced in the center, must be erected and matched up on something solid in order to obtain workable results.

A lattice truss, lying flat in the plane of the bottom chord, with a set of heavy girders under each chord member, was devised for this service. Its rear end is supported from the pier for the first panel, and hung from the last bottom-chord panel-points for the rest of the erection. Each side of its "flying" end is hung by two ties, each consisting of one long and several short pairs of eyebars from the last subpanel points erected. The length of these ties is adjusted for each succeeding panel by means of the short eyebars at their lower ends.

On top of the girders of this truss, under the splice and under the outer end of each bottom-chord section, are set four 100-ton hydraulic jacks to make the necessary adjustment. This bridge is raised by the main traveler by means of two pairs of lifting angles, and can be slid forward one panel and reset in a minimum of time.

The lower diagonal members are erected after the first half of the bottom-chord, which is the first member set in each panel. They are supported by guy tackles of wire rope attached to the subpanel points last erected. These tackles are pulled to the required tension by the derrick booms and clamped off with heavy, copper-lined eight-bolt cable clamps before the lifting tackles are loosened. They provide ready adjustment in making the pin connections with the other members meeting at the subpanel point. The outer ends of the bottom-chord members are next set. Then the remaining diagonals of the panel are erected. After the lower vertical members have been placed the upper posts are set, and last the top-chord members are placed. This chord is composed of two lengths and two banks of eyebars. To support the center pin during erection each panel length is packed inside a light riveted truss, which spans the panel, but takes no stress as a member of the bridge. The eyebars are packed in these trusses in the bridge yard, and hauled to the traveler and erected as a unit.

SAFETY PROVISIONS NECESSARY FOR RAPID ERECTION

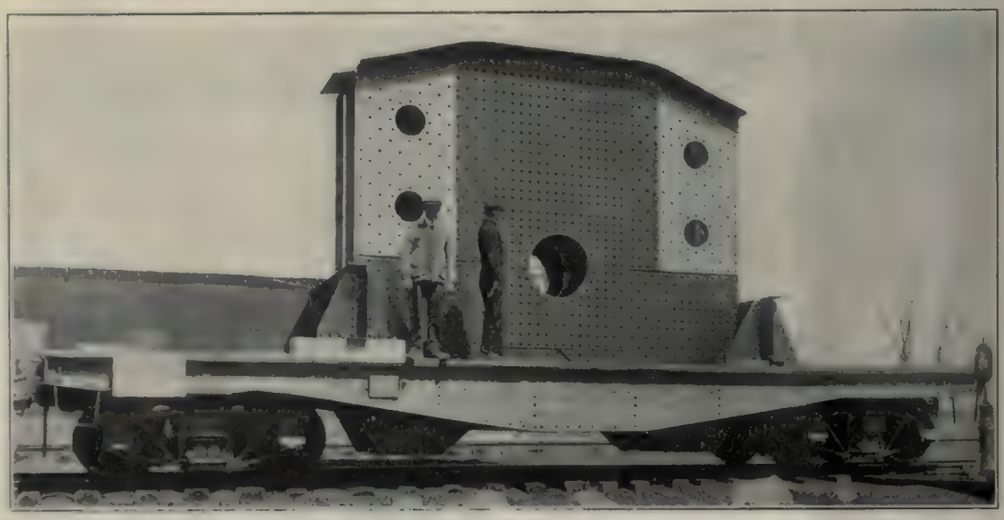
Pin-driving cages, provided with chain blocks for raising and inserting the pins, and holding the ram, are handled by the auxiliary cranes. These cranes also handle the riveting stages. A small electric winch mounted on the top of each main post drags a traveling riveting platform up each chord from panel point to panel point. These two platforms are connected by an ample runway with handrails carried on the top ties between the main trusses. Ample and solid stairways and wide, safe platforms are provided everywhere. Electric elevators are also installed to connect the track level with the ground at each abutment.

As a result of these provisions the men do not have their energies dissipated by holding to precarious perches while trying to work, and are able to get from point to point on the trusses without tiring themselves out in order to get to their work. Attention to these points would, it is believed, pay on any erection, but on a bridge of this size this is essential to progress. The cantilever arms of the bridge must be riveted practically as fast as they are erected, not only for safety, but because erection stresses would displace any riveted connections left drifted or bolted in the ordinary way and make it impossible to rivet them later. On the speed of this work, therefore, hangs the whole erection progress and everything is done to facilitate the riveting.

GOOD SHOP WORK HELPS ERECTION

The shop work on these large members is of the finest and the money spent on it has made erection accurate and easy. Although the fact is so incredible that the engineers are loth to be quoted about it, it is a matter of common knowledge at the bridge that the top pins of the main north posts, which are 310 ft. high, and contain six splices, were erected within 0.002 ft. of their calculated elevation for the prevailing weather conditions. Precise checks only confirmed the accuracy of the first measurement.

The north anchor arm has been erected and the north cantilever begun. It and the south anchor arm will doubtless be finished this season, as from 600 to 800 tons a day are being erected by each traveler. The north traveler next year can erect the suspended span. For this purpose its tower will be shortened by taking out two of the panels. The suspended span will be erected on towers, over the water at high tide, but on ground which is bare at low tide. The concrete footings for this falsework are now being placed. Meanwhile the south traveler can erect the south cantilever. The suspended span will then be floated into place and connected at the ends of the cantilever arms. There is nothing to prevent carrying out this program, as fabrication is well advanced. The steel for the north cantilever is practically all at the site, as is that for the south anchor arm, and also some of that for the south cantilever.

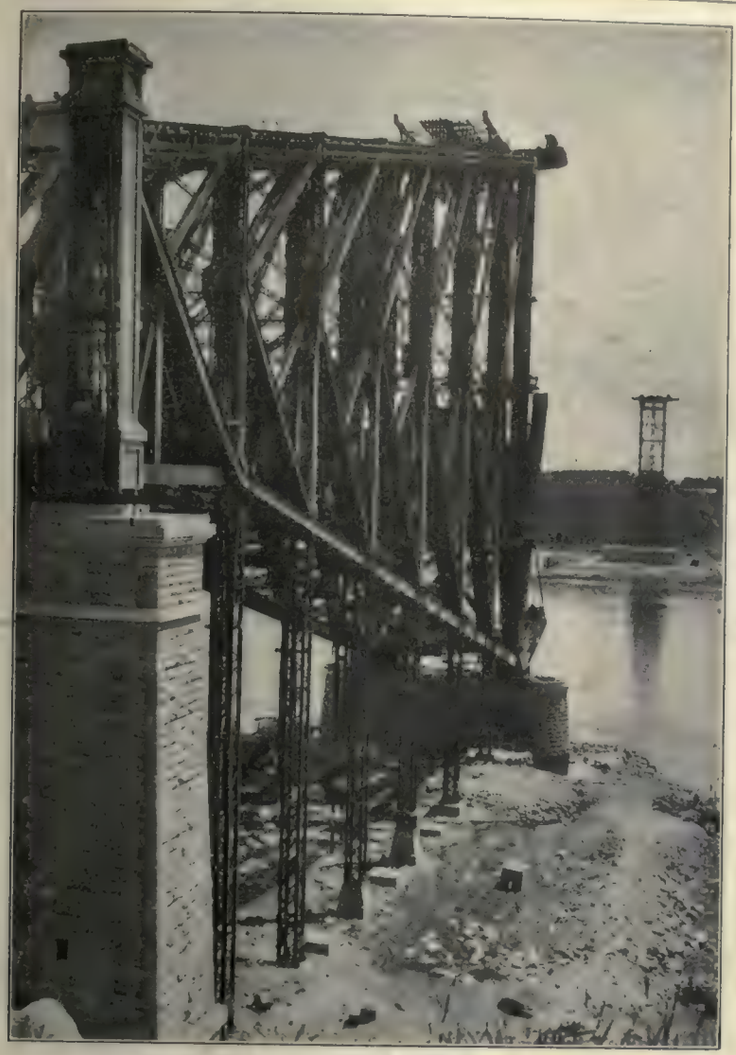


CARS WITH HOLES IN FLOOR REQUIRED FOR TRANSPORTING MANY MEMBERS

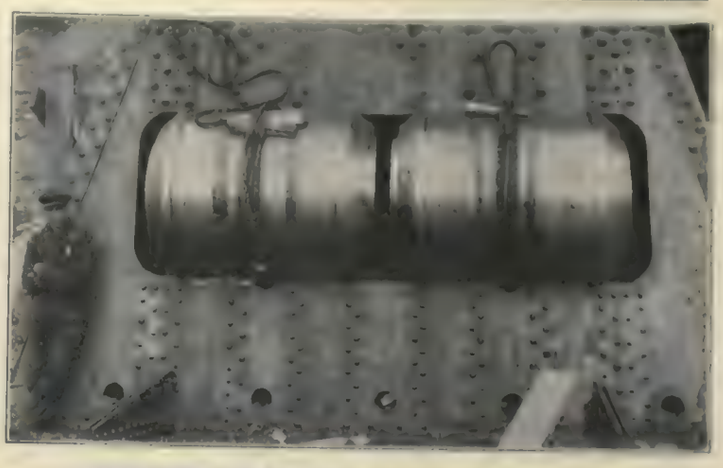
YARDS EQUIPPED WITH 90-TON CRANES

The steel is unloaded by the yard cranes and locomotive cranes in a large yard on each bank of the river, back of the approach tracks to the bridge. Here it is sorted and stacked and the top chords and lighter long diagonals, shipped in sections, are fitted together by the 90-ton traveling yard cranes. Members are loaded up on lorry cars as wanted and hauled to the bridge-head.

The personnel assembled by the erection of this bridge includes C. N. Monserrat, chairman and chief engineer of the Board of Engineers, Quebec Bridge, Ralph Modjeski and C. C. Schneider, consulting engineers to the board, and H. P. Borden, as-



INSIDE FALSEWORK REMOVED IS RE-ERECTED ACROSS RIVER



NOTCHES ALLOW REMOVAL OF SLINGS AROUND PINS



DRIVING PIN IN TOP CHORD FROM SPECIAL CAGE





LEFT, "FLYING FALSEWORK" FROM ABOVE—RIGHT, SAME FROM SIDE—NOTE GUY TACKLES AT TOP, ALSO "SAFETY" STAGING

sistant to the chief engineer. J. D. Wilkens is in charge of erection for the board as resident engineer at the bridge. With the St. Lawrence Bridge Company, which has the contract for the fabrication and erection of the steel, is associated S. P. Mitchell as consulting engineer. George F. Porter is erection engineer for the contractor, while William Fortune is in charge of all erection as superintendent.

Patrol System for Pennsylvania Road Maintenance

Newly Organized Plan of Caring for State Highways Will Be Inaugurated in August—Force Will Number 190 Men

THE patrol system of maintenance will be established on Pennsylvania State highway routes on Aug. 1. Caretakers will be employed and each man will be assigned to a designated section of highway, for the maintenance and repair of which he will be held responsible. One hundred and ninety men will be placed on this patrol work at the start and the territory covered will extend through forty-six counties. These men will be paid at the rate of from 15 to 20 cents an hour, depending upon the scale of wages for labor in their districts. This will mean an annual expenditure of $120,000, which will figure down to a maintenance cost of $65 a mile a year for the State highways. Maintenance charges heretofore have averaged $500,000 a year.

The patrol men will be directly under the county superintendents. They will be required to make out a daily report of the number of hours they work and these reports will be collected by the county superintendents, who will make out payrolls for the patrol men. As the county superintendents have been supplied with light roadsters, it will be possible for them to keep in close touch with these patrol men on the State highways and to ascertain whether or not the work is being done properly.

Tools and Equipment

Each patrol man will be supplied with tools and equipment necessary for his work and each one will have a small red flag which he will be required to place in a conspicuous position on the road when, for any reason, he is required to leave the roadside during working hours. Hence, either the presence of the patrol man at work or of his flag, indicating temporary absence, will be noticeable during the working hours.

Great care is being exercised in the selection of these patrol men and State Highway Commissioner Cunningham is determined to have none but sober, honest and industrious men in these responsible positions. If it is found that the patrol men are neglecting their work instant dismissal will follow.

The manner in which the caretakers will work is as follows: Along the side of the highway at frequent intervals will be placed small piles of stone chips and gravel, which will be used in patching holes as they are found in the roadway. Barrels, or drums, of bituminous material, containing approximately 45 gal. each, will be placed at intervals of from ¼ to 1/3 mile along the roadside. When the caretaker finds a spot in the road which shows signs of wear, he will place the stones and bituminous material on it, tamping it down carefully and making the surface of the road smooth and even. The caretaker also will look after the edges of the road and will keep the berms clear of weeds and grass and will protect the shoulders of the road to prevent water from getting underneath.

Each patrol man will be supplied with the following outfit: A small combination melting and pouring pot on wheels, a hand-pouring pot, an asphalt tamper, a wheelbarrow, a push brush, a pick, a short-handled and a long-handled shovel, a scythe and snath, a mattock, a rake and a brush hook.

As the patrol men will be under the constant watch of the county superintendent, it will be necessary for them to devote their entire time and attention to the territory to which they are assigned. It is the intention, ultimately, that no man shall have more than 6 miles of roadway to patrol, and this only in sections where the character of the road is such that he can cover it easily and conveniently in a day. In mountainous districts, and in places where peculiar formations make the care of the road more onerous, the patrol distance will be diminished.

Specific Duties Outlined

The following list of the general duties of the patrol men has been prepared by the State Highway Department and each man, as he is engaged, will be furnished with a copy of it and will have his duties explained to him in detail:

Keep drains and ditches open at all times.

Special attention must be given to defects in planking and condition of bridge floors.

Repair all defects in the surface of the road, maintaining same in a true and even condition.

Repair and whitewash guard rails.

Provide protection and red lights in cases of flood washouts, or other emergency conditions.

Remove brush from along the sides of the road, giving special attention to this condition at curves, approaches to railroad crossings, bridges, cross-roads, etc.

Keep the berms or shoulders of the road trimmed up, in that the surface water may be discharged freely from the road surface to the side ditches.

Remove all advertising signs from within the legal limits of the highway.

Paint and keep in first-class condition all department direction and warning signs.

Inspect culverts, head-walls, cribbing, retaining walls, etc., and report defects immediately to the superintendent.

Whitewash large rocks and the bases of poles on narrow sections of highway and at sharp curves. (Spring and fall.) Poles to be whitewashed to a height of 6 ft. above ground.

All equipment, tools and material placed in the charge of each caretaker must be accounted for by him at all times, and tools and equipment kept in thorough repair.

Economic and workmanlike results will be the most important factor recognized by the department.

Attention must be given to the entire section allotted to the caretaker, and work not confined to special and convenient portions.

Daily report postal card must be mailed every evening to the superintendent.

When working on the road caretaker must have flag, which will be provided, displayed at all times near where work is being performed.

When conditions require additional help, team hire, or material of any character, permission must be first secured from the superintendent.

All additional help and team hire must be carried on foreman's daily report form, together with regular pay roll form, etc.

All bills for material, etc., in amounts less than $10, must be covered by superintendent's purchase order; larger amounts by requisition of superintendent and department purchase order.

Caretakers are to be paid an hourly rate, and full value in service will be exacted for every dollar expended.

Caretakers must be courteous and considerate of the interests of the public at all times, and conduct themselves in a manner becoming representatives of the commonwealth.

Sobriety, honesty, industry, good character, and ability are the essentials required, and a failing in any of these will be met by dismissal.

The patrol system for the maintenance of highways is new in Pennsylvania, but has been tried with great success in other States. Chief Engineer William D. Uhler is an enthusiastic believer in this method.

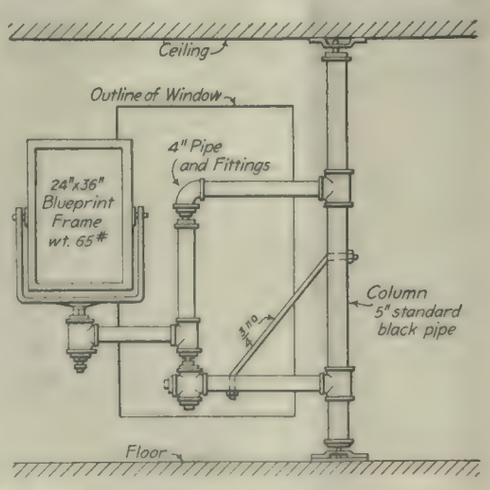
Swinging Blueprint Frame Is Cheap and Efficient

Designed for Use in Window Where Projecting Track or Other Very Noticeable Fixture Would Have Been Objectionable

By FREDERICK W. SALMON
Birmingham, Ala.

THE QUESTION often arises as to how best to arrange to handle a blueprint frame of moderate size, such as 24 x 36 in., which may weigh complete from 60 to 100 lb., and is too heavy to be handled quickly by the "boy" generally used for this purpose. Especially for offices in buildings that can not be cut or permanently altered, some device like the one here shown is needed.

The "specifications" or conditions to be met in this case were (1) that no cutting or permanent alterations of the building should be necessary, (2) that no track or framework should project from the building except just while a print was being made, (3) that the fire escapes should not be used in any way, (4) that any device employed should be neat in appearance at all times, (5) that it should not be expensive, (6) that it should be capable of receiving a "store-made" so-called "standard" blueprint frame and not require one made specially



BLUEPRINT FRAME OF PIPE FITTINGS

to order, (7) that all parts should be so rigidly secured that there would be no danger of a gust of wind causing any part to break loose and fall to the street below, (8) that the friction and inertia should be so low that a boy could make 100 24 x 36-in. prints per day without getting tired of his job, (9) that the device must not take up much floor space, but must be close to the wall when not in use, (10) that it must not interfere with the janitor's work in cleaning up the office, (11) that wood must not be used if avoidable, (12) that the design must be one that could be produced quickly, preferably from articles that could be bought in the open market almost anywhere and would not require expensive patterns, castings or shopwork, or parts that it would be necessary to send far away for, and (13) that it must permit being set up in about two hours by workmen, as workmen would not be allowed in the building at night, and it interrupted business to have them there in the daytime.

The result was the design shown, which answers all thirteen requirments and in addition eliminates noise and is so extremely stiff that probably a larger frame could be used on it. The cost was as follows:

Materials	$15.00
Drawings, cartage and incidentals	2.25
Blacksmith work	1.30
Machinist work	3.30
Cutting, fitting and assembling pipe	3.75
Erecting in place (2 men 2 hrs)	2.00
Painting	0.60
Total	$27.90

The main precaution to be observed in making such a frame is to draw up the fittings very tight.

Road Oil Is Successfully Applied on Moist Concrete Base

THE California Highway Commission recently made a practical test to see whether moisture on the concrete road base to be oiled affected the quality of the finished wearing surface. A stretch of highway about 1000 ft. long was well hosed in a manner calculated to remove all dust particles, and immediately afterward the oil truck passed over and the usual coat of refined asphaltic road oil at a temperature of about 320 deg. Fahr. was applied.

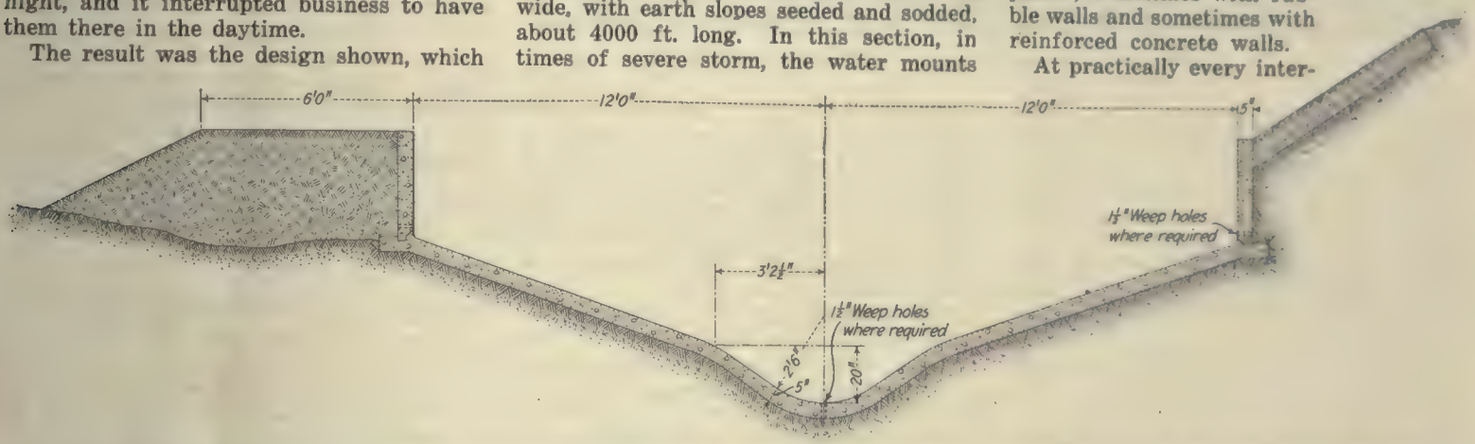
As the oil began to cool on the concrete innumerable air bubbles appeared, giving the surface an appearance very unlike that finished in the usual manner. All the bubbles disappeared, however, within the course of a few hours, and thereafter there was nothing to indicate that this section had been finished differently from the others. The wearing qualities are reported to be the same as of adjacent sections.

Concrete Lining Improves Sewage-Laden Creek

Self-Cleaning Invert Placed in Harrisburg Stream Abates Nuisances in the Business District of the City

By JOEL D. JUSTIN
Principal Engineer, Board of Public Works, Harrisburg

BY MEANS of concrete channel lining for a distance of about 15,000 ft., Paxton Creek, which flows through the business district of Harrisburg, Pa., has been converted from a succession of offensive, stagnant pools into a self-cleaning watercourse from which no nuisances emanate. The improved channel is of two types: One, 24 ft. wide, consists of a curved and sloping concrete invert with side walls 3 ft. high; its length is about 10,400 ft. The other section is a curved and sloping concrete invert 12 ft. wide, with earth slopes seeded and sodded, about 4000 ft. long. In this section, in times of severe storm, the water mounts above the top of the concrete and flows along the protected earth slopes. The extreme lower end of the improvement for a distance of 1200 ft. is not paved with concrete. The inverts are so designed as to secure a maximum velocity of flow during extreme low water conditions. The grade throughout is 0.8 ft. per one thousand. The invert is believed to be practically self-cleaning and it is expected that but slight expense will be required for maintenance.



THE INVERT OF THE CHANNEL LINING IS DESIGNED TO SECURE MAXIMUM VELOCITY OF FLOW DURING PERIODS OF EXTREME LOW WATER

SEWERS DISCHARGE INTO CREEK

Paxton Creek formerly was subject to severe floods. Much damage was done every time heavy rains occurred, but in 1909 the city constructed a flood control reservoir which, in time of storm, by-passes the flood waters, with the exception of approximately 300 sec.-ft., through a large conduit to the Susquehanna River.

The sewers of this section of the city formerly discharged into Paxton Creek, but an intercepting sewer was constructed intercepting the dry-weather flow of these sewers. Even with this improvement the creek channel proved a source of continual nuisance to the abutting properties and residents during the low water season in the summer time. Much refuse was still discharged or thrown in the creek bed, and during the summer time the creek was a continual succession of stagnant pools, giving off a considerable stench and breeding quantities of mosquitoes.

The watershed of the creek at the northern limits of the city is about 18 sq. miles, but owing to the flood control works mentioned above the maximum discharge reaching the creek channel is only 300 sec.-ft.

Just below the northern limits of the city the creek receives the drainage of Asylum Run, a small stream with a drainage area of about 4 sq. miles and very steep watershed having a maximum discharge of 1000 sec.-ft.

ALIGNMENT OF IMPROVED CHANNEL

From time to time work had been done on straightening the channel of Paxton Creek in the built-up portion of the city. Consequently, except for a stretch of 2500 ft. through unimproved property at the upper end of the work where the creek had a winding course, no material changes in alignment were necessary.

The alignment consists of a series of long tangents and gradual curves. There were many private walls varying from 6 to 10 ft. in height along the line of the creek. Some of these walls encroached on the alignment and had to be removed and replaced, sometimes with rubble walls and sometimes with reinforced concrete walls.

At practically every intercepted street a connection was made to the existing storm overflow sewers which discharge only in time of heavy rains. A section of the intercepting sewer, where it crosses the line of the improvement, had to be torn out and replaced by a siphon consisting of a double line of 30-in. sewer pipe laid in concrete.

A contract was let Sept. 11, 1912, to Karl T. Opperman of Harrisburg, to do this work. Progress made was not satisfactory, and on Oct. 15, 1913, the contractor notified the Board of Public Works that circumstances beyond his control compelled him to abandon the work. The work was then taken up by the Maryland Casualty Company, the bondsman for the contractor, and pushed to completion by the West Construction Company, of Baltimore. Many engineers give bonding companies the reputation for trying to side-step an obligation of this kind by every technicality known to the legal profession, but in this case at any rate the bonding company frankly and promptly acknowledged their obligation and proceeded to take over the work.

TRAVELERS HANDLE EXCAVATION

The excavation was done at the upper end by the original contractor by pick and shovel and by drag-scraper. The West Construction Company used travelers. The excavated material was loaded by hand into buckets, which were then lifted out of the channel by the traveler and dumped at the side of the channel, to be later used in making the embankment.

When it was desired to excavate any particular section a dam was built in the creek and the water diverted to the intercepting sewer, either through one of the overflow



CHANNEL IMPROVEMENT REMOVES ONE OF HARRISBURG'S EYESORES

sewers or by breaking a hole in the interceptor and cutting a short trench from the creek to the interceptor.

Following the traveler there was a gang which excavated the drainage trench in the center of the channel and laid the underdrain, which consisted of 8-in. terra cotta pipe laid with open joints and surrounded by crushed stone. When properly laid the underdrain kept the work clear of water for distances exceeding 1000 ft. At first, due to lack of care in placing the underdrain and the clayey nature of the soil, there was much trouble with water, but this was overcome by entirely surrounding the drain with crushed stone and using care in laying.

The water from the underdrain went to a sump from which it was pumped. At first centrifugal pumps were used, but later two Pulsometers were bought which proved very satisfactory. Set-ups were made from 500 to 1200 ft. apart, according to the distance that the underdrain would work properly. Following the laying of the underdrain, templates for the invert were set and grading completed.

How Invert Was Built

The concrete invert was then formed in 6-ft. alternate blocks. 1:2½:4½ concrete was used. The crushed stone was obtained from a local limestone quarry, and was run of crusher, maximum size 1 in. Tests were made on both cement and aggregate. Concrete was mixed in batch mixers and deposited fairly dry, screened and tamped. A top coat ¾ in. thick, consisting of 1 part cement and 1½ parts sand, mixed fairly dry, was then placed on the concrete base and tamped and screeded into place. This coat was then given a metal trowel finish. The total thickness of the invert was 5 in. At every sixth block an expansion joint consisting of three thicknesses of tarred paper was made.

After the completion of a section of invert the 3-ft. side walls were placed. Panel forms 12 ft. long were used, held by bolts through the weep holes at the bottom and by cleating at the top. The forms were held in place by short 2 x 4-in. struts, cleated to the invert. The concrete in the side walls was also 1:2½:4½, mixed fairly wet, and spaded. The side walls were reinforced by ¼-in. square bars 8 ft. long, running down into the invert and spaced 2 ft. apart. Where the bank was surcharged, or where, for any reason, greater pressure was to be expected, the reinforcement was increased to ⅜-in. square bars spaced 6 in., center to center. At the 12-ft. section at the upper end of the work the earth slopes are sodded and seeded to protect them from erosion in time of storm.

The mixer was generally located at some point accessible for the delivering of materials. Runs placed on I-beams spanning the channel were used, and concrete was run both ways from the mixer. The wheelbarrow haul was frequently 500 ft. By placing flash boards on the weir discharging into Paxton Creek all water from the Paxton Creek watershed above the city was diverted to the river through the large conduit at the Wildwood flood control works.

Whenever there were heavy storms on the small Asylum Run watershed the works on Paxton Creek got the full benefit of them. Three or four storms occurred during each construction season, and the contractor, aside from the delay, was subjected to considerable expense and damage thereby. The violence of such storms may be judged from the fact that on one occasion a 4-in. pump was washed down stream along the invert a distance of 600 ft.

The contractor's plant consisted of two travelers with hoisting engines, two centrifugal pumps, two Pulsometers, two 20-hp. boilers mounted on wheels, several smaller stationary boilers, and from two to four one-bag mixers.

The contract was let under the unit item system, and the prices on some of the principal items were as follows: 1:2½:4½ concrete, $7.40 per cubic yard; earth excavation, 70 cents per cubic yard; earth embankment, 57½ cents per cubic yard; steel reinforcement, $90 per ton.

The prices bid on the minor items were generally sufficient to warrant the expectations of a fair profit, but the prices on the two principal items were not sufficient to warrant the expectations of a fair profit, when the nature of the work is considered, and it is believed that both the original contractor and the bonding company lost money.

The work was conducted under the direction of the Board of Public Works of Harrisburg, of which W. H. Lynch is superintendent and James H. Fuertes of New York City, consulting engineer.

An Example of Costly Highway Construction

Route Near Los Angeles Finally Abandoned Because of 23-Per Cent Grade Even After Three Grade Reductions

BY WAY of contrast with modern economics of road building, it is interesting to note the extreme difficulties and dangers imposed upon traffic a generation or two ago for the sake of avoiding initial first cost in road construction. The accompanying illustration shows the road through Newhall or Fremont Pass, which was for many years one of the main lines of travel between Los Angeles and Bakersfield, Cal.

This route had been in use since General Fremont's time during the Mexican War. At that time, it is said to have been equipped with a windlass at the top for drawing the loads up the steep grade in the approaches to the summit. The grade at the Pass has since been subjected to three separate "reconstructions," each of which reduced the grade somewhat, but when finally abandoned a few years ago there was still a 23 per cent grade at the Pass with long approaches on either side of not less than 18 or 20 per cent. The cut at the Pass was made by the slow pick-and-shovel method, and is now 80 ft. deep. The sharp curves and steep grades were responsible for at least two fatal accidents in the last year of its service, and there was always great danger from rocks that rolled over the top and fell down into the deep cut.

This old route has been replaced by a broad, oiled-macadam pavement with a maximum gradient of 6 per cent. In surveying a new route through the Pass it was found that to keep within the limiting grade, any road over the summit would cost at least twice as much as a tunnel, and the route selected therefore involved a tunnel which is 435 ft. long, 20 ft. wide and 17 ft. high. It was built under the direction of A. E. Loder, chief engineer of the Los Angeles County Highway Commission.



AFTER THREE GRADE REDUCTIONS THIS CUT WAS 80 FEET DEEP AND THE GRADES STILL RAN AS HIGH AS 23 PER CENT

Automatic Device Controls Hypochlorite Application

Apparatus at Institutional Plant Proportions Accurately the Amount of Chemical to Varying Flow of Sewage

By E. E. LUDWICK
State Hospital, Warren, Pennsylvania

AN ingenious device for the automatic measurement of the hypochlorite solution used as a disinfecting agent in the sewage treatment plant at the State Hospital for the Insane, Warren, Pa., has been constructed recently and is operating in a very satisfactory manner. The plant was constructed during 1912-13, and treats all the sewage of the hospital group of buildings having a resident population of approximately 1800. The works comprise a 6500-gal. Imhoff tank, intermittent siphon, sprinkling filter, chemical house and a final settling tank.

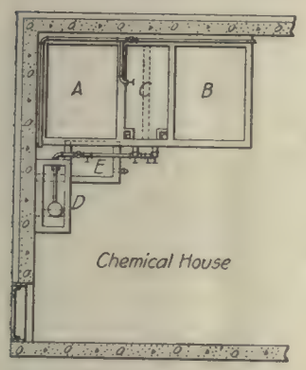


Fig.1

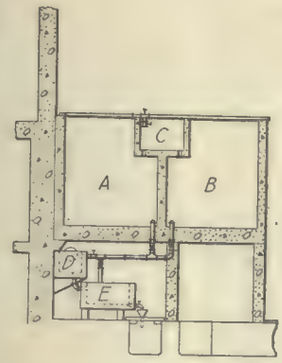


Fig.2

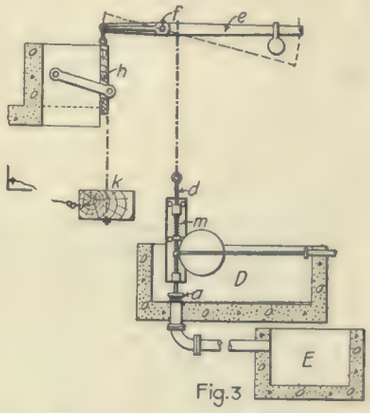


Fig.3

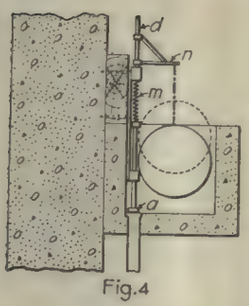


Fig.4

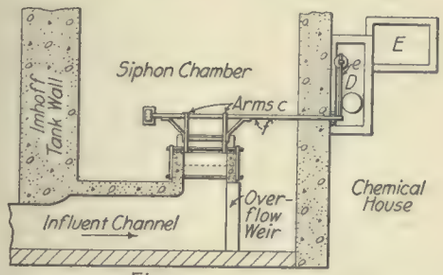


Fig.5

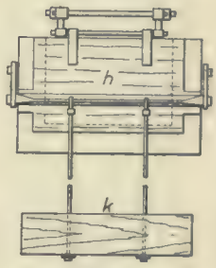


Fig.6

FIGS. 1-6—THIS APPARATUS PROPORTIONS CHEMICAL APPLICATION TO SEWAGE FLOW

LAYOUT OF CHEMICAL HOUSE

The chemical house is provided with reinforced-concrete tanks, arranged as shown in Fig. 1. In the northeast corner, at a height of 3½ ft. above the floor, are two dilution tanks, *A* and *B*, with a capacity of approximately 660 gal. each, separated by a 4-in. division wall. A mixing trough, *C*, with a capacity of approximately 100 gal., is supported by this division wall (Fig. 2). A short distance in front of the dilution tanks, and at a height of 2 ft. above the floor, is a measuring box, *D*, with a capacity of 20 gal., and a little to the side of *D*, at a height of 6 in. above the floor, is a feed box, *E*, with a capacity of 22 gal.

The hypochlorite of lime is first dissolved in the mixing trough, *C*, and then allowed to enter the dilution tanks, *A* and *B*, through the outlets shown in Figs. 1 and 2. These outlets are merely holes through the bottom of the mixing trough, which are closed by wooden plugs while the lime is being dissolved. After being diluted to the proper strength the valves in the two 1¼-in. galvanized iron pipes which lead through the front of each tank are opened and the solution flows equally through each to a point where they combine into one 1¼-in. galvanized iron pipe terminating in the measuring box, *D*. Here a ball float valve (Fig. 3), is located, and, as the two valves mentioned above are left open, this valve controls the flow of the solution from the tanks according to the operation of the automatic device to which it is connected at this point. After flowing through the ball float valve into *D*, the solution is discharged into *E*, from which it enters the mixing channel and becomes thoroughly mixed with the effluent from the sprinkling-filter bed.

AUTOMATIC MEASURING DEVICE

The automatic measuring device, which is operated by the rise and fall of the sewage in the siphon chamber, and which proportions accurately the quantity of chloride solution with the varying flow of the sewage, is connected with the outlet and ball float control valve in *D* by the method illustrated in Fig. 3. The outlet in *D* is fitted with a brass ring seat, as shown at *a*, into and over which fits a brass cap connected to a brass rod *d*, 2 ft. in length. This rod, which is supported in such a manner as to allow a vertical movement, is connected by a chain to a lever *e* in the loft of the chemical house, which, in turn, is connected to one end of a revolving horizontal bar *f* extending through the concrete wall separating the chemical house from the siphon chamber (Figs. 3, 4 and 5). This bar is supported by a concrete pier in the siphon chamber and connected by arms *c* to a heavy wooden gate, *h* (Figs. 3 and 6), constructed and supported in such a manner as to give it an oblique movement up and down, when acted upon by the flow of sewage, thereby opening and closing respectively the end of the influent channel (Fig. 5) conveying the effluent from the Imhoff tank into the siphon chamber. It will be noticed that the arms *c* are on the opposite side of the horizontal bar *f* from that of the lever *e*, thus giving them an opposite movement when the bar is rotated. The remaining accessories necessary for the proper operation of this device are a heavy wooden float, *k*, connected to the wooden gate in the siphon chamber (Figs. 3 and 6), a spiral spring, *m*, so connected to the brass rod in *D* as to insure a downward movement (Fig. 4), and a horizontal arm *n* on this rod to which the arm of the ball float is attached by a chain.

OPERATING DETAILS

The operation of this device is as follows: We will suppose that the siphon has just discharged the contents of the siphon chamber onto the sprinkling filter—the siphon chamber, therefore, is empty—and the large wooden float now supported by its connections to the wooden gate has, by its weight, pulled the gate down and against the end of the influent channel, thereby closing it. At the same time the lever in the loft of the chemical house has been elevated, thereby lifting the brass rod and cap in *D*, which opens the outlet at *a* and allows the contents of hypochlorite of lime solution to flow from *D* into *E*, from where it flows into the mixing channel, through which is now flowing the effluent from the sprinkling filter.

At this point of the operation the horizontal arm, *n*, attached to the rod in *D*, having been moved up with the upward movement of the rod, now lifts the ball float, by means of the chain connection, and closes the control valve *b*. As these relative positions are maintained until the rod moves down and closes the outlet in *D* it is seen that no lime solution can flow from the dilution tanks into *D* while its outlet is open.

BALL FLOAT REGULATION

The effluent from the Imhoff tank now entering the influent channel cannot flow into the siphon chamber on account of the wooden gate, which, as was stated before, is being held securely against the end of this channel by the weight of the wooden float. It therefore fills the channel until the level of the overflow weir (Fig. 5) is reached. This is merely one side of the channel constructed so as to be 3 in. less in height than the others. The effluent now overflows into the siphon chamber until in sufficient quantity to raise the wooden float, thus relieving the weight holding the gate in its closed position, and allowing it to be pushed obliquely upward (open) by the head of sewage behind it in the channel. The upward movement of the gate lowers the lever in the chemical house, and allows the rod in *D* to be forced down by the spiral spring, thereby closing the outlet at *a*. The ball float has also been allowed to fall, thus opening the control valve *b*, and allowing the solution to flow into *D* from the dilution tanks. The solution continues to flow into *D* until the surface of the same raises the ball float sufficiently to close the control valve, *b*, and then remains here until the siphon again discharges the contents of the siphon chamber, which releases it as before, the same operation being repeated as described.

DEVICE USED TO MEASURE SEWAGE IN PLACE OF METER

In the absence of a meter on the force main from the pump house this device is now being used to ascertain the number of gallons of sewage pumped every twenty-four hours. This is accomplished in the following manner: The chloride of lime, after being thoroughly dissolved in *C*, is diluted in *A* and *B* so that in every gallon of solution there is contained 0.0004 gal. of available chlorine. The intention is to add

1½ parts of available chlorine to every million parts of sewage.

As is seen by the operation of the measuring device just described each time the siphon discharges the contents of the siphon chamber there is a certain fixed quantity of chloride of lime solution measured and discharged into the sewage. Therefore, as the quantity of sewage discharged by the siphon each time is known to be 1300 gal., in order to add the required amount of available chlorine the arm of the ball float in *D* has been adjusted so as to close the control valve *b* when 5.5 gal. of lime solution have flowed into *D*. Each morning, after the lime has been dissolved and diluted, an accurate measurement of the elevation of the surface of the solution in the dilution tanks is taken and noted, together with the time. On the following morning, at the same time, another measurement is taken, and the amount of solution which has flowed from the tanks in 24 hr. computed. This quantity divided by 5.5 will then give the number of times the siphon has discharged, which, multiplied by 1300, will give the number of gallons of sewage discharged or pumped to the plant in 24 hr.

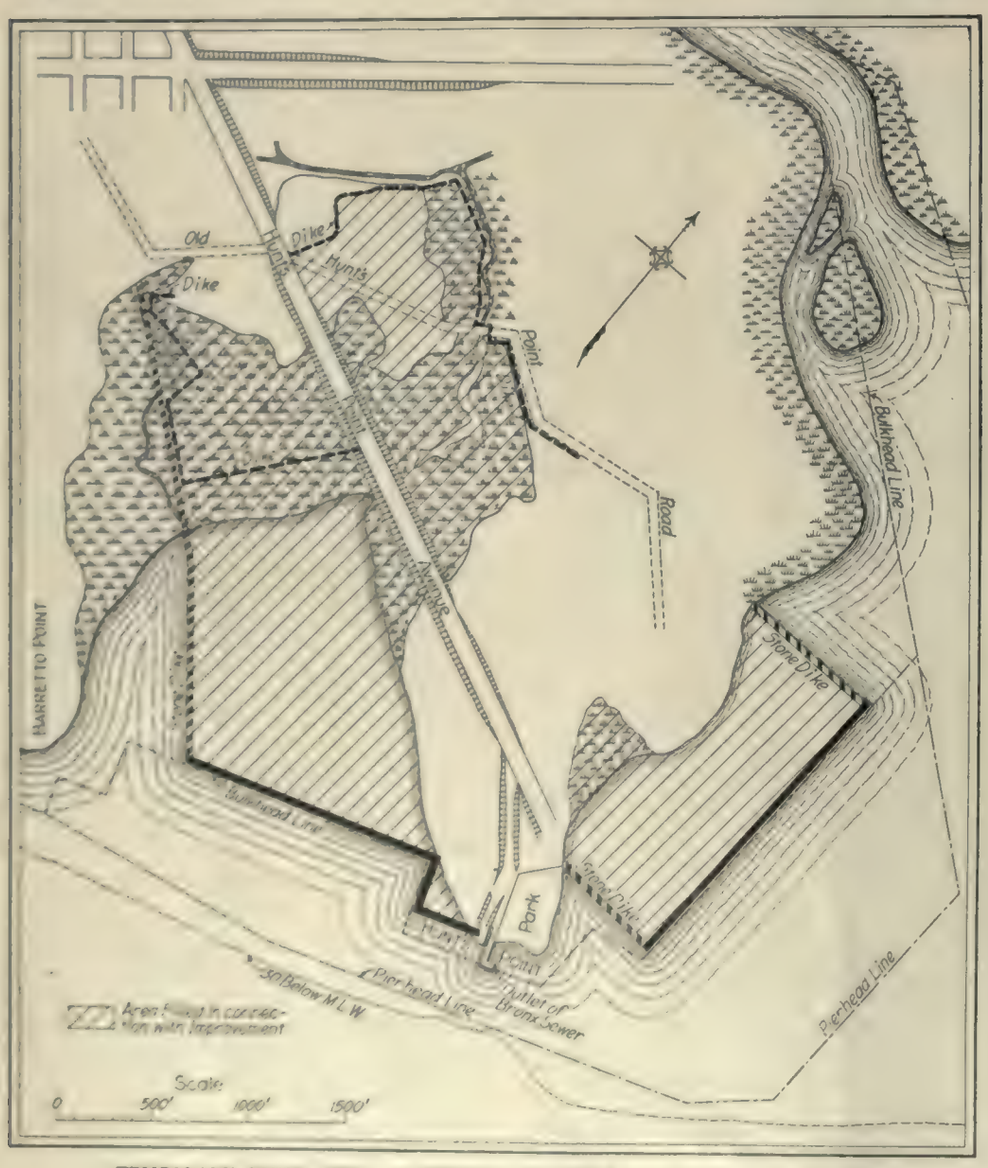
The plant and system entire was designed by C. F. Mebus of Albright & Mebus, consulting engineers of Philadelphia, and was constructed by P. L. Scholl & Company of Reading, Pa., under the supervision of the writer, who is now operating the plant for the hospital.

Hunt's Point Terminal in New York Involves Difficult Bulkhead Construction

Dredge Mud Out Before Building Pile and Riprap Bulkheads — Job Planned with Regard to Location of Preliminary Dredging and Backfill

CONSTRUCTING and filling behind 3600 ft. of bulkhead to reclaim 200 acres of ground and provide a water terminal which will later be connected to the New Haven, New York Central and Pennsylvania Railroads at Hunt's Point, Borough of the Bronx, New York City, involves heavy pile driving, deep dredging, the placing of nearly 400,000 tons of riprap, and the grading and filling of many million cubic yards of other material. A suction dredge has backfilled more than 1,000,000 cu. yd. of mud at the east bulkhead this spring, and 5000 cu. yd. of street sweeping and ashes are now being filled behind the same bulkhead each eight-hour day. A difficult feature of the work is capping and decking the bulkhead piles. The cut-off is at low tide, and work can only be prosecuted for a short while each day. The single driver employed can place seventy-five piles a shift, which is more than enough to keep ahead of the dock-building forces.

The general location and purpose of this development, together with some features of the design, were discussed in the Engineering Record of June 27, 1914, page 745, by J. R. Marsh, chief engineer of the Bronx Terminal Corporation. The development is being carried out for this corporation by the Jarrett-Chambers Company, Inc.



TEMPORARY DIKES USED AT FIRST TO CONFINE SOFT FILL TO PROPERTY

CONSTRUCTION PROBLEMS THOSE OF LAYOUT

As was stated in the article referred to, the line of both bulkheads lay over from 35 to 55 ft. of soft mud, bare in places at low tide, and covering very compact gravel or rock bottom. The effect of filling riprap among piles driven in mud of this kind is similar to that which could be had by exploding heavy charges of dynamite among the piles. It has been again demonstrated in the rockfills made from trestles on this job that the piles pull loose from any caps they are secured to, scatter in every direction and finish at any location or angle that might be least expected. It was necessary, therefore, to dredge off this mud blanket before building the bulkheads. The mud pumped had to be emptied in the swamps to be filled, but would not stay in place without temporary dikes to hold it. These dikes were built of blocks of turf and grass roots cut from the marsh land, and in places sacks filled with mud were used. They had to be located well behind the old shore line before a foundation could be found that would hold the pressure from the fill. This necessitated at times discharge lines from the dredge 4000 ft. long.

Dredging was begun on the east bulkhead site first, and the entire swamp area north of the Hunt's Point Road and part of that south of the road were filled in before the site of the first bulkhead had been cleaned. More than 500,000 cu. yd. of mud was disposed of by this operation. While piles for this bulkhead were being driven and capped, the dredge was transferred to the west bulkhead. The piles were delivered on scows, unloaded to catamarans made of logs with uprights spiked to them to keep the piles from sinking and floating off, and towed to the driver as wanted by a small gasoline tug. The riprap was placed behind the dock-building crew as it progressed on the north bulkhead.

FLANKING DIKES FILLED FROM BRONX SUBWAY CUT

Meanwhile trestles were built with an overhang land driver on the site of the stone fills which flank the north bulkhead. Stone brought by standard-gage dinkies from an adjoining contract on the east branch of the Bronx subway was used to make these fills. As will be noted from the accompanying layout plan, the property is cut at the actual end of Hunt's Point by a small park, in which is located the outfall of the Bronx sewer. The east bulkhead joins high ground just west of this park, but the other edge of the park was in water, necessitating a short stone fill at this point.

Stone from the subway was also largely used to riprap the east bulkhead. As soon as the east bulkhead was filled with stone it was backed with a blanket of street sweepings to retain the mud. The discharge of the dredge was then turned behind it, and the remainder of the mud dredged from the site of the south bulk-



MOVEMENT PRODUCED BY DUMPING STONE FILL IN SOFT MUD FROM THIS 2500-FOOT TRESTLE FINALLY TORE IT APART

head. More than 400,000 cu. yd. was placed in this location. The line of fill, made with rubbish and ashes, along the top of the stone dike for the north bulkhead, proved very hard to close, on account of the large tidal area still unfilled behind the dikes. A floodgate, to be of use, would have been of prohibitive size. The feat was finally accomplished after a week's hard work.

PROBLEMS ENCOUNTERED ON THE WEST BULKHEAD

Cleaning the mud off part of the west bulkhead site exposed the rock. Piles, of course, could not be put in here until some riprap had been placed through which to drive them. The first section of the rockfill is therefore being made in advance of the driver on the west end of this bulkhead with stone from the downtown subway cuts delivered on barges. A trestle 2500 ft. long was driven out to the west end of this bulkhead with a land driver. From this the stone fill for the flanking dike is being dumped. The fill is being made with stone from the Bronx subway cuts hauled by dinkies. As with the fill on the east end of the east bulkhead, this trestle quickly disappeared when dumping began. Attempts to maintain it were abandoned after the fill reached the surface, track being laid directly on the fill.

When the second bulkhead has been finished, the dredge will remove the mud from the pier slips out to the channel line, and dispose of it in the large bay south of the point.

FILL CONSOLIDATED WITH STREET SWEEPINGS

To make this mud fill solid, ashes and street sweepings are being used. It was problematical how much mud this material would take up, as the voids in a given yardage of it are an indeterminate quantity. About 700,000 cu. yd. of it was arranged for, to be used behind the north bulkhead, and 600,000 cu. yd. has already been placed this year. More will probably have to be used. Two 5-yd. orange-peel dredges, similar to floating dredges, but built on the bulkhead, are used to unload this material from scows into 10-yd. dump cars drawn by standard-gage dinkies. The dump tracks are carried on top of the fill as it progresses, for which purpose the fill has proved amply solid. This outfit is now placing street sweepings at the rate of 5000 yd. a day.

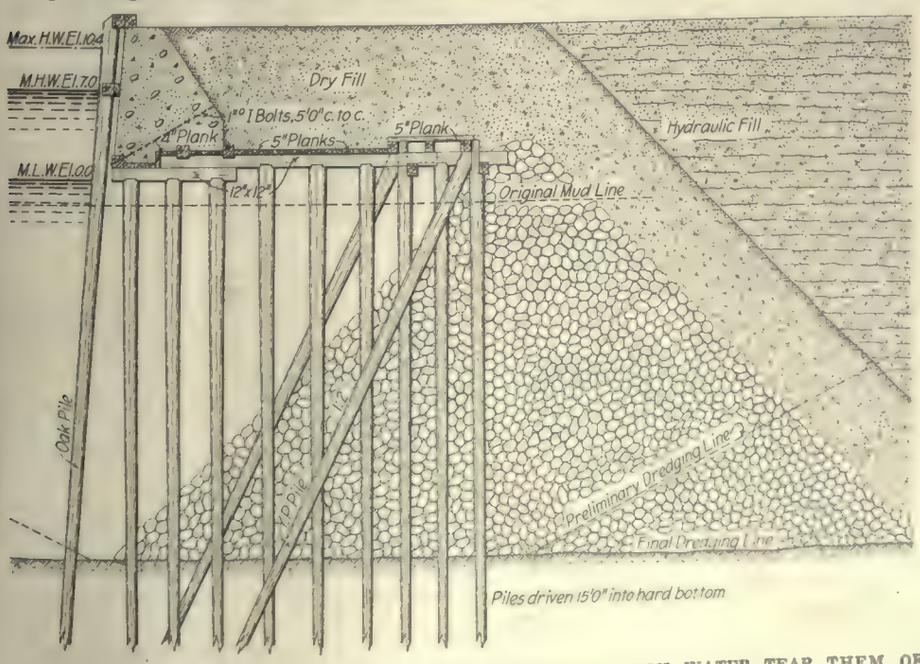


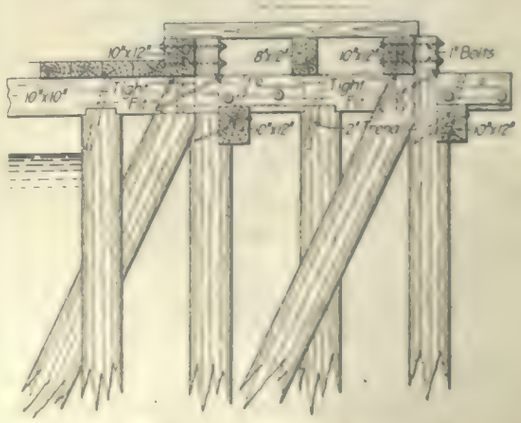
CLOSE JOINT AT TOP OF BATTER PILE

BULKHEAD WORK DONE AT LOW TIDE

Capping the piles and decking the bulkhead can only be worked at for a few hours each day. The rest of the time crews are kept busy framing timber. A large derrick boat, the derrick on the mixer boat, and a small derrick on the compressor barge are spotted where work is going on to handle caps, pile butts and plank, and to pull the piles into line. Wood-boring machines driven with compressed air are used. The joints between the batter piles and the straight piles and caps are of an especially stiff construction, and develop the full value of the batter piles. One is well shown in the accompanying illustrations.

None of the concrete wall has yet been placed. This work can be prosecuted very rapidly with a small crew and little overhead expense, and will be finished while the final filling is being done by the dredge. The barge on which the concrete plant is mounted was designed especially for the job. The mixer on this boat is mounted high enough to dump directly into the forms at low tide, and is fed through bins with a grab bucket.





PLANK LAID JUST BEFORE CONCRETING LEST ROUGH WATER TEAR THEM OFF—FRAMING DETAILS GIVE GREAT RIGIDITY

The job has been thoroughly planned, and a large chart, with straight lines showing the estimated progress of each class of work, is tacked on the wall of the superintendent's office. The actual progress is plotted on this chart each day, with the result that the expected progress has been lived up to or exceeded in every line of work.

The first contract on this work was completed by the Foundation Company under the direction of Ralph H. Chambers, then its chief engineer. The work is now being carried on under a second contract let March 26, to the Jarrett-Chambers Company, Inc. Edwin S. Jarrett, the other member of this firm, was formerly vice-president of the Foundation Company. Jefferson Davis, as superintendent, has had charge of the job since it was started.



LEFT — CHANNELS PROTECT TIMBERS WHILE RIPRAP IS DUMPED



RIGHT—RUBBISH ON SCOWS AT RIGHT WILL SOLIDIFY MUD FILL AT HUNT'S POINT TERMINAL

Mirrors Prevent Road Accidents

BY MEANS of a system of mirrors, Glencoe, Ill., has materially reduced accidents at one of its most dangerous street intersections, Green Bay Road and Hazel Avenue. Both the roads approach the street intersection on the down grade, and drivers of cars passing west through the viaduct on Hazel Avenue heretofore have been unable to tell whether a vehicle was approaching from either direction along the Green Bay Road. A large mirror eight ft. long and about six ft. in height has been placed at the southeast corner of the intersection at such an angle that the driver of a car approaching down the grade in Green Bay Road from the north can see a car coming west through the culvert, and give it the right of way. A smaller mirror has been placed on the side of the culvert at the northeast corner, by means of which the driver of a machine going west through the culvert can see a car approaching from the south in Green Bay Road. It is said that the mirrors are proving a success even at night, when the flare of the headlights is reflected in both directions.

HYDROELECTRIC PLANTS IN CALIFORNIA now in operation have a total generating capacity of 436,043 kw., according to the president of the California Railroad Commission, and last year the steam and hydroelectric plants of California combined developed more than 2,000,000,000 kw.-hr. There are twenty-five power companies in California operating seventy-nine hydroelectric plants which transmit energy through about 7500 miles of transmission lines and 18,000 miles of distribution lines.

Radical Changes in Rail Sections, Composition and Manufacture Urged

Gustav Lindenthal Condemns Present Standards—Favors Experimenting with Double-Webbed Rails—Other Engineers Discuss Subject

THE RAIL PROBLEM—how to get a rail that will carry the heaviest railroad load safely and be immune from the danger of suddenly breaking—is as yet unsolved. In his presidential address to the American Society for Testing Materials, abstracted in the Engineering Record of July 3, page 8, A. W. Gibbs, chief mechanical engineer of the Pennsylvania Railroad, pointed out the disappointing progress with the problem, and urged certain reforms. At the May meeting of the New York Railroad Club Gustav Lindenthal, consulting engineer, of New York City, made a more sweeping arraignment of present standards and practices, and proposed radical changes, the most marked being a double-webbed U-shaped section. As Mr. Lindenthal summarized his remarks he advocates:

1. Heavier rail sections for the present heavier wheel loads.
2. In the fabrication, holding metal in ladle at least ten minutes for self-cleansing.
3. Pouring ingots large end up with a sinkhead.
4. Rolling rails from reheated cold blooms.
5. Reducing speed of rolls in the last few passes to, say, 4 ft. per second.
6. Having finishing temperature below 750 deg.
7. Experimenting with double-webbed rail for the heavy sections with the probability of finer grain and longer wear in addition to greater strength and safety of the rail.

A number of other engineers, including Dr. P. H. Dudley of the New York Central, W. C. Cushing of the Pennsylvania Lines, G. J. Ray of the Lackawanna and J. O. Osgood of the Central of New Jersey, discussed various phases of the subject. Some of their views were decidedly at variance with those of Mr. Lindenthal. Mr. Ray cited experiences on his road that had made him distrust the heavier sections. Little was said of the double-webbed rail, and those who mentioned it at all seemed to think that a radical departure from the present T-rail would not be desirable. There was, however, general concurrence with other views expressed by Mr. Lindenthal, and others agreed with him that the situation was far from satisfactory.

An abstract of Mr. Lindenthal's paper follows:

IMPORTANCE OF RAIL PROBLEM

No other known structure or member made of steel is exposed to such destructive stresses of every kind as rails. It can hardly be gainsaid that although the mechanical improvements in the manufacture of rail-steel have been brought to a high pitch of perfection, the metallurgical methods are not as good as they should or can be to dispel that feeling of insecurity which, rightly or wrongly, will persist until a decided improvement has been made. We have mills that turn out 4000 tons of rails in twenty-four hours with no more manual labor than was needed for 400 tons some years ago, but has the quality of the product been improved? Many fractures, split heads and other mishaps would not occur if the rails were strong enough for the rough work they have to stand. Rails are but bridges whose safety should be as much beyond question as that of the largest structure; but as long as rails of ordinarily sound steel break in ordinary wear and tear, as they do now, they are not strong enough.

SOUND INGOTS FIRST

The first requisite of good rails is good steel and we must insist upon sound ingots to begin with. There is no difference of opinion of what is a sound ingot, but there are great differences of opinion on the method of getting it. Metallurgists favoring the present practice of pouring ingots with the small end up and without a sinkhead have really nothing to commend it for except cheapness of production. This is such a well-established practice, however, that it will not be changed without compulsion and extra compensation. The time has arrived when the rail consumers themselves must take the lead in determining

certain details in manufacture which will insure thoroughly sound steel, but they must also expect to pay, at least for a time, a higher price.

Not one of the present specifications for steel rails insures thoroughly sound ingots. The external defects of flaws and seams are more readily discovered by inspection and tests than the insidious internal defects caused by unsound metal. The latter are, in fact, discovered only by chance, notwithstanding the closest inspection, and the only way to prevent them is to insist on methods of manufacture that will absolutely avoid them.

Unbalanced rail sections, meaning those with thick heads and thin webs and flanges, should be given up. Really good and tough rails cannot be made that way. Neither can good rails be made by rolling them in the fewest number of passes and finishing at a high heat. But this is the only way the present form of heavy rails with thin flanges which get cold in the rolling while the thick heads are still waxy can be finished without breaking the rolls.

Experience indicates that the bulk of heavy steel rails in this country will hereafter be made of basic open-hearth carbon steel with carbon between 0.75 and 1 per cent, provided that phosphorus and sulphur are both kept low. The expensive alloy steels, like manganese, nickel or vanadium steel, will hardly be used for steel rails except for special purposes and in small quantities.

Defects of Fabrication

Ordinarily the manufacturing difficulties are not in the melting furnace. The defects of fabrication as regards soundness occur mostly after the metal, having been brought to the proper composition, is teemed into the ingot molds. Thereafter the defects in steel arise mainly from five causes—blowholes, piping, segregation, inclosure of slag and oxides, and other foreign matters. The first four causes occur in the ingot, the fifth in the roll.

Small blowholes are not harmful and are readily welded up in rolling, and larger blowholes can be avoided by the addition of aluminum. All oxides, sulphides and other chemical impurities will, if given sufficient time, float up into the slag on top. This self-cleansing process by holding the metal in the empty ladle before teeming is very important, and an interval of at least ten minutes should be allowed for that purpose. In the present practice the metal is teemed as a rule from the ladle into the ingot forms as quickly as it can be conveyed after the addition of the ferromanganese, and there is not allowed sufficient time for the cleansing of the steel bath from impurities before teeming.

While the addition of aluminum reduces blowholes, it increases piping; and piping facilitates segregation. In all real specifications piping and segregation are treated as unavoidable evils, and the only provision against their mischievous effect is the requirement for discard from the upper part of the ingot. As the extended pipe varies with each ingot and may reach all the way from 15 to 80 per cent down into it, the amount of discard would need in fact to be determined for each individual ingot. This is not practicable, and the amount is therefore assumed at some convenient percentage, which the rail maker wants to have as small as possible. To this "hit or miss method" must be ascribed the largest share of blame for unsound steel rails. Even a discard of 30 per cent is no real protection.

Cast Ingots Big End Up

The fundamental requisite for obtaining solid ingots is the maintenance of a fluid top and sinkhead for filling up automatically and quickly any cavities formed in the ingot by shrinkage during cooling. Stated more correctly, cavities must not be allowed to form at all, because immediately segregation takes place which cannot be cured thereafter by filling the frozen cavity with fluid metal. If the ingots were cast with the big end up, and the top of the steel kept fluid so that it should be the last to solidify, no deep pipe would form and no segregation would occur in the interior of the ingots. There are a number of well-known methods to this end, but all of them cause extra cost and labor and will therefore not be used unless made specifically a part of the contract and paid for.

In the present practice pipes and segregation, being at the smaller end of the ingot, pass into the rolls first and are closed up and squeezed into the metal and lengthened in the rolling to an unknown extent, forming interior seams and defects which cannot be discovered by inspection. This inferior method of rolling should be prohibited by the specification. Cropping may and may not remove pipe. Only successive croppings and a microscopic examination of the cropped ends would lead to the discovery of the interior defects, and that is impossible with the thousands of rails rolled in a mill in a day. Any method of forming ingots which will produce pipe and give precarious results is wrong and dangerous.

Bad Practices in Rolling

Sound ingots, free from blowholes, pipes, segregation and internal impurities are, however, only the preliminaries for the rolling of good rails. Wearing quality, great resistance to abrasion, and great strength and toughness are necessary, and these qualities depend not only on the chemical composition of the steel, but also on the fineness of grain, which is developed in the process of rolling. In practice the number of passes are made as few as possible so as to have for the rolling train the largest possible output. That does not put the kind of work on the plastic steel that will break up the coarse crystals which form during the higher heat. There is also considerable doubt as to whether the continuous process does not produce a sleazy metal unsuited to the formation of fine-grained texture.

All existing specifications permit the rails to be finished at too high a heat, which is evidenced by the high shrinkage allowance at the saws—from 5½ to 7⅜ in. prescribed for 33-ft. rail when it should be 4 in. This contributes to, but is not the sole cause of, coarse crystalline structures in the rail head, just where a fine grain is most wanted. For the high finishing heat the rail makers have a good excuse in the thin webs and flanges of the heavy rail sections. The flanges would otherwise cool down too quickly and get dark in the rolling while the head was still at a bright heat. Therefore, reform must begin with the rail section. Web and flanges must be thicker and head if possible thinner, so that the metal may keep a more even heat during rolling and cool more uniformly after rolling, avoiding large internal stresses. In a well-balanced rail section it is easier to break up the coarse crystals of the higher heat than permit the finer crystalline structure to be produced by the work of rolling at the lower heat, and finish the rail near the point of recalescence (675 deg. C.).

More time should be given to the last five or six passes of the rail through the rolls. At the high speeds used, 10 ft. per second, the pressure from the rolls may be sufficient to penetrate through thin metal, as in the web or face of rail, but it does not seem to be sufficient for the penetration through the 2½ in. of metal in the head. It will produce in the head a fine grain only near the surface if at all, leaving the interior coarse-grained and weak. As an experiment the speed for these last passes should not exceed 4 ft.

For the further control of quality of steel the minimum number of grains or pearlite cells per square inch of rail section should guide. This is fully as important as any tensional or bending test, or as the drop test. The aim should be a minimum of 70,000 pearlite cells per square inch, nearly uniform over the whole section.

Tests Inadequate

The drop test as ordinarily prescribed in rail specifications is crude and not sufficient for judging the quality of the steel. Additional acceptance tests are necessary. Drop tests on different rail sections could be compared only when the velocity of the tup is the same for all and when the weight of tup varies with the section modulus of the rail section. This condition is not fulfilled in present practice. The value of the test for comparative purposes is further impaired by the uncertainty as to the amount of force which is absorbed by the mass of the drop-testing machine, which amount varies with each rail section, and by the further fact that proportionality of fiber stress exists only up to the elastic limit of the metal, and not beyond it. The permanent deflection caused by the falling tup is, therefore, not computable, and by itself is not a criterion for the strength or quality of the steel. Therefore rail specifications of recent years prescribe certain tensional elongations of extreme fibers during the drop test. But these are not as reliable as tensional tests with specimens cut from rail, if they could only be made more expeditiously.

Bending tests are important for disclosing fissures caused by slag elongated in the rolling, but most important of all is the microscopic test for the determination of the fineness of grain and freedom from slag.

From a practical point of view the inspection of rails should particularly concern itself with the following features:

1. At the furnace and ladle, seeing that the proper method and time (minimum 10 min.) is given for the self-cleansing of the metal.

2. At the ingots, that the larger end is up and is provided with a sinkhead.

3. At the reheating furnace, that ingots are not exposed to an oxidizing flame and come out thoroughly heated at a uniform temperature.

4. At the rolling train, that the finishing temperature shall be below 700 deg. C., indicated by a dark red cherry color.

Stresses in Rails

The largest stresses in rails are produced by driving wheels of steam locomotives at

high speed; the largest wear of rail is caused by heavy freight trains. The largest wheel loads twenty-five years ago were 15,000 lb., and American rails then weighed from 75 to 80 lb. per yard. Since then wheel loads on passenger engines have reached 34,000 lb., an increase of 125 per cent, and speed, which greatly intensifies the impact stresses, has also largely increased. The weight and strength of rail have not, however, increased correspondingly. The stiffness of a rail is measured by the moment of inertia of its section and the strength by its section modulus, and each increases faster in proportion than the weight of rail, so that a 100-lb. rail, although only 25 per cent heavier than an 80-lb., is about 65 per cent stiffer and 50 per cent stronger in bending strength. But this is not enough for the 125-per cent increase of wheel loads and for the increased speed.

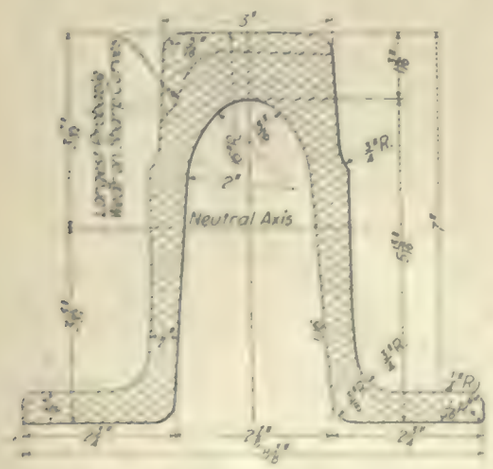
The bending, shearing and other stresses to which a rail is subject cannot be accurately ascertained for dynamic effect of loads at high speed. Much has been written on the subject, but real proof of actual stresses is wanting. Experience is an indispensable guide for determining the size of rail. If a rail is found to be not strong enough for any given condition it should be replaced with one stronger.

LARGER SECTIONS SHOULD BE USED

The 70 or 80-lb. rail (section modulus 10) was found to be strong enough for the wheel load of 15,000 lb. twenty years ago; for the 100-lb. rail (section modulus 15), the wheel load should be limited to 22,500 lb. but for the fact that the steel in this section is not of as good quality; because of this fact the load should not exceed 20,000 lb. For wheel loads of from 30,000 to 34,000 lb. a modulus of from 20 to 22 should be used,, which would correspond with the 135-lb. rail now in use on the Central Railroad of New Jersey—but that rail, the heaviest in the United States, is not a well proportioned section. The new 125-lb. section now experimentally used on the Pennsylvania Railroad has the same strength and stiffness and saves 10 lb. per yard as the result of a better distribution of metal. The head is lighter, the base narrower, and the metal more evenly distributed, insuring better rolling properties.

The carbon is 0.85 per cent desired, as against 0.70 per cent desired for the 100-lb. rail. The aim is to get for the heavier section a harder rail with longer wearing capacity sustaining a greater wheel tonnage.

Going a step further toward obtaining a fine-grained durable rail of heavy section, there are reasons for doubt whether any amount of care in the rolling of heavier T-rails will produce in the head, where it is most desired, a fine grain, toughness and a high elastic limit uniform throughout. Experienced rollers contend that the form of a T-rail precludes good results on the large head of the heavier sections. The rolling pressure on the rail is sidewise, at right angles to the action of the section and the direction of the wheel pressure, whereas the heaviest pressure during rolling should be at right angles to the top to produce a fine grain in the fixed head. The metal in the head is compressed in the most unfavorable direction, that is, crosswise to the stresses it will have to bear.



DOUBLE-WEBBED RAIL PROPOSED

Area of section, 13.4; moment of inertia, 78.1; section modulus, head, 22.1; section modulus, base, 22.5

U-SHAPED RAIL

Hence a modified and enlarged form of the old inverted U-shaped or double-webbed section might answer better the purpose of a heavy rail than the T-shape. In the double-webbed rail the steel receives pressure from the first half to the last vertically upon the head, producing the desired dense fine grain throughout its thickness. The metal can be first rolled flat then bent back to the form shown in the accompanying sketch, and in the last few passes the rail receives its final form. The very method of its rolling should insure the denseness and toughness of the steel.



HOW THE PRESSURES COME IN ROLLING T-SHAPED AND U-SHAPED SECTIONS

An experiment with a few miles of track laid with the double-webbed rail will show results in a year. There is no difficulty in making a splice as strong for the double-webbed rail as for the T-rail. For switches and frogs it need not be used. The T-rail can readily be connected to the double-webbed rail by a special rail joint.

Mr. Lindenthal then concluded his address with the summary given at the beginning of this article.

Discussion

In the discussion that followed Mr. Osgood of the Central of New Jersey spoke of the 135-lb. rail in use on his road. He pointed out that it was adopted experimentally in 1909, for use on sharp curves (running up to 13 deg. 30 min.) under heavy traffic in Pennsylvania, and that while it was conceded to be less strong than could be made at that weight, it had proved very satisfactory for the special purpose for which it was intended. At the end of 1914 the company had laid 9151 such rails, and of the 124 that have failed none of them were among the 1358 laid in 1914, and only nine were in the 4174 laid in 1913.

Mr. Osgood did not regard with favor the change to the double-webbed section. He was impressed with the difficulties to be met at frogs and switches, at joints, especially insulated joints, and in handling the rail, and believed that much more could be accomplished by improving the quality and uniformity of the steel than by any material change in section.

Dr. Dudley gave an extended discussion of the subject, disagreeing with a number of Mr. Lindenthal's points, and taking up many phases of the subject not gone into by Mr. Lindenthal. Mr. Cushing agreed with Mr. Lindenthal as to the importance of securing sound ingots, and also as to the need for methods that would prevent defects, such as seams, rather than attempt to remedy them. Neither he nor Dr. Dudley commented on the double-webbed rail.

MR. RAY HAS FOUND LIGHT SECTIONS MOST DEPENDABLE

Mr. Ray's discussion is abstracted as follows:

In general I agree with Mr. Lindenthal that the railroads, in many cases, have not increased the weight of rail to correspond to the increased weight of rolling stock. I believe, however, that one very good reason for this slowness is that the heavier rail has not been of as good quality, nor has it worn as long, as the lighter rail. On our Morristown line we have a considerable tonnage of 80-lb. rail, all of which has been in service thirteen years or more; some of it as long as twenty years. Pacific-type passenger engines, with axle loads of 62,000 lb., pass over this rail continually, and yet it does not cause and never has caused any trouble from breakage. The 91-lb. rail, from two to four years old, in the same service, does break continually.

Unfortunately the railroads have had to experiment with rail an unreasonable amount in order to determine for themselves the best available quality. The Lackawanna has bought premium rail from several different steel mills (on the latters' recommendation) during the past eight years. The cost of this rail has ranged from the standard price up to more than $80 per ton. The experimenting has all been done with a view of discovering some kind of rail which would wear well and at the same time be safe from a breakage standpoint. But few of these purchases have been at all successful—more have been complete failures.

DOUBTS DESIRABILITY OF HIGH CARBON

I do not believe that open-hearth rail, with carbon from 0.85 to 1 per cent, will come into general use, even with the heavier section of rail. I believe that rolled manganese rail of a much lighter section will prove more economical. We have a considerable tonnage of this rail, 101 lb. per yard, laid on sharp curves on a 1½-per cent descending grade, where from six months to a year is the maximum life of the best open-hearth rail. This manganese rail has now been in service 2½ years and looks as if it will last much longer, and with it we have not had a single rail failure.

When we increased our 91-lb. section to 101 lb., we had rolled a considerable tonnage with carbon up to 0.80 per cent. Two special allotments we had rolled with a minimum of 0.80 per cent and a maximum of 1 per cent. These rails were laid on the sharp curves above referred to, but before they had been in the tracks six months they were breaking so frequently that we had to remove them.

Prior to 1906 we seldom had a broken rail. Most of the rail on the main line was 80 lb. and our maximum axle load had been approximately 45,000 lb. for six years. The 90-lb. Bessemer rail, rolled between 1904 and 1908, showed a marked tendency to split heads, split webs and battered joints. Again this rail wore out so fast on sharp curves that it had to be changed out continually. In 1904 and 1905 100-lb. Bes-

semer was tried but it wore faster and gave no better, if as good, service as the 90-lb. rail. The maximum axle loads on fast engines increased in 1908 to approximately 56,000 lb. and at that time we started to use open-hearth rail. In 1908, 1909 and 1910 many thousands of tons of high-carbon open-hearth rail were purchased. Since that time we have been removing bad heats, and finally the entire rollings of 1908 and 1909 from the track. Our experience shows that the failures in high-carbon open-hearth rail are progressive, that is, they increase at a marked rate as the rail continues in service. It is true that we have had less breakage with the 101-lb. sections, but the same progression of failures is evidenced where the carbon is excessively high. In 1913 our maximum loads were again increased to approximately 62,000 lb., but strange as it may seem, the old Bessemer 80-lb. rail never did cause much trouble from breakage, even under the heavier wheel loads.

I am much more afraid of brittle rail than piped rail. A piped rail does not break in the drop test any more easily than one not piped, and I believe I am correct in stating that piped rail have caused few accidents compared with other forms of rail failures. A pipe as a rule shows up and is easily noticed by maintenance forces. Transverse fissures can seldom be found before complete failure. It might be interesting to state that we have never discovered a transverse fissure in any of the old 80-lb. Bessemer rail, while we have found them in both the 91-lb. and the 101-lb. sections from at least two different steel mills.

A Vicious Circle

I do not believe we can find justification for increasing the standard rail section to 125 lb. or heavier per yard on the ground that the increased cost will be made up from the saving in operating expenses with the heavier locomotives and bigger cars, nor do I believe that a considerable part of this expense can be saved by means of less maintenance force required. The stiffer rail section will reduce the amount of surfacing, but the cost of laying the rail will be materially increased; tieplates, track bolts and joints will cost more to purchase and handle. All frogs and switches will cost from 50 to 75 per cent more, and it will require a derrick to handle the frogs or even to change out a rail, when one has to be removed. Every part of the rail and rail fastenings will cost more money, and when main-track rail is relaid in side track or yards there will be a corresponding increase in the cost.

If such heavy rail were universally adopted, not one-quarter of the main track would be so equipped until the motive power department would want to increase materially the wheel loads of both engines and cars, and they would soon overload the new section. We would have to rebuild our bridges, widen our track centers and side clearances, and in fact spend all that could be saved in operating the big engines and cars in rebuilding the road and maintaining the equipment and tracks. I do not wish to convey the idea that a heavy rail should not now be used where the wheel loading is excessive, but I do contend that 125-lb. rail, or even a heavier section, will not eliminate all of our rail troubles, or even breakages.

Conclusions

In concluding I should like to sum up as follows:

1. I agree that as a general proposition a heavier rail section than is generally used is desirable where the wheel loads are extra heavy and the speed high.

2. Care should be exercised that excessively high carbon (above 8500 per cent) should not be permitted, even in the heavy rail, otherwise it will be apt to break as the rail becomes old in service.

3. It is very desirable to eliminate all pipes in rail, but other defects in chemical composition or rolling are more serious, and it is more desirable to test the finished rail from each ingot to detect segregation and brittle rail than for the elimination of piped rail.

4. The double-webbed rail, recommended for trial by Mr. Lindenthal, would be very expensive; a good splice bar would be very hard to get, and all special work, such as frogs and switches, would have to be made out of T-rail, as at present.

5. The present 2-in. limit of allowable flat stops on freight car wheels should be diminished.

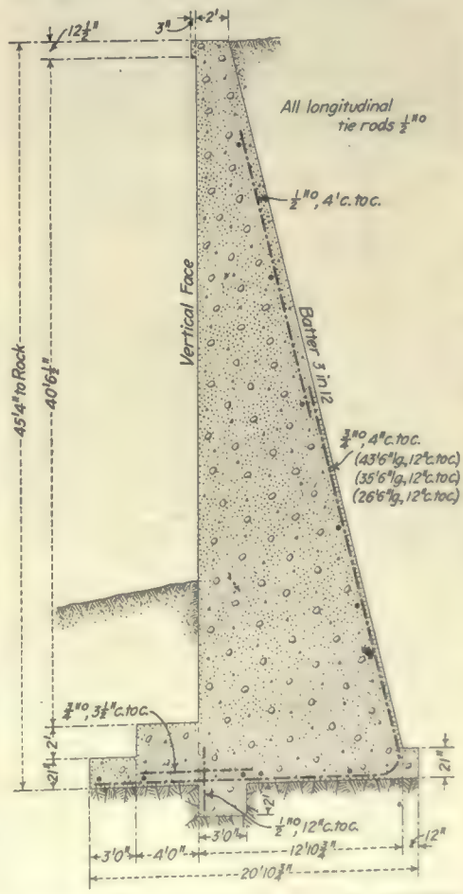
6. The increased cost of a 125-lb. or heavier rail section can only be justified by the safety consideration in handling the present heavy wheel loads, and not from an economic standpoint.

Unusually High Retaining Walls of Cantilever Type

Viaduct in St. Louis Contains Approach Fills Retained by Vertical-Faced Reinforced-Concrete Walls as High as 45 Feet

By S. W. BOWEN
Principal Assistant Engineer, with Brenneke & Fay, Consulting Engineers, St. Louis

SOME TIME AGO there was constructed in St. Louis a reinforced-concrete viaduct having approaches with retaining walls of unusual height. The structure was built by the St. Louis Terminal Railway Company; it carries Union Avenue over the right-of-way of the Terminal Belt Line, and has a total length of 1190 ft. The main crossing over the right-of-way is only 100 ft. in length, and consists of three spans. The long approaches are built of earth fill inclosed by retaining walls of the semi-gravity type, 80 ft. apart, to provide for a 60-ft. roadway and two 10-ft. sidewalks. For a considerable part of the length the retaining walls are unusually high, reaching about 45 ft. at the highest point. In order to avoid encroaching on the narrow roadways along each side of the viaduct the walls were designed with vertical front faces, putting all the batter in the back face. This necessitated a considerable projection of the footing course.



SECTION OF RETAINING WALL AT HIGHEST POINT OF APPROACH FILLS

A cross-section of the wall at the highest point is shown in the accompanying sketch giving full details of the reinforcement. Rankine's theory of earth pressure was used in the design, and a superimposed load of 100 lb. per square foot on the fill was assumed to allow for live load. This live-load factor is only a small part of the whole load for walls of this height, amounting in this case to about 2 per cent.

Estimates for Economical Batter

Because of the height of the walls an investigation was made to determine the most economical batter for the rear face. The thickness at the top was made 2 ft. in all cases, and several alternate designs were compared, using batters ranging from 2 in 12 to 3½ in 12. Estimates were made of the cost per linear foot of wall for each of the sections, including costs of concrete, steel, forms, excavation and earth fill. The cost per cubic foot of concrete was assumed to be a maximum for a ½-in. batter, due to the increased difficulty of placing in a comparatively narrow space and to the richer mix which would be necessary. The cost of the concrete was assumed to be a minimum for the 3½-in. batter, and between these limits the cost per cubic foot was assumed to vary uniformly.

It was found that the estimated cost per foot of wall did not change as much as might be expected, and the above refinements were necessary in order to determine the minimum cost. The batters and corresponding cost per linear foot of wall were plotted and an average curve was drawn, from which it was found that for the assumed conditions the economical batter was about 2¾ in 12. A 3 in 12 batter was then used in order to simplify the drawings.

A 1:2½:5 mix was used, with washed gravel for the coarse aggregate, and the reinforcement consisted of high-carbon steel deformed bars for which a unit stress of 20,000 lb. per square inch was permitted.

The viaduct was designed by Brenneke & Fay, consulting engineers, St. Louis, and built by Fruin & Colnon, contractors, also of St. Louis, at a total cost of $140,000, including paving, lighting and engineering.

TAMPERING WITH CANAL LOCKS, gates, buoys, bridges, dams or other structures by any person without authority is made a felony in New York State by a law passed by the last Legislature. In addition to petty thefts of State property along canals, local officials have frequently reported meddling with the locks, resulting in overflowing of the banks and injury to private property.

Steel Shields Protect Traffic During Removal of New York Subway Roof

Street Surface at Times Square Raised, Existing Structure Cut Into and Old Steel Replaced for Operation of New Seventh Avenue Subway

CONSTRUCTION at Times Square of Section 6-A, Routes 4 and 38, of New York City's new subway system involved the unusual work of raising the street surface temporarily about 2 ft., cutting out the roof of the existing subway without endangering its heavy traffic, and replacing the present roof of beams and the supporting columns with new steel so designed as to provide for the new track layout, and at the same time not interfere with train operation over the present tracks. This steel was handled under the street and over the existing subway roof with scant clearance.

Special steel shields, sliding on bolts previously hung through the concrete of the old subway roof, protected the tracks from falling pieces of concrete while the roof was being removed. As the roof panels were cut out, thin reinforced-concrete slabs laid on the lower flanges of the old roof beams kept the tracks inclosed and later served as forms for the new concrete roof.

LOCATION OF THE WORK

The present subway turns from Broadway into Seventh Avenue at Forty-fifth Street, and just south of Forty-third Street begins its swing under the Times Building into Forty-second Street. The new Seventh Avenue subway will leave the present subway on the west side of this curve, and when it is completed will carry all the Broadway trains down Seventh Avenue on a tangent from the Forty-fifth Street curve. A crossover connection with the existing northbound tracks from Forty-second Street will be used only for emergency operation. The columns and walls to be removed in making the new connection are shown on the accompanying drawing.

After considerable discussion between the contractor and the engineers of the Public Service Commission, a modification of the method of construction contemplated in the contract was agreed upon which involved the placing of the new steel bents midway between the old. This method had many advantages, in that either the old or new roof members always offered a substantial framework over the moving trains, from which framework the temporary street surface could be posted, and on which materials of construction could be moved about and a shield or screen maintained to keep objects from falling on the tracks. It also tended to decrease the amount of work to be done on the tracks.

It had been recognized that this contract might involve difficulties and delays, and as it was not the determining factor in point of time for the opening of the Seventh Avenue route, thirty-three months were allowed for its completion. Due to the plan of work adopted, the organization of the contractor and the co-operation of the designing and field engineers of the Public Service Commission, ten months after its beginning the work was nearly completed.



NEW ROOF BEAMS SET, I-BEAMS UNDER STREET POSTED TO OLD ROOF BEAMS

PLAN OF WORK INVOLVED RAISING STREET

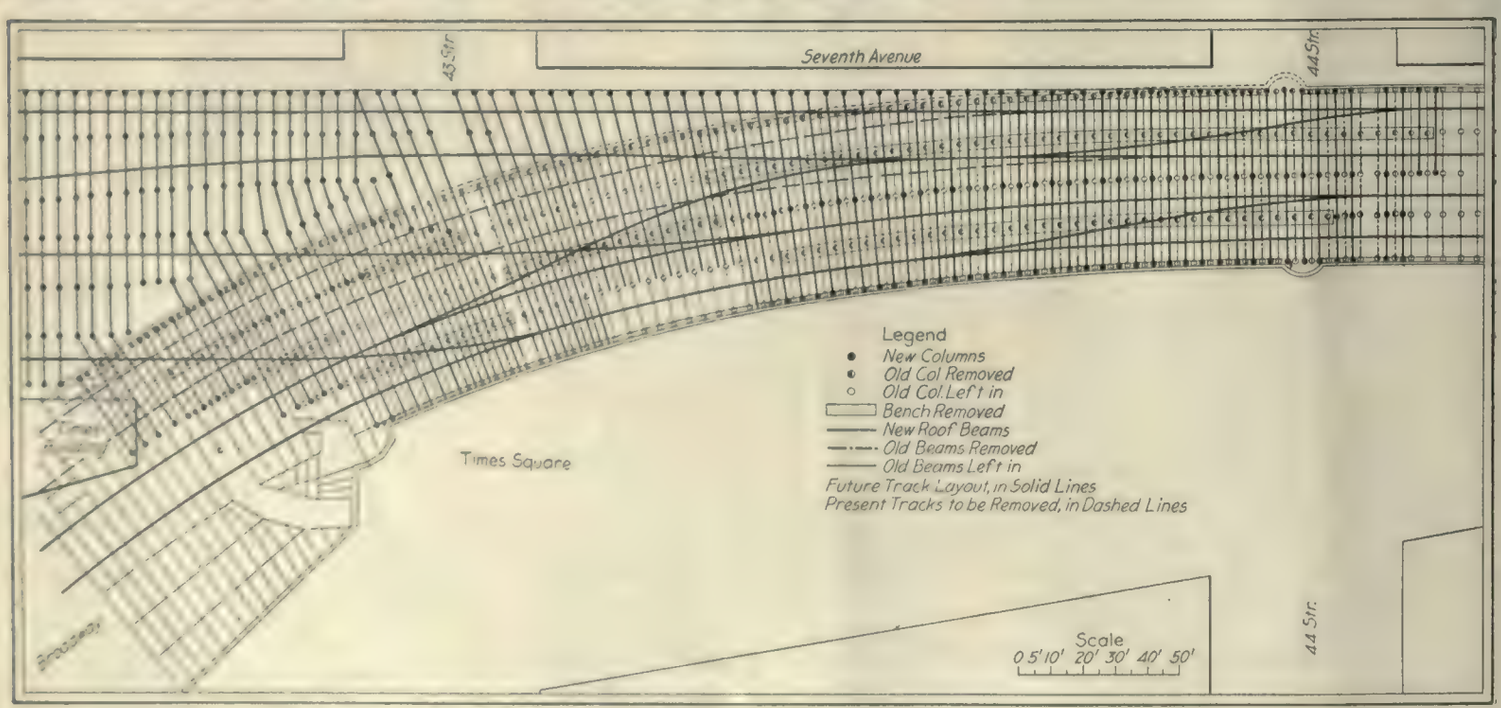
The first step taken was to raise the west sidewalk of Seventh Avenue about 2 ft. Next, the Seventh Avenue street-car tracks were raised, and then the street decking was placed on a level with them. This work necessitated turning northbound and southbound Seventh Avenue traffic into Broadway between Forty-third and Forty-fourth Streets for a few days, but crosstown traffice was maintained by means of ramps.

The decking consisted of an under course of 4-in. planks topped by 2-in. hardwood laid diagonally, and supported on 10-in. steel I-beams parallel with the street. These I-beams, in turn, rested on 12 x 12-in. timbers, which were posted down to the roof beams of the present subway.

The temporary raising of the street surface raised the yokes under the surface-car tracks, which had rested on the old subway roof, sufficiently to allow steel to be handled under them. The decking proved practically watertight in several severe storms and was very stiff and effective in supporting heavy traffic loads. The danger of flooding the old subway at this point was great, as the existing sewers are inadequate to carry the maximum rainfall.

While this work was being done above the old subway the short connecting section to the west under Seventh Avenue was decked over and excavated. This excavation was almost entirely in rock.

The street surface having been temporarily raised, cutting out of the old roof was begun from the west side. Several alternate roof arches were first cut out. The 5 x 12-ft. plate-steel shields used for this had two pairs of 2-in. Z-bars on the upper side, riveted facing each other, with a 1-in. slot between. T-head bolts, supported from beams composed of two channels back to back, resting on the old roof beams, were dropped through holes drilled in the concrete roof arch, inserted in these slots, and turned and wedged up with keys above the channel beams, the keys being driven



RECONSTRUCTION DESIGNED FOR OPERATION DOWN SEVENTH AVENUE WITH CONNECTION TO PRESENT NORTHBOUND TRACKS



RAISING STREET RAILWAY TRACKS ON SEVENTH AVENUE OVER OLD SUBWAY TO GAIN CLEARANCE FOR RECONSTRUCTING ITS ROOF

through slots in the upper ends of these bolts. The shields could be slid along under the arches while hung from these bolts. The concrete was cut away above the shields by drilling it with air hammers and splitting it with plugs and feathers. This work was done without endangering the trains passing below, although the roofs of these trains cleared the old beams at places by a scant 3 in.

As fast as the old arches were cut out the shields were moved ahead and precast 2-in. concrete slabs, reinforced with Hy-Rib, were put behind them on the bottom flanges of the old roof beams. These old beams, except the few that interfered with the building of depressed bays for pipe crossings, were left in place.

HANDLING THE NEW STEEL

The triangular space between Broadway and Seventh Avenue, North of Forty-third Street, was fenced in and used for a yard by the contractor. Steel was delivered on the Broadway side and passed under the decking by two gallows frames, one on the north side of Forty-third Street and one inside the inclosure near Forty-fourth Street. The greatest distance any of this steel had to be handled beneath the decking was 100 ft. This was done by passing a member in parallel to Broadway, skidding in on top of the roof beams to place and turning it into position on steel rails laid on the old roof beams. This turning required some shifting of the posts under the decking, but this did not prove so troublesome as was expected. Each member was then left on rails directly over where it was to go, the work described being done largely by the day crew.

After 1.30 a. m., when express traffic was suspended, the night crew lowered as much as possible of this steel into position before 6 a. m., when express service was resumed. Two sets of chain blocks were used on each of the new girders, some of which weighed 7 tons, and 5-ft. rails were kept beneath them on the lower flanges of the old beams until the last minute as a precaution.

The columns, which were short, and many of which weighed less than half a ton, were lowered with manila rope falls. The old columns taken out were lowered to the express tracks in the same way after the top rivets had been cut off, and skidded to a hole left in the roof over the southbound express track at Forty-third Street and Seventh Avenue, where they were hoisted out with a gallows bent. The few roof beams removed were slid endways into the cut under Seventh Avenue.

SUPPORT OF GIRDERS ON EAST WALL

The support of the new girders on the east wall of the present subway fell midway between the existing columns. Reinforcing stirrups over the old columns and under the new girders were used to support them.



STEEL SHIELD AT END OF TRAVEL ACROSS SUBWAY ROOF

The concrete in the tops of the panels between the columns of the old subway side wall was removed to permit the placing of this reinforcement.

Some of the new columns between the new express tracks at Forty-third Street are within the limits of the old southbound local track. In order to erect these columns the alignment of this track was changed to the west so that local-train operation may continue through the present subway until operation is begun southward along Seventh Avenue.

The roof to be carried by these columns was constructed previous to their erection, some temporary columns being used and vertical wells left to permit inserting a dolly to rivet up the column and bracket connections to the roof.

As fast as the new steel was placed the street load was transferred to it, and the slabs between girders were concreted. This buried the old beams several inches, as the new girders are deeper. In order that the car tracks shall go back to grade, slots had to be formed out of these slabs to receive the yokes referred to above. The concrete mixer is located at Seventh Avenue and Forty-third Street, and is fed with wheelbarrows. Concrete is distributed in carts, and poured through holes in the decking.

WORK UNDER SEVENTH AVENUE

The work under Seventh Avenue was similar to other decked street subway construction. When the excavation had been finished the west wall of the old subway was attacked with jackhammers and plugs and feathers. It has been entirely removed. The air plant for the drills, and the powder storage, were located in the yard referred to above. Material for this part of the work was handled through an opening in the east side of Seventh Avenue below Forty-third Street. A 5-ton Brownhoist locomotive crane, equipped with traction wheels, but running on a short track, served this shaft. These cranes do not have to boom up and down, but spot their load by swinging and moving on the track. Both motions are under instant control within 6 in. and the man in charge of the contract states

that he believes this shaft plant more rapid than others used in New York. The excavation has not approached the handling capacity of the outfit. Storage space for dirt skips was provided above and below ground, so that the excavation was never delayed for lack of teams.

The Holbrook, Cabot & Rollins Corporation of Boston and New York is the contractor, its engineer, George Hallett Clark, being in direct personal charge of the work. The work is being supervised by the engineer corps of the Public Service Commission for the First District, of which Robert Ridgway is engineer of subway construction. Andrew Veitch, Jr., assistant division engineer, is in charge of the work on Seventh Avenue from Sixteenth to Forty-fourth Streets, and the work described in this article was under the immediate supervision of Emanuel D. Pildain, section engineer.

Field Testing Machine Used on Welland Ship Canal

IN the construction of the concrete structures of the Welland Ship Canal it is required that field samples be taken during the progress of the work, formed into specimen beams, 4¾ in. wide, 3½ in. high and 3 ft. long, to be tested at specified ages. This work is done in the field office of each section where there is important concrete construction. Accordingly a cheap but satisfactory testing machine has been designed and is now in use. Details are given in the drawing, so that little explanation is necessary, while the photograph shows the machine set up, with the exception of the pouring can.

The load is applied by means of shot poured into the can on the end of the arm. The pouring can shown in the drawing is placed on a suitable stand and the gate opened. A string passes to the hook on which the loading can is hung so that when the concrete beam breaks the fall of the arm will close the gate. The spring on the end of the gate arm prevents the pouring can being thrown from its support. The breaking load of the concrete beam can then be read directly by means of the stress gage shown. The pouring can is made of No. 20 B. W. G. galvanized iron, is 7 in. in diameter, and has a sloping bottom so that there is no dead space.

The outfit was designed by Frank E. Sterns, designing engineer, under the direction of J. L. Weller, engineer-in-charge, Welland Ship Canal.



SIMPLE MACHINE USED FOR FIELD TESTS OF CONCRETE BEAMS

Preliminary Surveys for Michigan Highways Cost $2.72 per Mile

PRELIMINARY surveys of 1200 miles of road to determine the best location for State trunk-line highways were made in one year (June, 1913, to June, 1914) by the Michigan State Highway Department at a cost of $3,269.40, or an average of $2.72 per mile, states Frank Rogers, State highway commissioner, in his latest biennial report. The cost would not have been that much except for the survey of the prime meridian, which, for the most part, traversed rough cut-over lands, more or less covered with brush, on which the survey cost $3.50 per mile. The prime meridian was surveyed for a distance of 150 miles.

On the preliminary surveys the following information was obtained (when any controversy arose, the lines were fully mapped):

1. Character of country traversed; timber, cut-over lands—character of stumps; clearing; improved farms.

2. Approximate location of buildings; kind.

3. Condition of road grade, if any. (a) Approximate width, (b) alignment, (c) drainage.

4. Kind of soil on roadway—(a) sand, (b) clay, (c) loam, (d) swamp.

5. Location, condition and size of ditches, creeks and streams that must serve as outlets for water from the roadway.

6. Condition, location and measurement of present culverts and bridges.

7. Photographs of all truss bridges and others that might need to be repaired or rebuilt.

8. Bearings of roads traversed with compass.

9. Intersections within corporate limits of cities and villages.

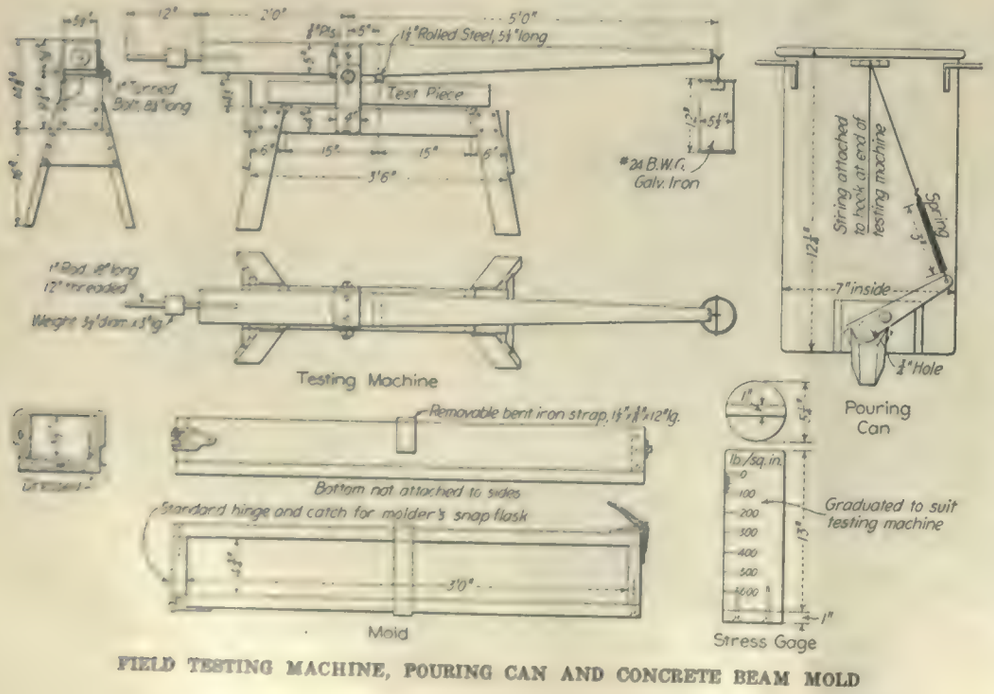
10. Slope, length and height of hills where grade exceeds 5 per cent.

11. On traveled roads, number and kind of vehicles passed, to make possible some estimate of public traffic.

12. Notes as to available road material, gravel, stone, etc.

13. Approximate estimate of cost of grading per mile.

Complete location surveys and plans were made for 299.45 miles of trunk lines at a total cost of $12,039.69, or $41.60 per mile.



FIELD TESTING MACHINE, POURING CAN AND CONCRETE BEAM MOLD

Ohio Highway Statistics

HIGHWAY statistics as compiled in Bulletin 23 of the State highway department show that Ohio has 55,268 miles of earth road, 15,652 miles of gravel, 12,144 of macadam, 440 miles of brick, 78 of concrete and 99 of miscellaneous types. In 1914 contracts were let for 495 miles of road which included 157 miles of brick, 120 of plain surface concrete, 181 of plain macadam, 26 of bituminous macadam, 4 of gravel and 6 of graded road. Ohio's yearly road construction mileage has increased from 33 miles in 1906 to 495 miles in 1914. The average cost per mile for the 307 miles of roads repaired in 1914 amounted to $625. In 1906 $10,332 was spent for new road construction and in 1914, $1,567,248. The State received $2,261,256 in 1914 for road improvements—its share of the 0.3 mill on Ohio's grand tax duplicate of $7,537,486,981.

THE AUTHOR of the article on the Point Defiance line of the Northern Pacific Railway in Washington, published in the Engineering Record of June 12, page 744, was David L. Soltau. In the article in question his name was spelled Soltan.

Severe Frazil Ice Attack at Holtwood Plant Does Not Disturb Service

Experience Has Also Enabled Conclusions to Be Drawn as to Effectiveness of Methods and Warning Signs—Changes and Experiments to Be Made

By F. A. ALLNER
General Superintendent, Pennsylvania Water & Power Company, Baltimore, Md.

IN AN ARTICLE in the last issue of the Engineering Record there was described the standardized operating precautions adopted by the Pennsylvania Water & Power Company to ward off trouble from river ice. It was there shown that the Susquehanna River is subject to frequent and severe jamming from ice packs, but that interference to service from such pack ice has never been experienced nor expected. However, strange to say, for a river located so far south frazil and anchor ice have been a menace and so necessitated the precautions outlined in the previous article. There have been three occasions when, due to frazil or to anchor ice, the operation of the plant might have been expected to be interfered with.

This article will outline very briefly the effects of the first two on-sets of frazil ice, but will discuss in considerable detail the operation during the third on-set, at which time the standard operating precautions were in force. The operation during the third attack indicates that frazil ice conditions, which formerly might have been considered very threatening to the service, have been met quite effectively and rendered harmless by a standardized operating procedure based on experience and experimentation.

WEATHER CONDITIONS

During the night of Jan. 29-30 the sky was clear and cloudless, but there was a 7 or 8-mile wind blowing, which was sufficient to keep the water in the pond from freezing over, except near the shores. A strip about 300 ft. wide along the York County shore was frozen over, as was also a space included within a line from the end of the ramp to the lower end of McCalls Ferry. There was very little evidence of floating slush ice. The forebay was about six-tenths covered with ice, the lower end being covered to Unit 7.

The day and night previous were cold and windy. During the night of Jan. 28 and early morning of Jan. 29 the sky was clear and a 20 to 30-mile wind was blowing. Frazil ice was expected at this time, but the water was probably not cold enough.

The air temperature during the night of the trouble decreased from — 6 deg. C. at midnight to a minimum of — 10 deg. C. at 7 a. m. and the water temperature from 0.6 deg. C. at midnight to a minimum of 0 deg. C. at 10 a. m. At 4 a. m. the air temperature was — 8 deg. C. and the water temperature 0.6 deg. C.; the forebay elevation, 167.7 ft.; the river flow, 80,000 sec. ft.; station load, 16,000 kw. Units 3, 5, 6 and 7 were running, and exciters 2 and 3 in service.



FRAZIL ICE ON SCREEN, JANUARY 30

PRECAUTIONS

In accordance with the operating instructions chains had been hung in the forebay for the purpose of detecting ice and No. 1 turbine-driven hand-control pump was running at a reduced speed so as to indicate the presence of ice in its penstock. The gatehouse steam boiler and the dinkey locomotive were in readiness with banked fires; hose and piping connections were in readiness to supply steam in the power-house air-piping system for warming the exciters and main unit wheel pits. No. 1 water-wheel exciter was on standby with its screens out. No. 2 motor-driven exciter was in service. Readings were taken on air and water temperatures in the forebay every half hour and a constant watch was kept on the test chains. All screens had been removed since the beginning of the winter season from one intake of each unit and the headgate left down to be raised on the first sign of ice.

The screen follower for lifting submerged screens had, in addition to the original trials, been tested and the men drilled in its rapid handling just previous to the day of the trouble to make sure that everything was working properly.

FIRST SIGN OF TROUBLE

Ice was first discovered at 3.55 a. m. when it began to form on one of the gatehouse test chains. The substation at Lancaster was notified of the ice beginning to form at 4.05 a.m. and the Baltimore substation at 4.08 a. m., and some of the day maintenance men were called out.

At the same time one of the screens on Unit 1 was lifted and some small blotches of ice, about 1¼ in. in diameter, were found. One of the screens of No. 3 unit was then lifted; about half the submerged area showed ice attached.

Previous to 3.55 a. m. No. 1 hand-control pump had shown signs of slowing up, but no evidence of ice could be found in the forebay. About the time that decided evidence of ice was detected on the forebay chains, the pump shut down completely. The hand-hole covers were taken off but no ice was found in the runners nor did any amount of water come through when the turbine valve was opened, indicating that the screens of the turbine penstock had clogged.

HANDLING HEADGATES AND SCREENS

At 4.15 a. m. the fourth headgates on Units 3, 4, 5, 6, 7 and 8 were raised. The screens of exciter 3 were raised at about the same time and the boiler and dinkey started. At 4.25 the fourth headgates on units 1 and 2 were raised. At 4.35 a. m. there were no signs of ice on the water sur-

TABLE 1—TIME OF REMOVING SCREENS AND THICKNESS OF FRAZIL ON THEM—ICE RUN OF JAN. 30, 1915

Screens	No. 1 Unit				No. 2 Unit				No. 3 Unit				No. 4 Unit				No. 1 Exciter
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	
A	Out	Out	Out	Out	Out	Out	Out	Out	Out	Out	Out	Out	Out	Out	Out	Out	Out
B	5.36 a.m. ½ in.	5.34 a.m. 10 in.	4.00 a.m. 10 in.	Out	5.30 a.m. 0 in.	5.28 a.m. 0 in.	5.26 a.m. 0 in.	Out	5.32 a.m. 5 in.	5.38 a.m. 5 in.	4.05 a.m. ½ in.	Out	5.41 a.m. 2 in.	5.43 a.m. 2 in.	5.45 a.m. 1 in.	Out	Out
C	7.13 a.m. 10 in.	1.25 p.m. 24 in.	8.10 a.m. 14 in.	Out	3.40 p.m. 13 in.	1.45 p.m. 15 in.	6.52 a.m. 4 in.	Out	4.35 p.m. 14 in.	2.00 p.m. 18 in.	11.35 a.m. 30 in.	Out	4.43 p.m. 15 in.	2.20 p.m. 18 in.	8.25 a.m. 14 in.	Out	Out

	No. 5 Unit				No. 6 Unit				No. 7 Unit				No. 8 Unit				No. 3 Exciter
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	
A	Out	Out	Out	Out	Out	Out	Out	Out	Out	Out	Out	Out	Out	Out	Out	Out	Out
B	5.47 a.m. 2 in.	5.49 a.m. 2 in.	5.51 a.m. 1 in.	Out	5.54 a.m. 3 in.	5.58 a.m. 3 in.	6.04 a.m. 4 in	Out	5.00 a.m. 4 in.	12.30 p.m. 12 in.	5.10 a.m. 2 in.	Out	5.15 a.m. 0 in.	5.17 a.m. 0 in.	5.20 a.m. 0 in.	Out	4.15 a.m. 0 in.
C	4.57 p.m. 16 in.	2.35 p.m. 30 in.	8.45 a.m. 18 in.	Out	5.00 p.m. 14 in.	2.48 p.m. 14 in.	10.45 a.m. 12 in.	Out	5.07 p.m. 0 in.	3.15 p.m. 14 in.	10.05 a.m. 18 in.	Out	5.15 p.m. 0 in.	3.28 p.m. 8 in.	11.25 a.m. 24 in.	Out	4.20 a.m. 0 in.

NOTE—Each main unit has four intakes, with five screens in front of each. The fourth and fifth screen sections, designated as D and E, were not removed, except that section D had in the early winter been removed, with A, B and C in the fourth intake as a precautionary measure. See last week's article for full explanation.

face in the gatehouse, nor was there any noticeable drop through the screens. About 1½ in. of ice had formed on all ropes and test chains.

At 5 a. m. the pulling of the second screens was in full swing and the screen pulling continued, as indicated in Table 1. At first the screens showed from 1 to 4 in. of ice, depending upon which units were running, the running units, of course, having more ice on their screens. At 6 a. m. the greatest thickness of ice observed on any of the screens was 4 to 5 in. From then on each screen pulled continued to show heavier ice, the maximum observed being about 30 in., measured from the face of the screen.

Difficulties with Lifting Device

Up to about 7 a. m. the screen pulling was progressing normally and was well in advance of the station load. At about this time, when the third sections started to come out, the screen follower, which was used to get hold of the submerged screens, started to give trouble.

The first difficulty with the follower was that the screens had become so heavily coated with ice that the follower hooks were unable to get hold of the upper channel. The ice had also accumulated to a thickness of 12 to 14 in. on the guides above the screens, preventing the follower from getting within reach.

The second difficulty was that the side angles on the follower were a little too short to keep the follower in the screen guides, making it very difficult to keep the pull of the crane cables in line with the direction of the screen guides as the horizontal component of the pulling force, plus the added weight of the heavy ice coating, would slide the traveller along the rails so as to swing the cables out of line.

Use of Grappling Hooks

It was then decided to abandon the use of the follower and to use grappling hooks. There was difficulty in using the hooks on account of the heavy accumulation of ice, and also because when the screen was lifted out of the water a man then had to go down and break the ice off the top of the screen so as to get a steel-rope sling through it. The small hook on the crane was then lowered and used to hold the screen while the big hook was slackened to release the grappling hook. The big hook was then put through the rope sling, the small hook released and the screen brought up. As the screens, loaded down with ice, were very heavy the grappling hooks repeatedly straightened out and new ones had to be supplied.

This method of course caused considerable delay in handling the screens and necessitated the gradual assistance of the Westport steam station for the safe carrying of the load over the peak.

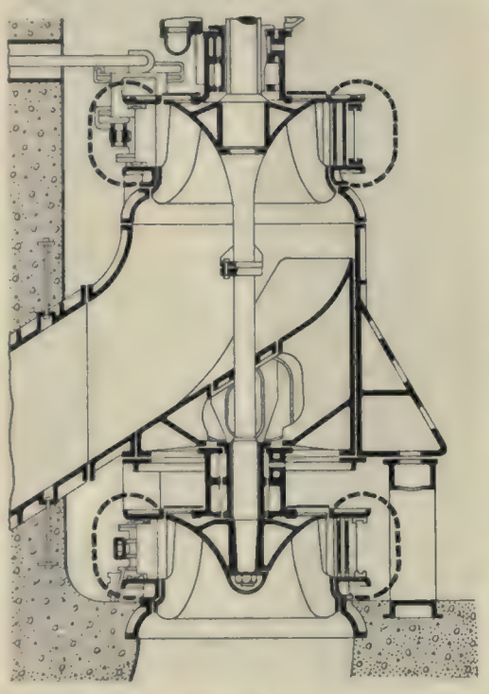
Exciter Capacity Always Ample

At about 6.55 a. m. No. 3 waterwheel exciter started to show signs of reduced capacity and load was transferred to the spare exciter which was in readiness. Steam was then admitted to the exciter which had been running, thus thawing out the ice and warming up the pit so that it was ready to take care of the load when the other exciter clogged up, which it started to do in about two hours.

No difficulty whatsoever was experienced in taking care of the excitation, as the exciters did not clog up quickly, so that while one exciter was running there was more than enough time to thaw the other out and get its pit warm. As the running turbine-driven exciter was kept heavily loaded, practically the entire capacity of No. 2 motor-driven exciter was available at all times, to say nothing of the storage battery. The periodic changing over of the turbine-driven exciters and the thawing out with steam were continued until the trouble ended.

Table 2—Load Conditions Jan. 30, 1915

Time, a. m.	Station Capacity, kw	Station Load, kw.	Westport Steam, kw.
6.00	47,000	35,000	.....
6.30	54,000	42,000	.....
7.00	54,000	38,000	10,000
7.30	54,000	42,000	10,000
8.00	52,000	49,000	8,800
8.30	50,000	47,000	11,000
9.00	48,000	42,000	12,300
9.30	50,000	40,000	7,000
10.00	50,000	42,000	2,000
10.30	50,000	44,000	2,000
11.00	65,000	44,000	2,000
11.30	65,000	47,000	.....
p. m.			
12.00	65,000	45,000	.....
12.30	65,000	44,000	.....
1.00	65,000	45,000	.....
1.30	76,000	47,000	.....
2.00	76,000	49,000	.....



BROKEN LINES INDICATE ICE ACCUMULATION AROUND VANES

Ice in the Wheel Pits of Main Units

At about 8 a. m. the main units started to give indication of ice forming in the turbines. This was evidenced by the units not increasing in capacity, in proportion to the number of screens removed. To overcome this trouble the turbine vanes were moved back and forth. This was successful in breaking the ice in all units and bringing them to full capacity, except No. 5, whose capacity stayed at about 40 per cent. No. 5 turbine was taken out of service at 11.35 a. m. and opened for examination. The entire upper runner was found enveloped in ice. There was no ice on the concrete nor on the operating shaft or reach rods, but the vanes were fixed quite immovably with the ice surrounding them, as indicated in the accompanying sketch. Steam was admitted to the unit for about an hour, and upon being again opened, it was found that the steam, while it had not melted the ice appreciably, had softened it considerably. The pit was then filled with water and after manipulating the vanes a few times, the ice broke. The unit was put back in service and delivered full capacity. After it had been running for about an hour on the bus the unit was again opened and examined and no trace of ice was found.

At 2.40 p. m. No. 3 unit, which was now delivering full power but which had previously shown signs of reduced capacity, was opened and examined. Ice was found on top of the runner, with a large accumulation near the water intake for the lignum vitæ bearing. Some ice adhered to the operating shaft, especially on nuts and bolt heads, and also in a few places to seams and irregular places in the concrete. This ice was softer than in No. 5.

Table 2 shows the station capacity, station load and Westport steam load every half hour during the trouble, indicating that at all times the station capacity was well in excess of the station load, in accordance with the rules of the Permanent Operating Instructions for fighting imminent ice trouble.

Improving Screen-Handling Devices

In reference to the difficulties with the screen follower, these can be remedied by lengthening the side angles to at least 6 ft. long. The hooks should have a length of about 3 ft. to clear the head of ice on the submerged screen, and in order to make the follower pull in line with the guides the crane traveler should be fastened on the rails in the proper position by chains that can be hooked in when required.

A previously proposed scheme of connecting the second and third screens so that when the second screen is lifted the third one comes with it, thus giving a large free opening for the water, will save considerable time in handling the screens. This will make it necessary to remove the second screen from the guides before starting to raise the third screen.

Contrary to expectations of last year there seemed to be no difference in the amount of ice which formed on the painted and unpainted screens, although the painted channel-iron gage at the river end of the station again showed very little ice while the unpainted iron ladder alongside of it had an accumulation of about 12 in.

During the next season three special test pieces, one with blank metal surface, the second one with the standard two coats of red lead and a third one with a very heavy coating, will be suspended in a characteristic location in the gatehouse in order to determine definitely the comparative influence of paints or other heat insulating coats on the formation of frazil ice.

Effectiveness of Steam

In regard to the effectiveness of steam in getting rid of the ice in the wheel-pits, it can be said that in the case of the exciters which were examined at frequent intervals during the trouble, that steam is very effective. On the large units the masses are so great that it takes longer for the steam to have an effect, but it has been noticed that steam applied to one of the main units for one hour will loosen up the ice considerably; applied for one to two hours it will cause the ice to become so rotten as to drop of its own weight and if for three or four hours the ice which forms within the runner drops off. This has been verified by later experience.

If the vanes are kept moving constantly they can not freeze solid, but some ice will form on the inside tips of the vanes and

also on the leading side of the runner blades, which must be thawed out by steam if the condition is serious. Experience has also shown that steam acts as a very prompt remedy when applied in the incipient stage of ice sticking to the turbine parts. On large masses of ice the effect of steam is considerably slower.

It was observed that the ice deposit was greatest where the velocity of water was highest. Such was the case in No. 5 unit, which had 12 to 14 in. of ice around the vanes and operating rings and elsewhere had none whatsoever. Obstructions, rust, barnacles, nuts, etc., seemed to be favorite starting points for ice clusters.

SINGLE-RUNNER UNIT BETTER PROTECTED

Unit 8, with its scroll case, has no protruding parts obstructing the flow of the water and when it was examined during a later ice flow, no ice was found adhering to any part of the turbine although some did adhere to cracks and rough spots in the concrete intake. It is very likely that the freedom from ice around the guide vanes of this unit may be due to the turbine parts conducting considerable heat from the warm air in the building to the water exposed surfaces, as the head cover of No. 8, with guide-vane spindles, etc., is exposed to the warm temperature of the operating chamber.

NEW FACILITIES FOR DETECTING TROUBLE

At some subsequent occurrence of frazil ice (Feb. 10 and 11, 1915) of less severe character than on Jan. 30, the small 50-hp. turbine driving the geared hand-control pump No. 1, invariably gave a very distinct warning about one hour ahead of any other observation of ice, on test chains, screens or other metal parts. This automatic alarm is very effective as it acts as an acoustic signal due to the change in the noise of the gears. There is one attendant permanently stationed in close proximity to hand-control pump No. 1 at all times and this warning can not go unheeded.

In order to still further increase the rapidity of ice formation on the screens that guard the 14-in. penstock leading to the 50-hp. turbine, a much finer mesh than employed in the present screen bars will be inserted. The principle of this idea could also be applied further to a more elaborate combination of a water jet controlled by such a screen-covered inlet, with an automatic alarm device transmitting the warning as an acoustic, optic or other kind of signal directly to the bench-board operator.

Another feature that will assist in determining ahead of time the critical climatic factors favoring the formation of frazil ice will be the new graphic thermometer that is now being installed in the gatehouse, having a chart of large scale around the critical temperature range for frazil ice.

COMPARISON WITH PREVIOUS ICE-RUNS

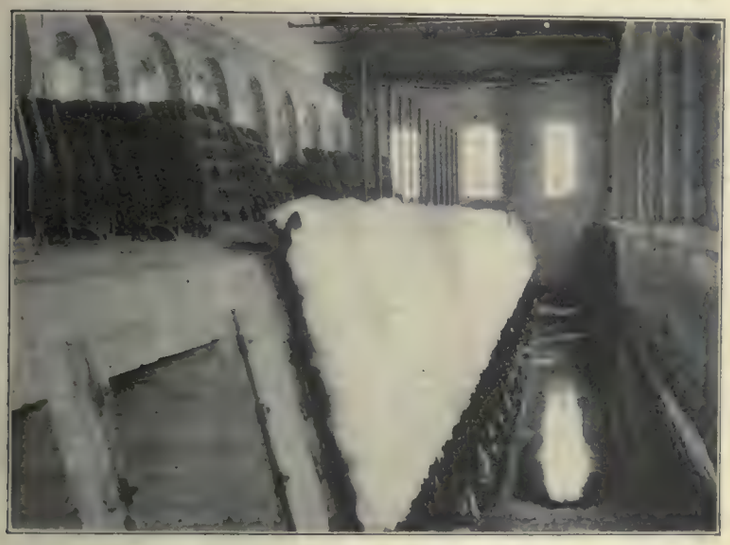
Previous to Jan. 30, 1915, the Holtwood plant was exposed only twice to frazil ice, Jan. 5, 1912, and Feb. 14, 1914.

Jan. 5, 1912.—No clogging up of the guide vanes on main units was observed on this occasion, and the disturbance to service was due to two causes, (1) the clogging up of the intake screens while proper facilities for removing them quickly were not available at that time; (2) the clogging of the runners (not guide vanes) in two small turbine-driven exciters after the removal of the screens. A motor generator exciter was at that time in process of installation but not yet available for service. Since then the alternating current driven exciter and the installation of an excitation storage battery of ample capacity has removed the danger from this source completely.

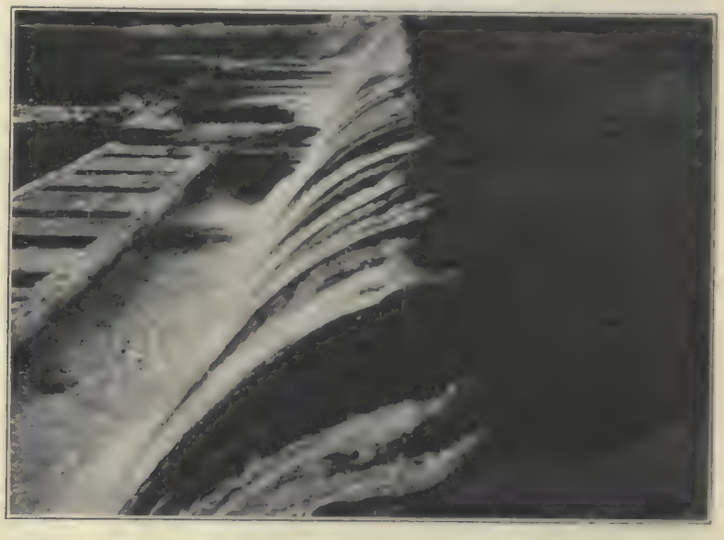
Feb. 14, 1914.—The reduced station capacity on this occasion was again due to the clogging of the screens. Although slight adhesion of ice occurred at the guide vanes, one is inclined to ascribe this to the fact that the operator permitted his water level in the pit to drop below the intake of the upper runner, the cold air then chilling the machinery parts around the intake excessively. With the wheel-pit gages mounted on the floor and the precautions given in our standard instructions for handling such trouble, there should be, in future, no difficulty whatever in the wheel pits being kept filled.

Jan. 30, 1915.—This is an occasion where the ice conditions were severe, but due to the methods of handling ice menace as developed from previous experiences, no interference to service resulted, although one main unit (No. 5) had its guide vanes (and probably also its runners) well clogged up, while the turbine-driven exciters suffered, at intervals, slight reductions in capacity. The waterwheel exciters were easily kept sufficiently clear with the assistance of steam. It could not be stated definitely whether any ice formed in the runners or about the guide vanes of these exciter wheels, because it was not necessary to inspect the exciter pits during the ice run. From previous observations, however, one is inclined to ascribe the occasional reduction of the exciter output to the formation of ice in the runner.

The fact that ice clogged up the guide vanes of main unit 5 is ascribed to the extremely severe conditions during this ice attack, and it is believed that probably any other type of turbine gate mechanism would have met with the same difficulty. On the other hand, it is believed that the movable-vane type of mechanism assisted materially on this occasion in clearing the water passages, for after a short application of steam had rotted the ice, the latter was easily broken up and cleared out by moving the guide vanes.



COATING OF ICE MAKES IT HARD TO GRIP SCREENS WITH HOOKS



FRAZIL ICE, ADHERING TO CREST OF DAM, RAISES WATER LEVEL

The practice of keeping the guide vanes steadily in motion during ice trouble probably helps a great deal to keep the openings clear. In the case of unit 5 on Jan. 30, it is believed that the moving of the vanes was not attended to properly by the operator during the initial stages of the ice run.

CONCLUSIONS

In regard to the possibility of further ice trouble at the Holtwood plant, there need be no more fear of the clogging of the screens or turbines, reducing the station capacity, as with the improvements now under way, and the method of handling the screens so that they can be taken out so quickly, the station capacity will suffer no appreciable reduction due to obstruction of the flow at that point.

There may be some obstruction to the flow of the water through the turbine, due to the ice packing in the runners, but on account of the various telltale devices that are now available to indicate imminent ice trouble, to say nothing of the better experience in regard to weather observations favorable to frazil ice, this can only occur with such forewarning that the necessary standardized precautions can always be taken with ease and such effectiveness as to prevent any disturbance to the service. All work necessary for handling ice trouble successfully has been carried out easily by the regular station shift force, assisted only by a few maintenance men who take care of the steam treatment, inspection of wheel pits and other extra work of special character.

Letters to the Editor

Comment on matters of interest to engineers and contractors will be welcomed

Canoes with Detachable Motors for Survey Parties

SIR: Some time ago there appeared in the Engineering Record an article on the use of canoes in survey work. The following data may, therefore, be of interest.

During the month of December, 1914, our party of four—G. K. Little, U. S. assistant engineer in charge of the Warrior River improvement, Alabama, with J. B. Battle, R. A. Meredith and myself, spent eleven days on the river above Lock and Dam 17. The trip was made to determine the value of the land that is now submerged by the filling of the pool above the dam.

We used for the trip two 18-ft. Old Town canoes equipped with 2-hp. detachable Evinrude motors. In these canoes we carried camp equipment, provisions, etc., and with each canoe loaded and carrying two men we made about 10 miles an hour. During the eleven days in the field we traversed approximately 500 miles, or nearly 50 miles a day.

On crossing shoals, we experienced little trouble, as our equipment was packed in "one-man" packs, and the canoes weighed only about 75 lb., while the motor weighed 50 lb.

Where conditions will permit engineers will find that this equipment will prove quite satisfactory. Progress is fast and pleasant. The Old Town stands the roughing, while the Evinrude is a "sure go" and good for 25 miles on one gallon of gasoline.

I used the two motors during January on two 20-ft. yawls carrying camp equipment, provisions, etc., with a party of eight for survey work on the upper river. With yawls loaded we traveled at an average speed of 4½ miles an hour, going about 12 miles on a gallon of gasoline. On one occasion we shifted our camp 41 miles in one day.

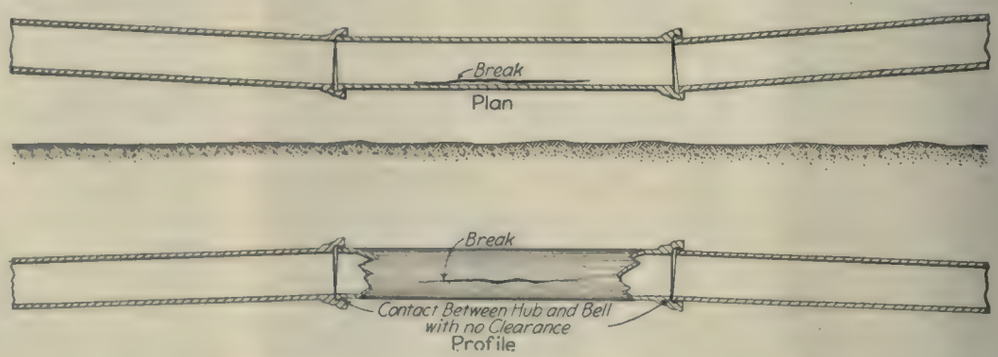
JAMES B. ABBOTT, JR.,
Contracting Engineer.
Tuscaloosa, Ala.

New Theory of Cast-Iron Water Main Breaks

SIR:—In the issue of the Engineering Record of May 8, page 588, are given the findings of J. W. Alvord on the break of a 60-in. cast-iron water main in Cincinnati on Dec. 6, 1913, which ascribed the cause to end pressures. In April of the current year our 20-in. supply main broke under the same general conditions as regards insufficient end clearances.

Herewith is a sketch of the main at the point of the break. The bottom or lower edge of the spigot and hub of the adjoining pipes and the north edge of the spigot and hub of the adjoining pipes had no clearance whatever. What does not seem perfectly clear is why the pipe should crack at the side opposite to which the compression would occur. I believe the crack on this side to be due to the fact that, a few days before, the main had to be closed and the increased pressure and slight amount of water hammer would have a tendency to expand the pipe or burst it. This bursting tendency was counterbalanced on the north side, under compression, and had nothing to withstand it on the south side or convex part of the curve but the strength of the pipe itself.

The pipe is laid on the north side of the State highway, with the convex part of the curve about 2 ft. from the road surface which is telford macadam. From the concave side of the curve to the property line there are about 10 ft. and just inside of the property line the cane teams of the sugar mills pass by, the ground being very soft. If the pipe had any tendency to move it must have been to straighten out. This of course would cause the end pressures on the concave side to increase, and this is my question: In a cylinder with one edge under compression, what is the nature of the stresses in the edge diametrically opposite, this edge being free?



LOCATION OF BREAK IN CAST-IRON WATER MAIN IN CIENFUEGOS, CUBA

In placing a new pipe we had to dig up the line for five pipe lengths and ease off the curve in order to have sufficient clearance. The broken pipe was in excellent condition. A milkman notified us at 10 a. m. and we reached the break in an auto at noon and with portable telephone called up a pipe team, brought a pipe stowed at a distance of 2½ miles, closed the main at 6 p. m. and by 5 a. m. next morning had the new pipe in place and the water flowing into the town reservoir.

FRANK M. AGUIRRE,
Chief Engineer, Cienfuegos Water Supply and Sewerage Systems.
Cienfuegos, Cuba.

Hydraulic Measures Vetoed in Pennsylvania

Sir:—In order to correct what appears to be an erroneous statement contained in the issue of the Engineering Record of July 10, under the heading "Hydraulic Measures Vetoed in Pennsylvania," wherein it is said the Governor "also reduced the appropriation for the stream gaging work to $10,000, thus practically putting a stop to the great work which the Commonwealth had in hand," I beg to advise you that the real facts are: The general assembly appropriated to the Water Supply Commission $50,000 for this work, but, owing to insufficient State revenue, the Governor was compelled to approve this item in the sum of $40,000, which is the same amount received by the hydrographic division two years ago. The amount approved will enable the commission to continue its hydrographic work without interruption along the high standard established by the State of Pennsylvania.

R. A. BOEHRINGER,
Division Engineer, Hydrographic Division.
Harrisburg.

Simple Solution of a Quadratic Equation by Slide Rule

SIR: Saul Shaw, who writes on the above subject in your issue of June 12, page 754, is evidently not well acquainted with slide-rule literature, or he would have known that the method he has "discovered" was in use some twenty years ago. In the eighth edition of my little book, "The Slide Rule," I described this method of solving quadratics and also showed its application to the solution of cubic equations. But various processes of the kind had been described previously by M. Beghin and others. I would add that in later editions of my book this section has been omitted, the space being required for matter of more practical value.

C. N. PICKWORTH,
Consulting Engineer.
Manchester, England.

A LARGE RELIEF SEWER has been started in Forty-first Street, New York City, under the supervision of the New York Public Service Commission, First District, to drain the area in the vicinity of the Grand Central Terminal. It will extend down Madison Avenue from Forty-third to Forty-first Street, and thence through a rock tunnel from 40 to 45 ft. below the surface eastward under Forty-first Street to the East River. That part from the west side of Park Avenue under the existing subway and to a point slightly beyond Third Avenue will be constructed by the Rapid Transit Subway Construction Company as part of its contract for the connection between the old subway and the new Lexington Avenue line. The rest of the work will be done by contractors for the city under the supervision of the Manhattan Bureau of Sewers. The work was started at the site of the proposed shaft at the southeast corner of Lexington Avenue and Forty-first Street. Robert Ridgway, engineer of subway construction for the Public Service Commission, turned the first shovelful of earth after it had been loosened by a pick wielded by R. A. Shaler, tunnel engineer of the Rapid Transit Subway Construction Company. The cost of the entire work will be about $240,000.

HINTS FOR THE CONTRACTOR

Details Which Save Time and Labor on Construction Work

Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

[*Contributions to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

Pavement Rooter Drawn by Street Cars Tears Up Brick Streets

A HEAVY pavement rooter in use in Cleveland recently tore up 1475 ft. of granite block pavement between two street-car tracks in three minutes. The rooter



PAVING THOROUGHLY TORN UP

consists of a heavy steel casting shaped so as to slide under and lift the paving blocks, mounted beneath a substantially built carriage which weighs complete about 11 tons. This plow is drawn along by a trolley car at about 500 ft. per minute. Including the time taken to set the plow in position, the entire operation took but 12 min. Two men ride the plow besides the crew of the motor car.

Owing to the speed at which the rooter traveled, it was difficult to catch it in action. One of the photographs shows it at work, but when the camera was snapped, the car drawing the plow had almost passed out of range to the left.



"ROOTER" MOVED SO FAST IT WAS DIFFICULT FOR CAMERA TO CATCH IT

Paint Twin Cableways Red and Blue for Electric Signal System

By HAROLD E. KETCHUM
Superintendent, Hunkin-Conkey Construction Company, Cleveland, Ohio

A SINGLE pole knife-switch attached to 100 ft. of lamp cord, which can be plugged in at intervals on a line buried in the ground, has proved the best means of giving signals for operating the large twin cableways that are building the Detroit-Superior high level bridge at Cleveland. Three wires, one for each cableway and one for a field telephone, are buried in ordinary ½-in. conduit along one side of the line of the piers. There is a wooden box of 2-in. plank with a hinged cover and padlock at each pier. This box is sunk into the ground, and inside it the conduit is raised above ground to prevent wetting the connections to the three condulets located in the box. These condulets, one for each cableway and one for the telephone, are fitted with receptacles for 2-prong connection plugs. Each signal man carries around with him a knife switch and 50 to 150 ft. of cord fitted with a plug. Satisfactory results have not been obtained with push buttons, though several styles have been tried out. By this means the signal men are able to stay close to where the load is being handled, plugging their line in where convenient.

In order that no confusion should arise as to the place to insert the plugs, each cableway has a color. One cableway, its engine house, carriage and fall block, is painted red, and the other blue. One end of each outlet box is painted red and the other end blue, and the receptacles are red and blue respectively, while the center receptacle is left white. It is connected with the telephone line. The cableways are known on



WATCHING HIS LOAD AT CLOSE RANGE WHILE SIGNALING WITH KNIFE SWITCH

the job as the red and blue, and are always so referred to.

At each engine house a 4-in. moisture-proof electric bell is provided for signaling. As an extra precaution a small 3.8-volt electric bulb is also used. The bell and light are operated by a relay, similar to a telegraph relay, which is controlled by the signal line. This arrangement gives a quicker, stronger, and more positive signal. With this arrangement the signals are always the same strength, no matter how far away the signal man's switch is plugged in. By the use of the light, five independent signals can be given in two seconds.

Can the Small Contractor Afford an Engineer?

AN EASTERN sewer contractor who, some years ago, discovered for the first time that college men are trained to think, is ready to answer the question "Can the contractor afford an engineer?" with an emphatic yes. In his opinion many small contractors taking jobs amounting to $100,000 or less cannot afford to run such work without engineering assistance.

This man had employed engineers, but did not consider their services essential. Some years ago he assigned to a sewer contract a young engineering graduate, chiefly because of his friendship for the young man's father. He paid no particular attention to what this man was doing, and did not seem

to care whether he stayed on the job or not. Consequently the fellow left. At once things began to go wrong, and the contractor found annoyances springing up from which he realized that he had been free during the past few months. The engineer was hunted up and induced to return. At the end of the job the contractor was about to approve the final estimate for the work, although he had a dim suspicion that there was something the matter with it. His engineer examined this estimate, however, and soon convinced him that errors and omissions amounting to more than $10,000 had been made by the city engineers. A protest resulted in the work's being remeasured, and the full sum added to the estimate.

This man on a pipe contract had been in the habit of ordering his special castings in a lump, storing them all at one place, and not distributing any of them until he had to have them for immediate use. The natural result was delays and long trips for a single light casting, which took up the time of his teams. The engineer had all special castings for each territory stored together at a convenient place in that territory, and when a given line was to be laid a truck would pick up all the special castings marked for that line and distribute them where they were wanted at a single trip.

Another apparently trifling thing on which this engineer saved his employer much money was in having the lengths of pipe turned properly when they were delivered to the trenches, so that they did not have to be returned by hand. Cast-iron pipe is laid, of course, with the bell up hill on a grade. The engineer located for the foreman all the grades and grade changes on each line, so that the trucks could be turned right before the pipe was unloaded.

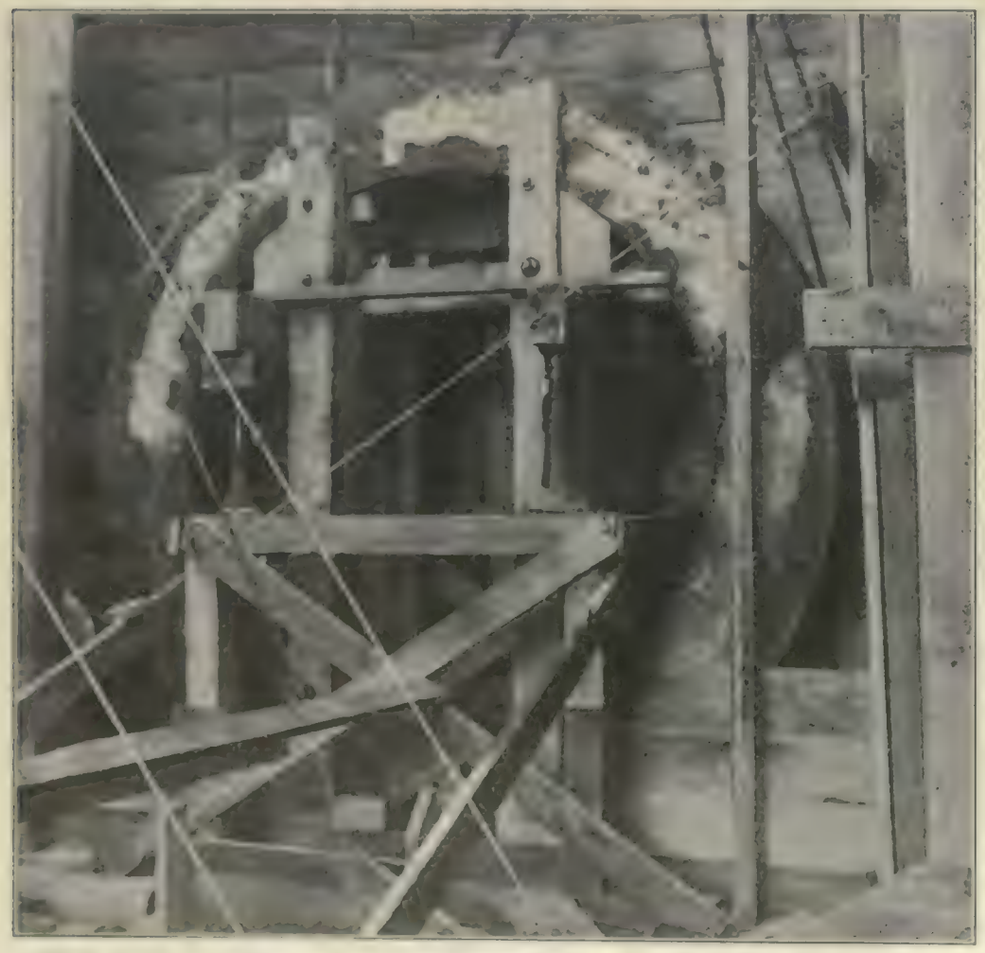
Heating Hub of Turbine Spider Saves Four Days' Time in Mounting

By HAROLD F. JOHNSTON
Banff, Alberta, Canada

INSTEAD of taking four days to put a 27-ton spider on a 15-in. shaft with a 100-ton hydraulic press an erection superintendent in Canada recently succeeded in making a satisfactory mounting in less than four hours by heating the hub of the spider enough to expand it a little. The cost of mounting the spider in the press would have been $60, while the actual operation performed cost only $5. As time was a most important factor in the contract, however, the saving of over three and one-half days was of much more value than the small saving of labor.

This spider carried the rotor and field coils. It had to be keyed to a 15-in. vertical shaft directly connected through a coupling to the turbine shaft. The shaft was first mounted, and the coupling bolted up. The spider, on which the field coils had already been mounted, was blocked up about 9 in. off the power-house floor. A ring of sand was then built around the outside of the hub, forming a pit under the hub in which a fire of dry pine chips was built. The top of the hub was covered with steel plates to help confine the heat. One man kept tending the fire, keeping it evenly hot all around the hub for three and one-half hours. The spider was then raised by the crane and easily fitted over the shaft. It was quickly turned to the proper position, the key driven home, and the mounting completed. The job proved entirely satisfactory, and the 100-ton press sent out by the contractor to comply with the specifications was returned unused.

The installation was made by the General Electric Company of Sweden, at the plant of the Calgary Power Company, at Seebe, Alta. Two 12,000-volt, 4200-kva. generators were erected.

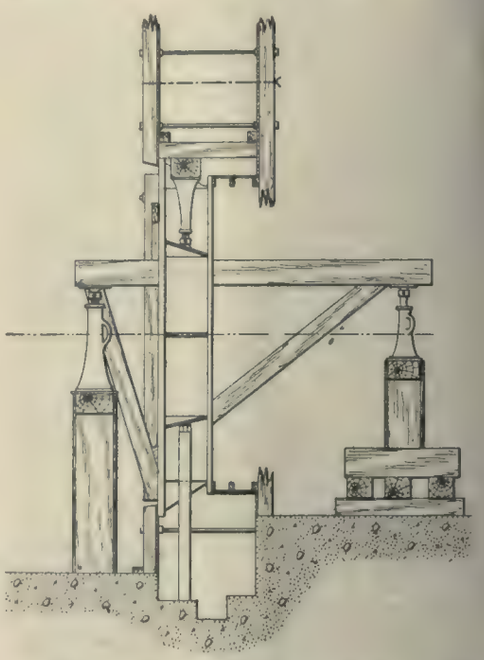


RING, HELD ON FRAME, WAS ALIGNED WITH JACKS, AND FORM BUILT AROUND IT

Eight-Ton Casting Hung in Place in Form on Special Frame

By F. M. BIERSACH
Erection Superintendent, Allis-Chalmers Manufacturing Company

SUPPORTING an 8-ton bulkhead-ring casting in exact position on the shaft center line while a concrete penstock wall was being poured around it was accomplished successfully as illustrated by the accompanying sketch and photograph. The ring was first raised to a vertical position. Two timber slings, or crosses, were then built and braced inside the ring. Under each end of



SHORING JACKS AT TOP AND BOTTOM USED TO ROTATE CASTING

each horizontal timber was set a screw-jack; the ring was lifted to place with these jacks and the necessary blocking. With this method the ring could be rotated, lowered or raised to bring the studs into the right position for the future erection of the turbine. Four jacks were set inside the form against stiffener webs on the casting to steady the ring. The lower jacks were pipe shoring jacks, which could be concreted in, while the upper pair, which could be taken out, were screw jacks. After the ring was adjusted, the form around it was finished and the concrete poured without danger of throwing the ring out of line.

This method was employed in constructing the Five Channels development for the Eastern Michigan Power Company.

DELAYS, INCIDENTAL EXPENSES, high awards and the expense of providing crossings joining severed property were given at the recent valuation conference by Thomas W. Hulme, general secretary of the Presidents' Conference Committee, and real estate agent of the Pennsylvania Railroad, as the four chief reasons why the railroads have found it advisable to avoid condemnation proceedings when any reasonable bargain for needed land can be made.

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

Proposes Six Viaducts Across River at Los Angeles

Chief Engineer of Utilities Board Presents Plan for Solving City's Grade-Crossing and Traffic-Congestion Problems

Considering the general subject of grade-crossing elimination and the reduction of traffic congestion in the industrial district of Los Angeles, Franklin D. Howell, chief engineer of the Board of Public Utilities of the city, has rendered a report which has been approved by the board. He points out that the city is fortunate in that all of its steam railroads enter the city through the trough of the Los Angeles River, but with railroads at different levels on both sides of the river and bridges across them so placed as to meet only the conditions at those particular sites, he sees danger of a complete shutting off of the river for use, except at the expense of destroying expensive concrete structures. He would, therefore, have an official grade line established along the river bed, with the same elevation on both sides, and would have six viaducts built across the entire valley to carry electric railway and vehicular traffic.

These five objectives are proposed by Mr. Howell:

1. Steam railroad tracks to be at street level, but to cross streets only, and not be granted longitudinal rights along same.

2. Grade to be established along river suitable for railroad grade to accommodate industrial district; railroads now on river banks to be required to conform to same; all structures crossing river to be adjusted to yield standard clearance above or below such grade.

3. Interurban railway to elevate or depress, as the particular locality requires, and to be removed from street surface; such elevated or depressed tracks to lead to suitable terminals, or to a loop subway with no terminal.

4. Street railways to be rerouted, and to use viaducts across industrial district and subways through congested retail district.

5. Viaducts at all principal thoroughfares across industrial district to accommodate vehicles and street cars.

The six viaducts Mr. Howell regards as of immediate necessity would be at Main, Macy, First, Fourth, Seventh and Ninth streets. The approximate lengths would be respectively 6700, 4150, 6100, 6750, 6050 and 5800 ft., making a total of 35,550 ft., and he estimates that they would cost $4,260,000, about $120 per linear foot. He would have the expense divided between city, county, industrial district, street railway and steam railroads, according to one of three schedules submitted.

Floods in Ohio and Missouri Cause Heavy Property Losses

Floods resulting from heavy rains in Ohio and Missouri, July 15 and 16, destroyed property to the value of over two million dollars, crippled railroad services and caused the death of several persons. Lima, Ohio, with a property loss exceeding $500,000, the death of three people and over a thousand driven from their homes probably suffered most. The Ottawa River at this point reached a height, after a rainfall of 4.2 in. in 24 hr., even greater than was reached in the flood of March, 1913. Two bridges were put out of commission and the temporary Pine Street bridge was swept away.

The Scioto River at Kenton also passed the 1913 flood stage, submerging the waterworks and leaving the city without fire protection. At Columbus, high waters in the Olentangy River broke through the levee on the north side and flooded several city blocks. A number of large factories were compelled to remain closed and a thousand men temporarily thrown out of employment.

The Missouri River at Kansas City reached the highest stage yet recorded, except during the flood years of 1903 and 1908. The dikes held well so the damage done was comparatively slight. Railroad service was badly crippled, the estimated damage to tracks and roadbeds, according to reports, amounting to almost a million dollars. The towns of Rosendale, Craig, Wyeth and Corning, Mo., were inundated for over twenty-four hours.

Burlington's Bond Issue Largely for New Bridges

Pres. Hale Holden of the Chicago, Burlington & Quincy Railway announced on July 14 the uses to which the road's new $15,000,000 bond issue will be put. The issue has been approved by the Illinois Public Utilities Commission. Mr. Holden said $500,000 would be used on the Mississippi River division of the Chicago-St. Paul line. One million dollars will be the Burlington's contribution to help build the bridge now under construction across the Ohio River at Paducah, Ky., and $1,000,000 will be spent to elevate the tracks and improve the right of way in Aurora.

Explosion Leaves Grain Elevator Practically Intact

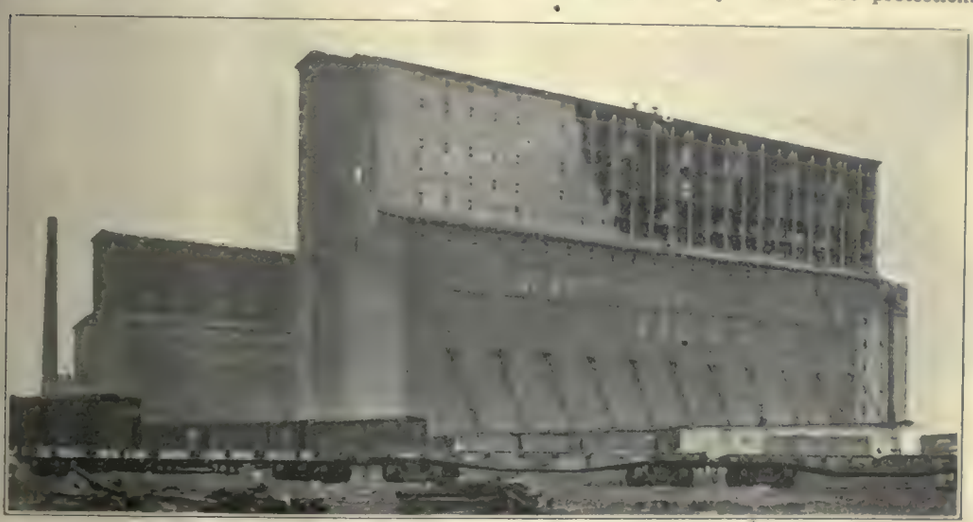
Construction of Building Responsible for Small Extent of Damage—Grain Dust Probable Cause of Explosion

An explosion in the 2,000,000-bu. grain elevator of the New York Central Railroad at pier 7 on the west bank of the Hudson River in West New York, N. J., on the morning of July 15, left the frame, bins and floors of the elevator, as well as the walls of the main structure, practically undamaged. Portions of the tile side walls of the cupola, as shown in the photographs, were blown out, and fell on the side roofs, damaging a few of the purlins. There was no fire, and the damage done to the machinery was negligible. Operation of the elevator was resumed inside of two days, as soon as the débris had been thrown off the side roofs.

The structural features of this elevator, which was put in service in 1904, were described on page 620 of the Engineering Record of Dec. 28, 1901. The building is of steel frame, with steel-walled cellular bins, and is 196 ft. 4 in. high from the track floor to the roof of the cupola. Its lower walls and the end walls of the cupola are of brick, supported on the foundation, which consists of concrete resting on timber piles driven to solid bottom. The side walls of the cupola are of tile, and are carried on girders which also carry the outside lines of columns of the cupola. The cupola has five floors, which are, from bottom to top, the spouting, motor, scale, garner and machinery floors. Numerous wide openings in these floors possibly permitted the air pressure from the explosion to be transmitted to the exterior walls over their full height, although if only the bottom part of the wall section had been blown out, the wall above would also have fallen.

There was nothing burnable about the building except the grain stored in it, which did not catch fire. The five bins in which the explosion seems to have occurred were undamaged, except that the floor covering the bins was blown off, the whole force of the explosion spending itself in compressing the air confined above the bins and in the cupola, and in throwing down the cupola walls. The whole construction of the building seems to have resisted the explosion very successfully.

No cause for the accident has been assigned, but the ignition of grain dust by a spark of some kind was undoubtedly responsible. Such sparks have been caused by flint pebbles,



THE WALLS BLOWN OUT WITH SLIGHT DAMAGE TO REST OF STRUCTURE



COMPARE WITH PICTURE OF OTHER SIDE

which are sometimes mixed with the grain in threshing, striking the tie rods of the bin cells as the grain is dropped into them. Press reports at first attributed the explosion to a bomb. There was, however, no evidence whatever of local damage near the seat of the explosion. A dynamite explosion would certainly have caused some local damage.

Illinois Takes Up Work on Dixie Highway Link

Illinois officially put its shoulder to the wheel July 14 in the construction of the Dixie highway, designed to link Chicago and St. Augustine, Fla., with a "good roads" thoroughfare. With delegations from practically every city along the proposed route of the Illinois division of the highway between Chicago and Danville in attendance, the first shovelful of earth was turned by "Uncle Joe" Cannon of Danville.

Scope of Present Efforts of Co-operative Committee Outlined

At the informal conference of those interested in engineering co-operation held in Buffalo, N. Y., June 24, a committee of volunteer helpers was suggested and the scope of its work, for the present at least, outlined. In general, it is hoped that each member of the committee will present to his local engineering society the needs and objects of a wider and more effective co-operation in the diffusion of information, employment and legislation. It is the aim to increase the list eventually so as to include an active, energetic man as a representative of each important engineering organization, though as yet the majority of the members have not been designated.

For the present the efforts will be concentrated on a systematic investigation of publicity methods and their results. Later, or perhaps during the progress of this work, steps will be taken to investigate the subject of employment of engineers.

Missionary work has been planned for the purpose of impressing the needs and benefits of co-operation on the members of the various local societies. During the coming winter a series of addresses is planned for important centers of population.

Among those who have already signified their willingness to serve on the committee are F. H. Newell, Urbana, Ill.; H. H. Esselstyn, Detroit; Farley Gannet, Harrisburg, Pa.; Charles R. Gow, West Roxbury, Mass.; A. J. Himes, Cleveland; A. Stuckie, Pittsburgh, and C. E. Drayer, Cleveland, secretary.

Wabash Railroad Sells for $18,000,000 in Foreclosure

The Wabash Railroad, which has been in the hands of receivers for three years, was sold at public auction July 21 at St. Louis to satisfy a $41,000,000 mortgage. The property, capitalized at $220,000,000, was bid in at $18,000,000 by representatives of the creditors' committee. In the reorganization that is now to proceed it is understood that the stock is to be assessed $20 per share.

Decrease in Cement Production During 1914 First Yet Recorded

A large falling off in the production of Portland cement and a still larger reduction in shipments, as compared to the corresponding period of the preceding year, occurred in the latter part of 1914, according to reports of the U. S. Geological Survey, and the net result for the year was a slight decrease both in production and shipments. Owing to the fact that the cement industry is particularly subject to local conditions the depression was not felt to the same extent in all sections of the country. The Gulf and Rocky Mountain States, for instance, where progress was checked by agitated industrial conditions, present a marked contrast to such States as New York, Pennsylvania, Ohio, West Virginia and Michigan. Although no statistics are available for the first half of 1915, it is believed that, as compared to 1914, there has been no appreciable loss or gain and that, if no unforeseen conditions arise to seriously affect business, the next six months should show an improvement.

Flood-Preventing (?) Bulls

Flood prevention studies have occupied much space in engineering literature during the last few years, but it remained for Prof. Daniel W. Mead, of Madison, Wis., to reveal to Occidental minds one of the oldest of flood prevention methods—or, rather, supposed flood prevention methods. When the commission of engineers investigated the Chinese flood situation last year, under the auspices of the American Red Cross, the members learned that over seven centuries ago, when the Chinese constructed the great Ming dike, thirty-five miles in length, to protect the plains of Southeastern Kiang Su, eight cast-iron holy bulls were placed on top of the dike as an additional precaution to stop the floods. Immediately after the placing of the bulls the floods ceased—a clear proof (to the natives) of the efficiency of the bulls. A century or two later, however, another tremendous succession of floods occurred, and upon examination it was found that some sacrilegious wretch had stolen the golden heart and silver entrails of the bulls. The images therefore, having been desecrated, could not longer be expected to perform their proper functions. They were, therefore, replaced by a second, and later by a third generation of bulls.



THE CHINESE EXPECTED THIS BULL TO STOP FLOODS

Professor Mead told the story before the Ohio Senate committee on drainage and irrigation, when amendments to the conservancy law of Ohio were up for discussion in March of this year. He aptly turned the story into a telling point against the amendments, by pointing out that the methods they would compel the valley to use would be no more feasible for flood protection than were the holy bulls of China.

As has been recorded in this paper the amendments were successfully resisted and as a memento of the occasion, E. A. Deeds, vice-chairman of the Flood Prevention Committee and director of the Miami Conservancy District, had small replicas of the bull cast and distributed, with copies of Professor Mead's speech, to those who had labored in the interest of the conservancy act and the Miami Valley project.

Illinois Highway Commission to Spend $990,000

The Illinois Highway Commission will distribute $990,000 among the various counties of the State for road improvement work during the year 1915-16. The allotment which was made July 15 shows that Cook County receives the largest sum—$108,994. Each county under the "Tice Law" has to put in an amount equal to that given by the State in order to obtain State aid.

Will Give Summer Course in Scientific Management

Pennsylvania State College will conduct a summer school of scientific management during the two weeks beginning Aug. 9. The session is planned for the accommodation of works managers, superintendents and other members of industrial organizations, and the time is restricted to two weeks to meet the needs of employees whose vacation periods are limited to that length of time.

The mornings will be devoted to lectures and discussions on industrial organization and scientific management under the leadership of Prof. Hugo Diemer, head of the Department of Industrial Engineering at the college. Professor Diemer has had charge of similar courses at the University of Chicago this summer. He has been superintendent of the National Motor Vehicle Company, and has done advisory work in planning organizations for various industrial plants.

The afternoons will be devoted to actual practice in applied methods of scientific management, and in the making of time studies, tool lists, instruction cards, routing and scheduling under the direction of W. H. Tabor, of the Tabor Manufacturing Company, which company has been credited with the most completely developed shop under scientific management in America. The shops of the Pennsylvania State College have been specially provided with means for teaching and demonstrating applied methods of scientific management.

The fee for the course is $15. Persons who are interested in taking the course are requested to apply at once to J. A. Moyer, director, State College, Pa.

Water Rate Fight Settled at Lake Forest, Illinois

Residents of Lake Forest, Ill., have won their long fight to reduce the rates of the Lake Forest Water Company. The Illinois Public Utilities Commission has ruled to cut the rates to consumers from 25 cents per 1000 gal. to 18 cents. Twenty cents per 1000 gal. was the rate for which the Lake Foresters contended. The old rate of $40 per 500 ft. of main for hydrant purposes remains unchanged.

Southern Pacific Acquires Five Oregon Lines

Five subsidiary lines of the Southern Pacific Company on the Pacific Coast, heretofore operated as separate corporations, were formally taken over as a part of the system on July 1. Directors of the several companies voted for the consolidation at the last annual meeting.

The railway lines absorbed include the Portland, Eugene & Eastern Railway; Coos Bay, Roseburg & Eastern Railway & Navigation Company; Salem, Falls City & Western Railway and the Pacific Railway & Navigation Company.

N. Y. Board of Estimate Approves Tunnel for Subway to Queens

At a special session on July 21 the New York City Board of Estimate unanimously adopted the alternate tunnel plan proposed to carry the Fifty-ninth Street subway traffic under the East River to Queens Borough. The other plan, which was definitely abandoned by the resolution as offered by President McAneny, provided this connection by remodeling the Queensboro Bridge. Although this action carried a notification to the Public Service Commission that the Board believed the tunnel should be built and was prepared to supply the funds, based on the $4,500,000 bid promised by the Degnon Contracting Company, the final decision depends upon the approval of both bodies.

The alternate estimates comparing the two plans showed an excess cost of the tunnel over the bridge plan of $1,937,000, or if cost of dredging on the Queens side be included, the total difference is $2,237,000. To offset this, the people of Queens claim there will be greater freedom of the bridge for vehicular traffic.

Order for Accident Compensation on Alaska Railways Approved

President Wilson approved the order covering compensation for accidents on the work of constructing the Government railways in Alaska, July 20. The system adopted is an extension of the act covering the Panama Canal, the Reclamation Service and the Bureau of Mines. It provides that employees of the Alaska Engineering Commission shall be entitled to receive compensation for injuries sustained in the course of their employment while actually in Alaska and that all claims resulting from such causes shall be settled by the chairman of the commission, providing, in case any such accidents result in death, that the claims shall be filed with him within a year after it occurs. No charge will be made for medical service to an employee thus injured and in case it is necessary or beneficial that the injured person should be conveyed to any other point in Alaska, or to Seattle, for treatment not available where the injury occurs, the cost of transportation will be borne by the commission.

Engineering Congress Issues Program of Society Conventions

The International Engineering Congress has issued a program which covers in outline the conventions of four of the National engineering societies at San Francisco, the meetings of the congress and the excursions to various points of engineering interest that have been planned, and gives information as to special trains, hotels and services of congress committee on local affairs. The booklet may be obtained from W. A. Cattell, secretary of the International Engineering Congress, Foxcroft Bldg., San Francisco.

Federal Trade Commission to Aid in Lumber Inquiry

The Federal Trade Commission has announced its intention to co-operate with the U. S. Forest Service and the Bureau of Foreign and Domestic Commerce in their study of the lumber industry. The purpose of the inquiry will be to make it of benefit to all branches of the lumber industry as well as to consumers. Conditions in the trade have changed in recent years due to the widespread use of other structural materials than wood, and, on the assumption that lumbermen are confronted with many problems, not fully understood by them and seldom appreciated by the public, the inquiry will make it its object to ascertain the facts and to put them before the people with the authority of a fair and unbiased investigation and to find practical and constructive suggestions looking to the improvement of existing conditions.

Personal Notes

L. E. Tuttle has been elected assistant city engineer of Stamford, Conn.

D. C. Wrighter has been re-appointed city engineer of Lewiston, Idaho.

John Shaw has resigned from the office of town engineer of North Bay, Ont.

Edmund B. Ulrich has been re-elected city engineer of Reading, Pa., for a term of two years.

Henry Hadley, Jr., city engineer of Verdun, Que., has resigned to go to the front in the European war.

A. L. Smith has been appointed resident engineer of the State Highway Department of Alabama, at Selma.

E. F. Ayres has been appointed resident engineer for the Oregon State Highway Commission, at Sherwood, Ore.

E. C. Buckland has been appointed president of the Central New England Railway, succeeding Howard Elliott, resigned.

E. F. Booth, formerly assistant city engineer of Youngstown, Ohio, has resigned to engage in the contracting business.

J. B. Trenholm has been appointed engineer of roadway of the Atlantic Coast Line Railroad, with office at Rocky Mount, N. C.

N. C. Ray has been appointed senior civil engineer for the Pacific district, Interstate Commerce Commission, Division of Valuation.

H. McAuslan has been appointed town engineer of North Bay, Ont., succeeding John Shaw, whose resignation is noted elsewhere in these columns.

G. E. Buckley, formerly engineer maintenance-of-way for the Southern Railway, at St. Louis, has been appointed engineer maintenance-of-way at Richmond, Va.

R. H. Gould, of the staff of James H. Fuertes, consulting engineer, of New York City, has been appointed resident engineer on the new sewage disposal plant at Dallas, Tex.

E. M. French has been appointed assistant on the engineering forces of the Erie and Ashtabula division of the Pennsylvania Railroad.

George W. Supplee has been appointed junior assistant on the engineering forces of the New York State Public Service Commission, First District.

Carl H. Watson, civil engineer of Great Neck, L. I., has been appointed supervising engineer of the Port Washington (L. I.) sewer district. Work on designs will be started immediately.

Ambrose M. White, formerly assistant engineer of the paving commission of the City of Baltimore, is now connected with the engineering forces of the Pennsylvania State Highway Commission.

Warren Travell, formerly engineer for the Tennessee Natural Development Company, of New York City, has been appointed construction engineer for the Atlas Portland Cement Company at Northhampton, Pa.

Eugene Somers, formerly assistant engineer with Ward Carpenter & Company, civil and consulting engineers, of New York City and Tarrytown, N. Y., has been appointed assistant city engineer of Woonsocket, R. I.

H. E. Tyrrell, formerly supervising engineer for the Southern Railway at Washington, D. C., has been appointed engineer maintenance-of-way at St. Louis, succeeding G. E. Buckley, whose transfer to another post is noted elsewhere in these columns.

Harold G. McGee, acting medical inspector in the office of the State sanitary engineer, Michigan State Board of Health, has been appointed sanitary engineer for the city of Jackson, Mich. Mr. McGee, who was graduated from the University of Michigan in 1913, was an assistant engineer in the Ohio State Board of Health from Oct. 1, 1913, to Dec. 31, 1914.

Edwin C. Hamilton, for the past two years connected with the U. S. Engineers Office at Louisville and previous to that district geographer for the U. S. Forest Service, at Albuquerque, N. M., has been transferred to the office of the surveyor-general of Alaska, at Juneau.

William Bowie, inspector of geodetic work of the U. S. Coast and Geodetic Survey, who was recently elected treasurer of the Washington Academy of Sciences, is conducting the course in geodetic surveying and practical astronomy for the summer school of Columbia University at the camp near Litchfield, Conn., in conjunction with C. A. Mourhess, computer, also of the U. S. Coast and Geodetic Survey.

H. E. Tanner has been appointed city engineer of Verdun, Que., succeeding Henry Hadley, Jr., whose resignation is noted elsewhere in these columns. Mr. Tanner was assistant to the town engineer of Chicoutimi, Que., for two years and had three years experience on the engineering forces of the Transcontinental Railway. Recently he has been engaged in metallurgical research work at the Institute of Technology, Pittsburgh.

Matt M. Bird, consulting civil engineer, who has recently been in charge of street paving at Lewisburg, Tenn., has moved his office to the Blount Building, Pensacola, Fla. He was graduated from the University of Tennessee in 1911 and from Cornell University in 1912. Before graduation he was engaged in various capacities on several engineering jobs. In 1912 he went to Cuba and was there employed by Ruiz & Taylor, engineers and contractors, on railroad location and construction. Since returning to the United States he has been employed principally on municipal improvements.

F. C. Hand, consulting engineer, of Purcell, Okla., and formerly chief engineer of the Oklahoma Central Railway, is now with the Rock Island Lines, engaged in the Federal valuation work. He received his professional education at Union College and entered railway service as rodman on the Texas Western Narrow Gauge Railroad. He was appointed assistant engineer on the Ohio River Railroad in 1883 and chief engineer of the Tavares, Orlando & Atlantic in 1884. During the Spanish-American war he served as a captain of engineers, U. S. V., and in 1899 was appointed chief engineer of the Twin City Railway between Dallas & Fort Worth, Tex.

William C. Downing, formerly general superintendent of the Central system of the Pennsylvania Lines West of Pittsburgh, has been appointed general superintendent of the Northwest system. He entered railway service in 1885, as rodman on the engineering forces of the eastern division of the Chicago, St. Louis & Pittsburgh, attained the grade of assistant engineer in 1888 and that of engineer maintenance-of-way in 1891. He was appointed superintendent of the main line division in 1902 and superintendent of the Pittsburgh division of the Pittsburgh, Cincinnat, Chicago & St. Louis in 1912. He became general superintendent of the Central system of the Pennsylvania Lines West of Pittsburgh in 1914.

Frank E. Winsor, department engineer of the Board of Water Supply, New York City, has been appointed chief engineer of the Board of Water Supply of Providence, R. I., in which capacity he will have charge of the development of the new water supply at Scituate. He was graduated from Brown University in 1891 and served until 1895 as transitman on preliminary surveys and construction on the forces of the Metropolitan Sewerage Commission of Massachusetts. Since then he has had an extensive experience in waterworks design and construction and in water supply problems, principally in New York State and in Massachusetts, in connection

with the Catskill Aqueduct the Weston Aqueduct and other works.

Prevost Hubbard has resigned from the office of chemical engineer, in charge of the division of roads and pavements of the Institute of Industrial Research, to become chief of the division of road material tests and research in the U. S. Office of Public Roads and Rural Engineering. He began his professional work as chemist for an ammonia company in 1900 and served as assistant in timber testing for the U. S. Bureau of Forestry from 1903 to 1905. He was appointed assistant chemist in the Office of Public Roads in July of the latter year and chief chemist, in which capacity he was engaged exclusively on chemical investigation of road and paving materials of practically all types in 1910. He was appointed director in charge of the division of roads and pavements of the Institute of Industrial Research in 1911.

R. W. Rea, formerly chief engineer of the Cascade irrigation district at Ellensburg, Wash., has been appointed chief engineer of the Coast Culvert & Flume Company, of Portland, Ore. He was graduated from the Michigan College of Mines in 1900 and was engaged in various capacities for mining companies at Redridge, Mich., until 1902. He served as assistant engineer in the office of the city engineer of Spokane in 1906, and as resident engineer with Earnest B. Hussey, consulting engineer, of Seattle, Wash., from 1907 to 1909. In 1910, as chief engineer for the Craig Mountain Lumber Company, of Winchester, Idaho, he made a survey for an irrigation project and designed and constructed a water and fire protection system for the town of Winchester. He was appointed assistant engineer of the Kittitas Reclamation District in 1911 on estimates, canal location and land classification, and, in 1913, chief engineer of the Cascade district in charge of the design and construction of improvements to the Cascade canal, including the relocation and reconstruction of about ten miles at a cost of about $360,000. In his new capacity he will have charge of the enlarging of the plant of the Coast Culvert & Flume Company to practically double its present capacity.

Farley Gannet has resigned from the office of engineer of the Water Supply Commission of Pennsylvania to engage in private practice as consulting engineer, specializing on cases before the State departments and commissions, including the Water Supply Commission, the Public Service Commission and the health and highway departments. His office will be in Harrisburg. He will engage in a general practice as well, and is organizing a force for this purpose. A chemical and bacteriological laboratory has already been established, with an experienced bacteriologist in charge, to handle analyses of water, sewage and trade wastes. Mr. Gannet was graduated from Massachusetts Institute of Technology in 1902 and was engaged under James H. Fuertes, of New York City, on the surveys and design of a 3-mile intercepting sewer at Harrisburg and as inspector of construction of twelve pipe sewers. In 1904 he was appointed assistant engineer on the design of a mechanical filtration plant for the same city, under the immediate direction of Charles G. Hyde. He was appointed engineer of the State Water Supply Commission in 1905. In the course of the ten years that he has occupied the office the commission's engineering force has been increased from two to fifty men and the reports have grown from paper covered pamphlets to volumes containing 800 to 1000 pages. The Pennsylvania stream-gaging survey and methods were initiated by Mr. Gannet in 1907 and the State laws for the supervision of streams are mostly the result of the work of his office. He has been desirous of entering the consulting field for several years but was restrained from resigning by the request of the late John Birkinbine, who was the chairman of the commission. Mr. Gannet is president of the Engineers' Society of Pennsylvania.

Obituary Notes

O. W. Jasper, well known in civil engineering circles on the Pacific Coast, died recently at Sacramento, Cal., aged 57 years. He was a graduate of the University of California, was engaged at various times in important railroad engineering projects, having been division engineer during the construction of the Western Pacific from San Francisco to Fresno, and chief engineer for the Northern Electric Railway during the construction period.

Frank R. Williamson, for the past six years assistant engineer with the Chicago Sanitary District, died in Chicago, July 11. He was born in 1867 and was graduated from the University of Illinois in 1892. His first service was with the Pittsburgh Bridge Company as draftsman and checker in the Chicago and Pittsburgh offices. In 1895 he was with Ralph Modjeski, assisting in the design of the draw span of the Rock Island Bridge across the Mississippi River. From 1897 to 1898 he was with the Chicago Drainage District, computing the strains for eight of the largest draw spans over the Drainage Canal, and assisting the bridge engineer. Then for two years he did bridge work for various companies, and in 1901 was appointed assistant engineer in charge of the drafting department of the Scherzer Rolling Lift Bridge Company. His last service was with the Sanitary District.

Civil Service Examinations

United States.—The United States Civil Service Commission will hold an examination for ordnance draftsmen, entrance salaries ranging from $3.28 to $5.04 per day, Aug. 4 and 5.

Examinations will be held Aug. 17 and 18 for senior, Grades 1 and 2, and junior land appraisers respectively, in connection with the Interstate Commerce Commission's valuation work on common carriers. The salaries are to be from $2,700 to $3,600 a year for Grade 1, and from $1,800 to $2,400 a year for Grade 2, senior appraisers, and from $900 to $1,500 a year for junior appraiser. Applicants for senior appraiser, Grade 1, must be 30 years or over; for Grade 2, 25 years or over, and for junior appraiser, 21 years or over. Application should be made at once for Form 1312, stating the title of the examination for which the form is desired, to the U. S. Civil Service Commission, Washington, D. C., or the secretaries of civil service boards at the post-offices of the principal cities.

Philadelphia.—The Civil Service Commission announces examinations as follows:

AUGUST 6—Tracer, salary $600-$900 a year; applicant must be 18 years or over. Rodman, salary $800 a year; applicant must be 19 years or over.

AUGUST 9 AND 12—Draftsman, surveys, salary $1,200-$1,500 a year; applicant must be 20 years or over.

AUGUST 10 AND 13—Draftsman, highways, salary $1,200-$1,500 a year; applicant must be 20 years or over.

These examinations are open only to citizens of the United States and residents of Philadelphia. Application should be made immediately to the Civil Service Commission, Room 875, City Hall.

Examinations Previously Announced

Date		See Eng. Record
July 31	Assistant Engineer, water power, storage and drainage, New York State Conservation Commission	July 3
Sept. 15	Aid, U. S. Coast and Geodetic Survey. Draftsman and junior engineer, U. S. Engineer Department	July 3
Oct. 13	Aid, U. S. Bureau of Standards. Civil Engineer and Draftsman. Draftsman, Navy Department. Engineer, Indian Service	July 3

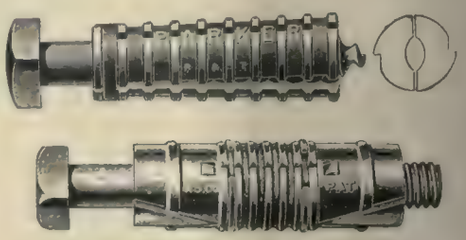
Control of Excavator and Loader Passes to New Hands

Exclusive manufacturing and selling rights of the Albrecht excavator and loader have been acquired by the T. L. Smith Company of Milwaukee, thus marking the entrance of this prominent concrete mixer company into the dirt-moving field.

The inventor of the machine, John H. Albrecht, has been developing the machine for over five years. A number of them have been sold and their performance has been such as to lead the T. L. Smith Company to believe that a very large business can be developed in this line. As has been described in this journal (July 19, 1914, Current News Section) the Albrecht excavator and loader is a combination scraper, excavator and wagon loader, suitable for the excavation of large foundations, basements and drainage ditches, for backfilling, loading sand and gravel, etc. It will dig at a distance of 100 ft. from the machine and at any desired depth for ordinary excavation at the rate of one round trip per minute. One of the largest fields expected for it is on highway excavation work, replacing the usual horse scraper. The machine carries a 12-hp. gas engine, providing power to dig and load 20 cu. yd. per hour.

Lugs on New Expansion Bolt Prevent Twisting

Lugs to prevent it from turning are the feature of the new type of expansion bolt which the Parker Supply Company, 527 West Twenty-fifth Street, New York City, has recently placed on the market. The projections are reversibly directed, as shown in the cross-



RIDGES RESIST DIRECT LINE STRESS

section in the accompanying illustrations, and effectively prevent both right and left hand movements. The circumferential ridges insure a proper resistance to stress in the direct line of the bolt.

The steel spring band on the second type of bolt manufactured by the company holds the halves together and is claimed as a noteworthy improvement. The spring band, on account of its flexibility, allows the shield to expand freely. Both types of bolt, it is stated by the manufacturer, are made of malleable iron of the finest quality to insure the maximum strength of casting.

Asbestos Brake Block Outlasts Several Sets of Wood Blocks

An asbestos-metallic brake block that showed only 0.04 in. wear after five months of service on a heavy duty coal hoist on which wood blocks lasted only a few days, has been put on the market by the H. W. Johns-Manville Company, Madison Avenue and Forty-first Street, New York City. It is a hard, tough, homogeneous material, dark gray in color and fibrous in structure, that is claimed to have a gripping power such as to afford perfect braking control and to produce but a very slight wear on the brake facings. It is asserted to be absolutely uninflammable, to be free from deterioration due to frictional heat and to be unaffected by oil, water or climatic conditions. Its record during the past months in service indicate that it will outlast six to ten sets of wood blocks.

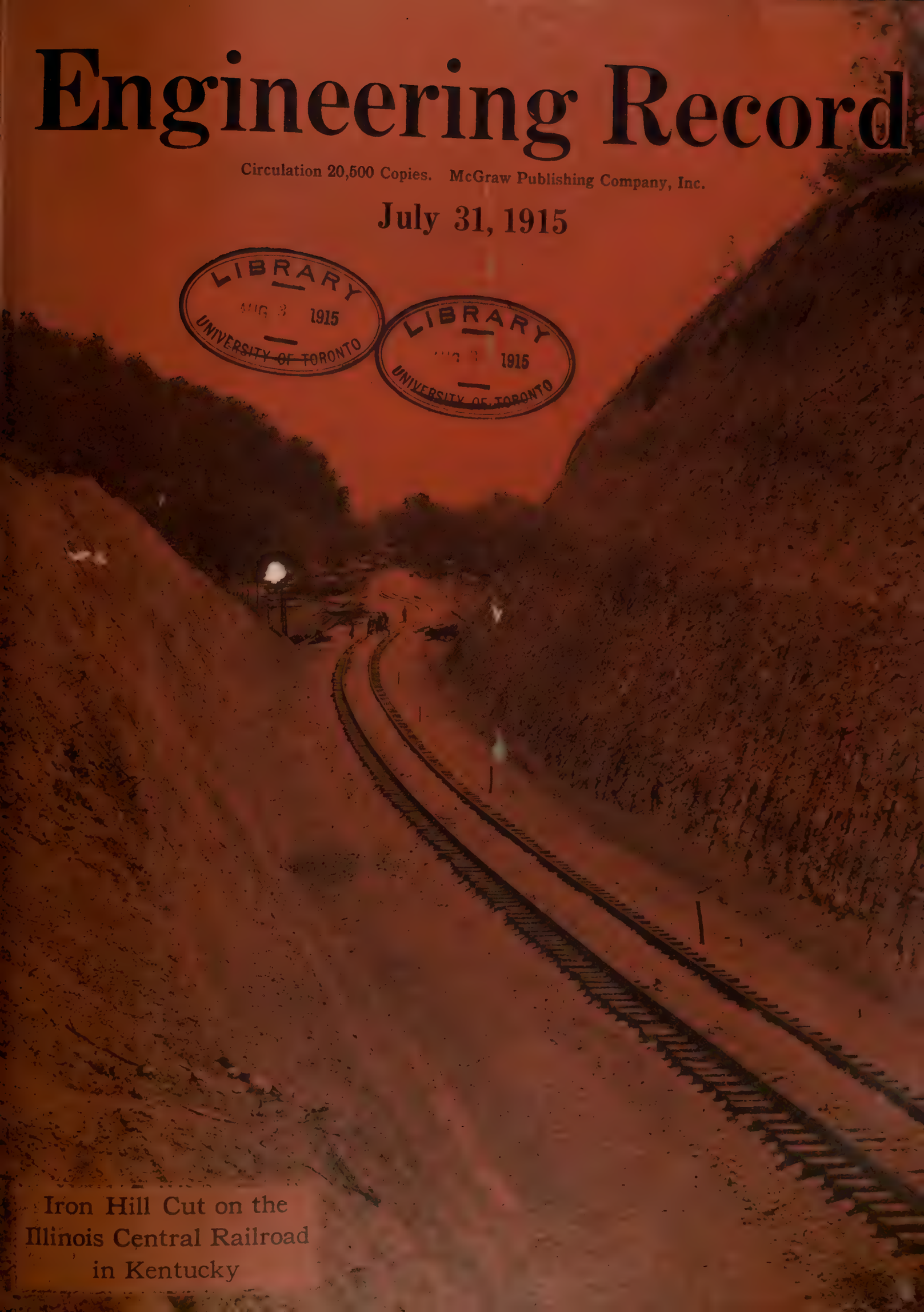
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THE HAYWARD COMPANY

50 CHURCH STREET — NEW YORK, U.S.A.

Engineering Record

A Weekly Journal Devoted to Civil Engineering and Contracting

PUBLISHED BY McGRAW PUBLISHING COMPANY, INC.

Volume 72 NEW YORK, SATURDAY, JULY 31, 1915 Number 5

An Obsolete Unit

DESPITE the fact that the barrel as a container for cement has disappeared, except for export trade, we still continue to use the unit, "the barrel," in ordinary conversation and in purchasing this material. The use of cement, however, is based on the sack, or upon a weight which is translated into a sack equivalent, while all shipments from mills are in cloth or paper instead of wood. There is no excuse for retaining the old designation, except custom and, possibly, some little difficulty in interpreting statistics rapidly growing musty with age. Is it not time that the barrel unit be discarded and all purchases, as well as the use, be based upon the sack? It may be contended that, all accidentals aside, the logical unit would be one of weight. That is true, but since concrete materials are now mixed by volume, and will probably continue to be mixed in this manner for a long time, it is convenient to have a volume unit. Logically, cement should be bought by the pound or the ton, but convenience is served by some volume measure of convenient size. For present purposes the sack now used gives satisfaction, and it might well become the accepted and only unit, keeping for it always a definite and accepted equivalent weight.

The Eastland Horror

ONE CANNOT escape the conviction that some time, in fact, more than once, in the Eastland's cranky history, engineers—naval architects is their general designation—were at fault or their advice was disregarded. As a consequence, the craft which as many as eleven years ago occupied columns in the Chicago newspapers, because of its crazy behavior, carried to death twelve or fifteen hundred people right within arm's reach of assistance. The world was shocked at the sinking of the Titanic, with its terrible toll of lives. There was some criticism of the action of the captain in running at high speed through a region known to be harboring icebergs, yet the ship itself had never been the object of suspieion nor was there any way in which public authority or engineering skill might have foreseen the disaster. In the case of the Eastland, however, it is unescapable that there was ample warning as to the unseaworthiness of the vessel. If it was not fully examined by competent naval authorities, those responsible for the failure to have the examination made should be punished. If the examination was made and the vessel was reported unseaworthy, then those entrusted with the enforcement of the law deserve to go behind prison bars. The third alternative is that the engineers, or naval architects, making the examination erred—a possibility but not a probability, especially in view of such statements as have already been made regarding the limited passenger-carrying requirements imposed some years ago upon the vessel. The point of special interest to engineers, however, is that upon them, in the last analysis, rests the safety of people traveling whether by water or rail. If their judgments are competently rendered, and the laws strictly enforced in accordance thereto, disasters of the Eastland type cannot be repeated.

Elevated Railway Humps

A DIFFICULT problem confronting the engineers of the Interborough Rapid Transit Company in the third tracking of the existing elevated railways in New York City, now approaching completion under the so-called Dual-System contracts, has been met by a very simple and effective solution. The article on page 138 of this issue describes the "hump" construction adopted at the express stations to provide access to the new center express track. The widening of the structure would have been very expensive, and the solution offered is not only practicable and economical in construction, utilizing existing center-track stringers, but should prove economical in operation. A very large percentage of the motive power is ordinarily lost in accelerating on leaving stations, while braking is an expensive operation. Deceleration will now be aided by the ascent of the hump, while less power will be needed in leaving stations, due to the down grade. Costs of operation on these center tracks will allow interesting comparisons to be made with the operation of lines having stations on level stretches. If the figures are as favorable as they are expected to be, they may indicate future possible economies not only on intraurban elevated, but also on electrified suburban lines.

Saving Through Expensive Tools

THE AMOUNT and kind of plant most economical for the road contractor has been receiving increased attention this year, because the slackness in other lines has brought many new competitors into this field. Some years ago while the paving contractor was buying concrete mixers and asphalt road machinery, the road contractor was still operating with a scraper outfit and the old blade grader. An attempt to use an expensive tool like a steam shovel on a road or pavement contract would have been looked upon as the height of folly. At that time, old pavements that had to be removed were torn up by hand methods, and practically all transportation of spoil and surfacing materials was by team. Recently the use of tractors to pull improved types of scrapers and elevating graders, the use of automobile trucks, traction trains and industrial railways to transport road materials, and the development of a type of steam shovel that is able to dig shallow cuts and old pavements with great economy, have revolutionized the business of the road and paving contractor. These new tools are described, the conditions under which each may be employed are given, and the money-saving and revolutionary methods of road building brought about by their use are outlined in the article on page 126 of this issue. In no contracting field at present are a greater number of changes in construction methods being made than in road and paving work, and the contractor who would progress must use every means to keep abreast of developments.

Eliminating Labor

CONSTRUCTION problems involved in the building of concrete roads and the laying of bases for other types of pavement have been given unusual consideration within the last few years. Rightfully so, too, because of the volume of this work and the high expense of repeated rehandling of the materials. Loading devices and discharging arrangements especially adapted for paving work were among the first of the big steps forward, and, simultaneously, contractors experimented with various methods of transporting materials from cars, pits and quarries to the roadside. What economies have been effected are pretty well known to the readers of this journal, through the numerous articles on highway construction. In this issue there is an account of a concrete road job in which the materials were mechanically handled from the pit to the road. Except in one particular, there are no special departures in the equipment used. The contractor has merely assembled wisely ideas quite common in construction work. Their combination has resulted in reducing labor costs very materially. The novel departure consists in using a side-loading instead of an end-loading mixer, but this comparatively slight change has solved what has always appeared to this journal to be a wasteful procedure, namely the depositing of sand and large aggregate on the subgrade and its necessary rehandling to the loader of the mixer. Without a doubt the combined ingenuity of contractors and manufacturers of road-building equipment will result in still other advances in the near future. In this connection, and by way of closing, it is not out of place to point out how largely the manufacturers of equipment have con-

tributed to the cheapening of all classes of road construction. The engineer may well plume himself upon improvements in design, but these alone would have left the present road-building era far in the future. It is the cheapening and betterment of equipment and the invention of new devices, requiring the investment of hundreds of thousands of dollars by way of experiment for their development, which are responsible for the cheapening of our highway work. The manufacturers, no less than the engineers, have played an important part in highway progress.

Psychology of the Chalk Line

QUITE a number of cities at present are trying to enforce traffic regulations which require pedestrians to cross streets only at intersections, and a number of them have adopted an ocular persuasive measure, consisting in the painting of lines across the streets at intersections, designating the boundaries within which crossing is permitted. At first sight it would appear that this simple expedient would be of little value. Brief observation, however, in one of the cities where the scheme has been tried indicates that the painted marks do have an influence upon the pedestrian traffic. Probably this is due to the fact that violation of the traffic ordinance—by crossing the street in the middle of a block—is due in most cases to thoughtlessness. Consequently, if at every intersection the pedestrian is reminded by the white—or in some cases red—marks that these safety spots are provided for his protection and in accordance with the law, he is apt to cross to the other side when this thought comes to mind instead of waiting until he is in the middle of the next block. Even with those who cross indiscriminately because they are indifferent to the law, the constant recurrence every 300 ft. or so of reminders that they are violating the law must in time have a restrictive influence. Eventually the use of these markings may be unnecessary, after crossing only at intersections becomes a habit with those who frequent business sections, but certainly as an educative means their use at intervals is well worth while.

Straight Talk for the Contractor

THE SECOND volume of a work by D. J. Hauer, on the economics of contracting, just issued, meets squarely and answers in the plainest and broadest manner the questions of handling and training men, planning construction work, financing a contracting business, and conducting it so as to avoid a needless legal and financial entanglement, and to gain the confidence of the public. These are matters on which the individual contracting business must stand or fall. It is along these lines that contracting is being led by its broadest men to a much higher plane of efficiency and usefulness than it has ever occupied. The basic principles laid down in this book are such as the Engineering Record has stood for and consistently attempted to hammer home. The contents of this work should be brought to the attention of every contractor in the country. Some additional notes on it will be found in the literature section of this issue.

Disorderly camps, and the practice of robbing men through poor food, exorbitant commissary prices, and short time, are going out of fashion. Almost everyone recognizes that these practices hurt the contractor seriously. Much remains to be done, however, in housing and caring for men out of working hours, both in the city and in the "sticks," so that their bodily and mental health will be increased. These factors are vitally reflected in the attitude of the men toward their work, which has everything to do with their efficiency and cash value to the contractor.

Allied with these questions is the liquor and saloon problem, which every contractor has to face. There is no doubt that this evil has dragged down the efficiency of a high percentage of the class on which the contractor must depend for his supply of mechanics and laborers.

Training men and playing fair with them when they have proved their worth are questions which are newer to contractors. They are of special importance at present when the organization that is trained and loyal from laborer to chief executive is taking the business and making the records and the profits. One Eastern contracting firm which considers itself up-to-date and attempts to train its own men has lost several of its most brilliant pupils through a parsimonious policy. Certain heads of this firm have each their own clique, and have taken every opportunity to browbeat several promising superintendents not of their personal following and to lay these men off at the ends of jobs, or refuse to pay them properly for their services. The company, of course, lost these men just as they were becoming of real value, and turned over to their competitors a lot of first-class construction brains trained at their expense.

Open and honest dealing with a contractor's customers, sub-contractors and creditors, which is backed by sound legal and business advice, is more widely appreciated. Fortunately the man who makes his living by defrauding owners and creditors is becoming scarcer. The man who gets into financial and legal troubles unnecessarily by failing to handle his creditors and his income properly, or by failing to consult such legal and expert advisors as are able to prevent his being imposed upon, is still with us. Such men must be educated, or their forced exit from the field will injure others beside themselves.

The relation of the contractor to the public is another important question well dealt with in this book. Proper publicity methods cannot but improve the standing of the business and increase public confidence in contractors.

Mr. Hauer hits straight from the shoulder and says many things that contractors may not like to hear. It is good for them, however, to hear them, for a time is coming when only those who know the principles he advocates and apply them will be able to succeed.

Following Materials Into the Field

IT IS patent that the ultimate test of any machine or material is the service that it renders when applied to the work for which it was designed. And yet, despite the fact that no one will deny the truth of the statement, manufacturers can be found in many lines who apply the acid test of field service to their product only when, through serious failure, they must replace the machine or supply a substitute for the product that has failed. Their interest, so to speak, is a trailing rather than a leading one. Instead of making a thorough analysis of the conditions under which their product will be used and insuring by careful study that it will be adequate for its purposes, they proceed on fragmentary data, trusting that they will guess right and that such failures as will occur will not be serious enough to cause them great financial loss. Of course, it is not always possible to see all of the conditions that will apply when a certain device is in service, and some measure of adjustment and modification must be expected even after the most painstaking design. Nevertheless, the changes and alterations in most American machines after they have first been placed on the market far exceed those that would be necessary were adequate consideration given in the first place to the conditions under which the product would be used.

Another weakness of many manufacturers is that they take volume of production and sales as their standard and not "service" to their customers. They will not hesitate to sell a material even if it is not adapted to the use in question. This practice in the selling of pavement materials has been criticised in this journal in the past. Progressive manufacturers have long since adopted the policy of refusing to sell their products for purposes for which they are not adapted.

This journal has noted with satisfaction the extent to which manufacturers selling equipment and materials to engineers and contractors have grasped these new theories of business getting. There is still tremendous room for improvement, but that should not lessen appreciation of the progress that has been made. Readers of the Engineering Record will recall the extensive inspection work being done by the cement manufacturers, individually and through the American Association of Portland Cement Manufacturers, on concrete road work. They feel that the best assurance of future prosperity in their industry is the intelligent education of cement users in the use of their product. A poor concrete highway, for example, deters others from using concrete in road work, and, in general, any misuse of cement reacts against it, even though the fault is due not to the material but to the builder or user. In the brick pavement line, the Dunn Wire-Cut-Lug Brick Company has proceeded on the same principle and maintains an engineering staff, whose duty it is to see that the blocks produced by their licensees are correctly used. Now comes the announcement that this company has employed a ceramic engineer, whose business it will be to confer

with the plants making wire-cut-lug brick, to learn their difficulties and help them solve their problems.

This spirit needs to be injected in every commercial line contributing to the construction of engineering work. It means a large gain to the public, and at the same time is the best policy, in the long run, for the manufacturer. He gains nothing by selling an inferior product or a good product for an improper use. In fact, such a sale inevitably sets him back and gives him a handicap not easy to overcome.

The Stability of Public Utility Investments

RECENT advances in industrial securities closely identified with the filling of war-material orders have caused holders of public-utility stocks in some instances to question the future of their investments. The decrease in the market price of the latter, which has been sympathetic with world-wide conditions, has led to the inquiry whether the holder should sell at a loss in the belief that present conditions are likely to continue or should retain his shares in the faith that brighter days will come. The Boston *Transcript* has rendered a service in a recent discussion of this matter, and rightly concludes that the holders of public-utility securities have no real cause for apprehension, in view of the inherent soundness of the properties engaged in supplying gas, electric and transportation service in this country.

The war in Europe came as a climax to a period of generally unsatisfactory business conditions, and naturally aggravated them in an unprecedented manner. Securities of street railway, gas, electric light, power and railroad companies all were affected to a greater or less extent. Gradually the stimulation of industries engaged in the manufacture of supplies for belligerent nations began to create a special demand for industrials of that nature. The speculation encouraged by a bull market distracted the attention of many investors from securities which had been considered fundamentally sound and not subject to wide fluctuation.

Earning power is the final test of a property, and so far as electric light, power and gas companies are concerned, they are unquestionably holding their own and in some cases are doing better than a year ago. The advent of the jitney bus has injected an element of uncertainty into the street-railway industry, but in view of the economic difficulty of rendering local automobile service at existing rates and the certainty of a greater measure of regulation, the street railway will remain an indispensable factor in local transportation, and it is inconceivable that public support in the long run should not be accorded it. The tendency in railway and other utilities is undoubtedly toward rates permitting a reasonable return upon the invested capital, and there is as yet no clear evidence, despite the Alaskan railway venture, that the American people prefer government ownership in any form to private ownership under governmental regulation. Public utilities have by no means reached the height of their usefulness, and, with the advent of improved business conditions, increased efficiency in serving the public and a broader expansion of service will create a better popular understanding of the inherent strength of well-managed public utility and railroad companies.

The Changed Reclamation Service

SLOWLY, but none the less surely, the U. S. Reclamation Service has been passing through most momentous changes. It will be remembered that at the very beginning of the present Federal administration it was intimated that politicians would "get" those who had headed the service for so many years. It is commonly believed that the opposition to Mr. Newell and Mr. Hill came with such force that, for the moment at least, the new Secretary of the Interior, Mr. Lane, was almost swept from his feet and much in doubt as to what move should be made. In this difficult situation he did the best thing possible—called a conference in Washington, at which the objectors were allowed to state their case. In order to estimate the strength of what might be termed the prosecution, the Engineering Record had a representative at the hearing, and his report was summarized in this journal at the time, showing clearly that the disgruntled water users failed to make a case. It then appeared for a time that there would be comparatively little change in the organization, but not long thereafter the commission management was substituted for that of the director. For a time this appeared to be just a perfunctory arrangement, and matters seemed to be handled much as in the past, with only the inevitable delay at Washington due to commission control.

But there were other movements under way, and one by one important men began to resign, because of interference in their work or other conditions which made their tenure of office distasteful and unpleasant. Finally Mr. Newell's resignation was accepted.

But influences were also at work from another direction, and, as readers of this journal well know, the Reclamation Service, heretofore independent of Congress as to the disposition of alloted funds, was put in the pork-barrel class, and now, with rivers and harbors and public buildings, will be a bone of contention for hungry and—why not tell the truth—"unscrupulous" congressmen, for it is unscrupulous, in the opinion of this journal, to get hundred-thousand-dollar post-offices for ten-thousand-dollar cities and to improve rivers and harbors out of all proportion to their relative importance.

Finally, as a last straw, has come the opening of the Denver office, and the concentration there of supervision of projects heretofore closely controlled in six districts. The result of the last change has been the virtual loss to the Government of veterans whose knowledge and initiative was invaluable to the Government, who every year saved their salaries many times over and whose places cannot be effectively filled without long and costly apprenticeship. Although not all of these engineers have been actually dismissed from the service, the reduction in rank which they have suffered means the same thing in many instances. It is apparent that the old esprit de corps of the organization has been killed, and naturally these engineers will find no interest in their lessened responsibilities and will leave the service when they can do so conveniently.

The final step in the reorganization has been made under the guise of economy, but it is difficult to see where this move will mean economy in the long run. Its first and most serious defect is the elimination of a few comparatively high-salaried officials, but it is impossible to conceive of a great manufacturing company or any large private interest adopting a policy of reducing expenses by discharging its department heads. Their salaries in the aggregate are but a fraction of what must be saved annually to show any material reduction in manufacturing costs, and, on the other hand, without their services the quality of product drops rapidly, efficiency is lowered, the rate of production decreases, and the management is lucky, indeed, if at the first serious difficulty the wheels do not stop altogether.

The Engineering Record does not impugn the motives of the present Secretary of the Interior. It believes he has been mistaken in his judgment, but it hopes that the reorganization he has brought about will not turn out to be disorganization. Without a doubt he has felt it obligatory upon him to make changes—changes which he believes will result in greater efficiency. Though this journal, in principle, favors individual rather than commission control, both the changes in Washington and the establishment of the Denver office are not necessarily foredoomed to failure. The changes are, however, disquieting to those who have followed with care the effective work of the service during the first ten years of its existence. Too much has now been conceded to the disgruntled elements in the West, to those who would like to get something for nothing from the Government. The country will await with anxiety proof that the service has not been disrupted.

For the Congressional blundering, one cannot entertain even hopes. The throwing of the service into the pork barrel will make it a political football, while the lengthening of time for payment of water rights was a concession to the elements that are never likely to make a success of irrigation farming. The work of the service has been made infinitely harder by this Congressional mismanagement.

Taken as a whole, therefore, this journal cannot escape the conclusion that the administration has blundered badly with reference to the Reclamation Service. It hopes for the best from those changes which can be justified by skillful administration and organization building. It despairs of any relief from the absurd conditions imposed by Congress, abetted, at least, by the executive branch of the Government.

Operation Analysis of New Machines Which Cheapen the Moving of Earth on Road Work

Light Steam Shovel Proving Efficient in Cuts of Moderate Depth, and in Removing Old Paving and Surfacing—Cost of Operating Dirt-Handling Machines

By A. B. McDANIEL
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IN HIGHWAY CONSTRUCTION it is necessary that the proper methods and machinery be used to secure economical and efficient results. The light, portable and adaptable types of excavators are the best suited for the varying conditions and light work of road and street construction. Each machine has its own peculiar sphere of usefulness and its most economical method of operation. A quarter of a century of experience has shown, especially in the Middle West, the value of blade and elevating graders in road grading and shallow excavation. Recent experience has developed a large-capacity wheel scraper, which is very efficient for hauls greater than 300 ft. A specialized form of the steam shovel has recently proved its usefulness in shallow cuts, and especially in the excavation of hard materials.

FOUR-WHEEL SCRAPER

A four-wheel scraper, made in two sizes, ½ and 1-yd. capacities, is proving to be very efficient in road and street excavation. The machine consists of a pan which is hung by chains from a steel frame supported on two trucks. The front wheels are underhung to permit of short turns. The pan, the front edge of which just touches the ground in the loading position, is operated with four levers by the driver, who is seated at the rear of the machine. A snatch team or traction engine is used in loading. The pan, when filled, is automatically elevated by a sprocket chain while the machine is in motion. The load is dumped through a gate in the rear of the pan.

This machine, known as the Maney four-wheel scraper, has only recently been used in road construction. It has, in several cases, with the soil conditions varying from a dry sand to a hard, dense clay, proved its adaptability and efficiency in this kind of excavation. The writer has made a study of the use of this machine in the excavation of the subgrade for street pavements in cities in central Illinois. The soil conditions were generally favorable—loam and clay, with occasional sand and fills of ash and cinders. The width of cut averaged 20 ft. and the depth of cut from nothing to 18 in., with an average of 12 in. The average length of haul was about 300 ft. and on nearly level ground. Each scraper was hauled by a two-horse team and loaded by a traction engine. Table 1 is an estimate of the average cost of excavation, based on the use of seven scrapers and one traction engine for a ten-hour day.

The four-wheel scraper is from 50 to 100 per cent more efficient than the two-wheel scraper for hauls of 300 ft. and over, and the efficiency increases with the increase in the length of haul. The scraper under ordinary conditions has an average speed of 120 ft. per minute, including time of dumping. With a traction engine about sixty scrapers can be loaded per hour under average conditions of soil, haul, etc. A 1-yd. scraper should average about 12 cu. yd. per hour or 110 cu. yd. per ten-hour working day. The cost of excavation, including overhead expenses, should, under average conditions, vary from 7 to 9 cents per cubic yard for a 200-ft. haul, and increase about 1 cent per cubic yard per 100-ft. increase of length of haul.

This type of excavator is not adaptable to the final grading up, crowning and surfacing of the excavation or subgrade. Some form of road or scraping grader should be used for this finishing work.

TABLE 1—COST OF EXCAVATION WITH FOUR-WHEEL SCRAPER

Labor	
2 firemen, at $3	$6.00
1 cableman	2.00
7 teams and drivers, at $5	35.00
Total cost of labor per 10-hr. day	$43.00
Cost of labor per cubic yard excavated, $43 500	$0.053
Loading Auxiliary	
1 traction engine and operator	$16.00
Cost per cubic yard excavated, $16/800	$0.020
General and Overhead Expenses	
Supervision and general expenses	$3.00
Interest on investment (7 per cent of $1,500)	0.62
Depreciation, based on 5 yr. life	0.88
Repairs, estimated	1.00
Total general and overhead expenses	$5.50
Cost per cubic yard excavated, $5.50/800	$0.007
Total cost of work per day	$64.50
Total amount of excavation, cubic yards.	800
Cost of work per cubic yard excavated, $64.50 800	$0.08



THE ELEVATING GRADER, DRAWN BY TRACTOR, IS EFFECTIVE ON WIDE ROADS

BLADE GRADER ON ROAD WORK

The blade or scraping grader is a time-honored and much used and abused machine for the construction and maintenance of earth roads. Its use and method of operation are so well known that it is unnecessary to discuss them here.

A great deal of difficulty has been experienced in the use of a road grader on the construction of earth roads, especially in stiff clay soils, in preventing the displacement of the machine due to the lateral thrust of the earth. Recently a type of grader, which was originally devised for ditch excavation on reclamation work, has been found to work advantageously under adverse conditions of road construction. This type of grader has pivoted axles so that the wheels can always be kept in a vertical position. Thus the weight of the machine is utilized to counteract the side pressure of the earth on the moldboard and prevent side draft. Where a large amount of road construction is included in one job it is economical to use a traction engine for hauling the grader. Two graders may be hauled by one engine and thus serve to move the earth from the ditch to the center of the road at one trip.

In a case of road construction in Van Buren County, Iowa, the tractor was a 60-hp. gasoline engine and the graders were the so-called Reclamation graders. Sixty miles of earth road was built at a cost of $20 per mile. The road measured 30 ft. from center to center of the side ditches, which had a width of 20 in. and a depth of 36 in. The earth was the ordinary loam and clay of the prairie country.

ELEVATING GRADER FOR WIDE ROADS

The elevating grader has been universally used on road construction in this country during the last quarter of a century. The ideal conditions for its use are in a prairie country which is fairly level and where few stumps and rocks exist to hinder the progress of the plow. It is a more economical machine than the blade grader in road construction, since the excavated material can be moved as cheaply 24 ft. as 10 ft. from the plow at one operation, while with the blade grader the distance to which the earth can be moved is limited by the length and set of blade. However, in the regrading of old roads where the side ditches are narrow and deep, the elevating grader is not serviceable and the blade grader should be used. As is the case of the four-wheel scraper, the elevating grader leaves the grade rough and uneven and a blade machine must be used to finish the surface.

The writer has been surprised to find that a great many contractors do not appreciate the economy in the use of power tractors

for the haulage of grading machines. In order to make this distinction clear, the accompanying comparative statement (Table 2) is given. This is based on average working conditions on road construction in comparatively level country. It is also based on the excavation and removal of the earth from the side of the road to the center. When it is necesary to carry the earth along the road, as in the making of cuts and fills, dump wagons must be used. For a haul of 300 ft. one elevating grader can handle five- 1½-yd. wagons, and one additional wagon is needed for each 100 ft. additional length of haul. The cost of a wagon and driver will be $5 for a ten-hour day. A foreman at $3 per day will probably be necessary both at the excavation site and at the dump. Hence in this case the cost of excavation will be increased to from 8 to 12 cents per cubic yard.

STEAM SHOVEL PROVING EFFICIENT

The steam shovel is one of the most efficient and universally used of all modern excavators. The original type of shovel with fixed platform has been generally employed in cuts deeper than 5 ft. when the yardage was sufficient to warrant its use. Highway construction, however, usually involves the excavation of a succession of light cuts with depths varying from a few inches to a few feet. Hence the steam shovel has been little used on road construction until the advent of the revolving shovel in recent years.

The revolving shovel is a machine of small capacity, light weight, rapid action and easy portability. The principal features of this type of shovel are the full-circle swing and separate hoisting, swinging and crowding engines, the last of which provides for thrusting the dipper forward into the earth and prying up hard materials. Its especial adaptability to highway construction of all kinds has been proved by its efficient excavation of cuts from 6 in. to 15 ft., of all classes of earth, and of street pavements and hard road surface materials, and by its ability to operate over grades up to 10 per cent, make cuts to a smooth and uniform grade and side slopes, and load cheaply into wagons, or overcast in side-hill work.

The average engineer or contractor, even at the present time, conceives of the economic field of the revolving shovel as in heavy excavation only. However, the experience of many contractors during the last two years has clearly demonstrated the efficiency and economy of the use of the revolving shovel in very shallow excavation, such as excavation for street pavement foundations and the removal of old street surfaces and pavements. Four typical examples of such work will be cited as evidence in substantiation of the truth of the above statement.



LEFT: TRACTION ENGINE MAY BE USED TO DRAW A NUMBER OF BLADE GRADERS



RIGHT: WHEELS TILTED ON PIVOTED AXLES TO TAKE UP THRUST OF BLADE

TABLE 2—COMPARATIVE COSTS OF EXCAVATION WITH ANIMAL POWER AND GASOLINE TRACTOR

Animal Power		
7 teams, at $2.50	$17.50	
2 drivers, at $2.50	5.00	
1 operator	3.00	
Total labor cost		$25.50
General:		
Interest on investment at 6 per cent	$1.20	
Depreciation, based on 10-yr. life	2.00	
Repairs and general expenses	1.30	
Total general expenses		4.50
Total cost for 10-hr. day		$30.00
Excavated per day	800 cu. yd.	
Cost per cubic yard	3.75 cents	
Gasoline Tractor		
Labor:		
1 engineer	$5.00	
1 operator	3.00	
Total labor cost		$8.00
Power:		
Gasoline, 30 gal., at 15 cents	$4.50	
Cylinder oil, 1½ gal., at 36 cents	0.54	
Grease, 2 lb.	0.20	
Repairs, waste, etc.	0.76	
Total power cost		6.00
General:		
Interest on investment at 6 per cent	$2.40	
Depreciation, based on 10-yr. life	4.00	
Repairs and general expenses	1.60	
Total general expenses		8.00
Total cost for 10-hr. day		$22.00
Excavated per day	1000 cu. yd.	
Cost per cubic yard	2.2 cents	

PERFORMANCE OF SHOVELS IN SHALLOW CUT

Three revolving shovels, one with a ⅝-yd. dipper and two with ¾-yd. dippers, were used in street grading in Minneapolis during 1914. The material excavated was the ordinary loam and underlying glacial clay, prevalent in the prairie States. On the ordinary grading work, with an average haul of 300 ft., the cost of excavation, hauling and dumping was 15 cents per cubic yard with 1½-yd. dump wagons and 11 cents per cubic yard with cars.

A Thew revolving shovel, equipped with a ⅝-yd. dipper was used in the excavation of the street surface preparatory to paving. The material of the street surface was a very hard, dense clay mixed with boulders. The use of a heavy pavement plow had been found to be impracticable on account of the extreme compactness and hardness of the surface. The average cut was 1 ft. and the ⅝-yd. dipper. The material excavated was a packed clay and loam surface material. Ordinary delays, such as moving up and waiting for teams, were not considered in computing the number of operating hours. Time was deducted, however, for delays due to causes foreign to the work. The average depth of cut was 10 in., total operating time 60 hr., total length of excavation 1788 ft., total excavation (place measurement) 1445 cu. yd. and number of teams used, ten. This gives an average of 24 cu. yd. excavated per hour.

The third instance is that of a Bucyrus revolving shovel, equipped with a ⅝-yd. dipper, which was recently used in street pavement work in Ogden, Utah. The contract included the removal of eight blocks, or 22,500 sq. yd., of concrete pavement about 10 in. thick. The shovel removed a section of concrete slab 600 ft. long and 20 ft. wide,

TABLE 3—COST OF STEAM-SHOVEL WORK AT MINNEAPOLIS

Labor		
1 engineer	$6.00	
1 fireman	2.50	
2 laborers, at $2.50	5.00	
Total labor cost		$13.50
Fuel		
Coal, ½ ton, at $6	$3.00	
Oil, grease and waste	0.15	
Repairs and overhead charges	1.05	
Total fuel cost		4.20
Total cost of excavating 250 cu. yd.		$17.70
Cost of excavation of 1 cu. yd., $17.70/250 =		$0.07

excavated earth was dumped directly into 1½-yd. bottom dump wagons.

The cost of excavation under average working conditions for an eight-hour day is given in Table 3, the data being furnished by F. W. Cappelen, city engineer of Minneapolis. The cost of 7 cents is the average cost of 1 cu. yd. of excavated material in the wagons, ready for haulage to the dump. An inspection of the data shows that an average hourly excavation of 31¼ cu. yd. was attained. This excellent record indicates efficient shovel operation and few delays for repairs or waiting for wagons.

The second instance is taken from the contractor's record for street grading in preparation of the subgrade for pavements in Lexington, Ky. The excavator used was a Thew revolving shovel equipped with a

TABLE 4—COST OF STEAM-SHOVEL WORK AT OGDEN

1 foreman	$4.50
1 engineer	3.00
1 fireman	2.00
2 pitmen, at $2	4.00
5 teams and drivers, at $5	25.00
Total labor cost	$43.50
Cost of excavation per square yard, $43.50 ÷ 1400 =	$0.03
Cost of excavation per cubic yard, $43.50/400 =	0.11

between the curb and the car tracks, during each working day. The loading of teams was delayed on account of the frequent passage of cars. The labor per day for this work is given in Table 4.

In the fourth case a Thew revolving shovel equipped with a ¾-yd. dipper was used (in 1912) for the removal of a macadam surface on a section of a street in St. Louis. The street was 28 ft. wide between curbs and the macadam was from 13 to 18 in. thick. The total excavation was 2915 cu. yd. (loose measurement), the total operating time was 94 hr. or an average of 7.8 hr. per day for 12 days, and the average excavation was 31.9 cu. yd. per hour.

OUTPUT OF A SHOVEL

The writer was recently asked to give his opinion as to the output which may be expected from a standard make of revolving shovel and the depth of cut which is the minimum that this type of excavator can handle economically. It is clearly impossible to state any fixed rules for the determination of the output of a steam shovel or any other type of excavator. On any job there are always known but variable factors and often unknown and indefinite factors which cannot be accurately estimated until the completion of the work. Ordinarily a shovel will be in actual operation about 40 per cent of the working time. Some of the conditions affecting shovel operations are: Character and physical conditions of the soil; presence of obstructions in soil, such as boulders, roots, pipes, old foundations, etc.; depth and width of cut; size, make and capacity of shovel; experience and efficiency of operator. The log of efficient shovel operation under favorable conditions would be about as follows:

	Per Cent
Moving shovel	10
Waiting for cars or wagons	15
Repairs	15
Actual loading time	60
Total working time	100

In shallow excavations the percentage of time spent by the shovel in "moving up" would be greater than that stated, and would vary inversely as the cut. There would result a proportionate decrease in the actual loading time. Hence it is clear that it would be uneconomical to use a steam shovel when the total quantity of excavation is so small that the fixed charges of installation of the shovel on the job and its removal therefrom would bring the unit cost of operation above that obtained by the use of other methods and machinery.

TABLE 5—PERFORMANCES TO BE EXPECTED OF A REVOLVING STEAM SHOVEL IN SHALLOW EXCAVATIONS

Depth of Cut in Inches	Classification of Material: Loose Earth, Yardage	Loose Earth, No. Observations	Packed Earth, Yardage	Packed Earth, No. Observations	Hardpan, Yardage	Hardpan, No. Observations	Pavements, Yardage	Pavements, No. Observations
18	360	12	280	5	225	3	300	2
12	300	5	240	7	175	4	250	4
9	250	3	200	4	150	1	200	2
6	200	1	150	3	100	1	150	1

Although it is impossible to state any definite rules governing the capacity and limitations of a revolving steam shovel in shallow excavations, the data in Table 5, which have been compiled from various sources, may be suggestive. This table is based on the use of a revolving shovel equipped with a ⅝-yd. dipper, efficiently operated under average working conditions for a ten-hour day.



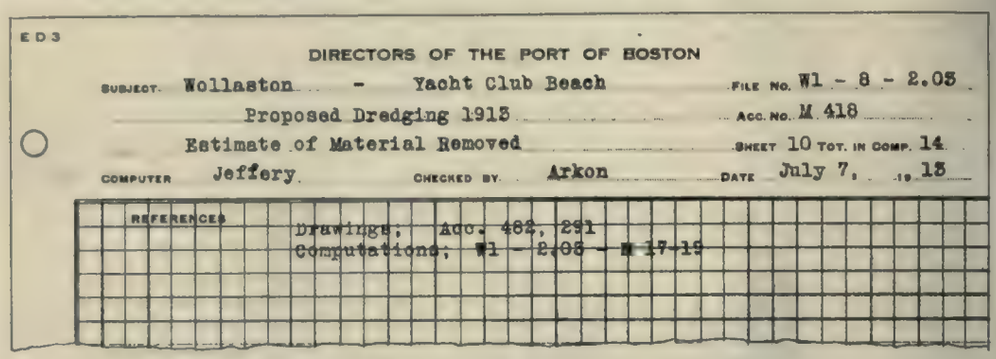
WHERE THE SURFACE IS HARD, THE STEAM SHOVEL PAYS ON VERY SHALLOW CUTS

Filing and Indexing of Office Computations

Discussion of Advantages of Bound Volumes and of Loose Sheets Filed in Binders and in Vertical Files

By FRANK H. JONES
Office Assistant, Directors of Port of Boston

THE FILING of computations presents, even in the well-regulated engineering office, more or less difficulty, depending on the nature of the work and the methods used by the computers in making calculations intended for record. Two distinct methods of making calculations intended for record are in vogue The first, and probably the most common, is by means of bound volumes in which computations are entered in sequence. These are dependent on their individual indexes as a guide to their contents. The manner of indexing the information contained in a large number of such volumes is generally vague and arbitrary, is often not attempted at all, owing to the amount of work involved, and is usually undertaken by persons not acquainted with the original intent and scope of the calculations.



FORM SHEETS INSURE ORDERLY KEEPING OF COMPUTATIONS

TWO METHODS USED

Such a series of books, if thoroughly indexed from the start and then indexed in a cumulative list, with periodic additions and corrections, serves faithfully the purpose of an accurate reference to a valuable collection of data. In the majority of cases, however, the individual computer is more than likely to neglect the proper indexing of his volume, and seldom takes either care or interest in reporting for the cumulative list valuable additions to his calculations. In consequence, half-indexed, poorly referenced volumes collect, which fail almost wholly in their attempt to furnish properly one of the most valuable adjuncts of a well-regulated engineering office.

The second method, now coming extensively into use, and acknowledged by all users as the most economical and the neatest, is that of loose-leaf calculation sheets and binders, with printed page headings for titling and referencing the computations, and periodic collection and filing of the sheets by those thoroughly familiar with the work contained therein.

MAKING THE CLASSIFICATION

Since card indexes are most universally used in referencing and indexing data, no mention need be made here of the older practice of index-book summaries of the contents of a file of data. The simplest and most reliable method of indexing or reindexing a set of calculation books containing individual indexes is to first prepare,

with a thoughtful regard of all present and future considerations, an outline, or mold, into which all data on hand, or foreshadowed, may be cast. To prepare this may require either a suitable alphabetical guide, or a decimal system of notation, where all data are subdivided under integral main heads. Great care should be exercised in laying out such a system of integral numbers and decimal divisions that the considerations implied in the finished outline are not too minute; rather should they be too broad, for no amount of subdividing in the future, when necessary, would compare in work and uncertainty with too minute divisioning in the beginning.

WOLLASTON Cont. 8-2.03

Proposed Dredging 1913
at Yacht Club Beach

Estimates of Material Removed

Sheets;
M 409 - 422
V 18 - 19
L 231 -242

LINEN TAG FOR ATTACHING TO FILES

The form of indexing adopted makes little difference with the method of filing or "locating" the data. When the volumes are referenced by volume and page numbers the data may be most conveniently indexed by checking off each distinct and separate topic contained therein and "pouring" it into the index mold formed for it, great care being taken not to mistake the original intent or identity of the topic. Though these instructions are simple in text and, at the first reading, cover almost nothing but ordinary common sense, only those who have had experience in re-indexing or indexing an extensive collection of such data can appreciate the work involved in first laying out a suitable mold to include every conceivable form of data that may be encountered, nor will the average person, unused to files and indexing, appreciate the value of watching each item of data that passes through his hands. Endless complications result from the use of arbitrary considerations of this and that topic, ending in files which are of little or no value because based upon momentary points of view soon forgotten when no rigorous system is used.

FILING LOOSE SHEETS

The methods of locating, referencing and indexing the bound volumes of computations are quite simple in comparison with the various methods of filing loose sheets. One method of filing loose leaf sheets is to bind them permanently on collection and file them by the same methods that are used for the permanently bound volumes. This method is entirely practicable and is used extensively, often keeping each computer's sheets in a separate volume and referring to them by letter or by number, or both, as the conditions of future reference warrant. A second method, that of vertical filing, is a trifle more expensive and requires more room, but keeps the data of a specific topic or sub-topic together, and allows all future data in connection with that topic to be added without interfering in any manner with the matter already filed. This consideration is not essential under some conditions. For instance, in the case of a small engineering firm where data once used and filed are seldom, if ever, needed again, the bound volume method or loose sheets arranged in volumes is best.

The maximum degree of availability of data in reference to specific topics or subtopics is reached in the arrangement of computation files somewhat after the pattern of a correspondence file, but with more careful indexing and referencing.

To successfully put into use such a file, the outline of the topics, locations, alphabetical subjects, or whatever skeleton form is used must be complete and thorough. In the writer's experience, the decimal divisioning of integral numbers in connection with alphabetically arranged locations proved best suited to the requirements. To further facilitate the handling of file numbers and location of data each alphabetical location was given a letter, or letters, as for instance, B stood for Boston, and Wl for Wollaston. It should be borne in mind, however, that these letters are used simply to save the spelling out of the location on each sheet.

The decimal divisions and subdivisions are a matter of local consideration in filing practice, and no attempt will be made here to suggest outlines or methods of outlining such a system. In general, integral numbers for general topics and decimal divisions for sub-topics are used. For instance, the integral number 11 may stand for a power house, 11.1, 11.2, 11.21, 11.231, etc. Then represent the various considerations and sub-considerations that are met in the construction of such a plant. With the decimal outline well arranged, each general topic may be given its file location, divided and subdivided by means of tabs and folders into as many divisions, jobs, contracts and general considerations as may be necessary, and the computation sheets, when collected, sorted into topic considerations and filed in each corresponding location, division and subdivision.

USE OF FILE BACK

The method best adapted to this scheme of filing for preserving and arranging the loose sheets is by the use of the ordinary file back, or piece of cardboard, to which are attached by a brass fastener the sheets of data and a cloth tag on which are written the location, contract, job number, the file number or decimal division, the full title of the topic upon which the computations are based, and any other information of service in referencing. The location and file number should appear on each sheet, together with all other information in full that will, in the future, serve to identify the sheet. A standard form of printed heading for computation sheets should contain all information of value conveniently tabulated for instant reference.

This method has proved to be a simple and efficient means of carefully preserving valuable computations and compares quite favorably in cost with the more cumbersome volumes and card indexes. In the writer's experience a file of this sort may be used for almost any amount of data without a single index card, but in case the file becomes too large a simple card index may be introduced, laid out exactly as the files appear. This would require only a few days to copy the headings on a set of cards, and thereafter each addition could be entered in the card index.

PERIODIC FILING

The question of availability of individual computations at all times to those in charge of the work or to the entire office force engaged, perhaps, on the same general line of work, is one that offers peculiar difficulties in some instances, especially in large offices. It is noticeable that individual computers, interested only in the details of their own calculations pay little, if any, attention to the proper heading and complete referencing of their computations.

To insure, therefore, an accurate, periodic record of individual calculations in the possession of the computers and a means of determining how much matter is regularly filed and the condition in which it is turned in, a standard form headed, "Computation Schedule for the Month Ending....19....," may be used to great advantage. Its use requires no large amount of extra work either on the part of the computer or the file clerk. Under a heading "Filed," in the body of the form, the computer gives a classified list of all computations turned in for filing, thereby checking himself, automatically, on the proper referencing and heading of his computations and saving no end of trouble in the sorting and classification by clerks or others less familiar with the individual work. By the use of this system, accurate and up-to-date filing of all computations is assured.

COMPUTER ..... LETTER .....

SCHEDULE OF COMPUTATIONS FOR MONTH* ENDING .....19.....

Location	Subject	Acc.	File
FILED:			
ON HAND			

*Monthly statements of computations on hand and turned in for filing must be made out on the last working day of each month and must accompany all computations handed in for filing at that time.

MONTHLY REPORTS SHOULD BE REQUIRED OF EVERY COMPUTER

Beat Scheduled Time Five Months in Building Huge De la Brea Sewer

How Los Angeles Built the Largest and Most Expensive Storm Drain in the West—Inspectors' Records Showing Rapidity with Which Work Was Carried Out

A RECORD in rapid sewer construction work was recently made when the $678,263 De la Brea sewer in Los Angeles, said to be the largest and most expensive storm drain in the West, was completed and ready for use more than five months ahead of the contract limit. One of the features of the work was the use of large reinforced concrete pipes with a capacity more than twice that of the Los Angeles aqueduct.

WHAT THE JOB INCLUDED

Work was begun April 30, 1914, on the 185,000 cu. yd. of excavation necessary in building the large drain and the entire job was finished in January, 1915. The main line of sewer is 7.7 miles long and there are 3.8 miles of laterals. The sources or heads of the new drain are at First and Alvarado Streets, Second and Colma Streets, Vendome and Council Streets and Bellevue and Coronado Streets, the last named being farthest north. The outlet is just beyond Third Avenue, near the Los Angeles Country Club. It empties there into a natural arroyo which, after many turns, empties into Ballona Creek. When the drain is filled to its capacity it discharges nearly 1000 cu. ft. per second.

The extent and diversified construction of the sewer can be seen from the following list of dimensions and lengths of the sections: Monolithic reinforced concrete, arch section 12 ft. 9 in. x 8 ft., 1240 ft.; 10 ft. x 8 ft. 4 in., 1621 ft.; monolithic concrete, rectangular section, 8 x 8 ft., 660 ft.; monolithic concrete, circular section, 8 ft. 6 in., 904 ft.; 8 ft. 3 in., 1225 ft.; 8 ft., 228 ft.; 6 ft., 804 ft.; 5 ft. 6 in., 2833 ft. reinforced-concrete pipe, 3-ft sections, 34 to 60 in. diameters, 26,790 ft.; brick, 1 ring, 23 to 36-in. diameters, 11,935 ft.; and vitrified pipe, 12 to 22 in., 9532 ft.

The appurtenances consisted of 8545 lin. ft. of vitrified pipe catch basin connections 12 to 16 in. in diameter, 357 catch basins, 137 manholes, 25 special junction chambers and one outlet structure. There were also five large wooden culverts to be uncovered and filled, existing catch basins to be connected, and modification made at paved intersections. In addition to the work mentioned the contract also called for the reconstruction of several sewers.

CONSTRUCTION PLANT

A Marion steam shovel, four oil-burning Parsons trenching machines, one Potter machine, and 500 men, were used in hurrying the large contract to completion. On sections up to and including 8-ft. widths the excavation was done by means of the Parsons trench machine with a capacity for 78 in. widths. The bottom of the trenches was shaped to receive the pipe. No concrete cradles were provided for, but gravel was frequently employed to give a stable subgrade.

The Western Reinforced Concrete Pipe Company, sub-contractors, began molding pipe along the line of the sewer on April 14, 1914. Steel forms for all diameters made the pipe in 3-ft. sections. The concrete mixture was 1:2:4 and the pipes were allowed at least fifteen days to cure before they were handled. Pipe 60 in. in diameter, having a 6-in. shell and weighing 3600 lb. per 3-ft. section, was the largest size used, and the maximum depth of trench in which it was laid was 27 ft.



THIS DERRICK PROVED VERY SUCCESSFUL IN LAYING PIPE

One of the photographs shows the style of derrick used to lower the pipe. T. A. Jordan, assistant engineer in charge of the construction for the city, had observed the



WITH AN AVERAGE DAILY CREW OF 7.3 MEN 598 FEET OF THIS INVERT WAS PLACED IN TEN DAYS

performance of one of these machines working in the Los Angeles Harbor District and recommended them to the contractor. Due to an error in the patterns, the dogs in the brake mechanism worked improperly, and the hoisting line had to run under the drum, which caused the line to bind. The photograph shows how it cut into the idler. The device is believed by those who had charge of the job to be much superior to the chain block affair heretofore used in Los Angeles.

A grout of 1:2 proportions was specified for closing joints. The operation consisted in placing shields of heavy roofing paper or sheet iron, 7 to 8 in. wide, on each side and tamping them tightly against the shield with sand or soft dirt. Grout was then poured from the top of trench through a chute into the joint on one side of the pipe until it made its appearance part way up the opposite side, when the pouring was continued in the latter side. This method was pursued to insure the continuity of the mortar joint. If the grout did not flow around, the joint was dug out and the trouble corrected.



TRENCH EXCAVATOR AT WORK, LOADING SURPLUS DIRT DIRECT INTO WAGON

RANDOM EXTRACTS FROM THE RECORD

The following examples of progress in pipe laying are taken at random from inspectors' daily reports. In a trench about 10 ft. deep, a crew of 10 men working 14 days, of 9 hours, laid 745 ft. of 54-in. and 193 ft. of 60-in. pipe, or an average of 67 ft. per day, the maximum day showing 116 ft. and the minimum 36 ft. laid.

In another trench 6½ ft. in width, 11½ to 18 ft. in depth in wet caving ground where a 6-in. subdrain was laid and gravel was used in the bottom to a depth of 10 in., 622 ft. of 54 in. diameter was placed in 13 days with a crew of 10 working 9 hours, an average of 48 ft. per day, 0.87 of a sack being the average amount of cement required for joints. Toward the latter part of the work 234 lin. ft. of 48-in. and 1326 ft. of 42-in. pipe were laid in 12 days, an average of 130 ft. per day, with a crew of 8.3 men. The trench was from 4 to 7 ft. in depth, and being in an isolated section was free from the interferences usually encountered when working in city streets. The average amount of cement per joint was 0.28 of a sack.

TRIMMED TRENCH MEANS FAST WORK

The secret of the fast pipe laying, says T. A. Jordan, assistant engineer, Los Angeles, was in keeping the trench carefully trimmed to templet, well in advance of the laying crew, and watching such details as having a hook or clevis that could be detached quickly from the pipe saddle, when timbers or jacks interfere.

The quantity of mortar needed for the joints varied noticeably at times, and depended upon the care used in placing and tamping the shields. This difficulty was avoided in pipe having the open joint inside for the lower half.

HOW THE EXCAVATION WAS HANDLED

The excavation was started April 30, 1914, on Tenth Street at Hobart Boulevard, with a Parsons excavator and a Potter trench machine. Surplus dirt was loaded in wagons direct from the excavator while the trench machine backfilled the completed sewer with the balance. Most of the backfilling, except that with the Potter machine, was done by teams and Mormon scrapers and wagons. On one stretch of deep ditch an engine and drum were rigged to drag the Mormon. Waste dirt was disposed of in ditches or otherwise low lying ground. At one point several hundred feet of 3 x 3-ft. wood drain and 12 x 16-in. vitrified pipe was laid in the old arroyo in order that it might be filled before the sewer became operative.

With scrapers and wagons 3060 cu. yd. were backfilled in a length of 765 ft. of trench 16 ft. wide in 13 days, with an average crew of 1½ men and 2 teams, drivers included. The trenches were all flooded, a fire hose with nozzle was shoved into the backfilling at close intervals until the latter was saturated.

RECORDS OF CONCRETE WORK

Records kept on the progress of concreting the monolithic sections show that 368 ft. of 5 ft. 6 in. diameter circular section, no reinforcement, were placed in 5 days with a crew of 15 men, an average daily yardage of 42.2 cu. yd., using 53 bbl. of cement. The depth of trench was 13 ft., and conditions were favorable. Further along in the same trench, at a depth of 17 ft., through an alley where very bad filled ground and two large residences close to the excavation complicated matters, the same crew concreted 442 ft. in 10 days, a daily average of 25.3 cu. yd., using 32 bbl. of cement. Placing and removal of forms were included in each of the above records. The comparison illustrates the influence of varying trench conditions on the progress of concreting, other factors being the same.

A record of a section of the arched type 13 ft. 4 in. x 8 ft. 4 in., shown in the accompanying photograph, is given herewith. The method pursued was first to concrete the invert and place the reinforcing. Templets were set to grade and a long, heavy straight edge was used to form the concrete after tamping; the steel rods previously bent were set and held to position by notched templets while their lower ends were imbedded. Of this invert 598 lin. ft. were placed in 10 days with an average daily crew of 7.3 men, equal to 24 cu. yd. each day, using 29.8 bbl. of cement.

For the arch 577 ft. were completed in the same period of time with a crew of 11.6 men, or approximately 62 cu. yd. per day, using 76.7 bbl. of cement. The quantities of cement given are actual counts.

Reinforcement was placed for 578 lin. ft. by an average daily crew of 5.2 men, working 10 days, and a corresponding number of feet of forms were erected by a crew of the same daily average in the same number of days. Five hundred and sixty feet of forms were removed by crew of 2.2 men for a 10-day period, of 9 hours a day. The number of men building forms changed from time to time as occasion demanded, but as a general rule 1100 sq. ft. complete, including oiling, using roughly 2500 ft. of lumber, could be turned out in 9 hours by a force of 3 carpenters and an equal number of laborers.

HOW PAVEMENT WAS CUT

Pavement was cut out with pick and sledge and with an Ingersoll-Rand rotary drill, operating with steam from the excavating machine. A drill bit was first tried, but proved unsatisfactory. A pick pointed tool was then substituted, and the rotation removed. The results were then quite acceptable. However, the comparison submitted herewith by Mr. Jordan, seems to favor the former method. Three thousand seven hundred and ninety-eight square feet of 3-in. asphalt, on a 5-in. concrete base, was cut out in 10 days, with an average crew of 2.7 men using pick and sledges, and with a drill 4750 sq. ft. was removed in the same time with average crew of 5 men. It is not believed that the quality of the concrete differed enough to affect the results. For rapidity in cutting holes in concrete and vitrified pipe, a sharp pick, where it could be handled, was found to work to

best advantage. It was much superior to a hammer and chisel.

DIFFICULTIES ENCOUNTERED

The excavation was required to pass a templet of the outside dimension of the sewer to line and grade with the result that trenches were frequently larger in places than necessary, particularly back of the steam shovel, aggravated at times by caving. This condition increased the daily consumption of concrete in several instances as much as 12 cu. yd. and for days at a time exceeded the requirements, but the contractor preferred to lose it rather than delay and fuss with back forms. The loss of empty cement bags through theft and use for protection reached the somewhat startling figure of nearly 20,000.

Weather conditions were very favorable until the latter part of the work, when several hard rains retarded the completion about two weeks and increased the cost to the contractor very appreciably.

LAND OWNERS ASSESSED

The district that was assessed to pay for the improvement included in round numbers 10,000 parcels of land. It was divided into a general district and four zones, the rate per square foot for each was derived from the following considerations: A 50 per cent higher rate than that of the general district was assumed for zones 2 and 4 because, due to the topography, the maximum benefits from the drain would accrue to them. Zone 1, located near the upper end of the district, was allowed a credit of $21,894, the estimated cost of extending the sewer later in connection with certain street paving. Zone 3 was given a credit of $3,036, the estimated value of the existing drains that were continued as part of the new system.

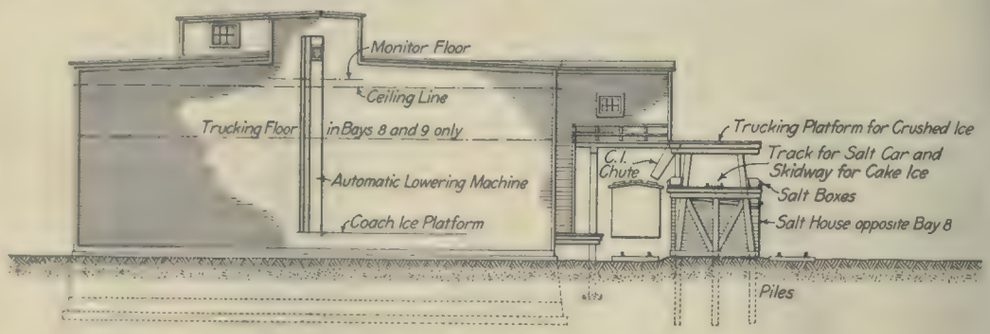
James Kennedy, Los Angeles, the contractor, was represented on the job by John P. Kennedy, manager, and J. R. Graham, engineer. For the city, Homer Hamlin, city engineer, was represented by A. C. Hansen, chief deputy, E. A. Tuttle, engineer of storm drain design, and T. A. Jordan in charge of construction. The Engineering Record is indebted to Messrs. Hamlin and Jordan for many of the figures quoted.

A COLORADO GRAVEL ROAD well placed and properly maintained will last for two or three years without any renewals, according to J. E. Maloney, State highway engineer. New gravel must then be added in worn spots.

40,000-Ton Railroad Icehouse Electrically Operated

Modern Icing Facilities Provided by Michigan Central Railroad in Connection with Expansion of West Detroit Yards

AN ICEHOUSE electrically operated, with a capacity of 40,000 tons, is a feature of the West Detroit yard expansion of the Michigan Central Railroad at Detroit. The house, which is a frame structure 87 x 580 ft. in plan, is made up of fifteen sections or rooms, each of which has elevator facilities for loading and unloading ice. The layout is arranged so that either cake or crushed ice can be delivered as desired. Provision is made for icing refrigerator and fruit cars at the same time. A salt house is located at the east end of the icing side of the house.



EAST ELEVATION OF DETROIT ICEHOUSE SHOWS LOADING SYSTEM

The entire structure has below ground 8 ft. of its total icing height of 38.7 ft. The side wall of the building which rests on a reinforced-concrete foundation wall 10 ft. 8 in. high is made up so as to have a 6-in. layer of cork against the inside sheathing of the house and a 6-in. air space between the outside of the sheathing. Outside the outer sheathing is a layer of Keystone insulator and then a drop siding. The sill is anchored to the concrete foundation wall by a ⅞-in. bolt 18 in. long. The ceiling of the ice rooms is upheld by four intermediate 12 x 12-in. posts, as well as by the side walls. This ceiling is made up of a 4-in. layer of cork resting on a 1 x 6-in. sheathing. The roof and monitor rest on wooden trusses which in turn rest on 12 x 12-in. posts.

The floor consists of a 6-in. layer of concrete resting on 8 in. of cinders; it has a pitch of 2 in. from the side walls to a 2½ x 2½-ft. concrete catchbasin located in the center of the building, a distance of 40 ft.

Ice is loaded from the crusher on a trucking floor which is built between sections 8 and 9, opposite and in line with which, on the outside of the building, there is a trucking platform for crushed ice. Beneath and at the east end of the trucking platform is a salt house, with a truck for salt car, salt boxes and skidway for cake ice on top. The coach ice platform is located at the east end of the building.

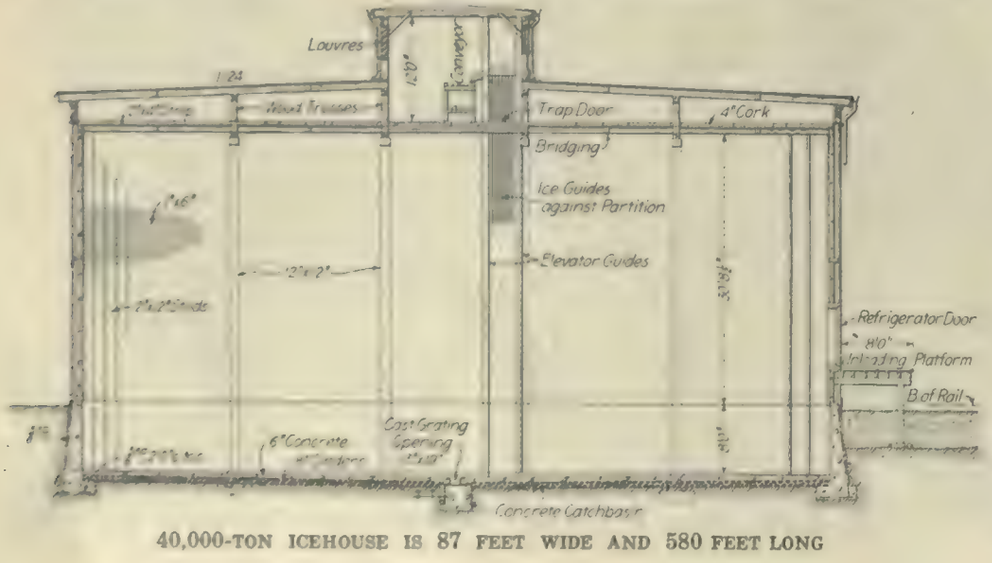
PUTTING A CAKE OF ICE THROUGH

In filling the ice house, ice is received on an unloading platform on the north side of the house and pushed through one of the fifteen refrigerator doors to an inclosed elevator, whose front is made in removable sections 4 ft. long. The elevator is then raised or lowered according to the height of ice in the room, the front sections are removed and the ice contents of the elevator are slid off into the room. The house is filled to within 2 or 3 ft. of the top.

When ice is to be taken from the house it is run on an elevator located in the center of the room, which carries it up to the monitor floor, whence it is automatically deposited on a conveyor which in turn feeds its icy burden to a crusher. The crushed ice is delivered, by gravity, to the trucking floor, on which ice carts of 1000 lb. capacity are located. Ice from the carts is then sent through a cast-iron spout to the waiting refrigerator cars. In obtaining cake ice the conveyor carries the chunks of ice to the east end of the house, where it is brought to the coach ice platform by an automatic lowering machine. The elevators have been arranged so that those used in filling the house cannot be operated when the inside lifts are in use. In this way the elevators can be operated by four motors instead of eight, which would otherwise be necessary. Also there is no necessity for using outside elevators when the inside ones are in use. Four Allis-Chalmers 440-volt motors, each operating four friction hoists, are used in connection with the elevators.

With the above facilities, 400 cars can be iced per day, the maximum to date being 200, and the average 100.

The building was designed and erected by the W. E. Wood Company of Detroit, under the direction of G. H. Webb, chief engineer of the Michigan Central Railroad, and J. F. Deimling, formerly engineer of construction and now assistant chief engineer.



40,000-TON ICEHOUSE IS 87 FEET WIDE AND 580 FEET LONG

FLAGPOLES AND AMERICAN FLAGS are supplied to all stations and buildings of the San Diego water department. Flags are displayed daily. For public information station designations and directions have been posted throughout the $8,000,000 system, which extends over nearly 100 miles.

Aggregate for This Job Is Mechanically Handled from Pit to Road

Storage in Elevated Bins at Main Plant and at Job—Efficient Operation Demanded Design of Special Mixer

EXCAVATED, screened, washed, dumped into railroad cars, carried to storage bins, dropped into industrial cars in proportional parts for a mixer batch, dumped from the industrial cars directly into the mixer skip, and finally spouted onto the subgrade as concrete, the sand and gravel for 11½ miles of 18-ft. concrete road on the Lincoln Highway, between South Bend and New Carlisle, Ind., is mechanically handled from beginning to end.

The aggregates are purchased by the contractor from the Geo. J. Hoffman Company, South Bend. The company's pit was originally opened about 7 years ago by the Chicago, Lake Shore & South Bend Railway, an electric line, for ballasting their track. New machinery was installed and the pit reopened this year by the Hoffman company.

Operations at the Pit

A 1-yd. Bucyrus steam-shovel excavates the material, dumping it into hopper-bottom cars running on a standard-gage track. These cars are then hauled by a 20-ton Davenport locomotive up a small incline to a trestle over a hopper and dumped. From this point a belt conveys the material to a revolving screen, which separates the boulders, of which there are a large number ranging up to a foot or more in diameter, the gravel falling into a bin. The boulders are run through a gyratory crusher and the broken pieces passed through the screen.

From this bin, which has a hopper bottom, the gravel is conveyed by another belt up to the washing plant, as shown in the accompanying photograph. This plant has two conical revolving screens of the Gilbert type and washes and separates the gravel into three grades, the finest material being a pure sand. The lower portion of the plant, as seen in the photograph, consists of the three large bins into which the material is delivered and stored. From these bins the gravel and sand for the concrete road are loaded by chutes into the cars of the Chicago, Lake Shore & South Bend Railway, each of which holds about 30 cu. yd. of material. The railway tracks parallel the road under construction for the entire distance, which has rendered delivery an easy matter.

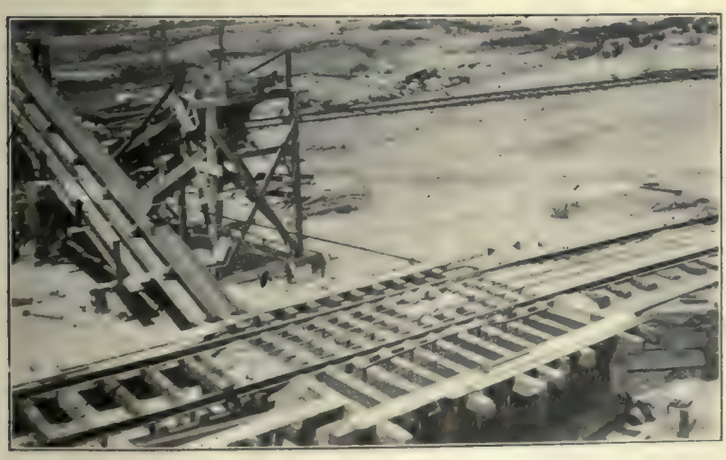
How Aggregate Is Handled on the Job

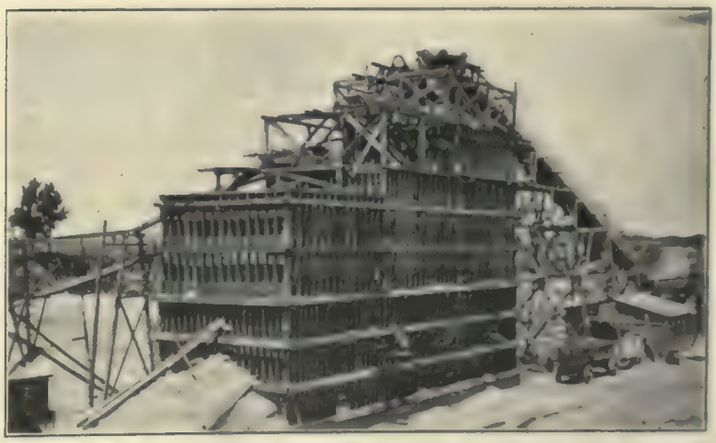
Three miles from New Carlisle a siding was put in and the contractor's gravel and sand bins and cement sheds erected. The railway at this point is on a fill, and so in putting in the siding a hopper was built under the track opposite the center of the bins. From this hopper both gravel and sand are raised by a small bucket conveyor to their proper bins. The bins are of equal size and hold about 35 yd. each. This is rather small but, as there is another electric line close by, the space was limited and it was impossible to build them larger. With unlimited space a capacity of about 75 yd. would have been used.

Chutes in the bottom of these bins discharge the sand and gravel directly into the Koppel cars, which run on the 2 ft.-gage industrial track built on the other side of the bins. Beginning at the sand bin each industrial car is loaded with 9 cu. ft. of sand, the amount being measured by a templet fitting into the car. Passing on to the gravel bin, 15 cu. ft. of gravel is added and last of all six bags of cement are piled on top from the cement sheds. Fifteen cars make up a train—a third of the total number—so at all times one set is being loaded, another unloaded at the mixer, and the third in transit.

The mixer is a special one built for the contractor by the Marsh Capron Company. One of the special features is the design of the skip, which is at right angles with the axis of the drum on the side of the mixer, so that when lowered the side-dumping industrial cars discharge their contents directly into it. By this means all rehandling of materials at the mixer is done away with, a much smaller crew is required and there are no wagons or wheelbarrows to cut into the subgrade. No material is lost by being trampled into the ground or getting mixed up with the earth subgrade. Moreover, there is little danger of cement getting wet in a sudden storm, and no cement pile for a leaky hose to play on.

The contractor feels, also, that there is less danger of having some batches of con-





PIT MATERIAL IS DUMPED FROM CARS INTO THIS HOPPER AND ELEVATED TO SCREENS AND BINS



MATERIAL CARS, LOADED FROM ELEVATED BINS AND CEMENT SHEDS, DISCHARGE DIRECTLY INTO ELEVATOR OF THIS SPECIAL MIXER

crete with improper proportions, as it is so much easier to fill the industrial cars with the proper amount of material than to count the number of wheelbarrows being dumped into the skip and to see that each is filled properly.

MISCELLANEOUS

Aside from the handling of materials there is little in the operation of this work different from other good-sized concrete-road jobs. In grading a Thew steam shovel with a ⅜-yd. dipper is used on some of the cuts, which range from 10 to 12 ft. in depth. As many as thirty-five teams have been employed on this part of the work. Part of the contractors' new equipment consists of steel side-forms, which are of the ordinary channel type. Joints are spaced 30 ft. apart and protected with steel plates. The mixer is equipped with a 15-ft. chute.

The concreting record so far is 450 lin. ft. in one day of ten hours. One train of fifteen cars has been unloaded and the concrete mixed and placed in 30 min. Water is obtained by pumping from wells. For that part of the work now in progress four wells were driven, about 2 miles from the New Carlisle end of the work, on the right-of-way alongside the grade. The pump is run by a 6-hp. engine using kerosene as fuel. It is figured that this will supply 18,000 gal. per day through fairly level country for a distance of about 2½ miles. A pressure tank insures a steady pressure of about 30 lb. per square inch. The 2-in. pipe line is provided with T's 150 ft. apart to furnish connections for 1-in. hose running to the mixer and for sprinkling the concrete. In addition there are cut-out valves about 700 ft. apart.

Plans and specifications for the road were drawn up by Henderson McClellan, county engineer of St. Joseph County, Indiana. J. M. Rush is deputy engineer on the job. The contractors are Jacob Akerman & Company, Laporte, Ind., with whom is associated F. Runyon of Valparaiso, Ind. The work was let at $174,675—an average of about $15,000 per mile of road. The width is 18 ft., the thickness 6 in. at the sides and 9 in. at the center. The concrete was mixed in proportions of 1:1½:2½.

THE REVENUE FROM THE WATER-SUPPLY SYSTEM in Los Angeles, Cal., was $54,713.43 for the first week in June. This is the first time the weekly income from this source has exceeded $50,000.

Water Motors Operate Gate-Valves in Nozzle Lines

Compact Design, Mounted on Valve Yoke—Nozzles Themselves Equipped with Ring Deflectors

By J. W. SWAREN
Hayward, California

IN a new double over-hung tangential unit which is being installed by the Alaska Gastineau Company at its Salmon Power House, one of the most interesting features is the use of two 20-in. motor-operated gate-valves in the nozzle lines between the terminal "Y" and the needle nozzles. These gates are operated by a water motor of standard Pelton design, with double-face instead of single-face buckets, these permitting economical operation with either direction of rotation. Referring to the accompanying view, the method of mounting this water motor on the stand of the rising-stem gate is plainly shown; also the gearing arrangement for driving the gate spindle.

OPERATION

The water for operating the motor is taken from a bonnet and a valve and two needle nozzles are provided on each motor, one for either direction of rotation. These nozzles are marked *C*.

The cycle of operation is as follows: Assuming the valve to be closed, if it is desired to open it, the needle valve *C* is opened; the motor, through the gearing, opens the valve. At *B* is shown a tappet on the stem of the valve. When the valve is fully open, this tappet strikes a tappet arm, the mechanism of which is shown at *A*, Fig. 1. This operates a deflector, which deflects the stream of water from the buckets and thus prevents over-running. When the valve is fully open, the operator closes the needle valve *C*.

When it is desired to close the valve, the needle valve on the opposite side is opened, whereupon the motor drives down the gate spindle until the tappet *B* strikes a corresponding tappet arm on the other side of the yoke, thus preventing over-running at closure.

Assuming the valve to be wide open and the operator by mistake to open the needle valve *C*, the tappet would be holding the deflector in such a position that no water would strike the buckets, thus preventing any possibility of damage to the mechanism.

Referring to Fig. 2, the general arrangement of the water motor is plainly shown. At *D* is shown the mechanism for operating the equalizing by-pass valve, so that the operator can easily equalize the pressure on both sides of the gate before attempting to open it.

At *E*, Fig. 1, is shown the deflectors which will be used for governing. These are of the ring type, a new development along this line, the advantages of this type being a material quenching of the energy of a jet when it is deflected.

The needles and the needle nozzle are hand operated by the usual needle mechanism.

The entire unit is designed to operate under 390-ft. head and develops 2500 hp. The photographs were taken on the erecting floor of the manufacturer prior to shipment.

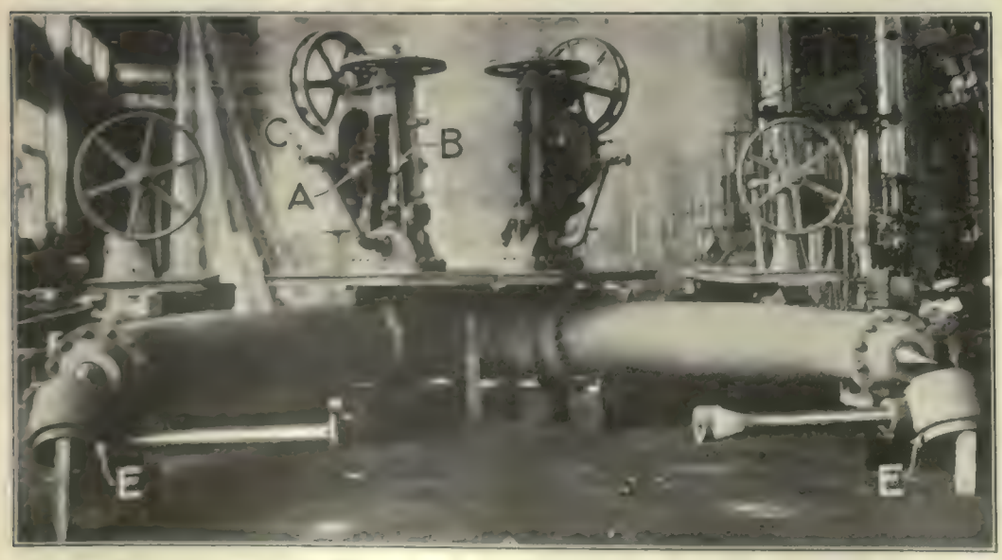


FIG. 1—GATE-VALVES ARE OPERATED BY WATER MOTORS MOUNTED ON VALVE YOKES

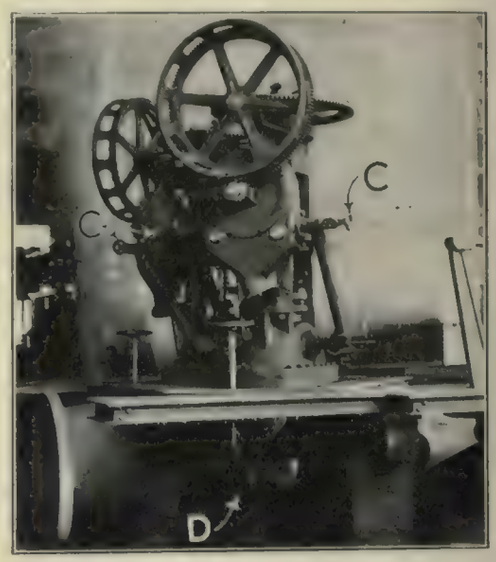


FIG. 2—CLOSE VIEW OF MOTOR

Illinois Central Railroad Reduces Grades in Kentucky

THE PICTURE on the front cover of this issue is taken at the Iron Hill cut of the Illinois Central Railroad in Kentucky, between Princeton and Paducah. By reducing the ruling gradient from 1.25 per cent to 0.50 per cent against southbound traffic (0.75 per cent being allowed against the lighter northbound traffic) the company has doubled its tonnage capacity per train. The cut shown was the largest on the improvement, which has just been completed; 630,000 cu. yd. were involved in the cuts. The work was done under the direction of F. C. Walter, Jr., assistant engineer, who reported to F. L. Thompson, assistant chief engineer.

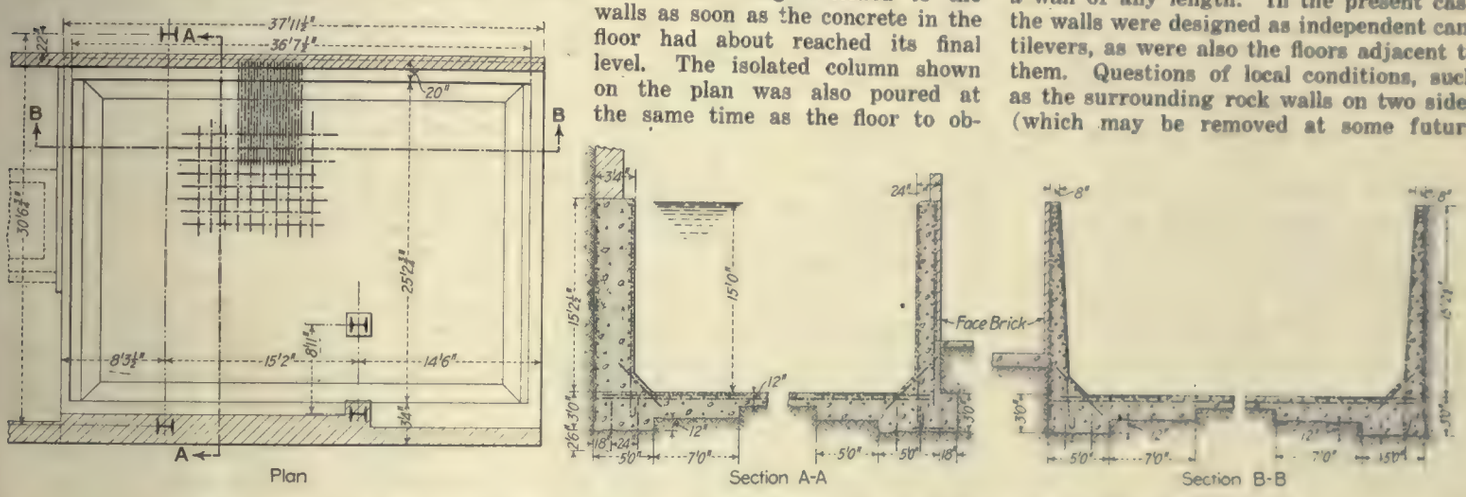
THE TOTAL PRODUCTION OF EXPLOSIVES in the United States during the year 1914, exclusive of exports, according to figures compiled by Albert H. Fay of the U. S. Bureau of Mines, was 450,251,489 lb. or 225,126 short tons, as compared with 500,015,845 lb. or 250,008 short tons for 1913. The production for 1914 is segregated as follows: Black powder, 206,099,700 lb.; "high" explosives other than permissible explosives, 218,453,971 lb.; and permissible explosives, 25,697,818 lb. The figures represent a decrease of 23,839,831 lb. of black powder; 23,932,573 lb. of high explosives; and 1,987,952 lb. of permissible explosives, as compared with 1913.

Reinforced-Concrete Tank of 100,000-Gallon Capacity Designed by Use of Diagrams

Forms Constructed to Insure Continuous Pouring of Concrete—Waterproofing and Dense Concrete Employed to Prevent Leakage

By A. R. JAMES
Bing & Bing Construction Company, Inc., New York City

IN THE ARTICLE entitled "Rapid Construction of Additions to Steel Building," by H. E. Mitler, which appeared in the Engineering Record of March 27, page 404, reference is made to the erection of a reinforced-concrete tank in the basement of this building, which furnishes the water supply for the operation of the sprinkler system. This type of storage reservoir is adaptable in the construction of loft buildings where there is need of a large supply of water, and where steel tanks would be undesirable owing to difficulties that would be encountered in their construction. The general dimensions and typical sections of the tank are shown in the accompanying figure. The location was in the basement below the arch of a mezzanine floor, which formed a cover for it, and which contained a manhole for entering the tank to inspect and clean it when necessary.



GENERAL DETAILS OF REINFORCED-CONCRETE TANK FURNISHING WATER SUPPLY FOR SPRINKLER SYSTEM

ANCHOR RODS AND FORMS

After the excavation was completed to solid rock, holes were drilled for 1-in. anchor rods, which were then placed and grouted in, and the entire floor of the tank was covered with 2 in. of concrete in order that the rock would be preserved during the process of form erection and fabrication of steel, all of which had to be done within the limits of the tank.

Forms for the inside face of the tank were constructed of 1-in. tongue-and-groove yellow-pine boards, which were nailed horizontally to 2 x 4-in. uprights spaced about 2 ft. on centers, and which were hung from the steel floorbeams above. To these uprights 4 x 6-in. timbers were spiked, running horizontally about 5 ft. apart. In order not to have any braces or other timbers resting on top of the floor, and in order to pour floor and wall in one operation, a central hip was constructed, also hung from the steel beams above, and from this hip 3 x 10-in. struts were run at 6 ft. intervals to the 4 x 6-in. horizontals on all of the forms. This system of bracing made it necessary to pour all four walls at the same time.

The concrete was machine mixed, using one part of a tested Portland cement to two parts of selected washed sand and four parts of clean, well-graded gravel, the intention being to obtain as nearly watertight concrete as possible by a proper grading of the aggregate, although it was thought wise to use a waterproofing compound as an additional precaution against any possible leakage.

The concrete, beginning with the floor, was poured continuously to the tops of the walls, the chutes being switched to the walls as soon as the concrete in the floor had about reached its final level. The isolated column shown on the plan was also poured at the same time as the floor to obtain a perfect bond at its base. The total amount of concrete, 250 cu. yd., was poured in about forty-two consecutive hours, the men working in ten-hour shifts.

The vertical bars in the walls were hung by wires fastened to 2 x 4-in. timbers placed on top of the steel floorbeams above the tank. The horizontal ½-in. bars were then clipped to the vertical bars with patented clips. This arrangement permitted the shorter vertical bars to be clipped to the horizontal ½-in. bars at the various heights and spacing required by the design.

In waterproofing the concrete it was decided to use the Trus-Con waterproofing paste, which was stirred into the water at the mixer. Two barrels were used, one for mixing the water and paste, and the other for the mixed product which was placed adjacent to the mixer. Where the 16-in. discharge pipe passed through the concrete wall the joint was sealed by packing with oakum soaked in a very viscid plaster bond. Cement was then troweled over the oakum, and both pipe and concrete adjacent to the hole were covered with two coats of hot tar. This seems to have made a tight joint, as there has been no indication of leakage in six months, although there is vibration of the pipe whenever the pumps are working.

DIAGRAM FOR CANTILEVER WALLS

In the design of this reservoir, the diagram on page 136 was used. The required thickness of any reinforced-concrete wall subjected to hydrostatic pressure with a head not exceeding 24 ft., and the required amount and spacing of steel in a section 12 in. wide at any height of wall for a given head of water can be obtained from this diagram.

The thickness of wall derived from the curves in this chart are minimum values only, and depend, as is shown more clearly by the formulas given later, upon shearing and bending-moment considerations. These thicknesses may be increased and the amount of steel reduced if thereby an economical result is obtained and the space occupied by the tank or retaining wall is not a determining factor. The effect of the steel used in the outer, or compression, side of the walls has been neglected.

Slab action in the upright cantilevers is neglected entirely in this design and also in the chart, as the reductions in stresses which would result may be made by the designer for any individual case, and because this action is almost entirely eliminated in a wall of any length. In the present case the walls were designed as independent cantilevers, as were also the floors adjacent to them. Questions of local conditions, such as the surrounding rock walls on two sides (which may be removed at some future date), a brick curtain wall carried by the concrete wall forming one side, incased steel columns and all other items whose consideration would tend to reduce the stresses as actually obtained, were all finally discarded and the strength of the structure figured for maximum conditions only. Should this type of reservoir be constructed on a clay or gravel bed, additional investigation would also have to be made at the base for proper distribution of the soil pressure.

Considering the typical section *BB* of the tank shown in the figure, at the top of the wall the thickness of 8 in. was adopted as a practicable minimum, including a 2-in. protective covering to the main steel, the bars being placed at a depth of 6 in. from the outside face of the wall.

THEORY AND USE OF DIAGRAM

The diagram contains three sets of curves: A bending-moment curve from which data are obtained for calculating any values of A_s desired; a set of lines for obtaining the required thickness of wall at base for any head of water h, or thickness of wall d' at any depth of wall h' sustaining a total head of water h; and finally, a set of curves which give the required area of steel A_s, for a length of 1 ft. of wall at any depth h' for a total head of water h. The thickness d of the upright cantilever at the top is assumed in all cases as 6 in., and the base thickness is determined either by the compressive fiber stress in the concrete for heads less than 17½ ft., or for greater heads (up to 24 ft.) by the shearing value of concrete. Reservoir walls whose heights

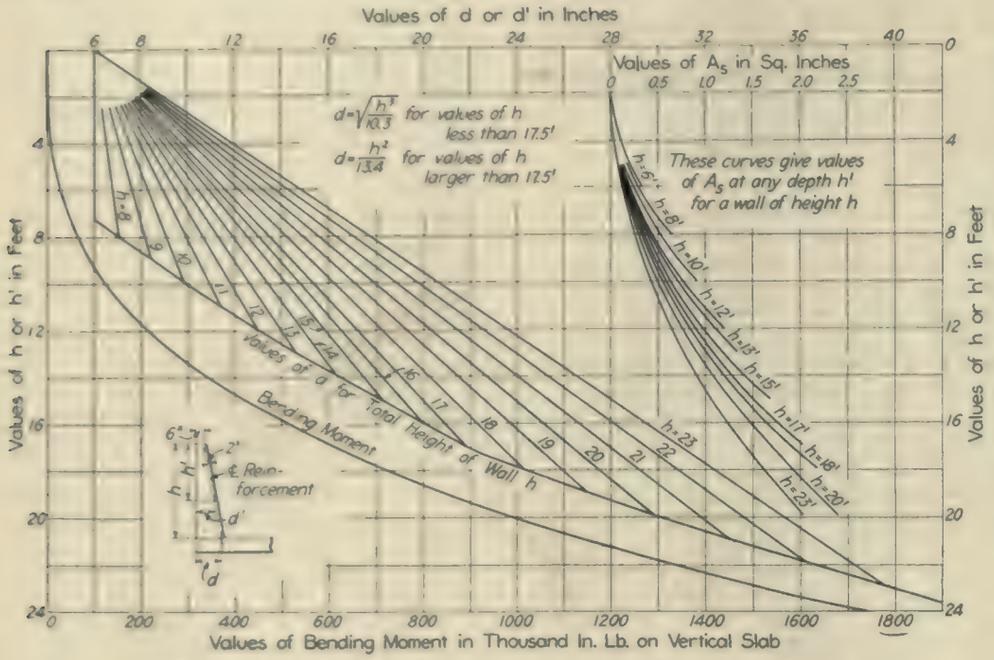


DIAGRAM FOR DESIGNING WALLS UNDER HYDROSTATIC PRESSURE

are greater than 24 ft. are usually more economical if designed with counterforts.

Having found the required thickness d at base of wall from the d curve, any intermediate thickness d' at any depth h' is obtained at once from the lines having their apex at $d = 6$ in. Equations from which the data for plotting these curves were obtained are given below, using standard notation. Let $f_s = 650$, $f_c = 16{,}000$, $v = 40$, $b = 12$ in., $k = 107.4$. Since $M = kbd^2 = wh^3/6$, w being taken at 62.4 lb. per cubic foot,

$$d = \sqrt{\frac{M}{107.4 \times 12}} = \sqrt{\frac{h^3}{10.3}} \qquad (1)$$

Total shear $V = P = vbjd = wh^2/2$ for hydrostatic pressure.

Assuming $j = 7/8$, and solving for d,

$$d = h^2/13.4 \qquad (2)$$

Equating these values of d and solving for h, $\sqrt{h^3/10.3} = h^2/13.4$ and $h = 17.5$ ft., or for a head of water of 17.5 ft. the thickness of wall is the same for both shear and bending-moment considerations. For values of h less than 17.5 ft. equation (1) governs, and for greater heads than 17.5 ft. equation (2) must be used. From these two values of d the d line is plotted, and at points on this curve corresponding to the different heights of wall lines are drawn to a point representing a 6-in. effective wall thickness.

The required area of steel in the bottom of the wall at any height for a 1-ft. length of wall is given on the A_s curves, which were plotted from the formula

$$A_s = \frac{8M}{16{,}000 \times 7d}$$

taking d directly from the d curve and M from the bending-moment curve. These curves give values of A_s at any point of a wall whose total height is shown on the A_s curve. To obtain depths at which, say, half this amount of steel and hence twice the spacing of bars is required, find the point on the A_s curve corresponding to half the area of steel required at the base, and on the right-hand margin find the depth at which the required spacing is to be made. Any other spacing may be found in a similar manner. Bars should extend beyond this point the distance of fifty diameters required for bond consideration.

Horizontal steel was assumed sufficient at 1-ft. centers, and was also placed, in conjunction with vertical bars of the same size and spacing on the outside faces of the walls around the entire tank to take up the shrinkage caused by temperature changes. In the floor of the tank the shrinkage bars were laid both ways 1 ft. on centers, and since the location of the tank prohibits the use of a toe at the bottom, the stresses in the top of the floor caused by the overturning moment were partly taken up by these bars, and the remaining stresses by special bars, placed as shown in the figure. The horizontal shrinkage bars were carried around the corners to some distance along adjacent walls, to prevent cracking at the corners.

It is possible that the thickness of the wall might be altered for certain conditions, as was the case in the present construction, where, for instance, a curtain wall 2 ft. 4 in. wide rested on top of one side of the tank, necessitating a thickness of $d = 3$ ft. 2 in., a value greatly in excess of that required for the head of water impounded.

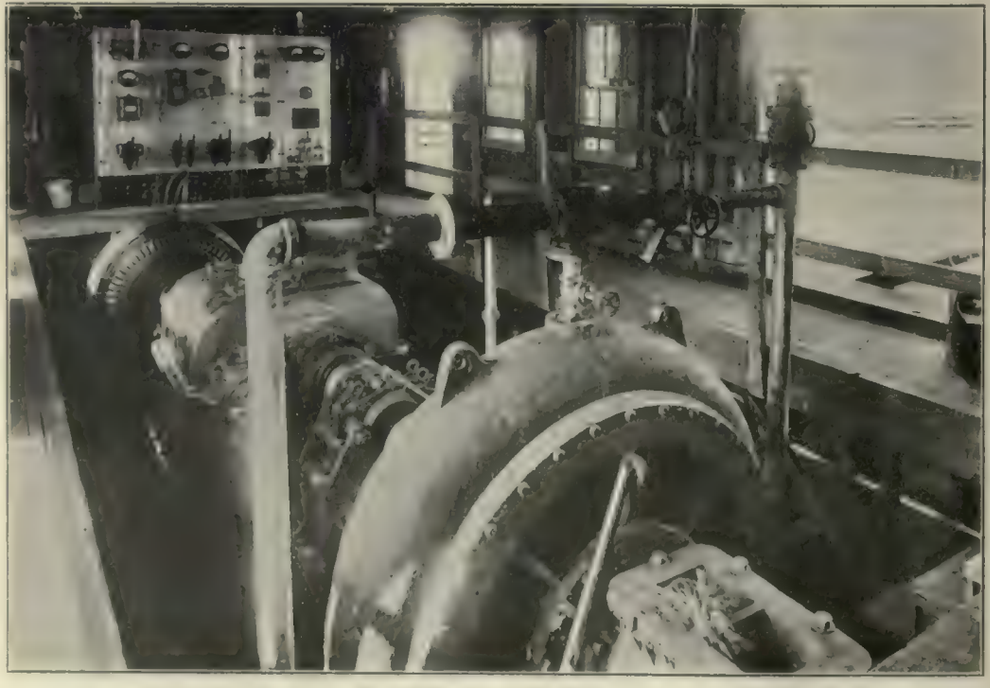
The tank was designed by the writer, and constructed under his supervision by the Bing & Bing Construction Company, Inc., of New York City, general contractors. The design was checked by Weiskopf & Burroughs, also of New York City, consulting engineers for the architect, I. E. Ditmars.

Minneapolis Dredging Pump Operates Electrically

Two-Speed Reduction Gears Give Low Power Consumption and Maintenance Cost in Driving 15-Inch Pump on Hydraulic Dredge

A SPEED REDUCTION from 720 to 300 and 250 r.p.m. between the motor and the main 15-in. dredging pump is effected by helical gears in a dredge designed in 1914 for improvement work on Lake Nokomis for the city of Minneapolis. The entire plant on this dredge consumed less than ¾ kilowatt-hour per cubic yard dredged in service. It was designed by the Norbom Engineering Company of Philadelphia, to the secretary of which, George S. Hoell, the Engineering Record is indebted for a summary of the features of the dredge, and the considerations governing its design.

The convenience and cleanness of electric drive for various types of machinery has for some time made it desirable to operate hydraulic dredges electrically. This motive power has been applied without difficulty to the auxiliary machinery. The cutter head, for instance, running at from 10 to 20 r.p.m., is operated through reduction gears and shafting with considerable flexibility. Even a sudden stop can be taken care of by a blowout switch. On the other hand, while electrically driven centrifugal pumps have been used successfully for many years, the electrically driven dredging pump presents features that must be given earnest study if the dredge is to be a success. A small and fast rotating runner such as is necessary with a direct-connected motor is very inefficient and soon wears out. Even



LARGE DREDGE PUMP DRIVEN AT LOW SPEEDS BY HIGH-SPEED MOTOR

Reduction and change of speeds accomplished by cut helical gears—pump running, shown by blurred shaft coupling; vibration slight, as indicated by sharpness of photograph.

the speed of an extremely slow motor, 350 r.p.m., is a high speed for dredging pumps, and furthermore such a motor is undesirable on account of its high cost, bulk and low efficiency. A one-speed motor, whether of high or low speed, is too rigid to be desirable for a dredge that one day has to pump against a 5-ft. lift and 200 ft. of pipe and the next against a 25-ft. lift with 2000 ft. of pipe line. If the motor and pump have been designed for effective work for the latter condition, they will be practically useless on the former. If the speed of the motor is varied by resistance in the circuit through a controller, the waste of power is very great. A multiple-speed motor is also undesirable, on account of its intricate construction and wiring, and its high cost.

LARGE RUNNER SELECTED

For the dredge at Minneapolis, then, a large pump runner, 54 in. in diameter, was selected to insure an efficient working length of the vanes. It is given flexibility by having two speeds, one 250 and the other 300 r.p.m. The pump is driven by a 500-hp. synchronous motor running at 720 r.p.m. The speed reduction and speed change are effected through two sets of cut helical gear running in an inclosed casing and lubricated with oil. A lever on top of the gear box, connected with a rigid clutch, locks the gears in position for the desired speed.

The combination of the synchronous motor and a pump of ample and efficient size, equipped with this speed-change device, furnishes an economical unit for dredging purposes. The loss of efficiency in transmission through the reduction gears is less than 2 per cent, and actual results with a pipe-line length varying from 500 to 2000 ft. over a period of two months have shown a power consumption of from ½ to ¾ kilowatt-hour per cubic yard of excavation. This figure includes all the power used on the boat, both for the auxiliary machinery and for the main pump.

The low speed is used with pipe lines up to 1200 or 1500 ft. in pumping against a 12-ft. head, and the high speed for any resistance greater than this. The cutter head is operated by a 50-hp. slip-ring motor, and the main hoisting engine by a 30-hp. motor of the same type. This hoist has five drums and two winch heads. A water-jet exhauster operated by an auxiliary pump is used for priming the main pump. There are also provisions for fire service, water sealing of the stuffing box on the pump and of the ball joint on the ladders, and for pumping out the bilges.

Three-phase 60-cycle current at 2300 volts is used without transformation for the three principal motors. This current is transformed to a lower voltage for the service motor, and a motor-generator set is installed for furnishing direct current for lighting. A 6000-candlepower searchlight, several arc and incandescent lights, and an electric horn for signal purposes are inserted on the direct-current circuit. The whole plant is installed on a hull 80 ft. long, 24 ft. wide and 7 ft. deep, which draws 40 in. of water.

The dredge under average conditions has excavated 5600 cu. yd. per day, place measurement. The maximum 24-hr. output so far recorded is more than 7000 cu. yd. The Northern Dredge & Dock Company is contractor for the improvement work on which the dredge is being used.

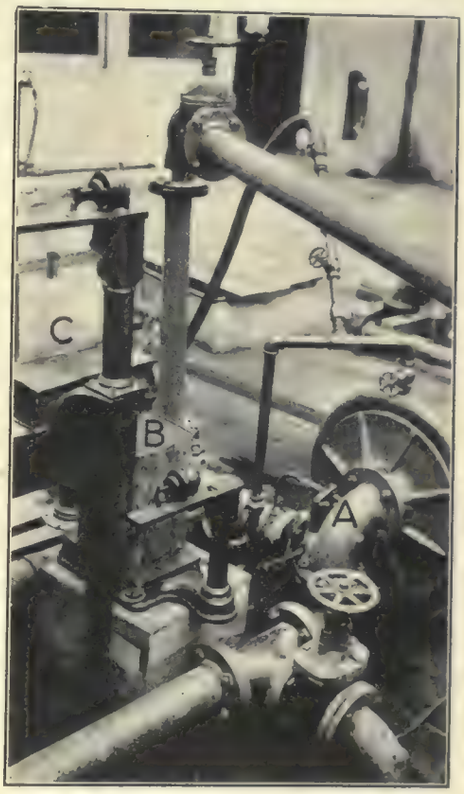
Salt Solution Method Used for Testing Centrifugal Pump

Accuracy Shown to Be Within 1.15 Per Cent, Even Without Refinements Hitherto Used for Turbine Tests

By BEN D. MOSES
Berkeley, California

THE recent suggestions as to methods of measurement of stream, turbine and pump discharges by the use of chemicals call for quite thorough verification. Two independent runs have been made on a small 3½-in. centrifugal pump, used for circulating purposes in the hydraulic laboratory at the University of California.

The pump took its suction from a 20 x 20 x 12-ft. concrete tank and discharged



PUMP TESTED BY SALT-SOLUTION METHOD

through a 3½-in. line, 40 ft. long, into a concrete weir box. From the box the water ran over a 30-in. weir into a spillway and could be deflected by a special scooping device into a 7 x 7 x 12-ft. rectangular concrete tank. This tank was fitted with a hook gage, graduated to millimeters, and had been carefully calibrated previously by means of a weighing tank. The actual measurement then was accurate to within at least 1 per cent.

In the first run a 25 per cent salt solution was used, it being introduced into the suction by means of a ¼-in. pipe tapped into the side of the elbow at *A* (see figure). This led, by means of a rubber tube, to a 5-gal. oil can, *B*, placed on a platform scale.

After the pump had been started and was running steadily a sample of the discharge was taken, then the salt solution admitted, after its weight had been carefully taken, and the time of flow obtained with a stop watch. During the run samples were gotten of the discharge, readings taken of the hook gage on the tank and time recorded.

The second run was a little more elaborate, there having been added another solution tank and a pair of scales, *C*, fitted with a float and pulley arrangement to insure a constant level in the tank directly connected to the pump. Samples were also taken right at the discharge, only some 14 in. from the "dosing" tap.

The data in the table show the general results and the possibilities of the method in connection with such tests.

It would seem from the above results that the greatest sources of error would be encountered in (1) the uniform introduction of the solution into the suction and (2) in the mixing of the dosing solution and the water.

It is to be hoped that the laboratories equipped with the means will run exhaustive tests, trying out different methods of dosing, sampling, etc. If, however, the method can be relied upon to within 1 or 1.5 per cent, as the first two tests indicate, its use is advisable over that of any other device. Even in the third case the error was less than 3 per cent. This error, while comparatively high, is really remarkably low in view of the fact that the salt solution had to mix in about one-fifth of a second and before it had moved 2 ft. It was injected at the wall of the elbow and removed at the wall of the discharge. Without doubt under the proper conditions of injection and sampling an accuracy of 1 per cent could be hoped for.

The above data seem to point out the following:

(1) The dosing and sampling stations should be as far apart as possible, say 100 times the diameter of the pipe.

(2) The dosing must be effected under a constant pressure, insuring a constant rate.

(3) A dosing and a sampling pipe that extended across the suction and discharge respectively and contained side perforations would assist in the mixing.

(4) A saturated solution of salt contains about 25 per cent, so that possibly a 20 per cent solution would in general be the safest, or about 2 lb. of salt per gallon of water.

DATA ON PUMP TESTS, USING SALT SOLUTION

	Test 1 Using one solution tank	Test 2 Using two solution tanks (Sample 40 ft. from discharge)	Test 3 Using two solution tanks (Sample at discharge)
Weight of solution in tanks before run, lb	57.1	73.20	73.20
Weight in tanks after run, lb	26.3	33.00	33.00
Amount injected, lb	30.8	40.20	40.20
Time of injections, min	4	6	6
Rate of dosing, lb. per sec	0.1283	0.134	0.134
Specific gravity	1.192	1.115	1.115
Q = Rate of dosing, cu. ft. per sec	0.00172	0.001921	0.001921
Comparative strength as obtained by filtration with $AgNO_3$ solution			
Supply water	0.968	1.55	1.55
Discharge water	8.88	10.19	10.015
Salt solution	5036	5510	5510
R = ratio salt strength to increase in water strength	636.5	639	651
Quantity discharged = R x Q, sec. ft	1.094	1.225	1.25
Quantity by measuring tank, sec. ft	1.099	1.215	1.215
Error	0.005	0.014	0.035
Error, per cent	0.46	1.15	2.88

(5) A rate of dosing of about 1 gal. of salt solution to 500 gal. discharge seems ample. This would mean on a 100,000-gal. pump 200 gal. of salt.

(6) The salt solution injected would better be weighed than measured volumetrically.

(7) A sensitive hydrometer, calibrated to thousandths, might be used for obtaining the specific gravity of the salt solution.

(8) The titration method is convenient and simple, there being only a call for comparative and not absolute strengths of the different samples, so that they may be rated in terms of the amount of titrating solution ($AgNO_3$) required for equal volumes.

In Test 1 the exact amount of salt in each sample was actually worked out, but in 2 and 3 all comparisons were made upon the amount of titrating solution needed.

In closing it may be stated that the whole scheme is clean, accurate, simple and scientific, and would appear to be applicable to all types of centrifugal-pump or turbine tests.

ROAD-DRAGGING is compulsory in Kansas, but the township highway commissioners are not allowed to expend more than $15 per mile per year for any one mile. The amount paid by law is not to exceed $1 per mile for each time dragged, provided the width to be dragged is not less than 16 ft. and if not less than 30 ft. the amount paid is limited to $1.50 per mile for each time dragged.

Stations for Third Track, New York Elevated, Placed Above Existing Platforms

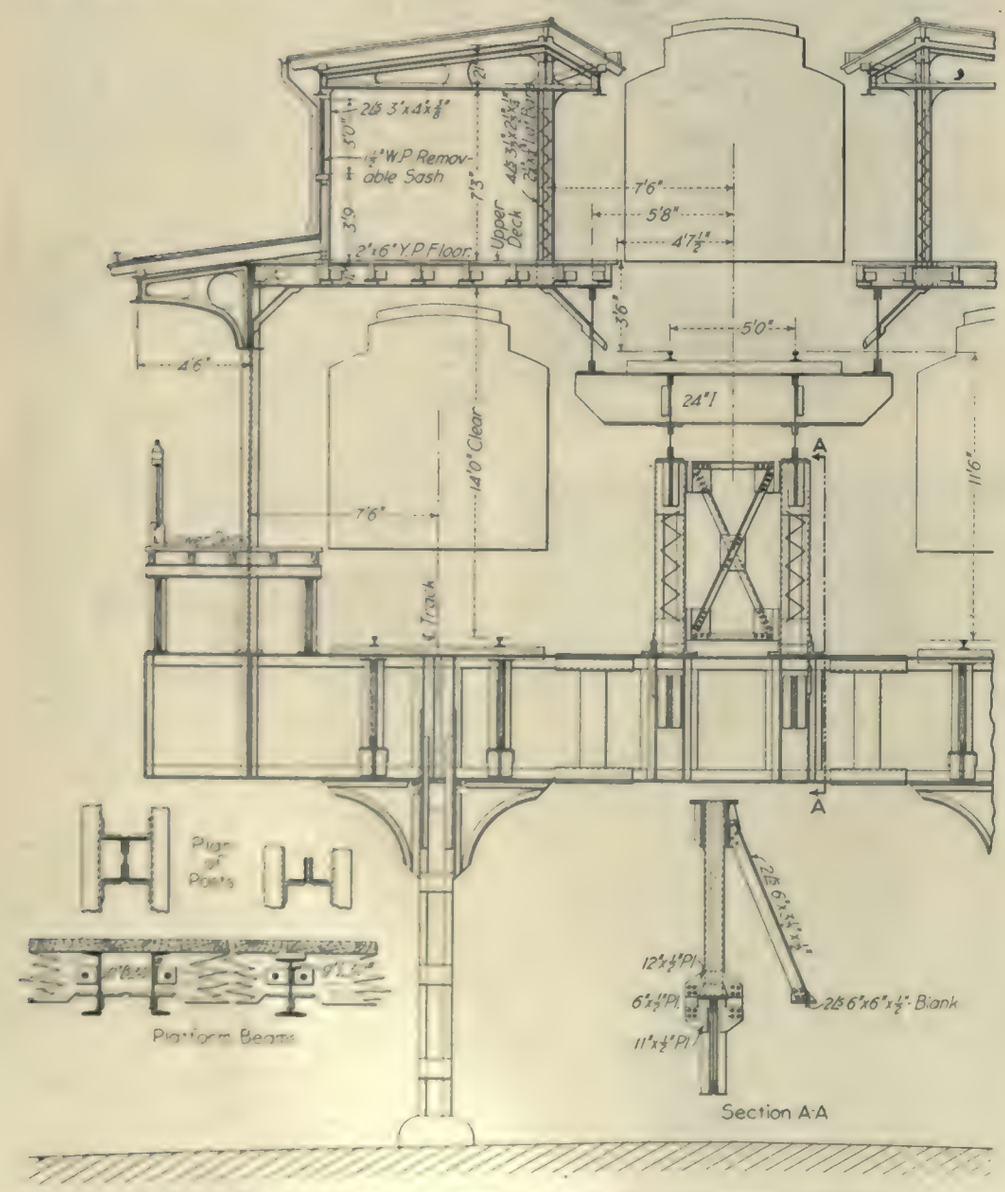
New Track Raised 11½ Feet Above Old Level Instead of Widening Structure—Special Provision Necessary for Bracing Bents Only 5 Feet Wide

SUPPLEMENTING the explanation in the Engineering Record of June 19, page 781, of some problems in the design of the third-tracking of the New York elevated railway, there will be described here some of the details in the hump construction at stations. For this purpose the Third Avenue line will be used. This construction is typical of the hump type adopted for the new express stations at Fourteenth and Eighty-sixth Streets, on the Second Avenue line, at Fourteenth, Thirty-fourth, Sixty-sixth and 145th Streets, on the Ninth Avenue line, as well as at Ninth, Twenty-third, Forty-second and 106th Streets on the Third Avenue line. An example of rapid erection on this work was given in the Engineering Record of Jan. 16, page 86.

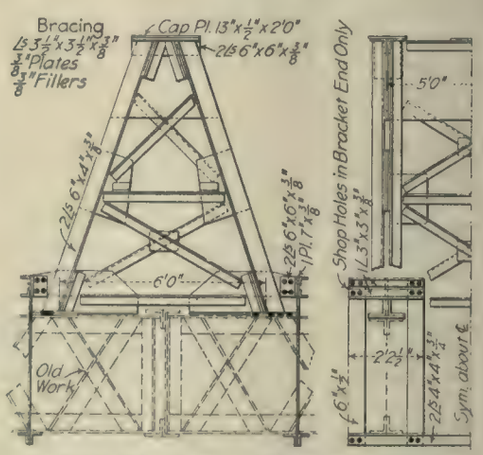
The general scheme adopted was to use hump construction supported by bents on the new cross girders, utilizing old stringers when possible. The maximum grade of 3 per cent, the 350-ft. express stations and the grade of the existing double-track line fixed the length of the hump. When the old line is level, it requires about sixteen panels to rise the necessary 11½ ft., allowing for the vertical curves at each end. If the existing track grades also form a hump, the length is increased; if the old track grades form a depression, the length is decreased. It is anticipated that the cost of operation of the express trains will be greatly decreased due to saving in braking when entering these stations and the rapid acceleration when leaving them. The special features include the tie plates connecting the higher bents with the cross girders, the new diagonal struts, with connections between the new bents and old track stringers, and the special bents carried by two adjacent panels at the Forty-second Street station.

NEW CONSTRUCTION REQUIRED

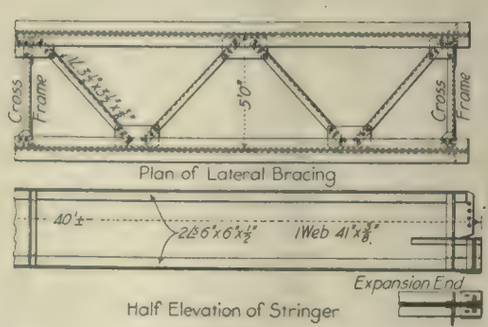
On the Third Avenue line the old double-track elevated construction, which had been partially reinforced, contained many panels of third-track stringers between the outside tracks, usually provided to allow the installation of cross-overs. Except below the upper platforms at the new express stations, where new columns and new cross girders were provided to carry the added platform loading, the old columns were reinforced to carry the third tracks. New cross girders were required at all other bents where no third-track stringers were already provided. The old center-track stringers were used, when available, in all cases where



CROSS-SECTION AT TYPICAL STATION FOR THIRD-TRACK EXPRESS SERVICE



DETAILS OF SPECIAL TOWER SUPPORT AT FORTY-SECOND STREET STATION



END DETAILS OF STRINGERS



BENTS WITH DIAGONAL BRACES SUPPORT NEW TRACK STRINGERS AND PLATFORMS

the tracks remained at the same level. When the third track had to be elevated to reach the upper-level express station, new plate-girder stringers, which varied in end details from panel to panel to connect to the cross girders, were used. The old stringers could not be utilized because of difficulties in cutting them out without injury.

When the stringers were several feet above the cross girders, small bents braced by a diagonal strut to the old track stringers, when such stringers had been provided, were used. The old stringers were retained in every other bay, except in special cases, as at the Forty-second Street station. If no old stringers were available, new latticed struts between the cross girders were used for the alternate panels and diagonal struts from the top of the bents connected to the first upper-panel gusset plates. The accompanying photographs and drawings indicate the method of connecting the new bents and struts, and show the details of the tie plates used for the higher bents. Wind pressure on empty cars was sufficient to require this tension connection, the bents being only 5 ft. wide in order to use struts to the old stringers which had the same spacing.

Details of Station Construction

In order to keep the new upper-level platforms as low as possible, only 12 in. was allowed for the platform beams and floor. The fixed height of 3 ft. 6 in. from platform to rail and the required overhead clearance of 14 ft. resulted in the rise of 11 ft. 6 in. required at all typical stations. The details of the steelwork at these express stations are shown on the drawing. The 24-in. I-beams over the bents support the inside longitudinal platform stringers, while the outside stringers are connected to the new columns carried by the main cross girders. Brackets from these columns support the canopy roof for the protection of the lower platform.

All the timber construction and details are of the standard type, as suggested by the general cross-section. Copper gutters and 3 x 4-in. leaders carried down beside the columns are used. Well constructed timber wind shields, with removable glass window sash, are provided outside the upper platforms. The general appearance of the station framing is shown by one of the photographs.

One of the detail drawings gives some of the end details of the new longitudinal stringers, the top lateral bracing and the position of cross frames. Where the 24-in. I-beams pass across the bents, the main webs of the stringers had to be blocked out at the ends as shown. It should be noted that all stringers are 5 ft. apart or directly under the rails, and, therefore, all columns of the bents are spaced only 5 ft. apart, hence the relatively small resistance to overturning due to wind or to centrifugal force on curves. The tension plates and their connections by plates to the cross-girder stiffeners and wing-plates on the columns of the bents are shown on the main section.

At the Forty-second Street station, on some bents of the north approach, the old track stringers in adjacent panels support the special form of bent shown in the accompanying drawing, in which the old latticed track stringers are shown by dash lines, and the bent with 6-ft. bottom spread straddles the old cross girders. This form of bent was adopted because of the difficulty at these cross girders in making provision for attaching columns. The slope to provide for grade is furnished by the beveled plates on the top of the bents at the ends of the stringers. Slotted holes are provided for the expansion stringers, as shown. At the 106th Street station there are two spans about 66 ft. long. In this case the old track stringers were replaced by deep triangular trusses, supported by the cross girders and carrying the level track on the upper chord.

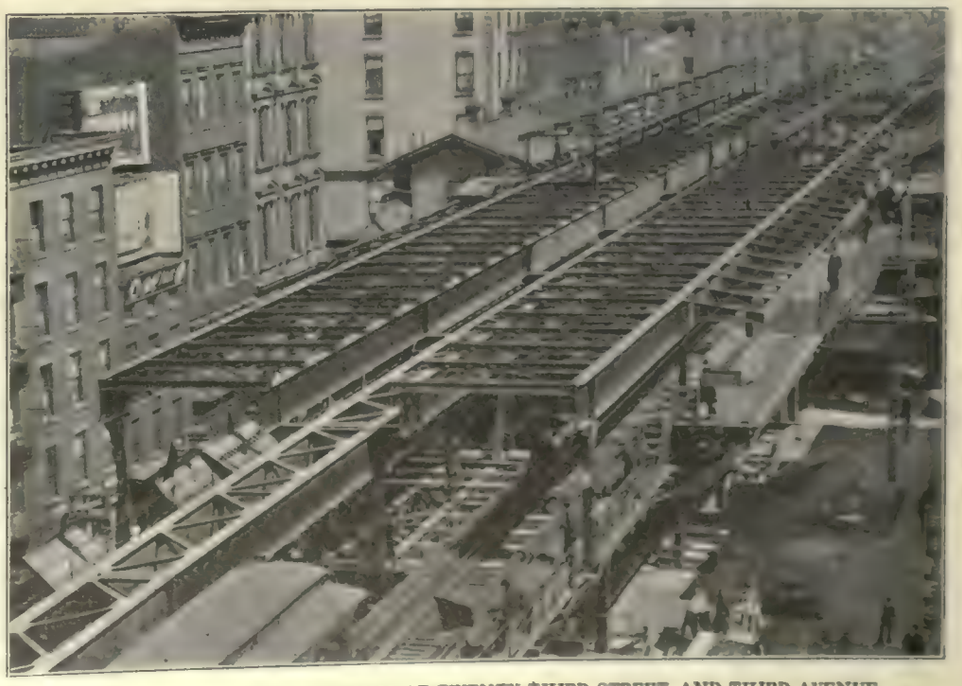
The design loads and stresses for this work were given in the article of June 19. The design and details have been prepared under the direction of George H. Pegram, chief engineer, F. W. Gardiner, principal assistant engineer, and S. Johannesson, assistant engineer, of the Interborough Rapid Transit Company. The contractors are the T. A. Gillespie Company, executives, Terry & Tench and Snare & Triest.

Compressed Air Cleans Concrete Road Base Before Oiling

ON certain parts of the California highway system now under construction it has been found that before the surfacing oil could be applied sufficient dust had formed on the concrete base to interfere with the proper bonding of the oil. After some experimenting a compressed-air apparatus was improvised which satisfactorily removes all dust and loose particles on the surface, it is stated, without requiring any extra trips over the road.

The device consists of a small air compressor mounted on the oil truck itself and geared to its main driving shaft. From the pump compressed air is conveyed to a 1¼-in. pipe fixed horizontally about 2 ft. above the road surface and 2 ft. ahead of the oil spreaders. This pipe is perforated by 1/32-in. holes spaced 1¾ in. apart. The air is delivered at a pressure of about 30 lb. per square inch and is said to drive off a continual cloud of dust even when working over a surface on which ordinary inspection shows no appreciable quantity of dust particles.

LEVEE WORK in Louisiana from April, 1912, to April, 1914, involved the handling of 16,607,836 cu. yd. of earthwork at an estimated cost of $3,809,919.



UPPER-LEVEL PLATFORM FRAMING AT TWENTY-THIRD STREET AND THIRD AVENUE

Construction Methods Used in Building Parkersburg Reservoir

Holes for Light Blasts Were Put Down with Auger Bits—Concrete Was Carried to Place in Light Cars Running on Top of Narrow Wall

By L. E. CHAPIN
Engineer, Pittsburgh, Pa.

THE city of Parkersburg, W. Va., originally pumped water from the Ohio River through the distribution mains and into two steel tanks, each of 1,000,000 gal. capacity, located on the highest elevation in the central part of the city. These tanks, twenty or more years old, having been repaired from time to time by replacement, in part, of the upper sheets, burst in 1910, causing serious damage and some loss of life. After the destruction of the steel tanks, temporary storage upon the same location was provided by the construction of four small wooden tanks, and arrangements made to construct a masonry storage reservoir in a new and higher location. This was completed about two years ago and offered some interesting features in construction in the use of forms and the method of distributing the concrete.

The reservoir is located on the top of a knob, just beyond the north city limits and about two miles from the pumping station. The reservoir hill is at an elevation of about 140 ft. above the general level of the city, and the basin, when filled, has a water surface 255 ft. above the low water in the Ohio River at Parkersburg, and from 140 to 215 ft. above the greater portion of the city.

The reservoir is circular, 202 ft. in diameter and 26.5 ft. in depth below the top of the coping, with a capacity, at a depth of 24½ ft., of 6,000,000 gal., equal to somewhat more than two-days' supply, based on the average daily consumption.

EARTHWORK

The work was started by removing a large portion of the material to be excavated by slip scrapers and by the construction of a circular trench for the wall footings. This trench had a bottom width of 12 ft., outside slopes of ½ to 1, and inside slopes of 2 to 1. In it the footings and walls were constructed, using wooden forms for the footings, and Blaw steel forms for the vertical section. After the entire outer wall, with the exception of the closure distance of about 11 ft., was constructed, the core within the walls was excavated and moved by slip scrapers and delivered through a trap into a boot, and then elevated by means of a Jeffrey elevator and delivered over the top of the reservoir walls. It was there solidified by use of water and surfaced by slip scrapers to a uniform level, 5½ ft. below the top of the reservoir wall. The width of embankment is 14 ft., and the outer slopes 2 on 1.

After the grading was completed the 11-ft. gap was closed and the embankment completed.

The larger portion of the material excavated was a dense red clay and the lower 5 ft. a hard greenish clay resembling soapstone. It required blasting for its removal, but on exposure to frost and air decomposed, forming a clay which readily compacted in the operation of flushing and in the travel of teams in surfacing up the embankment.

This hard material was blasted by drilling 1.5-in. diameter holes to the subgrade, with a special auger bit driven by a gasoline engine. These holes were spaced about 5 ft. apart and required about 30 min. for an average depth of 5 ft. As the holes were drilled they were loaded and shot with black powder. The explosions did not disturb the underlying material, but broke evenly, so that it could be readily plowed and removed by the slip scrapers.

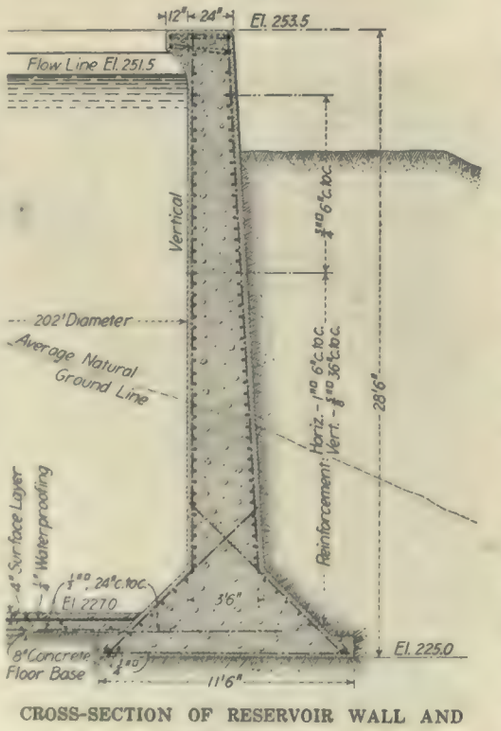
The subgrade was finished by picks, bars and shovels to the exact surface required for the bottom concrete.

WALL CONSTRUCTION

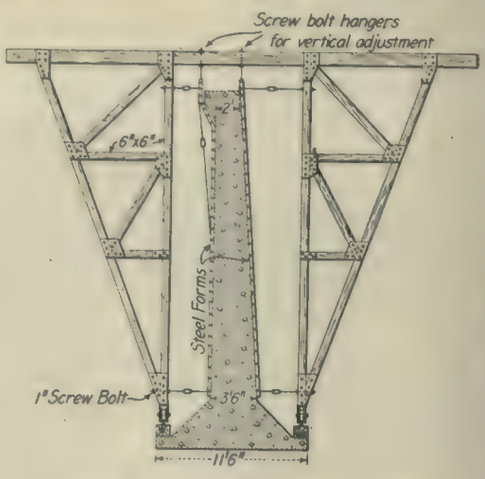
The footings and the sloping portion of the foundation were built with wooden forms, all in sections of 5 ft. in length. The upper 24.5 ft. of the wall was built with Blaw steel forms having panels 2 ft. in height and 5 ft. in length, bolted together and braced, forming two complete sections, each 25 ft. in length, one on each side of the wall. These completed sections were carried on and supported by an overhead traveler with side bents resting on sills, which in turn were carried on trucks. The track was built with 56-lb. rails, attached to ties laid on the upper part of the footing course. The traveler was moved along by a winch and lines.

FLOOR CONSTRUCTION

When the floor of the basin had been excavated to subgrade the concrete bottom was laid in two courses, the first, 8 in. deep, reinforced with ½-in. square rods. When the first course had been set up for two weeks it was covered with a ¼-in. waterproofing layer of Sarco asphaltum, poured hot and surfaced to a uniform thickness, which layer was extended up on the slope surface of the wall concrete.



CROSS-SECTION OF RESERVOIR WALL AND PART OF FLOOR



END ELEVATION OF WALL FORM

Then the wearing surface, 4 in. deep, was laid in 8-ft. squares, with ¼-in. joints. These were made by steel plates, which, when removed, allowed the joints to be filled with the asphaltum. When each section of the sidewall and each section of the bottom was completed and forms removed, the few rough spots found were plastered with cement mortar and the entire surface given two coats of cement wash.

WINTER CONCRETING

Concreting was carried on through the cold weather of December and January without difficulty by heating the water in the storage tank with live steam, giving a temperature of the mixing water for concrete purposes of 131 to 175 deg., and of the concrete when placed within the forms from 60 to 74 deg. At no time did the temperature of the concrete fall below 39 deg.

After each section had been filled with concrete coal fires were maintained for three days on each side of the forms and the heat retained by canvas covering.

TRANSPORTING CONCRETE

The first concrete was placed through three chutes directly from the mixer into the forms beneath. As the wall was extended track was laid on top of it and on the travelers, and the concrete moved in Koppel cars, propelled by a cable carried on drums, operated by a reversible friction gear connected to the mixer engine through a sprocket drive. The concrete was dumped through chutes directly into the steel forms, and also, through long chutes, for the footings to a distance of about 60 ft. ahead of the walls previously constructed. A Chicago No. 20 batch mixer, having a capacity of 15¾ cu. ft. of 1:2:4 concrete, was used. It was equipped with a 10-hp. engine.

Each section of the walls above the footing, being 25 ft. in length, contained 63.5 cu. yd. of finished concrete and was filled in in from 4½ to 6½ hr., depending on the haul from the mixer to the forms. The cars delivering the concrete over the top of the walls traveled at a uniform speed of 400 ft. per minute.

When concreting the floors a circular track concentric with the walls was laid on the subgrade. As the area was extended from the walls the track was moved, completing another annular area, until the entire bottom was concreted. In this manner about 90 cu. yd. was placed per day in the first course, and about 60 cu. yd. per day in the second, requiring 10 days to com-

plete the first layer and 8 days for the second.

LEAKAGE TEST

The reservoir was completed on Aug. 1, 1913, and water immediately admitted to a depth of about 2 ft., and then drained off, removing the accumulated dirt from the pipe lines and reservoir bottom. It was then filled to its full depth and allowed to stand with all valves closed for five days, at the end of which time the water surface had lowered ⅝ in., partly due to evaporation and partly to slight leakage found through the 10-in. blow-off valve. On raising and reseating this valve all leakage through it stopped and the reservoir thereafter was found to be watertight.

The cost of the completed reservoir was about $53,000. Under the authority and direction of E. G. Stephenson, superintendent of water, and B. F. Stewart, city engineer, the plans were prepared and the work superintended by the writer. The contractors were the Nelson-Merydith Company, Parkersburg.

Expansion Joints in Lock Walls, Welland Ship Canal

EXPANSION joints in lock walls on the Welland Ship Canal have embedded in them a copper strip riveted to steel plates. The steel plates are embedded in the abutting masses of concrete on either side of the joint, while the copper strip is bent Z-fashion in the joint itself. At the start of the work 6 x ¼-in. plates were used with 16-gage copper. It was found, however, that these weights were heavier than necessary, and 6 x ⅜-in. plates and 18-gage copper are now used. The copper is riveted to the plates with ¼-in. rivets on 2-in. centers.

REFORESTATION IN NATIONAL FOREST RESERVES of the West has been carried on extensively this season, 14,000 acres having been planted with young conifers. The young trees were grown from seeds sown in hotbeds. The work of setting them out was begun early in the spring and extended over several months.

200,000 Yards of Concrete Placed for $800,000 in Lake Washington Canal Lock

Economical Mixing and Handling of Concrete, Using Very Large Cantry Cranes and High Trestles, Were Factors in Low Cost of Work at Seattle

THE EIGHT-MILE ship canal which is being built in Seattle to connect Lake Washington with Puget Sound involves the construction of a large lock near its lower end, and the 200,000 cu. yd. of concrete used in the construction of this lock have been placed at very low costs, the average being $4 per cubic yard. The plant for handling materials was designed as carefully as the concrete structure itself, and a feature of the scheme for delivering the concrete to all parts of the work expeditiously was a pair of steel gantry cranes each 264 ft. long, which stood 75 ft. above the floor of the lock, and traveled from end to end so as to be able to deliver loaded dump buckets to every part of the work. These cranes and all other construction plant used were included in figuring the cost of the work, only a small percentage of the original cost of equipment being deducted as probable salvage value. The work has been carried out under the supervision of the U. S. Engineer Department, but funds were supplied by the Federal Government and King County jointly for dredging a channel between the locks and Lake Washington.

When the canal is completed it will create for Seattle a fresh-water harbor having an area of about 25,000 acres and a shore line 100 miles in length. The canal is, in reality, simply the improvement of the natural outlet of Lake Washington to make it suitable for shipping. The level of Lake Union, which is about 9 ft. below that of Lake Washington, will be made the new level for both lakes, and Salmon Bay, on Puget Sound, will connect with this level by means of the lock and dam now being completed. The depth of Lake Washington ranges up to 200 ft. as a maximum, while Lake Union has a depth ranging from 40 to 50 ft. Between the lock and Lake Washington 3,000,000 cu. yd. of material will be removed to provide a channel 100 ft. wide at the bottom and 36 ft. deep at low water. Below the lock 1,000,000 cu. yd. will be dredged out to form a channel 27 ft. deep at low tide and 150 ft. wide on the bottom.

GENERAL FEATURES OF LOCK

Some changes were made in the original design of the lock as first reported upon by Major H. M. Chittenden and described in the Engineering Record of Dec. 7, 1912, page 640. The main chamber, which will accommodate vessels up to 825 ft. in length



LOCATION OF THE LOCK

and 80 ft. in width, will have a free depth of 36 ft. Alongside the main lock is a much smaller lock suited to vessels with drafts up to 16 ft.; its inside dimensions are 30 x 150 ft. The large chamber can operate on effective lengths of 375, 450 and 825 ft. by means of its upper, lower and intermediate gates.

The dam between the lock wall and the south shore is 225 ft. long, and is provided with a spillway to maintain the level of the upper pool within limits of about 1 ft. of mean stage. Emergency dams are provided at the upper entrance to the large chamber and at both upper and lower entrances to the small chamber. The gates in the large chamber have a double skin, the heaviest leaf weighing about 200 tons. The gates and pumps will be operated entirely by electric power, a total of about 540 hp. being required, which is distributed from a central power house. The pumping equipment, comprising one 2½-in., one 10-in. and two 30-in. centrifugal pumps, will have a total capacity of 23,000 gal. per minute.

The large chamber will be filled by means of 8.5 x 14-ft. culverts, which extend almost the entire length of both walls. These communicate with the chamber through a number of small openings above the floor of the lock. Similar culverts 4.3 x 6 ft. in section will be used for the small chamber. In the large chamber the culverts will be controlled by Stoney gate valves, and the smaller one will be served by cylindrical valves. Both



AS THE LAKE WASHINGTON LOCK APPEARED FEBRUARY 23, 1915

types will be raised by means of screws controlled from operating stations on the walls. Three of these stations for the large chamber are on the north wall, while a single station between the two locks serves the smaller chamber. The lock gates are to be actuated by cables attached near the outer end of the toe on each leaf. As the gate swings through its arc of revolution the length of outstretched cable will change, and the radii of the drum spiral are so proportioned as to take up the slack due to such changes in cable length.

EXCAVATION AT LOCK SITE

Excavation at the lock site was carried out within the protection of a cofferdam built in the shape of a square-cornered letter C. The total length of cofferdam required was about 1350 ft. The cofferdam walls, which are 20 ft. apart, were made by driving three thicknesses of 4 x 12-in. planking in the form of Wakefield sheet piling, some of which is 60 ft. in length. The filling required was supplied from the excavation, clay being used where possible. At high tide the bottom of the excavation was 58 ft. below water level, but no seepage difficulties were experienced. The cofferdam area was unwatered by one 8-in. and two 12-in. electrically driven centrifugal pumps, after which a single 2-in. centrifugal pump, running two eight-hour shifts per day, handled all the seepage.

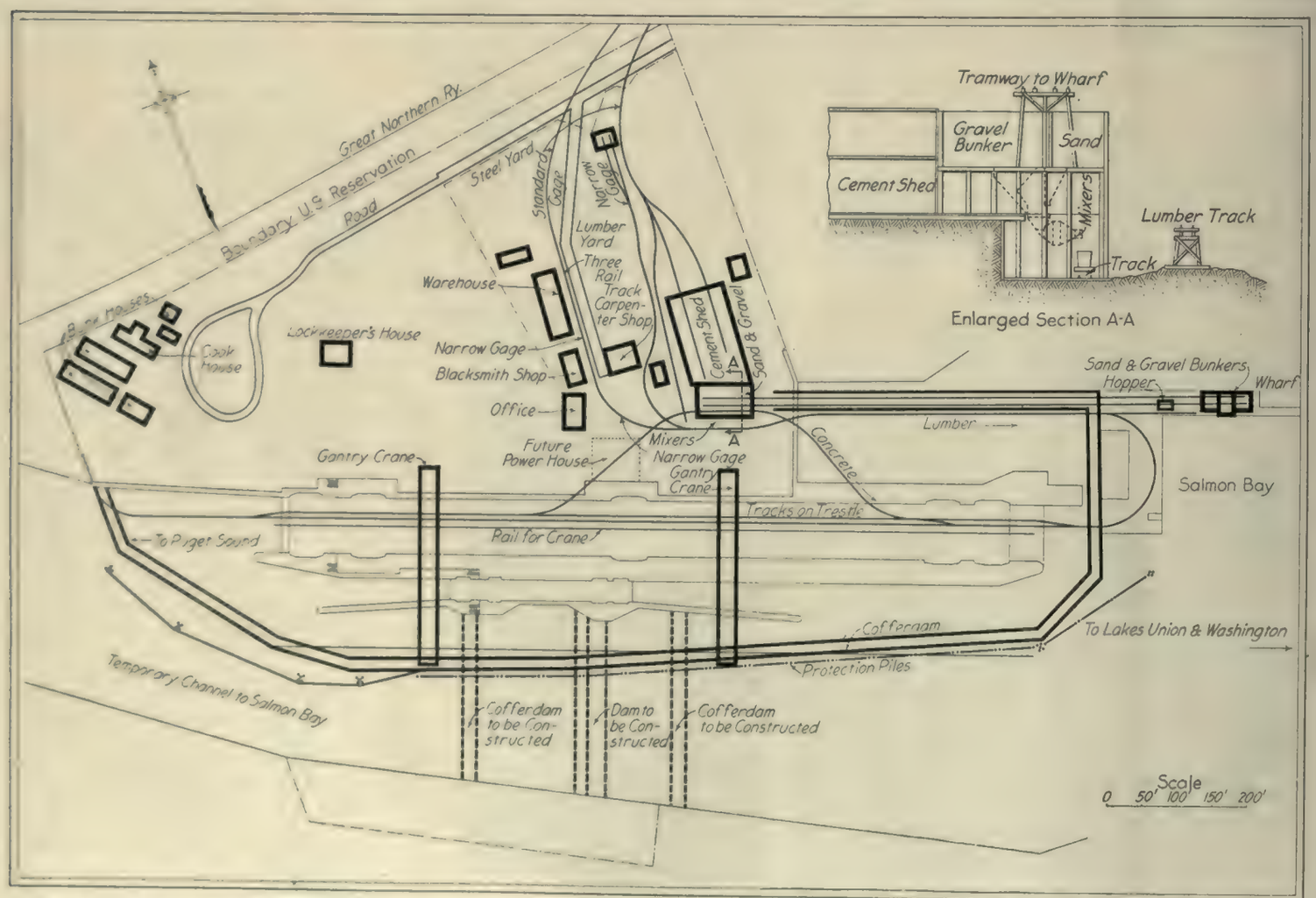
Under the protection of the cofferdam the excavation was completed to the required depth, and the erection of the two steel gantry cranes for distribution of concrete was begun. The cranes stood athwart the lock and were designed to move on a track running lengthwise with it, one rail being inside and just above the floor level, while the other was laid along the top of the cofferdam on the south side. These cranes, which weighed about 100 tons each, had a 176-ft. span between supports, and 88-ft. cantilever arms; their clear height above the rail was 75 ft. Each was equipped with two 30-hp. electric hoists and two separate trolleys, each capable of lifting 5 tons. The cranes were moved along the track by disconnecting one of the hoists from the trolley cable and coupling it to the mechanism on the cofferdam rail truck.



VIEW AT WEST END DURING THE CONSTRUCTION OF THE GUARD GATES

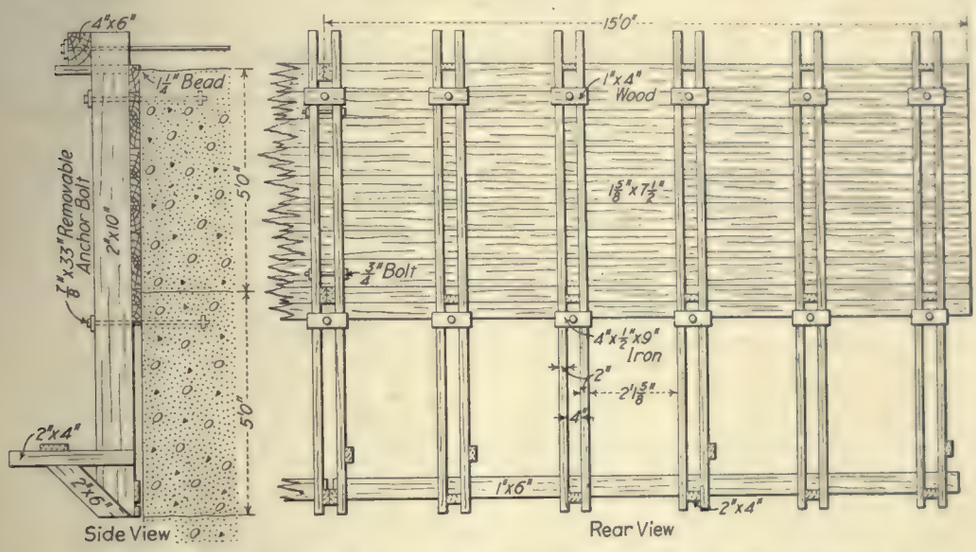
The cement receiving shed and store house, into which a spur from the Great Northern Railway was built, stood on the hill to the north of the excavation, about on a level with the top of the lock walls, and had a capacity of 20,000 bbl. The mixing plant was so placed that hand trucks on roller bearings conveyed the cement on the same floor level from storage room to the measuring hoppers above the mixers. Beside these hoppers were the devices for measuring water, and the hand levers which admitted sand and gravel from the bunkers above into the measuring and charging hoppers beneath.

Sand and gravel were brought to the lock site on barges, which tied up at a



IN THIS PLAN PERMANENT LOCKS ARE SHOWN LIGHT WHILE TEMPORARY WORK AND CONTRACTOR'S PLANT ARE SHOWN HEAVY

wharf built out from the Salmon Bay end of the cofferdam. On this wharf two bunkers with a combined capacity of 600 cu. yd. were built, one of them being divided by a partition so that altogether three separate compartments were available. Into these bunkers sand and gravel were loaded from the barges by a 1½-yd. clamshell bucket operated by an electric hoist. The bunkers discharged into 3-yd. automatic side-dump cars which operated on two tracks running under the bunkers and up a 7-per cent incline 800 ft. long, to the 2000-yd. bunkers over the measuring hoppers. A two-drum electric hoist at the upper bunkers operated these cars, and it is said that with this arrangement, which called for only one attendant at the hoist and one at the lower bunkers, 1200 cu. yd. of sand and gravel could be handled in an eight-hour shift.



WALL FORMS WERE CHIEFLY OF CANTILEVER TYPE, IN 15-FOOT SECTIONS

With a few exceptions for special work, the concrete mix used in the lock was 1:3:6, or six sacks of cement per 1½-yd. mixer charge. Each mixer required five men for its operation; one at the mixer discharge lever, one measuring and dumping the charge into the mixer, two dumping the required proportion of cement into the measuring hopper and one wheeling cement from the warehouse. The mixing battery consisted of three 1½-yd. Smith mixers, each driven by a 25-hp. motor. The mixers were located directly under the sand and gravel storage bins and were set with their centers 20 ft. apart so as to discharge directly into dump buckets on flat cars which coupled up with a spacing of 10 ft. on centers.

Three trains of eight cars each were used. Each train carried six buckets, providing for the drawing of two batches from each mixer; the two additional cars made it unnecessary to keep the train waiting while the gantry crane returned the last two empty buckets. Thus with six loaded and two empty cars a train would run under a gantry and receive on the empty cars the buckets which the gantry was waiting to dispose of. The loaded buckets were removed by the gantry, two at a time, and returned empty. As soon as the gantry picked up the last pair of loaded buckets, the train pulled out with six empty buckets and two empty cars.

In order that these trains need not climb grades in conveying concrete from the mixers to the cranes, a trestle was built on the inside of the lock for its full length. This trestle was about 46 ft. high. The gantry cranes, which remained stationary while handling concrete, could deliver loaded buckets to any point in the cross-section of the lock. With this equipment as high as 1140 cu. yd. of concrete has been poured in an eight-hour day, the highest monthly record being 23,591 cu. yd. Approximately 150,000 cu. yd. of concrete was placed in the nine months between May, 1913, and January, 1914.

CANTILEVER FORMS

The walls for the most part were concreted in 30-ft. lengths and the concrete was deposited in layers 5 ft. thick. The tops of layers in adjoining sections were kept at approximately the same level, and numerous bonding blocks 2 ft. square were allowed to project upward into the next layer poured. The forms were chiefly of the cantilever type, built in sections about 15 ft. long; they were fastened to the wall with ⅞-in. bolts 2 ft. long with threads on both ends. On the inner end a 3-in. square nut ½ in. thick was used, and this was left in the concrete when the bolts were removed. The bolts were removed after the forms had been taken off and were used again repeatedly. The bolts were coated with tallow just before placing the concrete and to break the bond they were given one turn about four or five hours after the concrete was poured. Each form was used about five times and then knocked down, the lumber then being used for built-up forms at the backs of the walls.

Where the width of the lock walls was not greater than 30 ft. tie rods were used to prevent the spreading of forms on opposite sides of the wall. These rods were spaced ten apart. The cantilever forms used were made up in slabs or sections 30 ft. long and 5 ft. wide. The form sections consisted of bevel-edged plank 1⅝ in. thick, placed horizontally and united by 3 x 10-in. uprights placed 3 ft. apart. The beveled edges left the face of each plank wider than its back in order to get a tighter form joint and give the concrete a better finished surface. This lumber was run at the mill specially for this work and cost about $12.50 per thousand delivered at the lock.

COST OF MATERIALS

The first concrete was poured in the locks in February, 1913, and in November, 1914, 200,000 cu. yd. had been put in place, practically completing the locks. The number of men employed on the work varied from 150 to 300. Sand and gravel cost 34 cents per cubic yard delivered on barges at the lock site. Cement cost $1.52 delivered on cars in the warehouse, and lumber costs were between $12 and $13 per thousand. The average cost of concrete in place in the lock was $4 per cubic yard, although for five months at a time the average had been as low as $3.70 per cubic yard. This figure includes all materials, reinforcement, form lumber, power, light, labor, overhead charges and practically the whole cost of the equipment used on the work, only a slight percentage of this latter item being written off as salvage.

The building of the lock was conducted entirely by hired labor under the direction of Major J. B. Cavanaugh, Corps of Engineers, U. S. A., A. W. Sargent, assistant engineer, being in local charge. C. A. D. Young, assistant engineer, was in charge of the design and erection of the gates and machinery.

PANAMA CANAL TRAFFIC established a new record in May, when 141 ocean-going vessels passed through. The previous record was 136, for the month of March. The March cargo exceeded that of May, being 635,057 tons, as against 578,708 tons in May. The total tonnage from the opening of the canal to June 1 was 4,347,568.



ONE OF THE GANTRY CRANES, AND THE TRESTLE FOR CONCRETE TRAINS

Rerating a Pitometer

Home-Made Whirling Apparatus Enables Sacramento Engineers to Calibrate Instrument After Slight Belling of Orifice

By CHESTER GORDON GILLESPIE
Assistant City Engineer, Sacramento, California

BY WHIRLING a pitometer in 18-in. of water on a 10-ft. arm of a home-made "merry-go-round" the city engineers of Sacramento, Cal., were able to rerate a pitometer, the orifices of which were slightly belled as a result of reaming out small burrs and irregularities about the mouth edges. The instrument was to be used in testing a new 15,000,000 high-pressure, centrifugal unit at the municipal pumping station.

"MERRY-GO-ROUND" USED

The "merry-go-round" consisted of a 10-ft. arm of 2 x 6-in. scantling, reduced in width at the end, to which the pitometer was attached vertically by using a corporation cock screwed into the arm. The arm was rigidly cleated by an iron stirrup to the 4 x 6-in. central shaft, 6 ft. long. A ⅝-in. pin in the bottom of the shaft rotated in a cup bearing, a hole drilled in a steel plate. The whole arrangement was carried on a pier of four piles, driven in the lake bottom. On top the shaft was steadied by an overhead T-frame carried on two posts and a tree, spread enough to clear all moving parts. Double 2 x 8-in. timbers, about 20 ft. long, were required for stiffness of the frame.

Rotation was secured and regulated by the use of a drill press, bolted to a standard above the shaft, connection being made with the shaft by a tongue and jaw arrangement, intended as a slip joint to prevent binding of the bearings when the operator's weight came on the framework.

The pitometer, about 6 ft. long, was steadied by a post at the end of the 10-ft. arm, and braced to a transverse bar nailed to the arm. This bar was used to adjust the plumbness of the pitometer by counterweighting one end.

OBSERVER WHIRLED WITH PITOMETER

Rubber-tube connections were made from each orifice tube to respective legs of an inverted glass U-tube mounted on a scale board. Deflections produced by the rotation were read by using colored carbon tetrachloride, the observer sitting on a revolving platform built around the shaft. Particular pains were taken to free the system of air. The U-tube was of a uniform bore, and hence knowing the neutral reading it was merely necessary to read the column in one leg, multiplying the difference by two to get the total deflection. The truth of this was tested at several ranges of readings. Deflections were read in every quadrant and the rotation time for a series taken by a stop-watch by the observer. Readings were set down by a recorder stationed above. About seven revolutions made a test.

Linear velocities ranging from 3.67 to 6.69 ft. per second were used, giving a deflection of from 5.58 to 18.68 in. The maximum variation in the determined coefficient was from 0.860 to 0.870, averaging 0.866. As given by the makers the coefficient was 0.84, showing the belling increased the value 3 per cent.

Including engineering, carpenter, foreman and all expense, the rating cost $90. It was carried out under the general direction of F. C. Miller, city engineer, by the writer.



THIS "MERRY-GO-ROUND" WAS USED FOR RERATING PITOMETER

Literature

For the Civil Engineer and Contractor

New Publications

WATER PURIFICATION PLANTS AND THEIR OPERATION. By Milton F. Stein, assistant engineer, Cleveland Filtration Plant. Cloth, 6 x 9 in.; 258 pages; illustrated, diagrams and plates. New York, John Wiley & Sons, Inc. $2.50 net.

MANUAL OF SURVEYING FOR FIELD AND OFFICE. By Raymond E. Davis, C.E., instructor in civil engineering, University of Illinois. Limp leather; 4 x 6¾ in.; 395 pages; illustrated. New York, McGraw-Hill Book Company, Inc. $2.50 net.

THE SLIDE RULE—A PRACTICAL MANUAL. By Charles N. Pickworth, editor of "The Mechanical World," author of "Logarithms for Beginners," "The Indicator," etc. Thirteenth edition. Cloth, 5 x 7 in.; 122 pages; illustrated. New York, D. Van Nostrand Company. $1 net.

This revised edition has been extended to include descriptions of various new slide rules and calculators. A note on the extraction of fifth roots has also been added.

STANDARDIZED SQUARE FOOTINGS OF REINFORCED CONCRETE. By Lewis A. Hicks, structural engineer. Paper, 6 x 9 in.; 62 pages; illustrated. San Francisco, Lewis A. Hicks Company, Rialto Building.

A thorough explanation of the use of diagrams devised for the solution of problems in connection with the design and review of square footings, principally in the form of two-line nomographs. The book is accompanied by a line sheet containing nomographs for stresses and design data. Most of the formulas are in the form proposed by Prof. A. N. Talbot in Bulletin 67 of the University of Illinois based on the only series of tests on column footings ever made.

THE ECONOMICS OF CONTRACTING, VOLUME II. By Daniel J. Hauer, consulting engineer, editor of the "Contractor." Cloth, 6 x 9 in.; 324 pages and appendix; illustrated. Published by H. E. Baumgartner, Rand-McNally Building, Chicago. Price, $2.50.

The general estimate of this book will be found in the editorial pages of this issue. In addition to the sections there commented upon, the work contains much valuable information on filing systems, and the organization and conduct of the executive functions and offices of a company. Valuable, and at times amusing, suggestions for handling customers are also presented. An appendix contains suggested by-laws for a construction company. The author's handling of English is not equal to his mastery of the principles of conducting a contracting business; the presentation is, however, clear and forceful.

Books Reviewed

Experience in Efficiency

Author, Benj. A. Franklin. Cloth, 5½ x 8 in.; 168 pages. New York, Engineering Magazine Company. $1.

This is a good book for the unbeliever in modern methods of increasing efficiency to start on. It will lead those back to conviction, too, who have lost their keen appreciation of the possibilities offered by thorough studies of business, industrial, and contracting operations.

Mr. Franklin tells simply and interestingly what has been accomplished in various plants by efficiency studies. Moralizing and theory are indulged only to a limited extent—sufficient to bring out the philosophy of the procedure and indicate the general principles involved in the specific cases cited. The variety of studies is such as to be suggestive to men in widely different branches of industry.

Cases are cited where efficiency has been increased by setting piecework prices on the basis of quality, by setting piecework prices on the production of whole gangs instead of individuals (a method that can frequently be used in contracting work), by scheduling the clerical force, by installing work-order systems and inspection departments, and by putting a whole plant, including the office, on bonus (a most unusual procedure). Mr. Franklin's views as to when additional clerical hire, for the purpose of developing statistics looking toward closer control of operations and reducing costs is justifiable, are very sensible and deserve a wide reading. A story on overhead reduction in a certain plant is particularly good, and will hold the interest of those who are constantly worried by the bugaboo of ascending "burden." Finally, Mr. Franklin emphasizes the need for the proper mental view in order that betterment studies may succeed.

While the incidents relate only to industries, they will start trains of thought for the civil engineer, particularly those in authority on municipal work, and for the contractor. The latter, unfortunately, has been slow to learn the value of minute

analysis of his operations, and to him the discussion on gang bonusing and on the advisability of clerical hire should prove especially valuable.

Sanitation in Panama

Author, William Crawford Gorgas, Surgeon General, U. S. A. Cloth, 7½ x 5 in.; 298 pages, 15 illustrations. New York, D. Appleton & Co. $2.

Reviewed by George C. Whipple, Professor of

Reviewed by George C. Whipple

Professor of Sanitary Engineering, Harvard University, Cambridge, Mass.

The story of sanitation in Panama has been told repeatedly, but never so well or so completely as in this new book by Major-General Gorgas, the master of sanitation. It is written in a popular style adapted to the general reader and is an intimate personal account of General Gorgas' work both in Havana and Panama. Although written as a narrative it is, nevertheless, thoroughly scientific and orderly in arrangement. Starting with the old ideas in regard to the transmission of yellow fever, he describes step by step the scientific work which placed the mosquito theory on a firm foundation. He shows how sanitation without a knowledge of the mosquito theory failed to eradicate yellow fever and how triumphant was the conquest of this disease after the Reed board had finished its work. Incidentally General Gorgas discusses malaria, plague, and other diseases, and of course describes in detail the work of the sanitary department, thus making the story complete.

In his concluding paragraph the author makes a statement that will at first seem extravagant, namely, that the elimination of tropical diseases is as important to the human race as was the discovery of America by Columbus in that it has opened to human habitation the immense areas of productive land in the tropics hitherto uninhabitable by white men.

The Essentials of Descriptive Geometry

Author, F. G. Higbee, professor and head of the department of descriptive geometry and drawing, State University of Iowa. Cloth, 6 x 9 in.; 204 pages; illustrated. New York, John Wiley & Sons, Inc. $1.80 net.

The principal object of this book, as stated by the author, is to develop the qualities of mind so essential in a draftsman—ability to solve problems, to visualize and to analyze a complex problem into its component parts. The book, therefore, confines its practical treatment to the third quadrant and includes those parts of the subject which possess industrial utility. The most distinctive feature is the extensive treatment of model making. Models are illustrated and many problems given, presumably with the purpose of aiding the student to obtain a clear understanding of the relation between the drawing and the actual object pictured. Practical problems are suggested and the text, after Chapter 7, is consistent in method of treatment in first stating a problem in the form of a "proposition," then outlining the method of solution in a "discussion" and finally describing the construction in detail.

The treatment as a whole is logical and essentially elementary in method of presentation. Particular care is devoted in the opening chapters on orthographic projection and the profile plane to create a clear conception of the elements upon which the whole subject depends. The chapters are short and always contain from ten to twenty problems each. After several chapters on separate propositions, Chapter 10 gives a thorough discussion of problems in points, lines and planes. The following five chapters are then devoted to planes, cylindrical and conical surfaces and their intersections.

Surfaces of revolution and warped surfaces are clearly defined and classified. The more usual and simple forms are discussed in full, the warped surfaces being clearly illustrated by models. The helix and the helicoid are included in detail, and the development of surfaces is illustrated. In the chapter on model making many practical suggestions and examples are given, including such problems as ventilator cowls, hoods, elbows, etc. The book closes with an appendix containing rather simple constructions usually given under plane geometry, but repeated for ease of reference. The figures are clear and well drawn and the typography is good.

The Modern City and Its Problems

Author, Frederic C. Howe. Cloth, 5 x 8 in.; 390 pages. New York, Charles Scribner's Sons. $1.50 net.

Comment has been frequently made in this journal on the broadening opportunities for engineers in municipal work. The complexity and high first and maintenance costs of our public works, necessitating the highest order of engineering training; the better appreciation of the place of the expert in modern administration, whether private or public, and the advent of the commission and of the commission-manager forms of government are responsible for this. Undoubtedly the opportunities will be still broader when engineers grasp such as are now offered and show their ability to handle the broadest phases—financial and administrative—of municipal work.

Consequently, the "Modern City and Its Problems" deserves a wide and careful reading from engineers. Many of the activities of European, especially of German, cities enthusiastically described by Mr. Howe look to the conservative mind to be intensely fraternalistic. In the last analysis, however, it develops that they are carried on on good business principles or are unescapable to the municipality that appreciates its responsibilities to its citizens. If, as Mr. Howe believes, American cities will very considerably enlarge their scope in the near future, it is all the more important that engineers understand fully what the German and British cities can do, and how they do it. From their long experience and their many experiments he will be able the better to formulate his own plans and to judge of the success of new municipal undertaking.

In order to give a background for the latter discussion Mr. Howe first reviews the status of the ancient and medieval towns, and then faces the development of the modern American city. Turning then to Germany and Great Britain he contrasts their methods and their progress with our own. An analysis is then made of the causes of American municipal backwardness, with the conclusion that it is due very largely to the lack of home rule, to the interference of legislatures in municipal affairs and the extent to which they have circumscribed the liberties of the city government. Recent improvements along the lines of the Federal charter adopted by Cleveland and the commission-manager forms of administration are discussed at length. These chapters, giving Mr. Howe's explanation for the present situation of American municipal government and the changes for the better that are being wrought, should be of the greatest value to him who wishes to understand the problem of American municipalities. The city and the public service corporation are discussed in one chapter, much to the detriment of the latter, while municipal ownership in South America and Europe are quite fully discussed, the finding in general being in favor of public ownership of tramways and electric-light, gas and water properties.

Probably the chapters that will best hold the interests of our American engineers are those on the city as a social agency, the housing problem, municipal housing in Europe, recreation and the problem of leisure, the city budget and new sources of city revenue.

The progressive engineer engaged in municipal work cannot afford to be in ignorance of the matters Mr. Howe discusses in this book.

Government of the Canal Zone

Author, George W. Goethals, U. S. A. Cloth, 5½ x 8 in.; 106 pages. Princeton, N. J. Princeton University Press. $1 net.

This little book is a reprint of the Stafford Little lectures for 1915. The aim of the lecturer was to cover these phases of the Panama experience regarding which little has been written. The first lecture deals with the acquirement of the Canal Zone by the United States; the extent of the authority of the United States; the treaty with the Republic of Panama; the difficulties with the Panamanian Government over customs and postal matters, and their final disposition; the reasons for the successive changes in the administration of the zone, leading up finally to the establishment of the "benevolent despotism" regarding which so much has been written. The point is made clear that no other form, of the various experiments tried, served properly to secure the sole end of the zone's acquisition—the construction of the canal.

The second of the two lectures discusses the economic, political, and administrative situation on the Canal Zone which necessarily are determinative of the permanent form under which the canal is to be administered. Much argument is adduced from diverse points of view, to show why the zone should be depopulated, except for the maintenance and military forces, necessary for the operation and defense of the canal. Finally there is a discussion of the various forms suggested for the permanent government, and a description of that finally adopted and now in effect—a continuation of government by executive order, the general form under which the zone has been since April 1, 1915.

TEMPORARY RAILROAD TRESTLES and other construction to be assumed as necessary in estimating reproduction cost new for the Federal valuation must, it was pointed out at the recent valuation conference, be much heavier than were actually built when the older roads were constructed, on account of the much heavier equipment now used.

Letters to the Editor

Comment on matters of interest to engineers and contractors will be welcomed

Railroad Field Data

Sir: In the notice of Professor Raymond's "Field Manual for Civil Engineers" in your issue of June 5, the reviewer expresses the opinion "that the exclusion of the exposition of typical curve problems will militate against its usefulness in the field." The writer believes this theory (apparently held by many of the instructors in our engineering schools) is erroneous, and he knows by reason of a long experience that if the students were well grounded in the theory and practice of geometry and trigonometry they would not need specific instructions in the details of each particular curve problem which comes up for solution. Any or all of these problems are most useful as practice problems to develop the student in the application of the theory to actual practice, but in the field all that should be needed is a book of the essential tables in the most compact form.

F. Lavis.

New York City.

Promoting Engineering Work

Sir: I am writing to comment on the recent article by George R. Bascom of the Extension Department of the University of Wisconsin as to the work they are doing. (See the Engineering Record of July 3, page 47.) It occurs to me that the principle laid down by this department, as described by Mr. Bascom, is highly commendable.

I do not believe that any engineer in private practice will disagree with me when I say that the average City Council in any small community contemplating municipal improvements has to be educated as to the amount and method of necessary work in the proposed improvement. As a general rule they will listen to anyone representing or connected with a State educational institution in preference to an engineer in private practice. This puts the question in a very delicate position and is a revision of the old question as to whether or not instructors in the schools should solicit and do private work. I do not believe that it is so much the fact that this is done as the way it is done and the rates charged that have led to the strong feeling against it among consulting engineers.

The work of the above-mentioned Extension Department is an excellent solution to the problem, and I would like to see it started in this locality also.

E. B. Murray,
Consulting Engineer.

Kansas City, Mo.

Sir: I have read the article by George R. Bascom of the University of Wisconsin relative to the university promotion of engineering projects and the editorial comment thereon. There may be a difference of opinion as to the advisability of an educational institution, supported in part, at least, by State funds, engaging in the business of promotion, but there can be no question as to the fact that such promotion, as explained in the article, does infringe upon and conflict with the legitimate duties of the consulting engineer.

According to the statements made in that article the university furnished, free of charge, an engineer who made a study of the local problem, outlined a plan, which must have been in somewhat complete detail in order to base upon it the estimate furnished, and a report, the nature of which is not stated.

As a rule, and in this statement most experienced engineers will concur, the work alleged to have been done by the university representative covered about all the really expert knowledge required, because with the fundamentals once established the details can very safely be left to subordinates. In fact, the context shows that such was the case in Bloomington. It seems to the writer that it would have been more graceful, more dignified and more in keeping with the proper functions of an educational institution had its services terminated in giving advice.

When a State institution, whether quasi or actual, engages in the business of furnishing, gratuitously, designs, plans, estimates of cost and reports for physical structures, then it usurps and infringes upon the rightful prerogatives of a class of men who have spent many years and much money in acquiring expert knowledge of their professions. The practice is a reprehensible one and, regrettably, not confined to the State of Wisconsin alone. The advice frequently given to the individual to "mind his own business" is equally applicable to the State.

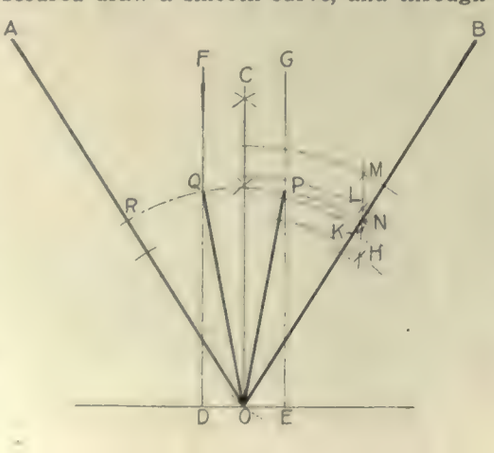
W. G. Stone, C. E.

Utica, N. Y.

To Trisect an Angle

Sir: The following simple and original solution of the problem to trisect any angle graphically may be of interest. In the accompanying figure, let AOB be the angle to be trisected. Draw OC so as to bisect the angle AOB, and draw through O a line perpendicular to OC and lay off $DO = OE$. Draw DF and EG parallel to OC, and with O as a center draw any desired number of concentric circles using any desired radii. From the points where these circles cut the line GE lay off chords on said circles equal to the distance DE.

Through the points H, K, L and M thus secured draw a smooth curve, and through the point N where this curve cuts the line OB draw a circle having O as a center and the distance ON as a radius. On this circle the cord $NP = PQ = QR$ and is also equal to the distance DE, and since equal chords subtend equal arcs the angle ROQ equals the angle QOP equals the angle PON, and the angle AOB is trisected.



By a similar theory and construction any angle may be divided into any number of desired parts.

B. K. Coghlan,
Associate Professor of Highway Engineering, Agricultural and Mechanical College of Texas.

College Station, Texas.

Mortar Cushion Under Vitrified and Stone Block Pavements

Sir: I have noticed several references in your paper recently regarding mortar cushion under vitrified and stone block pavements. In this connection the city of Baltimore has completely changed its vitrified-block specifications this year and has laid all such material on a lean mortar bed mixed one of cement and five of sand. Ordinarily there is sufficient moisture in the sand to cause this to set, but additional moisture is added when the pavement is sprinkled before grouting. Pavements under traffic since the first of March have shown no signs of weakness whatever.

Some granite-block crossings in street-railway tracks have been placed on mortar bed this season, with excellent results, and we have recently awarded two granite-block contracts with the blocks to be laid on a mortar bed, the same mixture as that under the vitrified-block pavements.

I believe that all our block pavements in the future in this city will be laid on a mortar cushion.

R. Keith Compton.
Chairman and Consulting Engineer, Paving Commission, Baltimore.

Eighty-five Million Feet of Timber is to be cut from the Chugach National Forest in Alaska for use in constructing the Government railroad in that territory, a permit covering this having been granted the Alaskan Engineering Commission by the U. S. Forest Service. The cut will be the largest amount of timber ever felled on the Alaskan forests in one operation, and at the average rate obtained for timber sold from the Chugach forest during the fiscal year 1914, it is worth approximately $145,000 on the stump. It will be nearly twice as much as the total quantity of National forest timber now cut and used annually for local purposes throughout Alaska, but the two National forests of Alaska contain about 78,000,000,000 ft. of merchantable timber, and it is estimated by the Forest Service that more than 800,000,000 ft. could be cut every year, forever, without lessening the forests' productivity. Tests of Alaskan spruce and hemlock are being made at the Forest Service laboratory at Seattle, and so far have substantiated the opinion of foresters that Alaskan timber is sufficiently strong for practically all structural purposes. While these tests are going on Forest Service employees in Alaska are marking the timber to be cut along the proposed railroad, the cutting to be done so that only mature trees are taken, the young trees being left uninjured and the condition of the forest being improved.

HINTS FOR THE CONTRACTOR

Details Which Save Time and Labor on Construction Work

Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

[*Contributions to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

Concrete Patches Repair Centrifugal Dredging Pump

By W. L. GRACE
Erie, Pennsylvania

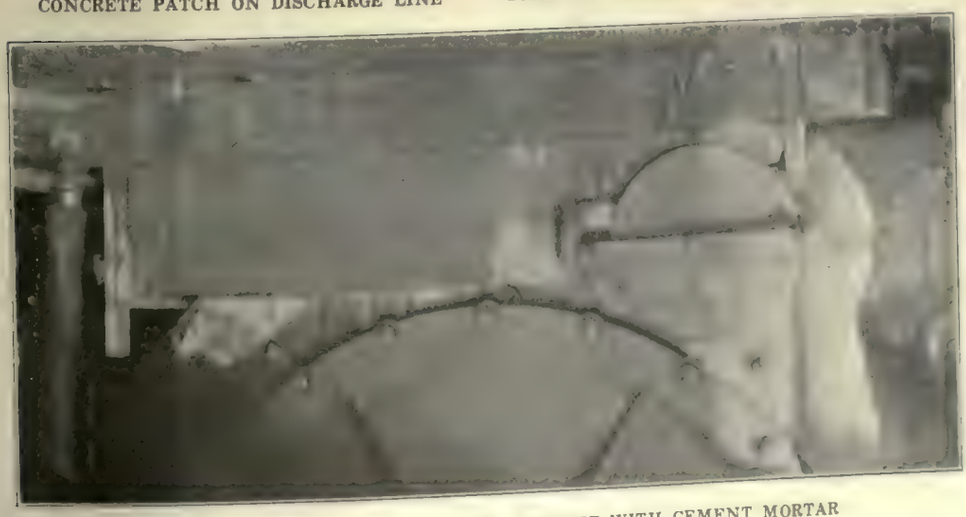
CONCRETE mortar has been used with success to repair temporarily a cracked centrifugal pump casing on a hydraulic dredge working in the Erie Harbor. A crack had started in the lower part of the casing, which was rapidly extending, and a piece of the casing threatened to break out. To avoid shutting down the pump, a wooden form was built around the cracked part of the pump casing, allowing a generous margin all around the break, and poured full of a wet mixture of 3½ parts of cement to 1 of sand. This was allowed to set for twenty-four hours, after which the pump was started up. In about four days the vibration broke the bond between the cement and the pump casing. The crack between the cement and the casing was, however, readily stopped with sulphur, which at once made the patch tight. So far this repair has proved very effective.

At the same time a "Y" in the discharge line, which had been patched before but was again nearly worn through, was given the same treatment. This patch proved even more effective than that on the pump casing, as the bond between the cement and the iron is still holding.

To take this pump casing off and weld it would have required considerable time. Now, however, the pump can be kept in operation while a new casing is ordered at the leisure of the owners.



CONCRETE PATCH ON DISCHARGE LINE



CRACKED PUMP CASING PATCHED AIRTIGHT WITH CEMENT MORTAR

Record Form Helps Contractors to Bid on Highway Work

By T. EADINGTON
Occidental Construction Company, Los Angeles, California

THE ACCOMPANYING record form has been found valuable by California contractors for keeping track of the prices at which work was actually going in different sections of the State, so that they might know what figures they would have to beat if they expected to land a given job. This has been necessary lately, as the dearth of work along other lines has caused contractors to turn their attention to the roads which are being built all over the country. The result has been keen competition and ruinously low prices. The contractor has to consider, not how fair a margin he can secure, but how low the other fellow is going to bid, and how near he can come to him and still make something on the job.

Most of the work in California consists of grading and laying a 4-in. concrete pavement, the State in recent months furnishing all material for the pavement. The form shows the location of the job, the contractor's price and the engineer's estimate, and gives in detail the unit prices, the top line showing the contractor's unit price and the second line that of the engineer.

STATE HIGHWAY WORK—CALIFORNIA

Date	Location	Miles	Contractor	Price	Excavation per cu. yd. Unclassified	Excavation per cu. yd. Earth	Excavation per cu. yd. Soft rock	Excavation per cu. yd. Hard rock	Concrete A cu.yd.	Concrete B cu.yd.	Pavement, sq.yd.	Oil surface
Apr. 24, '15	Yolo - Sacramento River, Yolo County, California	3½	Engineer's estimate..	$38,687	$0.50	....	....	....		$7.25	$4.08½	...
			J. Lawrence	24,205	0.86¼	....	....	....		6.00	2.85	

Home-Made Cableway Changes Shafting on Caisson Job

By H. D. HAMMOND
Associate Editor, "Engineering Record"

A CABLEWAY, made of a spare 1½-in. galvanized derrick guy, and operated by nigger-heads on two hoists already set up on the job, was used with success by the writer in sinking one of the caissons for the Pennsylvania Lines bridge over the Muskingum River near Coshocton, Ohio.



CARRIAGE STAYED ON THE TRACK

The new piers were sunk beneath a double-track main line in full operation. Shafting, cofferdam, etc., was, of course, built up as the caissons were sunk. A derrick was set up to handle locks and shafting at each end of each abutment, at the upstream end of pier 1, and at the downstream end of pier 2. Each of the piers had two airshafts, but as the downstream end of pier 1 was nearly under the old truss span at that point, it could not be reached by a derrick. Consequently, the shafting and a light man-lock used for this end were handled on tackle swung from the bridge floor.

Pier 2 required practically the same equipment. Two exits from the working chamber were necessary for safety, and for changing crews. The excavation, however, was mostly taken out with a blow-pipe, and the amount of material to be bucketed did not warrant setting up two derricks. The span over this caisson, which was of plate girders on pile piers, was narrow enough to allow reaching the downstream end with



CABLEWAY SAVED ERECTING DERRICK TO HANDLE SHAFTING AND TIMBER

a derrick. The upstream shaft was well out from the bridge, and this end of the caisson was in deep water where derrick staging would have been expensive. A gin pole was considered for changing shafting on this end, but would not have been a good rig for several reasons. The sections of shafting had to be floated alongside the caisson on rafts, raised and carried to the center of the caisson for erection. Besides, a gin pole could not be left standing on the caisson while it was going down. Neither could it be laid down on top of the caisson when not in use, as the carpenters building up the caisson cofferdam would have had to raise the pole every time they put in cross braces, to avoid leaving it where it could not be removed.

The cableway was strung from the portal of the west truss span to a bridle at the base of the mixing plant at the west abutment. This bridle was anchored to two piles already in place. The cable was arranged to hang as nearly as possible over the center of the shaft by slipping it on the bridle. The cable led down grade from the bridge truss. The carriage was made in the job blacksmith shop out of two small sheaves, some strap iron, two shackles and three links. From it hung a four-part manila rope fall, the lead line of which ran across the river to a hoist set up at one of the derricks for the west abutment. To prevent this line from sagging, it was led through two or three snatch blocks hung at intervals from the main cable between the pier and the west bank. To the carriage was fastened another line which led, in the opposite direction from the lead line, back to the bridge portal, across over the tracks, and down to the hoist at pier 2. This line pulled the carriage uphill. A slight tension on the fall line would pull the carriage downhill, and if carrying a load, the carriage would run downhill of its own accord.

To insert a new section of shafting in building up the caisson, the man-lock would first be removed and set on top of the caisson. The rope leading to the hoist at pier 2 would then be slacked till the carriage ran downhill over the raft, carrying the new section of shafting, on the west side of the caisson. This shaft would then be picked up, and the carriage pulled back over the caisson. The shaft would then be bolted in place, and the lock replaced on top of it. The sections of shafting, which were 4 ft. in diameter and 10 ft. long, weighed about 1800 lb.

The rig was new to the men using it, and caused a great deal of trouble in setting the man-lock for the first time. It was difficult to make the load hang level and swing it so as to match up the bolt holes without disturbing the gasket which had to be made up in the joint. After the first shift was made, however, shafting was inserted almost as readily as with a derrick, and a shift was even made at night on one occasion. The cableway also proved of great use to the carpenter gang, as it enabled them to set the 12 x 12-in. braces in the upper end of the cofferdam sections without having to slide them through under the tracks from the downstream end.

The work of building these bridge foundations was carried out by the Foundation Company, with Reginald Jackson superintendent. The writer, who rigged the cableway, was general foreman.

Mixer Plant on Flat Car Propels Itself Along the Job

By F. E. CANTWELL

Dominion Equipment & Supply Co., Winnipeg

IN ORDER to shift their concrete mixing plants over a distance of 17¾ miles in the construction of the Shoal Lake-to-Winnipeg Aqueduct, near Winnipeg, Canada, the contractors, Thomas Kelly & Son, have had three special self-propelling mixer car plants built. The Chain Belt mixers are mounted on 35-ft. standard gage, 60,000-lb. capacity flat cars. The water tank shown in the accompanying photograph on one end of each car has a capacity of 3000 gal. The mixer and boiler are fed from this water supply by a duplex steam pump. Piping is so arranged that the overflow from mixer tank is carried back to the water tank. Concrete is shot direct from the mixer to the aqueduct forms through special "U" shaped No. 10 gage steel spouts, each 18 ft. 9 in. long, made in two sections, rolled to 24 in. diameter with a depth of 8 in. They are reinforced on each side with angles, with holes punched every 6 in. for attaching supporting cables.

A Blasting Puzzle

By L. C. SCOTT

Engineer, Linn Creek, Missouri

THE following phenomenon actually happened. Can any of the readers of Engineering Record explain it? Holes 1 and 3 in the drawing were shot simultaneously and hole 2 went off 2 min. after the others



CENTER HOLE FIRED ITSELF

had gone and with no apparent cause. Electric fuses were used and wired as shown. The first explosion threw the lead wires high in the air and entirely away from holes. The holes were 1¼ in. in diameter, 3 ft. deep and were loaded with two sticks, split open, of 40 per cent DuPont dynamite. The battery contained six dry cells with coil. Holes 1 and 3 shattered the rock over the top of hole 2 and when hole 2 went it apparently had full strength. The rock is hard limestone.

Why did not all holes go at once, and, failing to do so, why did hole 2 go 2 min. later without an application of electricity?



THESE MIXERS SERVE A 17-MILE JOB AND CARRY THEIR WATER WITH THEM

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

To Submit Plans for $10,000,000 Power Development Project

It is reported that the Ontario Hydroelectric Commission will submit plans to the Ontario Government within the next week, which provide for eventual power development at Niagara Falls and from the stillways of the New Welland Canal of 250,000 hp. and an immediate development of 100,000 hp. The work will entail an expenditure of approximately $10,000,000, and will require three years to complete.

Of the power available on the Canadian side of the falls, under the treaty between the United States and Great Britain made some years ago, only 6600 sec.-ft. are left at the present time. Plans have been made for the utilization of this up to the limit by getting the greatest possible head of water. The plans, which will be submitted to the Government, will be capable of extension to develop ultimately 600,000 hp. This includes the 6600 sec.-ft. at Niagara and water that has been promised from the spillways of the Welland Canal. The chairman of the commission predicts that when this new development gets beyond the initial stage there will be a sweeping cut in power prices.

It is understood that the plans of the commission call for the construction of a great development plant at Chippawa Creek.

Chicago's Abolished Efficiency Division Revived Under New Title

An ordinance calling for the establishment of a Board of Standards and Apportionments and appropriating $15,000 for expenses has been passed by the Chicago City Council. The board will be under the supervision and control of the city comptroller and a representation of the council committee on finance, consisting of the chairman and three members. The duties of the new board are similar to those of the efficiency division, abolished several months ago by the new city administration, as is indicated by the following excerpt from the ordinance:

Section 4. That it shall be the further duty of said board to promote economy and efficiency in the municipal government. To perform such duty it shall conduct such investigations and studies from time to time of the efficiency of organization, administration, engineering and operating, accounting, finance and business procedure of the various departments and units of the municipal government and prescribe such standards and specifications necessary to secure economy and efficiency, as will enable it to pass with intelligence upon the various departmental estimates. The said board shall have power to inaugurate such changes and betterments as do not require council or legislative action.

Wastes Disposal Investigation Transferred to Cincinnati

The headquarters for the investigation of methods for the disposal of industrial wastes now being carried on by the U. S. Public Health Service was changed from Washington to Cincinnati, July 1. This change was made in order to co-operate with the Ohio River investigation, of which W. H. Frost, passed assistant surgeon, U. S. Public Health Service, is in charge. The industrial waste studies are under the supervision of Prof. Earle B. Phelps, professor of chemistry at the Hygienic Laboratory, Washington, D. C., with H. B. Hommon in charge of the Cincinnati and field offices. The staff consists of H. C. Colson, Jr., sanitary chemist in charge of tests at tannery, Luray, Va.; Walter E. Brown, sanitary bacteriologist in charge of tests at strawboard plant, Noblesville, Ind.; H. R. Crohurst, sanitary engineer, and W. D. Tiedeman and Emery J. Thierault, sanitary bacteriologists assisting in the studies of industrial wastes on the Ohio River watershed in the vicinity of Cincinnati.

Concrete Buildings Sustained Little Damage in Cincinnati Storm

The sixteen-story Ingalls Building, built of reinforced-concrete in 1902, emerged from the severe wind storm at Cincinnati, which was described in this journal July 17, with but a few panes of glass broken. The Lippincott Building, at Second and Main Streets, though in the direct path of the storm, suffered no damage whatever in the structural portion. About fifty panes of glass were broken and the parapet wall, which extended 8 ft. above the roof, was blown over. Buildings alongside of this structure suffered severely. Both of these buildings were erected by the Ferro Concrete Construction Company of Cincinnati, of which W. P. Anderson is the president.



CONCRETE BUILDING SHOWS UP IN DECIDED CONTRAST TO NEIGHBORING BUILDINGS

Engineer's Warning Regarding "Eastland" Unheeded

J. D. York Wrote U. S. Official Aug. 3, 1913, Saying Boat Had Structural Defects More than 1200 People Drowned in Chicago River

"You are aware of the condition of the SS. Eastland and unless structural defects are remedied to prevent listing there may be a serious accident." Thus wrote J. D. York, head of the Chicago firm of naval architects and engineers bearing his name. Mr. York's letter, written two years ago to the U. S. harbor master, Port of Chicago, was never answered. The letter is regarded as one of the most important pieces of evidence yet unearthed in tracing those responsible for the disaster.



OXYACETYLENE TORCH AIDS RESCUE WORK

Thirty minutes after the ill-fated steamer had capsized one of the editors of this journal was at the water's edge, having passed the police lines by presentation of his card. To attempt to describe the horror and results of the disaster would be futile and out of place in these columns. However, to the engineer, the cause and the means of rescue are of direct interest.

Improper Ballast Adjustment

"Improper ballast adjustment," caused the accident, according to a prominent Chicago engineer. "There was probably not sufficient ballast to compensate for the surging of the crowd of passengers and the shifting of ballast which resulted. According to evidence furnished me by a member of the crew, the ballast had been reduced in anticipation of an extra large number of passengers. When the boat started to leave the docks the passengers surged to the opposite side. This sudden surging caused a change in the center of gravity for which there was not enough ballast to compensate."

"Wanted, six men who know something about pulmotors," yelled a police sergeant from the side of the boat crowded with policemen. Not a man stepped out of the immense throng flocking the shores. It is to be noted that the policemen themselves were not acquainted with these powerful adjuncts for the saving of life.

Within a few minutes after the boat careened men were at work cutting holes through the hull in order that imprisoned passengers might be pulled through the apertures and saved. Oxyacetylene torches were imme-

diately called for and placed at work. However, few were alive when they were reached, being either suffocated or drowned.

Powerful Lights Aid Night Work

From prow to stern the Eastland was illuminated the nights of July 24, 25 and 26 by ten high-power searchlights. Six of the illuminators were placed along the north edge of the Reid-Murdock plant across the river and four were strung across the channel. Poles erected on the side of the boat also carried lights. To light the interior of the boat electricians crawled through the openings burned with acetylene torches, earlier in the day. In the interior three divers were kept busy descending into the water that rose to within 20 ft. of what was the starboard side of the boat.

Investigations to place the responsibility for the disaster are now being conducted by Federal, State, county and city authorities. The Great Lakes Dredge & Dock Company, Chicago, has been commissioned to raise the boat. Divers working in and about the hull of the boat declared they could make no progress because of the intense blackness of the water and the large amount of debris blocking their way. Even powerful waterproof electric lights were of no avail. To release the scores of bodies known to be in the forward compartments of the boat, and the many more believed to be buried in the mud under the side of the vessel, the company sent heavy dredges to the scene to dig out channels in the river bottom of sufficient width to allow for pontoons. They plan to place a number of pontoons under the hull to raise the boat.

When all the bodies are taken from the steamer, it will be towed down the river and dynamite will be used to bring out bodies that are supposed to be stuck in the mud at the bottom of the river where the boat turned over.

Convict Labor for California State Highway System

The convict labor bill recently passed by the State of California, which becomes effective Aug. 8, is to be put in operation at once on highway construction in Humboldt and Mendocino counties. Out of this month's sale of State highway bonds $250,000 will be used for road work, employing convict labor. The first units constructed will be from Cummings to the south fork of Eel River, 38 miles, and from Miranda to Garberville, 15 miles. Three camps of 60 men each will be established, each consisting of a working force, policing force and a camp or cooking force. The convicts will do their own policing and there will be no guards. Each camp will be in charge of a superintendent, and a foreman will direct the road work.

Under the convict labor bill dual control is provided for in such camps; the disciplining of the men will be under the State board of prison directors and the management of the work will be under the highway commission. A modified honor system will be in effect, whereby the men will get certain credits for their work and behavior. The plan contemplates sending out on road work only those prisoners who are selected as worthy of such special trust.

Chicago Survey to Locate Mosquito Breeding Places

A survey of Chicago to discover the breeding places of mosquitoes will be made by the health department. The City Council, at its last meeting, authorized an appropriation of $1500 for this purpose. Dr. John Dill Robertson, health commissioner, has announced that as soon as the survey is completed the department will take steps to destroy the insects by the use of oil.

Work on New $5,100,000 Museum at Chicago to Be Started at Once

After twelve years of planning, a contract has been awarded to the Thompson-Starrett Company, Chicago, general contractors, for the construction of the new $5,100,000 Field Museum in Grant Park, Chicago. The contractors are starting work at once. About 4,000 of the 9,221 southern yellow pine piles which will form the foundation are already on their way to Chicago. A large part of the 315,000 cu. ft. of white Georgian marble, which will constitute the exterior of the building, is already on hand. Three years is given as an outside estimate for the completion of the museum. The contractors say it can be finished in two years.

The site of the new museum is on the newly made land east of the Illinois Central Railroad and just south of Twelfth Street. Raised on an elevation of 10 to 15 ft. above the level of Grant Park and surrounded by terraces, the building will form a feature of the city plan designed by the late Daniel H. Burnham. Graham, Burnham & Company, the architects, began working on the designs several years ago. Careful study and investigation of museum plans were made both in the United States and Europe.

When completed, it is said it will be the largest marble building in the world, and one of the largest museums. It will consist of three stories and basement and will cover an area of 700 by 350 ft. The floor area will be 670,000 sq. ft., of which 400,000 sq. ft. will be devoted to exhibition purposes. The remainder will be used for scientific laboratories, lecture halls, offices and a restaurant. The total floor area of the National museum at Washington is 465,000 sq. ft. and that of the American Museum of National History at New York is 438,000 sq. ft.

New England Waterworks Exhibits to Be Set Up Sept. 5 and 6

Sept. 5 and 6 are the days named for the setting up of exhibits for the New England Waterworks Association Convention to be held at the Hotel Waldorf-Astoria, New York City, Sept. 7, 8 and 9, according to rules issued by the Exhibit Committee, July 10. Twenty square feet of space will be allowed each exhibitor. An extra charge will be made for each additional square foot. Uniform signs will be issued by the Waterworks Manufacturers Association. The committee is now ready to receive applications for space, which should be addressed to Fred S. Bates, 180 Broadway, New York City.

American Society of Civil Engineers Issues Convention Program

The American Society of Civil Engineers has issued its program for its forty-seventh annual convention, to be held in San Francisco Sept. 16 to 18. Headquarters will be at the St. Francis Hotel. The convention will open at 10 a. m., Sept. 16. President Marx will deliver the annual address, after which the business meeting will convene. The afternoon will be left free for a visit to the Panama-Pacific International Exposition. At 6.30 p. m. an informal reception, dinner and dance will be held at Old Faithful Inn on the Exposition grounds. The morning session of Sept. 17 will be reserved for the adjournment of the business meeting if necessary. Otherwise there will be no special program.

About 3 p. m. there will be an excursion by special train to Del Monte, arriving there in time for dinner. The following day will be spent there. A golf tournament is planned for the morning, and for those not caring to participate in this there will be an automobile trip, with lunch at Pebble Lodges. The golf tournament will be continued during the afternoon and there will be dancing in the evening.

A train will leave about 8.30 a. m., Sept. 19, for Santa Cruz, where the party will take automobiles to "Big Tree" Basin. Lunch will be served at "Governors' Camp" and a return will be made to San José for dinner. The train will leave there for San Francisco about 8.40 p. m.

Those who are in the golf tournament and prefer this to the excursion on Sunday will stay during the day at Del Monte, leaving for San Francisco about 6 p. m. and arriving there with the party from San José.

Although the program has been arranged for those in attendance at the convention of the American society a general invitation is extended to all members of other societies and other members of the International Engineering Congress to participate in its various features.

Surveys for Denver Municipal Waterworks Started

The Denver Public Utility Commission entered into a contract, July 20, with the Van Sant-Houghton Company, engineers and contractors, to make surveys, foundation borings and working plans for a municipal water system for Denver, in accordance with the wish of the citizens when a bond issue of $8,000,000 was voted five years ago. All efforts up to now to sell these bonds have been futile, bankers in Chicago and other Eastern cities advising strongly against their sale so long as there was such serious litigation between the existing company and the municipality.

The Van Sant-Houghton Company is a San Francisco firm which has an office in Denver to care for its contracts as Western representatives of the Unit Construction Company, St. Louis, for the umbrella trainsheds and the subways of the Union Station. Bonds to the extent of $150,000 are to be paid for in cash by the engineering firm and the cash is to be turned back to it in payment for the report, investigations and plans, which are to be completed in ten months. Mr. Houghton states that several parties will be recruited in Denver and placed in the field immediately. A. Lincoln Fellows, chairman of the commission, is of the opinion that the low costs obtained by the pneumatic concrete mixer equipment with which the company has been lining the tunnels of the Los Angeles Aqueduct and the Mile Rock sewer in San Francisco will reduce the tunneling cost 50 per cent below the original estimate.

No Evening Meetings Will Be Held at Engineering Congress

The opening session of the International Engineering Congress at San Francisco will be held at 10 a. m., Sept. 20. There will be general addresses of welcome and responses, and an address by Gen. G. W. Goethals, honorary president of the congress, subsequent to which the presentation of the John Fritz Medal will be made to Dr. James Douglas. The afternoon session, at 2 p. m., will also be a general session devoted to the Panama Canal.

During the remainder of the week sectional meetings will be held morning and afternoon, ending with a brief general closing meeting Saturday, at 11.30 a. m. No meetings of the congress will be held in the evening.

The committee on local affairs plans a general reception and ball for the evening of Sept. 20, a subscription dinner for the evening of Sept. 24 and special attentions for visiting ladies, including, presumably, an automobile drive in Golden Gate Park, an excursion by boat on the Bay, an excursion to Mount Tamalpais and a lawn party.

Special arrangements will also be made for participants in the meetings to see under the best conditions certain exhibits at the Exposition in which engineers are likely to take a particular interest, and, in general, every effort will be made by the committee of management of the congress to provide for visiting members and their families a pleasant week.

Will Build Annex to Polk Street Station, Chicago

The Chicago & Western Indiana Railroad has been granted, after more than a year's consideration by the Chicago City Council, permission to build an annex to the Polk Street Station. The ordinance permits the road to lay two tracks across Plymouth Court at Taylor Street. Opposition to the ordinance came under the following heads: Danger to citizens of having tracks at street level; contention that the ordinance was a terminal matter and that the railroad did not intend to give up its tracks at the end of the five-year grant. It was sought to compel the railroad to surrender street and alley space which the city contended it held illegally.

Materials to Receive Special Attention at Engineering Congress

The materials of construction will receive special attention in the proceedings and discussions of the International Engineering Congress to be held at San Francisco, Sept. 20-25. Volume 5 of the transactions will include about 25 papers covering the following subjects: Timber resources, preservative methods, brick and clay products, life of concrete structures, aggregates for concrete, waterproofing, volume changes in concrete, life of iron and steel structures, special steels and testing of metals, full sized members and of structures.

Personal Notes

R. H. Pembroke has resigned from the office of chief engineer of the Coal & Coke Railway.

John A. Bruce has been appointed city engineer of Omaha, Neb., succeeding Watson Townsend.

Walter C. Eberhard has been reappointed assistant in civil engineering on the instructing staff of the Massachusetts Institute of Technology.

William Wales, irrigation engineer, of Woodland, Cal., has been retained to do the preliminary work in connection with the proposed Southern Lassen Irrigation District, at Doyle, Cal.

George W. Simons, Jr., Howard C. Thomas and Andrew N. Wardle have been appointed assistants in civil engineering on the instructing staff of the Massachusetts Institute of Technology.

Edward J. Kelly, assistant chief engineer of the Sanitary District of Chicago, has been appointed by Governor Dunne of Illinois as one of the five members of the Illinois Waterway Commission.

Joseph E. Love, formerly structural engineer for the Chicago, Milwaukee & St. Paul Railway, at Butte, Mont., has been appointed engineer for the South Dakota Board of Railroad Commissioners.

J. Franklin Diggs, Jr., resident engineer for the southern division of the bureau of sanitary engineering of the Department of Health of the State of Maryland, has established his headquarters at Hyattsville.

Mayo Tolman, formerly assistant engineer for the Department of Health of the State of Maryland, has been appointed director of the division of sanitary engineering of the West Virginia State Board of Health.

Ray L. Jaeger has been appointed inspector in the U. S. Engineer office at Grand Rapids, Mich. This office has charge of the harbor and river improvement work along the east shore of Lake Michigan.

J. O. Jones has been appointed assistant professor of hydraulics at the University of Kansas. The announcement of this appointment was made in these columns, July 10, but the name was erroneously given as J. O. James.

Edward E. Krauss, for the past four years secretary of the American Concrete Institute, has been appointed district sales manager, at Philadelphia, for the Penn-Allen Cement Company of Allentown, Pa. His office is in the Widener Building.

Kenneth C. Grant, for the past two years connected with the Morgan Engineering Company, at Dayton, has been appointed as delegate to represent the State of Ohio at the Fifth National Drainage Congress at San Francisco, Sept. 17 to 20.

Edward Flad & Company, consulting engineers, of St. Louis, have been retained by the Murphysboro (Ill.) Waterworks, Electric Light & Gas Company on the engineering work in connection with the installation of a filtration plant in that city.

B. R. Cloyd, formerly engaged in special hydrographic work for the U. S. Reclamation Service, and previous to that, city engineer of Yuma, Ariz., is now connected with the engineering forces of the Copper Queen Consolidated Mining Company, Bisbee, Ariz.

John W. Hill, consulting engineer, of Cincinnati, has been retained by the conservancy commissioners of Miami, Clark and Shelby counties, Ohio, to prepare plans to be used in opposition to those prepared by the Morgan Engineering Company for conservancy work in that district.

Schuyler A. Obenshain, who has been engaged in contracting work at Bluefield, W. Va., during the past year and a half, has been appointed superintendent of construction for the Tangier Manors Corporation, on the improvements that company is making at Tangier, L. I., N. Y.

F. D. Cosner has been appointed engineer maintenance-of-way of the Coal & Coke Railway, with headquarters at Gassaway, W. Va. He will also assume the duties of the chief engineer, that office having been abolished with the resignation of R. H. Pembroke, which is noted elsewhere in these columns.

C. E. Smith, who recently resigned from the office of assistant chief engineer of the Missouri Pacific-Iron Mountain system to engage in private practice as consulting engineer, as noted in these columns, June 5, has been appointed consulting engineer of the Department of Public Utilities of St. Louis.

Milo R. Maltbie, formerly a member of the Public Service Commission, First District, New York State, and recently chairman of the valuation committee of the National Association of Railway Commissioners, has been appointed a member of the advisory board to C. A. Prouty, director of the valuation division of the Interstate Commerce Commission.

W. E. Moore has resigned from the office of vice-president and general manager of the West Penn Traction Company to devote his whole time to private practice as consulting engineer, with offices at Pittsburgh. He will engage in power development, transmission and railway work, and will also undertake appraisals, reports in connection with public service regulation and advisory work on public utility management.

Robert S. Brown has opened offices in the Legal Building, Asheville, Tenn., for the purpose of practising as a civil engineer and surveyor. He will engage particularly in topographic, highway, industrial railroad, county and municipal work. Mr. Brown was graduated from Trinity College, Durham, N. C., in 1908. Since then he has engaged chiefly in railway location and construction in various Western and Southern States.

Philip P. Farley, who was consulting engineer to the New York State Highway Department during the administration of Governor Glynn, has opened offices at 103 Park Avenue, New York City, for the purpose of continuing his practice as consulting engineer. Mr. Farley was graduated from Cooper Union in 1893. He served as chief assistant to the city engineer of Atlantic City, N. J., from 1896 to 1899 and as deputy fire commissioner of New York City in 1911. He was president of the Jamaica Bay Improvement Commission previous to his appointment as consulting engineer to the New York State Highway Department in 1914.

Theodore E. Seelye has resigned from the office of division engineer of the Water Supply Commission of Pennsylvania to engage in private practice with Farley Gannet, formerly engineer of that commission, whose resignation to enter the consulting field was noted in these columns last week. Mr. Seelye joined the engineering forces of the water supply commission in 1913. Previous to that he was connected with the hydraulic design department of the Electric Bond & Share Company of New York on hydroelectric work and with the U. S. Engineer on the construction of jetties and fortifications at the mouth of the Mississippi River and of navigation locks in Louisiana.

H. A. Kipp, who has been connected with the Office of Drainage Investigations, U. S. Department of Agriculture, for the past nine years, has resigned to engage in private practice as consulting engineer, specializing in drainage work, with office at the Southern Pacific Building, Houston, Tex. Among the drainage projects with which Mr. Kipp has been connected are the Everglades work in Florida, the St. Francis River project in Arkansas, the Toisnot Swamp project in North Carolina and the Tuscumbia and Belzoni projects in Mississippi. He recently completed a report and plan for the drainage of the entire area of Jefferson County, Texas, for the U. S. Government.

John A. O'Connor, formerly engineer in charge of terminal construction, New York State Barge Canal, and Arnold G. Chapman, consulting engineer, of Albany, N. Y., have been appointed executive engineers for the Flood Abatement Commission of Olean, N. Y. Mr. O'Connor has been engaged in engineering work since 1896, principally on the forces of the State of New York, on river improvement, highway and canal work. Mr. Chapman was graduated from Union College in 1906, and has also done most of his work in the office of the State engineer of New York. He was assistant to M. W. Williams, engineer in charge of the excavation and straightening of the channel of Neversink River, in the autumn of 1905, and deputy State engineer and surveyor, in 1910.

C. M. Rogers, consulting engineer of Daytona, Fla., has been appointed engineer for the proposed 1⅛ miles concrete bridge across the Indian River at Cocoa, Fla. Mr. Rogers was graduated from Rensselaer Polytechnic Institute in 1903 and was assistant engineer and division engineer on the construction of the Key West extension of Florida East Coast Railway from 1905 to 1907. He served for a brief period with the Florida Coast Line Canal & Transportation Company in the early part of the latter year, then returned to the Florida East Coast Railway as resident engineer on the Long Key viaduct. He succeeded to the business of the engineering firm of D. D. & C. M. Rogers of Daytona, in 1913, and, in 1914, was engineer in charge of the construction of a complete sewerage system for the board of public works of that city.

Obituary Notes

John G. Scurry, a well known civil engineer of Seattle, Wash., died in that city, July 14. He served under General Dodge on the original location of the Southern Pacific Railway over the Mojave Desert and was one of the locating engineers on the first transcontinental railroad of the Union Pacific. The later years of his life were spent in railroad work in Alaska.

Sir Sandford Fleming, who was an important factor in the building of the Canadian Pacific Railway, died at Halifax, N. S., July 22. He was born in Scotland in 1827 and went to Canada, where he joined the forces of the Northern railway, in 1845. He attained the grade of chief engineer of that

road twelve years later. In 1863 he made the surveys for the Intercolonial railway, which was subsequently built under his direction. He was chief engineer of the Canadian Pacific from 1871 to 1880, during the period of location and construction. The latter years of his life were confined principally to scientific research. He wrote several books on technical subjects, among them being "Time and Its Notation," "Memoirs of Universal Time and a Prime Meridian for All Nations" and "The New Time Reckoning."

Civil Service Examinations

United States.—An examination for junior civil engineer, Engineering Department, will be held at the principal cities of the country, Aug. 25 and 26. Candidates must be twenty-one years or over and must have had at least four years' experience in engineering work, or have been graduated from a technical school of recognized standing. It is further announced that eligibles from this examination who are unmarried, between twenty-one and twenty-nine years of age and graduates from an approved technical school, will have an opportunity to qualify for the examination for commissions as second lieutenants, Corps of Engineers, U. S. A., to be held by the War Department, on or about Oct. 25, 1915.

Examinations for senior drainage, drainage and junior drainage engineers, Department of Agriculture, salaries ranging from $2,220 to $3,000, from $1,800 to $2,100 and from $960 to $1,620 respectively, are to be held at the principal cities, on Aug. 17 and 18. The duties of these positions will consist of making surveys, preparing plans and reports upon drainage projects, collecting technical data, and conducting original investigations. Applicants for the position of senior drainage engineer must be graduates from an approved engineering college and must have had five years' experience in drainage work, or, if not graduates, nine years' experience; for the position of drainage engineer, must be graduates and have three years' experience, or have seven years' experience in drainage work, and for the position of junior drainage engineer, must be graduates, or have four years' experience in civil engineering work.

Application for any one of these examinations should be made at once to the Civil Service Commission, Washington, D. C., asking for form 1312 and stating the title of the examination for which the form is desired. Persons interested in the examination to be held for commissions as second lieutenants, Corps of Engineers, U. S. A. should apply as well to the adjutant general, War Department, Washington, D. C.

Examinations Previously Announced

Date		See Eng. Record.
Aug. 6	Tracer, salary from $600 to $900 a year; rodman, salary $800 a year; Philadelphia.	
Aug. 9-12	Draftsman, surveys, salary from $1,200 to $1,500 a year; Philadelphia.....	
Aug. 10-13	Draftsman, highways, salary from $1,200 to $1,500 a year; Philadelphia.....	July 24
Aug. 17-18	Senior, Grade 1 and 2, and junior land appraisers, salaries from $2,700 to $3,600, from $1,800 to $2,400 and from $900 to $1,500 respectively; United States	July 24
Sept. 15	Aid, U. S. Coast and Geodetic Survey. Draftsman and junior engineer, U. S. Engineer Department	July 3
Oct. 13	Aid, U. S. Bureau of Standards. Civil Engineer and Draftsman. Draftsman, Navy Department. Engineer, Indian Service.	July 3

Canvas Air Pipe Not Damaged by Tunnel Blasts

Early in the construction of the Mill Creek Sewer in St. Louis the contractors conceived the idea of having the pipe they used to carry air to their headings made of some sort of airtight, waterproof fabric, which would be flexible, light and easy to handle during blasts. The metal pipe usually used is hard to handle quickly, and each time a blast is made it must be taken down and carried back from the heading so as to escape damage from the explosion.

To supply the contractors' demand the Bemis Bag Company of St. Louis, developed a tubing which they call "Flexoid." It is made of 9-oz. canvas, waterproofed and made airtight by having a solution of asphalt and rubber forced into it. The tubing can be obtained in 10, 12, 16 and 24-in. diameters and comes in 100 and 200-ft. rolls.

Whenever blasts are to be made the air is shut off and the tube collapsed. Being light



CANVAS AIR PIPE FOR TUNNEL WORK

in weight and not bulky one man can quickly roll up 100 ft. of the tube and carry it out of the danger zone. The tube can be patched when necessary with a new piece of canvas and a little shellac. Connection between pipe sections is made by means of a short sleeve of metal pipe with two bands which clamp on to the tubing. A 16-in. size tubing handles 10,000 ft. of air per minute. The accompanying photograph shows the pipe in use on one of the sections of the Mill Creek Sewer. Thomas Connor & Son, one of the several contractors who are using the new tubing on this particular job, are carrying air from 500 to 1600 ft. The new fabric is being used for temporary water diversion in bridge and culvert work. It is also furnished flat and in large sheets for covering new concrete.

Non-Reduction of Area Is a Feature of New Hose Coupling

An air, steam or water hose coupling, so designed as not to decrease the area of the hose connection, has recently been placed on the



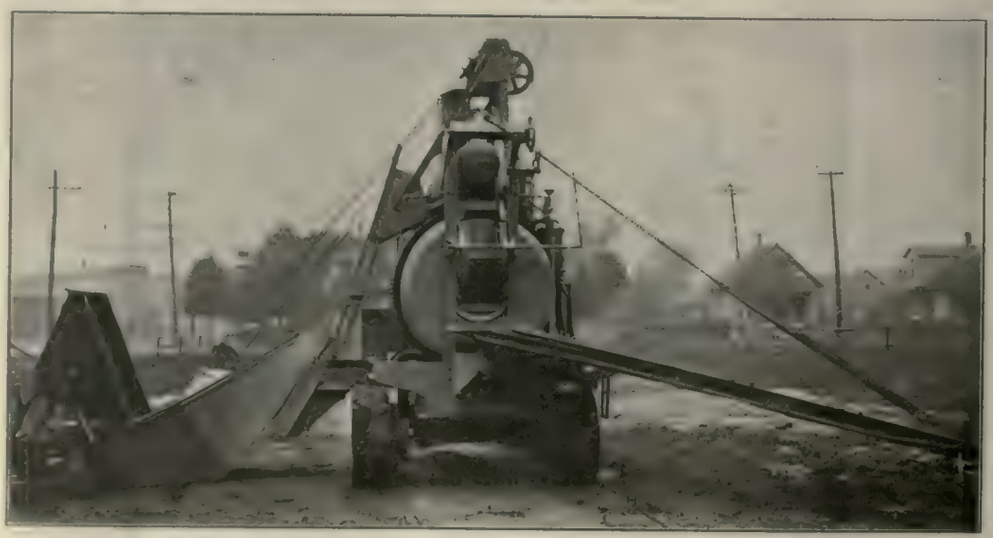
AIR, STEAM OR WATER HOSE COUPLING

market. The malleable iron hose socket is sufficiently corrugated on the inside to provide a positive grip when the hose is expanded, and by simply screwing the steel taper expander into the socket the hose is forced outward and into position. The area of the opening in the steel taper expander is the same as that of the hose, thus eliminating contraction. The hose connection requires only one or two turns with an ordinary hand wrench. The coupling is manufactured in all standard sizes by the National Hose Coupling Company, Peoples' Gas Building, Chicago.

Paving Mixer Has 40 Cubic Feet Capacity, and Loads from the Side

Exceptionally large capacity and ability to load from the side for use with industrial equipment are two prominent features of the latest model paving mixer to be placed on the market. The machine has a capacity of 40 cu. ft. of loose material and was designed for use on concrete road jobs where industrial tracks parallel the road. The first mixer to be placed in service is now working for Runyan & Ackerman of La Porte, Ind., contractors in charge of the construction of 13 miles of concrete road on the Lincoln Highway near La Porte.

Industrial cars holding 36 cu. ft. of material, or one batch for the mixer, are run on a track paralleling the road and as the mixer has its skip on the side they can dump directly into it. Concrete is distributed, by three ports in the bottom of the mixer's 15-ft. chute, at different points without shifting the machine. This new paver, which is said to be the largest capacity paving mixer and the only side loader yet to be placed on the market, is manufactured by the Marsh-Capron Manufacturing Company, Chicago.



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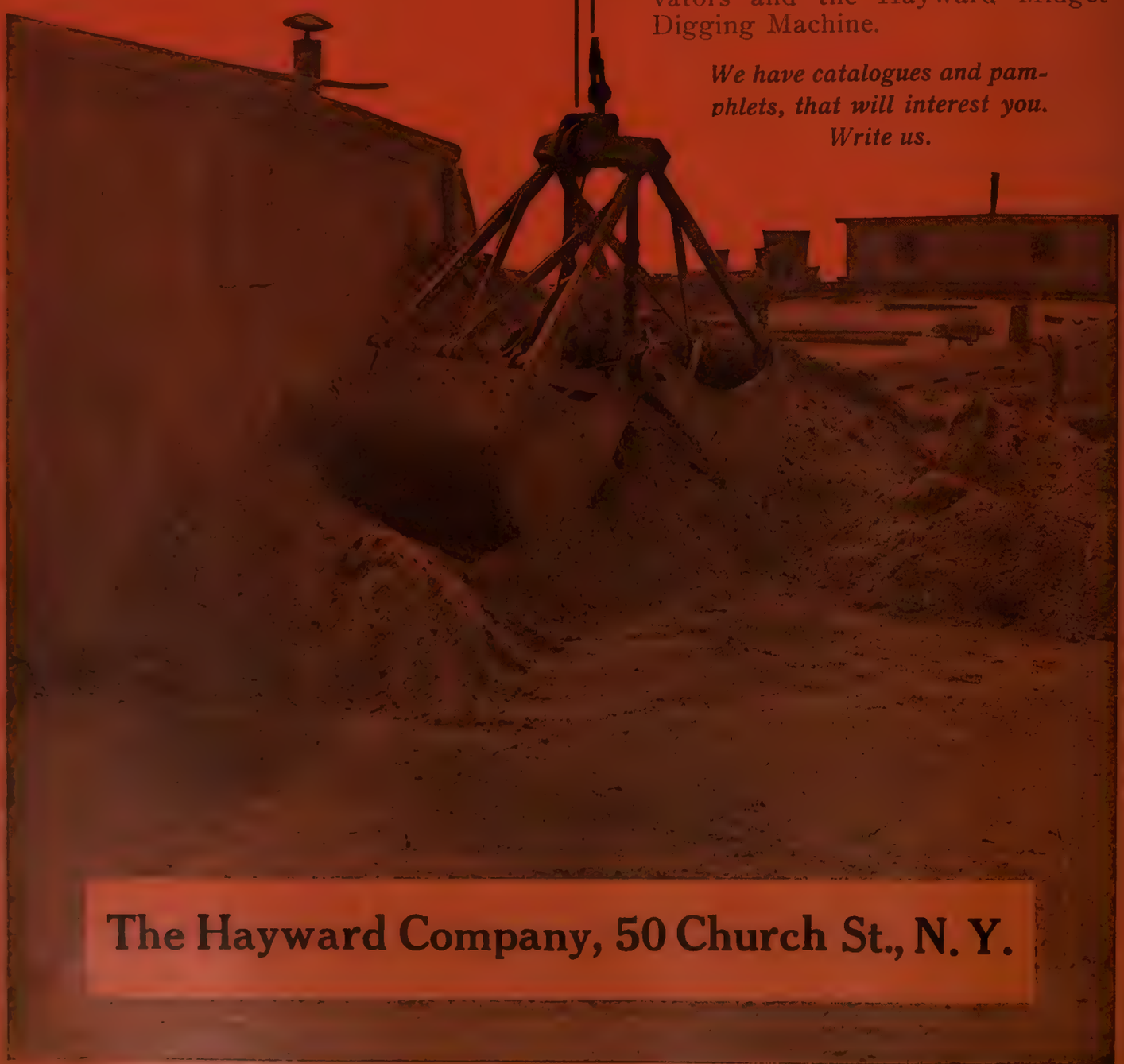
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Business Principles in Public Business

THE ACTION of the Secretary of the Treasury in setting definite classes into which the construction of post office and public buildings shall fall, these classes being dependent on the amount of business to be transacted in the building, will meet with well-nigh universal approval. Possibly members of Congress who have used public-building appropriations as evidence to their constituents of proper activity in the public interest, may dissent, but outside of that quarter intelligent opposition is not to be expected. The proposal to suit the building to its purpose is so evidently correct that discussion is superfluous. Nevertheless, the occasion should not be dismissed without an appreciation of the stand taken by the Secretary. If a rule founded on the same principle can now be framed and enforced for river and harbor improvements and then Congress be induced to place the allocation of the Reclamation Service's funds on a sensible basis, the pork barrel can be relegated to the museum of past congressional mistakes.

Uneconomical Truss Design

ALTHOUGH there are conditions under which it may be found necessary to design trusses with steep inclinations for the web members, the loss in economy which results can often be avoided. The building truss described on page 159 of this issue is an example of the excessively high stresses which result in the web members of a truss with steep diagonals, and of the resulting difficulties encountered in designing sections and providing joint details of sufficient strength. The use of tension diagonals sloping over the whole panel length of 27 ft. 3 in. for this truss, which is 22 ft. deep, would undoubtedly have resulted in appreciable saving, even though the short unsymmetrical end panel could not have been avoided. If intermediate loads must be supported, subdivided panels can be adopted with economy, and the diagonals designed with an inclination at least approaching the 45-deg. slope, which results in economical distribution of stress.

The International Congress

WITH final details of the International Engineering Congress rapidly being completed, it behooves those engineers who have not yet entered their subscriptions as members to act promptly and thus show the management that they appreciate its work. Necessarily the officers of the congress have worked under difficulties. The European war has curtailed the number of papers from foreign countries, but the list, nevertheless, is representative of much of the best thought of the entire engineering world. Roughly, one hundred and twenty-five of the papers are now in type, and the printing of the others is proceeding rapidly. The congress program is being molded into shape and the details of the entertainment features have been perfected. Naturally the representation of the congress from the Pacific Coast will be large. The engineers in that district have shown their loyalty in a striking manner, but since the congress is not a local affair but is even more than national in scope it is desired that the representation be as broad as possible. Aside from the mere matter of loyalty, the intrinsic value of the proceedings which will be distributed warrants hearty response to the congress' appeal. The advance copies of the papers to be presented, some of which this journal has been allowed to examine, promise most valuable contributions in every department of engineering assigned a place on the program. Without a doubt many engineers have concluded to join the congress, but in the customary fashion have carelessly put off the detail of writing and sending the necessary contribution. With the congress only a little more than a month away, now is the time for action. This journal cannot urge too strongly upon its readers that their response to the invitation to join should be no longer delayed. "Do it now" should be the slogan.

The West's Invitation

WHILE it is to be expected that many who will become members of the International Engineering Congress will find it impossible to attend, those who are able to make the journey are sure to be amply repaid. Not only will the sessions of the congress itself be well worth while, but the gathering of engineers brought together not only by the international meeting but also by the conventions, the preceeding week, of the national engineering societies and of the Pan-American Road Congress will be notable. The American Society of Civil Engineers has arranged an especially attractive social program and has extended an invitation to all engineers, whether members of the society or not, to participate. It is unlikely that there will be again for many a year so large and representative a meeting of engineers in this country. The engineers of the Pacific Coast, too, are doing everything in their power to arrange for the entertainment of their guests—and their reputation as hosts augurs well for the comfort and pleasure of those who attend the congress. But even aside from the congress and its entertainment, it is worth the time of any one, unfamiliar with the Coast and its spirit, to learn what that country is and what are its aspirations. With large visions as to the future, and energy and enthusiasm that are proverbial, a visit with the people of the Coast is an inspiration to every American. The coming meeting in San Francisco, therefore, is a most extraordinary opportunity for the eastern and the middle western engineer to broaden his engineering acquaintance, to gather new ideas on engineering subjects and to strengthen his patriotism by getting acquainted with the most progressive and one of the most virile sections of the country.

Self-Abnegation

DISCUSSING the meager compensation of engineers, a correspondent expresses tersely and vigorously indisputable views as to one of the chief causes. Engineers generally will agree with him—will heartily agree; but the difficulty is that they fail to "practice what they preach." No one denies that the engineer should be the director and not the follower, yet in practice he fails to assert himself and lets those with less ability, less knowledge of the subject, take the directing hand, generally, too, to the detriment of the work in hand. Our correspondent deserves quotation in full. He says: "During the past few years I have been associated with State, county, city and town engineers pretty steadily and have come to the conclusion that if the engineer is underpaid it is because he is constantly reducing the value of his services by his own tactics. A prominent engineer once told a lot of his brethren in my presence that their profession had the art of complete self-abnegation reduced to a science. And he was right. For example, one can go to the average engineer, especially in the East, ask him to consider a certain type of highway construction, let us say, and, after convincing himself of its merits, include specifications for this type on such roads or streets for which it may be suitable. Almost invariably the response will be that property owners, officials or certain politicians must first be seen, and, if they so instruct, he, the engineer, will prepare the specifications. Ask that same engineer if he will tell his physician what medicine to prescribe for him when ill and he would reply 'certainly not.' And yet the engineer should occupy the same relative position as regards any governmental body as the physician does to the individual. Let the engineer stiffen up his back-bone and insist on directing public improvements and not be simply a specification writer, and he will make his position so valuable that adequate compensation for his work will inevitably follow."

Pollution by Wash-Water

THE situation with regard to river pollution at Niagara Falls, N. Y., which has resulted in a court decision enjoining the municipal filtration plant from continuing its present method of disposing of wash-water and sedimentation-basin sludge, as set forth on page 160, is one which is not likely to arise with great frequency elsewhere. The unusual feature of the case is that the city is supplied with filtered water by municipal works and also by a private company—rivals in a keen competition for the local water-supply business. The city-owned plant is located upstream from the private plant and, it was claimed, polluted the water unduly at the company's intake 2 miles below by its wash-water and sedimentation-basin wastes. A number of waterworks experts testified and upon the data they presented Judge Laughlin based his decision. The case involved the principle of riparian rights which, the court stated, is founded upon the established rule that, while riparian owners do not own the water, each is entitled to a reasonable use thereof. It is not fair to assume that the case will serve as any general precedent. It would be a bold man indeed who would assert that one filter plant 2 miles upstream from another is necessarily a menace from the standpoint of pollution. In matters of this kind local conditions place each case in a class by itself, and into the problem there enter the complex elements of river currents and dispersion, in addition to the amount and character of the waste discharged. Still, the case is interesting, for it illustrates that an agency whose primary object is to protect the health of its patrons has itself been accused of complicating precisely the same task for its competitor. It can be argued that the city plant puts back into the river, in concentrated form, exactly the same substances which were there originally, with the exception of the chemicals. It then becomes necessary to determine to what extent this concentration is objectionable. Obviously no general formula will give the solution to this problem.

Justice—But Only Within Arbitrary Limits

EARLY in July the Public Service Commission for the Second District, New York, handed down a decision which holds, in substance, that the Legislature has empowered it to reduce rates, but not to increase them above certain maxima. In other words, while the authority of the commission is unlimited as to the service it may require from the roads, and as to its power to do justice to the public, its authority to increase rates and to do justice to the carriers is limited by maxima set by a Legislature unqualified for the task by experience or the possession of evidence as to cost of service. "Justice you may expect, but only if the 'just and reasonable' rates, guaranteed you by law, are within the two-cent and the three-cent maxima"—that, in effect, is what the commission says to the railroads.

The case in question was that of the Ulster & Delaware Railroad, petitioning for permission to raise its rate on mileage books from two to three cents a mile. The railroad company supported its petition by a careful report made by William J. Wilgus, consulting engineer, New York, a report convincing to the minority of the commission, which declared in favor of granting the railroad company the relief it requested. The majority, three members, including the chairman, did not pass upon the merit of the railroad company's application, so far as the showing of cost was concerned, but confined itself entirely to the question of jurisdiction.

It appears that before the Public Service Commission law was enacted a two-cent maximum rate for mileage was specified by statute. This law not only fixed the maximum rate, but forced all railroads in the State, over 100 miles long and organized subsequent to the act, to sell mileage whether they desired to do so or not. When the Public Service Commission law was passed this mileage act was not repealed, and later, on a recodification of the statutes, the mileage law was retained. Resting upon these facts, the majority of three holds that it was the intention of the Legislature to give the commission power over rates only within the maxima, despite the fact that it is expressly stated in the Public Service law that if the commission finds a rate insufficient to yield reasonable compensation for the service rendered it shall determine a new rate thereafter to be charged.

It cannot be denied that there is, to some extent, inconsistency in the legislative enactments. Two of the commissioners, holding fast to the theory that the setting of maximum rates by an uninformed Legislature is absolutely incompatible with the theory of commission control, have dissented from the prevailing opinion, holding that the railroad company should be permitted to raise its mileage rate to three cents.

The case is not without precedent in commission history, though, of course, it has not previously arisen in New York State. A similar situation arose in Missouri, and has resulted in the confirmation by the State Supreme Court of the full power of the commission, the finding being that the enactment of the commission law *ipso facto* set aside all previous rate enactments by the Legislature.

There is no ground for argument, in the judgment of this journal, as to the soundness of the finding of the Missouri tribunal. Commission control has come because a long and very unfortunate history of Legislative control in railroad matters demonstrated that those bodies could not intelligently supervise the relations between the public and the carriers. To an extent, it is a scientific solution of the haphazard system of control by the Legislature. The entire principle must fail if the authority of the regulating body is to be arbitrarily restricted. Despite the apparent confusion in the New York laws this journal does not doubt in the least that the Court of Appeals, if the case is carried to it, will uphold the authority of the Public Service Commission and declare that the setting of maximum rates by the Legislature is inconsistent with the law under which the commission operates. No other decision is possible if commission control is to succeed.

Giving the Railroad Employee a Better Chance—A Suggestion, Too, for Every Employer

THIS JOURNAL has heretofore deplored the haphazard way in which most railroads hire and promote their technical men. Doubtless the same system, or lack of it, obtains in almost every department of the railroad, and in a recent address to the Burlington Association of Operating Officers George M. Basford, chief engineer of the railroad department of J. T. Ryerson & Son, New York, outlined a remedy in the appointment of a special official who would report directly to the president and have the final word in all matters of employment and promotion. When a vacancy was to be filled each officer would have a chance to put forward his favorite candidate, but the special official would make the selection.

A man capable of filling such a position, Mr. Basford admits, would be hard to find, but that is only added proof that he is badly needed. Certainly some means must be found, if railroad officials, both important and petty, are in the future to measure up to their increasing responsibilities, of insuring that every employee in the great organization, except possibly the unskilled laborer, shall have a fair chance to show what he can do, and this not merely to a dull and unappreciative immediate superior whose own mediocrity damns his whole staff. The central officer will have opportunity to weigh in one balance all of the men doing one kind of work, and every man will have a chance and incentive to grow.

As to the details of the plan, Mr. Basford described a method used successfully by a certain superintendent of motive power. This official had a card form made out which bore the name, age and occupation of each employee and then tabulated his standing—"Very Good," "Good," "Medium" or "Poor"—under twenty-two heads. These included education, special knowledge and experience; personal virtues, such as honesty and temperance, and then a list of individual attributes, such as tact, reliance, foresight, initiative, assertiveness, accuracy, system, executive ability. These cards were filled out, signed and dated by the immediate superior of each man—the foremen listing their men, the general foremen doing the same with the foremen, and so forth. The cards were all sent to the superintendent himself, the senders not being allowed to retain copies, and every six months a new lot of cards was made out.

It can readily be seen, as Mr. Basford pointed out, that such a system puts the petty officer himself more or less on trial. It will not do for him to fill out his cards by guesswork; he is forced to study his men. Otherwise the contradictions of his

records will come back on him. This journal suspects that there will be some who, failing to see the importance of the plan, will violate the rules, keep duplicates of the data sent in, and simply copy them on the new cards. The extent to which this practice can go on will presumably depend largely on the personality and influence of the central officer. If he administers his office with sagacity and shows the men of all rank that proved merit is to be recognized, and by the same token that a good rating in "Honesty" is as imperative as tact, resource, energy or organizing ability, an *esprit de corps* will be created and the practice is not likely to go long undetected. If he simply makes his office another department, and turns the detail over to narrow and unsympathetic clerks, the whole system will become a farce. Above all, the central officer himself must be absolutely free of the taint of favoritism.

To apply such a card system to the engineering departments would be no easy task. These men, perhaps more than any others in the entire organization, need individuality, characteristics that cannot be defined and graded. Along with the other information on the cards there should be ample space for remarks. In the general designing departments the men who despise track work and love pressure lines and secondary stresses should be differentiated from those who revel in yard layouts but have no taste for structural complexities. Others do not belong in the designing departments at all, but should be out directing construction work. Some, without being specialists in anything, are very adaptable and can be relied upon to produce results in almost any emergency, while others of rather narrow vision and no executive ability may be capable, if given free rein, of evolving something of great value in the nature of research. Among the officials there may be similar differences that cannot be designated by "Good" or "Poor" opposite a single word. There are those who are engineers first, last and all the time, with only secondary interest in the other branches of the railroad business, while there are others who lean heavily toward operation, or law. In short, in any worth-while cataloging of engineers tables of measurable virtues must be supplemented by carefully prepared estimates of non-measurable characteristics.

Mr. Basford's plan deserves serious attention. The railroads are not building their engineering organizations for the future, as they are their equipment and permanent way. Too intent on the work of the immediate future, they are not developing men to handle the work of next year. When they have money they hire too quickly; when they run short, fire too quickly. In the past there has been a glamour in railroading, which has largely disappeared since the fall of the railroads from public grace. More than one conscientious and industrious engineer with five or ten years' railroad experience is advising young college-graduate friends to stay out. It behooves the railroads to take steps to get and keep their share of the engineering talent for what should be second to none as a civil-engineering field.

Effect of Interference of Official Body in Engineering Plans

BY VOTING to build a tunnel near the Queensboro Bridge rather than to use the bridge itself for rapid transit operation, the Board of Estimate and Apportionment, of New York City, has emphasized an interesting engineering problem, and also emphasizes the mistakes likely to be made when an official body goes counter to the recommendations of engineers specially qualified for and detailed to study a complicated engineering problem. When the Dual subway system was placed under contract it was planned that the trains of the Broadway subway should cross back to Long Island over the bridge. This involved the objectionable operating feature of raising the trains from below ground to a height of some 150 ft. above the water level. Nevertheless the bridge represented an exceedingly heavy investment and it was natural, therefore, to attempt to use it in any scheme of rapid transit development involving the crossing of the East River in the mid-town section.

Probably with this in mind and also because it was claimed that the placing of the subway trains on the bridge would decrease materially the capacity for vehicular traffic, the board has voted for the tunnel scheme. This action was taken on a proposal from a contractor to do the work for a sum certainly smaller than will ever be offered the city again. The contractor in question is said to be heavily interested in terminal projects in Queens that are expected to develop a heavy motor-truck traffic across the bridge.

There is no question that the action of the board has been taken in the best of faith, for the good of the city, as the board sees it. The backers of the terminal project are, of course, creating additional taxable values in Queens, which will give the city desired additional assets. The abandonment of the use of the bridge, however, is, in the judgment of this journal, a mistake, not only because it increases the cost of the Dual system about $2,500,000, but because it will cause an undesirable traffic routing condition, will delay the completion of the system and, finally, may prevent entirely the best development of the traffic problem between Manhattan and Long Island.

As has been pointed out the additional cost of the Dual system will be about $2,500,000, this being the lowest estimate that has been made. Furthermore, the whole matter of the operating contract for the system has been reopened. Although the designing staff of the Public Service Commission is bending every effort to complete plans for the change, the work will have to be relet and the shortest time for the completion of the tunnel is thirty months after the letting, this estimate having been made by an experienced tunnel contractor. The full operation of the Broadway subway, therefore, will probably be delayed a full year. Moreover, the extra expenditure and delay have been incurred in the face of the difficulty the city has in meeting its expenses and providing at the same time for subway construction—a difficulty that emphasizes the need of putting the new subways in operation as soon as possible.

As to the contention that the remodeling of the bridge would decrease the capacity for carrying vehicular traffic, it appears that the present roadway is 52 ft. wide and in that width contains two trolley tracks. Had the bridge been remodeled it would have contained at this level one roadway, about 28 ft. wide, with the two subway tracks on the north side. On the upper deck, which now has provision for four tracks, there would have been another roadway of the same width, with two elevated tracks on the south side. The approaches to this upper roadway would have been steeper than was desirable for horse-drawn loads, but well within the capacity of even the largest motor trucks.

The most serious questions, however, from the transit point of view, are that additional facilities are now being provided where they are not needed, and never will be needed, and that this construction will probably have the effect of deterring the city from building a tunnel farther up the river. The present facilities now building in Queens can supply about eighty trains an hour to the Steinway tunnel and the crossing at the bridge. Under the rejected plan, these two crossings could have cared for 120 trains an hour. The new plan will provide enough capacity to care for the population of Queens for a generation. This means that all future transit lines for that borough will pass through the Long Island bridge plaza, repeating, at first in miniature, and later on full scale the present deplorably congested conditions of the rapid-transit lines in the Borough Hall district of Brooklyn. The fact that the protest of the Brooklyn property holders in the Borough Hall section compelled the Dual system tunnel to be built through these already crowded streets, against the advice of the Public Service Commission, is enough to indicate that, having gotten a tunnel at Blackwell's Island, property holders in the lower corner of Queens will never allow the construction of another tunnel farther up the river.

In the opinion of this journal, a route extending the new Broadway subway up Central Park West to Eighty-Sixth Street and thence across the city, under the East River and out through the towns along the Sound is going to be sorely needed. This scheme would serve Queens much better than that of carrying every passenger from the Borough through one point—the Long Island bridge plaza.

Be it said to their credit that the engineers of the Public Service Commission have strenuously opposed the change which the Board of Estimate has made. They have been criticised for using the bridge as a link in planning the rejected layout, but the bridge was there or was under way before the Public Service Commission was in existence and they were expected to use it. The engineer, alas, is often remembered by his work long after the actions of boards and commissions that hampered his efforts are forgotten.



LOCATION OF THIS STATION IMPOSED SEVERE CONDITIONS IN DESIGN

Swedish Government Builds Hydroelectric Plant Above the Arctic Circle—Part 1

Prevailing Severity of Winters Results in Unusual Designs to Insure Continuity of Service in Spite of Ice Conditions

IN 1904 the Swedish Government, realizing the value of the water-power resources of the kingdom and the part they might be made to play in the country's economic development, took steps toward the acquirement and utilization by the State of certain water powers. The investigations, legal proceedings and plans progressed slowly, but the first plant, that at Porjus, just above the Arctic Circle, has now been placed in operation. The economic features will be discussed editorially in a later issue, and this article, therefore, is devoted to a description of the striking features of the design.

The dam, to be described in the first installment of the article, is unusual chiefly in the employment of arches instead of slabs in the decks of the hollow dam and in the provision of a sliding wedge of rock in the earth dams to insure continuous support of the core wall despite settlement and shrinkage.

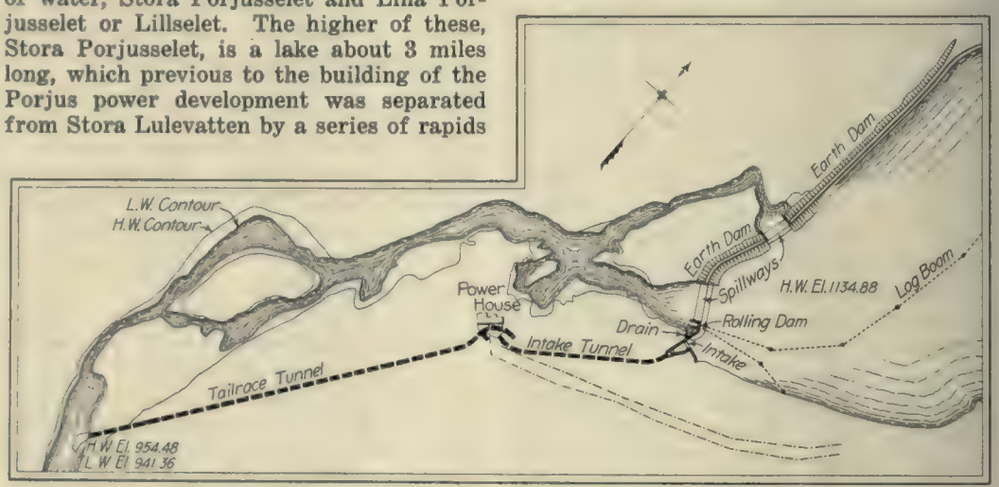
In the subsequent sections of the article space will be given to the intake and discharge tunnels and the power station, all underground as provision against interruption by ice. The forebay, the differential regulation of the tail-tunnel, and certain other details depart materially from customary practice. The drawings, photographs and part of the text here presented were obtained from the Swedish Royal Water Falls Commission. The text has been revised and expanded, however, by A. G. Hillberg, hydraulic engineer, New York City, who has for some years been collecting data on the plant.

The Porjus falls is the general name for a series of rapids and falls about 1½ miles long, between two comparatively calm pieces of water, Stora Porjusselet and Lilla Porjusselet or Lillselet. The higher of these, Stora Porjusselet, is a lake about 3 miles long, which previous to the building of the Porjus power development was separated from Stora Lulevatten by a series of rapids 2 miles long, the so-called Luleluspen, with a fall of about 28 ft. The building of the dam at Porjus has raised the surface of the lake, so that its additional head can also be utilized for the power works almost to its full extent.

The gross head at the power works at low water is 187 ft., and at high water, 180 ft. After making a deduction for friction losses in the conduits above and below the turbines, and for water hammer due to sudden changes in load, the net operating head is from 166 to 180 ft.

The design of the power works may be seen from the accompanying plan. The material on both sides of the stream is rock, covered in part with a thin layer of soil or sand.

The conduits were located on the east bank, this affording the most direct route and the most advantageous topographical conditions. Hence the intake is at the east abutment of the dam. Owing to climatic considerations it was thought desirable, when determining the situation of the power plant, to obviate long exposed tubes. Various plans were figured for comparison, and as the character of the ground was declared after a geological investigation to be satisfactory, the decision was made that the generator room should be located underground, and that the water should be conveyed to and from the turbines in tunnels, blasted in the solid rock. This arrangement insures continuity of the water supply during the winter. As the reservoir during the winter is covered by ice, often 4 or 5 ft. thick, the only place in which water comes into view is in the forebay at the lower end of the intake tunnel.



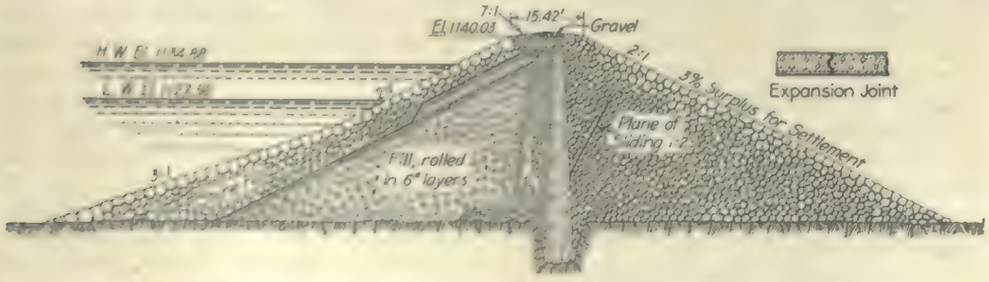
ICE CONDITIONS REQUIRED TUNNELS FOR INTAKE AND DISCHARGE LINES

THE DAM

In designing the dam structures the forces exerted by the expansion of the ice under the action of the heat of the sun had to be considered. To build a dam so strong that it could prevent the expansion of the ice, that is, resist a pressure equal to the crushing strength of the ice, was out of the question for both practical and economic reasons, as such a structure would require masonry of too heavy dimensions. It was, therefore, decided to use earth dams with stone facing on the upstream side, which would admit compression of the earth fill without injuring the dam.

A cross-section of the dam is shown. It consists principally of three parts, the stone fill on the downstream side, the dirt fill on the upstream side and a core wall of reinforced concrete carried to rock. The dirt fill consists of several parts, of which the middle has been carefully rolled and constitutes the waterproofing membrane. Over the dirt fill is a cover of puddle and stone in order to protect it from the action of frost and ice.

The stone fill on the downstream side serves as support for the core wall. In order to make this support more effective the fill has been built with an inclined plane of sliding. This was done, so that, should the stone fill settle, there will always be a direct transmission of the pressure from the core wall to the supporting fill. When that part of the stone fill below the plane of sliding



PROVISION OF A PLANE OF SLIDING IS THE NOVEL FEATURE OF THIS DAM

settles, the wedge-shaped upper part will slide against the core wall because of its weight, thus exerting an active pressure. The amount of this pressure, by shifting the location of the plane of sliding, has been so proportioned that it balances the pressure of the dirt fill on the opposite side of the core wall. The additional load on the core wall, because of the water pressure, is taken by the wall by means of reinforcement placed in its upstream side. Furthermore, the core wall has been anchored to the rock to insure cantilever action. The reinforcement in the wall is also ample to prevent cracking of the concrete. A certain amount of reinforcement has also been provided at the downstream side to take care of unbalanced pressures during construction, such unbalanced loads being due to the fact that the dirt fill, on which the work had to be sus-



NEEDLE DAM SECTION OF SPILLWAY WITH BRIDGE READY TO BE COLLAPSED

pended during the winters, rose slower than the stone fill.

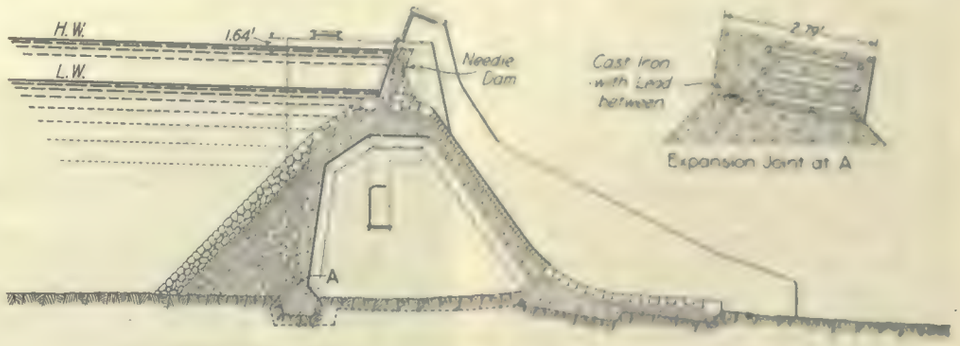
In order to ascertain whether or not the dam remains tight, an inspection gallery has been provided in one section, for 400 ft., through the stone fill at the base of the core wall.

SPILLWAYS

Over the west branch of the river between the earth dams, and over the major part of the width of the main branch, the dam consists of concrete spillways. The west spillway is 270 ft. long, while the east is 378 ft.

The upstream side of the crest is inclined. This was done in order to force the ice to break up and be pushed over the crest. A stone-protected dirt fill, furthermore, has been placed in front of the dam to insure against leakage.

The spillway structure is a modified Ambursen dam. It consists of concrete arches between concrete buttresses. The thickness of the buttresses is 4.92 ft. and the free span of the arches is 19 ft. The interior radius is 22.3 ft., corresponding to a rise of about 2.14 ft. The arches in front, against which the fill rests, have a curved exterior, while the arches forming the crest of the dam and the downstream side are covered by a flat con-



HOLLOW SECTION HAS STONE FACING FOR PROTECTION AGAINST ICE

crete deck paved with stone set in mortar. These latter parts of the structure and especially the dam crest have been given heavier dimensions because of the action of ice. The stone facing, which has been securely anchored to the concrete, has been considered as loading only and its strengthening effects have not been incorporated in the calculations.

Because of the reactions from the arches, which at the ends produce big horizontal forces, it was necessary to build solid sections at both ends of the dams. About 30 ft. at each end of the west spillway have, therefore, been made solid. The east spillway, which, because of the ground profile, is somewhat higher, has at its west end a solid portion about 46 ft. in length. Its opposite end abuts the gravity-section dam below the log sluice, the mass of which is sufficient to resist the horizontal pressure. Because of the necessity of bypassing the water during the construction period, the east spillway had to be built in two parts, thus requiring a solid section at the midpoint. As this portion, however, had to resist the horizontal component due to the dead load only it is about 29 ft. in length.

CONCRETE PROPORTIONS AND WATERPROOFING OF DAM

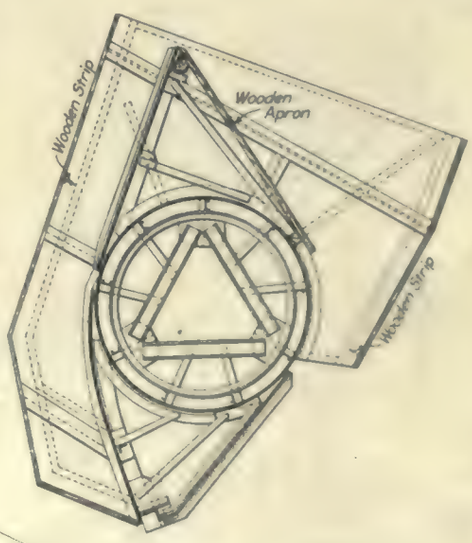
The concrete in the arches is a 1:3:5 mixture with the exception of an 8-in. waterproofing layer on the upstream side. The mixture in this layer is 1:2:2½. The concrete deck over the arches, however, consists of a 1:5:7 mixture as do the buttresses. The arches have been dimensioned so that they, without reinforcing, can carry the maximum load without exceeding a unit stress of 300 lb. per square inch. Because of the reinforcing, however, the maximum stress in the concrete does not exceed 225 lb. per square inch. The reasons for this reinforcement were that the structure is difficult to repair and that, consequently, it was thought that the stresses should be kept low, especially in the beginning before the concrete has attained its maximum strength. The reinforcing, furthermore, holds the structure together and prevents cracking.

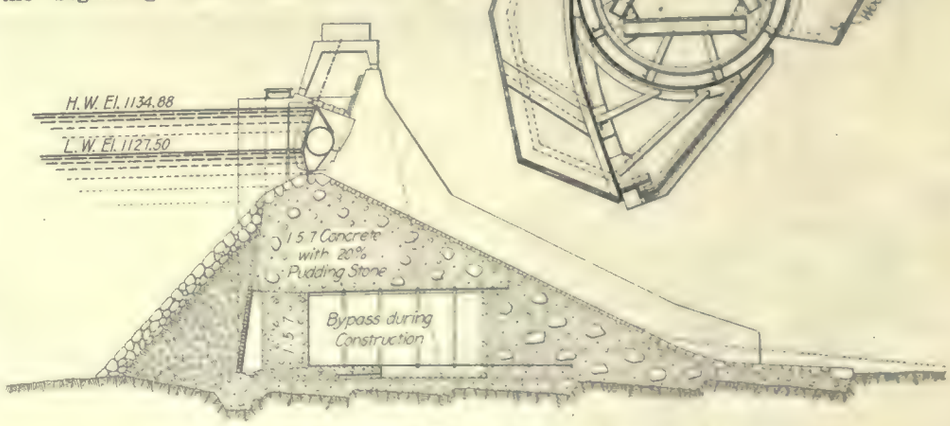
In the construction joints between arches and buttresses tightness has been insured by means of asphalt felt. The paved concrete deck at each buttress is provided with an expansion joint, tightened by means of oakum and tar painting. To insure tightness along the upstream toe the arches and buttress have been carried down about 3½ ft. into good rock. Between this cutoff and the arches proper there is a joint permitting the arches to deform without cracking under varying loads and temperatures. The joint has been made watertight as shown by means of lead strips placed in frames of cast iron, which in turn have been anchored in the concrete on both sides of the joint.

On the downstream side of the dam the arches abut an apron of concrete and stone paving.

The upstream side of the front arches has been covered with cement plaster and painted twice with an asphaltic solution. The degree of tightness attained by these precautions has been shown by measuring the leakage, which, half a year after the filling of the pond, amounted to only 1½ gal. per second.

In the original plan it was intended to use the volume of water between El. 1127.50 and El. 1129.11 for pondage. The crest, therefore, was to be provided with re-





ROLLING DAM WAS USED ON PART OF THE SPILLWAY SECTION

movable bents and flashboards of wood, which each year were to be taken away before the spring flood and replaced later on. During the construction period, however, the Legislature determined to complete the works for the first regulation of the available water supply. The collapsible sections on top of the spillways, therefore, have been built so that they permit the raising of the water surface to El. 1134.88. The movable dams consist of structural steel bents supporting wooden needles. These bents are hinged at the base and can be laid down on the crest of the dams. In order to stiffen them they have been covered with perforated steel plates. They are manipulated by means of chains.

ROLLING DAM

As stated above, the east end of the east spillway abuts the log sluice. This sluice is 39.36 ft. wide and is closed by a rolling dam. The shape of this sluice is shown in one of the accompanying drawings. Its crest is 3.28 ft. lower than the spillways. The upstream side is protected in the same way as that of the spillways, but the downstream side has a slope of 1 : 2 in order to facilitate the passage of the logs. Between this incline and the rock foundation below the dam is an apron similar to that of the spillways. On both sides of the sluice there are wing walls 10 ft. thick, in which are placed the recesses for the rolling dam. The log way on the downstream side is flanked by walls 6½ ft. high, protected by stone facings anchored securely to the concrete.

Through the masonry below the rolling dam were five sluices, which during certain periods of the construction served as bypasses for the river discharge. As shown in one of the illustrations these sluices had an interior steel plate lining, which, furthermore, was protected by an interior lumber sheeting. When the structure was completed and the water had to be raised, these sluices were closed by means of stoplogs lowered in slots on the upstream side, and after the planking had been taken out the sluices were partially filled with concrete. The leakage between the stoplogs was carried away in pipes as shown. The apron and the adjacent part of the dam were built in connection with the closing of the sluices.



CONTOUR REQUIRED AN EXTENSIVE DAM SYSTEM

The rolling dam, of which a cross-section is shown, was built in accordance with drawings made by Maschinenfabrik Augsburg-Nürnberg, A.-G., Germany. It consists of a cylindrical mantel of steel plate with an interior diameter of 5.15 ft. The over-all length of the roller is 44.02 ft. It is provided with a sheath in two parts, one extending from the cylinder downward to a wooden tightened strip, the other extending upward. The reason for building the sheath in two parts was that when the roller was ordered it was intended to put on the lower part only, but make the structure strong enough to permit the addition of the upper portion later on. Before the rolling dam had been completed, however, and shipped from the works, the Legislature passed the previously mentioned resolution with respect to the lake regulation, and the rolling dam, could, therefore, at once be given its full height of 11½ ft. The other details of the roller are the same as described in the Engineering Record of Dec. 13, 1913, page 654, in the article entitled "Design of Rolling Dams."

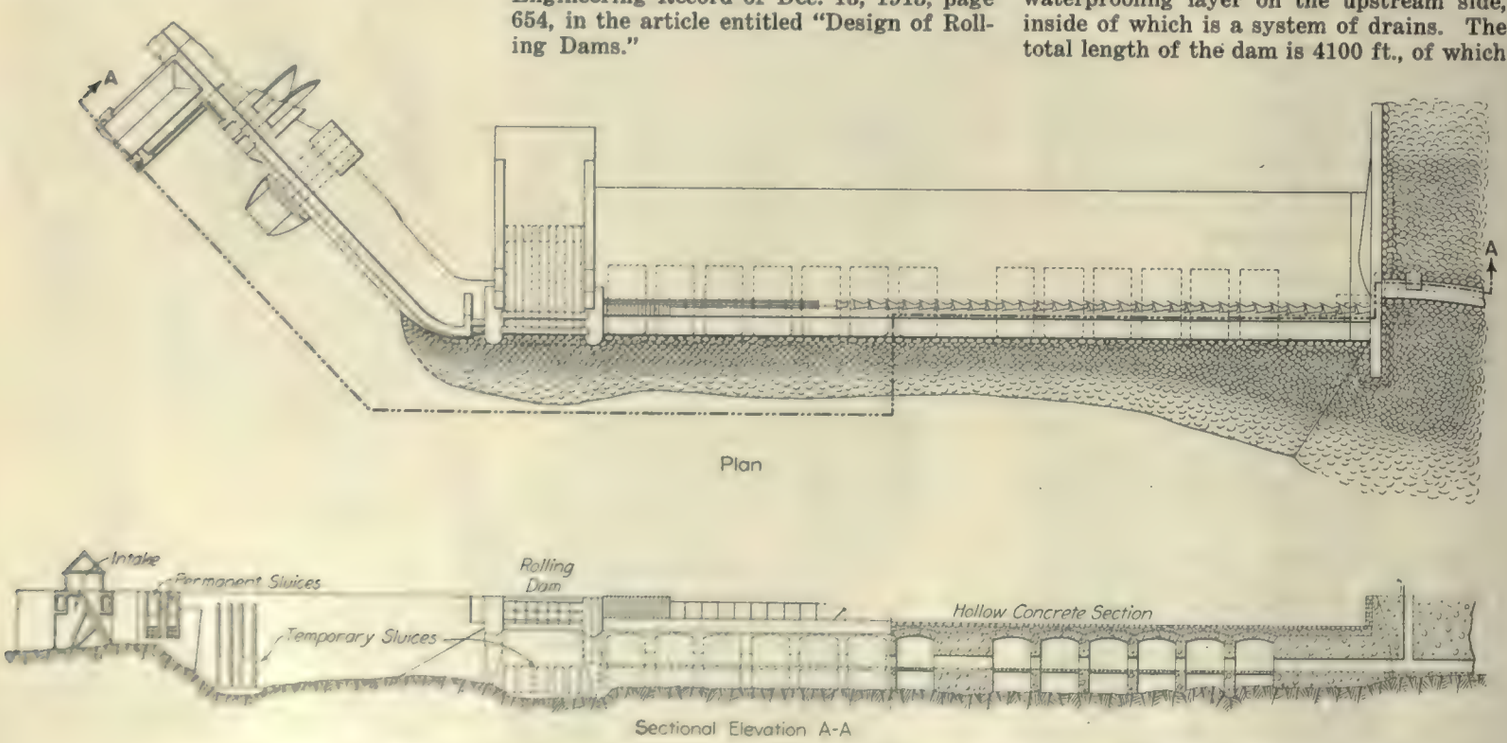
The builder of the rolling dam and its appurtenances was the firm of Nydqvist & Holm, Trollhättan, Sweden.

Between the rolling dam and the intake on the east shore the dam structure has such a position that ice pressures are not to be feared. It was, therefore, found feasible to build a gravity-section dam with the upstream side nearly vertical, and of the common triangular cross-section shown.

Adjacent to the intake are two permanent sluices, which are 5 x 5 ft. in section. The gates are made of steel and have been designed for hand operation.

In the crest of the dam next to the log sluice is a smaller opening closed by stoplogs. This opening has been provided so that, if desired, in the future, a logging flume can be connected to it. At the other end of the dam, next to the intake, is an ice sluice, 13 ft. wide and 2½ ft. deep below the water level. This opening is also closed by stoplogs.

The dam has been reinforced by counterforts on the sides of all openings. It has a waterproofing layer on the upstream side, inside of which is a system of drains. The total length of the dam is 4100 ft., of which



DAM SYSTEM AT PORJUS HAS SPILLWAY WITH BOTH ROLLER AND NEEDLE SECTIONS

3220 ft. consist of the earth dams and 648 ft. of the spillways. The following quantities in cubic yards had to be handled:

Earth excavation	44,600
Rock excavation	25,900
Masonry of mass concrete and stone	32,600
Reinforced concrete, etc.	22,500
Earth fill	132,800
Stone fill	146,500

At high water the dams can discharge 54,800 sec-ft. The maximum volume of water in the river during floods is about 53,000 sec.-ft.

(To be Continued.)

High Stresses Carried by Heavy Riveted Truss

Clear Loading Platform at First Floor of Mannheimer Building Furnished by the Use of 119-Foot Truss Supporting Eight Floors

UNUSUALLY heavy riveted-truss construction resulted from the requirements for clear space at the shipping platform for the purpose of loading and unloading goods imposed by the owners of the new Mannheimer Building in St. Paul, Minn. The truss illustrated in the accompanying photograph is about 119 ft. long and supports four columns of the seven-story building. Provision for another story is made in the design, and the specified floor load of 220 lb. per square foot on the first four floors and one mezzanine floor, of 265 lb. on the fifth floor and 190 lb. for three upper floors, combined with the dead load, resulted in high stresses in this truss, many members being subjected to a total maximum stress of over 2,000,000 lb.

The truss is 22 ft. deep, center to center of chords, and is unsymmetrical, since it

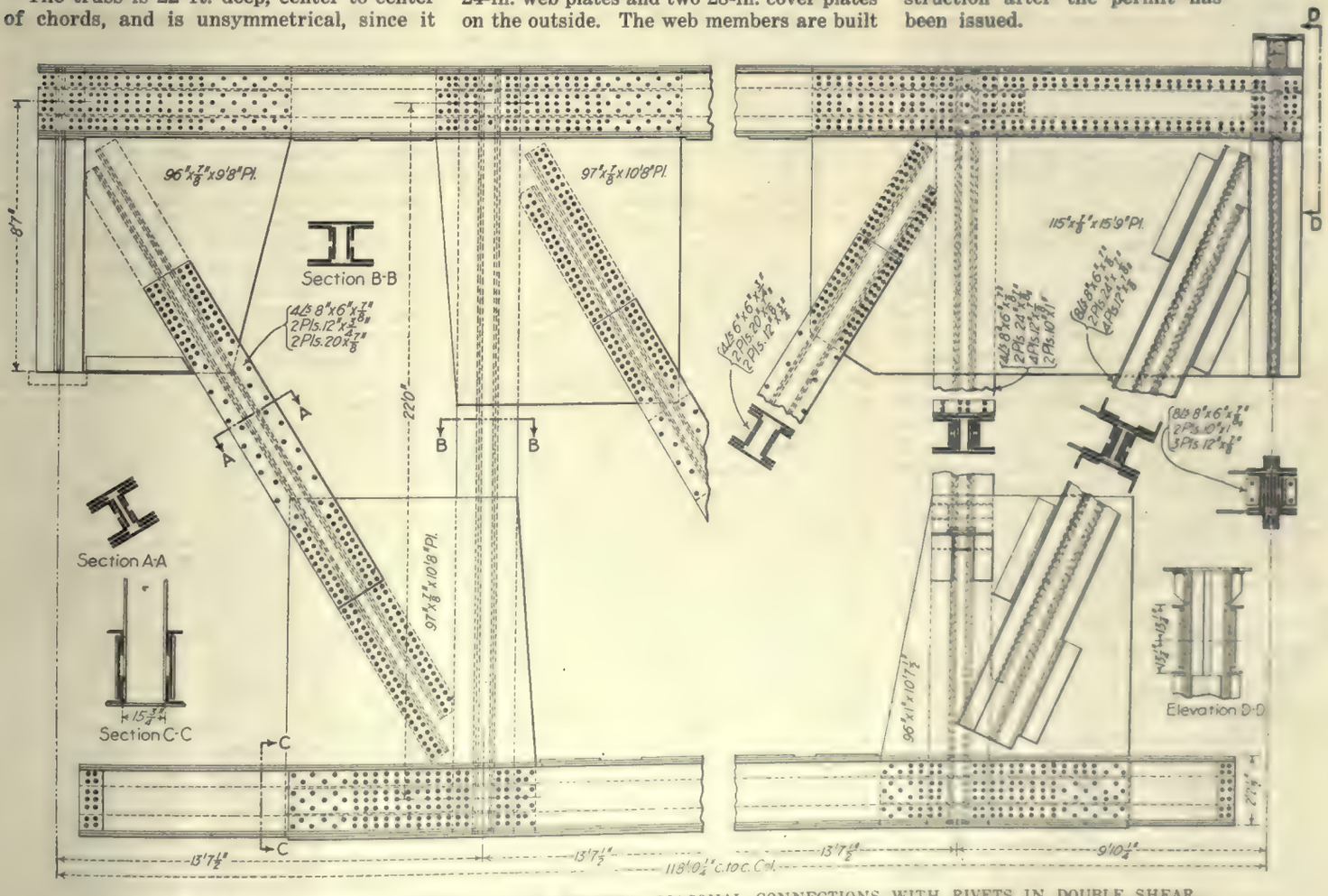


HEAVY RIVETED TRUSS 119 FEET LONG SUPPORTS EIGHT FLOORS OF BUILDING

supports four bays of the regular column spacing of 27 ft. 3 in. and one short end panel 9 ft. 10¼ in. long. Two panels per bay were used, so that the truss contains nine panels with diagonals of rather steep inclinations. The chords are built of ⅞-in. material, using four 8 x 6-in. angles, four 24-in. web plates and two 28-in. cover plates on the outside. The web members are built of angles and plates with latticing or tie plates as seen in the photograph. The extremely large ⅞-in. gusset plates and splices are noteworthy. In the end diagonals the rivets were placed in double shear by the use of outside plates in the 27-ft. 3-in. panel, and outside plates and angles in the short end panel, as shown by the accompanying detail drawing. The maximum stress in the web members occurred in the steep end diagonal and is about 2,146,000 lb. The maximum chord stress is 2,344,000 lb. The bottom chord is slightly below the mezzanine floor level, and the top chord 3 ft. 5 in. below the third floor level, the second floor and mezzanine floorbeams being supported by the vertical web members of the truss.

This building is owned by the Mannheimer Realty Company of St. Paul. The architect is A. H. Stem of St. Paul, and the engineer, O. S. Payzant of New York. The steel was fabricated by the Minneapolis Steel & Machinery Company of Minneapolis.

THE BUREAU OF SANITARY ENGINEERING, Department of Health, State of Maryland, covers the State in four divisions, with a resident engineer in charge of each division. His duties are to investigate the sanitary conditions with reference to the public water supplies and systems of sewerage and sewage disposal, and also to investigate typhoid epidemics. It is required under the laws of Maryland that, before any such systems are constructed within the State, plans and specifications must be submitted to the Department of Health for approval, and a permit issued. The resident engineer in charge of the division sees to it that this law is complied with and supervises the construction after the permit has been issued.



DETAILS OF END PANELS, SHOWING LARGE GUSSETS—DIAGONAL CONNECTIONS WITH RIVETS IN DOUBLE SHEAR

Solar Declinations Computed by Graphic Method

Practical Field Rules for Drafting Curve for Use with Any Solar Attachment—Found Preferable to Computation

By ROBERT R. V. REYNOLDS
Forest Service, Washington

THE PRACTICAL field method here outlined for obtaining solar declinations for use throughout the day with any solar attachment will be found preferable to computation, because of the comparative ease and certainty of getting results. Use any notebook having pages ruled into small squares or rectangles, and with a sharp, hard pencil proceed as follows:

1. At the left of the page, as shown on the sample page, write a vertical column of hours (apparent time) from 4 a. m. to 6 p. m., placing one hour upon each consecutive horizontal line.

2. Change the longitude of the station from Greenwich into hours and tenths by dividing it by 15.

3. Beginning from the line of 12 (apparent noon), measure up the page the hours and tenths derived from the longitude, and through the point thus located draw a line across the page parallel to the hour lines. This line graphically represents Greenwich noon in relation to the local meridian.

4. Refer to the Ephemeris and number the vertical lines of the page to correspond to the successive minutes of the angle in declination which the sun will pass through on the day for which the curve is drawn, progressing from right to left. Write the degrees of declination above. Each ruled square on the page then equals 60 sec. of declination, considered across the page, and an hour of time up or down the page.

5. Place a dot on the line representing Greenwich noon at the proper point to indicate the minutes and seconds of declination of the sun at Greenwich noon of the proper day, as given in the Ephemeris. This can easily be done within 5 sec.

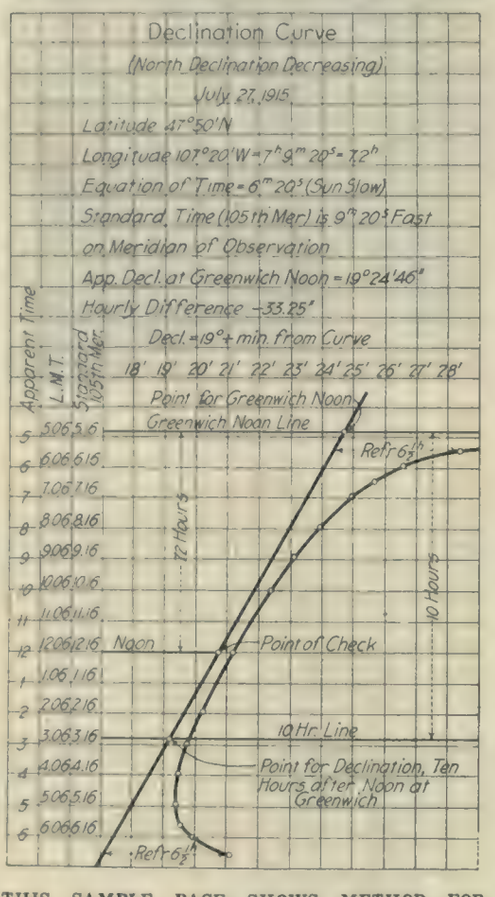
6. From the Greenwich noon line measure 10 hr. down the page, and through the point thus located draw a second horizontal line across the page. For convenience call this the 10-hr. line.

7. Multiply the "hourly difference," given in the Ephemeris, by 10, and reduce the product to minutes and seconds of declination by dividing by 60. If the sun's declination is increasing numerically (either north or south) the declination given for Greenwich noon must be increased by the change for 10 hr. If the declination is decreasing numerically (either north or south) the declination given for Greenwich noon must be decreased by the change for 10 hr. Plot a point for the resulting increased (or decreased) declination at the proper location on the 10-hr. line.

8. Draw a straight line exactly through the two points thus plotted. This line is the graphic representation of the change of declination for the current day, at the rate per hour given by the Ephemeris. For convenience call it the declination line. At the solstices June 22 and Dec. 23 the declination line stands nearly vertical. (At all other times it slants downward to the left if the declination figures are written to progress from right to left.)

9. Take from the table of refractions in declination the proper quantities for 0 hr. (12 m.), 2 hr., 3 hr., 4 hr., 5 hr., 5½ hr. and 6 hr., for the proper latitude and size of the declination angle, north or south, as the case may be. Interpolation becomes necessary only if an error of 5 sec. or more would otherwise result. Mark on the straight edge of a slip of paper a little scale of these refractions, drawn to the scale of the 1-min. spaces between the vertical lines on the page.

From the declination line scale off along each hour line (except 11 and 1) the appropriate distance representing the refraction for that hour. When the sun's motion in declination is northerly (December to June) these measurements must be laid off to the left of the declination line. Conversely, from the summer solstice to the winter solstice the refractions are plotted to the right of the declination line. No inconvenience in plotting is encountered at the equinoxes.



THIS SAMPLE PAGE SHOWS METHOD FOR OBTAINING DECLINATION CURVE

Sketch a curve through the resulting series of points. This curve indicates, by its intersections with the hour lines, for any (apparent) time of day, the proper quantity to be set off on the declination arc of the solar attachment.

10. Check is obtained by adding to (or deducting from) the declination for Greenwich noon the change of declination occurring between Greenwich and the local meridian, which is obtained by multiplying the hourly difference by the hours and decimal used in locating the Greenwich noon line. The result should check, within 5 sec. or less, the declination value of the point at which the declination line intersects the noon line.

11. Meridian observations with the solar attachment must be made by apparent solar time, while the observer's watch is ordinarily set to standard time. Hence it will be found very convenient to prepare two time columns, the first for apparent time and the second showing the corresponding standard time. Mean local time may also be shown if desired.

It is understood that this method was devised by Arthur M. Kidder, supervisor of surveys, General Land Office.

Court Forbids River Pollution by Filter Wash-Water

Municipal Plant at Niagara Falls Must Divert Waste Effluent from Intake of Competing Private Company

BASING his decision upon the established rule that while riparian owners do not own the water each is entitled to a reasonable use thereof, Judge Laughlin of the New York State Supreme Court, in the case of the Western New York Water Company vs. City of Niagara Falls, enjoined the municipal filtration plant, on July 5, from discharging its wash-water and sedimentation basin sludge into the Niagara River at a point above the intake of the private water company, whose supply, it was contended, was unduly polluted by this practice. The two plants compete in the business of supplying filtered water to the inhabitants of the city, and in some quarters credence was given to the rumor that the suit was merely one evidence of the ill feeling which rivalry between the city-owned and the privately-owned works had engendered. It was claimed by the defendants that the action was brought for the purpose of coercing the city into purchasing the plaintiff's plant and franchise, but Judge Laughlin found nothing to warrant the belief that the plaintiff had brought the action for an ulterior purpose, or that either party was acting in bad faith. For the Western New York Water Company H. F. Huy of Buffalo, James M. Caird of Troy, and his assistant, F. J. Longley, testified as experts.

QUANTITY OF SEDIMENT DISCHARGED

The city plant, described in the Engineering Record of June 1, 1912, page 601, takes water from the river at a point 2 miles above the plaintiff's intake. The evidence showed that the wash-water discharge from the municipal works amounted, in 1914, to 95,176,800 gal. or an average of 260,000 gal. daily, and that the average amount of suspended matter, not including solids in solution, in this effluent from the filter beds was from 4.56 to 8.9 tons per 1,000,000 gal. The defendant also discharges into the river from ten to twelve times per annum about 1,000,000 gal., the contents of each of two sedimentation basins connected with its filtration plant, consisting of bacteria and other impurities separated from the raw water, together with the chemicals added thereto by the defendants. The average amount of suspended matter, not including solids in solution, in this discharge is about 23 tons per 1,000,000 gal. From the sedimentation basins alone there is probably discharged into the river annually approximately 550 tons of suspended matter. About 300 tons of aluminum sulphate are added to the water annually in the coagulating basins and in the effluent discharged into the river. It thus appears that about 5/6 ton of chemical matter is discharged into the river daily on an average by the defendants in the operation of its filtration plant.

The currents of the river from the point of this discharge to the plaintiff's intake are toward or along the bank, and the flow of the current is about 1 mile per hour. The

average amount of suspended matter in the water at the plaintiff's intake is from 0.4 to 0.5 ton per 1,000,000 gal.

It is true, the Court states, that with the exception of the chemicals all of the impurities in the effluent have been taken from the river, but they have been taken so far from the bank that it is fairly to be inferred that none of them would have entered the intake of the plaintiff. Moreover, they are discharged in concentrated form. The waters of the river are otherwise largely polluted, both above and below the filtration plant of the defendants, and it is impossible to determine with any degree of definiteness the proportion of the entire pollution caused by the defendants, but it is fairly to be inferred that some of the pollution of the water from which plaintiff takes its supply is caused by this discharge of effluent from the filtration plant of the defendants. There is a trunk sewer in Buffalo Avenue adjacent to the filtration plant of the defendants, into which the effluent from the filtration plant could be discharged as conveniently and with no greater expense than into the river.

DAMAGES INDETERMINABLE

The acts of the defendants, according to Judge Laughlin, are in the nature of continuing trespasses for which an action at law does not afford an adequate remedy, and while ordinarily equity does not intervene to prevent the infliction of merely nominal damages, that rule does not apply to the case at bar for the reason that in such case nominal damages are deemed substantial. Moreover, it is evident that there are substantial damages, but it is impossible to show them with a sufficient degree of certainty to warrant a recovery. It is not even essential to the maintenance of an action for pollution that damages shall have been suffered if the plaintiff's rights have been invaded and there is danger that such invasion may ripen into a prescriptive right, as there is in the case at bar.

The Court further states: "There is no force in the contention that the action cannot be sustained without joining all parties who are contributing to the pollution of the river, and that since the water is so polluted by others that even if the discharge of the waste effluent from the filtration plant of the defendants were stopped, still the plaintiff would be required to filter the water, as doubtless it would. If the plaintiff were seeking to recover damages the extent of the pollution by others would have a material bearing, for defendants would only be liable for the damages caused by themselves; but otherwise these contentions have been frequently made in principle and overruled.

"The city of Niagara Falls is rapidly increasing in population, and the contamination of the river by this effluent from the filtration plant of the defendants will naturally be more and more. Without, therefore, expressing an opinion with respect to the right of the plaintiff to injunctive relief against others who are polluting the waters of the river, it is, I think, proper that a court of equity should enjoin a municipality, which is engaged itself in supplying part of its inhabitants with water, from unnecessarily contaminating and polluting the water from which the plaintiff takes its supply for others of the inhabitants of the city, and especially since it is evident that another outlet for the effluent from the filtration plant is available at a very small expenditure. The defendants, however, should have a reasonable time to enable them to construct another outlet."

Judgment, accordingly, has been entered enjoining defendants during the continuance of plaintiff's leasehold and franchise rights from discharging the effluent from their filtration plant into the Niagara River, but with the provision to the effect that it shall be suspended for the period of six months to enable the defendants to provide another outlet, and with leave to defendants to apply at special term, if necessary, for an extension of such period of suspension if for insufficiency of appropriation of funds or other cause they shall require further time.

Business Principles in Constructing Public Buildings

Secretary of the Treasury Issues Orders That Grade Buildings in Accordance with Business Transacted Therein

THE Secretary of the Treasury, Mr. McAdoo, has issued an order to the Supervising Architect's Office, putting into force his policy with reference to the construction of post-office and Federal buildings. The new order seeks to establish a rational system of uniformity and business economy in the construction of Government buildings and to get away from the "pork-barrel" system. The Secretary proposes hereafter to construct in a locality such a building as local conditions and the present and future needs of the service demand, and not to be governed entirely by the size of the appropriation.

For the past two years the Treasury Department has been following the same general business policy in the purchase of post-office sites. The Public Buildings Act of March 4, 1913, authorized the purchase of 303 sites in various parts of the country. To date only 136 have been acquired, but these have been bought for $571,775 less than the amount Congress authorized to be paid.

The Secrtary designates four different classes, depending upon the amount of business transacted, as follows:

CLASSES A AND B

Class A.—For post offices of the first class with annual receipts of $800,000 or over: Marble or granite facing; fireproof throughout; metal frames, sash and doors; interior finish to include the finer grades of marble, ornamental bronze work, mahogany, etc. Public spaces to have monumental treatment, mural decorations; special interior lighting fixtures.

Class B.—Post offices of the first class with receipts from $60,000 to $800,000: Limestone or sandstone facing; fireproof throughout; exterior frames and sash metal; interior frames, sash and doors wood; interior finish to exclude the more expensive woods and marbles; ornamental metal to be used only where iron is suitable; restricted ornament in public places.

CLASSES C AND D

Class C.—For post offices of the second class with receipts of $15,000 or over, and of the first class up to $60,000: Brick facing with stone or terra cotta trimmings; fireproof floors; non-fireproof roof; frames, sash and doors wood; interior finish to exclude the more expensive wood and marble; the latter used only where sanitary conditions demand; public spaces restricted to very simple forms of ornament.

Class D.—For post offices having annual receipts of less than $15,000. Brick facing, little stone or terra cotta used; only first floor fireproof; stock sash, frames, doors, etc., where advisable; ordinary class of building such as any business man would consider a reasonable investment in a small town.

GENERAL CONSIDERATIONS

Closing his order, the Secretary says:

"Wherever local conditions permit, labor and time should be saved in the design of building by utilizing plans of buildings hitherto constructed, provided the foregoing conditions are observed.

"Work on the standardization of full-sized details should be carried forward as rapidly as possible; and similar attention should be given to the completion of the work that has been undertaken in preparing standard specifications. The completion of these features should result in considerable saving in time in getting buildings under contract.

"In the preparation of specifications special consideration should be given to such changes as may be practicable to shorten the contract time.

"While I recognize the fact that frequently strong sentiment is expressed in favor of the use of local material in the construction of public buildings, I do not feel justified in limiting competition to such materials, or in awarding contracts for material so produced at prices which amount to subsidizing local industries. Bids should not be solicited specifically for local materials, but should be taken under such conditions as will insure the widest possible competition for the class of materials called for."

Columbus Experts Determine B. Coli Vagaries

Testing Methods and Relative Counts for Various Stages of the Purified Waters Compared for a Two-Year Period

COMPARATIVE presumptive B. coli tests were made for two years at the Columbus water purification works for the purpose of ascertaining the relative importance of the various methods in use when applied to the water as it passes through the different steps from the river to the final effluent. Russel D. Scott, assistant bacteriologist, in the June *Ohio Public Health Journal*, gives the results in detail. His conclusions are as follows:

1. The bacteriological character of the Scioto River water during periods of long storage varies from that during flood stages in that: (a) The number of bacteria is much less. (b) The 37 deg. agar count is a much higher proportion of the 20 deg. count. (c) Of the B. coli group, the saccharose-fermenting type are the most numerous.

2. The lime softened water varies bacteriologically from the raw water in that: (a) The number of bacteria is much less. (b) The ratio of the number of B. coli to the total number of bacteria is less. (c) The saccharose-fermenting types of B. coli are much more numerous. (d) The proportion of dextrose fermenters which do not ferment lactose is much greater. (e) The ratio of the 37 deg. to the 20 deg. count is

greater. (f) The ratio of the gelatine to the agar count is very much higher.

3. The proportion of organisms not fermenting dulcite is not affected either by storage or by lime treatment. This is also true of those which do not form indol.

4. The members of the B. coli group form somewhat less than 4 per cent of the total number of bacteria at 37 deg. C. This ratio is, however, quite irregular.

5. The proportion of organisms in the river water which ferment dextrose but not lactose is not affected by storage.

Life of Wood Pipe

D. C. Henny, Consulting Engineer of the U. S. Reclamation Service, Summarizes His Experience and Studies

IN the August number of the "Reclamation Record" there appears a report on the life of wood pipe made by D. C. Henny, consulting engineer of the U. S. Reclamation Service. It is based in part on his personal experience and observation, but more largely on data supplied to him by owners and managers of plants and projects using this type of conduit. In the report itself are long tables giving data on individual lines. These are omitted here. The lines listed used principally redwood and fir. Both wood-stave and bored wood pipe were investigated. Mr. Henny's conclusions relate only to the timber portion of the pipe and not to the bands.

Mr. Henny's report is, in part, as follows:

WOOD USED

The term "Fir" is applied to the most common wood of the Pacific Northwest. Scientifically it is a bastard spruce, first named by Douglas. Locally it is known as fir or Douglas fir, and distinction is sometimes made between yellow and red fir. These come from the same kind of tree, the yellow fir being most common. The large trees yield yellow fir, while the wood from smaller trees is apt to show a reddish tint. Sun exposure also appears to affect the color to some extent. In California the wood is termed Oregon pine. This wood is strong, and can be obtained in long lengths. Mill run of commercial sizes probably averages over 20 ft. in length. It contains pitch, which forms in seams and pockets, normally occurring even in commercially clear wood within certain limits. The trees usually yield less than 25 per cent of wood free from sap and knots. The expense of eliminating these defects has led to the practice, as regards pipe construction, of permitting some small and sound knots and sap.

Redwood grows on the Pacific coast from Santa Cruz north into southern Oregon. By reason of the average large diameter of the trees, the logs are cut shorter than in the case of fir, and the commercial mill run averages about 16 ft. in length. The wood is not as strong as fir. About 50 per cent of the wood cuts up clear and free of sap, which has led to the custom of demanding freedom from knots and sap in ordinary pipe specifications.

TYPES OF PIPE

Continuous stave pipe consists of staves breaking joint and clamped together with bands, which since 1888 have universally been made up of steel bolts and lugs, the latter being made of cast iron, malleable iron, or pressed steel. The butt joints are made tight by a metal or wooden plate.

Wire-wound or machine-banded pipe is pipe made up in sections from 10 to 24 ft. in length. It consists of staves held together by galvanized wire, spirally wound around the pipe under heavy tension. The wood is usually kiln dried, which is not the case with continuous stave pipe. The ends of each section are machine turned to an exact diameter, sometimes slightly tapered. Sections are united by some form of sleeve, a sleeve made up of staves and wound around with wire or individual bands being most common. Light-pressure pipes are often provided with mortise and tenon ends, dispensing with the necessity of sleeves.

DURABILITY

The wood surface in continuous stave pipe is, with a few exceptions, uncoated, while sectional pipe is heavily coated, the coat consisting of asphaltum and tar, with sawdust on the outer skin. The investigation has had in view especially the life of pipe as affected by the durability of the wood.

Reviewing the information as grouped under its headings, it may be estimated that under conditions of continuous water pressure the life of various kinds of pipe may be as follows:

LIFE OF THE WOOD IN WOOD PIPE LINES

Wood	Condition	Years
Fir	Uncoated, buried in tight soil	20
"	Uncoated, buried in loose soil	4-7
"	Uncoated, in air	12-20
Redwood	Uncoated, buried in tight soil, loam or sand, and gravel	Over 25
Fir	Well coated, buried in tight soil	25
"	Well coated, buried in loose soil	15-20

Under conditions interfering with complete saturation of the wood, the life is cut down materially. These conditions are in the case of uncoated pipe brought about by open-soil and low-water pressure. The effect of coating appears to be equivalent to tight soil cover, with possibly the additional advantage of tar in the coating acting as a disinfectant. The effect of unfavorable conditions as to lack of complete saturation is serious in redwood, resulting in a life which may be shorter than 15 years, but is much more marked in fir, where it may be as low, in spite of coating, as six years.

FACTORS IN DURABILITY

It is quite possible that the life of individual pipe is not merely affected by surrounding conditions, but may have been shortened by the quality of the individual pieces or the treatment of the wood. The wood from the bottom of a tree is close grained and likely to last longer than from the top of the tree, even though free from sap.

Bastard staves, especially in fir, resist penetration of the water in the pipe to a greater extent than diagonal grained or vertical grained wood and may show a shorter life. Again, too, rapid kiln drying, which may at times have been practised on lumber from which staves for wire-wound pipe were run, may have partially destroyed the vitality of the wood. It has not been practicable to differentiate between the causes which in this manner may have shortened the life of the wood in pipe, nor to ascertain what has been the effect of permitting some sap in the wood from which decay may have spread to the adjoining sound wood. Unquestionably much wire-wound pipe has been manufactured without being subjected to strict supervision and inspection.

CONCLUSIONS

On the whole the following conclusions seem justified as regards the relative life of fir and redwood in pipe:

1. Under favorable conditions of complete saturation fir well coated may have the same life as redwood uncoated.

2. Either kind of pipe will have a longer life if well buried in tight soil than if exposed to the atmosphere. Such life may be very long, 30 yr. and over, if a high, steady pressure is maintained.

3. Either kind of pipe will have a longer life if exposed to the atmosphere than if buried in open soil, such as sand and gravel and volcanic ash, provided in hot and dry climate it be shaded from the sun.

4. Under questionable conditions, such as light pressure or partially filled pipe, fir, even if well coated, may have only from one-third to one-half the life of redwood.

5. Under light pressure the use of bastard staves in fir pipe should be avoided.

6. The use of wooden sleeves in connection with wire-wound pipe is objectionable and has caused endless trouble and expense. It is possible that the objection may be partially overcome by dipping ends of sleeves in creosote and by applying a heavy coating of tar to the ends of the sleeves. Saturation of sleeve wood will never be as perfect, however, as of the straight pipe, and full creosote treatment of the wood or else some form of metal sleeve, either riveted iron or steel heavily coated, or cast iron will probably be well worth its extra cost.

7. If wooden sleeves are employed, they should be provided at least for sizes from 10 in. up with individual bands to permit taking up leaks.

PITCH AND KNOTS

Pitch seams do not occur in redwood. In fir they should be distinctly limited as to size, frequency and depth. In respect to knots, there appears to be no reason for making any distinction between the two classes of wood. Small, sound knots, if not passing through the full thickness and not occurring close to edges or ends might be permitted in either wood. Sap is objectionable, and the higher cost in prohibiting it entirely or of putting narrow limitations on it is probably justified in both fir and redwood.

Wooden pipe is not suitable in cases where it can not be kept full and under pressure during periods of use. Coating cannot under such condition be expected to afford protection against decay. Coating should be continuous and heavy, not less than 1/16 in. to be fully effective, and should preferably consist of more than one individual coat of a mixture of asphaltum and tar, or of an application of gas tar followed by one or more applications of refined coal tar. Little experience, however, can be quoted in support of all-tar coating.

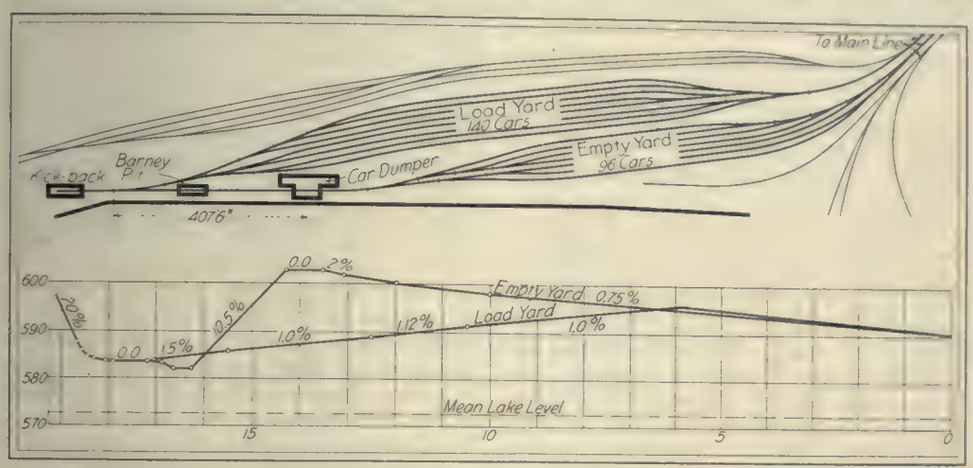
All tentative conclusions herein presented are necessarily based on the limited data which could be collected and will undoubtedly require amendment as further experience accumulates.

THE TYPICAL BASEMENT COLUMN of the Woolworth Building in New York City has a cross-sectional area thirty-six times that of the roof column.

New Coal-Handling Plant at Toledo Was Built Entirely During Winter

When Navigation Opened This Spring Users of Cincinnati, Hamilton & Dayton Facilities Found Improved Car Dumper and Layout on Site of Old

WITH THE OPENING of navigation on the Great Lakes, the Cincinnati, Hamilton & Dayton Railway placed in operation at Toledo, its principal port on Lake Erie, a modern coal-handling plant, dock and yard to facilitate the handling of traffic and provide for the steady growth of this business during recent years. The new facilities are situated on the Maumee River, at Rossford, and provide Toledo with one of the most modern terminals of the kind on the Great Lakes. The improvement was made entirely during the winter, when lake navigation was closed, work not being started until December of last year.



PLAN AND PROFILE OF LAYOUT—CARS MOVE ENTIRELY BY GRAVITY EXCEPT UP SHORT BARNEY INCLINE

The yard plan is shown. The terminal is laid out so that adjacent to the unloading machine is a yard with a capacity of 236 cars, and in this yard 140 loaded cars and 96 empties can be handled. To the south of the dock is a classification yard with a capacity of 3000 cars, affording ample space for assembling shipments.

The plans as prepared called for the construction of 802 ft. of concrete dock, the necessary foundations for the machine, the entire reconstruction of the load and empty yards and the fabrication and erection of the new mechanical car dumper with the necessary approach and run-off trestles.

Details of the concrete dock construction are shown. This type of dock was placed on both sides of the machine foundation. The dock immediately in front of the machine is of the same general construction, except that the batter piles were omitted, and the dock was made a part of the machine foundation, this foundation being of pile construction, capped with a reinforced-concrete slab, to which the dock is anchored.

CAR DUMPER

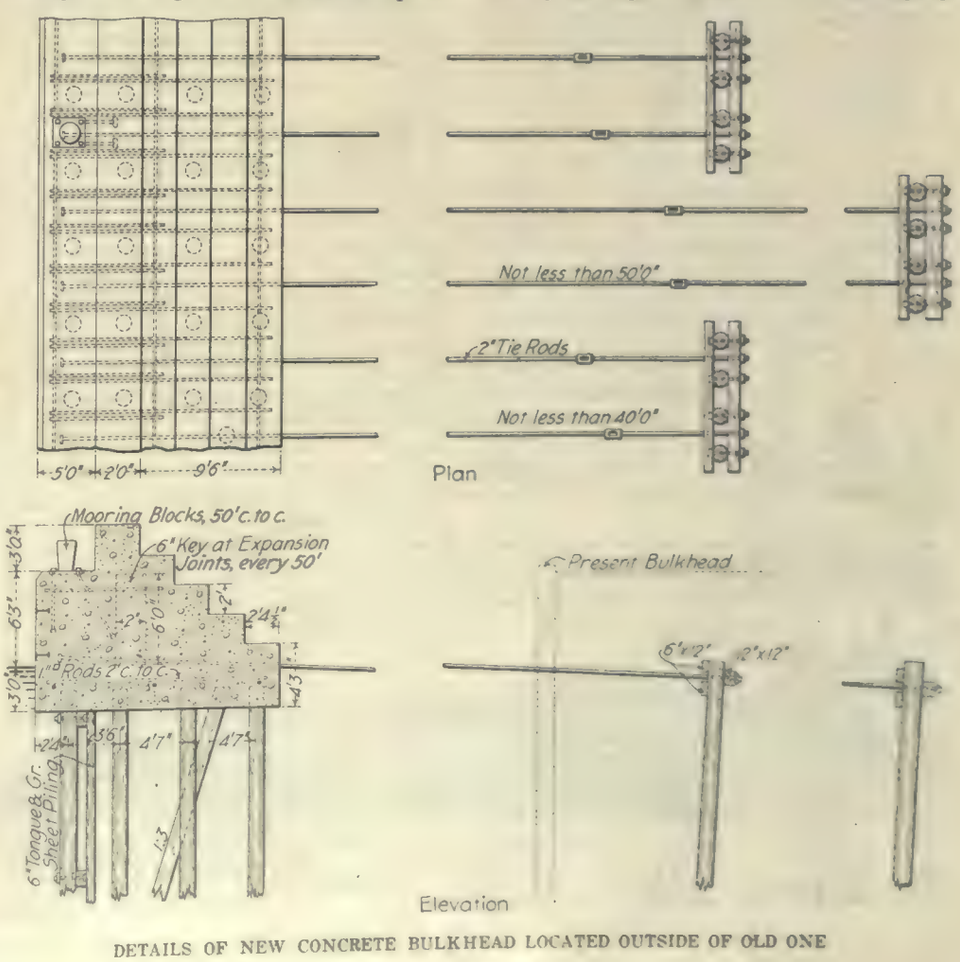
The car dumper is designed to handle cars of a maximum gross weight of 280,000 lb., and the clearance length of the machine is 53 ft., which will permit handling cars 52 ft. long over couplers. The machine is of the latest steam-operated type, with counterweighted cradle, the steam being furnished by two Scotch boilers, each with a capacity of 250 hp. It is designed to handle forty 100-ton cars per hour. The cradle rail is 30 ft. above the lake level, which is considerably higher than normally adopted for installations of this kind; the adoption of this elevation was due to the desire to reduce the amount of lift of cars in the machine to a minimum.

A disappearing barney was provided, which makes it possible to run a car over the barney pit from the load prior to the return of the barney from the delivery of a car to the machine. This is accomplished by means of by-pass gates in the barney track, which are operated by the steam cylinder, which controls the reversing mechanism of the haulage engine. The barney returning from the machine passes into the barney pit on the by-pass gate nearest the machine, and thence runs under the car to the end of the pit. The reversing of the haulage engine raises both by-pass gates, so that the barney in returning comes up behind the car by means of the by-pass gate farthest from the machine. This arrangement has the effect of keeping a car up to the machine at all times.

CONSTRUCTION RECORD

Contracts for the foundation and dock work and for the mechanical car dumper were placed about Nov. 1, 1914, and preparations made for actively starting the work at the close of navigation. The old machine was abandoned Dec. 2, 1914, and the dismantling and dock construction started the next day. The piles in front of the old dock were driven by floating equipment, using steam hammers. Those back of the old dock were driven by land drivers. The piles were driven to refusal to a bed of hard pan and small granite boulders, approximately 31 ft. below the lake level. The operation of the floating equipment for driving piles and sheet piling was made possible by using an ice tug, which kept the river ice broken and clear of the site of the work during extremely cold weather.

With the exception of the sand, all of the materials used in the concrete work were brought to the site by rail. The sand was unloaded from boats at the dock site. The mixing plant was located about 1000 ft. south of the machine, where the storage bins were provided and a heating plant for heating all material was installed. The concrete was transferred from the mixing plant to the site of the work in drop-bottom buckets on flat cars, by means of narrow-gage equipment. The concrete was placed continuously and without reference to the weather conditions. This was made possible by having the materials as mixed prop-



DETAILS OF NEW CONCRETE BULKHEAD LOCATED OUTSIDE OF OLD ONE



THIS COAL-HANDLING PLANT WAS BUILT ON SITE OF OLD ONE BETWEEN CLOSING AND RE-OPENING OF NAVIGATION

erly heated, and, after concrete was deposited, keeping it warm by means of the steam plant located at the machine foundation. Some of the concrete was placed with temperatures as low as —12 deg. Fahr. with no bad effects.

The machine foundation was completed Feb. 8, 1915. The concrete for the barney-pit construction was completed March 7. The superstructure contractor started operations Feb. 2, and the first steel was raised Feb. 15. The machine was finished, ready for the preliminary test of the cradle on April 9, and the entire machine was completed, ready for operation, April 12.

During the progress of the construction of the concrete docks, machine foundation and superstructure, the railroad company's forces reconstructed the yards to the revised alignment and grades, at an elevation of approximately 8 or 9 ft. above the old yards. The reconstruction and raising of the yards was begun Dec. 6, 1914, and the yards were in condition for operation April 12, at the time the machine was completed.

The erection of the approach and run-off trestles was handled by the substructure contractor, the material being framed near the site of the work, transferred to the final location and erected by means of a locomotive crane.

TWO MONTHS OF OPERATION

While the improvement as a whole was ready for operation April 12, 1915, three days prior to the opening of navigation, the machine was not put into active service until April 19, when the first boat was secured. For the two months ended June 19, the machine handled 10,439 cars, or 469,064 tons of coal. The two months' period has developed the fact that the machine and yard are capable of handling the coal as fast as anticipated. In one day's run of ten hours 340 cars were handled, with a total tonnage of 16,393. There were also handled in one day's run of twelve hours 405 cars; these runs involved the handling of from 45 to 49 cars per hour for short periods.

Smith-McCormick Company, of Easton, Pa., was the contractor for the substructure and approach trestles; J. C. Carlin of Toledo furnished the greater portion of the filling material, the Pittsburgh Construction Company of Pittsburgh was the contractor for dismantling the old machine, and the Wellman-Seaver-Morgan Company of Cleveland furnished the new car dumper. The design and construction of this plant were under the direction of F. L. Stuart, chief engineer of the railroad, and the work was prosecuted under the supervision of A. M. Kinsman, engineer of construction; W. S. Bouton, engineer of bridges; A. H. Griffith, assistant engineer, and P. Callahan, resident engineer.

Reinforced-Concrete Arch Bridge Has Stone Facing

Three Flat-Arch Spans and Low Piers for 300-Foot Crossing at South Bend, Indiana, Completed at Total Cost of $101,500

THE BRIDGE recently completed at South Bend, Ind., across the St. Joseph River from Leeper Park on the south side to the north shore drive was designed with special attention to external appearance, because of its location. Bedford stone, smooth finished and laid in non-staining cement mortar, was used for facing the entire bridge and for the handrail. An elliptical curve was adopted for each of the three arch spans of small rise, and the resulting outlines, as shown by the accompanying photograph, give a very satisfactory appearance. Work was begun on this bridge Aug. 20, 1914, and just about five months later street-car tracks were laid and practically all of the construction except sidewalks and paving had been completed.

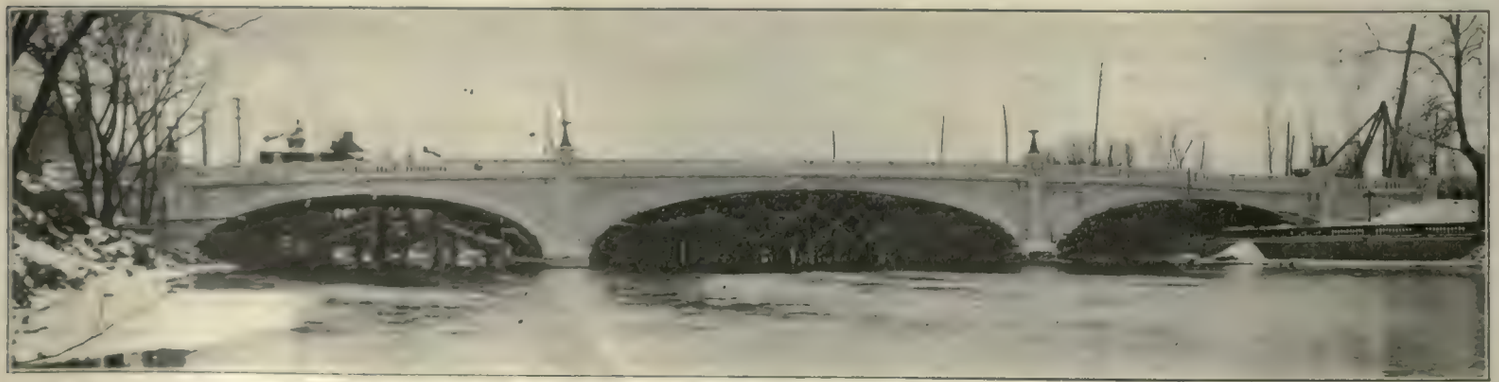
The structure is 300 ft. long and 70 ft. wide between spandrel walls and contains approximately 7000 cu. yd. of concrete. The foundation soil consisted of sand, gravel, clay and quicksand in the various locations, hence it was necessary to drive piles from 25 to 35 ft. long about 4 ft. on centers under all piers and abutments. In order to eliminate any danger from washing out of the quicksand at the foundation of the south pier, the 18-ft. steel sheet piling used for the cofferdam was driven down to a point 12 ft. below the footing.

DETAILS OF ARCHES AND PIERS

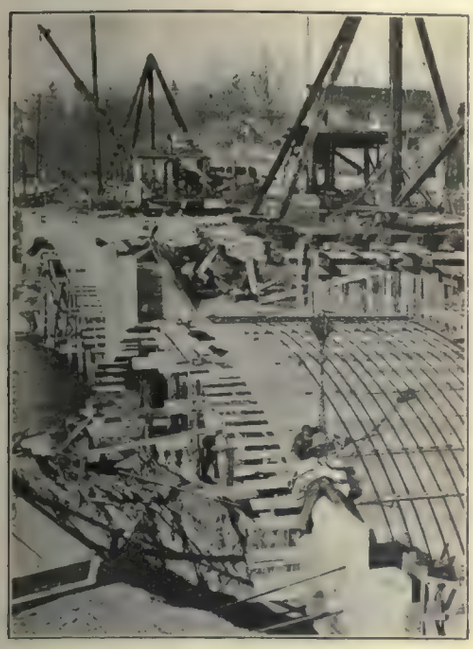
The center arch has a clear opening of 116 ft. and a rise of 16 ft. 8 in., or about one-seventh of the span; the two side arches are 80 ft. clear span and about 14½ ft. rise. The flatness of these arches was decreased by using a roadway grade line on a vertical curve with a rise of 4 ft. at the center of the bridge. The piers are 12 ft. wide and 87 ft. long, and extend 16 ft. below the springing lines of the arches. They were designed to withstand the unbalanced load on the longer arch, by making the footing 6 ft. wider on the side opposite the large arch.

The solid arch ring of the 116-ft. span is 2 ft. 4 in. thick at the crown, 4 ft. at the haunches, and 8 ft. 6 in. at the piers; the arch rings for the 80-ft. side spans are 1 ft. 10 in. thick at the crown, 3 ft. 3 in. at the haunches, and 6 ft. 6 in. at the abutments. These arch rings are reinforced at both intrados and extrados with deformed bars spaced 12 in. on centers and extending well into the piers and abutments. Lacing bars of ½-in. rods connect the main bars, which are also tied together by ½-in. rods running at right angles to them and spaced about 4 ft. apart.

The spandrel walls were built of concrete



BEDFORD STONE WAS USED TO FACE THE CONCRETE BRIDGE OVER THE ST. JOSEPH RIVER, AT SOUTH BEND



STONE FACING BEING SET PRIOR TO CONCRETING OF ARCH RING

reinforced with ⅞-in. bars and placed behind the Bedford stone facing already mentioned. As indicated by the accompanying photograph, the stone was used for the face form behind which the concrete was placed. After the stones were laid up they were coated on the back with a heavy coat of water-proofing, including a second coat of asphaltic paint, special care being used at the joints. The same treatment was given to the back of the arch rings and the spandrel walls, and no discoloring whatever has developed.

LOADS, MATERIALS AND COSTS

The arch rings were designed for a live load of 300 lb. per square foot over approximately one-half of the span; the line of pressure for this loading was found by the elastic theory to lie within the middle third of the joints for the entire arch. The dead load was assumed at 150 lb. per cubic foot for concrete, 100 lb. per cubic foot for earth fill and 100 lb. per square foot for the pavement. Concrete, composed of a 1:2½:4 mixture of Portland cement, washed sand and crushed stone, was used for the arch rings, and for the piers, abutments and spandrel walls the proportions were 1:3:5.

The contract price for the bridge, including the pavement and ornamental cast-iron lighting poles, was $93,663. For extras there was charged 40 cents per linear foot for piling, $2.50 per cubic yard for wet excavation, and $6 per cubic yard for concrete, bringing the final total cost to about $101,470, including the cost of the steel sheet piling left around the south pier.

Credit for the early completion of the work is due to the contractors, the Cleary Kuert Company of Indianapolis, who furnished a well-equipped plant and maintained a good organization, with A. Bessinger as resident engineer.

The bridge was designed and constructed under the supervision of Charles W. Cole, civil engineer, Mishawaka, Ind., from whom the foregoing data and photographs were obtained.

THE PRODUCTION OF MANGANESE ORES in the United States in 1914 amounted to 2635 long tons, which was 1413 tons less than the output of 1913, according to D. F. Hewitt of the U. S. Geological Survey.

Concrete Cribs Used Successfully in Dock Construction at Victoria

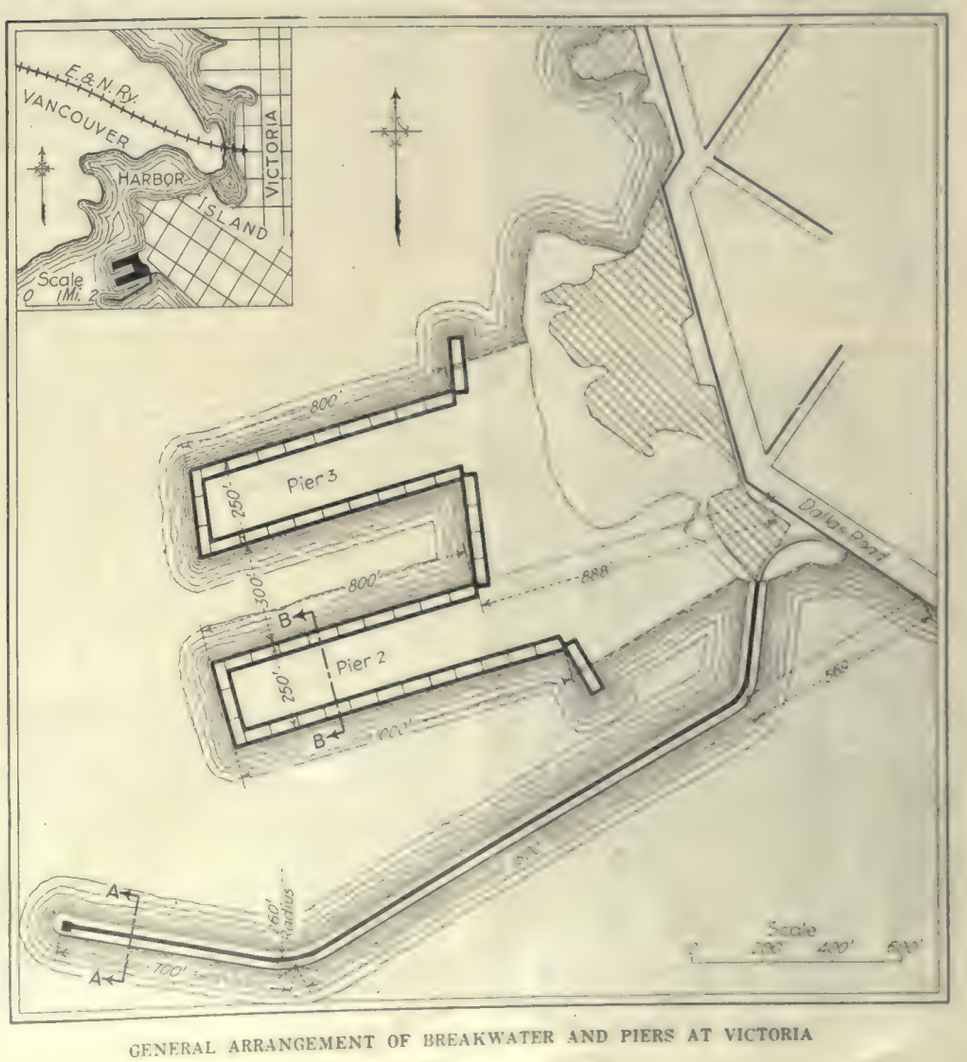
Cribs Placed Without the Aid of Diver After Foundation Rock Was Dumped from Tilting Scows and Leveled by a Plow

HARBOR DEVELOPMENT on an extensive scale is now well under way at Victoria, B. C., under the supervision of the Department of Public Works of Canada. The first units in the work are a 2500-ft. breakwater and two large docks in the outer harbor, all these being constructed with rubble-mound foundations and reinforced-concrete superstructures. The breakwater is expected to shelter a 90-acre area, and the two docks are being constructed close to it inside the sheltered area with the idea of adding more docks later as the traffic increases. These docks have berthing spaces from 800 to 1000 ft. long and are intended only for the largest vessels; smaller craft will continue to use the inner harbor, reached by a short but narrow and tortuous channel. The improvement of this channel is now under way, and when completed the corners will have been removed as far as feasible and a uniform low-water depth of 20 ft. will be maintained, so that vessels of from 3000 to 4000 tons displacement will have safe access to the inner harbor.

BREAKWATER

The breakwater consists of a rubble-mound foundation, surmounted by a superstructure of granite blocks on the sea side protecting a concrete superstructure built on the center line. The central part of the foundation consists of a fine quarry run built up to a depth of 35 ft. below low water, with both sides on a 1:1 slope. Larger rock, ranging in weight up to 16 tons per unit, is then dumped from scows until the quarry-run core is covered to a depth of 15 or 20 ft. below low-water level, and the base of the foundation has been brought out to a width of 115 ft. At this 20-ft. level, on the sea side, divers lay granite blocks, of not less than 5 tons weight, on a prepared bed 40 ft. wide at the base. The divers place the usual backing after each course of granite blocks is laid until low water is reached, when the work is advanced by ordinary methods.

In placing the concrete superstructure of the breakwater care is necessary in utilizing the lowest tides so as to minimize the detrimental action of lowering concrete through water. To facilitate this work the concrete is being placed in forms built up in sections about 26 x 20 ft. in area, and 7 ft. high, three sections making up the total height of 21 ft. To prevent currents from disturbing the concrete, a lining of jute tarpaulin is placed all over the bottom and 2 ft. high along the sides of the sections. Each section is built on land and placed in proper alignment by a 10-ton crane, after which the concrete is poured. In order to reduce the danger from settlement of the rubble foundation, a layer of tar felt is placed between adjoining sections.



GENERAL ARRANGEMENT OF BREAKWATER AND PIERS AT VICTORIA

The rubble foundations of the docks are placed in a manner similar to that used on the breakwater. A row of piles is driven 12 ft. from the front and back faces of each wall, to be used as guides, and all material is dumped from scows. To carry out the plan adopted by the contractors, there must be no rock projecting above 36 ft. below low water. Any rock that so projects is removed by a clamshell or orange-peel dredge, so as to insure a clearance at this level. The top of the foundation then presents a rough and uneven surface, and this is leveled up to a height of 35 ft. below low water, by means of the clam shell spreading



FIRST CONCRETE CRIB PLUNGING TO SITE, 3 MILES OFF SHORE

fine gravel. This leaves the foundation in shape for the use of the most novel feature of the construction work, which is a submarine plow, designed to scrape off the foundation and make it sufficiently level to form a satisfactory bed for the cribs, which are floated to place and sunk.

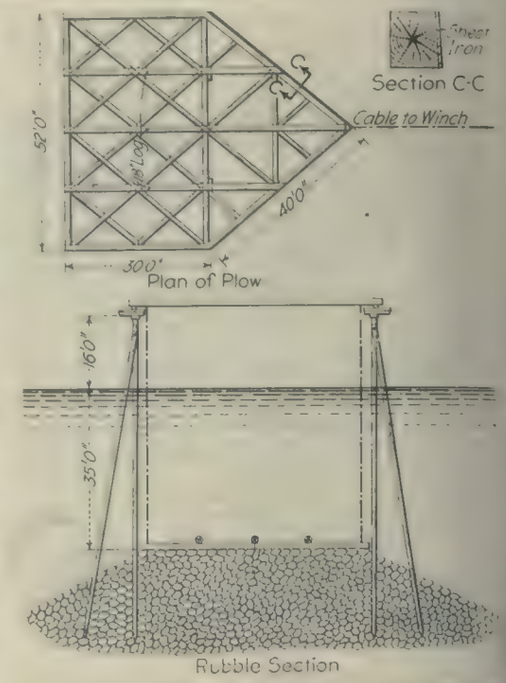
The plow is a thoroughly braced timber structure, with its forward end pointed and sheeted with iron. The frame is weighted by rock cribs placed at the corners, and is suspended by vertical rods from two horizontal beams, which move on trunnions resting on horizontal walings attached to the top of a row of piles, the level of the piles being established with reference to low-water mark. On the suspension rods are threads and screws by which vertical adjustment may be made to bring the plow proper to any desired position. When the plow has been adjusted to the proper level it is attached by cable to the engine on a scow which, in turn, is attached to a 10-ton anchor fixed in the foundations ahead. The frame is then drawn forward and performs its function of plowing off the foundation to the required level. It is to be noted that the success of this scheme depends on there being no projecting corners of large rocks in the sub-foundation. It may be said, however, that the foundations for the first two cribs were satisfactorily leveled off, and the alignment of the tops of the two cribs above water gives every indication that the method is successful.

All the rock dumped from scows had to be accurately measured. A scheme has been developed for doing this at the same time that the work is handled expeditiously. To accomplish this level-decked barges with longitudinal bulkheads are used, in which a watertight compartment along one side is connected to the sea by two 8-in. valves. When the barge is spotted at the proper point these valves are opened, and the inrushing water shifts the center of gravity so that the scow tilts and the load slips off. To facilitate the movement of the rock the deck of the scow has been sheeted with ¼-in. iron plates.

More than a dozen barges of this type are in use, and all of them have been carefully gaged to show the displacement for every ⅛ in. of mean draft. Gages placed at the four corners are read before and after loading, and the weight corresponding to the mean light draft is subtracted from that corresponding to the mean loaded draft to give the net weight of stone. In the case of hopper scows a correction had to be made to allow for the fact that part of the rock is submerged. Assuming 40 per cent for voids, 60 per cent, or three-fifths of the hopper volume, is rock and three-fifths of the hopper displacement has to be added to the apparent weight of the rubble to get the actual weight of rock on the scow. The correction, of course, applies only to the loaded draft, and is added only for gage readings of 3 ft. and more. Readings are taken for every 6 in. of draft, and the displacement for every ⅛ in. is obtained by proportion, a table being drawn up for each individual barge in service.

BUILDING AND PLACING CRIBS

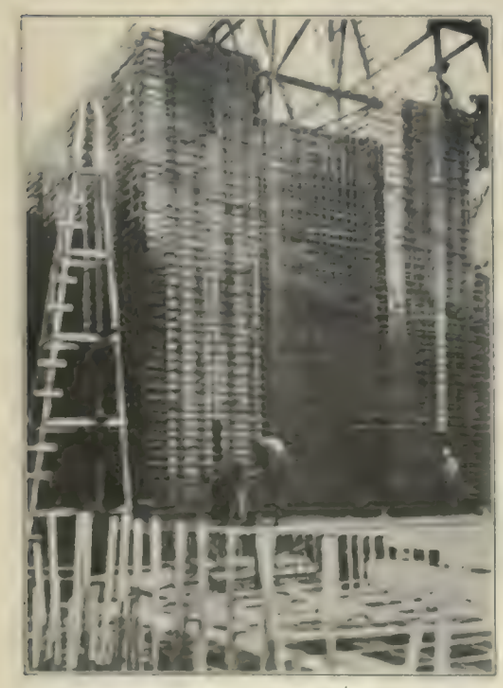
Each of the docks is 250 ft. wide, and around the perimeter it is the plan to place a line of concrete cribs to form the dock facing, the interior area being filled with loose rubble. The concrete cribs used to form this perimeter are cast on shore, and as their displacement is greater than their weight they can be floated to the desired position and sunk in place by opening sea valves. The cribs are 80 x 35 ft. in plan and 39 ft. high. The outer walls are 20 in. thick, with reinforcement sufficient to provide the necessary strength.



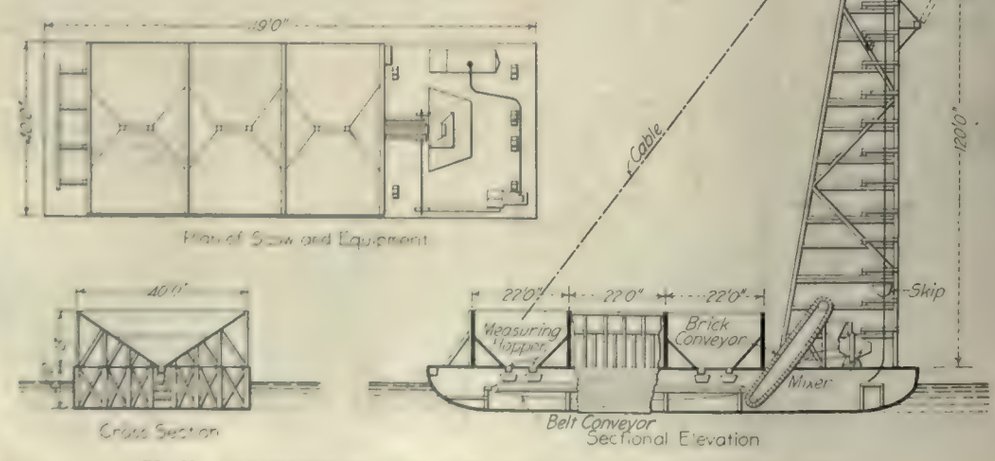
PLOW FOR LEVELING RUBBLE FOUNDATIONS IN PIERS

The internal bracing of the main outer walls consists of two longitudinal walls and vertical cross walls 10 ft. apart. To distribute uniformly the pressure of the weight of the superstructure built upon the crib, a small party wall is also placed between each main vertical cross wall. When the crib is in position on its foundation, 4 ft. of its vertical face will be visible at low water. A complete superstructure will then be built on the cribs up to the height of the wharf cope level.

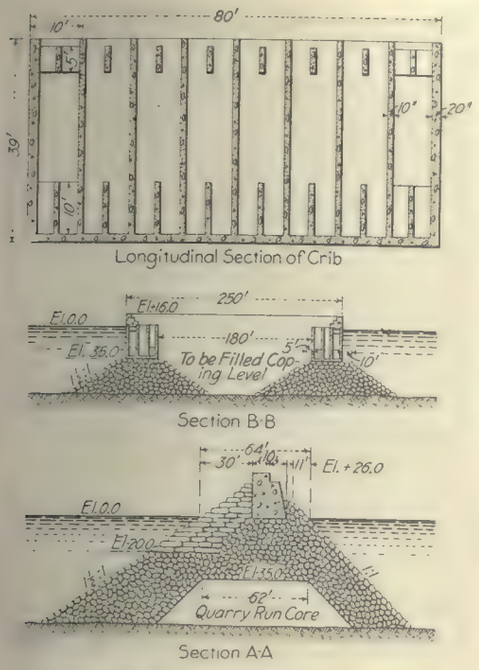
The contractors had planned to construct the cribs two at a time on a floating drydock, which had been specially fitted up for the purpose. The drydock was 325 ft. long and 35 ft. high from deck level to tower top. A braced framework 115 ft. high had been constructed to carry an electric crane, which was to be used in placing the molds and reinforcing steel. When the first two cribs were completed the drydock carried a total weight of 6000 tons. It was then to be sunk to a sufficient depth to float the cribs, which had been calculated to be approximately 34 ft. below its normal level.



REINFORCEMENT OF CORNER OF CRIB



PLAN, CROSS-SECTION AND ELEVATION OF CONCRETE-MIXING SCOW



CROSS-SECTIONS OF A CRIB AND ITS FOUNDATIONS

A serious accident, however, occurred when the drydock was being sunk, and was described in the Engineering Record of Feb. 20, 1915, page 247. The dock was wrecked, but the cribs remained intact and were eventually refloated and successfully sunk into position on their permanent sites, 3 miles from the point where they were launched. They were found to have a draft of 28 ft. and were sunk in exact position without any further difficulty. Since the accident to the floating drydock, a marine railway has been used for handling the cribs.

HANDLING CONCRETE

Concrete for the cribs is mixed and delivered by a special arrangement which has the advantage of being very compact. The whole apparatus is mounted on a scow 119 ft. long, 40 ft. wide and 10 ft. deep. Three hoppers, two for gravel and one for sand, occupy a length of 68 ft. on the scow, starting at a point 10 ft. from one end. The equipment for mixing and handling the materials occupies a length of 41 ft. at the other end of the scow. The hoppers are the full width of the scow, 22 ft. long and 13 ft. high above the deck. Sand and gravel are discharged from trap doors in the funnel-shaped bottoms into 10-cu. ft. boxes below the deck and between the scow bulkheads. When a measuring box is full the inlet is closed and the material passes out through the bottom to an endless conveyor belt discharging at the forward end of the scow. Here they are delivered into a bucket conveyor, which elevates them to the funnel of the mixer.

The concrete mix for the cribs is 1:2:4 and the mixer charge is proportioned so that one box of sand, two of gravel and five bags of cement are used in each charge. When the proper amount of sand and gravel has been delivered into the mixer funnel, the cement is emptied into an iron vessel in the cement house and blown by compressed air down a 4-in. pipe into the mixer funnel; after which the entire batch is allowed to enter the mixer. After mixing, the concrete is discharged into a skip, hoisted up a tower 120 ft. high, and poured into a funnel, whence it is distributed by pipe to any desired point on the crib.

The work is being carried out by the Department of Public Works, Ottawa, Canada, and J. S. MacLachlan represents the Government as resident engineer in charge.

Net Railroad Revenues Increase

GROSS operating revenues for May on the large steam railroads of the United States, according to a bulletin issued by the Bureau of Railway Economics, were $1040 per mile, showing a decrease of $7, or 0.8 per cent, as compared with May, 1914. Operating expenses were $732, a decrease of $68, or 8.4 per cent. Net operating revenues, therefore, were $380—an increase of $61, or 24.1 per cent, and operating income was $258—an increase of $63, or 31.9 per cent. It was, however, less than in May, 1913, or May, 1911, and only 3.3 per cent more than in May, 1912. The operating ratio was 70.4 per cent, as compared with 76.3 per cent in 1914, 72.8 per cent in May, 1913, and 71.6 per cent in May, 1912. Considering the three main districts, the respective ratios for May, 1915, and May, 1914, were as follows: Eastern district, 70.0 and 78.0; Southern, 71.4 and 76.1; Western, 70.6 and 74.5.

SAN DIEGO CONSUMED 80 gal. of water per capita in 1914—494 gal. per tap—and all of it went through meters. The cost of supplying 1000 gal. figured on total maintenance, was 9.944 cents. The cost to the consumer not a taxpayer was 10.7 cents, to a taxpayer not a consumer 12.4 cents and to a taxpaying consumer 23.1 cents.



SEA SIDE OF BREAKWATER, SHOWING GRANITE AND CONCRETE CONSTRUCTION

Los Angeles Nears Realization of "City Power" Plan

Preparations for Generating Aqueduct Power Facilitated by Validation in June by State Supreme Court of $6,500,000 Bond Issue

THE FIRST hydraulic plant in the chain of stations for developing power on the Los Angeles Aqueduct is nearing completion in San Francisquito Canyon at site No. 1, and the 100,000-volt transmission line which is to convey the current to the city, 47 miles away, will be finished and ready for service in a few months. Work on the power plant will go forward more rapidly, it is reported, since the decision rendered in June by the State Supreme Court validating the $6,500,000 bond issue, of which $1,250,000 was for completing the generating station and transmission line, and $5,250,000 for the acquisition or construction of a distributing system in Los Angeles.



MUNICIPAL HYDROELECTRIC PLANT AT SAN FRANCISQUITO CANYON NEARLY READY TO DELIVER POWER TO LOS ANGELES

STATION CONTAINS SIX UNITS

San Francisquito power plant No. 1 is shown in the accompanying illustration as it appeared on June 25, 1915. The plant is designed for six 7500-kw. units each with a 25-per cent continuous capacity overload. Three of the units are now being installed. The head will vary from 914 ft. under static conditions and zero flow to 814 ft. at the maximum flow of 1000 sec.-ft. Part of the generating machinery is already in place and the pipe for the penstock lines has been delivered.

At the top of the hill near the juncture of the aqueduct proper and the penstock lines is shown part of the elliptical surge tank designed by Prof. W. F. Durand of Leland Stanford, Jr., University, the calculations for which were published in the Engineering Record of July 29 and Aug. 12, 1911, pages 133 and 188 respectively.



POWER-DRIVEN FINISHING MACHINE RUNS ON STEEL SIDE RAILS

Washed Aggregate and Machine-Finished Surface, Features of Michigan Concrete Road

High Quality of Materials Permits Change in Specifications—Comparative Costs on Surface Finishing—Sand and Gravel Washing Adds Little to Cost

WITH its sand and gravel washed on the job, with its surface finished by machine, and with all the latest labor-saving concrete road-building devices, 4¼ miles of Oakland County, Michigan, road, now under construction, is said to be one of the most completely equipped highway undertakings of its kind in the country. The road lies about 10 miles northwest of Detroit, between Royal Oak and Birmingham.

SAND AND GRAVEL REWASHED ON THE JOB

About half way between Royal Oak and Birmingham a Stocker sand and gravel washing plant has been erected. Pit run material is brought to it in large, steel hopper cars, which empty directly into a pit beneath the track. A bucket elevator, operated by a 5-hp. electric motor, carries the material directly to the screen. On the opposite side of the plant water is pumped in, through a 3-in. pipe, from a pond about 100 yd. away, formed for the purpose by damming a small creek. The plant has a capacity of 15 cu. yd. per hour.

The sand and gravel after being separated and washed are held in Weller portable storage bins until required, when they are dropped into steel industrial cars, which run direct to the mixer. Cement, kept in box cars on a siding of the interurban line which parallels the road, is also distributed from this central point.

It has been found that the washing operation adds but little to the cost of handling the material. Supposedly washed material has been purchased and tested but found to be more or less unsatisfactory. The washing operation being performed directly on the job and under the supervision of the engineers in the employ of both the contractor and the county has resulted in obtaining a high quality of material.

The specifications originally called for a mix of 1 cement, 1½ sand and 3 gravel, but it was found that the aggregate was of such a quality that a better concrete would be made by raising the proportion of sand from 1½ to 2. Universal Portland cement was used.

FROM BINS TO ROAD

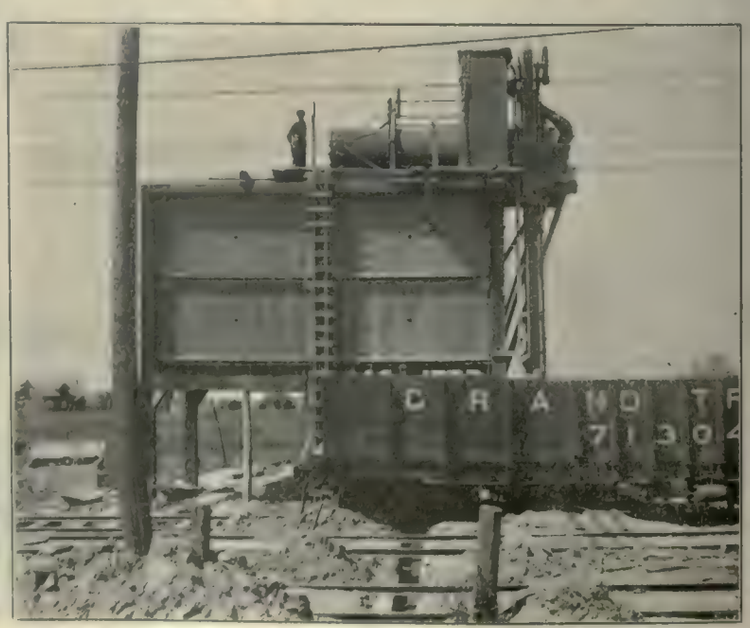
All materials are delivered to the storage bins by interurban cars. The bins have a storage capacity of 60 cu. yd. of sand and 60 cu. yd. of stone. Sixteen-car industrial trains, made up of 1½-cu. yd. Koppel cars, hauled by an 8½-ton steam locomotive, are run on a 24-in. gage track from the central washing plant to the mixer. At the mixer plant, the cars dump their loads of cement, sand and stone onto the grade and from there it is delivered to the mixer skip. The 16-ft. Koehring mixer keeps twelve wheelbarrows busy feeding it with material.

The industrial railway has been found not only to reduce haulage costs but has left the subgrade in such good condition that the work has been allowed to proceed smoothly and rapidly. One man is employed keeping the 2 miles of track in shape. The contractor figures that the total haulage costs run below 6 cents per ton-mile.

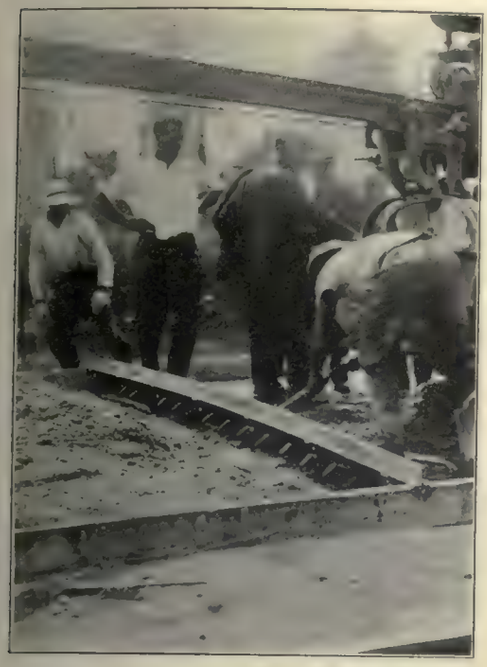
BETTER FINISH AT HALF THE COST

Instead of finishing and leveling the surface of the road by hand and template, a Baker finishing machine is used. As may be seen from the accompanying photograph, it runs on the steel side rails. It consists of five distinct and detachable parts, which facilitate moving from job to job. First are the two trucks, which run on the side rails, supporting the oscillating strike, vibrating and compressing pan, and the finishing float, all of which extend the full width of the roadway. Mounted upon one of the trucks is a 3-hp. gasoline engine, which transmits power to oscillate the strike and finishing float, and also to vibrate the pan. It also revolves drums which pull the machine forward by means of cables attached to the side rails. The strike can be raised or lowered by means of a lever, which enables the operator to feed back to the vibrating pan sufficient material to make a smooth, compact surface. The vibrating pan can be adjusted to increase or decrease both the amount of compression and vibration, and these changes are necessary in order to take care of the wide variation in the quality of materials. On this work, behind the concrete mixer,





GRAVEL IS BOTH WASHED AND SCREENED AT THIS CONVENIENTLY ARRANGED PLANT



STEEL EXPANSION JOINT IN POSITION

there are used two graders, the finishing-machine operator, and one man to dress up the edges of the road before taking down the side rails. It has finished as high as 600 linear feet of this 16-ft. roadway in a working day, and a regular progress of 500 ft. or more is secured. The machine is raised slightly when crossing the steel expansion joints.

The engineers in charge state that the finisher gives a better concrete surface than is obtained by hand, due to the tamping obtained by the machine vibrators. That it effects a considerable saving in labor as compared with the hand method of finishing is shown in the accompanying table.

Armored joints, with Elastite expansion material, are spaced 30 ft. apart. Baker steel side rails are used. Two men are able to keep this part of the work moving as rapidly as the rest of the job and are also able to take care of the grade stakes.

The work, which was awarded in June, will be finished about Sept. 1. The contract price was $60,000. An idea of the rapidity with which progress is being made may be gleaned from the fact that an average of

COST OF FINISHING BY HAND AND BY MACHINE

By Hand

	Per Hour	10 Hours
2 graders at	$0.25	$5.00
5 strike men at	0.225	11.25
2 helpers at	0.225	4.50
2 finishers at	0.50	10.00
One hour overtime for finishers to catch up at end of day and noon		1.00
		$31.75

By Machine

3 graders at	$0.25	$7.50
1 machine man at	0.35	3.50
1 finisher at	0.50	5.00
Gasoline and oil per day		0.20
		$16.20

800 sq. yd. of concrete is being laid per 10-hr. day.

PERSONNEL

The R. D. Baker Company, Detroit, is the contractor. Mr. Baker's construction superintendent is Frank Longman. Frank B. Tanner is the inspector for the county and Martin De Glopper is the county engineer.

Eye Is Best Means of Controlling Consistency of Mix

This Contention Made by Company Which Produces Large Quantities of Reinforced-Concrete Pipe

EYE MEASUREMENT, so the Lock-Joint Pipe Company, of New York, contends, is the best method of controlling the quantity of mixing water for concrete in thin sections wherever the highest grade of workmanship is required. The company's product consists of reinforced-concrete pipe, which is subjected to severe inspection because every length can easily be examined in the casting yard. Segregation of aggregate, lean mixtures, excess of laitance are all readily apparent. Every batch, too, shows up in the product practically by itself, so that a dry batch will not be helped out, as in mass work, by a following wet one. Furthermore, much of the pipe is used under pressure, which necessitates most thorough mixing, besides puddling and proper grading, in order to stand the service. As to thorough mixing, also, the company contends that the eye is the best judge.

As a result of long study the company has demonstrated to its satisfaction that even the variation in moisture in different parts of sand banks affects the consistency of mix, and, therefore, the character of product. For this reason it has discarded water-measuring tanks, since the variations required cannot with these tanks be made until a batch has been discharged and its consistency observed to be unsatisfactory. In mass work this batch, somewhat too wet or too dry, is brought to average by preceding and later batches. The company found that for its work constant manipulation of measuring tanks was necessary, and that even then the moisture content of the aggregate varied so much that the measuring tank necessarily lagged behind the vagaries.

OPEN MIXER USED

To carry its theories into practice the company has equipped itself with the open type of mixer, such as the Little Wonder and the Big and Little. One of these mixers is shown on pages 177 and 178. The batch is dumped by revolving the axis of the drum through an angle of 180 deg., so that it will discharge on the opposite side of the truck. It is apparent that a man standing on a platform somewhat above the level of the bed of the truck on which the mixer is mounted can watch closely the progress of the mixing.

Before proceeding, it should be remarked that the company also has a theory as to the order in which the ingredients of a batch should go into the drum. Instead of putting in the aggregate and the cement first and finally the water, it is the company's practice to put in the water first and then the cement. After this has been turned half a dozen times, securing a uniform thin grout the aggregate is added. It is the company's contention that more even distribution of the cement is insured by this practice than with other systems of charging.

CONTROLLING THE MIX

Returning to the method of controlling the mix, it is the practice to mount the mixer operator on the charging platform, shown in the illustrations. From a handy barrel he throws into the mixer a quantity of water somewhat less than he thinks will be necessary. Next the cement is put in and, after some turns, the aggregate. Watching the progress of the mix carefully he adds water as is needed to bring the mass to the desired consistency, and when it is entirely homogeneous, dumps it.

As a further check on the correctness of the mix, it is discharged in the first instance not into barrows or carts for transportation to the forms, but into a large pan, where the consistency can further be observed. If the consistency is not correct the batch is discarded.

In order to use the open type of mixer economically the company has devised special charging barrows and certain auxiliary kinks which are described in this issue under the heading "Hints to the Contractor."



NARROW-GAGE TRACK LAID WITHIN ROADBED LINES ON MICHIGAN ROAD JOB

METERS IN MEMPHIS now number 15,190, 1704 having been installed during 1914. During the year 1269 meters were repaired, 1281 were changed, 18 were started that had stopped, 301 leaking meters were repaired, 576 were inspected and found in order, 28 were repaired in the ground, 16 broken meter boxes were replaced and 101 lids were replaced.

Continuity of Policy and Experienced Personnel Necessary for Service Boards

These Principles and Single Commission Urged Upon New York Constitutional Convention by Committee of Engineers

IN ORDER to carry out the views of the Committee of Engineers representing National and local engineering societies (printed in the Engineering Record of May 1, 1915, page 561), Olin H. Landreth, professor of engineering in Union College, has introduced an appropriate amendment in the New York State Constitutional Convention. Professor Landreth, by the way, is the only engineer delegate to the convention. The sub-committee on public utilities of the Committee of Engineers has now addressed a letter to the committee on public utilities of the convention, urging the importance of the features embodied in this amendment, which is but one of several offered as a solution of the public-service control problem. Because of the importance of the subject and the fact that the amendment is being urged by those whose engineering training and familiarity with both public-service companies and public-service control enables them to speak with authority, the amendment and the sub-committee's letter are here reproduced in full.

THE AMENDMENT

The amendment is as follows:

"A public service commission of five members shall be appointed by the Governor by and with the advice and consent of the Senate. Each commissioner shall hold office for ten years. The terms of the commissioners shall be so arranged that the term of one member shall expire upon the first day of February in alternate years. Each commissioner should have had experience in connection with public utilities which would fit him for the duties of the office.

"The commission shall regulate and supervise all common carriers, all water supply, irrigation, drainage, gas, power, lighting, heating, intelligence-transmitting and other public utility corporations operating within the limits of New York State, including similar activities on the part of any other State department or political subdivision of the State.

"Removal by the Governor of any commissioner should be made only after the filing of charges and after affording the accused an opportunity to be heard in the matter, provided, however, that at any time within the first six months after making an appointment the Governor may exercise the power of summary removal. A successor to a commissioner who has been removed should be appointed to fill the unexpired term.

"Vacancies caused by removal or otherwise should be filled under conditions similar to those governing original appointment."

SUB-COMMITTEE'S LETTER

The letter of the sub-committee, signed by Charles Whiting Baker, as chairman, Gano Dunn and W. W. Brush, is as follows:

The thing which we consider of greatest importance in any plan for organization of a State public utility commission is the preservation of the principle of continuity already established in the present public service commissions. By this we refer to the system whereby the term of office of the members of the commission expire at different times, so that only one member of the commission at a time goes out of office. Under this plan, a new member has the advantage of association with colleagues who have had years of experience in the work. Thus the plans, policy and methods of the commission are continued with only such gradual change as experience may develop, and without the delays and unnecessary, and at times undesirable, changes which would be certain to occur if the entire membership of the commission were changed at one time.

Experience has proved also that under this form of organization the staff of the commission is a permanent, organized body. It can readily be understood that with the great responsibilities laid upon the public service commission, the members of the commission must devote their time to questions of general policy and the detail work must be done by the commission's staff of engineers, attorneys, accountants, etc. The character of the work done by the commission will depend very much on the sort of men it secures for its staff, and it can secure very much better men if those appointed hold their positions continuously as long as they display ability in the discharge of their duties.

If, however, a change were to be made in the public-service law so that an entirely new commission would be appointed with each new gubernatorial administration, there would be danger not only that the commissioners would be appointees without the experience and knowledge necessary to formulate and carry on a sound constructive policy, but that the principal employees of the commission would be changed for political or personal reasons with the coming in of each new commission.

QUALIFICATIONS OF COMMISSIONERS

The second important thing that we would urge upon your honorable body is the embodiment of some provision in the Constitution setting forth the general qualifications which candidates for the position of public service commissioner should possess.

There is no doubt that State and Federal control of those monopolies generally known as public utilities is here to stay; but it is a serious question whether these great powers of control will be so wisely and justly exercised that on the one hand the public will be satisfied and on the other hand the public utility corporations may be able to continue in business and meet the requirements placed upon them.

The vast responsibilities placed upon these public service commissions are hardly realized as they should be. Upon their proper handling of the very difficult questions before them depends the welfare, the prosperity, the safety of millions of people.

It is unfortunately the case that many of the appointments to State public service commissions have been of men who had not sufficient experience or ability to properly fill these positions. We have, therefore, proposed for incorporation into the Constitution the requirement that any man appointed to membership in the public service commission "should have had experience in connection with public utilities which would fit him for the duties of his office."

The questions which come before a public service commission require for their intelligent decision intimate acquaintance with technical matters, financial matters, commercial matters, legal matters. There can be no question that men who are already familiar with matters of this sort from experience in the management of public utilities can render much more valuable service in the control of these utilities than men who are without such experience.

BROAD-MINDED MEN TO BE HAD

There are to be found among those connected with public utility companies men with as broad conceptions of public rights and of the duties to be fulfilled to the public as can be found in other walks of life. We believe that such experienced men, knowing well what can be done and what cannot be done, would be able to deal more firmly with the companies than would members of a commission who lacked such technical experience.

It should be understood, moreover, that the constitutional requirement we have suggested—previous experience in connection with public utilities as a requisite to a commissioner's appointment—is not to be construed as a rigid limitation upon the Governor's discretion in making appointments. The responsibility would properly be upon the Governor to judge as to how much experience was requisite to fit a candidate for appointment. The value of such requirements embodied in a statute, or a constitution, is that they define the requirement which the Governor should have in mind in the selection of candidates. It is not pretended that this requirement or any other which could be framed could prevent the selection of unfit candidates. It is believed that such clauses are of value, nevertheless, in setting up a standard to which most men in the long run will seek to conform.

ONE PUBLIC SERVICE COMMISSION

The third important feature of our recommendation is that there should be one public service commission for the whole State instead of two as at present, it being understood that under such a proposed reorganization the work of constructing and administering the New York City rapid transit system would be transferred to the city, which now owns the system, and would cease to be a State function.

New York is the only State which has two separate public service commissions. The reason why New York has two commissions has to do with conditions which existed a quarter century ago and which do not exist at the present day.

Great as is the task of controlling in the public interest all the public utility operations of the Empire State, it is certainly much more easily within the powers of a single commission of five men to do this than it is within the powers of the seven men of the Interstate Commerce Commission to control the utilities of the entire nation, with its population of a hundred million. By having a single commission for the entire State, moreover, certain difficult questions as to division of responsibility between the two commissions are set permanently at rest.

While we heartily believe in this feature which we have recommended, we consider

it unimportant in comparison with the other two features which we have discussed above. If your honorable body shall see fit in its discretion to provide for the perpetuation of the principle of continuous organization in the control of public utilities, and shall provide that public service commissioners shall have had previous experience which would fit them for the duties of their office, the main purposes of our committee will have been accomplished.

Diagrams Facilitate Estimating Highway Bridges

G. F. Burch Plots Curves for Steel and Concrete Required in Standard Spans of Illinois Highway Department

HELPFUL diagrams for use in the selection of the most economical type and in making estimates for highway bridges have been plotted by G. F. Burch, assistant bridge engineer, Illinois Highway Department, based upon the standard plans of bridges prepared by that department and the quantities of material in many standard designs. These diagrams, which were published in the June issue of "Illinois Highways," give the weight of steel and the amount of concrete in steel truss spans from 50 to 160 ft. long, with a 4-in. concrete floor, in reinforced-concrete girder spans from 30 to 60 ft. long, and in reinforced-concrete slabs from 5 to 30 ft. long. In addition curves are given for the amount of concrete in the abutments, both plain and reinforced.

The following abstract includes the essential data for all except the reinforced-concrete abutments, which are omitted because of limited space and the fact that the weight of the steel reinforcement is not given and no detail plans are included. The curves given are for quantities only. The cost of labor and material must be determined for each and every job and applied to the given quantities, which are intended primarily for use in the field.

Material in Superstructures

The steel trusses are of the ordinary Pratt truss type with parallel chords and riveted connections. The design provides for a 4-in. concrete floor, with a wearing surface assumed to weigh not less than 50 lb. per square foot. On account of the weight and rigidity of the concrete floor no allowance is made for impact. Floor systems are designed to carry a 15-ton traction engine in addition to the dead load. Trusses are designed to carry a uniform load of 100 lb. per square foot of road surface for spans from 50 to 150 ft., and a uniform load of 85 lb. for spans exceeding 150 ft. long. The usual A. R. E. A. unit stresses are used in the design. Pony trusses are used for spans of from 50 to 85 ft., and through trusses for spans of from 90 to 160 ft.

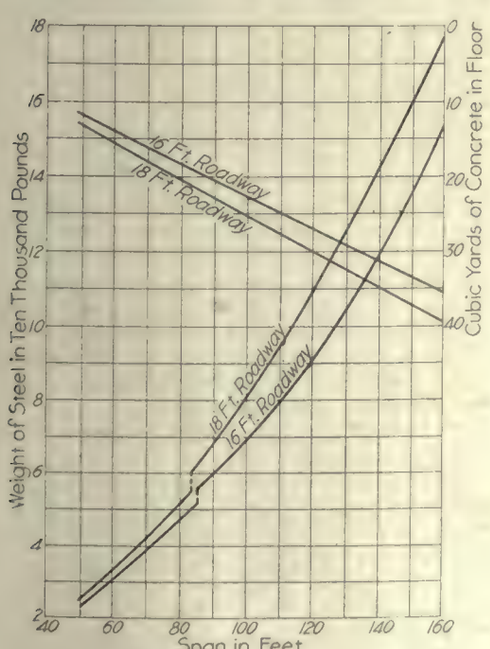


FIG. 1—STEEL TRUSS SUPERSTRUCTURES

Fig. 1 gives the curves for the weight of structural steel, and the yardage of concrete in floors, for 16 and 18-ft. roadways. The break in the steel curves is at the point where the change is made from low to high trusses.

Reinforced-concrete through girders are used for spans of from 30 to 60 ft. This type of structure is designed to carry either a uniform load of 125 lb. per square foot, or an engine load of 24 tons. The design provides for a wearing surface weighing 50 lb. per square foot. As free expansion and contraction are allowed by the cast-iron rockers placed under each girder at one end of the spans, the allowable unit stresses used are quite high. Designs are figured for a steel stress of 16,000 lb. per square inch and a compression stress in the concrete of approximately 1000 lb. per square inch. A maximum unit shear of 120 lb. per square inch is allowed. Stirrups are provided for all shear in excess of 40 lb. per square inch. Fig. 2 shows curves giving the quantities of concrete and reinforcing steel for 16, 18 and 20-ft. roadways.

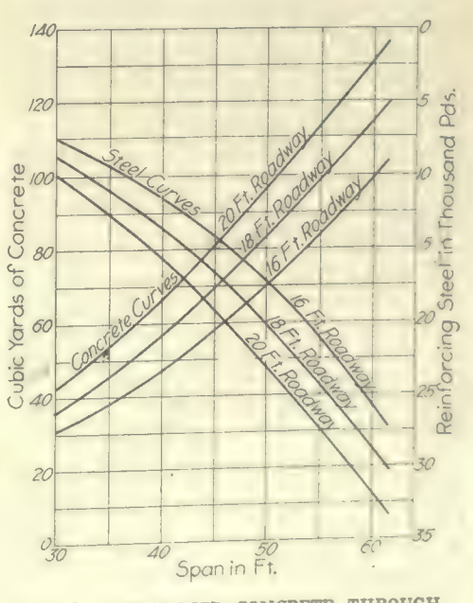


FIG. 2—REINFORCED CONCRETE THROUGH GIRDER SUPERSTRUCTURES

For spans less than 30 ft. the slab type of construction has been found to be somewhat cheaper than the girder type, due to the fact that the arrangement of the steel is much simpler and less steel is used per cubic yard of concrete. It has not been found practicable to make provision for free expansion of slabs. Accordingly, a stress of 12,000 lb. per square inch of reinforcing steel is allowed for dead-load and live-load stresses. The concrete stress is 800 lb. per square inch. Slabs are designed for the same live load as girders. Fig. 3 gives the quantities of concrete and steel in slabs having clear roadways of 16, 18, 20, and 24 ft., for spans of from 5 to 30 ft.

Plain Concrete Abutments

In preparing curves to show the quantities in abutments it was found that there were many variables which might be considered, but which if used would produce such complex formulas as to make the curves of little use in the field. It was found that curves giving reliable results might be obtained by plotting the cubic yards of concrete in two abutments against a formula which represented a measure of the quantities desired. The variables in this formula are H, height of abutment from bottom of foundation to top of roadway; R, clear width of roadway on superstructure, and W, length of average wing wall. For plain concrete abutments the best results were obtained by using the term $H^2\ (R+2W)$.

Plain concrete abutments for steel bridges are designed with a footing width of one-third of the height over all, and the thickness of the footing is usually from 18 to 24 in. The width of the base of the

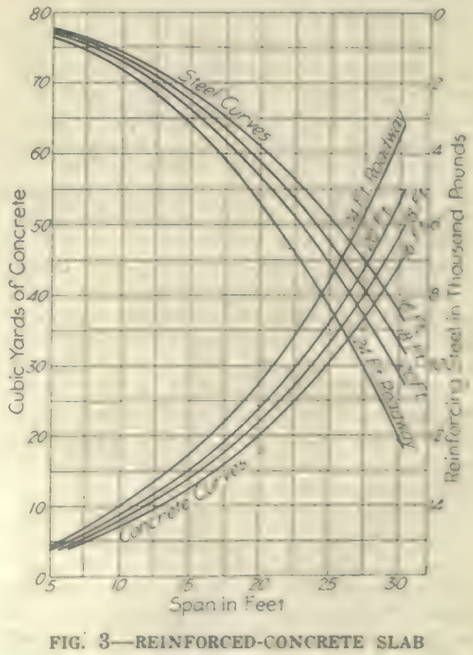


FIG. 3—REINFORCED-CONCRETE SLAB SUPERSTRUCTURES

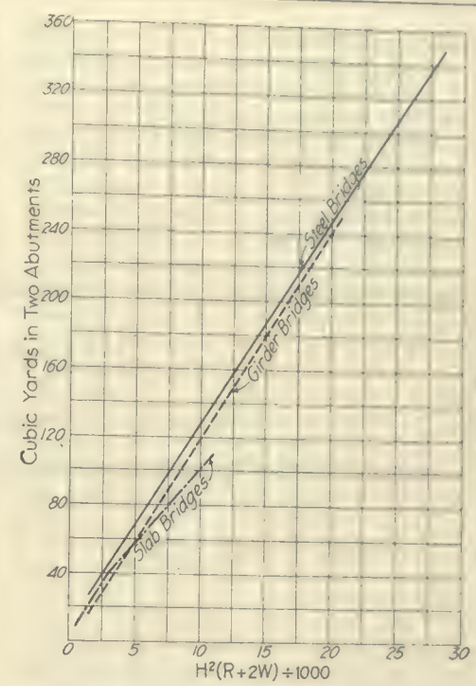


FIG. 4—PLAIN CONCRETE ABUTMENTS FOR THREE TYPES OF BRIDGES

abutment and wing walls at the top of the footing is made approximately one-quarter of the height of the walls. The back of the abutment wall is vertical and the face of the wall is battered to a top width of from 30 to 38 in. The wing walls are battered on both sides and have a top width of 12 in. Fig. 4 shows the curves from which the yardage of plain concrete abutments for steel bridges may be obtained. When field measurements are made to determine the necessary height of abutments, and the width of roadway is decided upon, it is easy to estimate the length of wing walls which will be required. These figures are then used in the formula and the yardage of concrete is read directly from the curve.

The design of plain concrete abutments for girder bridges is similar to the design for steel bridges, except that the wing walls are battered on the face side only, and the top width of the abutment wall is 18 in. Fig. 4 shows the curve from which quantities for this type of abutment are obtained. Plain concrete abutments for slab bridges differ slightly from the preceding design. The width of footing on the abutment wall is limited only by the safe bearing capacity of the soil, with a minimum of 3 ft. This width may sometimes be less than one-third of the height. This is deemed to be safe on account of the restraining effects of the superstructure. The top width of the abutment wall is 12 in. and the curve for estimating the yardage is shown in Fig. 4.

When these curves are used for plans based on the Illinois Highway Department's standards, the maximum error for superstructures is only about 3½ per cent and for substructures about 5 per cent.

Yellowstone Park Automobile Regulations Now in Effect

REGULATIONS governing the admission of automobiles into the Yellowstone National Park for the season of 1915 became effective Aug. 1. The park is open only to such automobiles as are operated for pleasure, and not to those carrying passengers who are paying for the use of the machine. Motorcycles are not permitted to enter the park. Tickets for passages must be secured and paid for at the checking station where the automobile enters the park. These will show name of owner, license number of automobile, name of State issuing license, make of machine and manufacturer's number, name of driver, seating capacity and number of passengers.

Muffler cut-outs must be closed while approaching or passing riding horses or horse-drawn vehicles, camps, hotels, or soldier stations. The machines, while in motion, must not be less than 100 yd. apart, except for the purpose of passing, which is only permissible on comparatively level or slight grades. All machines, except while shifting gears, must retain their gears constantly enmeshed. The machines on entering the park must be in good working order. There must be sufficient gasoline in the tanks to reach the next place where it can be obtained, and two extra tires must be carried.

Speeds are limited to 12 miles per hour, ascending, and 10 miles per hour, descending, steep grades, and to 8 miles per hour when approaching sharp curves. On good roads, with straight stretches, and when no team is nearer than 200 yd., the speed may be increased to 20 miles per hour. Horns must be sounded at all curves where the road cannot be seen for at least 200 yd. ahead and when approaching teams or riding animals. Teams have the right-of-way, and automobiles must be backed, or otherwise handled to enable them to pass with safety. In no case may automobiles pass animals on the road with a greater speed than 8 miles per hour. Fines or other penalties will be imposed for the arrival of automobiles at any point before they are due to arrive, according to an established schedule which is published with the regulations.

These regulations and schedules do not apply to automobiles passing over the country road in the northwest corner of the park, en route for the town of Yellowstone.

Literature

For the Civil Engineer and Contractor

New Publications

PRACTICAL TRACK WORK. By Kenneth L. Van Auken. Cloth, 5½ x 8 in.; 216 pages; illustrated. Chicago, Railway Educational Press, Inc. $1.50.

WATER SUPPLY PAPER 342—Surface Water Supply of the Yukon-Tanana Region, Alaska. By C. E. Ellsworth and R. W. Davenport. 343 pages, illustrated, 2 inserts.

GUIDE TO THE REPORTS OF THE ROYAL COMMISSION ON SEWAGE DISPOSAL. By G. Bertram Kershaw, engineer to the commission. Cloth: 5¼ x 8¼ in.; 178 pages. London, P. S. King & Son, Ltd. $1.25 net.

PROGRESS REPORTS OF EXPERIMENTS IN DUST PREVENTION AND ROAD PRESERVATION, 1914. Bulletin 257, U. S. Department of Agriculture. Paper; 6 x 9 in.; 44 pages, 25 tables. Washington, Government Printing Office.

OIL-MIXED PORTLAND CEMENT CONCRETE. By Logan Waller Page, director, Office of Public Roads. Bulletin 230, U. S. Department of Agriculture. Pamphlet 6 x 9 in.; 26 pages, illustrated. Washington, Government Printing Office.

Books Reviewed

Catalog of Technical Periodicals

Compiled for libraries in the city of New York and vicinity by the assistant librarian, Alice Jane Gates, with the co-operation of a committee of the New York Library Club. Cloth; 8 x 10½ in.; 110 pages. New York, Library Board of the United Engineering Society. $3.

Following the original suggestion of Dr. John Shaw Billings, made in February, 1911, to W. P. Cutter, librarian of the Engineering Societies, this catalog was begun and has just been completed. It is a valuable aid to those engineers who are searching technical periodicals, as it gives the location of the sets of periodicals and transactions to which they may wish to refer. The book is the result of the authorization and approval of the governing body of the Library Board of the United Engineering Society, and contains about 2600 main entries and cross references, with an entry for all general indexes, and a statement of the library or libraries in which each periodical may be found.

The following libraries are included:

The New York Public Library, the Library of Columbia University, the Library of the American Society of Civil Engineers, the Library of the Chemists' Club, the Library of the Stevens Institute of Technology, the Public Library of Plainfield, N. J., and the Library of the Engineering Societies.

This work is part of an extensive plan to include, ultimately, other sections of the United States and Canada. The question of a subject classification of all engineering knowledge is also being considered, and it is hoped that a more satisfactory system than the present inadequate Dewey decimal system will result with the publication of a subject index. This first book is well printed, and is arranged to facilitate the location of references. In giving the history of changes of names of old periodicals it is of general interest in addition to its value as a reference work.

Conservation of Water by Storage

Author, George Fillmore Swain, LL.D., Gordon MacKay professor of civil engineering in Harvard University. Cloth, 7 x 10 in.; 384 pages, 91 illustrations. New Haven, Conn., Yale University Press. $3 net.

Reviewed by Morris Knowles
Consulting Engineer, Pittsburgh

Occasionally there appears a work which marks an epoch in the field of endeavor to which it belongs, and which therefore stands pre-eminent in that field. Such a work is the book entitled "Conservation of Water by Storage," for which we are indebted to Dr. George F. Swain, Gordon MacKay professor of civil engineering in Harvard University, past president of the American Society of Civil Engineers, Chairman of the Fourth Conservation Congress, etc. The volume comprises a series of lectures given by Professor Swain at Yale University in 1914, the composition of the book being such that these essays constitute a coherent and perfectly balanced treatise.

The work discusses the fundamental aspects of conservation from the point of view of public welfare and enlightened citizenship and omits any discussion of the subordinate matters of design and construction. It is readable, being popular rather than technical in character, which should add greatly to its usefulness.

Neither the facts used, nor the conclusions reached are, for the most part, new. The author quotes extensively from the leading reports on conservation, and from the opinions of prominent conservationists. But in a field where much of the discussion has been characterized by confusion of issues, ignorance of fundamentals and fallacious reasoning, the work is pre-eminent in its convincing logic and in its clear-sighted refusal to be misled by the dilemmas arising from considerations which, though of importance, are shown to be foreign to the real subject.

The opening chapter deals with conservation in general and the facts concerning waste of our natural resources are brought out succinctly and with startling emphasis. The true conservationist is defined as he who believes in the avoidance of preventable waste, in contrast to the "so-called" or "self-styled" conservationist who confuses all sorts of social, economic and govern-

mental policies with conservation; and this idea is insisted upon and often reiterated throughout the book.

The relations and differences between water and other natural resources are discussed in chapter 2. Natural resources are divided into three classes from the point of view of conservation: (1) "Those resources which are not renewable," e. g., mineral deposits; (2) "Those resources which are self-renewing, though at a comparatively slow rate, requiring considerable time for a complete renewal," e. g., forests; (3) "Water power falls in a different class from either of the above. . . . While resources of the first two kinds, if not utilized, are in general stored and preserved for the use of future generations, water power, if not utilized, is constantly wasting with no good results to anybody."

The author then points out that the use of water not only prevents its own waste, but such use replaces an equivalent amount of fuel which is thus conserved. He states that, "Any use is better than no use at all, because every use conserves a non-renewable resource and is also or may also be made an aid to navigation. In one case, therefore, our guiding principle is restriction. In the other case it is the encouragement of the greatest possible development. If any one disagrees with this proposition he must disagree with it, not as a conservationist, but from some other point of view."

The author then goes at length (chapters 3, 4 and 5) into the legal and legislative aspects of the "water-power question," with particular reference to the controversy over Federal control of water power. This part of the work is without doubt the most thorough digest and discussion of this matter ever presented in a single work.

The important distinction is clearly drawn between the rights of the government, as owner of public lands, or of riparian lands, and rights purchased at dam sites on navigable streams—and its constitutional power to regulate commerce. The limited application of this latter power to private development of water on navigable streams is convincingly argued. The General Dam Act and the water-power policy of recent administrations are criticised in detail, and it is shown that they have discouraged, rather than encouraged, water utilization, and thus have hindered true conservation.

Finally, the author submits a constructive program for a water-power policy designed to promote water conservation, both on government-owned and privately-owned riparian lands.

Chapter 6 deals with "The Technical Aspects of Conservation," and in a pleasing style presents the various uses of water storage, the fundamental technical problems confronting the hydraulic engineer, the effect of storage on the uniformity of stream flow and the use of water as a source of power for water supply, for irrigation and for navigation.

The discussion on "Forests and Stream Flow," in chapter 7, is perhaps the most remarkable in the book. Dr. Swain attributes the confusion which has obscured this subject largely to the attempted use of inductive reasoning on a problem which can be solved only by deduction. The manifest error of extremists on both sides is emphasized and the conclusion is reached, in a manner which should convince the most skeptical, that the truth lies somewhere in the middle ground; that forests do regulate stream flow to some extent, and that upon steep mountain sides especially they exercise a restraining effect upon run-off and are of inestimable benefit in preventing erosion of the soil.

The work closes with a chapter on "Floods" which is both descriptive and technical. An analysis of the methods of flood prevention is presented and its relation to water conservation discussed. In general, stress is laid upon the importance of a thorough and comprehensive engineering investigation of each particular case.

The reader is introduced to the volume by a quotation from Bacon:

"Read not to contradict and confute, nor to believe and take for granted, nor to find talk and discourse, but to weigh and consider."

It is earnestly to be hoped that many will heed. A study of this volume should prove invaluable to legislator and engineer alike.

Building Code Recommended by the National Board of Fire Underwriters

Fourth Edition Completely Revised, 1915. Flexible cloth; 5 x 7½ in.; 326 pages, illustrated. New York, National Board of Fire Underwriters.

This noteworthy attempt to produce a standard building code of such excellence that it will recommend itself to all city authorities and tend to bring about much-needed uniformity in such codes, is issued by the committee on construction of buildings, and written by Ira W. Woolson, consulting engineer of the National Board of Fire Underwriters. It incorporates the most advanced requirements in fire-protective building construction, and in the field of materials and allowable working stresses has taken a firm stand for conservative and safe standard practice. The many principal points in which this new edition is an improvement over the old were mentioned in the announcement in the Engineering Record of June 5.

The requirement for a certificate of occupancy stating the purpose of use, maximum allowable live load and maximum number of persons allowed per floor, and prohibiting use for any other purpose marks a distinct advance in code regulations. Change of occupancy is permitted only under a new certificate. In classifying buildings both according to construction and by occupancy, the code is well written and definite. The requirements for fireproof construction contain severe limitations on the use of combustible materials.

The limiting allowable thicknesses for brick walls are clearly shown by diagrams and tables. Hollow-block construction is permitted for all walls except party and fire walls in buildings not over 40 ft. high, the minimum thickness being the same as for brick walls. Instead of limiting the thickness of the terra-cotta hollow blocks, the allowable stress is based upon the gross sectional area of the bedding faces. Factors of safety of 10 are prescribed, and minimum average test values given for use with cells vertical and cells horizontal. Comparing these with the newly adopted requirements in the New York code, it is seen that the latter allow a lower value for cells vertical (100 vs. 120) and a higher value for cells horizontal (50 vs. 30). It is worthy of comment that the New York code allows 150 lb. per square inch on hollow concrete blocks filled with concrete, an increase of 100 per cent, while the proposed code of the National Board makes no increase in allowable stress; an explanatory note states that tests have not shown sufficient gain due to filling with concrete to warrant recognition.

TABLE OF ALLOWABLE UNIT STRESSES IN TIMBER

	Bending		Compression	
	Extreme Fiber Stress	Maximum Longitudinal Shear	Perpendicular to the Grain	Parallel to the Grain with l/d less than 10
Oak	1,400	120	400	1,000
Yellow pine, Grade I	1,600	120	350	1,200
Yellow pine, Grade II	1,200	85	300	900
Douglas fir	1,400	100	300	1,100
Eastern spruce	1,000	75	200	900
Western hemlock	1,200	75	250	1,000
Norway pine	1,000	75	250	800

l = unsupported length in inches
d = diameter or least side in inches

Where a moderate increase in deflection after first placement of the load is not objectionable, the compression and extreme fiber stresses here given may be increased 10 per cent. Stresses for timbers subject to vibration and impact should not be thus increased.

Except for shear, the same stresses may be used for Douglas fir of grades I and II as for yellow pine of grades I and II, provided the fir is selected in a manner to insure material of corresponding quality.

The sections specifying allowable floor areas between fire walls very properly increase the allowances by large percentages when sprinklers are used. The method of limiting the area according to the number of frontages on streets is an excellent principle. The limits to height are conservative and probably would prove to be a source of difficulty if introduced into any proposed city code. Provisions for safety egress, specifying size of doors, number and width of exits, and ruling against elevators, escalators and revolving doors as fire exits are included. In the treatment of outside stairways, fire or smoke-proof towers, and details of their construction, the code is most complete and represents the best requirements in this direction.

The sections treating materials and allowable working stresses follow the usual standard practice. The A. R. E. A. straight-line formula for steel columns is specified, except that the maximum allowable unit stress is made 13,000 instead of 14,000. This requirement is wholly justified by results of recent tests, which show that for l/r below about 50, the crippling load, is practically constant. In this respect the code is superior to the revised New York code, which prescribes the same formula without any maximum upper limit whatever. Both codes use the same formula for cast-iron columns.

The allowable stresses in timber are based upon the latest reports of the U. S. Forest Service and definitely abandon the terms longleaf and shortleaf yellow pine in favor of precise grading rules. This is a most advisable move. The inclusion in the Appendix of the grading rules proposed by the U. S. Government materially adds to the value of the volume, and should result in the more general adoption of this scientific method of grading yellow-pine timber. The timber unit stresses mark so important a change in practice that they are here given in full. They apply only to seasoned timber kept in a dry location.

The requirements for reinforced-concrete construction and working stresses follow the Joint Committee recommendations. Especially conservative are the specified bending moments in two-way flat slab construction on girderless floors, when compared with the allowable values in the new Chicago code. The provisions include limit-

ing the time for removal of forms, and to prevent freezing are to be commended. The recommended strength tests for floors and factor of safety based upon third-point loading mark a notable advance in test methods.

The complete treatment of the subjects of interior vertical openings, provisions for light and ventilation, and for automatic sprinklers, together with the beam tables in the appendix and the suggestive explanatory notes and references scattered throughout the text make the book most satisfactory as a helpful guide to the best modern thought on the subject of proper building laws for cities.

Letters to the Editor

Comment on matters of interest to engineers and contractors will be welcomed

Sloping Versus Curved Crowns for Highways

SIR: The interest of the writer has been attracted to the experiments of S. C. Marcus of Watsonville, Cal., one of the supervisors of Santa Cruz County, in constructing country roads with a sloping crown rather than with a parabolic-curve or circular-curve method. Mr. Marcus has used successfully a straight slope from the center each way to the sides. He has constructed some 8 or 10 miles of this kind of road, a considerable part of which is a type of oil macadam similar to that used in this section of California. This road presents a firm, smooth asphaltic appearance. The slope used, noted above, has been ample for drainage purposes, and the road does not present an unsightly appearance.

It appeals to the writer that such a type of crown has many advantages, and that the familiar circular type has many disadvantages. Particularly is this true of country roads which have to bear high-speed automobile traffic. The arguments which appeal to the writer in favor of this sloping type of crown over the circular type commonly used are:

1. It is possible, by using this type of road, to do nearly all of the grading and spreading with a road grader or a drag. This advantage is fairly obvious and in practice works out favorably to the sloping type.

2. A much more uniform distribution of traffic is obtained.

3. The pleasure of riding on the road is greatly enhanced. With an automobile passing any other vehicle and traveling at the rate of 20 miles an hour, as the automobile approaches the edge of the curved road there is a distinct falling tendency, also a tendency to skid, which is felt unpleasantly by the occupants of the machine.

4. Any extra widening in the roadway is much more easily accomplished.

5. By reason of the better distribution of traffic and the elimination of the skidding action, maintenance charges on the road should be considerably reduced.

6. The flat place in the center of the road which is commonly used by a large percentage of the traffic is entirely eliminated. There is too little slope over the center of the road in the present type of crown used, which makes a rather serious lack of drainage.

There is no perceptible difference from an æsthetic standpoint in the appearance of the two classes of road. Should it be desired to construct gutters which would keep drainage off the roadway, this may be easily done by dishing them slightly or sloping them more rapidly. The rate of slope could, of course, be changed to meet conditions, but that used by Mr. Marcus has worked out very satisfactorily.

The matter of a more equitable distribution of traffic should appeal very strongly to engineers.

The writer should like to hear a discussion of this matter.

W. S. FARLEY.

San Francisco.

[The Engineering Record joins with Mr. Farley in hoping the subject will be discussed in these columns.—EDITOR.]

An Artistic American Water Tower

SIR: I note in the Engineering Record of July 10, page 48, under the heading "Appearance Considered in German Towers" some sketches, together with a description of two concrete water towers designed by a German engineer. Lest your readers feel that we have to go to Germany for artistic designs of water tanks, I am inclosing a photograph of the Riverside (Ill.) water tower. This structure seems to be more pleasing in appearance than the towers illustrated in your issue of July 10.



RIVERSIDE'S PICTURESQUE WATER TOWER

The brick tower was originally built in 1870 and supported a wood tank which was replaced once or twice and finally, in 1913, burned, although containing water At that time the city officials decided to put in a more permanent installation and retained Dabney Maury and Douglas Graham of Chicago as consulting engineers, with W. D. Mann as architect. Under their supervision the present tank was built by the Chicago Bridge & Iron Works.

The height of the brick tower was increased 20 ft. and a 150,000-gal. elliptical-bottom steel tank was installed. The steel plate roof and ornamentation at the top, as well as the new brick work, were all designed to carry out the appearance of the lower part of the brick tower as originally built, and the resulting structure is generally considered artistic in appearance, besides being substantial and absolutely watertight.

C. S. PILLSBURY,
Chicago Bridge & Iron Works.

Chicago.

Thin Concrete Base, Reinforced, for Pavements

SIR: With considerable interest I have read your presentation of the paper read by Prof. James S. Tucker, director of the School of Engineering of the University of Oklahoma, before the Iowa State Engineering Society. (See the Engineering Record of June 5, page 719.) While the matter will doubtless be discussed more ably by others, I wish to offer a few comments which seem pertinent, and to offer such arguments as occur to me, to prevent, if possible, the acceptance by younger engineers, or others, whose lack of construction experience and desire for an academic economy of construction may mislead them into errors which they will later regret, of any such ideas as are advanced by Professor Tucker.

The slabs used in the experiments were of but 27-in. span, which implies only the narrowest of trenches. A much worse condition would be given by a leaky water main in a street which might saturate the soil for many feet in area. The loads also are much less than would be encountered in ordinary street construction.

Consider, for instance, an asphalt truck of 5 tons or more capacity. Such a truck will weigh empty about 11,000 lb., with the weight about uniformly distributed on four rubber tires, each 10 in. wide, giving a load of approximately 2750 lb. on each tread for truck alone. The load hauled will often equal 15,000 lb., of which 10,000 lb. may be on the rear axle, giving an additional tread load of 5000 lb., or a total of 7750 lb. While it is true that this load is distributed over an area of probably 40 sq. in., due to the flattening of the rubber tires, there is nevertheless the shear upon the concrete to be cared for, and this is no doubt the direction in which the concrete will fail.

The practical method of applying this load is not by careful laboratory placing with even bearing, but at a speed of from

12 to 20 miles per hour with all the shock accentuated by the speed of the truck and the inequalities of the pavements or débris left thereon. And in this connection I will state that my observation shows that the shock of a truck loaded in this manner, as noted on the wood-block paving of a highway bridge, appeared eminently greater on both the paving and the bridge than the passage of a 35-ton, high-speed electric car over the same bridge.

The failure of a concrete base, as noted by the writer, occurs more often than any other way by the successive breaking down of the edge in front of a wheel or roller. The base continues to crumble ahead of the wheel until a place is encountered where the subgrade is hard enough to give adequate support. With the utmost care in preparation of subgrade some soils are of such a character that it is impossible to compact them in a permanently satisfactory manner, and absolute dependence must be placed on the base to support the traffic.

The results of tests made in other cities, as well as those conducted in connection with paving in this city, indicate that with the present methods of mixing concrete, even with the most careful proportioning of materials and accurate grading of aggregates, a compressive strength in excess of 1000 lb. per square inch for a 1:3:6 mixture, or 1500 lb. per square inch for a 1:2:3½ mixture should not be counted on for safe practice. Taking the shearing strength at half the compressive strength we should have 500 and 750 lb. respectively as the shearing strength to be depended on. The stresses to which a concrete base may be subjected are, however, so varied that it is almost impossible to reinforce for them all.

Also, in a somewhat extended experience I have yet to see the contractor's crew which would accurately set the reinforcement in a 3-in. slab when laying base at the rate of 15,000 or 20,000 sq. ft. per day, and unless the reinforcement is accurately set it certainly can have little value.

The statements that a "3-in. reinforced slab is easily as good as a 6-in. plain one," or that "wherever there is need for a 6-in. base one 3 in. thick with five cents worth of reinforcement will do equally as well," will, I believe, not be accepted by practical paving engineers, if applied to paving work. Nor will any engineer who has had experience with old, unknown fills or trenches, leaky water pipes or other defects of foundation difficult or impossible to provide against concur with the statement that we "need not assume that we must design to meet the non-supported condition in practice," for that is one of the assumptions that certainly must be made for a correctly designed paving within certain limits.

The statement of Mac Adam referred to, in which he states that a "well drained and compacted subgrade will bear any wheel loads that could be put upon it," seems to have been doubted by Mac Adam himself, as he promptly superimposed a wearing surface, usually about 12 in. thick, of stone, interlocked and compacted in a manner which brought fame to Mac Adam for all time. It is also to be commented upon that the wheel loads in 1815 were considerably less than those usual in 1915.

Another matter which has not been commented upon in Professor Tucker's article is the matter of cuts in the pavements for utility companies, or other purposes, and the repair of the same. Every city has to contend with this condition, no matter how well its affairs may be handled, and it is but the part of wisdom to prepare for it. For the ordinary repair it is necessary to depend either on the area of the patch for support, or on the mechanical interlocking of the new concrete base with the old, as adhesion is many times imperfect. It will be seen that the thicker the old base the greater will be the strength of the interlocking and also the opportunity for adhesion. As a practical matter a reinforced patch cannot be placed in a reinforced base unless it has an appreciable thickness, and then only with considerable difficulty.

In conclusion, I wish to say that I speak from knowledge of failures of 5-in. concrete bases of accurately and properly mixed 1:3:6 concrete in cases where the subgrade had been thoroughly drenched and then rolled with a 10-ton Macadam roller until practically unyielding, and where the causes of failure were shown to be as stated before, leaky water pipes, hidden springs or old trenches which the roller did not discover to usual inspection.

C. S. POPE,
Engineer of Paving, City of Los Angeles.
Los Angeles.

[The foregoing letter was submitted to Professor Tucker, who replies as follows. —EDITOR.]

SIR: I thank you for the opportunity to comment on Mr. Pope's letter, as well as thanking him for assisting me to emphasize certain points I am trying to make. I read his letter as chiefly dealing with three points: (1) That leaky water mains and wet spots due to other unknown and unseen causes are common; (2) that motor trucking introduces loads not contemplated in the tests described, and (3) that under these conditions pavement foundations have been wont to fail by crumbling ahead of the wheels until a sound subgrade is reached.

There is no argument on any of these points, certainly. Nor do they, in the writer's opinion, affect in any way the validity of the contentions he has heretofore put forth.

Mr. Pope says that on a poor subsoil the foundation must carry, or at least assist to distribute, the load. Assuredly so, but is this any argument for not economically strengthening the foundation? Or can anyone say that even the poorest and wettest subgrade will support nothing? Even water has a marked flotative power! It is plain that bridging out in every direction, as in a continuous slab, suitably reinforced, will assist the foundation to bear the loads otherwise likely to shear through the foundation into the soft subsoil. To hold otherwise is to say that plain concrete is as strong in tension as is concrete substantially reinforced.

It is further felt that the argument for accurate place of the reinforcement here lacks force. It is pertinent where the loads are of known intensity, of definite application, and the points of support or reaction are all clearly defined. But none of these conditions exist here. Hence it is believed that practically it is as reasonable to let part of the reinforcement lie near the top to strengthen against contraflexure as for it all to lie at the bottom of the slab, good only against downward deflection. Since in the practical use of the reinforcing fabric this is just what would usually happen, why not make a virtue of necessity and say that is just what is wanted, because it will always be impossible to tell at which points, precisely, it should lie at the top, and at which at the bottom?

And finally, referring again to Mac Adam's theory of soil support, Mr. Pope draws inferences from the facts quite different from those of the writer. He seems to say that he would put considerable reliance on the load-supporting capacity of a flat arch, built of chips and fragments of broken stone, bound together with water—an arch with no skewbacks or abutments. If the natural soil is not to be counted on as carrying anything under modern trucking, then the soil might be safely washed away from under such an arch with no bad effects on the traffic using it. It is suggested that there are no observations that will warrant such an assumption.

JAMES I. TUCKER,
Professor of Civil Engineering, University of Oklahoma.
Norman, Okla.

Cracking of Brick Pavements Is Prevented by a Mortar "Cushion"

SIR: It may be accepted as a general truth that vitrified brick pavements do not wear out but are destroyed. Though this precept is no doubt occasionally found not to hold, in the vast majority of cases there can be but slight error in the statement as above made.

Comment was made in the editorial pages of the Engineering Record under date of July 3, page 3, of a method of analyzing the causes of brick pavement failures. While the general scheme was therein outlined exceptionally well, it would perhaps be better at this time to review the question, throwing if possible some additional light upon it.

The writer suggests that anyone doubting the validity of the arguments there set forward, should take his hammer and examine the pavements in his own neighborhood. He will find that with but few exceptions the conclusions will be borne out. In these few cases the fault may lie elsewhere, either in too weak a grout, or, what is more probable, in a failure of the foundation. But it may be said with but small chance of successful disproval that few foundations fail. In an article in the Engineering Record under date of June 5, 1915, page 719, Prof. J. S. Tucker shows very conclusively that almost any soil is capable of sustaining the loads normally coming upon it.

It takes not much of an engineering imagination to see that in a type of construction, like the vitrified surface of a brick pavement, very slight deflections will put an extremely heavy compression in the top surface of the pavement. This compression will sooner or later destroy the grout at the top. In areas where the grout near the top has been disintegrated, it is almost universally found that the pavement is hollow, unless the disintegration has proceeded so far that the unsupported area has settled down upon the shrunken sand cushion.

Let the examiner proceed further with his hammer, striking the edges of the brick unsupported by grout. A few light blows will result in a spalling of the corners. Then proceed to a portion where the grout is still intact, due to the fact that the brick rests upon the sand cushion. He may easily

wear out his hammer and patience trying to break down the corner of a properly grout-protected brick.

The new specifications of the city of St. Louis contain the following clauses:

BEDDING COURSE

"*General*—The materials for the bedding course must be mixed in a machine satisfactory to the President of the Board of Public Service, or if by hand on a watertight mixing board or pan, or on a clean finished street pavement. Under no circumstances shall the mixing be done on foundation concrete. The materials shall be thoroughly mixed dry until a uniform color is obtained and shall be deposited in this condition.

"*Specific*—The bedding course shall be composed of one part of cement to four (4) parts of sand as specified under Fine aggregate, or clean limestone screenings, if screened to pass through a three-sixteenths (3/16) in. mesh sieve in every direction.

"The bedding course shall be laid not sooner than seven (7) days nor more than fourteen (14) days after the concrete foundation has been finished, unless weather conditions make necessary a longer time.

"The foundation concrete shall be swept clean. When clay or foreign material not easily removed with a dry broom is present, water shall be used.

"The Engineer will test such guides as the contractor may desire to lay for the support of the template which is to true up the bedding course. A guide shall be laid along the center of the street or on the track rail, and the guide at the curb may rest on the curbstone.

"The design for the template and guides for use in finishing the bedding course must be submitted to the President of the Board of Public Service before any of them are constructed, and only such types as he may approve shall be used.

"The bedding course mixture shall be deposited dry upon the concrete. It may be brought to approximate surface by means of shovels, lutes or rakes, but except in inaccessible places, must be finally surfaced by means of the template, the edge of which shall be three and three-fourths (3¾) in. below the surface of the finished pavement."

The writer does not desire to intimate that this is the final form of construction. A still further step in advance has been suggested and put into effect by W. T. Blackburn, consulting engineer of the Dunn Wire-Cut-Lug Brick Company, and Allan Jay Parrish, contractor, of Paris, Ill., who had developed a method of laying which finishes the entire pavement at one operation. [This was described in the Engineering Record of July 10, 1915, page 54.] On the green concrete foundation is spread a damp mortar cushion and immediately upon this course the brick are laid and grouted. The pavement is then a monolith with the bricks forming a structural part of the base, leading to an even greater distribution of load upon the sub-grade and permitting the earlier opening of the pavement by the time ordinarily required for the concrete base to harden. Incidentally the concrete will harden under better conditions, being protected from excessive evaporation by the brick wearing surface and making necessary only one period of sprinkling and protection—that is, the formerly usual period required for the hardening of the grout.

It is the writer's opinion that, under this method of laying, 3 in. of concrete and 1 in. of a mortar bedding course will be sufficient. The strength, as a slab, of 4 in. of grouted brick and 4 in. of concrete, is very nearly the same. In the old style of pavement there was a 4-in. layer of brick and a 6-in. layer of concrete, separated by a sand cushion, through which no horizontal shearing stress could be transmitted. These two layers, therefore, acted as separate structures, and the index of their strength would be $(4 \times 4) + (6 \times 6) = 62$, while under the new form the index would be $(4 + 1 + 3)^3 = 64$.

Since the distribution of the load is a factor not of the strength but of the deflections, a truer index of the value of the new construction would be gotten by the following expression $(4 \times 4 \times 4) + (6 \times 6 \times 6) = 280$ for the old type, and $(4 + 1 + 3)^3 = 512$ for the new type.

There has been altogether too much "Rule of Thumb" in pavement construction. While road-making is one of the oldest outlets for engineering thought, we still have a marvelous faith in the half-foot as a proper thickness for concrete foundations, whether the soil is light loam, sand or solid clay, free from or full of recent excavations; or whether the loads coming thereon are the light loads of residence districts or the heavy loads of teaming sections. It is high time that these factors be considered even as they are in bridge design, for while there is, perhaps, not much danger to life involved in the failure of a brick pavement, there are surely vast economies possible if a little more time is spent over the desk and less on the job itself.

MONT SCHUYLER,
Engineer in Charge, Municipal Testing Laboratory.
St. Louis, Mo.

Common Sense Regarding Academic Freedom

SIR: I have read with great interest your editorial in your issue of July 10, page 35, entitled "Common Sense Regarding Academic Freedom," and I cordially agree with the view which you take of the possibilities of abuse resulting from too great license in the teaching of economics. In my opinion, this country has suffered immensely in the last ten or fifteen years from the over-production of cheap and alluring theories as to finance and economics by sensational writers in the popular magazines, immature and partisan socialists, inexperienced college professors, misdirected sympathizers with the public, and demagogues generally.

There seems to be a well-spread and general idea in this country to-day that economics and finance are not subject to any fundamental conditions, but can be formulated and swayed to fit the sentimental feelings and wishes of the popular desire. This ill-advised propaganda is bearing fruits in bad results all over the country in public and private ill-considered schemes which ignore fundamental economic facts and well-established conditions. It is, for instance, just now conspicuously seen in the attitude of some of the newer public utility commissions and their immature engineering staffs, and it is also preached by the politicians in search of political preference and anxious for the limelight. College professors are not exempt from the alluring and baneful temptation of the use of their positions to disseminate what seem to them to be creative ideas, but which are often in reality pure fallacies long since exploded by practical experienced men in contact with the realities of life.

The engineering profession is not without its numerous regrettable instances of otherwise fairly able men who have yielded to the subtle temptation to ignore the teachings of history and practical experience in favor of some momentarily illusive theory; and while in our colleges it is difficult on the one hand to draw the line between radical attempts to foist imperfect conclusions and crude and visionary ideas upon the younger generation, and, on the other hand, to allow reasonable latitude in intellectual liberty, still there must be a limit in collegiate responsibilities to that license which would permit the instruction of our youth by those who, from some unfortunate cause or another, have no intellectual ballast or grasp on the realities, but who, nevertheless, have been unfortunately selected and appointed to the instructing force or on the faculty. The responsibility for properly drawing a clear line between sound instruction and mental vagary must naturally devolve upon boards of trustees of our colleges.

The American people to-day are in great need of safe and sane views on thrift, finance and sound economics, and that liberty in teaching which leads us away from such important anchorage is dangerous and fallacious and in my humble opinion should not be encouraged.

We have before us to-day the most astonishing example of the results of propagating erroneous ideas in university life in Germany, and we can look with amazement and horror upon certain ideas the results of which are now devastating Europe. These ideas, in some small part, in my opinion, have been due to false theories of the State and of might and right inculcated in German universities, and have been unchecked by conservatism and good sense.

A German professor is now engaged in showing to that country that England logically torpedoed the Lusitania in order to involve the United States in war, and I suppose if he were teaching in this country or in England, it would be set up that intellectual liberty must not be checked, and his propaganda would continue undisturbed.

We do not want our intellectual liberties unduly curtailed, but at the same time we do not want our youth instructed by brain-crazed instructors such as Erich Muenter, or even that milder type of unbalanced minds who ride particular economic hobbies to death, and so set back the advancement of sound common sense among the coming generations.

I am not at all informed as to the University of Pennsylvania situation, and what is said here has no local reference to that case, but it is caused by an increasing regret at the constant disposition on the part of a certain type of gentlemen (some of them titled in halls of learning) to substitute sympathetic prejudices in place of practical experience in economics, particularly when the world is full of facts and experience tending to point out fundamental principles based on common sense.

Let our college trustees, therefore, exercise their trust and live up to their responsibilities whatever may happen. It is their duty to see that the teaching in their colleges is as safely sane as it is informing.

JOHN W. ALVORD.
Chicago.

HINTS FOR THE CONTRACTOR

Details Which Save Time and Labor on Construction Work

Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

[*Contributions to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

Barrel Blowoff Trap Stops Noise from Compressors

By WALTER BAZORE

Master Mechanic, Rapid Transit Subway Construction Company, New York City

AN EMPTY oil barrel, with both heads left in, has been used successfully by the writer on the blowoff line of several air plants on aqueduct work for New York City to eliminate all noise. If the line is 2 or 2½ in., it is bushed up to 6 in. one or two pipe-lengths before it reaches the barrel. This allows the air to expand and reduces the pressure considerably before it enters the barrel. The 6 in. line ends with half of a flanged coupling, which is bolted to one head of the barrel. This head is taken out, the hole cut in it, and the flange bolted on. The head is then replaced, and the whole barrel screwed onto the end of the 6 in. pipe by means of the flange.

The barrel is bored full of 1-in. or 1½-in. auger holes, to more than equal the area of the 6-in. line. The air on reaching the barrel is thus able to expand till atmospheric pressure is reached, and escapes through the auger holes without noise. If a larger blowoff line is to be used, it should be bushed up to 10 in. before reaching the barrel.

Float Used to Finish Tunnel Floor Concreted Continuously

By H. C. LIGHTFOOT

Gilman, Montana

THE FLOAT shown in the accompanying photograph enabled the contractor for two small tunnels on the Sun River project of the U. S. Reclamation Service in Montana to finish the tunnel invert and at the same time place the invert concrete continuously without a joint from end to end of each tunnel.

The tunnels were of typical horseshoe section with a 9-in. lining. The walls and arch were concreted first, and the invert concreted last. Concrete was brought in from one end of the tunnel, shoveled into place from the cars, and struck off to the approximate shape of the invert with a shovel. The track was taken up as the work progressed back toward the end of the tunnel where the mixing was done. After the concrete was leveled, a float, conforming to the curve of the finished invert, was dragged over it 2 ft. at a time toward the end of the concrete track. Three men stood inside this float, and finished the 2 ft. strip of invert just dragged over while the laborers placed more fresh concrete in advance of the float.

The float was then dragged back and another 2 ft. strip finished. Thus the placing and finishing of the concrete was simultaneous, and was carried continuously without having to leave any joints in the invert. The finishers, of course, worked a sufficient distance behind the point of concreting to give the concrete time to stiffen sufficiently after it was placed to be worked easily. A fairly stiff mixture of concrete was used.



TUNNEL INVERT FINISHED TWO FEET AT A TIME AS IT IS CONCRETED

The work is being done for the U. S. Reclamation Service by Olof Olson, subcontractor for McArthur Brothers of New York City.

Devices for Insuring Correct Mix on High-Class Work

ELSEWHERE in this issue is an article under the title, "Eye is Best Means of Controlling Consistency of Mix," telling why the Lock Joint Pipe Company, of New York, which makes reinforced-concrete pipe, a product requiring high-class workmanship, has selected small mixers of the open type for its work. When it began buying these mixers it realized that schemes would have to be developed in order that they might be used with the greatest economy. The equipment to be described was, therefore, designed. It consists of a special charging barrow, allowing of accurate measurement of aggregate, a support for the barrow while being dumped and a discharging pan.

GENERAL SET-UP

The general set-up is clearly shown in the accompanying photographs. The charging platform is somewhat higher than the bed of the truck carrying the mixer, and is sufficiently large to allow the wheelers to turn conveniently and allow sacks of cement to be piled along one side. A second

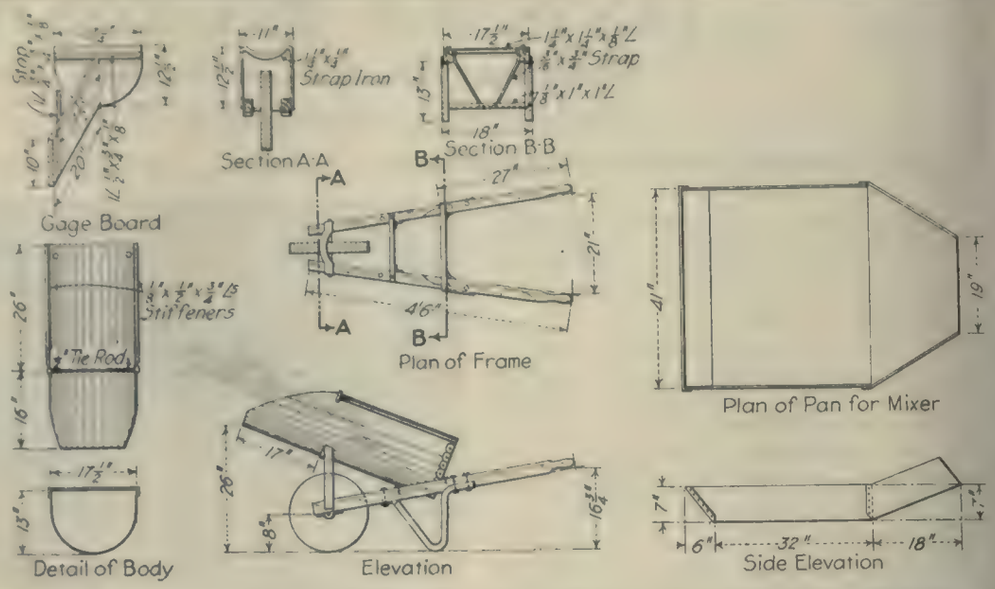


BARROW RESTS ON SADDLE WHILE BEING DISCHARGED INTO MIXER

runway, for empty barrows, was not in place when the photographs were taken. A water barrel is placed in a handy position on an extension of the platform.

Details of the barrow are shown in the drawing. The one detailed is for use with the half-bag mixer. A larger one is used with the one bag-size outfit. The latter differs from the one shown only in having a larger body. The special advantages of the barrow are:

1. Its compactness and strength.
2. The straight top, allowing the aggregates to be struck off and thus be accurately measured.
3. The ease of varying the proportions of sand to large aggregate,—by merely changing the position of the stop on the gage board.
4. The narrow spout, fitting into the open mixer and thus allowing the latter to be charged without the loss of sand or stone.



SPECIAL BARROWS, WITH GAGE BOARDS AND DISCHARGE PARTS, HAVE BEEN DESIGNED

USE OF BARROW

In use the sand is put in the barrow first, filling the space between the end of the body and the gage board. The size of this space is determined by the position of the stop on the shank of the gage board, which comes up against the tie rod across the front of the barrow. After the sand is loaded, the board is removed and the remaining space filled with the large aggregate.

In order to discharge the contents of the barrow into the mixer it is run against an angle-iron saddle (see photo) and lifted as shown. It will be noted that the wheel is thus raised from the platform.

DISCHARGE PAN

On the discharge side of the mixer is a pan with a capacity of 6 cu. ft. It has two advantages: (1) It forms a reservoir for several batches and (2) allows the mix to be inspected. It will be noted that the lip has a rise of 7 in., equal to the height of the sides. The hoe shown in the picture suggests how barrows are filled from the pan.

It will be noted that the frame supporting the pan is independent of the mixer truck. In fact, experience has shown that the frame must not be allowed to touch the truck. If it does the vibration of the engine, communicated to the pan, causes the large aggregate to settle out with surprising rapidity, quickly forming a packed mass that can not be broken up by the hoe.

The devices illustrated have been in a course of development for the past three years, and have enabled the company to secure very satisfactory service from the small mixers, of which it uses two makes—the Little Wonder and the Big and Little.

Follow These Pointers to Avoid Trouble with Blasting Fuse

IN EXAMINING fuse, to see whether the powder core is injured, it is necessary, according to the *DuPont Magazine*, to give consideration to the waterproof covering. This is made of compounds of asphaltum, tar, etc., as well as gutta-percha. If improper materials are used, the compounds may penetrate through the yarns to the powder, and this will give it a very dingy and somewhat sticky appearance, and may be so bad as to ruin it. Powder that is wet will be soft and dingy black in color, but usually after it has been dried it will harden into grayish, lumpy particles. When the moisture has entered from the outside, the white exterior color is usually left in a lusterless, chalky condition.

Fuse may become injured in transit, storage, or handling, and it is important that fuse be stored in a cool dry place. Fuse stored in too warm a place is liable to be affected by the melting of the waterproofing materials, and their penetration to the powder. Fuse should be warmed to a temperature of from 60 deg. Fahr. to 70 deg. Fahr. before uncoiling, because in cold weather the waterproof material becomes brittle and will crack, unless the fuse is carefully handled. Moisture kills the powder, and even when insufficient to actually kill it, its presence retards the burning speed.

Cut off about two inches from each end of the coil before using to be sure that the ends are dry, as the powder may have absorbed moisture from the air. For this same reason it is unwise to cut up the fuse lengths much ahead of actual need unless they are stored in a dry place. Cut off the ends of the fuse squarely, especially where they are to be inserted in a blasting cap. One cut diagonally is apt to fold over and interfere with the spit. For wet holes, the joint of the cap should be made waterproof by an application of waterproof paint or heavy axle grease.

The kind of stemming material used is important on account of the fact that considerable gas is generated by burning fuse, and if it is too closely confined by a material that is not porous the pressure of the gases rises to such an extent that the speed of burning is very much affected. Usually the speed is increased as the pressure rises. In experiments made with moist fire clay as a stemming material, the rate of burning of the fuse was increased over 50 per cent; but with dry sand, moist sand, and dry fire clay the increase in burning rate was comparatively small.



DISCHARGE PAN HOLDS SEVERAL BATCHES AND ALLOWS MIX TO BE INSPECTED

FOR FILING PAMPHLETS, trade publications, bulletins and clipped portions of the proceedings of the National societies relating to subjects of particular interest to the sanitary engineer, Prof. W. C. Hoad of the University of Michigan has extended the Dewey decimal system and placed the papers in wood and cardboard boxes the size and shape of a book to fit into an ordinary book case. Index numbers are pasted on the back of the box.

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

Sinking Land Wrecks Cement Company's Power Plant

Sudden Drop of Supporting Soil Causes Collapse of Steel Frame Building and 170-Ft. Chimney—Comment by State Geologist D. W. Newland

Without warning about 3 acres of the soil supporting the power plant of the Knickerbocker Portland Cement Company near Hudson, N. Y., rendered fluid by heavy rains, suddenly shifted and dropped downward just before 6 o'clock Monday morning, Aug. 2, and caused the complete collapse of a steel-frame brick power-house, a 170-ft. reinforced-concrete smoke stack, and the sinking of a 20,000-ton pile of crushed rock from a height of nearly 40 ft. almost to a level with the original ground surface. A square concrete elevator tower about 40 ft. high is now leaning at a sharp angle and is half buried by the stone around it. Five men lost their lives in the boiler house and four others were badly injured by being caught in the débris and burned by escaping steam.

Ground Drops 15 Feet

The photographs suggest the nature of the sudden shifting drop of the soft, loamy earth or glacial drift and the resulting damages to

(*Continued on page* 180)

Cloudburst Floods Erie and Destroys Bridges

Excessive Rainfall on Aug. 3 Forces Mill Creek Out of Its Banks—Buildings Damaged—Bond Issue for Reconstruction

A 10-in. rainfall on Aug. 3, culminating in a veritable cloudburst about 7 p. m., resulted in the loss of at least a score of lives and property damage aggregating several million dollars at Erie, Pa. Mill Creek, a small stream flowing through the center of the city just one block east of State Street, the main street, rose within 2 hr. to a height of over 6 ft. and spread across State Street. It carried great masses of heavy wreckage which stove in the foundations of buildings and soon caused their collapse. The wreckage accumulated in huge piles, deflecting the course of the torrent so that at one time there was more than 2 ft. of water over State Street.

Mill Creek has a fall of 1 ft. to the hundred through the damaged section. It rises about 5½ miles southeast of the city and empties into Lake Erie. About a mile outside of the city limits it runs between hills, making a fairly narrow ravine, spreads into a pond at Glenwood Park, and falls over a dam 40 ft. wide, built of concrete. The dam is standing to-day, although the earth is washed out at the abutments.

The creek flows through a section composed entirely of sand and gravel and blue slate. It cut through this until a brick brewery building was reached just outside the city limits. The building collapsed and the timbers and wreckage piled up against two low bridges with loose plank decks; the planks floated down with the other wreckage to Twenty-sixth Street, where the first big bridge in the city was reached. This structure was a brick arch with stone abutments. The wreckage clogged the opening so that the water rose behind it to a height of over 20 ft. The bridge finally gave way, except for a small portion which was rebuilt about two years ago. Several bridges with concrete abutments and low timber decks failed, or at least their parapet walls fell off. Eight concrete arches withstood the test, suffering only damage to the steel railings.

City Engineer Benjamin E. Briggs stated to a representative of Engineering Record that a council meeting to be held before the end of the week will probably arrange a bond issue to defray the expense of restoring the bridges. There have been plans under consideration for some time to divert the stream flow into Walnut Creek, which empties into the lake about 9 miles west of Erie, or building a large enclosed sewer to take the place of the creek.



TWENTY-SIXTH STREET BRIDGE AT ERIE WASHED OUT



SEARCHING FOR BODIES IN THE STORM'S WRECKAGE



DAMAGE IN FRENCH STREET NEAR LAKE SHORE BRIDGE



WASHOUT BROKE SEWERS AND WATER PIPE

Cement Plant Wrecked

(*Continued from page* 179)

the buildings, which occurred within 3 min. The surface of the ground, which was originally nearly level back of the bluff which dropped about 15 ft. to the bed of Claverack Creek, is now a series of depressions with sharp breaks at which settlements and relatively smaller sidewise shifting are plainly seen, the drop varying from 15 to 25 ft. and occurring in long curving lines which gradually run out several hundred feet each side of the stone pile and power house. A profile view on a section perpendicular to the creek would probably show the present ground surface to lie in a series of at least three sloping steps with steeply inclined upper surfaces, sloping away from the creek. The creek itself has been shifted many feet into a meadow for a distance of about 200 yd.

Supporting Clay a Fluid Mass

D. W. Newland, assistant New York State geologist, made an examination at the site and has sent the Engineering Record the following statement of the probable cause and the nature of the geological disturbance:

"The Knickerbocker Cement Company power-house and smaller buildings were destroyed by the subsidence of the ground, which involved 7 acres along Claverack Creek. The plant is built on a clay terrace, which marks the bottom of an old glacial lake, 200 ft. above tide. The clays at this point are probably 50 ft. or more thick and are the characteristic blue plastic clays that are used along the Hudson River for bricks. The clays are underlain by shales which are solid and compact, free of any cavities sufficient to cause extensive caving.

"The cause of the disturbance is the situation of the lower beds of clays below water level and the heavy rains, forming a fluid mass under the upper firm clays. About 50,000 cu. yd. of limestone piled on the ground, with the weight of the building, overloaded the surface, which consequently collapsed, going down in sections 15 to 25 ft. below the former level. The pressure on the substratum of fluid clay raised the adjoining creek bed 20 ft. above the old level, and several acres across the creek are slightly raised. Numerous dead fish on the dry creek bed show the suddenness of the movement. Rebuilding of the power plant on the present disturbed ground is impracticable. The mill itself lies back of the point of subsidence and its safety is not immediately threatened. Slips of this sort have occurred frequently along the Hudson Valley, coming usually after heavy rains."



VIEW FROM EDGE OF CEMENT PLANT'S STONE PILE, SHOWING SLIP AT SIDE-HILL BREAK

The collapsed power-house is about 90 x 120 ft. in plan, built of steel columns and roof trusses, with brick walls, and erected the latter part of 1910. The reinforced-concrete chimney is 8 to 10 ft. in diameter and 170 ft. high with a heavy concrete base which lifted out as a whole and with unbroken connection with the chimney, which fell toward the uphill side. The chimney was, of course, broken by its fall, although semi-cylindrical portions are still intact for short lengths. The effect on the columns and walls of the power house can be seen in the photographs, the steel withstanding the bending stresses remarkably well. Power-house and chimney were about 150 ft. from the creek.

The circular storage system for piling the crushed rock was centered in the 6 ft. square concrete elevator about 200 ft. from the power-house. Stone was delivered to this elevator from the crusher at the quarry by an underground conveyor. The elevator discharged at convenient locations to allow the stone to be rehandled by an electric locomotive crane running on a track of 65 ft. radius and operating a 2-yd. grab bucket to deposit the stone outside the circular track. The total storage capacity was 50,000 to 100,000 tons, although at the time of the accident only about 20,000 tons were in the piles, according to the officials at the plant.

The smaller frame buildings which are still standing, though inclined at sharp angles, are the barn shown in one picture, where a man was just cranking the automobile when the slide occurred, and the bag storehouse at the other end of the disturbed area toward the north.

The general superintendent of the plant, Myron Hammond, has estimated the loss at about $300,000. It will take from four to six months to get the plant in working order. Arrangements may be made temporarily for electric power to operate the mill, the main buildings of which are entirely undamaged.

Texas College Adds New Division to Engineering Department

The Agricultural and Mechanical College of Texas has added a division of railway engineering to its department of civil engineering.



MADE FLUID BY HEAVY RAINS FOUNDATION STRATA OF CEMENT PLANT NEAR HUDSON, N. Y., SINKS, WRECKING BUILDINGS

Court Holds Central Control Filter Patent Claims Valid

In the Minneapolis filter patent case, which has been pending in the U. S. District Court for some time past, a decision has been reached sustaining two of the Jewell claims. They are summed up in claim 1 of patent 649,110 for central control of operating valves, and in claim 14 of patent 649,411 relating to holding-down screens over gravel layers in a tank having a tapered lower end. The court held that the ridge-block system was a series of tapered lower ends and that Jewell is entitled to the permanent injunction prayed for and an accounting of damages. The holding-down screens at Minneapolis were abandoned a year ago. A royalty on sixteen hydraulic operating tables will have to be paid if the decision is ultimately upheld. The final decree will not be issued for a month.

Severe Storm Visits New York

While it broke no records as to total precipitation or intensity of rainfall the storm which swept over New York City on Aug. 4 was severe enough to do a good deal of damage. The maximum wind velocity was 64 miles per hour from the southeast. From the local offices of the U. S. Weather Bureau the following figures have been secured:

In the twenty-four hours ending at noon, Aug 4, there fell 2.19 in. of rain. The intensities, by 5-min. periods, were as follows: 5 min., 0.05 in.; 10 min., 0.17 in.; 15 min., 0.29 in.; 20 min., 0.37 in.; 25 min., 0.46 in.; 30 min., 0.53 in.; 35 min., 0.58 in.

The maximum previous precipitation for a single day in August was 5.05 in., recorded on Aug. 16, 1909. For this storm the intensities were: 5 min., 0.52 in.; 10 min., 0.97 in.; 15 min., 1.22 in.; 30 min., 1.35 in.; 1 hr., 1.66 in.; 2 hr., 1.80 in.

Pennsylvania Highway Department to Purchase Turnpikes

The State highway commissioner of Pennsylvania has opened negotiations with a number of turnpike companies with a view to the purchase of their properties so that no turnpikes will exist on State highways. The Pennsylvania appropriation for such purposes for 1915 and 1916 is $250,000, and Commissioner Cunningham believes that great progress will be made if the counties through which they pass furnish the right co-operation and, possibly, financial assistance. In cases where excessive prices are demanded the highway department contemplates either the construction of a road paralleling the turnpike and connecting with the State highways at either end or diverting the money from the county involved to be used for the purchase of turnpikes in other counties where a disposition to play fair is manifested.

Pan-American Road Congress Issues Advance Program

The Pan-American Road Congress has issued an advance program, which outlines the work to be followed at the ten sessions to be held at the Municipal Auditorium, Oakland, Cal., Sept. 13-17. The first session will be taken up with the opening exercises. Addresses will be made by Governor Gates of Vermont, chairman of the executive committee; Governor Johnson of California, Mayor Davis of Oakland and Director of Congresses Barr of the Panama-Pacific International Exposition. Responses will be made by G. W. Tillson, president of the American Road Builders' Congress, and Fairfax Harrison, president of the American Highway Association. The program schedules twenty-one papers open to discussion. A special train has been arranged for, which will leave Chicago Sept. 2, and arrive at Oakland Sept. 12. It will travel over the Chicago & Northwestern Railway to St. Paul, over the "Soo" line to the Canadian border, over the Canadian Pacific, through the Canadian Rockies, to Vancouver and Seattle, and, thence, to Oakland, over the Northern Pacific and Southern Pacific.

Survey Looking to Improvement of New York Harbor Recommended

Comptroller Prendergast of New York City recommended to the Board of Estimate and Apportionment, Aug. 5, that a committee of three engineers be appointed to survey the Port of New York and to report as to what improvements are needed, in its opinion, to bring it to the highest state of efficiency. The recommendation carried with it a proposition to appropriate sufficient funds to defray the cost of the work. Those mentioned as members of the committee are Prof. George F. Swain, past-president of the American Society of Civil Engineers and professor of civil engineering at Harvard University; John F. Stevens, who was, for a period, chief engineer of the Isthmian Commission, in charge of the construction of the Panama Canal, and William C. Loree, formerly general manager of the Baltimore & Ohio Railroad.

$16,200,000 Flood Expenditure Proposal for Los Angeles County

The board of engineers appointed by the Board of Supervisors of Los Angeles County, California, to study the flood control problem reported, July 27, recommending prevention and control methods costing $16,208,900, of which $12,824,400 is for structures and $3,384,500 for right-of-way. The report will be taken under advisement, and any action will be under a State law which becomes effective Aug. 10. This law creates a flood-control district, comprising all of Los Angeles County south of the north line of township five, San Bernardino base line, excepting the islands.

The report takes up all phases of the subject. Conservation of the run-off by diversion into the gravels in the headwater district, retardation of the run-off by contour plowing, reforestation and impeding dams, and stream diversion in the coastal plains, are all recommended. Under the last head there is recommended the changing of the mouth of the Los Angeles River from the harbor, at San Pedro, to Alamitos Bay.

Prospects are that the preliminary steps, in the way of securing final plans and proceeding with the necessary legal steps, will be pushed at once, the flood loss of over $10,000,000 in the early part of 1914 having aroused the public to the need for preventive and protective measures.



AFTER THE GROUND SUBSIDED THE STEEL FRAME AND BRICK CEMENT POWER PLANT NEAR HUDSON, N. Y., WAS COMPLETELY DEMOLISHED

This Organization Would Aid the Average Engineer

The American Association of Engineers, an organization drawing members from all branches of the engineering profession and designed to promote the interests of the "commoner" or average engineer, has recently been formed in Chicago, with a charter membership of 300. The association aims to bring recognition to the average engineer in the following ways: By affording means for the interchange of information, maintaining a service clearing house, affording patent and legal advice, supervision of legislation and by proper publicity. The offices of the association are Room 1056, 29 S. La Salle Street, Chicago.

One Hundred Reservations Made for Engineering Congress Special

Reservations have been made for about one hundred persons on the special train to the International Engineering Congress to be held at San Francisco, Sept. 20-25, up to July 27, according to G. S. Harner, passenger agent for the New York Central Lines.

News of Engineering Societies

The Engineers' Society of Western Pennsylvania made an inspection of the Magnolia cut-off improvement of the Baltimore & Ohio Railroad, July 17, as guests of A. W. Thompson, vice-president of the road. This work, which is situated at the east end of the Cumberland Division, cost $6,000,000 and resulted in a shortening of the line of 5 4/5 miles in a distance of 11 4/5 miles.

Personal Notes

G. McArthur has resigned from the office of city engineer of Regina, Sask.

A. J. Widmer, contracting engineer of St. Louis, has removed his offices to the Century Building.

Alvord & Burdick, of Chicago, have been retained as consulting engineers on the Franklin County, Ohio, conservancy district.

H. G. Batten has resigned from the office of supervisor of bridges and buildings of the Detroit division of the Grand Trunk Railway.

Joseph F. Karnes has been appointed junior structural engineer on the forces of the Interstate Commerce Commission, at Chattanooga, Tenn.

R. M. Mark has been appointed assistant engineer on the forces of the New York State Highway Department, with headquarters at Rochester.

B. J. Finch, formerly engaged on road work in the National parks, has been transferred to Portland, Ore., to take charge of road work in Division 6, U. S. Forest Service.

P. S. McCallen, formerly connected with the Morgan Engineering Company of Memphis, Tenn., is now connected with the Jackson Iron & Bronze Works of Jackson, Tenn.

H. T. Power, who has been a member of the California board of water power control since 1911, has been appointed chief engineer for the water commission of that State.

G. H. Frith has been appointed acting assistant engineer of the Belleville division of the Grand Trunk Railway, with headquarters at Belleville, Ont. He succeeds George A. Butler, resigned.

J. Russel Ellis, formerly principal assistant city engineer of Regina, Sask., has been appointed acting city engineer, succeeding G. McArthur, whose resignation is noted elsewhere in these columns.

D. C. Miller, for the past year assistant professor of civil engineering of the Agricultural and Mechanical College of Texas, has been appointed associate professor of civil engineering at that college.

C. C. Jones has been appointed supervisor of bridges and buildings of the Detroit division of the Grand Trunk Railway, with headquarters at Detroit. He succeeds H. G. Batten, whose resignation is noted elsewhere in these columns.

John J. L. Houston, who, until recently, was connected with Jacobs & Davies, consulting engineers of New York City, is now connected with the office of the division engineer maintenance-of-way of the New York Central Railroad, at Oswego, N. Y.

Paul Hansen, engineer of the Illinois State Water Survey, has been given a leave of absence to organize the new sanitary engineering bureau of the Illinois State Board of Health. He has the title of acting chief engineer and will hold the position until such time as civil service examinations are held and some one has been certified.

John W. Ash, civil engineer and contractor, formerly of Chattanooga, Tenn., has removed to Corvallis, Ore., where he is erecting a plant and installing machinery for the manufacture of cement sewer pipe, drain tile and other products of a similar nature. He is also starting work on the construction of a reinforced-concrete pavement for which he was recently awarded a contract.

H. S. Philips has been granted leave of absence from his duties with the Department of Public Works of the city of Toronto, Ont., to accept a position as assistant engineer in the Buffalo office of the International Joint Commission, which is engaged in studying means for the control of the pollution of Niagara River, under the direction of Prof. Earl B. Phelps of the U. S. Public Health Service.

Oro McDermith, formerly assistant project manager of the Salt River irrigation project, U. S. Reclamation Service, has been appointed manager of the Rio Grande project, with headquarters at El Paso, Tex. He was graduated from Colorado State Agricultural College in 1902 and has been engaged continuously in hydraulic work since that time. He was appointed assistant engineer with the U. S. Geological Survey in 1903 and entered the U. S. Reclamation Service in the latter part of 1904.

The Snare & Triest Company, contracting engineers, Woolworth Building, New York City, has purchased the business, good-will, plant, plans and records of R. P. & J. H. Staats, Inc., who, for 27 years, have been established in New York City as engineers and contractors on the design and construction of piers, sheds and similar harbor work. R. P. Staats has retired from active business and J. H. Staats, having secured an interest in the Snare & Triest Company, has associated himself with it as vice-president.

Wilson T. Howe, who has been engaged on hydroelectric work and waterworks construction at Greenville, Tenn., Allendale, N. J., and Henniker, N. H., since 1912, is now connected with the office of the city engineer of Salem, Mass., on the construction of that city's new high pressure water supply system. The work includes the construction of a concrete covered 10,000,000 gal. reservoir, the laying of 5 miles of 36-in. cast-iron mains and the installation of a new pumping plant. Previous to 1912 Mr. Howe worked three and a half years in the Philippine Islands.

Prof. A. C. Love, for the past two years associate professor of civil engineering at the Agricultural and Mechanical College of Texas, has been appointed professor of the recently created division of railway engineering at that college. He was graduated from the Agricultural and Mechanical College in 1899 and, after about three years spent as assistant professor of drawing there, entered the railway service on the forces of the Gulf, Colorado & Santa Fé Railway. He also served on the Atlantic system of the Southern Pacific Railway and was resident engineer in charge of the construction of the first ten miles of the Stockdale-Cuero extension of the Galveston, Harrisburg & San Antonio.

Mayo Tolman, whose appointment as director of the division of sanitary engineering of the West Virginia State Board of Health was noted in these columns last week, is a graduate of the Massachusetts Institute of Technology and has had experience in the health departments of two other States. He was first employed as assistant in the engineering department of the Massachusetts State Board of Health, from which position he resigned to accept an appointment as assistant engineer in the bureau of sanitary engineering of the Maryland State Board of Health. Later he was appointed resident engineer in charge of the western district of Maryland. He received his appointment as director of the West Virginia sanitary engineering division about the middle of June and opened the office, July 1.

F. E. Chesley, formerly resident engineer for the city of Beaver Falls, Pa., on the construction of the sanitary sewer system recently completed there, has been appointed resident engineer in charge of the construction of a sanitary sewer system at Downingtown, Pa. He was graduated from the State University of Iowa in 1904 and was engaged, until the end of that year, in the office of the city engineer of Iowa City. From 1905 to 1908 he confined himself almost exclusively to concrete work. As resident engineer for the Iowa Engineering Company of Clinton, from 1910-1912, he had charge of the construction of waterworks systems in various towns in Iowa. He was appointed an inspector for the Corps of Engineers, U. S. A., at Sterling, Ill., in 1912, and resident engineer on the Beaver Falls work in 1913.

Black & Veatch, consulting engineers, of Kansas City, Mo., have succeeded to the business of the firm of Worley & Black. E. B. Black, who has been with the firm of Worley & Black since its organization in 1909, and N. T. Veatch, who has been with the original partnership for the past four years, constitute the membership of the new firm. Previous to his connection with Worley & Black, Mr. Veatch was assistant engineer for the Kansas State Board of Health and was, for a year and a half, with the American Waterworks & Guarantee Company of Pittsburgh. J. S. Worley, one of the original partners, resigned from the firm early in 1914 to devote his entire attention to the work of the Interstate Commerce Commission, Division of Valuation. The offices of Black & Veatch are located in the Inter-state Building, Kansas City.

E. W. Lewis, formerly assistant engineer on the New York, New Haven & Hartford Railroad, at New Haven, Conn., has opened an office at 234 Union Street, New Bedford, Mass., for the purpose of engaging in a general practice of civil engineering. His first engagement along engineering lines was as assistant in the office of the city engineer of Somerville, Mass., from 1874 to 1876. From 1877 to 1879 he was engaged on Government land surveys and townsite work in North Dakota. He entered railway service, as leveler on the Northern Pacific, in 1879, and continued in this service until 1897, attaining, in 1878, the grade of assistant engineer. For the next two years he was engaged, as U. S. inspector, on harbor improvement work at Duluth, Minn. In 1899 he returned to the Northern Pacific as assistant engineer. He was appointed assistant engineer on the New York, New Haven & Hartford about nine years ago and retired from that office in October, 1914.

Gerard H. Matthes, formerly division engineer in charge of flood investigations in Pennsylvania, for the State Water Supply Commission, has joined the engineering staff of the Miami Conservancy District, with headquarters in the City National Bank Building, Dayton, Ohio, to engage in the flood prevention work in the Miami River valley. He was graduated from Massachusetts Institute of Technology in 1895 and, after a year spent as draftsman and instrument man for the town of Brookline, Mass., served as instrument man for the Massachusetts State Board of Harbor and Land Commissioners on soundings in Boston Harbor and the plane table survey of the Connecticut River. He was engaged for several years with the U. S. Geological Survey on hydraulic and reclamation work, and entered the U. S. Reclamation Service in 1903 as district engineer. He was principal assistant engineer in the hydroelectric department of the American Waterworks and Guarantee Company of Pittsburgh for more than two years, resigning from that office, in 1914, to accept an appointment with the Pennsylvania State Water Supply Commission, in which service he continued until recently.

Obituary Note

Charles D. Ward, who was identified with many well known engineering works previous to his retirement from practice some years ago, died in New York City, July 30, at the age of seventy-eight years. During the latter years of his life he specialized in waterworks, being connected, at one time, with the Providence (R. I.) system as principal assistant engineer, and later, with the Brooklyn, New York City, water department. He was admitted to membership in the American Society of Civil Engineers in 1869.

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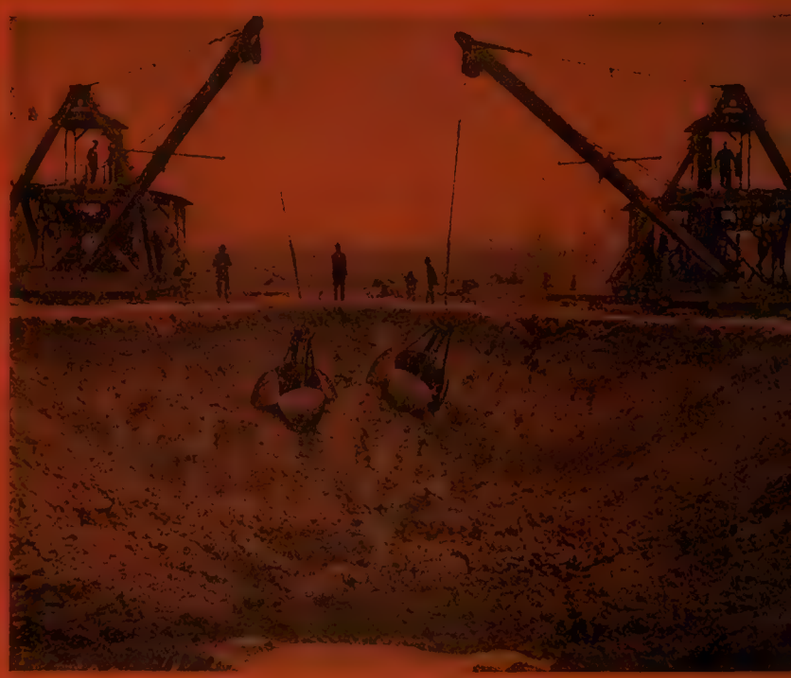


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Water causes no delay or expense when canals are dug by

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Erie and Los Angeles

THOSE who have followed flood-prevention matters closely will be very much interested in two articles in this issue, the one being an account of the Erie flood and the other an abstract of the flood-prevention report recently rendered by Los Angeles' engineers. The Erie situation is discussed in another editorial in these pages and needs no further attention here. The Los Angeles report is chiefly of interest in that it proposes two schemes novel so far as American practice or recommendations go. One is the spreading of the flood waters in the upper reaches, so as to store them in the gravel and retard their flow into channels of destruction, and the other the impeding of the flow in steep canyons by the construction of impeding dams. On neither head is sufficient information available at present to speak with an air of finality. The proposals are, at present at least, chiefly of interest. Nevertheless such observations as have been made in a number of canyons near Los Angeles where impeding dams have been built indicate that they may have a very valuable influence in desynchronizing the peaks from the various tributaries to a main and important channel. Not only do the dams impede the flow but they give an opportunity for the growth of brush, which affords an added retardant. It is interesting to know that an experiment station, equipped with a suitable dam and gaging stations, has been provided near Los Angeles in order to study thoroughly the effect of these dams. It is to be hoped that the appropriation suggested in the report will be made, to the end that complete data on this interesting scheme may be made available. The Erie flood, coming hard upon those at Dayton and Los Angeles, with many minor disasters in various parts of the country, shows the wisdom of the comprehensive studies made in a few locations. Other communities must awake to their danger, and flood prevention investigations must become fairly common in the near future. Unless they do, serious disaster will continue to be invited.

The Porjus Plant

THE TECHNICAL side of the Porjus development (see page 194) has features to which special attention should be called. American engineers will probably differ with their Swedish brethren in the selection of double-runner units. Here the single-runner, high-speed, high-power wheel has been made the standard, and at Porjus would probably have given higher efficiency than the design actually adopted. At Niagara Falls double-runner units are used in most of the plants, but the advances in the design of single-runner wheels have led the Canadian Niagara Power Company to design its new units with single runners. Three wheels of this type are proposed and will run at the same speed and have the same output as the double-runner units in the same plant. Single-runner units, too, would have been of material advantage in the design of the generator room, as the floor could have been located at a higher elevation, thus doing away with the costly waterproofing and drainage system. The method of connecting the vertical penstocks with the forebay could also, it would seem, be improved upon. As now arranged, the penstocks do not connect directly with the forebay, a gate being interposed between them. While the engineers have figured this forebay to act as an ordinary surge tank, the interposition of the gate will really give a differential action. A design of this sort was used at a Canadian plant some years ago, but the trouble encountered was so serious that both penstocks and units had to be replaced. The surge chambers on the tailrace tunnel are, of course, unusual, but only because the type of plant with a long discharge tunnel is more or less uncommon. Similar chambers, it will be remembered, have been used at the large Mockfjard plant, completed in Sweden somewhat over two years ago.

Discussion at the Congress

THE papers to be presented at the International Engineering Congress in San Francisco next month will be, in at least one important particular, radically different from those ordinarily read before technical societies, and therefore a word about the kind of discussion that will be in order may not be amiss at this time. The special feature of these papers is that they have been drafted primarily to present a concise review of the best contemporaneous methods and practices in the branches of engineering covered. If papers prepared with this primary object are discussed by a gathering of experts and the good points of the discussion are properly edited, it will be possible to compile in the bound volumes a symposium on engineering which will be unique in the history of technical literature. However, to make this possible, and the Engineering Record assumes that all who attend the congress will concur in desiring this end, it is desirable that the discussion shall include comment from a large number of engineers, each viewing the subject from his own angle and each in a position to speak from experience. This will only be possible, in view of the brief time allotted for each session, if all bear in mind that comment must be limited to that which is strictly to the point. In the numerous sessions of the congress there will be opportunity for discussion on a wide range of subjects, there will be a proper time and place for all important comment and there will be no excuse for introducing other than strictly relevant discussion in any session. The system adopted for reporting the proceedings of the congress prevents even a temporary record of irrelevant discussion. The several committees which have been appointed to organize and direct the compilation and presentation of the papers have been working in a most commendable manner toward making the congress productive of the very best results. Excellent papers have been secured. It remains only to secure a large volume of pertinent discussion to insure the unqualified success of the meeting.

Swedish Power Development

COMPLETION of the Porjus hydroelectric plant, described in this and in the preceding issue of the Engineering Record, marks the end of the first important step in the hydroelectric development program adopted by the Swedish Government in 1906. Economically it is of singular importance in Swedish affairs. As is quite generally known, the country is rich in potential power projects, yet when coal prices are normal about $5,000,000 is paid out by Swedish railways annually for imported coal. Added to that is a tremendous consumption of foreign fuel in the industries. It was, after a careful survey of this situation, that the Government itself determined to enter into the ownership of hydroelectric plants, primarily for the purpose of electrifying the State railways. Power rights were purchased at the very start on three streams, but not until 1910 was the Porjus project outlined and authorized. The selection of this as the first development was due to the excellence of the prospective power load, that is, the transportation of ore in large volume and over heavy grades. The power available at Porjus, however, was more than sufficient for the electrified line from Kiruna, in the mine fields, to the Norwegian frontier, but investigation showed that the mining industry of the district would furnish an ample market, even at the start, for a considerable surplus power. Furthermore, it seemed likely that the market would grow and justify the extension of the plant when water was made available by the construction of storage works on the Lule lake and river system. Aside from the hard and cold economic facts, however, the Govern-

ment felt, on comparing the Porjus plan with an alternative project that it would be decidedly advantageous to encourage development in such a remote section of the country, and while this was a minor consideration, it nevertheless had weight with the Swedish Legislature in voting for the Porjus as against the other proposal.

Should the Rattler Go?

IN VIEW of the doubt frequently expressed as to the value of the rattler test it is not surprising to learn that one city—St. Louis—has after a long use of this type of testing equipment abandoned it in favor of ordinary visual inspection. Just what will be the outcome of the St. Louis experiment cannot at present be foretold, but judging by the knowledge accumulated by the St. Louis Municipal Testing Laboratory for a number of years as to the output of each of the plants likely to sell in St. Louis territory the result should be satisfactory. As a matter of fact, acceptance of paving block does rest primarily upon the visual test, the fact being long since determined that certain plants regularly meet the specifications so far as the rattler is concerned. That does not mean that the rattler test has not been made, but merely that the block has so consistently passed that the actual acceptance or rejection has depended upon visual inspection. There can be no question but what the rattler performs one very excellent function—as a definite and final arbiter between engineer and manufacturer. It must not be supposed, however, that the St. Louis engineers would advocate dispensing with the rattler when the product of a new plant was first to be considered. They hold, rather, that it may be safely dispensed with when the product of the plant is already pretty well known. In other words, the visual inspection is relied upon to test the variations from a given plant, the absolute comparison, however, of a block from one plant with that from another not being involved in visual inspection. No one contends that the rattler test is rational, that is, that its results are at all comparable with the service which block is expected to render in service. Resistance to abrasion and strength to withstand blows are, of course, necessary in the pavement and are revealed to some extent by the performance in the rattler, but thoroughly rational the test is not. With competent and reasonable inspectors the St. Louis scheme should work very satisfactorily. With arbitrary inspectors, and no recourse to a test independent of the personal equation and judgment, such a specification may work a hardship on a manufacturer.

Aero Engineering

NEW branches of engineering that appear from time to time and are novelties for awhile, almost without exception develop into important fields in which specialists are trained and which finally become closely identified with the necessities of civilization. Such will undoubtedly be the case with aero engineering. It is interesting to note the variety of influences which are working to develop the art of flying to a point where it will be more useful than at present. The greatest of these, of course, is the need for air craft in military operations, and no doubt much progress toward the production of safer and more effective machines will result from the urgent need in the present European conflict. However, so great is the need for military air craft that other fields of usefulness are likely to be lost sight of, and it may be worth while to point out some of these. Recently, on the occasion of an accident to a pleasure boat just off shore from a popular beach resort in California, it was demonstrated that an aeroplane could be used effectively for dropping life preservers to persons struggling in the water beyond the surf line. This incident started a campaign to have the life-saving service equipped with aeroplanes. The plan, if successful, would greatly increase the effectiveness of that department in carrying aid to vessels in distress. Post-office officials in Washington have long recognized the advantage of using aero delivery service for crossing the deserts and mountains of the West and North, and in many cases where means of communication are uncertain it seems almost a necessity. Even in well settled Western districts mountain chains often necessitate circuitous rail routes, and these afford opportunity for great time-saving if aerial mail service were established. For example, a letter leaving Portland, Ore., on Monday does not reach Eureka, Cal., via San Francisco, until Thursday, yet the stretch which causes the delay could be bridged by a two-hour aerial run between Eureka and Redding, Cal., which are only 95 miles apart as the crow flies. Those whose duty it is to watch for forest fires, to patrol transmission lines or to carry relief into frozen wastes or the desert areas, and, in short, many whose work is now accomplished under difficulties because of transportation problems, will be able greatly to increase their range and efficiency when the aeroplane as a safe and well controlled conveyance is at their disposal.

Drowning Sensational Reports with Truth

NEED for education of the public in engineering matters has been commented on in this journal many times, but a trivial accident in Chicago last week brought it to the front vividly. Tension over the safety of the public on all kinds of transportation facilities is at an abnormal pitch due to the Eastland disaster. It was reflected in the hysteria with which some of the newspapers magnified an insignificant collision of two elevated trains on the Wells Street bridge, overlooking the overturned boat. Questions as to whether an elevated train could plunge into the river through an "open" bridge were anxiously asked. None of the reporters thought to go to the offices of the company to find out what safeguards, if any, were provided to prevent such an accident.

Finally the engineers of the company called up one of the dailies. They found the editor more than willing to be shown. Finding the reporter he sent was interested, the electrical engineer and engineer of maintenance of way spent three hours with him, first going over the plans of the interlocking system and then demonstrating to him on the ground the various safety devices. A boat came through and he saw the sequence of six distinct safeguarding operations which finally permitted the bridge to be opened. The engineers concluded just for once as an experiment to take plenty of time to get the idea into the reporter's head correctly. Whether they were disappointed or not, the newspaperman's article, logically handled, could not help but allay any fears that the earlier discussions had aroused in the minds of thousands of thoughtful readers.

It will pay the engineering profession big dividends to be patient with the newspaper man, to give him plenty of attention and time so that he can thoroughly understand an intricate problem. He cannot put his ideas on paper in an intelligent way unless he has grasped the situation. Once understood he can be trusted to feature the big points in their proper proportions. The lesson to engineers is, as Professor Newell has explained it, to drown out the sensational, which is rarely correct, with plenty of truth.

Plumbing as Viewed from the Engineers' Standpoint

WITHIN a generation a great change has taken place in the status of plumbing. Thirty years ago sewer-gas was regarded as an important cause of certain diseases, and even ground air was so much feared that Prof. William Ripley Nichols, chemist of the Massachusetts State Board of Health made a study of the ground air of the Back Bay district of Boston to ascertain if it possessed harmful characteristics. Suffice it to say that the celebrated chemist gave the ground air a clean bill of health, while present-day bacteriologists absolve sewer air from the charge of disease transmission.

To a great extent, therefore, plumbing has ceased to be an acute health problem. That being the case why should not the inspection of plumbing be transferred from health to building departments? There already appears to be a drift in this direction. Also, if the question of health be a remote one, why should not there be a material simplification of plumbing designs with an elimination of some of the useless vent pipes, running traps, and what not? The money thus saved might well be expended in better materials and more fixtures.

In another respect the plumbing business has changed. The day of the lead worker has passed. The plumber is no longer a skilled handler of lead; he is becoming an assembler of fixtures, machine made and easily put together. The number of wiped joints is being steadily decreased and the

skill demanded of the workers is being lessened day by day. It is, of course, desirable and necessary to have pipes and fixtures well installed, because even though sewer air may not cause disease it should not be allowed to contaminate indoor air. It is offensive and, after all, may be found to be not wholly without influence on health. Plumbers should, therefore, be licensed as heretofore and care taken to have good workmanship. But greater emphasis should be given to the inspection of plumbing materials. Standards should be set, not only for pipes but for all sorts of fittings and for connections.

Another matter that deserves study is that of fitness of materials for particular services, as, for instance, the relative value of cast-iron or wrought-iron for soil pipes and the use of brass pipe for hot-water services. There are scores of problems of this character that might be profitably studied. With the cost of plumbing installations equaling 5 to 10 per cent of the total cost of buildings, and with our large office and factory buildings housing as many people as are found in a small village, it is time that great attention be given to plumbing not so much from the standpoint of health as from that of economy and efficiency. Furthermore, the steel frames of our buildings may be liable to injury from the escape of moisture and corrosive gases through holes in pipes. Such being the case, plumbing standards cannot well be neglected.

City and Corporation Co-operate in Subsurface Problems

AN INTERESTING case of possible co-operation between a municipality and a public-service corporation has been brought to light by the study of the subsurface conditions in New York made by the Public Service Commission. It appears that the present gas companies in New York represent the end results of the consolidation of six companies, all of which had one or more mains in various streets. As a result, there are probably about 500 miles of unnecessary line. As franchises of some of the companies have expired, the city has insisted, previous to the laying of new pavements, that the old lines be cut out of service. However, when subsurface structures interfere with proposed subway lines the Public Service Commission, under the law, is obliged to restore the property as far as possible as it finds it, or in any event to provide an equivalent service. That would mean that even if one main were adequate to the service and two others were in the street, having been laid by one of the merged companies and now unnecessary, the commission nevertheless would be obliged to furnish capacity equivalent to the three in the restoration. Apparently this is a great waste for the city and of no value to the gas company. In fact, it may be the source of loss to the latter because of the higher maintenance charges. Nevertheless, the company cannot stand idly by and allow the mains which still hold franchise rights to be eliminated. The value of these mains has been capitalized and to destroy them would require changes in the capital account. For that reason the situation is not one to be decided by fiat, but is distinctly of the type of problem where broad-minded consideration is necessary on part of both the city and of the company. In the long run, no doubt, both would be gainers by the elimination of unnecessary lines.

In reporting on the subject recently, Charles N. Green, engineer of subsurface structures of the Public Service Commission, suggested that this matter be taken up with the gas companies with a view to adjustment. He recommended also that legislation be secured which would allow the three companies now existing (two of which are controlled by the largest company, the Consolidated) to consolidate, thus releasing a still greater number of lines, and that unnecessary franchises be condemned. Further than this, Mr. Green recommends that a new system of gas distribution be designed, that all changes be made to conform to it and that the advisability of locating certain structures under the sidewalk be considered. The last point, the use of the sub-sidewalk space, has already made marked progress in New York. There is no question as to the desirability of water, electric-light and pneumatic-tube services being so placed, but there is question as to whether this is a suitable location for gas mains, due to the danger of leakage and resulting explosion. Nevertheless by a proper design it may be possible to overcome the objections that have been offered.

Taken altogether the problem is one that can be solved only by co-operation between city and company. The present procedure is not only wasteful, and therefore should not continue, but results in taking space unnecessarily that may before long be needed for other utilities.

Preparedness—What Its Neglect Cost Erie

PREPAREDNESS is a word which has been so closely linked with the subject of national defense that, for the present at least, people are apt to think of it only in terms of battleships, coast defenses, munitions and military training. The recent flood at Erie, Pa., which collected a toll of thirty lives and several million dollars in property damage, is a forceful reminder of the need for a kind of preparedness which has nothing to do with war.

Theodore E. Seelye, who visited the stricken Pennsylvania city in order to give to the readers of this journal the facts regarding the flood, does not mince words in stating just what was responsible for the disaster. In his article on page 186 he lays the blame squarely upon the inadequate waterway of Mill Creek, due to encroachments by buildings and insufficient bridge and culvert openings. When, on Aug. 3, rain fell at an excessively high rate—4.31 in. in 4 hr.—the restricted stream channel, which passes through the very heart of the city, was called upon to perform the task of carrying a flow far beyond its capacity. The invasions of its right-of-way by structures misplaced or poorly designed could have but one result—the backing up of the flow and the accumulation of debris which, forming impromptu dams, served to divert the surging current into the city streets. Buildings were floated from their foundations or were undermined and collapsed, pavements were ripped up, water and gas mains broken and all the damage characteristic of other severe floods was done.

Who, then, is responsible for allowing the channel of Mill Creek to become cluttered with obstructions which strangled its free flow at the very time when it should have been working at maximum capacity? The city had ample warning of the damage which would follow an intense precipitation, for the flood of Aug. 3 was the third of its kind, the other two having occurred in 1893 and 1878. It is fair to assume that the city's engineers must have foreseen the possibilities of an unusually severe storm but, assuming that they did so, it is not unthinkable that their recommendation should pass unheeded by the authorities empowered to approve of the location of encroaching or inadequate structures or to supply funds for the improvement of the creek. In this connection a quotation from Mr. Seelye's article is illuminating:

"The failure of the 50-ft. dam at Austin, Pa., on Sept. 30, 1911, resulted in the passage of a law by the Legislature of the State, providing for the investigation of the safety of every dam, and that no new dams could be built until the plans had been approved by the State Water Supply Commission. This law also provided for the approval of plans for bridges, culverts and encroaching buildings or other structures. Unfortunately the buildings and encroachments which caused the damage along Mill Creek were built before this law was enacted. Recently applications have come before the commission for the construction of culverts and buildings on and along this stream, and the engineers of the State have pointed out the necessity for leaving a large unobstructed channel and have met with decided opposition."

It generally takes a disaster such as the one at Erie to overcome opposition of the kind to which Mr. Seelye refers. The catastrophe emphasizes again the need for the supervision, by a disinterested body, of the occupancy of flood-plain land and the adequacy of bridge openings. Upon city and State officials there rests a responsibility for preparedness against repetitions of the Erie flood which, taken in the aggregate, is by no means insignificant when compared to preparedness of a strictly military nature. And yet, just preceding the Erie flood, the State of Pennsylvania felt obliged to adopt measures of retrenchment which resulted in the curtailment of the activities of the State Water Supply Commission and the discharge of a number of the members of its engineering staff—the very men specially qualified to forestall such disasters as the one of Aug. 3.



ERIE'S STREETS AFTER THE FLOOD WERE PILED HIGH WITH THE WRECKAGE OF FALLEN BUILDINGS

Restricted Stream Channel Responsible for Erie Flood Damage

Encroachments by Buildings, Bridges and Culverts on Line of Mill Creek Back Up Water of Severe Storm, Causing Loss of Thirty Lives and $2,000,000 Property Damage

By THEODORE E. SEELYE
Of the Firm of Farley Gannett, Consulting Engineer, Harrisburg, Pa.

THE loss of thirty lives and $2,000,000 worth of property by floods following the severe storm at Erie, Pa., on Aug. 3, was due to encroachments by buildings, bridges and culverts upon the channel of Mill Creek, which passes through the city for 3 miles. The rainfall of 4.31 in. which preceded the catastrophe resulted in a run-off too great for the restricted channel to carry off, and the water backed up at points narrowed by encroaching buildings, inadequate bridges and culverts until these structures failed and the accumulated water and débris descended to repeat the operation at a lower point.

MILL CREEK AND ITS WATERSHED

Mill Creek flows into Presque Isle Bay, Lake Erie, through the city of Erie, draining at its mouth 12.9 sq. miles. It rises a few miles to the southeast of the city and flows west, parallel to the lake shore and 3 miles south of it, turning abruptly north about 2 miles before it enters the built-up section of the town. Its watershed lies in the sandy, gravelly soil typical of this once glaciated region, and is underlaid at a slight depth by a gray slate formation which is productive of a high rate of runoff. It is in a high state of agricultural productivity, containing, however, no other municipalities than Erie. The countryside is composed of rolling hills with little timber on them or in the valleys. Just before entering the city the stream emerges from a narrow valley through which it passes for about 2 miles. The sides of this valley rise steeply about 100 ft. above the water.

Its slope through the 2.75 miles of its course within the city is very steep, the fall being 187 ft., or nearly 70 ft. per mile. Beyond the city limits the fall is 47 ft. per mile, and becomes less steep farther upstream. This character of profile is most unusual, and is due to the descent from the higher lake terrace, on which most of the watershed lies, to the Lake Erie level.

The thriving city of Erie lies upon the shores of Presque Isle Bay and has a population of about 75,000. It is the center of a large manufacturing district and is provided with transportation facilities by the New York Central, Pennsylvania and Nickel Plate railroads and by navigation upon the lakes.

The recent flood on Mill Creek was the first serious catastrophe suffered by the city, though two previous floods had resulted in some damage. Considerable difficulty was experienced in the search for bodies, due to the immense piles of wreckage and débris, and it will probably be some time before an accurate death list can be made. It is believed that a majority of the deaths were caused by crushing and blows from débris. From authentic sources it was learned that several people were removed from the wreckage, still alive, as long as 48 hr. after the flood.

The flood took its course through a low-lying portion of the city, and most of the houses destroyed were of the cheaper type, although in the lower reaches an excellent residential section lay in its path. Altogether about 200 houses were destroyed, including residences, public garages, jobbing houses and manufacturing plants. An area about 2½ miles long and one to three blocks in width was affected. State Street, the main business street, suffered only to a slight extent, although in close proximity to the raging waters, which in a few places flowed to a depth of several feet over its surface.

The fact that the damage was wrought after dark, between 8.30 and 9.30 p. m., made the loss of life greater among the residents of the district, although it probably resulted in less loss of life in the mills and business houses. Owing to the darkness rescue work was most difficult, and lives were lost which might otherwise have been saved. There was, however, great heroism shown in many of the rescues. Many people who had gone to bed were taken unawares, and had no opportunity for escape when their houses were floated off by the current.

FLOOD WARNINGS UNHEEDED

There is one striking point which stands out among others with regard to the human element in this flood. The fact that so long a time had elapsed, over twenty-five years, since this stream was in flood before, made it impossible for many of the people, even though they were warned, to believe that this tiny stream with which they were familiar could possibly reach the heights and do the damage which it actually did. These people, therefore, did not heed the warnings which were given them and remained in their houses to be carried off with these structures when they went downstream.

Immediately upon the receipt of word of



ALONG PARADE STREET FRAME HOUSES WERE SWEPT FROM THEIR FOUNDATIONS

The Path of the Erie Flood Is Marked by Battered Structures, Eroded Streets and Piles of Debris



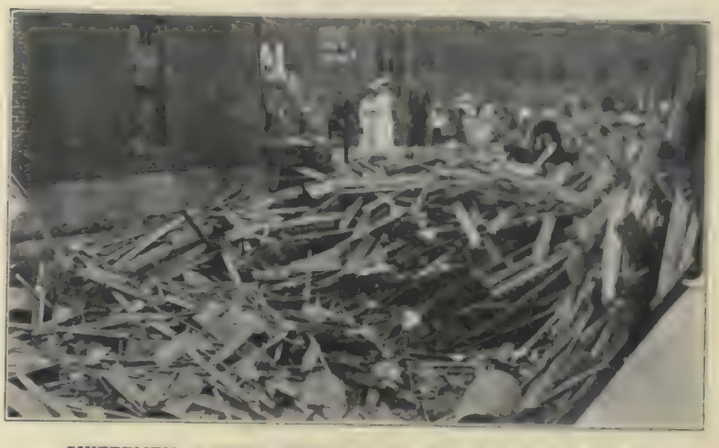
ALL THAT IS LEFT OF A BRICK ARCH BRIDGE



REPAIRS STARTED ON NICKEL PLATE RAILROAD CULVERT



SEVENTEENTH STREET BRIDGE WAS COMPLETELY WRECKED



SIXTEENTH STREET BRIDGE CHOKED BY FLOOD DÉBRIS



ASPHALT PAVED STREETS WERE RIPPED UP BY CURRENT



GARAGE WHICH WAS UNDERMINED AND COLLAPSED



HIGH WATER REACHED LEVEL 12 FEET ABOVE CREEK BED



GLENWOOD CONCRETE DAM WHICH WITHSTOOD FLOOD

the flood the State Health Department sent men to Erie to look after the health and welfare of the city and to direct the clearing up of the débris. The State constabulary, Federal marines, State militia and the city police guarded the damaged district against pillage. The Health Department men were all experienced in the very similar conditions which they found at Austin after the failure of the dam above that town four years ago. The Water Supply Commission of Pennsylvania was also represented by some of its engineers.

RECORDS OF RAINFALL

The water performed many freaks in its passage through the city. Sheets of asphalt, 20 ft. or more square, were torn up, and in some cases were left standing on end against buildings. Large frame buildings, sometimes practically intact, were moved to new sites, or wedged in between other buildings. Steel superstructures of bridges, smoke-stacks, boilers, automobiles, and other heavy objects were carried long distances.

The rainfall from noon, Aug. 3, to noon, Aug. 4, was the greatest recorded at the U. S. Weather Observatory in Erie during the forty-two years since its establishment, a total of 5.77 in. having fallen from 3.24 p. m., Aug. 3, to 5.30 a. m., Aug. 4. The larger part of the precipitation occurred during the first 4 hr., when 4.31 in. were recorded. The greatest intensity for 5 min., 10 min., etc., is shown in Table 1:



AT RIGHT — REMAINS OF TWO BRIDGES WHICH CROSSED MILL CREEK



AT LEFT—FLOOD WASHED OUT ABUTMENTS OF STATE STREET BRIDGE

TABLE 1.—GREATEST RAINFALL INTENSITY FOR DIFFERENT TIME INTERVALS

Period	Inches of Rain
5 min.—6.44 to 6.49 p. m.	0.39
10 min.—6.43 to 6.53 p. m.	0.66
15 min.—6.34 to 6.49 p. m.	0.87
30 min.—6.24 to 6.54 p. m.	1.38
1 hr. —5.53 to 6.53 p. m.	1.50
2 hr. —4.53 to 6.53 p. m.	2.84
3 hr. —3.53 to 6.53 p. m.	4.04
4 hr. —3.24 to 7.24 p. m.	4.31

It will be noted that the greatest intensity was recorded for the 10-min. interval between 6.43 and 6.53 p. m., when 0.66 in. fell.

The precipitation by 15-min. intervals from 3.30 to 7.30 p. m. is given in Table 2:

TABLE 2.—PRECIPITATION BY 15-MINUTE INTERVALS

Time Interval (p. m.)	Precipitation, Inches	Accumulation, Inches
3.30 to 3.45	0.13	0.13
3.45 to 4.00	0.18	0.31
4.00 to 4.15	0.39	0.70
4.15 to 4.30	0.52	1.22
4.30 to 4.45	0.16	1.38
4.45 to 5.00	0.07	1.45
5.00 to 5.15	0.12	1.57
5.15 to 5.30	0.64	2.21
5.30 to 5.45	0.39	2.60
5.45 to 6.00	0.22	2.82
6.00 to 6.15	0.03	2.85
6.15 to 6.30	0.16	3.01
6.30 to 6.45	0.74	3.75
6.45 to 7.00	0.51	4.26

Three distinct storms are to be noted in the precipitation record, one occurring between 4 and 4.30 p. m.; one between 5.15 and 5.45 p. m., and the last between 6.30 and 7 p. m.

The earlier storms were of sufficient intensity to saturate the top soil thoroughly and fill the stream, while in the periods between storms, about 45 min., a sufficient amount of rain fell to maintain a complete saturation and cause a high rate of runoff for the last part of the rain.

The maximum rate of discharge during the flood is difficult of determination, but all the methods used indicate that it was unusually high and some unexpected results were obtained. Three methods were used—the discharge over the Glenwood Dam, Kutter's formula at a section of the creek about 1500 ft. below the dam, and by a distribution of the precipitation over the drainage basin.

GLENWOOD DAM SURVIVES

The Glenwood Dam was built by the city across Mill Creek in Glenwood Park, on the outskirts of the inhabited area, about ten years ago. It consists of a hollow, reinforced concrete spillway about 35 ft. long, 6 ft. high, and 3 ft. below abutments, in the bed of the creek, flanked by earth embankments, 125 ft. long on the east end and 75 ft. long on the west end. The dam was completely overtopped during the flood, and water to a depth of about 4 ft. passed over the embankments. The west embankment was breached in two places, but to a depth only a little lower than the spillway crest. Contrary to press reports, the failure of the dam had nothing whatever to do with the flood in the city, since it was not only almost entirely submerged, but its storage capacity was negligible.

RATE OF DISCHARGE DETERMINED

With a 4-ft. depth over the earth embankment, the quantity passing the dam amounted to 7050 cu. ft. per second, or at the rate of 760 sec.-ft. per square mile for the tributary drainage area of 9.27 sq. miles.

A cross-section of the creek about 1500 ft. below the dam, and shortly below the site of the Elliot Street bridge, was used as a basis of computation by Kutter's formula. Slope measurements made by the Water Supply Commission of Pennsylvania at the section indicated a slope of 1 per cent. With $n = 0.066$, a discharge of 8855 sec.-ft. was obtained, or at the rate of 850 sec.-ft. per square mile for the 10.4 sq. miles of tributary drainage area.

The third method used was to divide the watershed into small areas, and, assuming a distribution over the entire shed of a rainfall similar in intensity and character to that which fell in Erie, compute the time interval required for the water vented from each section to reach a given point. This method is applicable only to small watersheds. By this method a runoff of approximately 900 sec.-ft. per square mile of drainage area was obtained. The maximum rate of discharge was probably at the rate of about 800 sec.-ft. per square mile.

The bridges over the stream at the street crossings were largely responsible for the extraordinary flood losses. These were not only inadequate to carry the discharge, but soon became clogged with débris, causing the flood to pass over them or carry them away. At Twenty-sixth Street the street level was about 25 ft. above the creek, which flowed under it through a small brick culvert. This crossing acted as a dam until water passing over it carried the bridge approaches away, causing a rush of water below and great damage. This was repeated at successive bridges, causing a great increase in the height of the flood water. About twenty-five bridges cross Mill Creek in the city limits, and all but three or four of these were either destroyed or new channels cut around them. About thirty highway bridges were destroyed in the country districts.

Several important manufacturing establishments were built over the creek, forming complete obstructions. The water swirled around these plants, clearing away all frame buildings and causing a complete ruin of all material, machinery, etc., in the ground floors and basements of the factories.

Railroad traffic was suspended for a period as the result of washouts and the destruction of bridges. The Nickel Plate Railroad crossing over Mill Creek in Erie was destroyed, the small concrete culvert which was built to carry the stream proving entirely inadequate. Severe erosion of the fills and roadbeds of the railroads attested to the intensity of the rain.

Fourmile Creek, near Erie, flooded in a manner similar to Mill Creek but was not so obstructed, and did little damage other than the destruction of a few bridges. Neighboring communities reported damage of lesser importance indicating that the precipitation covered a fairly wide area.

This is the third great flood in Mill Creek of which record has been obtained, and it is

to be hoped that there may be truth enough in the superstition regarding the success of the third time to enable the city to construct works to prevent a fourth occurrence.

On Sept. 10, 1878, the first flood came, and several people lost their lives, while much property was damaged. The population of Erie was small then, only 28,000 as compared with 75,000 to-day. The channel was not so much encroached upon and the losses were much lighter.

In 1893 came the second inundation, causing much damage but no loss of life. Following this experience an attempt was made by some of the citizens to pass a bond issue to effect a remedy. It was unsuccessful, and now that still further reductions have been made in the channel capacity, still more valuable property and buildings placed in way of floods, still more lives put in jeopardy in houses in the flood zone, the penalty of procrastination has been paid.

We do not know how the discharge during the floods of 1878 and 1893 compared with that of Aug. 3, but we do know that the loss in this most recent one was far greater than in the others, and that this greater loss in life and property was due to ill-considered construction of buildings, bridges and culverts along and over the stream. Unfortunately the design of a small bridge usually consists in getting a structure to suit the traffic and purse, and its suitability to the stream which flows under it is seldom considered. Such a catastrophe as this accentuates the necessity for considering seriously this factor in bridge design. It also emphasizes the wisdom of thorough investigation before locating dwellings and factories in the flood plain of streams and rivers, and of preventing the construction of such buildings in locations which will reduce beyond safe limits the waterway capacity of the channels.

The failure of the 50-ft. concrete dam at Austin, Pa., on Sept. 30, 1911, resulted in the passage of a law by the Legislature of that State, providing for the investigation of the safety of every dam, and that no new dam could be built until the plans had been approved by the State Water Supply Commission. This law also provided for approval of plans for bridges, culverts and encroaching buildings or other structures.

Unfortunately the buildings and encroachments which caused the damage along Mill Creek were built before this law was enacted. Recently applications have come before the commission for the construction of culverts and buildings on and along this stream, and the engineers of the State have pointed out the necessity for leaving a large unobstructed channel, and have met with decided opposition.

Doubtless this difficulty will not now be encountered, and a thorough study will be made of the best way to lock the door securely now that the horses have been stolen. Just as it was necessary for seventy-eight lives and hundreds of thousands of dollars' worth of property to be sacrificed at Austin to teach the lesson concerning secure dams, so thirty lives and millions of dollars of property had to be lost to force home the necessity for intelligent supervision, by a disinterested body, of the occupancy of flood plain land and the adequacy of bridge openings.

THE AVERAGE COST OF 35.9 MILES OF HIGHWAY in California, for which contracts were awarded last month, was $7,541 per mile.

Gains Made by State Management of Road Construction and Maintenance

J. E. Pennybacker Summarizes Progress—Urges Elimination of Politics and Shows Need for Uniform Legislation

IN support of his contention that the development of State road management has been toward a larger measure of participation by the State through increased appropriations and more comprehensive State supervision, J. E. Pennybacker, chief of road economics of the U. S. Office of Public Roads, gives in the 1914 Yearbook of the Department of Agriculture, statistics covering the more important State-aid work accomplished. Of the States which, for magnitude of expenditures, mileage of roads constructed, and comprehensiveness of system, stand out most prominently, Mr. Pennybacker has selected several for individual mention, so that the reader may obtain a more intimate knowledge of the operation of the policy of State management.

POLICIES OF LEADING STATES

Massachusetts, which established its highway department in 1892, had expended out of State appropriations to Jan. 1, 1914, about $14,000,000, had completed more than 1000 miles of State highway, and had aided in the improvement of more than 350 miles of small-town highways. The State obtains its funds for road work through the issuance of State bonds and the levying of automobile license taxes. In constructing the system of State highways the entire cost is borne in the first instance by the State, but the counties are required to repay to the State 25 per cent of the cost. The motor-vehicle fees are applied entirely to the maintenance of State highways and improvement of small-town roads.

Connecticut, which established its highway department in 1895, had expended to Jan. 1, 1914, about $11,500,000, a portion of which was derived from the sale of State bonds. The aid granted by the State varies according to the taxable valuation of the towns, but has been usually from three-fourths to seven-eighths of the cost of the roads on which the State has granted aid. Like Massachusetts, the Connecticut system provides for the application of automobile revenues to road maintenance.

New York established its highway department in 1898 and expended some $25,000,000 of State funds additional to the authorization in 1906 of the first State bond issue of $50,000,000 for road construction. A second State bond issue was authorized in 1912, amounting to $50,000,000. This provided a total of $100,000,000 through the issuance of bonds for the building of a system of State and county highways. The system as laid out divides the highways into four classes, namely: State highways, to be improved and maintained solely at the expense of the State; county highways, to be improved and maintained at the joint expense of the State, county, and town; county roads, improved and maintained by the county; and town highways, improved and maintained by the town with the aid of the State. The bond issue was originally intended for the improvement of a system of county highways aggregating 8380 miles, and to this was added a system of State highways of 3617 miles. Approximately 4300 miles of the State and county system were completed up to Jan. 1, 1914, with a total outlay of State funds aggregating $67,155,000.

VIRGINIA MAKES RAPID PROGRESS

Virginia has made rather remarkable progress, largely in the building of cheaper types of road than have been constructed in New York and the other Eastern States. The Virgina department was established in 1906 and had expended out of State funds to Jan. 1, 1914, a total of $1,663,000. To show for this outlay, the State reported for the same period a total of 2052 miles of road constructed under State supervision. Under the Virginia plan the local contribution comprises one-half of the total cost, but many of the counties accept State convict labor in lieu of money aid from the State. The law also provides that bond issues shall be expended under the direction of the State highway department. The total mileage of roads constructed under the direction of the Virginia department exceeds the total reported by any State except New York and Michigan, and as the latter State grants aid on local roads only to the extent of a small reward or bonus, the mileage reported would not be comparable on the same basis as the mileage reported by the Virginia department.

Ohio established its highway department in 1904 and constructed to Jan. 1, 1914, a total of 578.29 miles at a total contract cost of $4,847,768, or an average of $8,383 per mile. Under the present law the State levies a tax of one-half mill, which provides an annual revenue of about $3,500,000. In the expenditure of this fund the counties, townships, and abutting property owners must provide an equal amount, so that the annual outlay under the direction of the State highway department is now approximately $7,000,000. A system of intercounty highways has been laid out connecting all of the county seats in the State, and this system is rapidly being improved and maintained under the direction of the State highway department.

Maryland is engaged in the construction of a system of State highways about 1285 miles in length, to be constructed and maintained entirely at the expense of the State. Bonds have been issued and authorized by the State to provide the necessary funds. The total thus issued and authorized to Jan. 1, 1914, amounted to $9,170,000. During 1914 additional issues were authorized, bringing the total up to something like $15,770,000, and it is estimated that the entire system will cost approximately $18,000,000. The total mileage of the State system completed to Jan. 1, 1914, aggregated 490 miles. The State has been granting aid toward the improvement of roads since 1898, and the total of roads completed on which the State has paid a part or all of the cost to Jan. 1, 1914, aggregates 1430 miles.

NEW JERSEY PIONEER IN STATE AID

New Jersey, which has the distinction of being the first State to adopt the policy of State aid, began its work in 1892 and had made a total outlay to Jan. 1, 1914, of about $5,800,000. The State had completed

during that period 1833 miles of road, partly paid for out of State funds and party by county funds. The State's contribution toward the total cost aggregates about 40 per cent. Revenues derived from the registration of motor vehicles are applied to the maintenance of the roads, and recently provision has been made for the laying out of a system of State highways similar to the plan adopted in many other States.

Wisconsin, which has been operating under a State-aid plan since 1911, follows a system somewhat local in character, under which the boards of county commissioners are required to select "a county system of prospective State highways." These roads are constructed by the town, county, and State, jointly, each paying one-third of the cost, or a county can assume two-thirds of the cost and the State one-third. The improvements are made under the direction of a county highway commissioner selected by the county board, under the general direction and in accordance with plans and specifications of the State highway commission. The first appropriation made by the State was $350,000 in 1911, and a similar amount in 1912. For 1913 the appropriation was increased to more than $800,000 and for 1914 to $1,230,000. Under the joint township, county, and State plan more than $4,300,000 is available for 1914. That rapid progress is being made is indicated by the fact that 996 miles of road were constructed during the year 1913, bringing the total constructed under the direction of the State highway department to 1436 miles.

California has undertaken to construct a system of State roads comprising two trunk lines traversing the State from north to south, and a system of laterals connecting the county seats with a trunk-line system. A State bond issue, amounting to $18,000,000, was authorized in November, 1910, and the work of constructing this State system is now well under way. State highway bonds to an aggregate of $5,200,000 were sold to Dec. 31, 1913, and contracts had been awarded for the construction of 356 miles of highway, estimated to cost about $2,900,000.

Cost of Roads

The cost of a road is dependent upon not only the type of construction, but the amount and character of grading to be done, the cost of labor and materials, the width and thickness of surfacing, the character and amount of drainage required, and other factors of equal variability. Based upon general averages, however, it has been ascertained that under average conditions macadam roads can be built in southern States at from $4,000 to $5,000 per mile, gravel roads at from $1,500 to $2,500 per mile, and sand-clay and topsoil roads at from $800 to $1,500 per mile. In New England and the other eastern States, macadam roads are reported at from $6,000 to $9,000 per mile, gravel roads at from $3,200 to $5,000, and bituminous macadam from $8,000 to $13,000, according to the character of construction, whether surface-treated, penetration, or mixing method. The bituminous type is quite general in the eastern States.

As indicating costs in other sections of country, the State Highway Commissioner of Michigan reported in 1913 the average cost for macadam roads $4,300 per mile, clay-gravel roads $1,500 per mile, and concrete roads about $10,000 per mile. The average cost of State highways constructed in Ohio in 1913 was $8,383. According to types, in 1912 the brick-paved highways averaged $14,650 per mile and the macadam highways $5,950. In California the first 356 miles of the State system of highways cost an average of $8,143 per mile and consisted principally of thin concrete with a thin coat of bitumen. The maximum and minimum figures given in this paragraph are not absolute, but are intended to present the usual range of costs. The rates given include grading, drainage, surfacing and engineering costs.

Efficiency of State Management

The efficiency of State road management has been impaired in some of the States through the influence of politics. Changes of administration have brought about upheavals which have proved prejudicial to the efficient and economical administration of the highways. This condition is gradually being remedied through the placing of nonpartisan commissions in charge of State highway departments, so that in the appointment of highway engineers and their assistants political considerations shall have no weight. Furthermore, competent engineers may be attracted to the work by the realization that they will not be disturbed in office so long as they render efficient service.

Maintenance

In the early stages of State road management little or no provision was made for the maintenance of roads constructed with the aid of State funds. This condition has developed into a serious problem, and many of the States are finding it difficult to obtain sufficient funds to resurface and properly maintain the large mileage of roads already constructed. It was thought at first that if the States aided in the construction of roads the counties could be depended upon properly to maintain them. This has been found to be a case of misplaced confidence, and the only way in which the States could obtain proper maintenance was to place the work under the immediate direction of a State highway department. Automobile revenues are for the most part applied to the maintenance of roads, and many of the States are providing annual cash appropriations in sufficient amounts properly to meet existing conditions.

State Control

The realization has become quite general that, in order to render maximum service, State highway departments should be given some measure of control over the construction and maintenance of local roads. For this class of roads an amount exceeding $160,000,000 is expended annually, with comparatively little result to show in the form of improved road mileage for this great outlay. The State of Iowa has met this situation by placing all the road work in the State under the direction of the State highway department.

Traffic is increasing so rapidly as to cause excessive wear upon the roads, especially in the vicinity of congested centers of population. This results in a heavy annual maintenance cost, averaging in the large eastern States not less than $750 per mile per annum. Many experiments have been made in the effort to devise types of road which can be maintained at relatively low cost. Thus far, aside from the cheaper forms of construction, the States are depending upon the various forms of bituminous macadam, concrete and vitrified brick road.

Features of Successful Management Summarized

Summarized briefly, the essentials to successful State highway administration, as demonstrated by the experience of the various State highway departments, are as follows: (a) The elimination of politics as a factor in State highway work; (b) the control by the State highway department of all work on which State funds are expended; (c) adequate appropriations for continuous maintenance of highways under efficient supervision from the day the highways are completed; (d) State supervision as to surveys, plans and specifications of roads and bridges constructed under bond issues, and supervision of such other road and bridge work as requires considerable cash outlay and the exercise of engineering skill and knowledge.

Highly desirable progress toward the attainment of efficiency in State highway management could be accomplished by a general revision of State road laws, so as to eliminate all obsolete and conflicting legislation and to reduce the really essential laws to a few simple, clear-cut statutes which would define duties and responsibilities and provide ways and means for conducting highway work. A literal compilation of the road laws of the several States has already been made. This great mass of legislation exceeds 4,000,000 words. It is difficult to imagine conditions in any State which would necessitate more than 10,000 words to deal adequately with all phases of highway improvement. If this average were maintained for the forty-eight States, it is evident that without any loss whatsoever in efficacy 3,500,000 words could be wiped off of our statute books.

Conclusion

State road management is a concrete manifestation of the universal demand of the age for efficiency and equity in the management of public affairs. Its advocates contend that only by State appropriations can the burdens of constructing roads of more than neighborhood importance be equitably apportioned; that only by reaching such adequate sources of revenue as are possessed by the State can sufficient funds be obtained to improve the roads commensurate with their importance; that only through the establishment of a State highway department can the best engineering and practical ability be obtained for the benefit of the entire State, as by any other plan only the wealthier counties could afford to obtain such assistance; that through this centralized management correlation of road work throughout the State may be obtained and the influence of local politics in some degree eliminated or modified; and that standardization as to methods, costs and administration may be greatly promoted by such centralized control. It must be said as evidence of the efficiency of this system that no State is on record as having permanently abandoned the policy once it has been adopted. The whole development of State road management has been toward a larger measure of participation by the State through increased appropriations and more comprehensive State supervision.

Minneapolis Loses Filter Infringement Suit

Gates Operated from a Single Position and Underdrains with Holding Down Screens in Tapered Bottoms Are Held to Be Inventions

THE filter patent litigation brought against Minneapolis by Ira H. Jewell has been decided in two of the eight claims in favor of the patentee, as noted in last week's issue of the Engineering Record, page 181. After a delay of more than a year Judge W. F. Booth of the fourth division of the U. S. District Court, district of Minnesota, handed down the decision. An abstract of a portion of the decision is given below:

The suit is in equity to restrain the city from constructing and using filters embodying inventions numbered 649,410 and 649,411. The answer of the defense was non-infringement, anticipation and absence of invention. At the final submission eight claims only were contested but they can all be summed up in claim 1 of 649,410, reading as follows: "A filter provided with a system of controlling valves which are provided with actuating devices located so as to be accessible for control from a single position of an operator," and claim 14 of 649,411 reading, "a filter comprising a tank having a tapered lower end, and an opening at the bottom of the same, a screen at the lower end of the tank in line with said opening, a granular filter bed within said tank, the part of said bed contained within the tapered portion of the tank being made of relatively large granules whereby water passing upwardly therethrough in washing the filter is laterally deflected so as to be distributed throughout all parts of the bed and a screen interposed between said larger granules and the part of the bed above the same."

Opinion on Screens

In commenting on the difference between the cup-shaped strainers in the Hyatt patents and that proposed by the Jewell claim Judge Booth states as follows: "In the Hyatt structure the upper screen, or perforated metal, in its normal action is not intended to and does not hold the coarse material underneath in a rigid position. In the plaintiff's structure the upper screen in its normal action intended to and does hold the coarse gravel underneath in a rigid position. Further, on the assumption that the Hyatt structure may be so used as to wash the sand, without transferring it to a separate compartment, a considerable portion of the filter sand bed in the Hyatt structures is not directly and wholly above the coarse or granular material, and therefore, the water in the washing process in passing through the coarse material does not strike effectively the bottom portion of the sand in all parts of the filter bed. Accordingly, the bottom of the filter bed is more or less incompletely washed. In the plaintiff's structure, the idea and aim of the inventor was to have the sand bed of the filter directly and wholly above the coarse or granular material. This was accomplished by the tapering form of the lower part of the filter bed with gravel, above which rested the sand bed. Unwashed areas were thus avoided.

"This arrangement or combination, taken as a whole, in my judgment, was a real step in advance, and constituted invention. It is not claimed that plaintiff invented high velocity washing of filters, but it is claimed that he so arranged the elements going to make up his filter structure (the tapering bottom, screen at the lower end with restricted openings, the filling of the tapering portion of the filter bed with coarse granular material, the holding it rigidly in place with an upper screen and the position of the sand bed such that all parts of it should be directly above the coarse granular material) that high velocity washing became a practical and efficient process. It was this final step in making the combination and organization above noted that constituted invention on the part of the plaintiff. It is easy to see now that the arrangement made by the plaintiff in his structure is a remarkably practical and efficient one to produce the desired result; but, no one saw it until after the plaintiff had himself taken the advance step.

"The zeal of counsel has collected quite a number of old patents which, it is claimed, embody every one of the elements of the plaintiff's structure, sometimes singly, sometimes in various combinations. It would serve no useful purpose to analyze in detail these various patents; it is sufficient to say that, in my judgment, the evidence shows that claim 14 of the plaintiff's patent was not merely a mechanical aggregation of old and well known elements, but a combination and an organization of elements in a structure which constituted a distinct advance in the art of filtration, and that the steps taken by plaintiff in bringing together and combining those elements were of such a character as to constitute invention."

Operating Tables Infringe

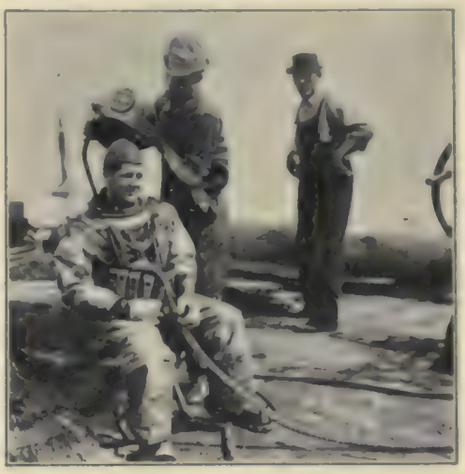
Applied to the control feature the decision states that all of the claims but No. 1 of 649,410 refer to a central station for all of the filters and no such station exists at Minneapolis. Claim 1, however, was held to relate to a single filter unit. The anticipatory examples of the plants at Wilkes-Barre and Atlanta were equipped with hand-operated levers or hand wheels. On this point Jude Booth is of the opinion that the size alone of the Minneapolis filter, leaving efficiency out of the question, makes a different device necessary than is used at these other cities. It was urged by the defendant that the change from hand operated to power operated valves did not involve invention and that the substitution of hydraulic valves was but a double use for an old device. Judge Booth declared as follows: "This raises a question, which under the evidence and the authorities cited, to my mind, is not free from doubt, but I think that the doubt should be resolved in favor of the plaintiff. The patent was granted, claim 1 being included, and this raises at least a presumption of invention."

MINNESOTA SPENT $1,464,773 on road and culvert construction, $323,111 on road maintenance and $236,236 on bridge construction during 1914, according to G. W. Cooley, State engineer, in his latest annual report. The total amount of work supervised by the State Highway Department during 1914 was $4,809,792. The cost of supervision on all the work amounted to approximately 5½ per cent.

Wrecked Ship's Backbone Broken with Dynamite

How Divers Placed Charges in Removing Steamer Sunk Last Winter in Ice Floes off Entrance to Chicago Harbor

DYNAMITE charges carefully placed by divers were the main factor in removing the wreck of the steamer "Iowa," which was sunk in the running ice about 2 miles off the entrance to the Chicago harbor Feb. 4, 1915. The passengers and crew were saved by walking to shore on the ice. The upper works of the ship were badly torn away, causing the hull to roll over as it sunk.



DIVER GETTING READY TO GO DOWN

The depth of water in the vicinity of the wreck was 36 ft., and the depth over the wreck was 16 ft.

The vessel, which was built in 1896, was made of wood. It was 202 ft. long, 36 ft. wide and of 13-ft. draft, and had a gross tonnage of 1157 and a net tonnage of 846. Part of the cargo was salvaged by the owners, the Goodrich Transit Company of Chicago.

Forty Days to Remove Wreck

Contract for the complete removal of all parts of the wreck to a clear depth of 30 ft. below datum was awarded in Chicago May 21 to the Great Lakes Dredge & Dock Company by Lieut.-Col. W. V. Judson, Corps of Engineers, U. S. A. The specifications and contract provided that the work should be commenced within ten days after the re-



DIVER IN HIGH DIVE

ceipt of the approved contract agreement, and that the whole job should be completed within forty calendar days after the date set for the commencement of the work. Liquidated damages in the amount of $100 per day for any period of delay beyond the allotted time were provided. The contract also required that no material removed should be deposited in the lake where the depth of water was less than 60 ft. or where there was less than 35 ft. clear depth. It further specified that all floating material be secured and disposed of otherwise than in the water.

DIVERS MAKE INSPECTION

On June 1 divers made an inspection of the wreck and reported that the boat was lying upside down, that her bow was pointed toward the harbor and that the north side of the hull was raised 4 to 5 ft. off the lake bottom by broken parts of the bulwarks and by part of the cargo which had been carried on deck. For the next few days the divers worked placing dynamite racks and salvaging such parts of the cargo as could be reached. The cargo consisted mostly of tanned leather hides and parts of machinery, including electrical equipment, gears and castings.

BREAKING THE SHIP'S "BACKBONE"

The divers formed a trough 1 ft. wide, from stem to stern on both sides of the upturned keel, by setting 2 x 4 in. scantlings on edge and spiking them along the bottom of hull about 1 ft. away from and parallel to the keel. Sacks containing 50 lb. of dynamite were then lowered into place in the trough at 10-ft. intervals, alternating on either side of the keel so that the distance between sacks on each side of the keel would be 20 ft. Wires extended up through the water to small floats. Five sets of these blasting wires were connected by lead wires to a battery about 500 ft. from the wreck. Five bags of 50 lb. each, or 250 lb. of dynamite, set and located as described, were set off in each blast. The blowing up of the stem piece and bow required an additional blast of 250 lb.

No sand bags, mattresses or other devices for holding down the force of the explosion were used, the water itself acting as a cushion. The force of the explosion can be readily seen and estimated from the volume of water thrown, as indicated in the accompanying photograph. The column of water rose to a height of at least 200 ft. and extended over an area the radius of which would be 400 ft. In fact, the first day the dynamite was exploded the work-boat was about 400 ft. away from the wreck and all of the men aboard were drenched by the spray and swell. The first blast of dynamite was handled by the diver attaching exploders, but later it was found better to have all the wires attached and have the diver only set the sacks.

The initial blast was shot on Monday, June 14, and the entire job was completed within three days of the time limit.



LETTING DYNAMITE SACK DOWN TO DIVER

THE SIX AUTOMOBILES owned by the Wisconsin Highway Commission have traveled a distance of 88,100 miles in two years of road-inspection work. The total cost of automobile service, taking depreciation into account, was $6378; the average cost per mile of operating the cars was 7.24 cents. The best showing was made by automobile 2, at an average cost of 5.6 cents, and the least favorable was made by automobile 5, which averaged 10.84 cents. The variances in cost per mile were largely due to the difference in the general conditions of the roads in the various road divisions.

Production of Rolled Iron and Steel Decreases in 1914

Gross Production Falls Off 6,421,047 Tons, or 25.9 Per Cent, as Compared with Output of 1913, Total Tonnage Being 18,370,196

THE American Iron & Steel Institute has recently published the figures for 1914 in special statistical Bulletin 4 of the Bureau of Statistics. The production of all kinds of iron and steel rolled into finished form (including blooms, billets and axle blanks rolled for forging purposes and semi-finished products which were rolled for export that year), shows a decrease of 6,421,047 tons, or 25.9 per cent, as compared with the output in 1913. The total gross tonnage rolled in 1914 was 18,370,196. It consisted of 1,945,095 gross tons of iron and steel rails, 4,757,814 gross tons of plates and sheets, 2,431,714 gross tons of wire rods, 2,031,124 gross tons of structural shapes not including plates and 7,204,444 gross tons of bars, skelp, and all other forms. Of the total tonnage, 1,167,776 gross tons were iron, and 17,202,420 gross tons were steel.

Items showing 288,471 gross tons of steel bars for reinforced-concrete work, 35,314 gross tons of rolled sheet piling and 33,249 gross tons of steel railroad ties are among those of interest to the engineer and contractor.

Skewed Joints Recommended for Concrete Road Construction

SKEWED joints for concrete roads, instead of joints at right angles to the direction of traffic, are recommended by C. H. Moorefield and James T. Voshell, of the U. S. Office of Public Roads, in Bulletin 249 of the Department of Agriculture. With the joint at right angles the two wheels of a vehicle strike the joint at the same time and thus produce the maximum amount of impact. By skewing the joint at an angle of about 15 deg. the wheels strike one at a time, and the total resultant impact is reduced by at least one-half. This is advantageous to both the traffic and the pavement, and since the difficulties involved in constructing skewed joints are not at all serious, there is no apparent objection to their use, are opinions expressed by the bulletin.



CONNECTING LEAD AND FUSE WIRES



ONE OF THE SMALLER BLASTS

How Oiled Earth Roads Are Built in Kansas

W. S. Gearhart, State Engineer, Tells How to Get the Soil Ready, What Kind of Oil to Use, How to Apply It and the Equipment Needed

WITH but few exceptions—and those due to the use of a light oil—oiled earth roads have proved satisfactory in the twelve Kansas counties in which they were constructed, according to W. S. Gearhart, State engineer. Where a light oil was used it was found to act only as a dust preventive and not to form what is known as an oiled earth road. The following method of construction, says Mr. Gearhart, has given the best results.

Getting the Soil Ready

A shoulder furrow is plowed on each side of the roadway, making the width to be treated from 16 to 18 ft., and the loose earth is graded outside of this width. Where the crown of the road is too steep the center is plowed and the material thrown out to the sides. By plowing only the shoulders it has been found easy to shape the subgrade to a crown of about 1 in. to the foot. Practically the same care is exercised in preparing the subgrade for oiled earth road work as for macadam. After shaping the subgrade is thoroughly rolled to compact the earth as well as to take the spring out of the ground. The use of the solid shoulder is to prevent the oil from spreading and to facilitate the mixing and tamping process.

Sandy soils were found to be best adapted to the oil treatment, but satisfactory results are being obtained on clay and heavy gumbo soils where the earth is thoroughly pulverized.

Grade of Oil Used Important

The grade of oil to be used is much more important than the kind of soil. Light oils and those having a paraffin base have been found to be little better than so much water. The oil should be one having an asphalt base of at least 85 per cent. It should be free from paraffin and all lighter oil, and applied to the road at a temperature of not less than 250 deg. Fahr. An oil containing 85 per cent of asphalt will have to be heated before it can be taken from the tank cars which have special steam coils for this purpose. It is necessary to heat the oil to a temperature of 340 deg. Fahr. in the car in order that it may be delivered on the ground at a temperature of 250 deg. Fahr. This will require a steam pressure of 100 lb. per square inch. The amount of oil used is from 2 to 3 gal. per square yard, and should be placed in two courses.



FINISHED OILED EARTH ROAD

How the Oil Is Applied

After applying 1¼ to 1½ gal. of oil on the rolled subgrade, sufficient earth is graded on top of the oil to absorb it. For treatment of 1½ gal. to the square yard about 4 in. of loose, fine earth is graded in on top of the oil, and then thoroughly soaked with water distributed from a sprinkling wagon, and the tamping process begun. A disk harrow, with blades set at an angle, and a drag are employed to stir and mix the oil with the earth. The harrow and drag precede the tamping roller. As soon as the first course is thoroughly mixed and rolled another application of 1½ gal. of hot oil per square yard is applied and about 4 in. of fine earth graded in upon it, and the oil and earth thoroughly mixed and rolled as before. The amount of earth used should be just enough to absorb all of the oil. When the tamping roller rises to the top and the surface has been thoroughly compacted a water-tight wearing surface of from 5 to 6 in. thick will have been formed. The rolling is done from the sides to the center, the same as in macadam construction, in order to maintain the crown.

Should any surplus oil come to the surface after the travel has been allowed on the road a small amount of loose earth is thrown on in order to absorb it, and the surface of the road may be made more durable by the application of 1 in. of sand or gravel.

Equipment Needed

The greater part of the work of preparing the road for treatment can be done with a traction engine and a road-grader. The earth can be thrown back either by a road grader or a road leveler, the latter being much more rapid and leaving the road in almost a perfect cross-section. The oil should be hauled in a distributing wagon built for that purpose, which holds about 600 to 800 gal. It will require two teams to haul such a wagon. One or two teams will be required on the disk harrow and two teams on the tamping roller. The work of grading the earth on the oil is followed closely by the placing of the oil, to prevent it cooling and to assist in the mixing.

There is very little danger of using too much water. The wetter the materials the more thoroughly the oil and earth can be mixed. Oiled earth roads cannot be constructed successfully without thoroughly pulverizing the earth. Treating the surface with oil is not satisfactory, says Mr. Gearhart, except for laying the dust, and this is only effective for a short time. Oiled earth surfaces are not satisfactory for city streets on account of the oily dust. In Kansas the actual cost of the materials and the construction of oiled earth roads as recommended above is from 10 to 20 cents per square yard, averaging about 15 cents.

ONE HUNDRED AND SIXTY-THREE CONTRACTS had been awarded prior to 1915 by the Board of Water Supply for furnishing materials and constructing New York City's additional water supply system. Of these, sixty-one had been completed by the end of 1914. Only a few of the larger construction contracts remained to be completed at the beginning of 1915. These were the Ashokan and Kensico dams, the Hillview reservoir, parts of the Yonkers siphon and the city tunnel, the supplementary shaft and tunnel of the Moodna siphon, the Narrows siphon and the Silver Lake reservoir with parts of the Richmond conduit.



OIL APPLIED AND READY FOR MIXING WITH EARTH



TAMPING ROLLER CONSOLIDATES ROAD SURFACE



DRAFT-TUBES DISCHARGE INTO UNLINED TAILRACE TUNNEL

Swedish Government Builds Hydroelectric Plant Above the Arctic Circle—Part 2

Local Conditions and Necessity of Protecting Conduits and Forebay from Freezing Resulted in Use of Underground Station

IN the first part of this article, published last week, page 156, there was a description of the dam system of the Porjus hydroelectric plant, the station north of the Arctic Circle, recently completed by the Swedish Government. Among the interesting features of the dam system were the measures taken to protect the structures from damage by ice, the use of a sliding wedge of stone to balance the earth pressure against a core wall and of arch decking for a hollow reinforced-concrete dam. This, the concluding part of the article, gives details regarding the hydraulic end of the station, which is entirely underground, and of the conduits and forebay. The last named, taken in conjunction with the equalizing, or surge, chambers on the tailrace tunnel, is of special interest.

Intake

The intake, as was shown in the drawing in Part 1 of this article, is located at the east abutment of the dam, and is built integral with it. There are four openings, each 36 ft. wide and 14.8 ft. high, two for the first installation, now completed, and two for the second. Behind the gates are inclined racks, made of bulb bars spaced 4 in. on centers and supported on a structural steel frame. Stop-log slots allow each gate to be isolated for inspection.

Behind the screens is a basin connecting the broad but shallow section at the screens with the narrower but deeper part in front of the intake tunnel.

The gate controlling flow into the tunnel is about 65 ft. in front of the tunnel intakes. The design of this gate is shown in a drawing herewith. It is 24.6 ft. wide and 21.9 ft. high, suspended from chains and operated from a bridge above. In open position it is protected by an inexpensive timber housing. The gate consists of three horizontal trusses, supporting vertical beams, which carry the buckle-plate skin plate. The hydrostatic pressure on the gate is transmitted to the tracks by eight 2.46-ft. wheels, four on each side. In order to get an equal distribution of the pressure on all wheels, they have been mounted in pairs on equalizers having their bearing pins fastened to the side girders of the gate.

Tightness is insured along the bottom by a timber bolted to the gate. At the sides and along the top there are loose wooden strips, fastened to the gate by springs, and forced against steel strips in the masonry by the water pressure. No by-pass has been deemed necessary. Should it be required to open the gate when the intake tunnel is empty and the basin filled with water, it can be done by opening it a few inches and waiting until the pressures are balanced. To enable the opening of the gate these first few inches, two screw-jacks, which can be attached to the operating chains, have been provided on the overhead bridge. Although the gate has been designed for hand operation, provisions have been made for electrical operation should this be found advantageous.

Intake Tunnel

The intake tunnel, with a net area of 538 sq. ft., has been blasted through rock, which did not require lining except for 425 of the 1725-ft. length. Its slope and location are such that its whole length is below the hydraulic gradient. This was done so as to enable the utilization of the full section at all stages of water and all loads on the station. The slope is 1 : 800, which approximately, corresponds to the loss in head at maximum discharge.

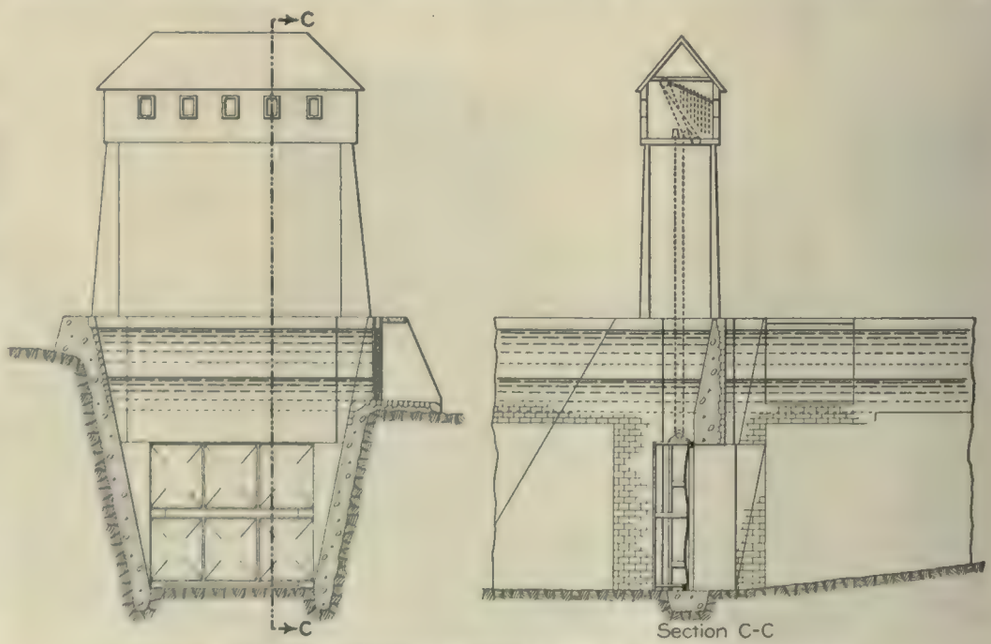
In the section requiring lining a wide fissure filled with clayey material and surrounded by loose and deteriorated rock was encountered. In blasting this section it was necessary to timber the roof. As the fissure appeared again in the excavation for the generator room, it was important to prevent the water from finding its way through it. It was, therefore, necessary to design a lining which would not permit any leakage. The arch was provided with double reinforcing.

Forebay

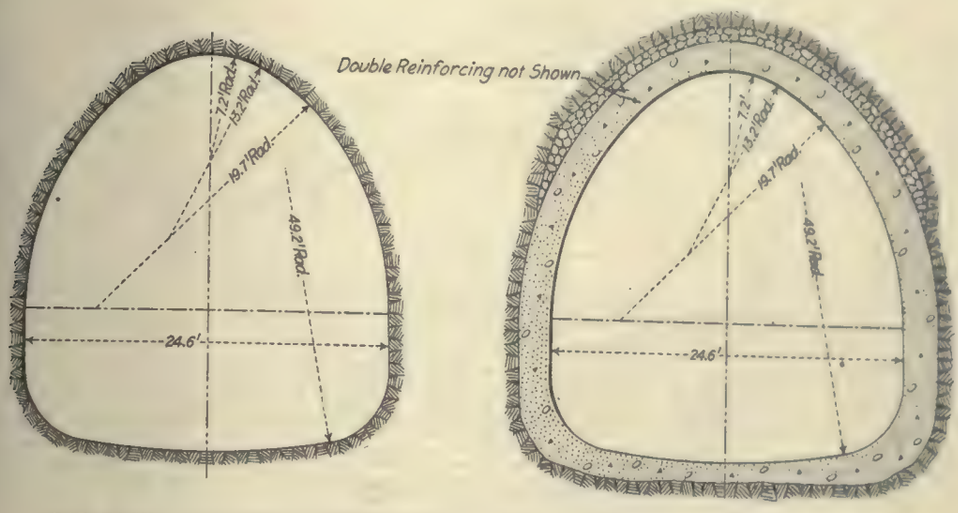
For developments like that at Porjus, where the discharge is carried to and from the turbines in long and closed conduits, subject to sudden fluctuations, it is important to determine carefully the area of the forebay and of the equalizing chambers, which have been provided on the discharge tunnels. The load fluctuations at Porjus are sudden and large, because the greater part of the power is used for traction.

Basing the calculations on load diagrams of electric railways, it was determined that the maximum load changes possible will correspond to an increase or decrease in discharge of about 320 sec.-ft. The area of the forebay is 11,300 sq. ft. and of the equalizing chambers 7500 sq. ft.

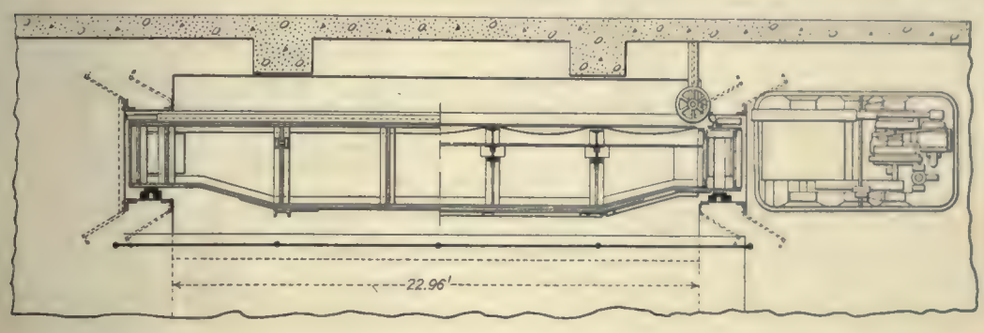
In the diagram on page 195 is shown the result of such an increase—the surges for an increase from 750 to 1070 sec.-ft. The surges on the intake side represent the action in the forebay. On the discharge side of the turbines, the fluctuations in head, because of the wave action in the forebay, will create another set of waves or surges. These will begin with a sudden increase, at about the same time as the first lowering



THIS GATE ARRANGEMENT CONTROLS FLOW TO TUNNEL INTAKE

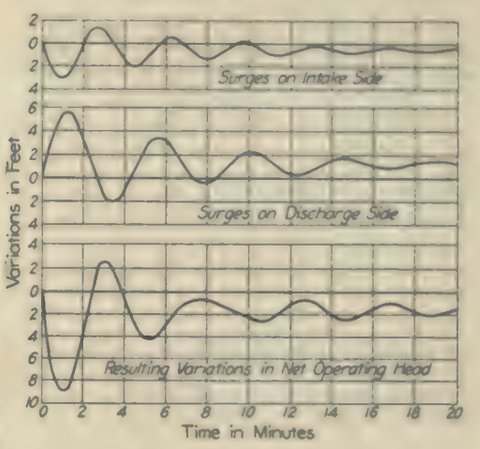


BAD ROCK CONDITIONS NECESSITATED LINING OF SOME PARTS OF INTAKE TUNNEL

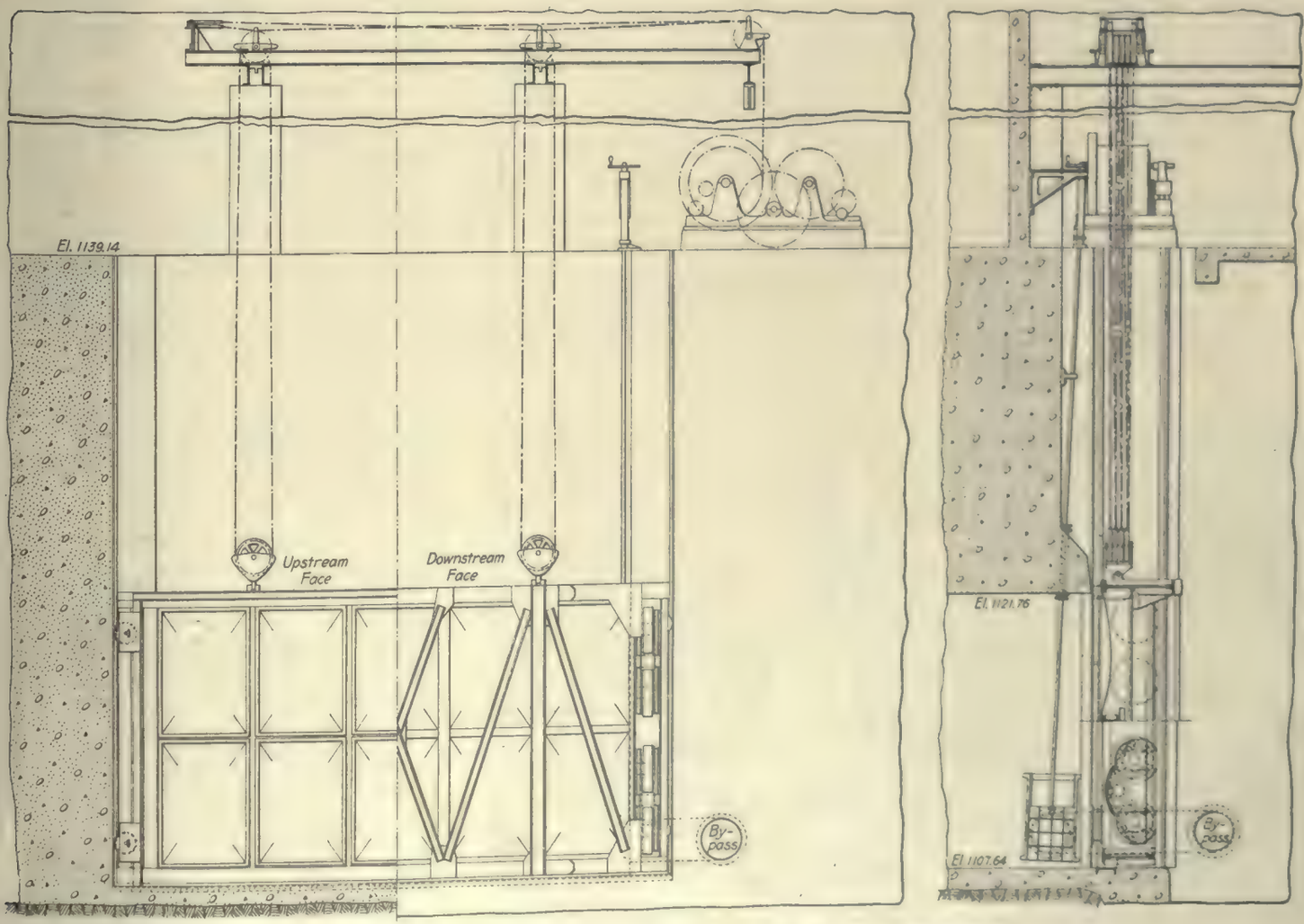


of the water surface in the forebay. As shown, the maximum decrease in head, due to increase in load, amounts to 8.85 ft. and occurs about 1 min. after the change in load. The variation in head is so slow that it does not influence the speed of the units, which, as usual, have been provided with automatically operating governors.

Should a sudden decrease in discharge of 320 sec.-ft. take place, the surges are about the same, the only difference being that the surges increase the head. Should an accident occur so that the decrease in discharge should amount to more than 320 sec.-ft., the surges will be greater than shown. The worst case would be a decrease from 1070 sec.-ft. to nothing. In such a case the water surface in the forebay will rise until water begins to spill over the overflow,



SURGES DUE TO LOAD VARIATIONS



THESE GATES ARE IN FOREBAY CONTROLLING FLOW TO VERTICAL PENSTOCKS

which is connected to the tailrace tunnel by a vertical shaft.

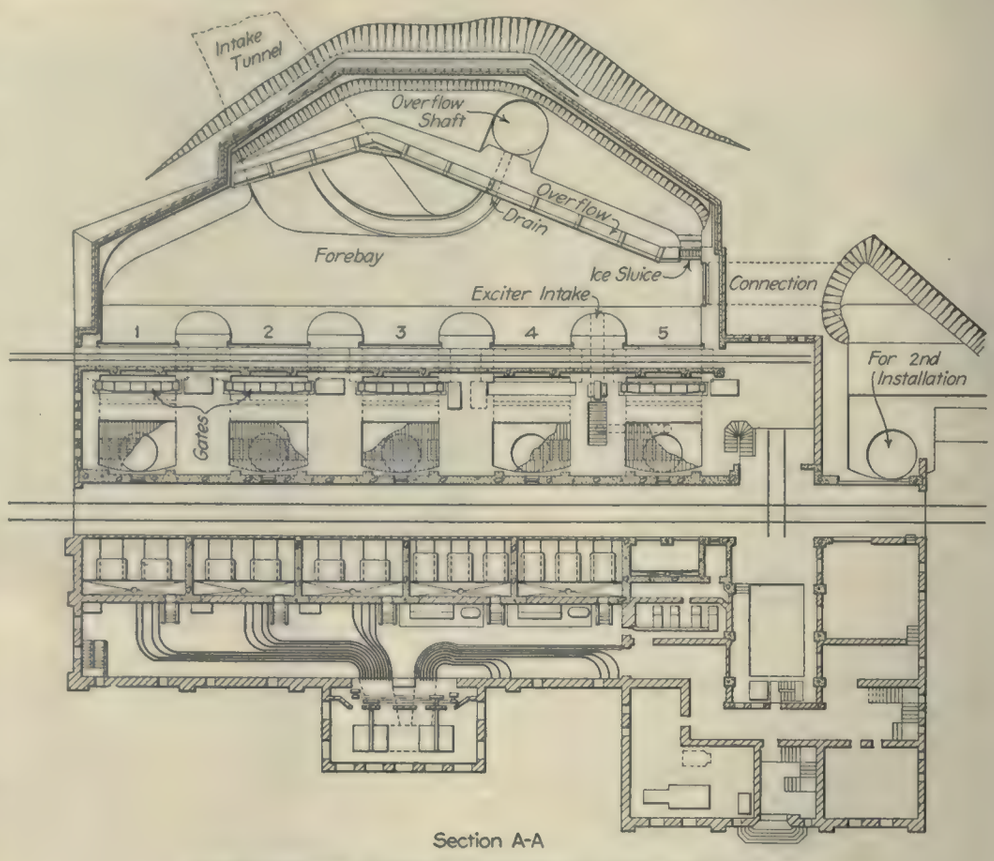
For the calculation of these waves and their corresponding intervals, the engineers have used the method devised by Prof. Fr. Prazil of Zurich, Switzerland, and that of R. D. Johnson of New York. Mr. Johnson's method was described in the "Proceeding" of the American Society of Mechanical Engineers, 1908.

Details of Forebay

The forebay arrangement is clearly shown in accompanying drawings. To enable the intake tunnel and the forebay to be drained, the latter has a depression running from the end of the tunnel to the face of the overflow. A 2.5-ft. pipe, closed by a hand-operated gate, connects this depression with the overflow shaft.

It is of interest to note that when water is discharged it sometimes fills the entire area of the shaft, thus drawing the air with it. The action, therefore, is similar to that of an enormous vacuum pump. It has been found necessary to build a monitor on the roof so that air is admitted freely. This arrangement serves also for the ventilation of the equalizing chambers of the tailrace tunnel.

The overflow is a stone-set spillway, 150 ft. in length. Its crest is at the same elevation as the high-water back of the dam, i.e., 1134.88. At its south end there is an ice sluice, 5.75 ft. wide, with the crest at el. 1122.74. This opening is closed by stop logs up to the crest of the spillway.



LARGE COVERED FOREBAY ADJOINS TRANSFORMER HOUSE

For location of this section see vertical cross-section below.

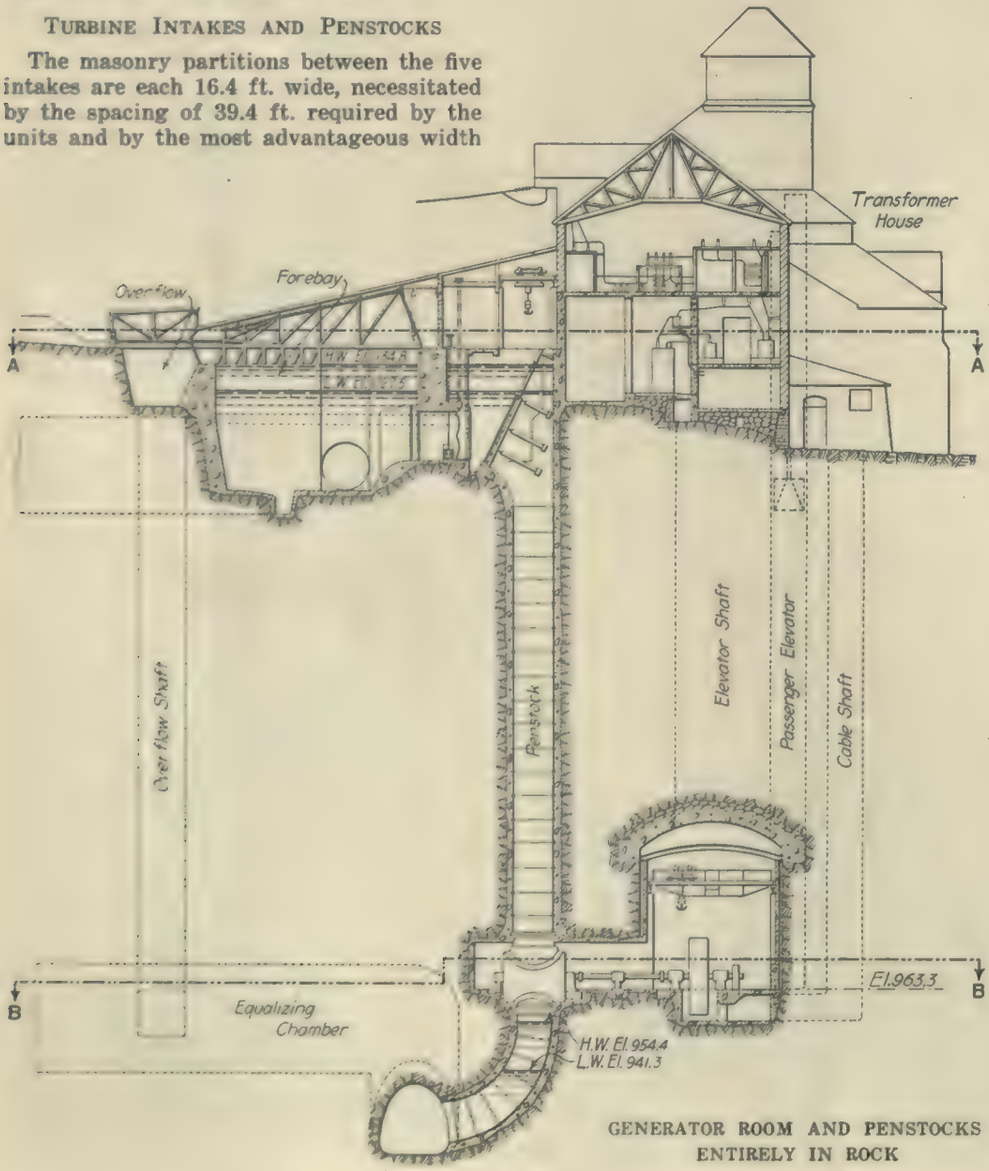
Turbine Intakes and Penstocks

The masonry partitions between the five intakes are each 16.4 ft. wide, necessitated by the spacing of 39.4 ft. required by the units and by the most advantageous width of the intake chambers, which is 23 ft. Originally, it was intended to let as much as possible of the rock remain as a core in these piers, but the quality encountered made this impossible. The piers are, therefore, made of concrete, with a very lean mixture in the center portions.

The intake for the exciter penstock is located in the pier between units 4 and 5.

Each turbine intake is closed by a single steel gate. The free opening is 23 ft. wide and 13.1 ft. high. The gates, which are shown in detail, consist of plate-girder frames with beam verticals and buckle-plate skin plates. Wheels and provisions for tightening are the same as for the gate at the intake end of the tunnel. Pipes have been provided in the concrete around the gate slots so that, should it be found necessary, steam can be used for thawing out the gates.

Inside of each gate is a groove connected by a pipe with the tailrace tunnel. This groove serves to collect leakage, when the gates are closed, thus permitting inspection of the turbines.



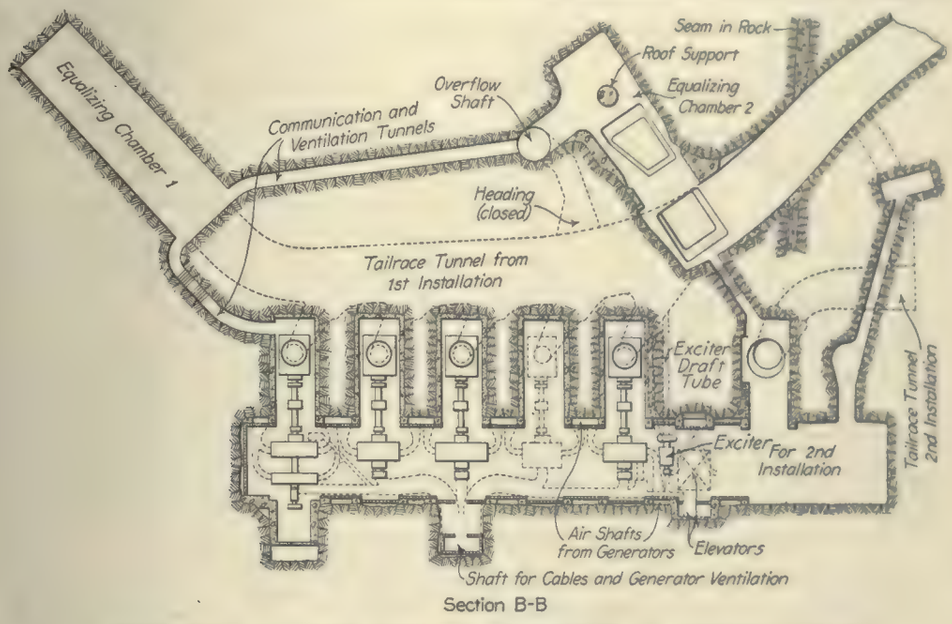
GENERATOR ROOM AND PENSTOCKS ENTIRELY IN ROCK

Racks and Penstocks

The racks, just behind the gates, have been so arranged, that, should it be found desirable, they can be heated electrically in the same manner as is now successfully done at the Trollhättan plant in Sweden. The reasons why heating arrangements have not been provided from the start is that in this development, with its covered intake conduit and large reservoir, no troubles of this kind are anticipated.

Above the racks is a crane which serves the turbines, and runs out over an extension at the south end of the building, to which the machinery parts are brought on cars.

The penstocks, which are 11.5 ft. in diameter, are lined with steel plates, varying in thickness from ¼ in. at the upper end to



EQUALIZING, OR SURGE, CHAMBERS ARE PROVIDED ON TAILRACE TUNNEL

For location of this section, see vertical cross-section, page 196.

13/16 in. at the lower. The space between the steel lining and the rock has been filled with concrete. This filling has been provided with vertical drains, to prevent hydrostatic pressure on the outside of the penstock, when they are empty.

The exciter penstock is 2.8 ft. in diameter, made of plate steel from ¼ to 5/16 in. in thickness. The intake, as above stated, is between units 4 and 5, but the penstock is turned to the right hand and carried through the shaft for the penstock of unit 5. It is then carried still further to the right, the exciter set being placed beyond that unit.

GENERATOR ROOM

The general layout of the generator room is shown in the accompanying plan. Its width is 36 ft., its height 37.7 ft. and its present length 312 ft. As mentioned before, the spacing of the units is 39.4 ft. on centers. The recesses for the turbines are 49.2 ft. deep, 19.2 ft. wide and 13.1 ft. high.

As shown on the cross-section, the generator room has a false ceiling. The space here created and also the spaces between the rock and the side walls are used for conveying the heated air from the generators. Cold air is forced down through the cable shaft and conveyed to the generators through ducts in the floor. From the generators the heated air is carried through another system of ducts to spaces back of the side walls and rises in them to the chamber above the false ceiling. This in turn is connected to the elevator shaft, and thus to vents in the tower on the transformer house.

The heated air, which, as stated above, passes between the rock and the side walls, prevents condensation. In winter, when the air is too cold to be conveyed directly to the generators, it is heated by mixing it with the heated air. When this is necessary the heated air is not conveyed through the conduits but is discharged, through ventilators, into the generator room. It then passes through the elevator shaft to the floor of the transformer house, where the fans mix it with the cold air and force it down to the generators.

The floor of the generator room is at el. 963.3, which is about 165 ft. below the surface of the ground and about 8.8 ft. above the high-water level at the discharge end of the tailrace tunnel. Because of friction losses in the tunnel and heavy surges, it is possible that the water pressure in the upper end of the tailrace tunnel, in exceptional cases, may correspond to a fictitious water level above the floor of the generator room. It was not possible to locate the floor above the fictitious elevation, as its location is determined by the proper suction limit of the draft-tubes at low water. In order to prevent flooding of the floor, the cable conduits and the generator pits, it was necessary to waterproof the entire foundation of the generator room. The rock was covered with a course of concrete; a coat of cement plaster, containing "Ceresit," was applied, and a system of drains was provided before the concrete floor was laid. These drains terminate in a pit, from which the leakage is pumped.

UNITS

Five large units have been provided for in the first installation, of which, at present, units 1, 2, 3 and 5 have been installed. Of the units now in place, 2 and 3 are for railway traction purposes. They have a maximum capacity of 12,500 hp., run at 225 r.p.m., and are directly connected to single-phase, 4100-volt, 15-cycle generators. The normal output of these units is 6250 kva. each at a voltage of 4100. Their maximum output each, however, is 10,000 kva. at a voltage of 4150. Unit 5 will furnish the power to the mine fields. Its normal capacity is 12,500 hp., and its maximum 14,000, at a speed of 250 r.p.m. The generator is a 3-phase, 11,000-kva., 10,000-volt, 25-cycle machine. Unit 1 is for emergency use. On its shaft are two generators, one single-phase and one three-phase, so arranged that either one can be driven by the turbine. In this way the unit serves as spare for either kind of current.

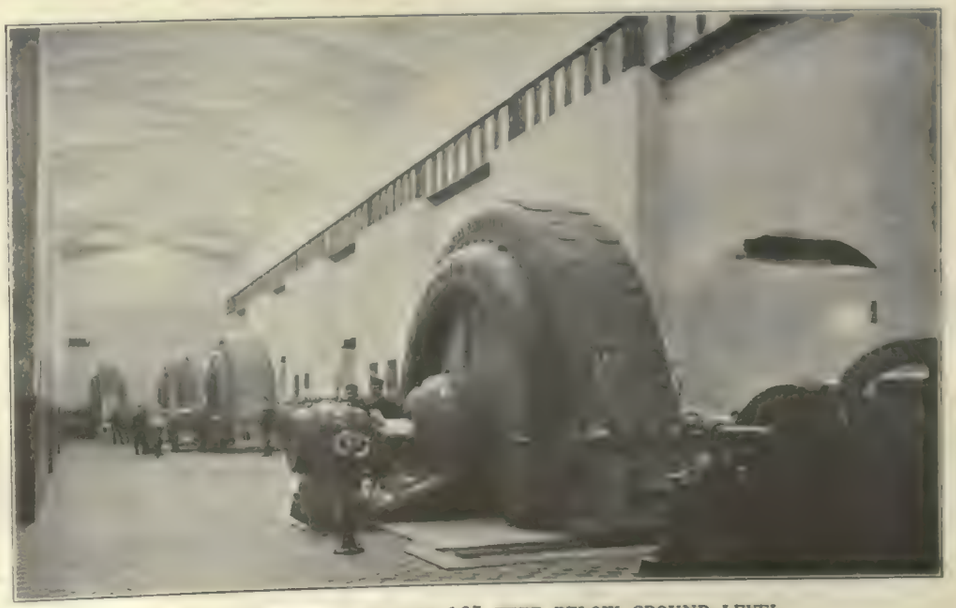
The turbines have been designed and built by Nydqvist & Holm of Trollhättan, Sweden, the same firm that delivered the turbines for the Trollhättan development. They have double runners, encased in cylindrical cases of plate steel with ends of steel castings. These cases have been designed and tested for a hydrostatic pressure of 377 lb. The draft chests are made of cast-iron and are connected to plate-steel draft tubes, concreted in the rock. The operating ring and the wicket gates are of cast steel. Between turbine and generator there is a short piece of shafting, supported on a third bearing and removable. When this short piece of shafting and its bearing are removed, there is sufficient room for taking down the turbine, without disturbing the generator. All bearings are water cooled.

The exciter unit consists of a 525-hp., single-runner, scroll-case turbine, running at a speed of 500 r.p.m., direct connected to a 350-kw., 220-volt, direct-current generator. Its scroll case is of cast-iron, while all other parts, including the runner but excepting the shaft (which is of rolled steel), are of cast steel. This unit is governed by an oil-pressure governor assisted by a fly wheel and a bypass.

Each main unit has been provided with an oil-pressure governor, capable of regulating the speed of the unit as follows:

Per cent variation in load	100	50	25
Per cent variation in speed	15	6	3

The necessary pressure oil for the servomotors is supplied by belt-driven oil pumps, one for each unit. A central pumping plant, consisting of an electrically driven pump of sufficient capacity to supply two units at



THIS GENERATOR ROOM IS 165 FEET BELOW GROUND LEVEL

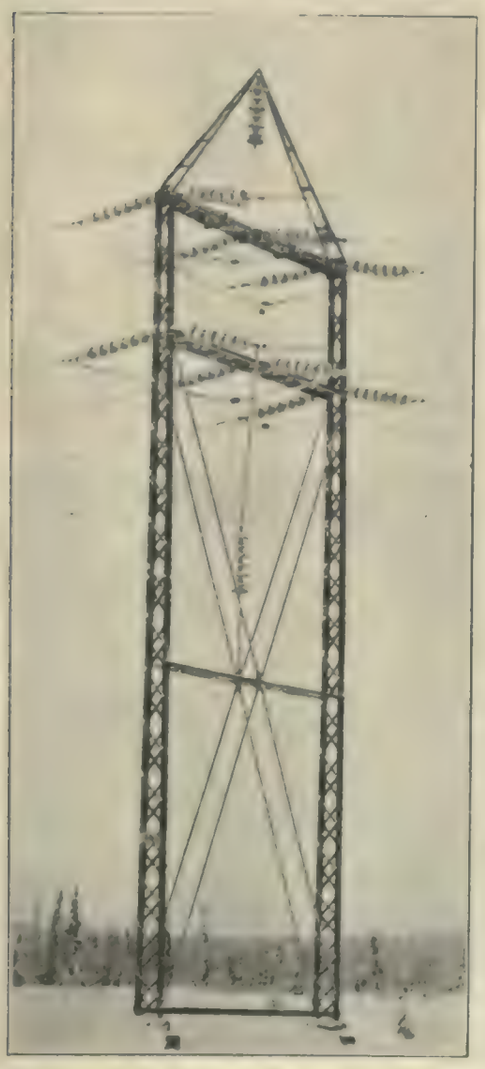
the same time, has also been provided. The oil-pressure tanks are partly filled with air in order to make them respond quickly. The pressure is 20 atmospheres, and the pressure air is supplied to all tanks by one compressor.

TAILRACE TUNNEL

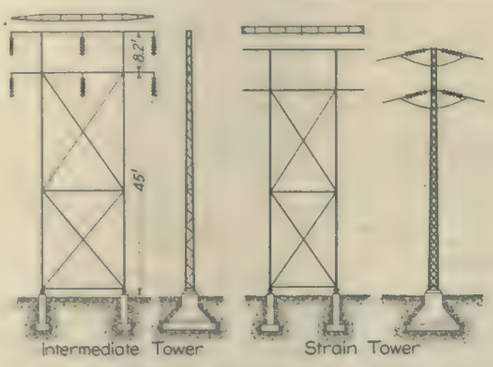
The length of the tailrace tunnel, center of the discharge opening of unit 1, is 4180 ft. Its net area (538 sq. ft.) and cross-section are the same as those of the intake tunnel. In front of the draft tubes, however, the area of the tailrace is larger. From the upstream equalizing chamber to the center line of the discharge end of the draft-tube of unit 1, the area is as stated above. In the distance between unit 1 to unit 4, the area is increased to 1076 sq. ft. This area is maintained until the tunnel has passed the second equalizing chamber, beyond which, in a length of 131 ft., it is again reduced to 538 sq. ft., which continues to the discharge end.

The reasons for enlarging the tunnel in its first part are to facilitate the flow of water to and from the equalizing chambers when surges occur, and to reduce the influence of eddies.

The equalizing, or surge, chambers are each 32.8 ft. wide and 32.8 ft. high. Their total area, in plan, is 7500 sq. ft. Their angular location was selected to conform with the cleavage planes of the rock. In order to permit inspection of the water levels in them, communication tunnels have been provided from the most advantageously located unit recesses. The vertical overflow shaft from the forebay discharges



STRAIN TOWER, PORJUS TRANSMISSION



INTERMEDIATE AND STRAIN TOWERS

into the downstream equalizing chamber.

At the discharge end of the tunnel both sides have been provided with stone-faced concrete walls with slots for stop logs.

MISCELLANEOUS

As already stated, the water supply at Porjus can be materially increased over that now available, provided the regulation of the watershed is carried out as planned. Provisions, therefore, have been made, so that the generator room can be extended, a second intake tunnel with a separate forebay built and another tailrace tunnel driven. Of this work only part of the intake at the dam and part of the excavation for units and generator room have been made. This had to be done in order not to interfere with the present plant, when the second installation is built.

The total cost of the first installation, including dwellings for the operating staff, real estate purchases, construction of roads, temporary hydroelectric plant for the construction, transmission lines, etc., was $3,425,000.

The designs have been worked up by the Royal Swedish Waterfalls Commission, which also carried out the construction on force account. The chairman is Col. F. V. Hansen, who also supervised the design and construction of the Trollhättan development. The designs were in the charge, first, of G. Malm and then of A. Ekwall, assisted by K. A. Fröman. A. Westerlind was office engineer, in charge of construction, and the resident engineer at Porjus was A. Granholm, who was succeeded in 1913 by N. K. Sundlad.

Capacity of Scraper Misstated—Should Be Less

THE four-wheel scraper described in the article, "Operation Analysis of New Machines Which Cheapen the Moving of Earth on Road Work," by Prof. A. B. McDaniel, on page 126 of the issue of the Engineering Record for July 31, 1915, is stated in the table at the bottom of the left hand column, page 126, to have a capacity of 800 cu. yd. in 10 hr. Professor McDaniel advises us that this figure should have been 600 cu. yd. in 10 hr., and that all the units in this table should be calculated on the basis of 600 yd. This would make the total unit cost 10.7 cents, instead of 8 cents, as given.

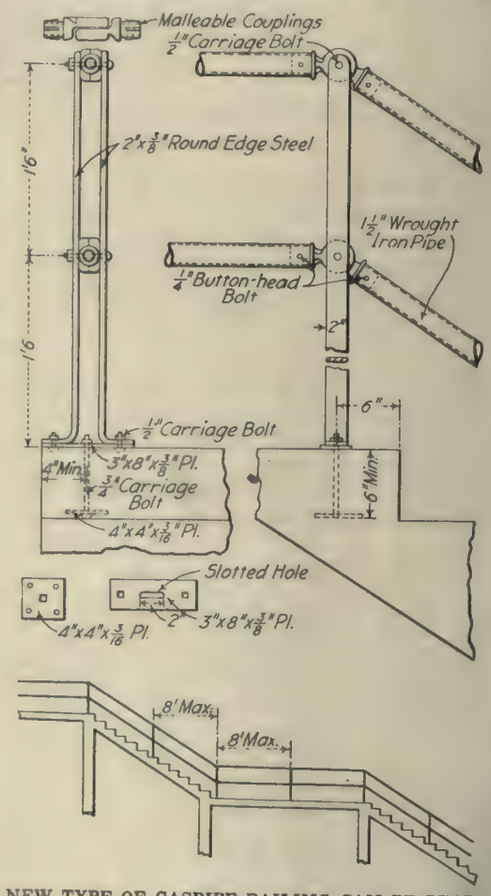
A BRIDGE INVESTMENT of $4,703,506.68 is reported in the latest annual report of the Sanitary District of Chicago. Of this amount nearly $3,000,000 was paid for the thirteen bridges over the Chicago River and $1,146,457 for fifteen Main Channel crossings.

New Type of Gaspipe Railing Proves Satisfactory at Cincinnati

By EDGAR K. RUTH
Assistant Engineer—Structures, Cincinnati

THE Division of Structures of Cincinnati's Engineering Department has recently designed and erected on some of its new flights of reinforced-concrete steps an improved style of two-bar pipe railing with adjustable posts and couplings which is proving very satisfactory.

The city is rapidly replacing the large number of flights of wooden steps scattered through its hilly sections with reinforced-concrete construction. Landings are provided at frequent intervals and the slopes of the flights vary somewhat according to the topography. For this reason a railing was needed which could be readily adjusted



NEW TYPE OF GASPIPE RAILING CAN BE READILY ADJUSTED TO FIT ANY FLIGHT

to fit any flight, and which could be erected easily and in true alignment.

DETAILS OF RAILING

The details of the railing, which is 3 ft. high, are shown in the drawing. Expansion is provided for by omitting on the lower side of every fifth post the ¼-in. bolts which connect the two rails to the post couplings, and by giving a ¼-in. clearance between the ends of the pipe and the shoulder of the couplings at these points.

Whenever the direction of the railing does not change at a post the coupling for the lower rail is omitted and the pipe made continuous for two panels and bolted directly to the post plates.

All parts of railing, including bolts and couplings, are heavily galvanized.

Until recently the fence complete, including galvanizing, has cost the city about $1 per linear foot, erected, but the present high cost of spelter has considerably increased the cost of galvanizing.

Direct-Lift Span Provides 55-Foot Clearance Over Louisville and Portland Canal

Waterway Improvements at Louisville Include Unusual Type of Vertical Lift Span Raised 40 Feet by Levers on Approach Spans

EXTENSIVE improvements of the Louisville and Portland Canal at Louisville, Ky., carried on by the U. S. Government, have been in progress for several years past and are now nearing completion. They consist principally in widening the canal from 86½ ft. to 200 ft., in building a new lock 600 ft. long by 110 ft. wide alongside of the old locks and in the renewal of the two existing swing bridges crossing the canal. The new lock was described in the Engineering Record of June 26, page 794.

The old swing bridges were originally built about the year 1866, one at the head of the locks and the other at Eighteenth Street over the canal proper at Louisville. The former is being replaced by a swing bridge 275 ft. long spanning both old and new locks, the pivot pier being located between them. The Eighteenth Street swing bridge has just been replaced by a Strauss direct-lift bridge spanning the entire width of the 200-ft. canal. The old swing bridge had unequal arms, spanning 87 ft., the former width of the canal.

Conditions Governing Design

The craft that navigate in the Ohio River at Louisville do not require more than 55 ft. vertical clearance above high-water level. On account of the low vertical clearance required, compared with the length of span, the lift type of bridge was considered best. The invitation asking designs for this structure, as issued by Major J. C. Oakes, Corps of Engineers, U. S. A., in charge of the work, contained the following clause:

"In making a comparison and selection the following are some of the points which will be considered: First cost, probable cost of maintenance and operation, advantages and disadvantages of the type of operating machinery as to the reliability of operation and chances for accidents, and provision for preventing the lift span from falling if any accident happens to parts of the operating apparatus."

First cost, therefore, was only one of a number of factors which were considered in selecting the type of lift here adopted.

General Features of Design

The bridge consists of the main, or lift span, 210 ft. long, and an approach span at each end, 85 ft. and 75 ft. long respectively. The main trusses, which contain eight panels, each 26 ft. 3 in. long, are of the Pratt type with inclined upper chords, and are spaced 18 ft. apart. The approach trusses are spaced 18 ft. 6 in. apart, and the unusual offset top strut to the main column, required to allow clearance for the counterweights, can be seen in the photograph showing an end view.

The existing stone center pier of the old swing bridge has been utilized for the west pier of the lift span, and a new concrete pier, founded on rock, supports the opposite end. Photographic views reproduced herewith illustrate the finished structure. The rectangular pier showing under the center of the span is the old rest pier of the swing bridge, which, together with the old stone canal wall, will be removed when the new wall and widened part of the canal are completed.

The bridge is designed for highway traffic only. The roadway has 16-ft. clear width, the floor system and its supports being designed for a live load of 100 lb. per square foot, or one 15-ton truck on two axles 10 ft. on centers. The trusses are designed for a live load of 100 lb. per square foot of roadway. The usual unit stresses for work of this character were followed in proportioning the members. The specified permissible stresses were allowed an increase of 25 per cent during erection.

Counterbalancing the Lift Span

The lift span is counterbalanced by counterweighted crane-like trusses pivotally mounted on the main vertical posts of the approach spans at either end. These counterweighted trusses are provided with a pair of hangers, pin-connected near their mid-sections, while the lower extremities are pin-connected to the lift span, and their upper extremities are pin-connected to a member termed the "counterweight link," the rear extremity of which is pin-connected to the counterweight.



OFFSET TOP STRUTS PROVIDE CLEARANCE FOR COUNTERWEIGHTS

The concrete counterweight itself is so connected to the rear extremity of the counterweight trusses that the four main pin points form a parallelogram. By virtue of this parallelogram and the connecting hanger the main span and center of gravity of the counterweight are permitted to move vertically. The lower auxiliary fixed counterweight balances the weight of the hanger and brings the center of gravity of all the dead-load forces to the center of the main trunnions at the top of the tower post. The moments of span and counterweight about the main trunnions are ex-



CLOSED POSITION OF NEW DIRECT-LIFT SPAN 210 FEET LONG—CENTER PIER OF OLD SWING SPAN TO BE REMOVED

actly equal for any position of the bridge.

The span was erected in the partly open position to permit navigation. The half of the span over the new part of the canal was built on falsework, and the other half, over the navigable canal, was cantilevered out without the use of falsework in the existing canal. The alignment of the new bridge coincides with that of the old, but it was not necessary to maintain highway traffic during erection.

ELECTRIC OPERATION

The span travels a vertical distance of 40 ft. from the closed position to the fully open position. The movement is effected by means of electric operation, the operating pinions, four in number, being located at each corner of the span below the floor, and engaging vertical fixed racks on the inside faces of the tower posts. These pinions are actuated, through shafting and intermediate gears, by two 11 hp. direct-current motors located near the center line of the span and controlled from an operator's house, at the center of the span, suspended from the top chords above the clearance line as seen in the photographs.

One minute is required to raise the span, by electric power, from the closed to the fully open position, and the same period is required to lower it. Emergency hand operation is also provided by two turning levers which can be used at each end in the center of the roadway. Indicators are installed in the operator's house, consisting of white and red incandescent lights showing the various positions of the bridge. The movement automatically cuts out the lifting motors when the span is 6 ft. from the fully open or the fully closed position. However, a spring switch is provided which, if held closed, will render the automatic cut-out ineffectual and enable the bridge tender further to operate the bridge. Safety gates are provided on the approaches, controlled from the operator's house and interlocked with the lifting machinery so that the latter cannot be operated until the gates are closed, and the gates cannot be opened again until the bridge is closed.

The structural steel in the lift span, counterweight trusses and approaches, weighs approximately 250 tons. The operating machinery and trunnions weigh approximately 20 tons. The steel was furnished by the Penn Bridge Company of Beaver Falls, Pa., and erected by the Middle States Construction Company of Columbus, Ohio. The Strauss Bascule Bridge Company of Chicago, consulting engineers, furnished the plans and specifications under the direction of Major J. C. Oakes, U. S. engineer at Louisville, in whose office the contract for construction was awarded in July, 1914. The bridge was completed and first operated June 23, 1915.

Rattler Test for Paving Brick Abandoned in St. Louis

Instead There Has Been Substituted a Standard Sample of One Hundred Bricks by Which Shipments Are to Be Judged

By MONT SCHUYLER
Engineer in Charge, Municipal Testing Laboratory, St. Louis

NO DOUBT the rattler test in all of its various forms has improved vastly the quality of paving brick. It is necessary that a certain strength both against disruption and abrasion should be present in every brick, and this quality, or set of qualities, is, of course, measured coarsely by any method involving rough handling, such as the rattler test undoubtedly is. But that the brick's value as a paving material can be determined with any accuracy by this method is a matter upon which more and more people have reached, first, a doubting stage, and, then, finally, a stage wherein the rattler is considered merely as a method of adjustment between the brick seller and the brick buyer. In other words, the rattler test is not an engineering instrument.

VISUAL INSPECTION IN THEORY AS WELL AS IN PRACTICE

Though, as above stated, the rattler has done much to improve the character of brick, and no doubt will in the future maintain a certain position in the paving field, still it is the writer's belief that, as time goes on, less and less attention will be paid to the extreme refinements added during the past few years. The machine will then be used perhaps in conjunction with other machines to determine the presence or absence of certain qualities in the product of this or that factory, the actual acceptance or rejection of brick being based openly, as it is now actually, on visual inspection while brick are being handled from the kiln to the pavement.

While this thesis may be disputed in various quarters, it cannot be denied that many engineers and brick manufacturers are tending toward a gradual abandonment of the rattler. This the writer knows from many conversations with men from all parts of the country.

Following out this general tendency the city of St. Louis, in its new specifications, has omitted all reference to the rattler test, placing reliance solely upon the general knowledge of brick extant in that city's construction and testing department. The new specifications, referring to paving brick, read as follows:

PAVING BRICK

General

"Vitrified paving brick shall be made from suitable shales or inferior fire clay burnt to uniform texture throughout. They shall be thoroughly and uniformly vitrified and annealed, containing neither unfused nor glassy spots, and shall not be salt glazed. They shall be tough and uniformly hard. They shall be free from defects such as laminations, fire cracks, cooling checks, etc. They shall be free from lime or other impurities. They shall be unrepressed, side wire-cut in such a manner that the lugs will be formed during the process of cutting and shall have the ends beveled.

"At least one month before the contractor begins laying the wearing surface he shall submit one hundred (100) specimen brick of the brand he expects to use to the Board of Standardization, unless samples of brick proposed to be used are already on file. The type, the range of burning, the variation in dimensions and the general condition of the brick which the contractor expects to furnish shall be exhibited by these specimens. The president of the Board of Public Service will cull from this lot the brick



DIRECT-LIFT SPAN IN OPEN POSITION WITH CLEARANCE OF 55 FEET—SPAN LIFTED 40 FEET BY LEVERS AND PARALLEL LINKS

which are not suitable under the terms of the specification. All shipments to the work will be examined by such method as may be deemed expedient and must be equal in quality, shape and dimensions to the specimen brick which have been considered satisfactory.

Specific

"Brick shall not be less than eight (8) inches nor more than nine (9) inches in length. They shall be four (4) inches in depth and from three and one-fourth (3¼) inches to three and three-fourths (3¾) inches in width, excluding lugs. The brick in any one contract shall vary not more than one-eighth (⅛) inch in width or depth and not more than one-fourth (¼) inch in length, the length desired being eight and one-half (8½) inches; and the brick must be the product of one plant.

"The imprint or name of the brick or maker, if used, shall be in recessed letters and not raised letters.

"All brick shall have one wearing surface such that when the brick is laid on a horizontal plane on this surface, no portion of this surface shall be more than three-thirty-seconds (3/32) of an inch from the plane.

"The lugs shall be of such dimensions that when the brick are laid in the street there will be an average separation of courses of not less than one-eighth (⅛) inch nor more than one-fourth (¼) inch.

"The president of the Board of Public Service may inspect or sample the brick either at the kiln or on the street, or at both places. All brick shall be subject to thorough inspection before and after laying and rolling."

Already the sample brick are being delivered in accordance with the specifications and the process of carrying out the culling of the samples will be shortly completed.

APPLYING THE STANDARD SET BY SAMPLE

Let us see what a tendency of this method of specifying paving bricks is. Assume that bricks have been delivered to the street. Undoubtedly the city's cullers will reject some particular type of brick, but their rejection will not be based upon the insensible training which they have acquired during many years of the same sort of work, but upon the standard sample which covers the entire range of bricks which the manufacturers can deliver and which the city is willing to accept. This standard sample has carried them back to streets which have been in service, for the culling of the standard sample has been predicated upon experience with brick in the street. That is to say, in examining the standard sample a brick is not thrown out if actual observation has shown that a specimen of the same characteristics has worn satisfactorily in the streets for a number of years.

Now let us make the assumption that a certain type of brick has been adjudged unsatisfactory by the city's representatives. The brickmakers have retained a duplicate of the standard sample and have, in addition, of course, the official sample to refer to; and, if in their opinion the rejected brick are duplicates of those in the standard sample, it becomes a very easy matter to make a comparison and to be sustained if the comparison shows substantial similarity.

It is, of course, assumed that there exists a certain knowledge of paving brick characteristics. The use of brick as a paving material has become so general in the past ten years that there is hardly a city of any size which has not one or more streets paved with brick. Most municipalities, in fact, have gone to the extent of purchasing rattlers, and it is felt that if a city has talent enough in its employ to properly run a rattler in accordance with the methods laid down by the American Society for Testing Materials, it must be able to "size up" and adjudge a standard sample of 100 brick. In any case, however, in those places where culling is conscientiously carried out, the method adopted by the city of St. Louis will add no new difficulties, but, while abandoning a laborious test, will eradicate any chance of dispute between buyer and seller.

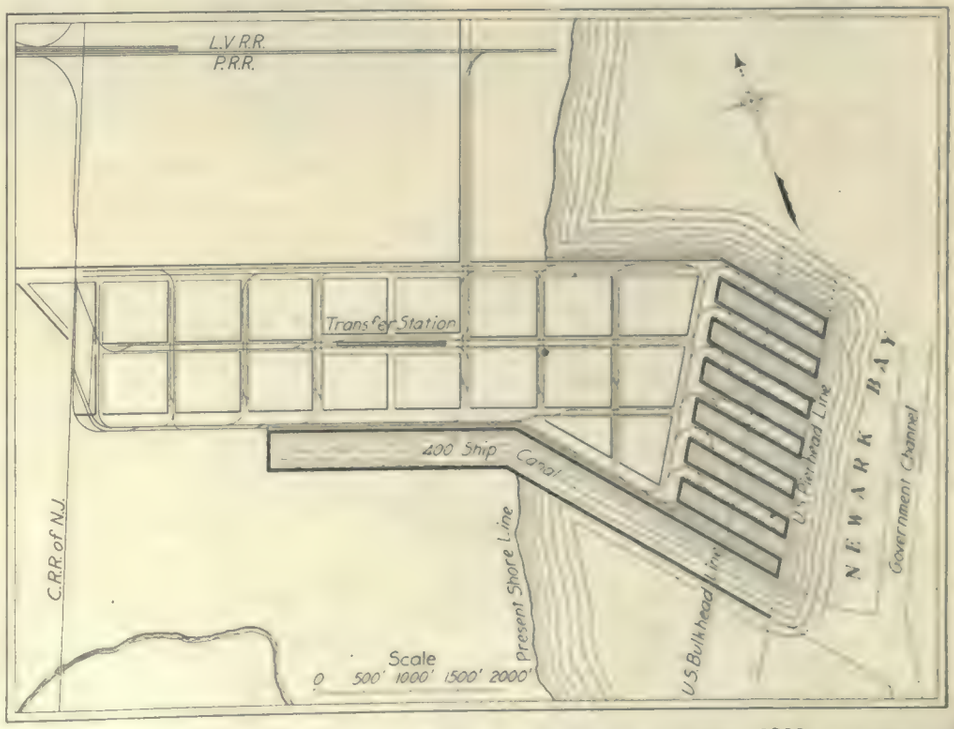
Newark Is Rapidly Creating Its Own Water Terminal in New Jersey Meadows

By Reclaiming 260 Acres and Providing Wharfage and Rail Connections New Jersey Metropolis Aims to Attract Shipping and Industries

AN EXPRESSION of the growing determination of the New Jersey communities opposite New York City not to sit idly by and allow New York, by offering superior port development, to absorb the bulk of the enormous water traffic coming to New York harbor is seen in the extensive development that has been quietly under way in the southern part of Newark for the last year. Under the direction of the Board of Public Works of that city, 260 acres of meadow land bordering Newark Bay are being reclaimed and converted into a modern water terminal. The new seaport will be reached by a 20-ft. government channel, and connections with three railroads are expected to make the site an attractive one for factories. The engineering features include a large amount of hydraulic fill, the use of both concrete and timber bulkhead walls, and the construction of a heavy creosoted timber dock carrying railroad and crane tracks. The work now under way is part of a larger project to cost from $12,000,000 to $15,000,000.

The site of the improvement is at Peddie Creek and Newark Bay, 4 miles from the Newark city hall. The Newark-Elizabeth line of the Central Railroad of New Jersey parallels the bay a mile inland. Half a mile north of the development the Lehigh Valley Railroad and the Greenville freight branch of the Pennsylvania Railroad cross the bay. The present development is confined to the tract north of Peddie Creek. As shown on the accompanying map, a strip of meadow 1700 ft. wide, at an average elevation of 5 ft. above mean low water, extending outward from the Central Railroad of New Jersey to the shore line, is being filled to an elevation of 11 ft., and this fill is being carried on out into the bay about 1600 ft. farther to the city bulkhead line, which is moved back 600 ft. from the government line to make possible the construction of 1200-ft. piers. On the south side a 400-ft. ship channel will extend inland 2500 ft. from the present short line.

Along the ship channel is being constructed a heavy timber dock 50 ft. wide, carrying two railroad tracks. Behind the dock the fill will be held, as far as the present shore line, by a concrete wall on a timber substructure below low water. Beyond the present shore line the concrete wall is replaced by a creosoted timber bulkhead, which passes on around the east and north sides of the fill to the present shore line. At the outer end of the development one of the seven piers contemplated is to be built at the present time. South of Peddie Creek and the ship channel an equal area



TRACKAGE ARRANGEMENT AND TRANSFER STATION FOR THE SEVEN 1200-FT. PIERS OF NEWARK'S PORT DEVELOPMENT





THROUGH A PIPE LINE ON PONTOONS DREDGED MATERIAL FOR THE HYDRAULIC FILL WAS PUMPED A DISTANCE OF 5700 FT.

is ultimately to be developed in a similar manner.

Typical details are shown of the bulkheads and the timber dock. Along the outer side of the dock a traveling crane will run on a track of standard gage. For about one-quarter of its length the dock will be elevated 4 ft. 2 in. to permit direct loading into cars on the track in its center. A ramp at each end on a 2 per cent grade will lead to the elevated part of the platform. All tracks are being laid with 100-lb. rail.

In making the hydraulic fill it was necessary to pump the material the greatest distance at the start, when the dredge was obliged to work from the government channel in the bay, 3500 ft. from shore. The 27-in. pipe line was on pontoons to the shore line, and thence on a light timber trestle built up the middle of the improvement. Material was thus pumped as far as 5700 ft. As the dredge worked its way into the central channel of the improvement the pipe line was shortened, and at present any section of the fill is used with a short line.

The pipe line is generally laid with a "Y" near the outlet, with valves at the "Y," and as one branch is being extended or moved the other takes the flow of material. This material varies greatly, from soft mud when the dredge is working near the surface to heavy red clay when the maximum depth is used. In general, however, the material is light enough to spread readily over the settling areas, and no great amount of pipe shifting is required.

Beyond the present shore line the bay was soft mud for a depth of some 20 ft. Before the bulkhead piles were driven this mud was dredged away in a channel 70 ft. wide at the bottom, and the channel was refilled with a substantial material, into which the bulkhead piling was driven. This method was considered more satisfactory than placing the material around the piles.

The edge of the meadows is nearly a mile inshore from the line of the Central Railroad of New Jersey. Preliminary to starting the improvement proper, therefore, it was necessary to grade an approach thereto,



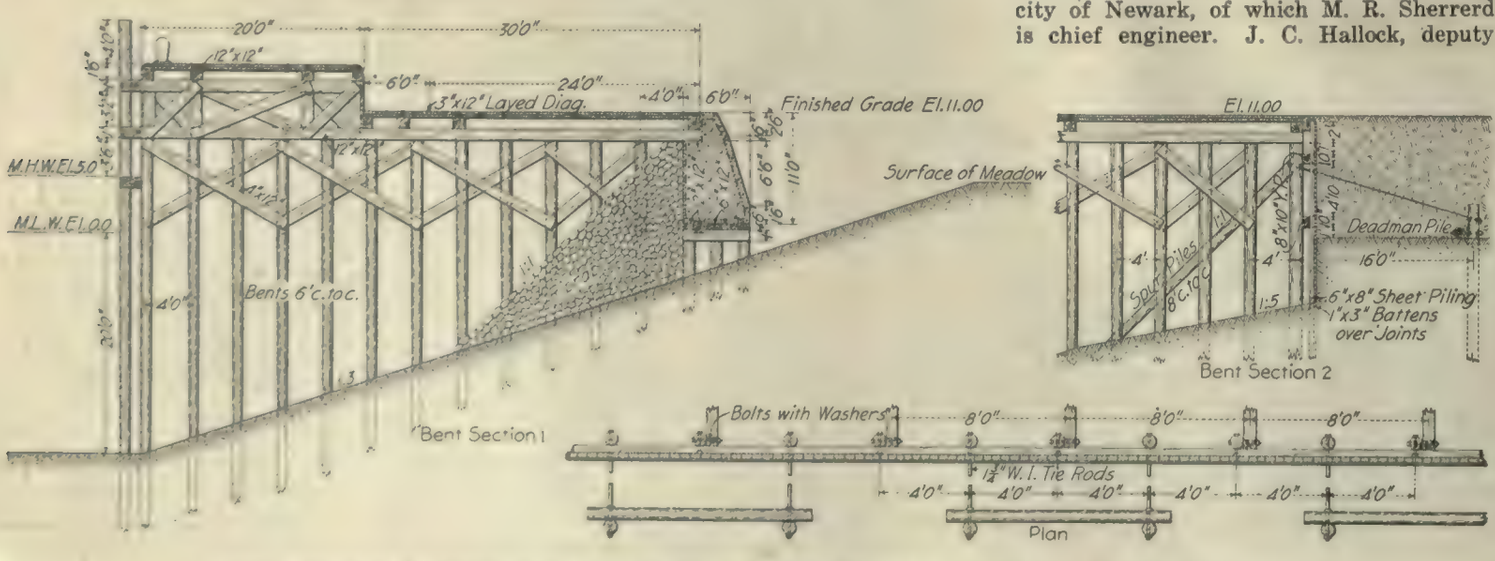
DRIVING INCLINED SPUR PILES

and this in reality constituted about the most difficult part of the filling, because of the necessity for working outward from the end of the fill, and because of the numerous sink holes encountered, making it necessary in places to use a crude timber cribbing. This approach fill was made of household refuse and ashes, and the first work on the improvement was the construction of a trestle at the inner end of the approach. The refuse wagons drove on the trestle and dumped into cars on the construction track, which now reaches to the Central Railroad of New Jersey.

While the details of the trackage to be provided on the improvement have not been worked out, the main features will be substantially as shown. A main classification yard will be built alongside the Central Railroad of New Jersey, and at about the center of the tract will be a smaller transfer yard. The connection shown to the Pennsylvania and Lehigh Valley railroads has already been built.

Only a few of the principal streets will be paved at the present time. Before the tract can be properly accessible for industrial purposes it will be necessary for the street railway company to build a line down the Bay Avenue approach. It is not desired, however, to lay extra tracks in the streets of the terminal to accommodate electric cars, nor to permit trolley wires over the tracks to be used by steam equipment; therefore storage-battery cars only are to be operated east of the Jersey Central, these cars to use the steam road tracks. Bay Avenue is to be carried over the Jersey Central by a bridge.

The improvement, on which $1,500,000 of the preliminary appropriation of $2,250,000 has already been spent, is being carried out by the Department of Public Works of the city of Newark, of which M. R. Sherrerd is chief engineer. J. C. Hallock, deputy



TYPICAL DETAILS OF BULKHEADS AND TIMBER DOCK FOR NEWARK'S $15,000,000 WATER TERMINAL



TIE RODS FROM DEADMAN PILES WILL AID IN RETAINING FILL

chief engineer, is in direct charge of the work, and A. J. Simpson is the assistant engineer on the ground. The contractors are the Atlantic, Gulf & Pacific Company on the dredging and hydraulic fill, and O'Gara & McGuire on the dock construction.

Overcrossing Has Provision for Future Sidewalks

New York Central Reinforced-Concrete Viaduct Near Batavia Contains Embedded Rods with Threaded Ends for Future Brackets

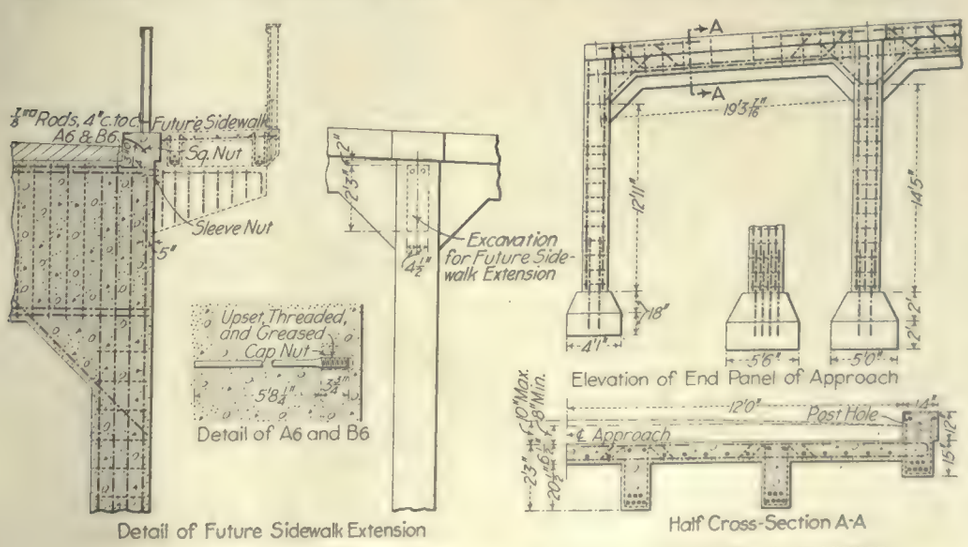
A RATHER unusual detail was adopted by the engineers of the New York Central Railroad to provide for future sidewalks on the new reinforced-concrete viaduct approaches of the East Main Street overcrossing east of Batavia, N. Y. A 24-ft. clear roadway is furnished, as shown, and provision is made for the future addition of a 5-ft. clear sidewalk on one side. On the steel truss spans this sidewalk is provided for by the design of the east trusses for brackets to be added later. In order to support the future sidewalks at the piers of the approaches the method shown by the accompanying drawing was adopted.

A 5-in. excavation 9 x 27 in. in size is to be made for the new brackets in the concrete of the piers when the sidewalk is added. The tension connections for these brackets is provided by the two ⅞-in. square rods shown, to which sleeve nuts will connect the new reinforcing steel in the brackets. A temporary cap nut protects the screw thread at the end while embedded in the concrete.

The bridge consists of three truss spans and reinforced-concrete viaduct approaches at each end on 6-per cent grades. The steel triangular truss spans are supported on square columns with skewed protection walls from 11 to 12 ft. high. These spans are approximately 126 ft., 76 ft. and 50 ft. long. The two approaches are 96 ft. and 98 ft. long, each consisting of five panels 19¼ ft. in length. The accompanying detail drawing of an end panel of one of the approaches indicates the method of reinforcing. Following the usual practice of this railroad, all reinforcing rods are given shipping marks and separately detailed.

The crossing was designed under the supervision of J. W. Pfau, engineer of construction; N. F. Thompson, engineer of grade crossings, and H. T. Welty, engineer of structures, of the New York Central Railroad. John M. Holler of Albany was the general contractor.

NUMBERING COUNTRY ROADS is proposed for Iowa highways in the June issue of the Service Bulletin of the State Highway Commission. It is proposed to use the Capitol building at Des Moines as a center from which to number the roads in the four quadrants. Another suggested scheme is to label every road at intersections by its local name. Both schemes carry the proposition of numbering all farm houses.



PROVISION FOR FUTURE SIDEWALK MADE IN DESIGN OF OVERHEAD CROSSING

Railroad Subgrade Troubles—Preventives and Cures

Importance of Drainage Emphasized Suggestions for Second-Track Construction—Remedies for Settling and Sliding Fills

By J. T. BOWSER

Maintenance of Way Department, Queen & Crescent Route, Danville, Ky.

ALL RAILROADS, it may be said, except those traversing very dry country and those where the material in the subgrade is exceptionally good, experience more or less trouble from slides, settling fills and soft places, due to a great extent to improper construction methods, or failure to anticipate conditions which could have been foreseen had the proper investigation been made prior to construction. A strict adherence to the average specifications for grading, and a careful investigation of foundation, fill material and drainage, will prevent the greater part of such difficulties, and, where such conditions exist already they can be corrected in many cases by simple and comparatively inexpensive means.

It is no doubt true that with practically no exceptions all such conditions are due to the presence of water in unnecessary quantities in the subgrade. In many cases this is due to improper construction methods, such as refilling through cuts where excavation has, through error or design, been carried below grade. Only the best of material should be used for such purposes, and when the backfill is only a matter of a foot or so, it is probably more economical to raise the track up to grade on ballast.

On second-track work a careful inspection of the old grade should always be made to detect the presence of old slides which may have ceased to give trouble, and of seeps and wet-weather springs. Provision should be made to drain or otherwise insure that the old slides will not slip again under the weight of the new fill, or that the seeps and springs will not soften or render unstable the foundation under the fill or the material in the fill itself.

Where it is possible to do so the culverts under fills should always be located at the lowest point under the fill, and where this is not practicable provision should be made to drain the low point. Where the slope assumed by the material in the fill is greater than was estimated and the culvert is found to be too short, the necessary extension should be made immediately in order to prevent the blocking of the culvert and the possible saturation of that part of the fill beyond the end of the culvert.

A poor foundation for the fill cannot always be improved, but in many cases the condition can be remedied by the interception of seepage or by other provision for drainage of the water which renders it unstable. Such seepage can be intercepted by French drains, tile or even open ditches parallel to the track and up slope from it, and drainage of the foundation can be effected by transverse French drains or tile ditches. In some cases where none of these are practicable, the character of the strata underlying the bad material may often permit drainage by dynamiting, that is, by drilling a large number of large holes well into rock or hardpan, and opening up fissures in this material by the explosion of heavy charges of dynamite in these drill holes. The expense of work of this nature will probably be slight when compared with

the expense of maintaining track on a settling or sliding fill, or of draining it after the fill has been made and the settlement started.

Drainage ditches parallel to grade are often blocked in making fills, and provision should always be made to dispose of the water from even the smallest of them.

In farming countries the impounding of water against embankments for use of stock or other purposes, has often been done as a consideration for the acquisition of right-of-way or for other privileges. Even under the best of conditions the economy thus effected is likely to be false, and it is more than probable that many times the amount saved will be spent in maintaining such an embankment when it has become saturated with water thus impounded.

The usual specifications for grading also provide for the drainage of borrow pits, but many sliding or settling embankments owe their condition to the lack of enforcement of this clause. It is not always sufficient to see that an opening is made from the borrow pit, but the entire pit should drain to this opening. The small amount seeping from a low place in the pit during the rainy season may be quite enough to start the settlement of an adjacent fill.

Further provision is usually made in specifications for grading for the proper bonding of the new fill to the old, but the effectiveness of this bond is often destroyed by having a low place in the top of the new grade near the junction with the old embankment, even though such a low place be comparatively small. Such a place would in all probability be filled with ballast or other porous material, and would become a small reservoir to supply the seepage to start the new fill sliding on the face of the old.

Old embankments are often widened with light friable material, cinders and the like, and heavier and less permeable material placed on this in making the grade for an additional track becomes a dike to hold, in the light material, the water which may fall on it at the surface, or seep into it from other sources. In some classes of material this will finally result in the settlement of both the new and the old embankments.

In many cases where sliding or settling fills, or soft places in subgrade, already exist, they can be remedied by a relatively small expenditure, that is, small when compared with the expense of maintenance under the existing conditions. In considering the best means of remedying such conditions, there may be some few instances where the use of piling or retaining walls is not only effective but is also the most economical and practicable expedient, but it may be said that such cases are comparatively few, that the use of piling does not give permanent relief and that the construction of expensive retaining walls is not justifiable when other methods are considered. Neither of these gets at the cause of the trouble, neither provides for better drainage.

For the settling fill of small or medium height, when the trouble appears to be from within, transverse drains, cut from the toe to a point back in the fill well under the track, and tiled or backfilled with stone or porous material, will often provide the necessary drainage and stop the settlement. Tile will not answer in all cases, as it is likely to get out of line or surface, while stone backfill not only provides the necessary drainage but adds to the stability of the fill. Of course the trouble may be from without, in which case the above style of drainage is unnecessary. A pocket on the slope, caused by unequal settlement or some other cause, may be supplying the water which is causing the settlement.

While settlement of embankments is usually caused by conditions within, sliding is usually caused by conditions without or underneath. The interception of seepage, the drainage of old borrow pits ditching or tiling on the uphill side, as outlined above in connection with construction questions, are also applicable as remedies for existing slides according to conditions. This is also true of drainage by blasting, although in this case a careful study should be made to locate the holes correctly and to get them well down into the material to be fissured to provide drainage. Such blasting is most effective when the holes are drilled by a well drill and are shot heavily. The holes should be located in a row parallel to the track, and rarely more than 30 ft. apart.

$16,000,000 Required for Los Angeles County Flood Protection—Part I

System Recommended Eliminates Reservoirs but Includes Retarding Dams, Underground Storage, Levee Work and Stream Diversion

RECOMMENDATIONS for a comprehensive project for control of floods in Los Angeles County are contained in a series of reports presented to the Board of Supervisors on July 27, by the Board of Engineers, Flood Control, appointed in April, 1914, signed by four members, H. Hawgood, chairman, Capt. Charles T. Leeds, J. B. Lippincott and Frank H. Olmsted, secretary. The fifth member of the board, James W. Reagan, filed a dissenting report. Supervisor F. H. Woodley, director of public works, Los Angeles County, has been in touch with the Board throughout its investigations. The report is in five parts, a main section and four additional sections, each devoted to some special phase of the subject. These phases were assigned to individual members of the board. Among the measures recommended are retarding works and ground storage in the higher reaches, levee construction and stream diversion.



ONE OF SEVERAL PLANS FOR DIVERTING LOS ANGELES RIVER TO ALAMITOS BAY

COST

Estimates accompanying the reports indicate that the cost of carrying out the projects suggested would be, for structures, $12,824,400, and for rights-of-way, $3,384,500, making a total cost of $16,208,900. The loss which occurred in the flood of 1914 was over $10,000,000 and investigations extending back over a period of many years, says the general report of the board, show that destructive floods will occur at average intervals of less than five years, and these conditions, with the rapidly increasing cost of right-of-way, indicate the public necessity of promptly carrying out measures for relief.

The engineers, in their studies, have had to deal with the physical characteristics of an area which includes precipitous mountains, detrital valleys and coastal plains with rivers subject to enormous winter flood discharges, through channels whose gradients rapidly change, and whose courses gyrate through wide stretches of the most highly improved agricultural and horticultural districts in the United States. The engineering problems involved include flood prevention, flood protection and harbor preservation, with the only existing precedents in Europe, India and Japan, and none in this country.

CHARACTER OF TOPOGRAPHY

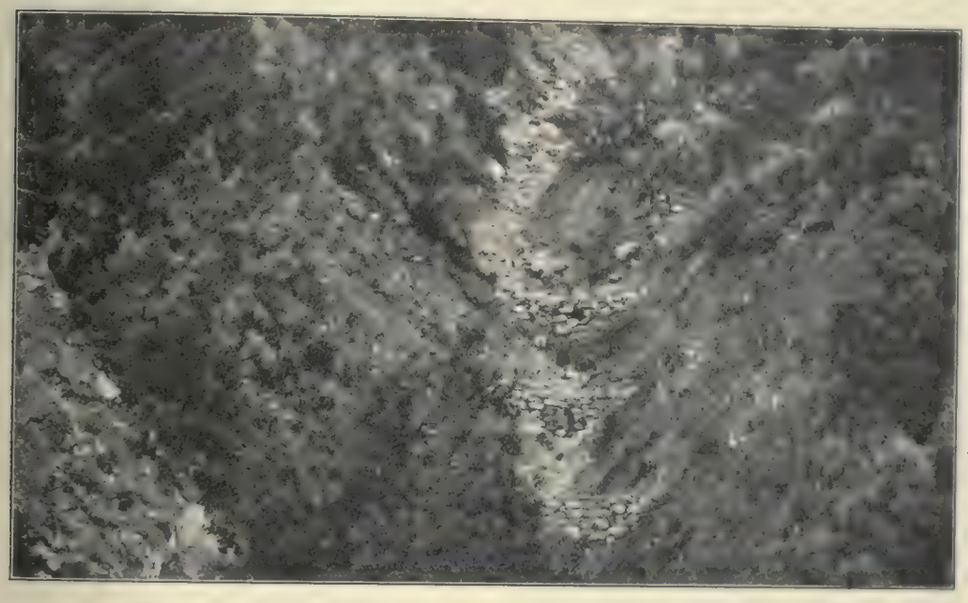
The Southern California streams debouch from mountain canyons upon detrital cones, extending over gravel-filled valleys. Because of the detrital deposits, the streams raise themselves above the surrounding country, so the report states, and in floods break their banks and make for themselves new channels. The mean annual rainfall on the coast is about 14 in., increasing in intensity with elevation, as the crest of the Coast Range is approached. Storms create violent, erratic, and usually quickly passing floods. Plans for flood control must recognize that history shows that floods 70 per cent greater than the disastrous one of 1914 have occurred, and must be provided for in the future. The board enumerates methods of flood control used elsewhere—forestation, impeding reservoirs, storage reservoirs, channel rectification and levees. The problem here is to utilize all the above methods with the addition in this locality of "spreading." This general report outlines briefly flood control plans by districts, designated respectively as the Mountain District, San Fernando District, San Gabriel District, and Coastal Plain District.

The mountain district has an area of 750 sq. miles with twenty-five main drainage lines. The discharge has reached 45,000 cu. ft. per second from its largest

individual catchment area, the San Gabriel, 222 sq. miles in area. Larger streams slope from 200 to 300 ft. per mile, the smaller ones from 700 to 1400 ft. In the February, 1914, storm the crest discharge rates ranged from 120 cu. ft. per second per square mile from the San Gabriel area to as high as five times that from smaller drainage areas.

RETARDING WORKS

Retarding works should be as successful here as in Europe, as the mountain formation here is largely granitic, compared with the foreign sedimentary rocks, so the relative amounts of detritus carried out should be less here than there. The precipitation here is less in total amount, but probably the rate of rainfall is much higher. The opportunity here for "rebrushing" is less on account of the long summer season, and protection against fire and waste of every kind is less. Water conserved by retarding devices would have greater economic value here than there.



EXPERIMENTS ARE BEING MADE WITH THESE SMALL IMPEDING DAMS

In recommending spreading and assisting water to percolate underground at the mouths of certain canyons, it is mentioned that the experience in spreading waters in San Bernardino Valley shows they may be put underground at a cost of approximately 14 cents per acre-foot for operating and interest charges. The treatment of the coastal plains district must recognize the conditions arising from construction of storm drains by the city of Los Angeles, which will deliver an ever increasing percentage of the runoff in a manner conducing to sharp flood peaks. Construction of impeding dams in the canyons will tend to desynchronize peaks from these sources.

In the summary the report points out that restoration and preservation of brush would enhance summer water supply, check winter floods and lessen production and discharge of debris onto the plain. The conservation of winter storm waters on debris cones is heartily endorsed. Water may be stored underground by surface spreading at a cost of less than 5 per cent of its value for irrigation purposes, but spreading cannot eliminate great floods, because flows are too great and swift, and because the turbid nature of the water retards infiltration. Spreading will take care of lesser flows succeeding the peaks.

The most vital element in the control of the rivers passing through the coastal plain to the sea, is the protection of Los Angeles Harbor from silt discharges, and the report recommends, as the only safe and adequate protection of the harbor, the complete diversion of the rivers to Alamitos Bay to be accomplished at some point above the vicinity of Dominguez through the construction of diversion dikes. The co-operation of the Government will be required to put this plan into effect. Incidentally, the Forest Service has indicated its desire to co-operate in forest protection.

In the lowlands, no way to obviate the necessity for levee construction exists. It is found necessary to handle the waters of the lower San Gabriel River in two separate channels. The portion from the main drainage basin of the San Gabriel proper, as well as from its eastern tributaries, should be carried in the Eastern Channel through Paso de Bartolo to a point of confluence with the diverted Los Angeles River east of Bouton Lake. Water from the district between Arroyo Seco and the San Gabriel naturally collects into the western flood channel known as the Rio Hondo. It should be permitted to continue in this course, joining near the County Farm the waters of the lower Los Angeles River between the city and the harbor.

Mr. Olmsted on Conservation

Mr. Olmsted's specific assignment, in dividing the work of the board, was the study of absorption of gravels and the spreading of floods.

Mr. Olmsted mentions factors which will make future damage exceed that of preceding years, unless a wise policy of control is energetically pursued from this time on: The unchecked erosion from fire-swept mountain areas, the removing of original brush protection on the foothills in the natural course of settlement and growth, the present deplorable stream-channel conditions, and the relatively greater value of lands and improvements. The large initial outlay for flood control by storing and retarding the waters is justified on the ground of conservation and permanent control. While Los Angeles County conditions imperatively demand flood channels, the permanency of the lower flood channels can be insured by eliminating the silt and debris, and by conservation work in the upper tributaries.

RUNOFF

The rivers discharging into San Pedro Bay and Alamitos Bay have a mountain catchment area of 615 sq. miles. The average elevation of this mountain district is 3680 ft., and the average annual precipitation is between 20 and 30 in. The rainfall over this mountain area, during the four-day flood period of February, 1914, averaged 14 in. Accumulation of silt, sand, gravel, and boulders at critical locations created points of extreme danger. Diminution of this peak flood flow now demands controlling structures above the canyon mouths.

In the 1914 flood a single hour showed a 1.49-in. rainfall, 21 per cent of and seventeen times its proper proportion of the four-day storm. This heavy fall occurred after 13 hours of rain. The report gives a tabulation of the high water marks in all the canyons.

The opportunity for storing flood flow in large reservoirs in Los Angeles County does not exist. Protective work in the lower channels alone would not be effective due to conditions arising from the presence of detritus, while spreading of flood flows on the gravel cones below the canyon mouths promises only limited relief. Adequate control requires an attack on the floods at their sources in the high mountains, and utilization to the greatest extent practicable of surface storage, flood spreading, and channel rectification and control.

RETARDING DAMS

Experimental work in Haines Canyon and on Clear Creek, shows the applicability of the European system of retarding dams to the county's needs. Haines Canyon, in the 1914 storm, showed a run-off of 712 cu. ft. per second per square mile, which was normal considering its small area, its lately burned-over slopes, and its badly eroded washes. Haines Canyon has a total watershed area of 6.50 sq. miles, with 3.90 sq. miles of this area above the valley. The sides of the canyon have been entirely denuded of brush and timber by fire. Under Mr. Olmsted's supervision, there have been constructed in Haines Canyon 384 small checks for retarding the velocities of the stream flow, the cost of each structure running from $5 up to, in one case, $500. The total construction cost amounted to $4,650.50 for the dams, and $1,350 for trails, administration, etc. The average expenditure directly for the dams was $12.11 each, and for the dams with the collateral trail construction and administration, $15.62 each. The foreman in charge of construction was Clarence S. Buck, who previously had built many structures of a similar kind in Alaska.

Four small dams finished in Western Empire Canyon, a tributary of Haines Canyon, prior to the 1914-15 floods, which in this 22-acre watershed probably showed a precipitation for the full storm of Jan. 28 to 30 of 9.85 in., with 1 in. of rain in the lower section in a single hour and a half, showed that the check dams so retarded the flood water that no flow whatever reached the main drainage line of Haines Canyon, and now, July, 1915, the bed of the stream is being rapidly grown up with willows and brush where previously nothing ever grew.

The movement of small volumes of water

down this canyon, having a slope of 13 deg., was about one foot per second. The average retarding effect of the 6½ ft. dams, as determined by potassium permanganate was 0.2 ft. per second. A heavy flood will have a surface velocity equal to a 5.2-per cent grade, instead of that due to a slope of 23-per cent grade. Assuming that the class of construction utilized in Haines Canyon is permanent, the results there have demonstrated that the excessive flood peaks for this particular tributary are subdued, and only minor flood flows are to be provided against in the lower channels.

The report reviews briefly some of the important work done abroad with retarding dams. The greatest erosive action of the water is not when the flow is largest. The moment the velocity commences to decline, the largest and heaviest boulders are dropped and the still comparatively rapid current, forced to follow a serpentine course is deflected against the easily eroded banks. The stream will then continue to take in suspension additional load until an entirely new regimen is acquired. This regimen is dominated, first, by the relative depth of the water; second, by the width of the channel, and last, by the grade. The widening of the stream by an increased separation of the banks at once lessens the depth and diminishes the velocity, with resultant deposits of suspended matter.

EXPERIMENTS

Experiments are being made at a station in Clear Creek to furnish definite data for determining (1) the action of a large flood crest in a small canyon as nature left it; (2) the parallel action of the same flood crest when the channel has been cleared of obstruction; (3) the action when definite breaks and check dams obstruct the channel; (4) the class of dam that will withstand the flow. The equipment of the station consists of a dam, gaging stations and signal devices. The dam is of the rock-fill type, the fill having a slope of 2 to 1, while the up-stream face is a masonry wall approximately 30 in. thick. The dam is 24 ft. high, will hold about 124,000 cu. ft. of water, and is equipped with a collapsible wooden gate 5 ft. wide by 7 ft. high, located at the lowest point in the face of the dam, and so constructed in sections that it gives an instantaneous opening of this size. The general scheme is to allow the water to rise to a given depth and then suddenly release it, creating artificial flood conditions in the channel below. The receding crest of this extreme flood wave in its successive crossings of the various gaging stations is then noted.

RESULTS

In experiment 1, July 6, the reservoir contained 15,000 cu. ft. of water, standing 9 ft. deep at the gate. It took the crest water 2 hr. 50 min. to travel 7300 ft. from the dam to the mouth of the canyon. Calculations show that with the type of channel the water should have reached the mouth in 9 min. 21 sec., provided water is being continually supplied in sufficient quantity to maintain the above hydraulic radius at all points in the channel during the passage. The flattening of the crest and decrease in velocity may be due to one of three, or all of three, causes: channel obstruction, decrease in water supply, and flattening of the slope. Hence, all reduction of velocity in the experiment cannot be credited to the obstruction factor, and due weight must be given to the decreasing hydraulic radius, and to increase or decrease of slope.

The natural obstruction at present in the channel is large and its value an unknown quantity. Its removal and the substitution of check dams and cross breaks would permit application of hydraulic formulæ in seeking for the cause of reduction of crest and retardation of velocity. A second experiment with part of the channel cleared gave a velocity of 6.8 ft. per second, attributed to a larger volume of water in storage, which increased the hydraulic radius of all sections. Data obtained are considered inconclusive. Conclusive data require experiments on a channel fully cleared for 1500 ft., and then, after finishing a full series of experiments on a clear channel, a second series after installing a complete system of check dams.

An appropriation of $100,000 is advised for rebrushing denuded slopes.

ENFORCED PERCOLATION

The balance of Mr. Olmsted's report is devoted to an itemized consideration of conditions in individual canyons, and a detailed estimate of works for minimizing flood crests in the form of check dams and brush breaks. The improvement of the important Verdugo Channel, for the protection of the property in Glendale and for causing waters diverted into the gravel to replenish underground storage for pumping purposes, is proposed through the construction of an improved channel. This will effect the desired purposes by bank protection and by reducing the grade of the stream to 0.4 per cent by means of falls or weirs built in the channel, similar to the Indian diversion weirs, the basic theory of which is, that the length of the base or impervious floor of the weir, that is, the length of enforced under percolation, is a function of the height of the structure and of the character of the material on which it is built, or $l=C\,H$ in which l is the length of floor, H the height of weir above normal stream channel, and C a co-efficient depending upon the character of the material of the stream bed.

For stream-bank protection a 4-in. reinforced concrete slab on a 1 to 1 slope is proposed.

Control of the San Gabriel is proposed by effecting varying retardations of the peaks in its several tributaries, so that the peak in the main channel will not be the accumulated product of synchronous run-offs. Detailed studies for each tributary are presented. The estimates for the work proposed in Mr. Olmsted's report amount to a total of $4,130,838, divided as follows: Impeding dams, etc., $1,410,400; masonry dams, $450,000; rock fill dams, $154,726; spreading, $2,015,712; forestry, $100,000. This estimate covers the improvement of all the watersheds in Los Angeles County. Definite plans for the individual structures in so wide a range of territory will vary according to the conditions encountered, and will be affected by the results obtained from the Haines Canyon work and the Clear Creek experimental station.

To be Continued.

The second part of this article will contain abstracts of the reports of Messrs. Hawgood, Leeds and Lippincott, dealing respectively with flood control in the San Gabriel district, in the coastal plain and in the San Fernando Valley.

Omit Transverse Joints in Brick Pavements

U. S. Office of Public Roads States That Longitudinal Joints Are Sufficient and Specifies Their Proper Width

IT has been customary in the past to provide both longitudinal and transverse bituminous expansion cushions in grout-filled brick pavements, but recent practice has demonstrated that the transverse cushions may be advantageously omitted if proper longitudinal cushions are provided. This is the opinion expressed by Vernon M. Peirce and C. H. Moorefield of the office of Public Roads, in Bulletin 246 of the U. S. Department of Agriculture. The principal objection to the use of transverse expansion cushions is based on the fact that the material composing the cushions frequently softens during warm weather and runs out toward the curb, thus leaving the edges of the adjoining brick exposed to destructive impact from the wheels of passing vehicles. Even if the cushion consists of a material which does not run in warm weather, it is necessarily softer than the brick, and the natural result is still the development of unevenness in its immediate vicinity. No such objection can exist concerning longitudinal expansion cushions, however, if they are placed adjacent to the curbs and constructed of proper material. They not only furnish a means for the pavement to expand and contract with changes in temperature, but they also eliminate to a large extent the disagreeable rumbling which has been so frequently associated with grout-filled brick pavements. The bituminous material of which the expansion cushions are made should be such as to remain firm in summer and not to become brittle in winter. It should also possess the quality of durability.

EXPANSION CUSHION THICKNESS

Expansion cushions should be provided for at the time the brick are laid by placing a board of the required thickness on edge adjacent to each curb. Small iron wedges may be inserted between the curb and the board at the time the board is set. These wedges may be readily loosened and removed after the bricks have been laid and grouted, and may consequently be made to facilitate the removal of the board.

The proper thickness for expansion cushions is a matter concerning which much difference of opinion exists among highway engineers. Some engineers advocate a minimum thickness of 1 in., while others claim to have secured their best results by using expansion cushions having a minimum thickness as low as ⅜ in. for very narrow pavements. It is generally agreed that the thickness of the cushion should vary with the width of the pavement. The following suggestions for proportioning the cushion are offered as being fairly representative of the best practice:

For a 20-ft. roadway the cushion thickness should be ½; for 20 to 30-ft. widths, ¾ in.; for 30 to 40-ft. widths, 1 in., and for widths over 40 ft., 1¼ in.

THE ULTIMATE DEVELOPMENT of the highways of Colorado will include about 16,000 miles of State road, or more than 50 per cent of the total mileage in the State. The maintenance on these roads, according to the State Highway Commission, will cost about $640,000 a year—an average of $40 per mile per year.

HINTS FOR THE CONTRACTOR

Details Which Save Time and Labor on Construction Work

Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

[*Contributions to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

Concrete Material Tables Have Saved Money on Road Work

TO give the men in charge of distributing concrete paving materials an idea of how much material to send a given section and how much to unload at a given spot, the accompanying tables have been employed by the road commissioners of Wayne County, Mich. They have proved a great success in reducing to a minimum the rehandling of materials, caused by accumulating too much at one point.

TABLE GIVEN TO STORAGE YARD FOREMAN—AMOUNTS FOR 1 MILE OF ROAD

Width of Road	Pebbles			Sand			Cement		
	Cu. Yd.	Tons	Carloads	Cu. Yd.	Tons	Carloads	Bbl.	Tons	Carloads
12 ft.	1369	1916	55	684	855	20	2396	455	13
15 ft.	1711	2395	69	855	1069	24	2995	569	16
16 ft.	1825	2555	73	912	1140	26	3194	607	17
18 ft.	2053	2874	82	1026	1383	31	3594	682	20

1 cu. yd. pebbles, 1.4 tons; 1 carload pebbles, 35 tons; 1 cu. yd. sand, 1.25 tons; 1 carload sand, 44 tons; 1 cu. yd. cement, 0.19 tons; 1 carload cement, 36 tons.

TABLE GIVEN TO MAN ON THE GRADE—AMOUNTS TO BE PLACED PER 100 FT. STATION

Width of Road	Bbl.	Yards		Wagon Loads		
	Cement	Gravel	Sand	Cement	Gravel	Sand
12 ft.	45	26	13	4	20	10
15 ft.	56	33	16	5	25	12
16 ft.	60	36	17	6	27	13
18 ft.	68	39	20	6	29	15

Cement—45 sacks to 1 load; gravel—1⅓ yd. to 1 load; sand—1⅓ yd. to 1 load.

Three Types of Bridge for Carrying Gas Mains Across Subway Cuts

THE ACCOMPANYING photographs show three types of bridge developed for carrying gas mains across street intersections in New York City while subway construction is going on. These mains have to be laid temporarily above the street surface, as an accident to them in the course of construction for the new subways might prove very serious.



LIGHT TRUSS BRIDGE FOR GAS MAIN



SUSPENSION BRIDGE WITH TIMBER TOWERS GUYED TO CONCRETE ANCHORAGE

The suspension bridge with timber towers is probably the least expensive type. The one shown crosses Broadway and Seventh Avenue at Forty-second Street, and was built by the Rapid Transit Subway Construction Company. The truss bridge shown was built because a necessary bend in the pipe line made a suspension bridge impossible. It crosses Broadway below Thirty-fourth Street. The third type, a suspension bridge with simple steel towers, the towers and cable anchorage being set in a single concrete block, saved some sidewalk space. The bridge shown is across Broadway at Thirty-second Street. Both of the bridges at Thirty-fourth Street and Thirty-second Street were built by the United States Realty & Improvement Company.



SUSPENSION BRIDGE WITH STEEL TOWERS

Proper Distribution of Castings Saves Money on Pipe Contracts

AN intelligent distribution of pipes, special castings and appurtenances will lower the water main contractor's costs considerably and will turn into profits what would otherwise be sheer waste. This is especially true in the case of work done in large cities.

A definite program of the procedure should be decided upon well in advance of opening the ground. Then the proper pipes, special castings, valves and hydrants should be ordered shipped to the nearest railroad station or dock for each particular section. This should not be done too far in advance of actual operations. Materials of this kind laid out on the streets mean either the expense of watchmen and lamps or the risk of police violations or accident liability.

Pipes should be distributed uniformly along the line of work. They should not be laid down in bunches, with a shortage all along the way and a cluster every hundred feet or so. Pipe rolling costs money. Even the most inexperienced know that a pipe that lays 12 ft. in the trench, with the spigot shoved back home into the hub, will occupy that length, plus the depth of the hub, distributed along the curb. Yet even experienced contractors frequently forget this important fact. What should be done is to distribute the pipe along the curb and place an extra length at intervals of, say every twenty-four lengths or less, dependent upon distance between the ends of the pipes, so that the longitudinal roll would never be more than 12 ft. Accurate measurements are not necessary to accomplish this. Pacing the distances will be found sufficient. Constant supervision of the distributing gangs is not necessary either. The number of pipes to lay out

within a given limit may be chalked up conspicuously on the pavement, a parallel fence or some other convenient place.

Special castings weighing 300 lb. or more should be set down at a point convenient to where they will ultimately be used. It will be found most economical to locate those weighing less in a yard, near a shanty, or in some other place where a watchman is on duty at night. These light castings are a constant temptation to thieves, being readily handled, and in city streets losses from such causes are considerable.

Hydrants should also be set down where they belong. These are very seldom tampered with. But it is almost a defiance of fate to distribute the lighter valves, those under 8 in. in size, in remote places along city streets. On one large job in New York City a contractor did this with his 6-in. valves. Not only were many stripped of their readily removable brass parts, but several were opened up and gutted as well. Those valves that are so heavy as to make rehandling expensive may, with reasonable security, be distributed at the points where they belong. But the smaller brass parts should be removed and kept under lock and key. One contractor adopted the simple precaution of covering the brass parts of his valves with burlap so as to conceal them.

80-Ton Excavator Ferried Over River at Small Cost

DUE to the ingenuity of S. McIntosh, director of the Irrigation and Reclamation Works Department of Australia, a large Austin excavator was recently transferred intact across the River Murray at a cost of £50, about one-twentieth of the amount that engineers figured would be required by other means suggested. Engineers in South Australia advised him that he would have to dismantle the large machine, carry it in sections, and erect it again on the new site. The American manufacturers advised building a big pontoon and floating it across. The first method would have cost £250 and the latter several thousand pounds. It was figured that a pontoon after construction would have been of little use for anything except as a float for the excavator.

Mr. McIntosh decided to use two barges which were required in the general operations of his department. The barges were lashed together and the big machine was run on them over heavy bridge timbers. The weight was equally divided between the two, and, towed by a steamer, the float with its strange freight crossed the river. The bulky machine then crawled once more onto terra firma.



TWO BARGES CARRY CATERPILLAR EXCAVATOR ACROSS AUSTRALIAN RIVER

One-Course Method Reduces Asphalt Patching Costs 15 Per Cent

By F. N. BINGHAM
Superintendent of Paving, Department of Public Works, Spokane, Washington

IN the repair of the ordinary sheet asphalt pavements which consist of a binder course and wearing surface the usual methods of using the two courses in making repairs has always seemed to me unnecessarily expensive, necessitating as it does the making of one operation in laying the binder course, and then going all over the work again in putting on the wearing surface.

In a day's work of repairing asphalt pavements, the ground covered frequently extends over several blocks, and in the case of repairing cuts made by the installation of public utilities in the newer paved districts, the repair work may extend over miles in a day's work. This not only makes two operations for the street crew, in fixing each cut, but causes an increased plant expense in handling the larger sized mineral aggregate for the binder course during part of the day, and then changing over to the finer aggregate for the wearing surface.

Every superintendent familiar with asphalt repair work realizes the difficulty in estimating the amount of material required for just the right amount of top or binder for a day's run on patch work, and therefore it is often the case that the plant foreman will prepare more binder than can be used or run the risk of not having enough.

To repair sheet asphalt pavements by the "once over" method I have used in our work here for sometime past an asphaltic concrete mixture of the following amount of asphaltic cement and mineral aggregate, and have had most excellent results with the same.

ASPHALTIC MIXTURE FOR PATCH WORK

	Per Cent
Asphaltic cement	9
Mineral filler passing through 200-mesh sieve	5
Sand passing through 80-mesh sieve	10
Sand passing through 40-mesh sieve	25
Sand passing through 10-mesh sieve	15
Crushed rock passing through ¼-mesh sieve	26
Crushed rock passing through ½-mesh sieve	10

Screens used in the order named.

The cut or worn place in the pavement to be repaired is prepared in the usual manner by cutting away the defective material until a good joint can be secured in the sound pavement and then carefully trimming the edges of the cut and painting with pure hot asphalt. If the patches are unusually large or located on a grade where there might appear to be danger of the patches creeping on the base, I paint the concrete base with a hot asphaltic paint consisting of 80 per cent asphalt and 20 per cent distillate, and then proceed to fill the holes as prepared above with the hot asphaltic concrete mixture the same as is done with sheet asphalt, using special care in tamping and smoothing the joints and securing the maximum amount of compression by rolling, and finally dusting with cement.

It is well to have the mixture to be used fairly hot, at least 300 deg. Fahr., in order to secure thorough compression by tamping and rolling.

This method might appear objectionable on the grounds that the patches made with the asphaltic concrete mixture would plainly show in contrast to the sheet asphalt pavement. However, this is not the case, and a few days after the patches are put in they are not distinguishable from the original pavement, and by this method I have been able to decrease our cost of maintenance from 15 to 20 per cent.

THE COST OF A BRICK PAVEMENT may be determined roughly by a formula given in a bulletin published recently by the U. S. Department of Agriculture. The cost of such a pavement, it is pointed out, depends so much upon so many variable factors, such as the locality, freight rates, and the distance from brick kilns, that it is not possible to make any definite estimates. The cost of the rough grading, however, should be considered entirely apart from the cost of the pavement, for the grading would have to be done no matter what kind of a road was to be built. Excluding this item, the bulletin furnishes the following formula as a rough guide for the probable expense of a brick road with a 6-in. concrete foundation and suitable grades: Cost per square yard $= 1.90\,L + 0.213\,C + 0.138\,S + 0.157\,A + 0.040\,B$. In this formula C equals cost of cement per barrel, S equals cost of sand per cubic yard, A equals cost of coarse aggregate per cubic yard, B equals cost of paving bricks per 1000, and L equals cost of labor per hour. It is assumed in this formula that all materials are delivered on the work. About 10 per cent should be allowed for wear on tools and machinery, and for every inch subtracted or added to the thickness of the foundation there will be a corresponding difference of 8 to 12 cents per square yard.

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

Will Build Storage Reservoirs in Primeval Wilderness

The Quebec Streams Commission has given a contract to the St. Maurice Construction Company of Montreal for the construction of the St. Maurice storage dam, which will impound 160,000,000,000 cu. ft. of water. The object of the storage is to improve the power conditions of the St. Maurice River. Fraser, Brace & Company, Ltd., Power Building, Montreal, will supervise the work for the contractor. The dam will contain 70,000 cu. yd. of concrete.

The dam is located on the St. Maurice at a point fifty miles from the nearest habitation and thirty-five miles from the nearest point on the Transcontinental Railroad. The getting in of supplies, therefore, will prove a very difficult task. That problem has not yet been solved, but the expectation is that it will be possible to use the river for about thirty miles and a narrow gage line for the remainder of the distance.

The project was described by J. W. Thurso in the Engineering Record of Oct. 10, 1914, page 395, and Oct. 31, 1914, page 490.

Engineering Company Granted Decision in Infringement Suit

The Cleveland Dock Engineering Company of Cleveland has been granted a decree sustaining its patent to a special type of concrete dock, built in 1907, for the Detroit Iron & Steel Company, a subsidiary of the M. A. Hanna Company, restraining the latter company from further infringement and calling for an accounting. After the original dock was completed the Detroit Iron & Steel Company, undertook extension to it, in 1913, ignoring the original engineers and the designers, it was claimed, and practically duplicating the original design. The dock design as originally developed and used consists essentially of a heavy girder wall, supported on piles, connecting integrally with a heavy floor or deck, extending back to a parallel shore or tight wall, properly supported. The case was tried in the U. S. District Court, Eastern District of Michigan, sitting at Detroit. Judge Tuttle presided.

Transit System to Aid Employees in Life Insurance Payments

The Brooklyn Rapid Transit Company, New York City, has entered into an agreement with the Travelers' Insurance Company of Hartford, Conn., whereby that company will insure the lives of employees of the transit system under the group insurance plan. The Brooklyn company will pay one-half of the annual premium on insurance up to $1,000 and, in certain cases, the total premium.

Grand River Roller Crests and Accessories Weigh About 280 Tons

The roller crests of the Grand River Roller Dam, in Colorado, which are shown in the accompanying illustrations, weigh, with accessories, about 560,000 lb. They are seven in number, six having a length of 70 ft. and a height of 10¼ ft., and one having a length of 60 ft. and a height of 15⅓ ft. The dam, as a whole, consists of an ogee masonry weir with the roller crests. The maximum height of dam is 24 ft., the length of weir, 546 ft. The volume of concrete used in its construction totaled 16,500 cu. yd. The main canal from the headworks has a capacity of 1400 sec. ft. The mean monthly flow of the Grand River, at Palisade, Col., varied from 1200 sec. ft. to about 33,000 sec. ft. in the period between 1902 and 1911.



PIER DETAIL AND END OF ROLLER

The reason for the installation of this type of dam was that the Denver & Rio Grande Railroad, at the point of crossing, is about 3 ft. above water level and the rolling crest was adopted in order to keep the level of the water approximately constant by raising the rollers and permitting flood waters to pass through the dam.

Pioneer Heading at Rogers Pass Tunnel Is Finished

Remarkable Records Result of Sustained Effort as 452 Feet Is Lowest Average Monthly Progress on Any Heading for 1915

The month of July saw the completion of the pioneer heading at the Rogers Pass Tunnel on the Canadian-Pacific Railway near Glacier, B. C. At the same time the greatest progress for the job in enlarging the main heading for double track was made, 812 ft. of the west end of the tunnel having been excavated and timbered during July. The largest month's progress of enlargement for double track on the east end, 726 ft., was also recorded for the month of July. The best progress on the pioneer headings was 808 ft. for June and 932 ft. for January, 1915, both made in the west heading. This last figure is the American record for progress in any size tunnel. The best month's work in the east pioneer heading was 776 ft. for June, so that June was the high month for the pioneer bore, with 1584 ft. of progress made in both headings.

Record on Main Heading

The highest progress made in a main heading was in March, when the heading at the west end was advanced 752 ft. The lowest full month's work in any heading has been 393 ft., which was the progress made in the west main heading in June.

High Average Progress

The average monthly progress shows that the records made have been backed by sustained effort, and are not merely the result of favorable conditions.

Progress on the entire work for the seven months averaged as follows: Pioneer headings, east, 668 ft.; west, 719 ft.; main headings, east, 452 ft.; west, 601 ft., and enlargement for double track, east, 554 ft.; west, 526 ft.

There remains to be driven 2.05 miles of main heading and 3.31 miles of double track enlargement. The concrete lining of the earth section is nearing completion, and it is expected that all the rock section which requires lining will be concreted this year. The completed tunnel will probably be ready for operation in September, 1916.

A description of the methods used on this remarkable contract, which is being carried out by Foley Bros., Welch & Stewart, under A. C. Dennis as superintendent, will be found on page 604 of the Engineering Record for Dec. 5, 1914, when the work was in the early stages of construction.



ROLLERS RAISED TO PERMIT FLOOD WATERS TO PASS THROUGH DAM WITHOUT ENDANGERING RAILROAD TRACKS

Los Angeles $1,000,000 Municipal Dock Completed

Municipal Dock No. 1, in the outer harbor of San Pedro, Cal., costing nearly $1,000,000, is practically completed and will soon be formally dedicated. Work on the structure was begun in April, 1912, and its completion is said to represent one of the largest harbor improvement schemes ever undertaken by a municipality. Sixty-six acres of land were reclaimed by the city before the work started. The completed structure includes a reinforced concrete wharf 2520 ft. long and a transit shed of steel and concrete 1800 ft. long and containing 180,000 sq. ft. of floor space. Foundation piles for the construction of a proposed six-story warehouse, 480 x 152 ft. in size, with approximately ten acres of floor space, are now being driven. Channels 35 ft. deep will accommodate the largest sized steamers. The approximate cost of the various units composing the ultimate structure may be stated roughly as follows: fill, dock, shed and proposed railroad spurs, $897,000; transit shed, $250,000 reinforced concrete dock, $444,000.

Concrete Road Congress Sub-Committee Organization Completed

The organization of sub-committees for the Second National Conference on Concrete Road Building to be held in Chicago, Feb. 15-18, 1916, has been completed. Seventeen committees have been named. Each of them will investigate a specific topic in connection with the construction of concrete roads and will submit a report on it. The committees are made up of college and university professors, engineers, contractors and State, city and county officials. The topics cover questions of design, aggregates, proportions of materials, joints, construction problems, estimates, specifications and maintenance.

The program for this conference will follow the general lines worked out for the first meeting, with the exception of a few changes dictated by new conditions. The advisory committee has again elected Dr. W. F. M. Goss, dean of the college of engineering of the University of Illinois, as chairman, and J. P. Beck, as secretary. An invitation is extended to all interested in highway improvements to correspond with the secretary and to participate in the conference.

The secretary's office is at 208 S. La Salle Street, Chicago.

Sanitary District North of Chicago Engages Engineering Talent

The North Shore Sanitary District, an area along Lake Michigan 20 miles long and about 1 mile wide in Lake county, Illinois, has appointed John W. Alvord, Harrison P. Eddy and George W. Fuller as a commission of engineers to determine a method of disposing of the sewage in the district. Preliminary data, consisting of drawings of sewage systems, underground conditions, material costs, water supply conditions and sewage gagings have been collected and collated in a report submitted in June by Langdon Pearse and S. A. Greeley, the local work being done by R. J. Smith and C. E. Russell of Waukegan.

New York's Payroll Report Shows Decreases in Some Departments

Considerable decreases are shown in the salary disbursements during 1914 as compared to the preceding year of various city departments in New York City which generally employ large forces of engineers, according to a report submitted to the Board of Estimate and Apportionment by Comptroller Prendergast. The Bridge Department shows a reduction of $144,060, the Department of Docks and Ferries, $193,586, the Department of Water Supply, Gas and Electricity, $325,969, and the Board of Water Supply, $386,809. Increases are shown in various other departments to such an extent that the city's payroll, as a whole, shows an increase of almost $4,000,000 over that of 1913.

New York Public Service Commissions Adopt First Joint Order

For the first time in the history of the commissions, the New York State Public Service Commission of the First District and that of the Second District, sitting at a joint meeting to consider the removal of grade crossings and other obstructions on the lines of the New York & Harlem River Railroad and the New York, New Haven & Hartford, adopted, during the week of Aug. 2 to 6, a joint order providing for such removal. The obstructions in question are located near 241 Street in the Borough of the Bronx, New York City. The order calls for a shifting of the tracks and the construction of a viaduct to carry the street at that point so that the present dangerous and inconvenient conditions will be done away with, and that the full effect of recent grade crossing improvements at Mount Vernon, which is in the Second District, may be realized. These improvements were ordered some time ago, but, owing to conditions in New York City, the new highway could not be opened until a connection from the New York City end was provided.

Restoring Bridge Destroyed During the War in France



MOST OF THE WAR PICTURES OF BRIDGES RECEIVED IN THIS COUNTRY SHOW MERELY THE DEMOLISHED STRUCTURE. THIS VIEW INDICATES HOW THE ESTACADE BRIDGE OVER THE MARNE IS BEING REPLACED BY THE USE OF PONTOONS

Memorial Will Be Central Feature of New Technology Group

The Walker Memorial, the student club house, will be the central feature of the new group of buildings now in the course of erection along the Charles River Basin for the Massachusetts Institute of Technology, which was described in the Engineering Record, Nov. 15, 1913, page 48; April 4, 1914, page 393, and May 15, 1915, page 634. It will be a building of about one hundred and fifty feet front and three stories in height, and will cost about $250,000. It will stand at an elevation above the street level so that the basement will be high studded and well lighted. The main floor will be approached from the river front by broad steps leading to a curved pillared portico two stories in height, above which the building will continue up another story on the line of the wall behind the portico. Pavilions with engaged columns, the latter also two stories in height, define the ends of the structure, standing somewhat forward of the main facade.

The architecture is to be of the simple classic style of the educational group, the main building with a conventional triglyph frieze, the pavilions differing somewhat in detail.

Entering the building through the portico the visitor will find himself in a spacious tripartite lobby, which will be the living room. Comfortable cosy corners will abound, for many angles are provided. There will be two open fireplaces in the lobby and others in adjacent rooms. To the left will be the dining room and to the right a spacious lounge, eighty to ninety feet in length. The whole rear of the first floor will give space for an auditorium for about five hundred, centrally disposed in the width of the building. The second floor will have reading, writing and social rooms, a library and a room devoted to the use of faculty and alumni. The third story will be divided into many small rooms, which are to be the homes of the many student activities. The basement will contain kitchen, service and utility rooms, a small gymnasium, showers and toilets. The building is so planned and the others, with reference to it, that available land for future extension to more than double its original size will be available.

Sewage Disposal Commission in Chicago Abolished

After three years of work and without waiting for a final report the Sanitary District of Chicago has abolished its commission of engineers appointed to investigate the development of water power and the best method of sewage treatment. A report was made on the power plant development and the disposal of electricity last winter. The members of the Commission were L. E. Cooley, John Ericson, W. A. Artingstall, L. K. Sherman and Henry M. Walker.

International Engineering Congress Has Almost 3000 Members

Up to July 12, 2927 members were enrolled on the books of the International Engineering Congress. The American Society of Civil Engineers furnished 10.1 per cent of the total membership. The foreign membership is only 27 per cent of the total enrollment. California, with 466 members, New York, with 446, Pennsylvania, with 176, and Illinois with 111, lead all other States and foreign countries in the order named, in the number of members resident within their boundary lines. Up to July 12, 192 papers had been received.

Chicago's Smoke Committee Claims Railroad Electrification Unfeasible

That Chicago does not need electrification of its railroads and that the proposition is not feasible is the position taken by the Committee on Smoke Abatement and Terminal Electrification of the Chicago Association of Commerce according to the Chicago newspapers. The information came to them from Washington correspondents, who claimed to have access to a copy of the report. No confirmation could be obtained from the Chicago office, and furthermore it was declared that no information would be given out before Sept. 15. The following notes are taken from the Washington account. Intimations have come from various quarters that the findings which were adopted in June were adverse to the electrification propaganda. The complete report, the despatch says, bears out the prediction. The cost was fixed at more than $200,000,000. Electrification projects are figured for 4501 miles of track, of which 2819 miles are within the city limits. Some of the items of expense are 1600 locomotives at $40,000 apiece and power houses of a capacity of 1,000,000 to 1,500,000 kw. at $100 per kilowatt.

With regard to smoke, the steam locomotives at present are charged with 22.06 per cent only. One of the members of the committee when smoke inspector of the city in 1911 reported that 43 per cent of the smoke came from railroads (see Engineering Record, April 15, 1911, page 426).

Health Association to Hold Annual Meeting Sept. 6 to 10

The annual meeting of the American Public Health Association will be held at Rochester, N. Y., Sept. 6 to 10. The first session of the sanitary engineering section will be a joint meeting with the laboratory section.

Will Hold Water-Power Conference at Portland, Oregon

As the result of a resolution passed by the Oregon Legislature last spring, empowering the Governor of Oregon to send invitations to various States to participate in such a conference, a water-power conference will be held at Portland, Oregon, Sept. 21, 22 and 23. Oregon, Washington and Idaho are especially interested in National water-power legislation. A very considerable portion of the streams in these States that are capable of hydroelectric power development are situated on Federal lands of various sorts. It is hoped that the conference will bring to a focus various thoughts on the subject of water-power legislation that may result in putting the matter before Congress in such a way that some definite results may be secured at the coming session of the National body.

Take Steps Toward Enforcement of New York Jitney Bus Law

The Public Service Commission, Second District, New York State has taken its first steps toward the enforcement of the New York jitney bus law, passed at the last session of the Legislature, by applying to a supreme court justice, at Kingston, for a permanent injunction restraining two individuals in Rochester from operating jitney lines without the consent of the local authorities or a certificate of public convenience and necessity from the commission. The law requires that all bus lines, motor vehicles, stage routes, any vehicle carrying passengers for 15 cents or less, or any vehicle operating in competition with a common carrier must procure the consent of the local authorities or obtain a certificate of public convenience and necessity from the Public Service Commission before operating in the streets of any of the cities of the State. The statute, in specific terms, makes all negaging in the jitney business, as defined, common carriers and subject to all provisions of the law as such.

Urge Appointment of Five Engineers to Solve Cedar Lake Problem

Committees representative of the Pacific Northwest Society of Engineers, the Municipal League of Seattle and the new Seattle Board of Commerce have jointly recommended to the City Council of Seattle, Wash., that a board of five engineers be appointed to study the leakage problem at Cedar Lake Reservoir and to devise a method of remedying it.

Automobile Rural Mail Delivery Routes Go Into Operation

Two hundred and eight automobile rural mail delivery routes in the United States went into operation Aug. 2. They will cover a total stretch of about 11,440 miles, distributed in Oklahoma, California, Georgia, Colorado, Kansas, Louisiana, Florida and Texas.

Clay Products in 1914 Indicate a General Growth of the Industry

The brick and clay industries of the United States, in 1914, produced material to the value of $129,588,822, according to the U. S. Geological Survey. Though this is a considerable decrease as compared to the production in 1913, it shows a general growth for the industry as compared to previous years.

Common brick, as judged by value, comprised over one third of the value of all brick and tile products in the past year. The total value produced was $43,769,524. Fire brick, at $16,427,574, ranked second in value. Sewer pipe was produced to a total value of $14,014,767, vitrified paving brick to a value of $12,500,866, drain tile to a value of $8,385,337 and fireproofing, including hollow building tile, to a value of $8,385,337.

Personal Notes

J. W. Hamilton has been appointed city engineer of Pasco, Wash.

Carl Olsen has been appointed city engineer and superintendent of waterworks of Rhinelander, Wis.

William L. Bradley, formerly division engineer of the Atchison, Topeka & Santa Fé Railway at Fresno, Cal., has been appointed division engineer at Needles, Cal.

J. W. Haynes has been appointed assistant engineer to I. A. Baum, city engineer of Texarkana, Ark. Mr. Haynes was graduated from the University of Mississippi in 1914.

M. C. Bryan, formerly division engineer for the Atchison, Topeka & Santa Fé Railway at San Bernardino, Cal., has been transferred to the Albuquerque division, with headquarters at Winslow.

Commonwealth Engineering Company, formerly located in the Plaza Building, and later in the Emerson Building, Oakland, Cal., has moved its offices to the Rialto Building, San Francisco.

P. C. McArdle, assistant State highway engineer of Illinois, has been granted a leave of absence to become consulting engineer of Vermillion County, in connection with its projected road system.

G. J. Bell, formerly division engineer on the Atchison, Topeka & Santa Fé Railway at Marceline, Mo., has been appointed engineer of the western district of the Eastern Lines at Newton, Kan.

Walter W. Weir, drainage engineer of the U. S. Department of Agriculture, has been assigned to Stockton, Cal., to make an investigation of drainage conditions in the South San Joaquin Irrigation District.

James W. Routh, formerly a member of the public works staff of the New York City Bureau of Municipal Research, has been appointed engineer on the staff of the Rochester Bureau of Municipal Research.

M. C. Blanchard, formerly office engineer for the Atchison, Topeka and Santa Fé Railway at Topeka, Kan., has been appointed engineer of the eastern division of the Eastern Lines. His headquarters will continue to be at Topeka.

L. L. Holladay has become associated with Henry Negstad in his consulting practice in the field of power plants, utilities and industries. The new firm, Holladay, Negstad & Company, has offices at 109 North Dearborn Street, Chicago.

G. A. Flink, consulting and construction engineer, of Harrisburg, Pa., has been selected by the Governor of Pennsylvania to prepare plans for and supervise the construction of the proposed $60,000 concrete bridge to be built in Northumberland County.

Rudolph Hering, hydraulic and sanitary engineer, of the firm of Hering & Gregory of New York City, has been retained by the city of Johnstown, Pa., to pass upon the plans for the proposed sanitary sewerage system and sewage disposal plant for that city.

H. A. Kluegel, civil engineer of Oroville, Cal., has been retained to assist in an investigation relative to the proposed new water supply for Denver, Col. Mr. Kluegel has had considerable experience in railroad, water supply and hydroelectric work in Hawaii and on the Pacific Coast.

R. A. Riley, formerly of the contracting firm of Evans & Riley of Pottsville, Pa., is forming a new company for the purpose of engaging in a contracting business, at Pottsville, in partnership with H. O. Knapp. The Riley-Knapp Construction Company is located in the Biddal Building.

W. C. Baisinger, formerly division engineer for the Atchison, Topeka & Santa Fé Railway at Chanute, Kan., has been appointed division engineer at Marceline, Mo., succeeding G. J. Bell, whose appointment to another office is noted elsewhere in these columns. Mr. Baisinger is succeeded by H. A. Hatch.

Elmer H. Olsen, formerly assistant engineer on the Gulf, Colorado & Santa Fé Railway at Galveston, Tex., has been appointed office engineer on the Atchison, Topeka & Santa Fé at Topeka, Kan., succeeding M. C. Blanchard, whose appointment to another position is noted elsewhere in these columns.

James S. S. Jones has been transferred from the field service of the U. S. Coast and Geodetic Survey to the position of computer in the tidal division. This division furnishes the survey parties with all tidal data necessary for soundings and has charge of the preparation of tide tables for the United States.

Charles G. Atkin, formerly connected with the Hyde-McFarlin-Burke Company, contractors, of New York City, has been appointed civil engineer on the forces of the Acme Contracting Company, at Herkimer, N. Y. Previous to entering the contracting field Mr. Atkin served as assistant civil engineer in the department of the State engineer of New York.

John N. Carlisle, who was retained in an advisory capacity by the Highway Department of New York State, upon his retirement from the office of State highway commissioner early in the year, resigned from that department, Aug. 8. He was appointed State highway commissioner by Governor Sulzer in 1913 and was succeeded in that office in March of the present year by Edwin Duffey.

Bickel Company, engineers and constructors of Kansas City, Mo., has taken over the business formerly conducted by the Commercial Construction Company, Reliance Building, Kansas City. This is merely a change of name, the officers and policies of both companies being the same. The Bickel Company has

established offices in the Interstate Building and will specialize in municipal and factory work.

Joseph Weidel, formerly assistant engineer on the Atchison, Topeka & Santa Fé Railway at Lubbock, Tex., has been appointed valuation engineer on the same road, with headquarters at Chicago. He was graduated from the Agricultural and Mechanical College of Texas in 1893 and entered railway service on the Atchison, Topeka & Santa Fé in 1900. He attained the grade of assistant engineer about two years later.

Edgar E. Ball, formerly division engineer of the Atchison, Topeka & Santa Fé Railway at Los Angeles, has been appointed division engineer of the Valley division at Los Angeles, succeeding William L. Bradley, whose appointment to another division is noted elsewhere in these columns. Mr. Ball entered the service of the Atchison, Topeka & Santa Fé in 1897 and was engineer of construction on the construction of the second track of the Albuquerque division, total cost of which was about $5,000,000.

Alvin A. Horwege has been appointed city engineer of Petaluma, Cal. He received his professional education at the Polytechnic College of Engineering, at Oakland, Cal., and entered the service of the Southern Pacific Railroad in 1908. From 1910 to 1912 he was connected with the Board of Public Works of the city of San Francisco on the construction of various sewers. He also served on the forces of the Great Western Power Company, the Warren Improvement Company, the Sierra & San Francisco Power Company, and, as assistant engineer, under the superintendent of construction and repair of the Board of State Harbor Commissioners, at San Francisco.

H. M. Roy, formerly chief field engineer with the American Zinc & Chemical Company on the construction of its zinc smelter plant, modern town and 1500-ton coal mine at Langloth, Pa., has accepted the position of engineer, with the Stone & Webster Engineering Corporation, on the construction of a zinc smelter plant at Keokuk, Iowa. He was graduated from the University of Illinois in 1905 and, after two years spent in the service of the U. S. Coast and Geodetic Survey on harbor surveys and precise leveling, entered the engineering department of the Pennsylvania Lines West of Pittsburgh, where he was engaged on construction and maintenance work until 1913. He left railroad work to accept the appointment on the forces of the American Zinc & Chemical Company.

Vernon M. Eager, civil and drainage engineer of South Bend, Wash., has established a branch office at Cathlamet, Wash., where he is engaged as construction engineer in charge of the construction of State Road 19, a unit of the State highway system. This unit will ultimately comprise 35 miles of permanent highway, extending through Wahkiakum County. Mr. Eager received his professional education at Washington State College and began work as chainman for B. W. Huntoon at Bellingham, Wash. He served as deputy county engineer of Whatcam County, Wash., from 1909 to 1910, and as deputy county engineer of Pacific County, from 1910 to 1911. He was appointed city engineer of South Bend in 1911 and occupied that office until 1913, when he resigned to engage in private practice.

Edgar L. Tenny, who for a number of years past has been in the designing and estimating department of the Illinois Steel Company, North Works, has opened an office in the Monadnock Building, Chicago, to engage in practice as a consulting engineer. He was graduated from Iowa State College in 1904 and entered the employ of the General Electric Company soon after. He was engaged in construction work for the Indiana Steel Company during the period of building the plant at Gary, Ind. For a number of years following he was bridge designer for the Chicago & Northwestern Railway Company. During his service with the Illinois Steel Company he made a specialty of derrick design, which he proposes to include in his consulting field, along with bridges, buildings and foundations.

Charles B. Buerger has resigned from the position of principal assistant engineer of the firm of George W. Fuller, consulting engineer, of New York City, to accept an appointment as consulting engineer for the Atlantic Refining Company of Philadelphia. Mr. Buerger joined the staff of Mr. Fuller in 1913, having been previously senior assistant engineer in the filtration division of the Department of Water Supply, Gas and Electricity of New York City. He was graduated from the College of the City of New York in 1898, and from Stevens Institute in 1900. He was connected with the Atlantic Refining Company once before, having been in charge of mechanical equipment and designer in its service from 1900 to 1903. He also served for several years on the engineering forces of the Bureau of Water of the city of Philadelphia.

Herbert A. Whitney, formerly hydraulic engineer of the city of San Diego, Cal., has been appointed consulting engineer for the California State Highway Commission. His first engagement along engineering lines was as draftsman for F. W. Wheeler's Ship Yard, at Bay City, Mich., from 1893 to 1896. In the latter year he was appointed surveyor in the city engineer's office at Bay City, where he remained until 1898. From 1908 until 1910 he served as hydraulic engineer and water superintendent for the city of Tacoma, Wash., and, from 1910 to 1912, as city engineer of Bellingham, Wash. He was appointed hydraulic engineer for San Diego in 1912. In this capacity he had charge of the design and construction of waterworks improvements to a value of $2,500,000, including distributing systems, subaqueous pipe lines, pumping plants, conduits and three dams.

Morris Knowles, consulting engineer, of Pittsburgh, has acquired the engineering business formerly conducted from offices in Pittsburgh and Canton, Ohio, by the late Loomis E. Chapin, whose death was noted in this journal, June 26. Mr. Knowles was graduated from Massachusetts Institute of Technology in 1891 and began professional work as assistant engineer for the East Jersey Water Company, at Newfoundland, N. J. He was associated with Mr. Chapin for several years, the partnership being formed in 1902 and terminating with Mr. Knowles' appointment as chief engineer of the Bureau of Filtration of the City of Pittsburgh. He opened offices to practise as consulting engineer in Pittsburgh under his own name in the latter part of 1910. He will conduct the combined business from his office in the Oliver Building, continuing to specialize in waterworks, waterpower, sewerage, sewage treatment and disposal, sanitary investigation, town planning, flood prevention and valuation work.

Thomas J. Gannon has opened an office at 143 Liberty Street, New York City, to engage in practice as consulting mechanical and hydraulic engineer on power plants, water supply, sewage disposal, coal and fuel economy, mechanical equipment and testing and reports. Mr. Gannon was graduated from Lehigh University in 1892, after having spent four years in practical work in the shops of the Bethlehem Steel Company. From 1892 to 1896 he was engaged alternately in the employ of the Bethlehem Steel Company and in postgraduate work at Lehigh. From then until 1902 he was employed by the New York Sugar Refining Company, Westinghouse Church Kerr & Company, J. G. White & Company, and the United Coke & Gas Company successively. He was appointed mechanical engineer on the forces of the Department of Water Supply, Gas and Electricity of the City of New York in 1902, in responsible charge of the mechanical work of that department, and continued in this service until recently. The present standards of that department for pipes, special castings, valve boxes, hydrants and gate valves were prepared by him.

G. F. Stickney, formerly consulting engineer for the Lake Erie & Ohio River Canal, having recently completed the preliminary investigations for that project, has opened offices in the Arkay Building, Albany, N. Y., for the purpose of practising as consulting engineer. He was graduated from Sheffield Scientific School, Yale University, in 1891 and served from then until 1893 as rodman, leveler and resident engineer successively for the Mexican International Railway. From the latter year until 1895 he was U. S. assistant engineer on river improvement work in Kentucky. At the outbreak of the Spanish-American War, in 1898, he was commissioned as captain, in command of Company C of the Third Regiment, U. S. V. Engineers, serving in the United States and Cuba. From 1901 to 1902 he was assistant engineer for the Lake Superior Power Company, and, from 1904 to 1905, U. S. assistant engineer on river and harbor improvements in the vicinity of New York City. Resigning from this office he entered the service of the State of New York, where, as supervising engineer on the State Barge Canal, he had charge of the preparation of a considerable part of the plans for that waterway. He left this work to become consulting engineer on the Lake Erie & Ohio River Canal.

Charles D. McArthur, who since April, 1914, has been chief engineer for Foley Brothers, Welch, Stewart & Faquier, contractors, of Halifax, N. S., on work in connection with the construction of the first unit of the Halifax Ocean Terminal for the Intercolonial Railway of Canada, has again assumed the office of chief engineer of the Blaw Steel Construction Company of Pittsburgh, and will be in personal charge of its engineering service department. All form problems requiring special design will be handled under his direct supervision. He received his professional education at Antioch College, Yellow Springs, Ohio, and was in the service of the Gleason Tool Company of Rochester from 1899 to 1900, engaged in the design of metal-working machinery. From 1900 to 1903 he was mechanical engineer in the motive power department of the Buffalo, Rochester & Pittsburgh Railway, and from 1905 to 1906 was designing engineer for the building bureau of the New York City Board of Education. He was originally appointed chief engineer for the Blaw Steel Construction Company in 1908, in which capacity he developed forms for the Panama Canal, the Catskill Aqueduct and the New York City and Boston subways. He resigned from this office in 1914 to take up the work at Halifax.

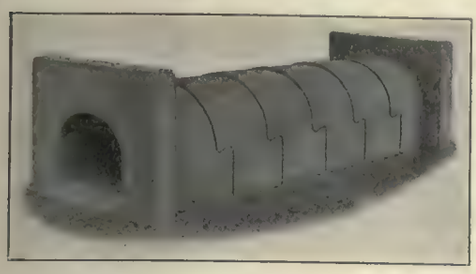
Civil Service Examinations

Examinations Previously Announced

Date		See Eng. Record.
Aug. 17-18—	Senior, Grade 1 and 2, and junior land appraisers, salaries from $2,700 to $3,600, from $1,800 to $2,400 and from $900 to $1,500 respectively; United States	July 24
Aug. 17-18—	Senior drainage, drainage and junior drainage engineers, Department of Agriculture, salaried from $2,220 to $3,000, from $1,800 to $2,100 and from $960 to $1,620 respectively; United States	July 31
Aug. 25-26—	Junior civil engineer, Engineering Department; United States	July 31
Sept. 15—	Aid, U. S. Coast and Geodetic Survey. Draftsman and junior engineer, U. S. Engineer Department	July 3
Oct. 13—	Aid, U. S. Bureau of Standards. Civil Engineer and Draftsman. Draftsman, Navy Department. Engineer, Indian Service	July 3

Interlocking Concrete Culvert

Expansion joints as protection against frost action, smooth interior as an aid to the flow of water, flat base and perpendicular sides, together with square end blocks, to insure a permanent setting, and an interlocking device are some of the features of the Hall Interlocking Concrete Culvert which has recently been



CULVERT MAY BE BUILT TO ANY LENGTH

placed on the market. The culvert sections are all reinforced. The steel forms used in manufacturing the culvert can make five sections at one casting. Both end blocks, being oppositely locked, are cast together. Sections can be fitted together to obtain any desired length. The forms for the new culvert, which come in seven sizes ranging from 12 to 48 in., are manufactured by Schulz & Hodgson, 19 South La Salle Street, Chicago.

Bonds Plaster to Concrete and New Concrete to Old

To make plaster adhere satisfactorily to a concrete surface a process known as "Par-Lock," which consists essentially of applying with patented apparatus a film of waterproofing compound to the concrete surface, and then sticking into the surface of this film by means of a low pressure blast a coating of coarse sand, has been in use about eighteen months, and is said to have solved the difficulties involved at a reasonable cost.

The apparatus, shown in the accompanying photograph, consists of an air-tank mounted horizontally, a tank under pressure containing the mastic, and a third tank containing the carefully screened and washed coarse sand, on which 6 to 8 lb. pressure is carried. The mastic is fed through a hose to a special nozzle, where it is projected into an air blast, carried to that point independently, which is under 50 lb. pressure. This blast carries the mastic through an outer nozzle and projects it with great force against the surface to be coated. All holes are filled, and it is said even the larger ones, such as nail holes, are permanently filmed over. This work is followed very closely by the sand blast. The result is a rough surface that bonds effectively with the plaster, and is said to quite prevent its flaking and falling from ceilings. The process, it is claimed, has also been used with success in bonding old and new concrete work.

The mastic used is an asphalt-gum compound carried in a volatile hydrocarbon medium. This latter entirely evaporates in four days, leaving a surface which can be plastered at any time thereafter. Hardening begins as soon as the mastic is applied, so that it must be sanded within a short time. As the mastic is waterproof the plaster is protected from all strains due to efflorescence from the concrete, or to water finding its way through the concrete from the outside.

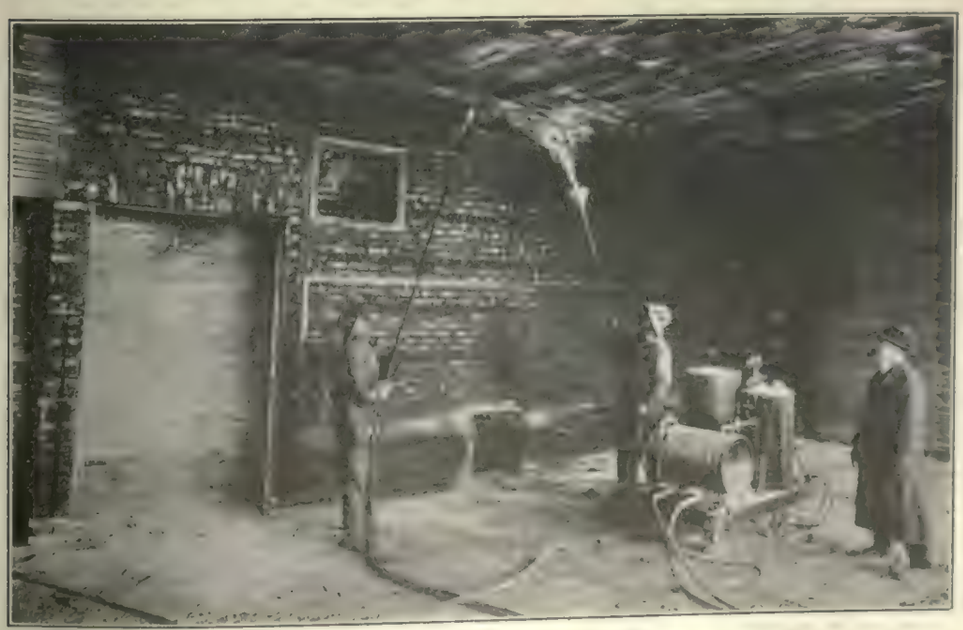
Tests made by the Industrial Testing Laboratory of Cleveland indicate that the tensile strength of the mastic is 240 lb. per square inch, and that it grips the sand grains with a strength of 160 lb. per square inch. Its bond with the surface to which it is applied is so good that test specimens break either in the concrete or in the material later applied to the sanded surface.

The process was used on the East Milwaukee School of Milwaukee and on a large number of concrete school buildings in Cleveland. It is now being applied to a concrete building of the Curtis Publishing Company in Philadelphia, where trouble with falling plaster had been experienced. The process is used to coat brick and other structural surfaces. The mastic used is known as "Lifekote Damp-Proof Bond," and is furnished by the Union Products Company of Cleveland. The following operating companies apply the "Par-Lock" process: the Mastic Bond Company, Inc., of New York City, the Bagnall-Taylor Company of Cleveland, and the Waterproof Plaster Key Company of Chicago.

New Interlocking Brick Has Insulating and Damp-Proof Features

A new type of interlocking channel brick, providing a double wall containing a 2-in. air space which serves as an insulation against heat, cold and moisture, has been placed on the market by Fiske & Company, Inc., 40 West Thirty-second Street, New York City. The material is known as "Fisklock" tapestry brick and its characteristics are shown in the accompanying illustration.

Only one row of blocks per course is needed for a wall 8-in. thick. As compared with ordinary brick, therefore, the operations of a mason in laying a wall are reduced. The channel of the new brick is 2 in. wide so that webs of the blocks may be grasped readily



MAN AT LEFT SPRAYING MASTIC, MAN IN CENTER PUTTING ON SAND



AIR SPACE IN WALL OF INTERLOCKED BRICK INSULATES AGAINST HEAT AND COLD; THERE ARE NO THROUGH MORTAR JOINTS

with one hand. No inside construction scaffolding is needed as there is no backing-up wall to lay. Special features of the new construction are the bond secured by the interlocking feature and the fact that there is no mortar joint extending through the wall, one of the reasons cited to substantiate claims for damp-proofness.

Tests of an 8 x 8 in. pier 6 ft. high at Columbia University developed an ultimate crushing strength of 109 tons per square foot, gross area. A fire test of a wall also was made, and the construction passed the specifications of the proposed building code of New York City.

With the introduction of this new material the company has adopted a sales policy claimed to be entirely new in the brick business—a frankly advertised "open price," uniform to all.

Want Data on Hauling Capacity? Get This Catalog

A good share of the existing information about the tractive force of locomotives, the effect and amount of rolling friction with different kinds of equipment on various grades and curvatures, and tables checked by actual tests giving the hauling capacity of Porter locomotives for different equipment and varying conditions are included in the second part of the new catalog of the H. K. Porter Company of Pittsburgh, just published. Simple engineering formulae and tables are given which would enable a contractor who is not an engineer to measure grades and curves on an existing track, or determine them for a new one, and select the proper size and type of locomotive to haul a given number of cars of a certain type over the line at the most economical speed. To an engineer confronted with this same problem the book will prove of great use, as it gathers between two covers the recent and complete data on these subjects. Master mechanics will find some useful hints on the care of boiler flues.

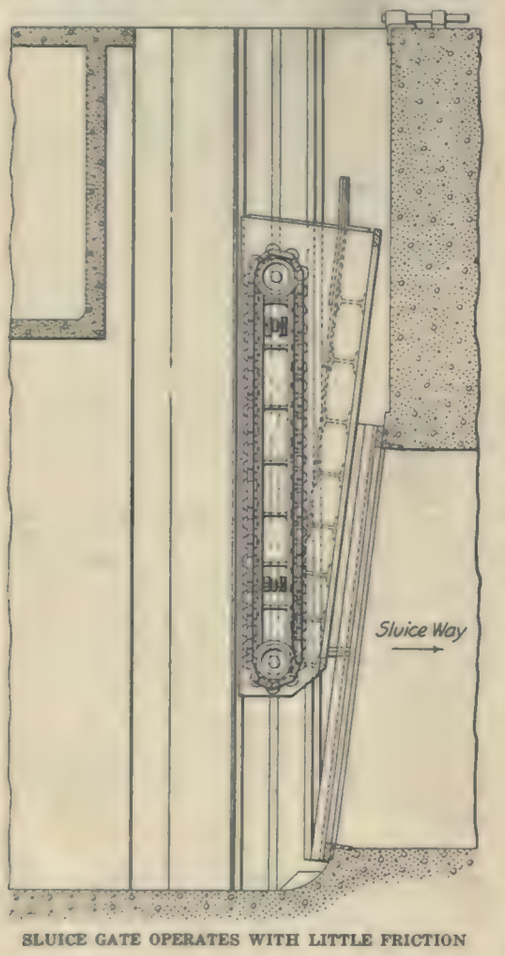
The third part of the catalog contains tables of operating costs, and of the cost of track per mile, arranged so as to give this cost for any price of materials. The weight, size, load capacity and cubic contents of standard railway, contractor's and industrial rolling stock are given. A table giving the proper weight of rail for different sizes of locomotives is also included. Weights of lumber and track materials and metric conversion tables are included.

The trade part of the catalog describes

steam and compressed air locomotives from the 6,000-lb. dinky to a 190-ton engine with tender. The publication is for distribution to those interested at the price of $1.

Inclined Seat Eliminates Sliding Friction in New Sluice Gate

By means of a seat, inclined with respect to the vertical gate movement, sliding friction is practically eliminated in the new Broome sluice gate, which is manufactured by the Exeter Machine Works of Pittston, Pa. The deck plate, being inclined, the forces operating to close the gate are reduced to the submerged weight plus the vertical component of the



SLUICE GATE OPERATES WITH LITTLE FRICTION

water pressure. Consequently, the supporting mechanism is always in tension, whether operating or closing. This does away with heavy compression stems and permits the use of the gate for extreme heads. Guideways are unobstructed to the full depth so that the gate is readily accessible for inspection. It is supported at the sides by endless roller chains, which bear on tracks attached to the movable gate and on guides supported on the masonry structure. On each side, at top and bottom, are squaring rollers, useful chiefly for securing minimum side clearance.

Simplicity of Operation Feature of This Back Filler

High broad-tired wheels, which prevent it from sinking to any extent in soft soil, ability of the operator to move it in any direction, backward or forward, without shifting his position, and plenty of power, are features of the latest back filling machine to be placed on the market. It is equipped with a 6 hp. Novo engine and the clutch used in pulling the cable is of the standard hoisting engine type. It is also provided with a break for holding the line when raising pipe, and a ratchet and pall which allows the hoist to be set permanently.

A multiple disc clutch is used in connection with the traction arrangement. The line or cable comes from the drag to the machine and is run through a swiveled sheave, which allows



NEW BACK FILLER IS EASY TO HANDLE

it to turn in any direction and thus permits the operator to work the scraper from any point. The new machine is manufactured by the Oshkosh Manufacturing Company, Oshkosh, Wis.

New Radial Interlocking Brick Lessens Cost of Sewer Construction

A new radial interlocking brick which is claimed by the manufacturer to materially lessen the cost of sewer and conduit construction, as compared to ordinary brick, due to the lesser thickness of wall required, has recently been put on the market. It is made to fit the radius of the circle in sewers or conduits whatever the diameter may be. When the brick, upon being laid, are shoved up the mortar is forced into openings in the ends, forming rigid dowels and bonding the structure lengthwise. Radial interlocking is secured by projections and grooves, and the bonding is further strengthened by the tapered section. They are claimed to give a much stronger construction than ordinary brick. The saving is in the lesser quantity of material required with the consequent saving in hauling, handling and mortar required. These bricks, known as the Frost Radial Interlocking Brick, are manufactured by the Los Angeles Pressed Brick Company of Los Angeles, Cal.

Trade Publications

The following companies have recently issued trade literature:

Ayer & Lord Tie Company, Railway Exchange Building, Chicago. Booklet, 6½ x 3½ in., 16 pages, illustrated. Interior wood block for plant floors.



RADIAL INTERLOCKING BRICK WITHSTAND GREAT PRESSURE IN THIS TEST

Fairbanks Steam Shovel Company, Marion, Ohio. Folder, 9 x 12 in., 4 pages, illustrated. A brief description of the Fairbanks gasoline ⅝-cu. yd. standard and revolving traction shovels.

Stow Manufacturing Company, Binghamton, N. Y. General catalog 14, 6 x 9 in., 96 pages, illustrated. Covers flexible shaft drilling, grinding and buffing machinery and their appurtenances.

Zeiser Brothers, Berwick, Pa. Catalog, 5 x 7¼ in., 24 pages, illustrated. All steel sidewalk forms and curb and gutter forms for concrete construction. Features in manufacture and application are described.

Knickerbocker Company, Jackson, Mich. Catalog, 6 x 9 in., 40 pages, illustrated. Knickerbocker batch concrete mixers, in 6-ft. and 10-ft. sizes, and Coltrin continuous types. The descriptions are general, the detailed facts being confined to specifications.

W. J. Stevenson, 1720 Cedar Street, Milwaukee, Wis. Catalog, 8 x 11½ in., 12 pages, illustrated. Contains comments and testimonials on the achievements of the Stevenson improved sewer cleaning machine, and illustrates it in action with some of the results.

Mead-Morrison Manufacturing Company, East Boston, Mass. Pamphlets 103, 104 and 105, 6 x 9 in., 4 pages each, illustrated. This company's latest type of electric grab bucket, its contractors' derrick swinging engine and hoist, and independent electric motor drive for hoist.

Barber Asphalt Paving Company, Iroquois Works, Buffalo, N. Y. Booklet, 9 x 6 in., 16 pages, illustrated. Contains a number of excellently reproduced pictures of roads on large estates, parks and country clubs. The text discusses the advantages of the roadways illustrated.

Asbestos Protected Metal Company, Pittsburgh. Booklet, 3½ x 6¼ in., 12 pages, illustrated. Embodies general points on the construction and use of Pittsburgh paving joint, an asphalt compound reinforced with linen mesh which, it is claimed, prevents stretching or distortion.

Otis Elevator Company, Eleventh Avenue and Twenty-sixth Street, New York. Booklet, 6 x 9 in., 32 pages, illustrated. An artistic presentation of an article on the emergency dams and girder and hoisting machines at the Panama Canal, manufactured and installed by this company.

Mesta Machine Company, Pittsburgh. Bulletin Ka, 6 x 9 in., 4 pages, illustrated. Reproduces a horsepower chart for determining the variables for gears, pulleys, rope wheels and other rotating parts transmitting power. A blueprint sixteen times the size of this reproduction may be obtained on application.

Jenkins Brothers, 80 White Street, New York. Catalog 20, 4 x 6¾ in., 256 pages, cloth-bound, illustrated. A complete catalog and price list of this firm's line of valves, packing and mechanical rubber goods. It embraces renewable disc, extra heavy brass and iron, radiator, gate, heavy cast-steel valves, flanges and drilling, gages, mason regulating devices and mechanical rubber goods. Price list of parts, tables of dimensions, telegraph code and a general index are appended to complete the publication.

Du Pont Powder Company, Wilmington, Del. Bulletin. A comprehensive treatise, covering the location, building and maintenance of roads. It discusses civic and economic progress relative to roads, gives detailed advice on right-of-way, grubbing, drainage, road building equipment and different kinds of roads and instructs the reader in regard to the uses of explosives and their handling. Obviously the publication promotes the rational use of explosives, yet its text is much broader in scope and covers phases of road construction distinctly far apart from just that.

Engineering Record

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Engineering Record

A Weekly Journal Devoted to Civil Engineering and Contracting

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The Galveston Storm

GALVESTON'S sea-wall was subjected to a severe test by the tropical storm which swept over the city on Aug. 16. To what extent the structure broke the impact of the huge waves which piled up against it and withstood their damaging blows is not known at this time, for telegraphic communication with the Texas city has been almost completely demoralized. Press reports, however, make no mention of any failure of the sea-wall, although certain portions of the city were said to be under several feet of water. The injury to structures along the waterfront, apparently, has been severe, but without the concrete wall it is fair to infer that the damage would have assumed much more serious proportions. The storm of last Monday is another justification for the measures which the city took to prevent repetitions of such disasters as the one of Sept. 8, 1900. For what degree of mitigation of the storm's fury the sea-wall was responsible Galveston has her engineers to thank.

Analysis of Indeterminate Structures

PRACTICAL engineers are apt to give little attention to elaborate methods for exact analysis of indeterminate structures proposed by the mathematician or the theorist. This may be due to either or both of two causes—inability to apply quickly a complicated mathematical method and the feeling that the fundamental assumptions upon which the theoretical analysis is based are not sufficiently exact to justify any claim for accuracy of results. While the description of the proposed accurate slope-deflection analysis of the wind stresses in the framework of high office buildings, given on page 231 of this issue, indicates that an appreciable decrease in the labor required for such analysis has been attained, this journal believes that the fundamental assumptions are not wholly unassailable. As stated by the authors, the assumption of absolute rigidity at the joints can be demonstrated only by tests, and none are available. Furthermore, the presence of knee-braces or solid web brackets at the columns would probably modify the theoretical relations appreciably, particularly in the effect on moments of inertia, on the unsupported length and on the position and nature of the end moment. The further effect of solid walls and interior partitions in resisting wind loads, of the floor slabs in modifying the lateral deflections of columns in adjacent bents, of unequal temperature deflections, not to mention the large relative error in the assumed wind pressure itself, all make exact stress analysis impossible. While such extended theoretical studies are of value in showing which of our approximate methods are probably best, for daily application these mathematical theories, even when simplified by approximations, are evidently not justifiable for ordinary practical design unless assumed conditions are closely realized.

Boston's Newest Tubes

THE location of a section of the Dorchester tunnel under the Fort Point Channel in Boston was purposely made to escape easements that would have been necessary if the obvious plan of running under the city streets and crossing the river at right angles had been adopted. At first sight this selection would seem to invite trouble, as it involves driving two tunnels for a long distance in water-bearing ground with relatively thin cover, as described on page 218. The engineers' confidence in borings which indicated that the ground was most favorable for tunnel driving with compressed air, however, is being justified. The soil is relatively stiff, and not subject to blow-outs. To further reduce danger from this source, the shields were provided with the sliding platforms used in driving open tunnels in soft ground. These platforms can be employed to help hold the working face, so that excessive air pressure need not be carried. To increase the economy of driving another method adapted from open tunnel practice is to be used. Belt conveyors will carry spoil from the shields back 100 ft. and deposit it in muck cars. This clear space behind the shields will be used to carry on the operations of waterproofing and concreting. For this latter work, sectional steel forms mounted on a carriage that rolls on the finished invert, and that clears the belt conveyors and the concrete cars, are being used. Another feature of this work which will be watched with interest is the use of wood block as against cast-iron segments for the outer lining. It is thought that these blocks will be placed with the ease and speed of pressed steel lining, while they furnish a direct surface for waterproofing, which can thus be put in its logical place, outside and not inside the concrete lining.

Graphic Standards Proposed

TO SECURE uniformity in the graphical presentation of data a number of associations of national scope have appointed representatives to serve on a joint committee which is making a study of the methods used in different fields for converting statistical matter into the form of curves and diagrams. While the membership of the committee is not confined to engineering organizations, three of the national engineering bodies are represented, the chairman being Willard C. Brinton of the American Society of Mechanical Engineers. The committee's work, apparently, has two main objects: First, to promote a more general use of the graphic method of presenting facts, and, second, to standardize the form of presentation. Among engineers the value of curves for illustrating the relationship between variable factors is so well appreciated that it is reasonable to assume that an educational campaign for graphic presentation will be directed chiefly to other fields. In the matter of standard forms for diagrams, however, engineers will find a great deal of timely and profitable information in the committee's preliminary report, which was issued last week. The object of curves is to render complex information susceptible of quick and accurate interpretation, and if the use of certain basic principles in the plotting of diagrams can be made general the value of the graphic method will be greatly enhanced. Although most of the fundamental principles which the committee enunciates are not new, they will bear repetition. The general arrangement of a diagram should be from left to right. The zero line should always appear even if it is necessary to make a horizontal break and close up the two sections of a diagram which would otherwise be of excessive vertical height. In curves involving percentages the 100-per cent line should be emphasized. Curve lines should be sharply distinguished from co-ordinate rulings, and in no case should the co-ordinate lines be closer together than is necessary to guide the eye in recording the diagram. But the final suggestion of the committee is, possibly, the most important. It makes a plea for a clear and complete title to every diagram, and this recommendation deserves hearty support. Engineers are so prone to neglect this point, not only in diagrams but in all forms of detail drawings, that it cannot be emphasized too strongly. In printed matter or reports diagrams or plans often are remotely separated from the text discussing them, and it is essential that they be labeled in such a way as to leave no doubt as to their subject. The committee has a large task before it, and if its mission is to be fulfilled it must receive co-operation from those whom it is striving to serve.

Expense Accounts at Conventions

NEXT MONTH there will be an opportunity for many small cities to make profitable investments. The New England Waterworks Association will hold its annual convention in New York, Sept. 7, 8 and 9, and, if past meetings of this society are a criterion, the occasion will offer to waterworks engineers an unusual opportunity for absorbing information of a decidedly useful nature—information which can be applied directly to the conduct of their work at

home. In the small town, however, the waterworks superintendent does not always receive a salary which will allow him to bear, without considerable sacrifice on his part, the traveling expenses and hotel bills incident to attendance at a convention. And so, often, he is compelled to forego a trip which would benefit not only himself but the town he serves. Under such circumstances the city will do well to pay the convention expenses of its representative. Laymen, unfamiliar with meetings of reputable engineering organizations, are prone to regard them as mere junkets, but happily these opinions are fast losing ground, for the good work of associations, such as the New England, is making itself felt throughout the country. The waterworks convention offers to engineers and superintendents a common meeting ground where they can exchange experiences and profit by learning of the successes and failures of their fellows. The small town engineer is the very man who needs this broadening influence. Progress is making rapid strides in the waterworks field, and the city which fails to apply these improvements to its own works follows a short-sighted policy which will soon place a needlessly heavy financial burden upon the shoulders of its taxpayers. It is true that the waterworks superintendent may learn of developments in his profession through the medium of books, society proceedings and the technical press, but these sources of information should supplement, not supplant, the knowledge gained by attendance at engineering meetings. For at such gatherings it is possible to receive, informally, advice on important subjects which, for many reasons, may never make its appearance in print. Then, too, there is the exhibit of waterworks equipment and appliances, nowadays an education in itself. All of the newest cost-saving and labor-reducing devices are on display. The engineer who has had an opportunity of investigating all of the manufactured products in a particular line is best qualified to save his city money in the purchase of equipment, for he is in a position to discriminate intelligently as to what will best serve its needs. The convention offers to him this opportunity. Let municipalities, therefore, send their waterworks' officials to the New York meeting. The cost will be returned to them manifold.

Wane of Speculation Helps Colorado's Irrigation Situation

IRRIGATION projects in Colorado and many other Western States are passing from the promotion stage into a period of completion and fruition and, in consequence, little of a spectacular nature is being said or done. The optimistic irrigation land promoter has long ago passed on to more fertile fields. There is little opportunity for the locating civil engineer. Settlers and town-builders are needed now. The operating engineer and the municipal engineer are transplanting the constructing engineer and contractor.

This settling up period is a trying one for all concerned, particularly the investors, who always feel that the process is going too slowly. It is going slowly, but steadily, for that is the way practically all successful irrigation projects have grown. Those in Colorado who are in a position to know feel that the natural laws of growth are being followed at present and that on the whole matters are better than they are usually pictured. Of 4,000,000 acres irrigated or planned under irrigation systems, projects representing not more than 500,000 acres are in trouble, and most of these will probably be successful eventually.

John E. Field, in his latest report as State engineer, observes that the exact situation, particularly to those who have become unfamiliar with conditions during the last two years, is little known. As compared with the activity of five or ten years ago, quiet reigns, and on that account the casual observer concludes that development has ceased, and some individuals, especially among financial interests, consider it discredited. Summing up the situation, Mr. Field says:

"Speculation has been practically eliminated both in the development of projects and in the purchase of lands. In the elimination of the speculator and the investor who never really intended to move upon the land himself, a very considerable amount of land has been thrown upon the market, so that to-day one may obtain choice tracts for very reasonable figures, much less than their intrinsic value.

"Those irrigation enterprises which had not been financed and had not reached the construction stage, one might say, have been discarded for the present, perhaps wisely so, because in almost every period when there was a large development in irrigation construction has been several years ahead of the necessities, with the result that they were not profitable to the originators.

"On those projects which were under construction, or which had been financed, the efforts of the builders have been directed to putting the enterprise on a paying basis, insuring revenue and payment of interest and maintenance. Many of the projects have been changed and only certain portions finished, the idea being to finish in units and settle each unit before another was undertaken.

"On some projects having considerable merit, although not financed, reorganization has been attempted by making the development a mutual enterprise, eliminating the profit of the promoters and builders. The cost, whatever it may be, is to be distributed on the acreage basis equally. The owners of the land in control elect their own officers, direct their own work on new organization and pay the old organization the value of the work actually accomplished. This, of course, included investigations and surveys. During the past two years the efforts on old irrigation projects have been directed to increasing the efficiency, and, where actual experience has demonstrated that during dry years and dry periods the water supply has been insufficient, in obtaining better water supplies.

"The period is also marked by another condition—there are not enough settlers on the land as yet and the percentage of land irrigated under the new settlers is hardly sufficient to pay the interest charges and maintenance. During the past year those in control of the various enterprises have realized this condition and are making extra effort to get settlers of a permanent character. The speculative element is discouraged and the non-resident holder is not considered desirable."

Why the Western Rate Decision Is Disappointing

DISAPPOINTMENT in the decision of the Interstate Commerce Commission in the Western rate-advance case is softened only by the dissenting views of Commissioners Daniels and Harlan. Instead of asking for a horizontal increase, as the Eastern roads did last year, the Western roads selected certain commodities, mainly carload commodities, which they held were not contributing their share, and asked for specific increases thereon. A few of the advances are granted, but most of them are not, and the increase in revenue is estimated by Mr. Daniels at a paltry one-fourth of one per cent. Quoting from Mr. Daniels: "In the essential outcome of the majority's report I am unable to concur, believing that on the record the carriers have in general sustained the burden of proof cast upon them by the statute and are of right entitled to increases in rates productive of revenue far in excess of what they are accorded by this decision." After showing a disposition in the latest Eastern rate case to give the railroads occasionally the benefit of reasonable doubts, the commission now invokes the doctrine (quoting again from Mr. Daniels) "to disallow increased rates save where the specific evidence relating thereto makes a refusal manifestly impossible." Mr. Daniels characterizes this as a novel doctrine invoked for the first time. This journal does not regard this attitude as novel, but rather characteristic of the Interstate Commerce Commission in handling recent rate cases. It agrees with Mr. Daniels, however, that "the failure to follow established premises to their legitimate conclusion only beclouds the principles upon which the commission may be expected to act in future, and leaves nothing certain but uncertainty."

On another point Mr. Daniels thinks the commission has gone astray, and that is in penalizing all of the railroads for the mismanagement of a few. He thoroughly condemns the wrecking of such systems as the Rock Island and the Frisco, but suggests that the remedy is the prosecution and punishment of the individual offenders. He compares railroads with banks. He reminds us that the bank official who misapplies or misappropriates funds can do so only under the shadow of the law, and that no one would seriously suggest that banks generally should be prevented by law from raising the rate of discount in case competitive conditions warrant, merely because there have been banking defalcations.

In summing up the situation, the En-

gineering Record can do no better than to quote Mr. Daniels' concluding paragraph: "In the matter of rate regulation and fixation we have reached a point where one of two courses ought deliberately to be chosen and clearly announced. If, despite increased costs not offset by increased revenue, increases in rates are to be denied, except where, in individual instances, gross injustice would be occasioned by their denial, the carriers ought to be apprised of this policy, so that they may set their house in order, if they can, against such a situation. If, on the other hand, we are to acknowledge in general what we are perforce compelled to admit in detail, just and reasonable increased rates should be permitted, not grudingly, but with such fair measure of allowance as will indicate that the transportation industry is entitled in the interest of the public to earnings sufficient to provide a service commensurate with public needs."

Trend of Laws Affecting Labor

IN these days every man must be his own lawyer or have counsel at his elbow most of the time. This reflection is emphasized by an examination of the "Review of Decisions of Courts Affecting Labor," recently published by the Bureau of Labor Statistics. On nearly every page of this useful book there is information of value to employers of labor and especially to those engaged in construction work.

Noted more or less at random are decisions holding unconstitutional an Oregon statute requiring union labor to be employed and fixing the rate of wages at $2 per day; placing in a like category an Illinois law which undertook to permit a subcontractor to secure a lien the same as a contractor; and holding, in a North Carolina case, that the incompetence of a fellow servant was the cause of liability of the employer, a workman assuming the risk of negligence of his fellow servant, but not of the negligence of the employer in selecting incompetent employees. Another case, the knowledge of which might save a contractor a lot of money, was one decided under the New York employers' liability law holding that the duty of the employer to furnish a safe and proper scaffolding was not delegative. Evidently it is not safe to put incompetent employees into positions where their ignorance may endanger others or to assume that having delegated the building of a scaffold to another, liability may thereby be escaped.

This view again emphasizes the fact that we are living under a new dispensation so far as workmen's compensation laws and their interpretation are concerned. "In course of his employment", as construed in various States, means that a Wisconsin employer is liable for injuries incurred by an employee while on the way to the place of his employment; that a Michigan employer is liable for injuries sustained by a man running to punch the time clock when the noon whistle blew; and that under the same law a workman leaving a roof for luncheon at the invitation of his employer, and injured while coming down by a way of his own choosing, is "within the protection of the act," although other workmen came safely down from the roof by another route. Rulings on the subject of extra-hazardous employment go so far as to hold that a carpenter engaged in putting up shelves in a store and attempting to sharpen a chisel in a workshop belonging to another was engaged in an extra-hazardous occupation. The Washington Industrial Insurance Commission held to the contrary and was reversed by the supreme court of the State.

In another category entirely, but no less illuminating as to the trend of decisions affecting labor, was the decision of the appellate division of the supreme court of New York ruling on the effect on individual contracts of a collective agreement made by a labor union. It was decided by the court that a collective agreement was of such validity as would support recovery of the difference between the amount stipulated therein and the employee's wages under a contract made in ignorance thereof.

What Railroad Freight and Passenger Service Cost

BEGINNING on page 226 of this issue the Engineering Record gives three pages to what it considers a most thoroughgoing and unusual effort to apportion the cost of running a railroad among the different classes of service and determine not merely whether the traffic as a whole is earning enough, but whether a certain large part, the passenger traffic, is bearing its share of the load.

Doubtless there are some engineers, whose tastes run to highly technical studies, who will question the appropriateness of such an investigation in these columns. It is true that, in general, the engineer cannot concern himself with the details of rate-making. It is also true that such a division of expenses and investment as Mr. Wilgus has produced is largely a matter of bookkeeping. It is equally true, however, that maintenance, which is strictly the province of the engineer, is a vital element of railroad operation, the cost of transportation and, therefore, the rate, and that every-day railroad accounting is frequently botched by bookkeepers who do not appreciate engineering and by engineers who do not appreciate bookkeeping. This journal commends the Ulster & Delaware for putting its passenger-rate investigation in the hands of an engineer of Mr. Wilgus' experience, and believes every railroad man will find a careful reading of that investigation instructive.

Some members of the committee on economics of railway location of the American Railway Engineering Association have been striving to make a start toward determining scientifically the relative destructiveness to permanent way and structures of passenger and freight traffic. These engineers will, perhaps, be disappointed at the way Mr. Wilgus has cut the Gordian knot. Two or three years ago the committee suggested, more for the purpose of arousing discussion than because of any firm conviction, that a passenger ton be figured twice as destructive as a freight ton. The whole matter was referred back to the committee after wide differences of opinion had been expressed on the subject, and although the question was conceded to be very important, and the committee was instructed last year to make special efforts to collect information thereon, no further recommendations have been ventured. And now Mr. Wilgus simply equalizes the two classes, believing that drippings and droppings, imperfections of equipment, heavier wheel concentrations and numerous other items peculiar to freight service are enough to offset the greater speeds and impacts of passenger trains. There is some question whether Mr. Wilgus has not proved his point too well—whether some railroad men will not now conclude that the freight ton should have the multiplier.

The foregoing is a question applying only to maintenance of track and structures, one item among many in Table 2 of the abstract on page 226. The entire table, as well as the other tables setting forth the several different methods of allocating properly the various items of railroad expenses, merits close examination. Many items are readily separable into the two main classes of traffic. The ton-mileage basis, with or without a multiplier to put freight and passenger tons on the same footing, is undoubtedly best for the track structures actually worn down by traffic. On the other hand, such items as fences, signals and the removal of snow and ice are incidental to the operation of the railroad as a whole. The heavy or fast train affects them no more than the light or slow one, and the proper basis is evidently the train-mile. The same is true of the dispatching of trains. Under the different main heads are various miscellaneous items, and these Mr. Wilgus allocates in the same proportion as the sum of the other items under that head, while the subhead "general expenses" he subdivides according to the average of all other expenditures. For the maintenance of equipment he uses the mileage of the unit, but when he comes to analyze the so-called passenger traffic itself he uses still another unit, the car-foot-mile, as the weights of contents are negligible and the costs of mail, express and passenger service are indeed approximately according to the car-foot mileage.

Tables 5, 6 and 7 are of interest mainly as showing the generally low rate of return on the entire property and the disproportionate sharing of running expenses by the different kinds of traffic. Mail and express are carried at a dead loss, but the most disquieting disclosure is that if the traveling public saw fit to avail itself of mileage tickets it could compel the railroad to haul it at nearly 15 per cent below cost. The New York Public Service Commission has decided that it lacks the authority to grant the increased rates that would produce the modest net returns set forth in Table 8, but surely compelling a railroad to sell transportation actually below cost is an economic anomaly that cannot long continue.



STEEL FORM IN SECTION WATERPROOFED AND READY FOR CONCRETE LINING

Belt Conveyors Will Help Simultaneous Driving and Lining of Air Tunnel

Tubes Under Old Point Channel for Dorchester Tunnel in Boston Driven by Shields Having Sliding Tables to Hold Working Face

By G. D. EMERSON
Division Engineer, Boston Transit Commission

BELT CONVEYORS will be used in driving the Dorchester tunnels in Boston to carry clay spoil from the shields back 100 ft. through the concrete forms to muck cars, so that the operations of driving, waterproofing, and lining the tunnels can proceed simultaneously. To avoid expensive easements the tunnels were located under the Fort Point channel, where the ground was excellent for tunnel driving. They are being built under compressed air with shields which have two working platforms, thrust forward by hydraulic jacks to help hold the face. Behind these shields is placed wood block segmental lining.

LOCATION OF TUNNELS

The Dorchester tunnels are among the newest routes of Boston's underground transportation system. They begin with a direct connection to the Boston terminal of the Cambridge subway at Tremont and Winter Streets, run under Winter and Summer Streets, the Fort Point Channel, and Dorchester Avenue to Andrew Square, Dorchester, a total length of a little more than 2 miles. Section E of this route, some features of which are described in this article, includes the portion under the Fort Point Channel and private property between Summer and West First Streets, a length of about 3200 ft., of which 2160 ft. is directly under the channel, and the remainder under streets and private land. The Fort Point Channel is a somewhat irregular navigable waterway connecting Boston Harbor with a tidal basin called South Bay. Construction has been in progress on this section for several months.

The location of the portion of the route included in Section E, under the middle of and parallel with the channel, as shown on the accompanying plan, was governed by the locations of the adjacent tunnel stations and the opportunity of avoiding expensive takings in private property. The maximum grade established for the tracks of this route is 3 per cent, and the minimum radius of curvature 500 ft.

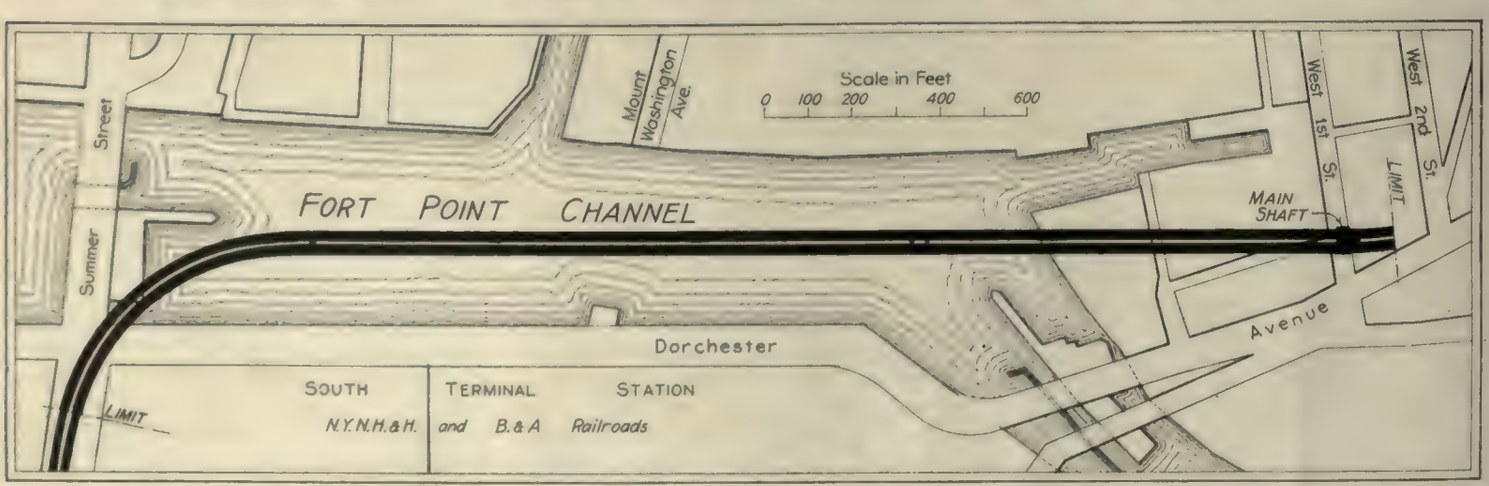
NATURE OF SOIL FAVORABLE

The tunnels will be built largely through a fairly stiff blue clay. Near the northerly end borings indicate occasional pockets of sand, with hardpan near the bottom. The minimum depth of the top of the tunnel under the channel is 35 ft. below mean low water, except at its northerly end, where, in a length of 300 ft., its depth is decreased from 35 to 25 ft. The minimum thickness of earth cover between the top of the tunnel and the bottom of the channel is about 15 ft.

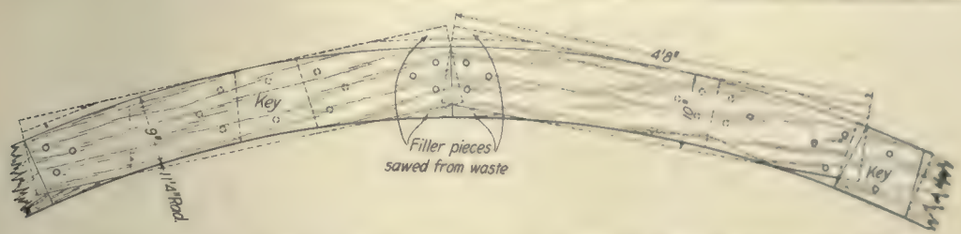
There are two parallel, circular, shield-driven tunnels, each accommodating a single track. The circular shields have an external diameter of 24 ft. 4½ in., and are 12½ ft. long. Each shield is equipped with twenty-four 8-in. hydraulic rams, each with a maximum working pressure of 5000 lb. per square inch. The forward ends of the shield decks are fitted with sliding platforms. The platform of each deck is divided into two sections, each section being operated by two 86-in. hydraulic rams. While excavation in the shield is in progress sufficient pressure is exerted continuously by the platform rams to keep the front edge of the platforms pressed against the earth, thus providing two horizontal lines of support for the working face. The main shield rams react against the end of the outside wooden lining when shoving the shield forward, the ram heads being shaped so as to distribute the pressure over nearly the whole end area.

SEGMENTAL WOOD LINING USED

The outer shell of each tunnel is made of Southern longleaf pine, 9 in. thick, with an external diameter of 24 ft. 2 in., and is built up of segments accurately sawed to shape, each segment being about 4 ft. 8 in. long and 9¾ in. wide. Sixteen segments and a key-piece complete each ring. The wood segments are put in place in the tail of the shield in about the same manner as the commonly used cast-iron ones, but on account of their lighter weight they are erected by hand. The segments of each ring are fastened to the preceding ring by means of ½-in. steel pins. There are three pins in each end of each segment. The pins, which are 15 in. long, are in-



LOCATION OF TUBES UNDER CHANNEL AVOIDED EXPENSIVE EASEMENTS AND GAVE DIRECT ROUTE BETWEEN STATIONS



LINING BLOCKS SAWED ECONOMICALLY AND MADE TO GIVE SMOOTH SURFACE

serted in holes previously bored in the segments before being erected, and when each segment is in position the pins are driven into the next ring behind by means of the shield rams. The ends of the segments are chamfered on the inside, as shown in the illustration, so that they may be cut from smaller sized timbers, thereby considerably reducing the amount of waste lumber. The irregularities thus left in the inside surface are filled in with wedge-shaped fillers in order to provide a smooth surface on which to apply the waterproofing.

Before placing the interior concrete lining a waterproofing membrane is applied to the interior of the wooden shell. This membrane consists of layers of a treated cotton fabric mopped with hot asphalt. Two layers are put on the invert and three on the sides and arch. In applying the waterproofing to the sides and arch the first layer of cloth is mopped on one side with asphalt and is then nailed to the wood lining with roofing nails, the mopped side being against the wood. The second and third layers are then stuck on with successive moppings of hot asphalt.

The inside concrete shell has a minimum thickness of 2 ft. and is unreinforced. Blaw steel forms are used for concreting the sides and the arches. These forms are made up in 5-ft. panels and are handled by means of a traveler running on steel rails laid on the invert. The traveler is 15 ft. long and carries three form panels at one time.

In each tunnel there are two horizontal muck-locks each 50 ft. long by 7½ ft. in diameter, and one man-lock 30 ft. long by 6 ft. in diameter.

The excavated earth is hauled out of the tunnels in 1½-yd. side-dump steel cars. Both muck and concrete cars are at present being hauled with drag-lines and compressed-air winding engines. When the shields get some distance away from the locks it is the contractor's intention to substitute small electric mine locomotives for the drag-line. Temporarily the muck cars are being loaded by hand at the rear of the shields, but later belt conveyors will be installed which will carry the earth back about 100 ft. from the shields, where it will be plowed off into muck cars on either side. This arrangement is expected to do away with any interference between the operations of handling the earth and waterproofing and concreting the tunnel linings.

The main shaft, the bottom of which is about 60 ft. below the surface, was excavated in free air and the shield for the easterly tunnel was started without compressed aid and was advanced without difficulty for about 180 ft. from the shaft, when the clay suddenly began to flow in at the heading faster than it could be taken out. Excavation was stopped at this point until the air locks could be installed and the tunnel put under compressed air. The same thing happened in the westerly tunnel when its shield had advanced about 100 ft. from the shaft. The depth of earth over the top of the tunnels at this point was about 35 ft.

SHIELDS EASILY CONTROLLED

No difficulty has been experienced so far, except during the first few weeks when the tunnel men were getting acquainted with somewhat unfamiliar duties, in keeping the shields within a couple of inches



WOOD BLOCKS, PLACED IN TAIL OF SHIELD, FORM OUTER LINING OF TUNNEL



WATERPROOFING IS OUTSIDE OF CONCRETE

of the true line and within about an inch of the proper grade. The homogeneous character of the ground makes the control of the shields comparatively easy. The alignment of the shields is checked once or twice a day with a transit and the elevations are checked once a day. Between checks the grade is controlled by an ordinary carpenter's level, which, in plan, is set parallel to the axis of the shield and in elevation is pivoted at one end and at the other is clamped to a short arc. This arc is graduated so that when the level bubble is brought to the center the graduations show the per cent pitch of the shield up or down, as the case may be. For example, if the grade of the track is 3 per cent down, and the shield is kept at a pitch varying from 1.8 per cent in free air up to 2.5 per cent with an air pressure of 20 lb. gage, it will follow very closely the 3 per cent grade of the track. Any change in the character of the ground will, of course, introduce another variable into this adjustment.

COST AND PROGRESS

The average progress at present is from 10 to 12 ft. per day, although the working force is not yet completely organized, and a daily progress of from 12 to 15 ft is expected after the belt conveyors are installed in the tunnels.

The contractor's bid for the 3200 ft. of double tunnel is $1,955,375. This figure is the sum of unit price items and covers practically all costs except engineering, administration, interest, and land damages.

The Dorchester tunnels are being constructed for the City of Boston by the Boston Transit Commission, of which Prof. George F. Swain is chairman, E. S. Davis chief engineer, and the writer division engineer in charge of construction. The contractor is P. McGovern & Company. Charles R. Gow is consulting engineer and A. A. Cohill superintending engineer for the contractor.

STEAM SHOVELS BURN NATURAL GAS in the construction of a remote part of the Ridge road in southern California where the gas mains from the oil fields passed near heavy excavation. Burners that would give satisfactory combustion were found after some experimenting, and 180-lb. normal pressure in the gas mains is cut down to about 10 lb. at the burners by a reducing valve. The gas company sells the gas to the contractor at a flat rate per shovel. The shovels used are a Bucyrus 60 and a Marion 31.

Cement Drain Tile in Alkali Soils Tested for Durability

Report on First Year's Investigation by R. J. Wig and G. M. Williams Shows That the Richer Mortars Withstand Disintegration

RESULTS of the first year's observations in a series of investigations being conducted by the U. S. Bureau of Standards for the purpose of determining the effect of the strongly alkali soils and waters in arid regions of the Western part of the United States upon cement mortar and concrete have just been reported by R. J. Wig and G. M. Williams in Technologic Paper 44. Because of the direct economic importance of tests on tile, the investigation was started by exposing various cement mixtures in the form of drain tile. As there are few known deposits of clay available for the manufacture of satisfactory clay tile in the regions where alkali soil is found, while materials for cement tile are usually close at hand, the value of reliable information regarding the permanency of cement tile can be realized.

Many engineers believe that well-fabricated concrete will not disintegrate when exposed to alkali salts and that many cases of failure which have been reported have not been caused primarily by the alkali, but resulted from the use of poor aggregate, improper methods of fabrication, or other causes which result in a poor quality of concrete.

Previous Investigations and Field Survey

A laboratory investigation was started in 1908 by the Technologic branch of the U. S. Geological Survey to determine the effect of alkali waters on cement and concrete. Briefly, these investigations showed that practically all cements are attacked by alkali waters upon exposure in the laboratory and complete disintegration can be obtained under certain conditions. Similar investigations have been made by other laboratories with similar results. Laboratory tests, however, must always be interpreted with caution, as conditions often differ somewhat from service, and it is on this account that a field investigation was undertaken.

The Bureau of Standards has made a field survey of concrete structures exposed to alkali waters in several of the Western States. A description of five of the structures which were examined will serve to illustrate the conditions found: 1. A small concrete "turn-out" for irrigation water, built about 1907, showed one portion completely disintegrated, while another portion is sound, the sound portion being a beam on the lower side extending into wing-walls exposed to the earth at each end, and located half above and half below the concentrated alkali waters. 2. The lower end of a small concrete gate culvert was found badly disintegrated, alkali salt being visible on the surface of the soil surrounding the lower end. 3. The concrete wing-wall of a large culvert was cited as a case of disintegration due to alkali salts, but upon investigation it was found that during flood the creek carried heavy boulders against the wall. Alkali salts visible in the pores of the eroded surface indicate that the alkali is present, but probably incidental and contributory rather than the initial cause of disintegration. 4. A large railroad culvert with a portion of an old concrete structure in the foreground was examined. The latter was completely disintegrated, so that it could be torn apart with the fingers, and alkali salt was found in the pores. The newer culvert, about eight years old, appeared sound and normal with the exception of a few spots near the ground line. 5. A small concrete retaining wall coping was found disintegrated, the surface of the surrounding soil showing the presence of alkali salts.

Field Tests Instituted

It is practically impossible, according to the authors, to analyze some of the failures which have occurred and state definitely the part played by the alkali salts. It was therefore deemed desirable to make field tests in which concrete of known composition and fabrication would be exposed in some of the worst known alkali districts in the West. A committee was organized and finally developed a program which required the manufacture of about 8800 cement drain tile made up of sixteen different varieties. The proportions of cement and sand varied from 1 : 1½ to 1 : 4.

The tile were made under contract at a commercial tile plant, the Armstrong Cement Works of Armstrong, Iowa. Both hand-made and machine-made specimens were used, and the curing was either by sprinkling or by steam. The tile were installed in operating drains on eight projects in the most concentrated alkali soils available in the West, and, for comparison, on projects where there was practically no alkali.

Tests and Results

The first physical tests of the tile were made in 1914, about one year after the tile were placed, by a small portable hydraulic testing machine. The results are generally quite uniform and compare favorably with other tests of drain tile. Occasionally results of tests of similar tile differ by 30 or 40 per cent, but usually they agree within a few per cent.

Notes were made on the length and thickness of the tile at each end, and its condition if in any way abnormal. Some of the tile which had a normal or slightly reduced strength showed evidence of alkali action by sharpened edges or cracked surfaces. Where such action has been noted it is possible another year or two of exposure may cause the failure of the tile, although this need not necessarily result.

Conclusions

Special care should be observed in the use of cement drain tile to employ only the best materials and good workmanship in its fabrication. If these precautions are not observed, failure will result if the drain is located in some of the more concentrated alkali soils similar to those found at Grand Junction, Col., and Garland, Wyo.

Drain tile of cement mixtures not leaner than 1 : 3, manufactured as described, are apparently unaffected structurally when exposed for one year in operating drains in very concentrated alkali soils similar to any of those included in this investigation. Cement mixtures leaner than this should not be used for drain tile in localities where the character of the alkali and concentration are similar to that found at the sites of drains mentioned above. It is possible that subsequent results will show that no leaner mixture should be used in any district where appreciable alkali is found.

Drain tile, manufactured as described, of 1 : 4 mixture (the leanest used) is apparently unaffected structurally by exposure of one year in an operating drain in localities where the character of the alkali and the concentration are similar to those found at Fort Shaw, Mont.; Sunnyside, Wash.; Yuma, Ariz., and Roswell, N. M.

It is anticipated that this report will be amended from time to time as later results are available.

Erection at Hell Gate Arch Checks Calculations

Operation of Stressing Upper Backstays Brought Out Accuracy of Fabrication—Boom Mounted on Rear of Traveler Sets Upper Ties

THE ACCURACY of fabrication and erection at the Hell Gate bridge of the New York Connecting Railroad, New York City, was strikingly brought out by the operation of raising the saddles under the top set of ties on the Long Island side to bring the weight of the cantilevered arch panels on them. This operation raised the outer end of the arch section and inclined the end post toward the pier, loosening the lower set of ties, which were attached to the top of this post, and permitting their removal. A lift of 19⅝ in. applied to the saddles of the upper set of erection ties put the lower set of eye-bar ties in compression. The calculated lift to loosen these ties was 19½ in.

The erection of the arch trusses for this bridge over the East River is taking place by the cantilever method. The backstays of both sides have been devised from plate girders to be used in the approaches, and the floor stringers and other parts of the arch bridge have been utilized for towers, struts and bracing of the backstays, so that little extra material is required in the erection.

After the pins in the lower set of erection ties were removed, and the 2400-ton jacks had raised the upper saddle farther than the required 22 in. above the elevation at which jacking began, the pins in these ties were found to be within ⅛ in. of their calculated elevation. The final jacking raised the east part of the arch, which hinges about its abutment pedestals, so that it will meet the west half at the right elevation for making the closure. The jacks on both sides of the river will be lowered together in making the closure, and before the 22-in. drop is finished the two ends of the arch will fit together, all the deformation stress from dead load compression will be taken up, and the upper erection ties will be relieved of stress. With the members being built out into space accurately to height and direction as previously determined and constantly checked with a special transit for this purpose, it is expected that the arch ribs will come to an accurate closing with the compression stresses in the key pieces as predetermined. The erection stresses computed in the office of the chief engineer are measured during erection with Howard strain gages, and it can be recorded that the computed and the actual measured erection stresses show close agreement.

Reduced Uplift on Anchorage

During the operation of transferring the stress to the upper ties on the Long Island side, the behavior of the anchorage was carefully watched. The lower ties put a

much greater uplift on the anchorage than the upper set. The anchorage had been weighted accordingly, and when the stress was transferred to the upper ties, it was feared that the reduced uplift would allow too much weight to come on the footings under the anchorage and that settlement might result. This, however, did not occur, and it was not necessary to remove from this anchorage any of the sand piled on it for weight.

After the lower ties were in place seven panels were erected with their support. The main traveler was then backed down to within reach of the backstay traveler, which mounted a boom on its rear end. The main traveler then moved out erecting with this boom the upper ties beyond the reach of the backstay traveler. When these were in place the rear boom was unshipped and laid on them. After the arch is swung the traveler will back down to the fifth panel, this boom will be shipped again, and the upper ties removed with it.

Operation Repeated at West End

The accompanying photographs, taken Aug. 10, show these operations in progress at the Ward's Island side. The backstay traveler is erecting the main post to carry the saddles for the upper ties, and the main traveler is being backed down to mount the extra boom on its west end.

After the upper ties on the west end are in place, erection of the balance of the arch across the river will proceed from both sides simultaneously by the methods outlined on page 586 of the Engineering Record for May 1, 1915. This work will be arranged so that car floats, on which all steel is delivered, will not have to be handled in mid-stream when the tidal currents are strongest, as it is likely that several tugs would be required to handle each float if this were attempted.

Special Falls for High Hoist

As the erection progresses over the river the arch rises until a vertical hoist of between 300 and 400 ft. is necessary to raise members from the car floats and set them. The main falls handle all members on a single hitch, and contain twenty-six parts of line each. To hoist 300 ft. with them would require drums that held a mile and a half of wire rope. Each fall is rove from the ends in, and has two lead lines, each wound on a separate drum. The combined capacity of these drums is only 7000 ft. of rope. To overcome the obvious difficulty, the lower block of the falls is made of two double and three triple blocks, the two doubles being mounted on the outside. The falls can be pulled to "two blocks," and the center triple block, or all three of the triple blocks, detached from the lifting beam and bolted by straps to the upper block of the falls. In the latter case, eighteen parts of line are left standing, while only eight overhaul with the lifting beam. These eight parts have a capacity of 80 tons, which will handle all the lighter members. The hoisting speed is more than tripled by cutting out the eighteen center parts, and only 1200 ft. of rope is overhauled by each drum in making a 300-ft. hoist.

Engineer's Report Blames Eastland Disaster on Poor Design, Overloading and Mishandled Ballast

Grand Jury Findings, Compiled by Prominent Structural Engineer Member, Recommend Eight Regulations—Dangers of Water Ballast Discussed

INSTABILITY of the steamship Eastland, the immediate cause of the disaster in the Chicago River July 24, was due to overloading with passengers, to mishandling of the water ballast or to the construction of the vessel. One, two or all three of these causes were responsible for the accident, according to the report and recommendations of the Grand Jury to the judges of the Cook County Criminal Court. Indictments for manslaughter have been returned against four officials of the owning company and against the captain and engineer of the ship for criminal carelessness in the handling of the vessel, passengers and ballast.

The compilation of the report was the work of Andrews Allen, consulting engineer, who, with an architect and a layman, were delegated by their confrères to reduce the findings of the jury to paper. Its conciseness, as well as the unusual character of the accident from an engineering standpoint, has led this journal to print the report, practically in full, below:

Findings of Report

The boat arrived at Clark Street dock and began to take on passengers *with no ballast in her tanks*, of which there were five on each side. She listed to starboard and the engineer started to fill port tanks 2 and 3. The passengers meanwhile were crowding onto the boat and when the load shifted so as to list the boat to port, the engineer attempted to pump out tank 3. When the boat did not right herself he shut down the pump and attempted to fill the tanks on the starboard side, but it was too late.

At the time of the accident the No. 2 port tank was filled or partially filled, No. 3 port tank empty or nearly empty, and No. 3 starboard tank just beginning to fill. That is to say, most of the ballast was on the port side, and two or possibly three of the tanks were but partially filled, so that the water could surge with every movement of the boat and produce a condition more dangerous than if the tanks had been empty.

The handling of the ballast by the officers of the boat indicates an entire lack of understanding of the nature and proper uses of water ballast, and an absolute disregard of safety after repeated warnings and frequent indications of extreme instability.

Design Faulty

The underlying cause of the disaster was the general construction of the vessel and that of her ballast tanks. The water ballast system was single, permitting the filling of the tanks from one seacock by gravity only, and made it impossible to empty some tanks while filling others, or to pump from one set to another. She was unsafe for passengers unless properly ballasted, and a very imperfect system of water ballast was used when *fixed ballast sufficient for proper stability* should have been required by the inspectors and owners.

As actually operated, with the tanks used for trimming purposes only, the safety of the boat at all times depended, *first*, on the quick wit and the judgment of the engineer and the captain; second, on the oper-



LOWER ERECTION TIES HOLD ARCH SECTION AT LEFT, WHILE WEIGHT OF THAT AT RIGHT HANGS FROM UPPER TIES

ating condition of the valves, pumps, and seacock, any of which could have easily been clogged, and thus prevented the stabilizing of the boat.

The instability of this vessel, abundantly indicated by experience, would have been easily shown by calculation or by inclining test, and could have been easily corrected by means of fixed ballast. That it was not corrected years ago the jurors regard as indicating criminal carelessness or incompetence on the part of all persons connected in any way with the design, construction, control, operation and inspection of the steamship.

The fact that at various times, from the date of the construction of this boat to the time of the disaster, inspections were made by inspectors representing ship registry companies and insurance companies for the purpose of classifying said steamship Eastland for insurance purposes or vessel rating purposes, are additional contributory causes to this great disaster, and adds to the chain of careless, reckless and criminally negligent inspection of boats.

INSPECTORS INCOMPETENT

The Government inspectors had authority to refuse a permit to the Eastland until such changes had been made as would have made her seaworthy under all conditions of service. It appears, however, that the most important and fundamental question of stability was never investigated by the inspectors. The steamboat inspectors are generally not trained technical men, and are, therefore, not competent to make reliable stability calculations or to conduct inclining tests and to make competent calculations to determine the stability of the boat inspected by them under various loading and other service conditions.

The filing of plans of boats to be built or reconstructed has only been required in recent years, and the jurors were unable to get any plans at all of the Eastland. Such plans as have been turned in during the last two years have been used to determine only the character and strength of structures, machinery, boilers and appurtenances, have not been used except possibly in a visual manner to determine the stability of vessels.

RECOMMENDATIONS

In compiling the following recommendations, as well as in the preparation of the report, Mr. Allen had the advice of Col. Henry A. Allen, mechanical engineer, who has been representing the city of Chicago in its investigations as to the future tests and inspections.

1. The jurors recommended that no permits be issued until plans and calculations are submitted and approved.

2. That proper inspection be maintained during construction. Upon completion the vessel shall be subjected to inclining tests and calculations made from the tests to determine the safe load carrying capacity under service conditions.

3. That the stability of the vessel used in passenger service shall in no case depend upon movable ballast.

4. That water ballast shall be allowed for trimming purposes only, and when used the system shall be arranged with at least two seacocks with pipes cross-connected so that one set of tanks on one side can be filled while the other set is being pumped out, and so that water may be pumped from one set to another.

5. That all pertinent data relating to stability under service conditions shall be reduced to a convenient form and a printed copy containing necessary and desired information shall be posted in a prominent place in the pilot house of all vessels for ready reference by the officers of such vessels.

6. That definite regulations be issued by the Federal Government governing the carrying capacity of excursion and other passenger steamers, specifying the carrying of sufficient life saving equipment, passenger space, and limiting the number of passengers that can safely be carried, such loading to be based on the stability of the vessel under service conditions.

7. That the Steamboat Inspection Service be re-organized in a manner to make all branches co-ordinate and thus eliminate the confusion caused by the statutes delegating special powers and authority to subordinate branches. Such service should be provided with technically trained and experienced inspectors, all under proper systematic control.

8. That the Steamboat Inspection Service be transferred from the Department of Commerce and Labor and be placed under the control and direction of the Navy Department of the United States, and it was further urged that the Illinois representatives in Congress endeavor to secure legislation to this end.

Circular Sewers Versus Egg-Shaped, Catenary and Horseshoe Cross-Sections

Comparisons Made by Means of Curves—Superiority of Different Sections Shown to Be Dependent Upon Quantity of Flow

By R. DeL. FRENCH
Lecturer in Municipal Engineering, McGill University, Montreal

THE CLAIM of egg-shaped sewers for consideration from sanitary engineers rests upon the fact that by their use it is possible to secure comparatively high velocities with small flows, and hence the danger of a sewer's becoming obstructed by deposits is lessened. Just what their superiority in this respect amounts to is stated only generally in the standard texts on sewerage and hydraulics, if, indeed, it is quantitatively stated at all. Professor Ogden, in his "Sewer Design," compares the velocities in egg-shaped and circular sewers for four *depths* of flow. This seems hardly a logical proceeding; really it is not the same *depth* of flow that should be compared, but the same *quantity*. Folwell's "Sewerage" devotes a page to the discussion of this point, but gives only one specific example.

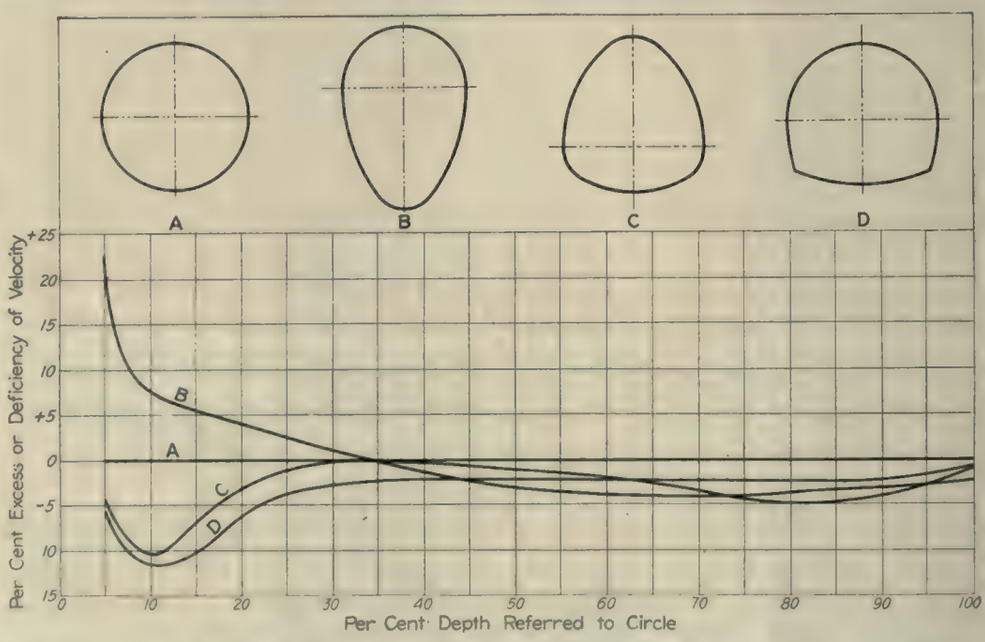


FIG. 1—DEPTHS OF FLOW AND VELOCITIES WITH CIRCULAR SECTION AS STANDARD

All rights to the above drawing are reserved by the author, to whom application should be made for permission to reproduce it.

SECTIONS COMPARED

Eltinge and Beard of Kansas City made a comparison of the velocities of flow in egg-shaped and circular sewers, and gave a diagram to cover the case. Their letter on the subject was published in the Engineering Record of July 26, 1913, page 112. The writer is not aware of the method they employed in the computations for this diagram, but is under the impression that it must have been similar to his own, used in the development of the curves of Fig. 1.

It is often stated that other sewer sections, such as horseshoe, parabolic, semi-elliptical, rectangular, etc., are inferior to the circular, but no definite statement of the amount of their inferiority as regards velocity has ever come to the writer's attention. As there seems to be an utter dearth of data on this subject, the writer has computed and plotted the curves of Fig. 1 for use in his classes.

The four sections shown were chosen as typical and are respectively circular, egg-shaped, the catenary section of the Metropolitan Water and Sewerage Board of Massachusetts, and the horseshoe section adopted as a standard by St. Louis, Mo. As shown in the diagram, they are drawn to scale so as to give equal capacities when laid on the same grade. Consequently it

may be roughly judged from the sketches how they will compare in dimensions for any given case.

METHOD OF COMPUTATION

A short description of the methods used in computing the quantities from which the graphs of Fig. 1 were plotted will more clearly show their meaning than is possible otherwise. Assume that the circular and egg-shaped sections are to be compared. Data for the curves of Fig. 2 must first be computed and the curves constructed therefrom.

In this case the Kutter formula was used, but any other would serve equally well. These give the relation of the velocity and discharge at any depth of flow to the corresponding quantities when the section is flowing full for the two sections under comparison, and will be recognized at once as the familiar curves of "hydraulic elements."

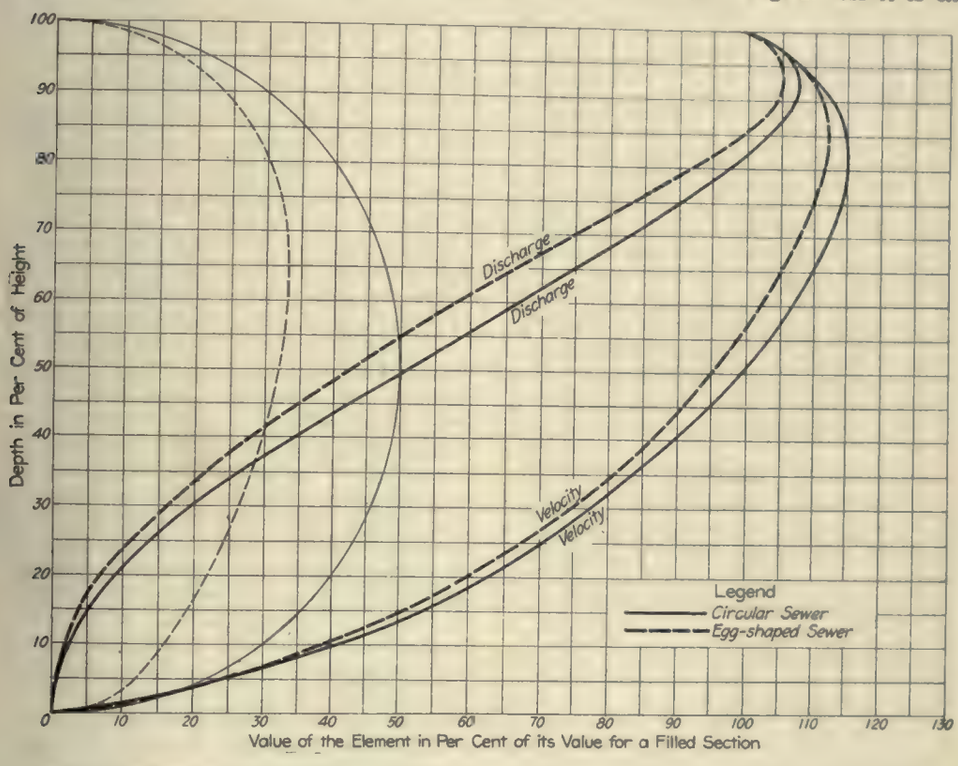


FIG. 2—HYDRAULIC ELEMENTS OF CIRCULAR AND EGG-SHAPED SECTIONS COMPARED

Since the circular section is the most common form in use, we will call this the standard, and the curves of Fig. 1 are referred to it. Assume a depth of flow in the circular section of, say, 10 per cent of its diameter. From Fig. 2 the discharge and velocity are then 2.2 per cent and 40.8 per cent of their respective values when the section is flowing full. Turning to the egg-shaped section, we find that when 2.2 per cent of the total capacity is flowing, the velocity is 42.0 per cent of the velocity when flowing full.

If the velocity in the two sections were equal when both were flowing full, we should now be in a position to compare the velocities for partial flow just found. The velocity in the egg-shaped section is, however, only about 95.7 per cent of the corresponding velocity in the circular section, both flowing full. Therefore, the partial velocity for the former must be corrected to bring it to a basis of comparison with the latter partial velocity. Thus, the partial velocity in the egg-shaped section, referred to the standard circular section, is 42.0 ÷ 0.957 = 43.8 per cent. The excess of velocity in the egg-shaped section over that in the circular for the same discharge (10 per cent of the total depth of the circular section) is then 43.8 — 40.8 = 3.0, and the percentage excess is 3.0 ÷ 40.8 = 0.075 or 7.5 per cent.

Making similar computations for other depths of flow in the circular section will give points enough so that a smooth curve like those of Fig. 1 may be drawn. The procedure followed in developing the graphs for the other sections is exactly similar to the example just given.

ACCURACY OF CURVES

The accuracy of Fig. 1 depends wholly upon the accuracy of Fig. 2. As it is extremely difficult to read correct values from these latter curves below a proportional depth of about 5 per cent, no attempt has been made to extend the curves of Fig. 1 below this point. Even here it is probable that the curves are slightly in error. However, as all the computations are based on Kutter's formula, which is known to give results which are not entirely correct, it is thought that Fig. 1 represents the case as nearly as the facts warrant.

An inspection of these curves brings out the following points regarding the merits and defects, from a velocity standpoint, of the four sections examined:

1. The egg-shaped section is superior to the circular, up to a point where the quantity flowing is sufficient to fill an equivalent circular section to about 35 per cent of its depth. For larger quantities the circular section is superior, but by only about 4 per cent.

2. The catenary section is superior to the horseshoe, except for flows which will nearly fill either, and then it is only about 2.5 per cent inferior. For flows up to those which will fill an equivalent circular section to about 25 per cent of its depth, both these sections are quite inferior to the latter, the deficiency in velocity ranging as high as 10 per cent. For flows which will fill a circle half full or more they are practically as good as the circular.

Old Steel of Razed Building Examined for Rust

Only Slight Deterioration Found in Painted Members of Champlain Building, Chicago, Built in 1894

FROM a recent examination of the rusting of the 20-year-old steel members of the 15-story Champlain Building in Chicago, which has been razed to make way for a new structure, Holabird & Roche, the architects who prepared the original plans, conclude that the exclusion of air and moisture is essential for the preservation of the steel and also of the paint. The appearance of the rust suggests that it may have been formed soon after the building was constructed in 1894 and that it has not been progressive. Even if the worst case of rusting had been progressive and should continue at the same rate, it would be more than a century before failure of the member would result, according to the architects. They conclude that the present practice of encasing all structural steel in concrete or plastering it with Portland cement mortar, of separating the pipe shafts from the steel and of using greater care in covering terra cotta anchors, safeguards the framework of the structure for a much longer period than the probable economic life of such buildings.

The lot occupied by the Champlain Building is approximately 66 x 105 ft. The building, which cost $500,000, was 15 stories above grade and one shallow basement story below grade. It consisted of a structural steel framework with joists spaced 5 ft. apart, flat-tile arches of porous terra cotta, porous terra cotta fireproofing, shallow spread footings on a blue clay foundation, locally called floating foundations, and brick and terra cotta curtain walls.

CONDITION OF THE PAINT

The steel was painted with a proprietary brand of iron-oxide paint, in accordance with the following specifications: "The contractor will be required to paint all ironwork and steelwork one coat of the best quality of mineral paint before putting up. After it is set, carefully go over all work, clean and remove all rust and dust and paint another coat of the same kind of paint."

The condition of the paint varies from complete disappearance to "good as new." So far as protection to the general structure is concerned the paint has deteriorated beyond all usefulness. In places there is no trace of it. Over most of the steel the paint still shows, but is broken up by rusted areas, in a few places it still has its color and luster over considerable areas. Even where small blisters showed in the paint, the steel underneath was bright and free from rust.

RUSTING OF STEEL

There was no pitting of the steel observed, the rust occurring in flakes or layers. Some pieces having areas from 50 to 100 sq. in. were removed from webs of I-beams. By weighing some specimens of rust scales taken from the inner sides of the webs of beam box girders not filled with fireproofing and reducing to the equivalent metallic iron, the loss due to corrosion is computed to be .007 to .009 in.

This is very much greater than the average loss, as these specimens represented the worst condition except one case. One col-

umn in the first story showed rust amounting to perhaps four or five times the amount stated above. This bad rusting was along a pipe shaft where the steel was doubtless subjected to moisture or circulation of air.

FOOTINGS, PIPES AND ANCHORS

The footings were built of steel I-beams unpainted, embedded in Portland cement concrete. When removed they showed no corrosion. The pipes in the building were generally in fair condition. There is no record of any of them having been replaced since the building was constructed. However, one pipe, presumably a soil pipe, was so decayed that it could be broken as if made of earthenware.

It was specified that the terra cotta be attached to the steel frame "with substantial wrought-iron or copper anchors, and thoroughly embedded in cement mortar." Wrought iron or steel was used. The anchors were generally in good condition, but some pieces were rusted so much that they were broken in wrecking. It is probable that these pieces were not well bedded in cement mortar at the points where the rusting occurred.

Tropical Road Maintenance Complicated by Floods

Philippine Engineers, in Annual Conference, Discuss Means of Preventing Erosion of Surfacing During Periods of Inundation

THE conference of district engineers in the employ of the Bureau of Public Works of the Philippine Islands, held at Baguio, Feb. 10 to 16, was devoted principally to the design, construction and maintenance of roads in tropical countries. Oiled roads, asphaltic macadam, or concrete surfacing and a dike on the downstream side of water-bound macadam roads were suggested as means of preventing damage to roads subject to periodic flooding. The painting of structural steel was recognized as particularly important in the Philippines and several recommendations were made as to means of obtaining the best results. One speaker recommended fords instead of bridges, in places where the depth of water would not be sufficient to interfere seriously with traffic, as one means of obtaining the maximum mileage of road from the moneys appropriated for such purposes.

OVERFLOW SECTIONS

Overflow sections, as defined by one of the speakers, is a name applied to a section of road subjected to periodical inundation, generally two or three times a year. This subject was dealt with by a committee of five. Three general cases were cited: Meandering rivers, where the channel requires a bridge and is one-half to one-fourth the width of the overflow section; sections where the ditches and culverts are inadequate, and flat country where the road is covered with water, at times, several feet deep. In the latter case the water sometimes flows across the land in one direction while rising and in another when receding.

Three different methods of treating these conditions were named. The first method consisted in building an embankment high enough to prevent the water from rising above it. This idea was discarded as being prohibitive in cost and on account of the certainty that the embankment would act as a dam and would have its stability endangered by percolation beneath it. The second method proposed a viaduct, which also would be impractical in the Philippines on account of the excessive cost. The third method involved treating the surfacing so that it would be able to withstand the scouring action of the flowing water. Methods proposed for accomplishing this were by oil, asphaltic macadam, concrete surfacing, and, in the case of water-bound macadam surfacing, by building a dike on the downstream shoulder. Asphaltic overflow sections have proved fairly successful in the Philippines in locations where the flood water does not remain on the road longer than a day at a time and where the subgrade is well drained. But where the road is submerged for long periods and, especially where it is subjected to wheel traffic while saturated, the asphaltic compound is said to deteriorate through emulsification and the surfacing rapidly goes to pieces. Concrete pavement is also subject to certain objections, of which the high cost is most serious. The dike method bases its claim to effectiveness upon the proposition that water-bound macadam is not injured by being submerged provided the water actually in contact with the metaling is not in motion. Hence the downstream shoulder is raised to a certain distance above the crown and the downstream side slope is sodded or riprapped against scour. The crown, for best results, should be very flat or even entirely absent.

ECONOMICS OF HIGHWAY CONSTRUCTION

H. F. Cameron, senior supervising engineer of Mindanao and Sulu, presented a paper on the economics of highway construction. Among the points he emphasized were: Location by careful surveys and investigations; an adequate right-of-way obtained in advance of construction; the acquisition of all quarry sites and gravel deposits, whether on roads to be built in the near future or not; large jobs instead of small and widely scattered jobs; care in considering the purchase of machinery for work in sections where labor is cheap. He also suggested, as a means of obtaining the greatest mileage from the funds appropriated for road building purposes, that where the depth of the water is not sufficient to interfere with the class of traffic for which the road is designed, a rock ford or a concreted or asphalt overflow section should be substituted for a bridge.

OIL TREATMENT OF SURFACING ROADS

Oil treatment was characterized by one speaker as being cheap and capable of giving an excellent dustless surface in dry weather, but as having the disadvantage of forming an oily mud during the rainy season, very destructive to rubber tires. One application per year was considered as sufficient under ordinary traffic.

It was questioned whether bituminous construction is adapted to present conditions in the Philippines. The limitations of any asphaltic compound in the presence of excessive moisture were fully recognized but, in view of the increasing heavy demand being made upon the improved roads by motor trucks, the desirability of further experiments with bituminous macadam was generally conceded.

Recommendations as to sizes of maintenance material varied considerably. For filling shallow ruts, correcting slight unevenness in the road surface and similar repairs, ½-in. and ¾-in. stone were generally preferred for both gravel and macadam roads.

DRIVING CONCRETE PILES

The experiences cited by different speakers revealed the fact that concrete piles can be driven with almost any kind of a driving outfit that can be put together. In a case in one province the driver and boiler were placed on the bank, separate from the pile driver, thus permitting the moving of the driver with less work, cost and time than if the weight of the engine and boiler had to be moved. The power plant remained at one location during the construction of each bridge, the cables being let through snatch blocks so as to obtain a direct pull. For driving concrete piles in clay it was recommended that a hole be made by driving in a 12 x 12-in. timber and then withdrawing it.

PAINTING OF STEEL STRUCTURES

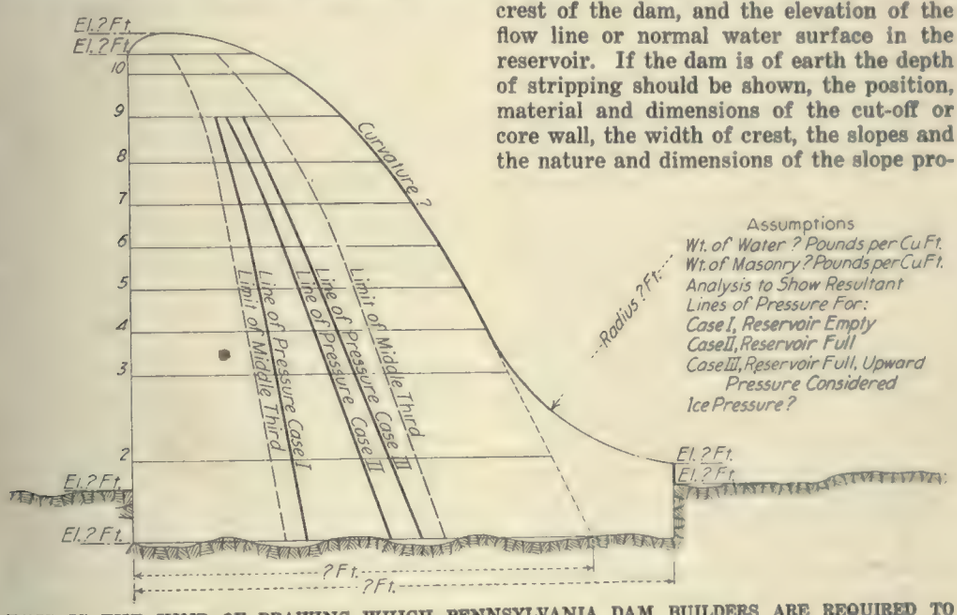
Preservation of steel structures was conceded to be a matter of vital importance, and it was admitted that past experiences with paint had not been as successful as could have been desired. Several recommendations were agreed upon, among them the following: The use of pitted steel should be prohibited by specifications; standard specifications should provide that all plates and shapes be cleaned by sand blasting before assembling in the shops; for shop painting red lead should be used, as at present; all bridges painted with graphite primer should be thoroughly cleaned and repainted in accordance with standard specifications; no field painting should be done except after the most careful and thorough cleaning of the steel surface, and then only after 4 hr. of sunshine on a bright, warm day, so as to insure a dry surface on which to paint; the use of tar paint should be discontinued, except as required for special purposes, in which case special specifications should be prepared by the division of design or in duly authorized tests; boiled oil should be used for bridge painting instead of raw oil, and one or more portable sand blast outfits for use in the field should be supplied. The Kansas City method of coating steel with cement grout put on with a cement gun and held by wire mesh reinforcement came in for a slight discussion, and it was suggested that the method might prove advantageous for steel bridges over salt water.

THE GERMAN MUSEUM of Munich, which has done such notable work in bringing together an historical collection showing the development of engineering in all branches, has, in conjunction with the Bavarian government, fitted out a Red Cross train for use of the Bavarian troops. The museum has taken full advantage of its distinguished technical membership to insure that the train lacks none of the improvements which medical and engineering science render available. The operating and disinfecting cars are exceptionally well equipped. The train consists of twenty-nine cars, as follows: Fourteen cars for enlisted men, each containing fourteen beds; one car for officers, with seven beds; two cars for doctors and nurses, and two for other hospital attendants; three cars for baggage and storage and one each for operating, disinfecting, electric lighting equipment, officer in charge, cooking, provisions and linen. The car for linen is fitted with a small laundry. The crew for handling the train, including doctors and nurses, is forty-six.

Pennsylvania Commission Issues Rules Regarding Dams

Give Complete Instructions for Prospective Dam Builders to Aid Water Supply Board to Study Propositions

AN ACT passed by the Pennsylvania Legislature in June, 1913, makes it unlawful to construct any dam or other water obstruction, or to make any change in or addition to an existing dam in that State without the consent or permit of the Water Supply Commission upon written application, to be accompanied by complete maps, plans, profiles and specifications and such data as the commission may require. Rules and instructions have just been issued by the commission to aid its engineering department and for the guidance of those interested. The following extract of the requirements for submitting plans is taken from these instructions, and is accompanied by a typical drawing of the cross-section of a masonry dam. Five other sample drawings are included in the pamphlet issued by the commission.



THIS IS THE KIND OF DRAWING WHICH PENNSYLVANIA DAM BUILDERS ARE REQUIRED TO SUBMIT FOR APPROVAL TO THE WATER SUPPLY COMMISSION

DETAIL OF PLANS SUBMITTED

The plans and specifications to be submitted with each application should illustrate and describe in detail the proposed structure and the methods to be employed in its construction, and should include the following:

(a) A location plan or map, showing the stream on which the dam is to be built, the tributary drainage area and the principal topographical features of the surrounding country, such as streams, roads, railroads, cities, towns, etc. The scale of such a plan should be about 1 in. to the mile, unless this scale would make a plan of inconvenient or unwieldy size, in which case a different scale may be used.

(*b*) A general plan of the dam and reservoir to show accurately the position of all essential details, such as spillway or wasteway, its point of discharge into the stream, pipes through the dam, inlets, outlets, screen chamber, gate or valve house, headrace, canal, mill or power plant, tailrace, etc. The area of the water surface of the pond or reservoir should be shown in acres, and the capacity indicated in cubic feet or gallons.

(c) A longitudinal section of the dam or cross-section of the valley at the site of the dam, showing the elevation of the crest of the dam, the elevation of the flow line of the reservoir, the original surface of the ground, the nature and depth of the underlying strata, and the probable depth of the excavation for the foundation or cut-off. Subsurface investigations should be made at the site of the dam, by means of test pits or borings.

(d) Typical cross-sections, which should be drawn to a scale of not less than 1 in. to 10 ft., and include a maximum section of the dam. They should show the original surface of the ground, and subsurface conditions as disclosed by test pits or borings, the probable depth of excavation for foundations or cut-offs, the elevation of the crest of the dam, and the elevation of the flow line or normal water surface in the reservoir. If the dam is of earth the depth of stripping should be shown, the position, material and dimensions of the cut-off or core wall, the width of crest, the slopes and the nature and dimensions of the slope protection, the position and dimensions of outlet pipes or culverts and cut-offs to prevent seepage along such structures, the disposition of different qualities of earth, if of varying quality, and the methods and manner of construction. If of masonry, the cross-sections should show all dimensions and should indicate the position and kinds of masonry to be included in the structure.

(e) Detailed plans of the spillway, wasteway or overflow, showing the depth of the opening and its length, together with the width and shape of the crest, grade and shape of the approach and discharge channels, if any, methods of protecting the toe of the dam or end of the discharge channel from erosion. They should also give the dimensions of all walls, floors, paving, etc. Inasmuch as a large percentage of dam failures is due to lack of adequate spillway capacity, special attention should be paid to this feature of the design.

(f) Detailed plans of the outlets or controlling works, showing the location and dimensions of all valves or sluice gates, intakes, screen chambers, racks, outlet towers and gatehouses and appurtenances.

(g) Diagrams of forces for masonry dams, showing the results of the graphical or mathematical analyses, together with the weights and different conditions assumed, and the maximum pressures under these conditions. (See drawing herewith.)

(h) For reinforced-concrete dams, in addition to the above, detailed plans should be submitted showing the sizes and spacing of all reinforcement, expansion joints, dimensions, etc.

SPECIFICATIONS

The specifications should describe carefully and in detail the preparation of the site of the dam, the materials to be employed in its construction, their arrangement in the structure, the methods to be used and the results to be obtained. If stone or concrete masonry is to be used the different kinds or classes should be carefully described, and the materials and proportions accurately specified.

If an earth embankment forms an essential part of the dam the quality or qualities of material should be specified, and the manner of depositing in the embankment; and if in layers, the thickness of the layers, weight and kind of roller to be used, manner of sprinkling, size of stone to be allowed to remain in the material, etc., should be specified. The slopes to be used on the upstream and downstream sides should be indicated, as well as the manner of protecting each slope from erosion.

REPAIRS

If it is proposed to make changes in or alterations to an existing dam, or to use flashboards, or to make repairs, other than ordinary maintenance work, an application for a permit should be filed with the commission. The plans accompanying applications in such cases should show in detail the existing conditions as well as the proposed changes.

CONDITIONS ATTACHED TO PERMITS

When an application for a permit to construct or repair a dam is approved by the commission the following general conditions are made a part of the permit, together with such other conditions as are considered necessary in the particular case under consideration:

1. That the commission shall be notified in advance of the proposed time of commencement of work upon the dam and of the time of the preparation of the foundation for the same; that work shall not be started upon the foundation subsequent to this notice until the said foundation has been approved by the engineer of the commission or his representative.

2. That the dam shall be built under the direction of a competent engineer, and that he or his representative shall be on the ground daily (or frequently, depending upon the importance of the project) during construction to interpret and enforce the plans and specifications.

3. That a detailed report upon the status of the construction shall be furnished to the engineer of the commission on the fifteenth and last days of each month.

4. That the construction of the dam shall at all times be subject to inspection by representatives of the commission, and that no changes in the plans as approved shall be made except with the written consent of the commission or its engineer. The commission reserves the right to require such changes as may be deemed necessary during the progress of construction.

HIGHWAYS to be constructed this year in King County, Washington, and exclusive of work within city limits, will total in cost about $1,000,000. This includes 1.4 miles of brick pavement, 6.5 miles of one-course concrete pavement and about 100 miles of graded and graveled highway.

Railroad's Maintenance Expenses Allocated Between Freight and Passenger Service

Percentages Used, and Reasons Therefor, in Rate Case Studies Made by William J. Wilgus for the Ulster & Delaware Railroad

THE gradual reduction in its net income and the impossibility, on the present basis, of earning an adequate return on the investment caused the Ulster & Delaware Railroad to make a thorough investigation of its revenue and expenses with the view of praying for such relief from the Public Service Commission of the Second District, New York, as the facts disclosed would warrant. For this investigation the railroad company retained William J. Wilgus, consulting engineer, of New York. As a result of his findings, the company petitioned the Public Service Commission for permission to increase the mileage book rate from two cents to three cents per mile. A discussion of the decision of the Public Service Commission, which was adverse to the railroad company's request, will be found in the Engineering Record of Aug. 7, 1915, page 154.

In making his studies Mr. Wilgus gave much time to the allocation of expenses between passenger and freight service, a matter, as is well known among railroad men, beset in some classes of expenses with very great difficulty. He has studied at length, for example, the matter of allocating the maintenance-of-way and structure expenses between the two classes of service. The portion of the report printed below relates chiefly to this feature, but since the allocation of these particular expenses influences other allocations, the entire distribution is followed through to the final percentages, and then to the final study, which consisted in splitting what are ordinarily considered as passenger revenues and expenses between actual passenger, express and mail service.

VALUE OF PROPERTY

Antecedent to the study of revenues and expenses a valuation of the property was made. While the book cost is $5,961,953, the evaluation, on a reproduction-less-depreciation basis, was found to be $8,230,512. With working capital added, the appraised investment, with depreciation deducted, is $8,719,051. Mr. Wilgus does not favor the deduction of the depreciation, amounting to $682,199, but since this matter is much in dispute and in order to remove it from the controversy he has deducted it. Mr. Wilgus also found that there should be added to expenses for the year 1914 $32,086 in order that they may fairly reflect the true and proper cost for that year, or in other words, that sum should have been credited to operating reserves on account of deferred maintenance.

The portions of the report printed below follow the text very closely, omitting only the detailed exhibits and, from some of the tables reproduced, the amounts in dollars and cents, as from the standpoint of general interest the ratios are the more important. The portion of the report relating to allocation of expenses is as follows:

USAGE PRINCIPLE APPLIED

It is claimed by many that the division of common or joint expenses between freight service and passenger service is impossible of reasonably accurate accomplishment. For instance, it is said that a large share of the costs of tie renewals and track labor is in part governed by the action of the elements, and to that extent may not be divided on any basis of usage; also that the movement of freight and passenger trains is so interdependent that any favoritism to one class throws an extra burden of expense on the other, without any possibility of making a fair distribution.

Beyond question a precise allocation of common or joint expenses is not practicable, but on any given road it would seem feasible to make a division that will be so equitable that the margin of error may be considered negligible or at least unimportant. In other words, a carefully chosen method, based on usage, should give approximately correct even if not precise results. As a rule the adoption of a defensible alternate usage method of dividing a common expense will not produce a substantially different result.

DIVISION OF PROPERTY INVESTMENT

When it comes to a division of the property investment there has been room for even wider ranges of opinion. Some have taken the position that the revenue or return should be the measure, but the Minnesota Rate Case decision very properly has disposed of this illogical method in the following language:

"If the property is to be divided according to the value of the use, it is plain that the gross earnings method is not an accurate measure of that value."

"The value of the use, as measured by return, cannot be made the criterion when the return itself is in question. . . . When the rates are in controversy it would seem to be necessary to find a basis for a division of the total value of the property independently of revenue, and this must be found in the use that is made of the property."

The usage methods employed in the report are in harmony with the general principle thus approved by the Supreme Court, and they are believed logically to accord with railroad conditions and practice.

ALLOCATION OF REVENUES

Operating revenues, constituting 97 per cent of the gross revenues reported in the income account of the company, are assignable direct to freight and passenger services respectively. The small remainder, consisting of "other income" and not from auxiliary operations, has been allocated in the same proportion as the operating revenue, viz., 63.1 per cent to freight and 36.9 per cent to passenger service.

Profit and loss adjustments, affecting as they do the property as a whole, have been apportioned at the ratios hereinafter found to apply in the case of the investment in road and equipment, viz., 59.8 per cent to freight and 40.2 per cent to passenger service.

Allocation of Operating Expenses

MAINTENANCE OF WAY AND STRUCTURES

Track and bridge items have been apportioned on the basis of the gross ton-mileage that passes over them, in which is included the total weights of locomotives, cars and contents multiplied by the miles moved.

As regards the comparative effect per ton of weight of passenger and freight trains, it is the opinion of Mr. Wilgus that, generally speaking, there is no appreciable difference, if in considering the higher speeds in passenger service equal attention is paid to destructive agencies peculiar to the freight service, such as drippings and droppings from coal and refrigerator cars, imperfections of equipment and heavier wheel concentrations, twisting action of the locomotives at slow speeds and the interference of slow trains with track labor, the fouling and destructive action of the products of combustion of inferior grades of coal often used in freight services, and more frequent stoppages and reversals of movements.

EFFECTS OF FREIGHT TRAFFIC

Corrosive drippings are detrimental to floorbeams and stringers, and solid floors of bridges; to track fastenings such as spikes, tie-plates, bolts and splices; and to rails, frogs and switches. Droppings from freight trains such as lumps of coal, rubbish, loose doors and other broken parts, increase danger and add to the cost of policing.

Side bearings on freight cars are so stiff as to provide much less freedom of adjustment to varying track conditions than on passenger cars. This has been strikingly shown on tracks used exclusively for freight traffic, where trucks in passing from curve to tangent retain their slewed position and grind the outer rail for considerable distances. Springs under freight cars are less delicately adjusted than on passenger cars, with correspondingly greater shock to track and structures, especially in the case of eight-wheel coal cars having 18,750 lb. per wheel as contrasted with twelve-wheel passenger coaches, weighing but 12,500 lb. per wheel. Superworn tires, flat spots on wheels, dragging brake-beams and draft rigging, and similar imperfections peculiar to freight equipment, cause additional wear and tear.

Slowly moving freight locomotives when exerting their maximum tractive force, cause a twisting action from side to side that tends to work track out of line as much or more than higher speed passenger trains; and it is well known that a long slow-speed freight train causes more interference with track labor, from suspension of operation of section men while the train is passing, than in the case of passenger trains that move quickly and therefore are out of the way more promptly.

Freight locomotives consume more coal and frequently use a poorer grade of fuel, and the resulting larger volume of cinders, gases, and smoke fouls the ballast, corrodes metallic structures, and injures paint on buildings, bridges, and signals to a greater extent than with passenger power.

Freight locomotives under load stop and start more frequently, causing slipping of drivers that blisters and wears the rail. Local freights do more or less switching on main tracks and at stations, with accompanying wear and tear on track and structures.

JUDGMENT MUST GUIDE DECISION

It therefore seems clear that relative speeds of passenger and freight trains are so variable, and the instances in which the

latter are more destructive to track and structures so numerous, that any attempt arbitrarily to fix the percentage that one exceeds the other would lead to questionable results. Judgment, which in any event must guide a decision, would seem to lead to the conclusion that, taking all these facts into consideration, the added cost of maintenance chargeable to passenger service by reason of higher speeds is practically offset by many features incident to the slower speed traffic.

As to the comparative effect of locomotives and of the load they haul, it is possibly true that the former cause somewhat more damage per ton than the latter, but not to the extent that might be imagined. For instance, taking two loaded coal cars weighing 150 tons, their smaller diameter wheels, less perfect construction and maintenance, and drippings and droppings may be said to go far toward equaling the twisting and corrosive effects of a locomotive of the same weight; and in passenger service the smaller wheels and tail-end side swing may be considered as going far toward equaling the destructive action of the locomotive.

Summarizing, in the absence of precise data, and taking into account the complexity of the problem, it seems fair to say that under *average conditions* a gross-weight ton of passenger train creates the same destructive effect on track and bridges as a gross-weight ton of freight train; and that an attempt to assign constructive tonnage to portions of the rolling load as the measure of their assumed excess wear and tear on track and structures, will result either in complications and contradictions, or in so many variations in the formula as to make the exceptions prove to be the rule.

Other Maintenance of Way Items

Such items as crossings, fences, signals, removal of snow and ice, buildings, docks and wharves, have been divided on the basis of train-mileage, as that measure of usage appears to most nearly fit the case.

The maintenance of certain tracks and structures has been assigned direct to the service in which they are exclusively engaged.

All items unapportionable on a usage basis, such as superintendence, stationery and printing, etc., have been allocated in the same proportion as the sums of the other items.

Maintenance of Equipment and Traffic Expenses

Locomotive costs have been divided on the basis of locomotive mileage, car costs have been assigned direct, and all others have been apportioned from the sum of the allocations thus obtained. Locomotive costs have been divided on the basis of locomotive mileage, because the same engines are used interchangeably in freight and passenger service—in other words, the road has only one class of locomotives.

The larger part of traffic expenses are assignable direct and the small balance has been divided on the ratios obtained therefrom.

Transportation and General Expenses

Items affected by train movements, such as dispatching trains, signals and interlocking, crossing flagmen and gatemen, train supplies and expenses, and station costs have been apportioned on the basis of train-mileage, except those portions that are assignable direct.

Yard expenses have been allocated on the basis of yard locomotive mileage, while road enginehouse costs, and lubricants and other supplies for road locomotives, have been apportioned on the basis of road locomotive-mileage.

For allocating the costs of enginemen, fuel, water and trainmen in road service, ratios were ascertained from actual observations and tests on the ground, as the company's records do not separate these items between the two classes of service.

Of the remaining items a portion could be assigned direct, and the balance, unapportionable on a usage basis, including superintendence, stationery and printing, etc., has been allocated in the same proportion as the sums of the other items.

A small part of the general expense was found to be assignable direct, and the remainder has been divided in the same proportion as the totals of all of the other operating expenses.

Following the procedure as thus outlined the resultant ratios, shown in detail in Table 2, are those given in Table 1.

Allocation of Other Items

Hire of equipment is assignable direct, but taxes have required division and for this purpose the use of the ratios found to

Table 1—Percentages of Expenses Chargeable to Freight and to Passenger Service

Account	Freight Service, Per Cent	Passenger Service, Per Cent
Maintenance of way and structures	61.2	38.8
Maintenance of equipment	47.2	52.8
Traffic expenses	28.5	71.5
Transportation expenses	58.8	41.2
General expenses	56.2	43.8
Total, operating expense ratios	56.1	43.9
It is interesting to note in this connection that the operating revenue ratios are	63.1	36.9

Table 2—Percentages Showing Allocation, in Detail, Between Passenger and Freight Services, for Year Ended June 30, 1914.

Items	Basis of Allocation	Passenger, Per cent	Freight, Per cent
I.—Maintenance of Way and Structures:			
(1) Ballast; ties; rails; other track material; roadway and track; bridges, trestles and culverts; and roadway tools and supplies—in joint service	Gross ton mileage	34.9	65.1
(2) Above-mentioned items (1) exclusively in passenger service	Actual	100.0	...
(3) Above-mentioned items (1) exclusively in freight service	Actual	...	100.0
(4) Removal of snow, sand and ice; over and undergrade crossings; grade crossings, fences, cattle-guards and signs; snow and sand fences and snow sheds; signals and interlocking plants; buildings, fixtures and grounds; and docks and wharves—in joint service	Rev. train mileage	55.9	44.1
(5) Above-mentioned items (4) exclusively in passenger service	Actual	100.0	...
(6) Above-mentioned items (4) exclusively in freight service	Actual	...	100.0
		38.8	61.2
(7) Supt.; injuries to persons; stationery and printing; other expenses; and maintenance joint facilities	Av. of above allocations (I)	38.8	61.2
Total, maintenance of way and structures		38.8	61.2
II.—Maintenance of Equipment:			
(1) Locomotives	Rev. loco. mileage	47.2	52.8
(2) Passenger-train cars	Actual	100.0	...
(3) Freight-train cars	Actual	...	100.0
		52.8	47.2
(4) Supt.; work equipment; injuries to persons; shop machinery and tools; stationery and printing and other expenses	Av. of above allocations (II)	52.8	47.2
Total, maintenance of equipment		52.8	47.2
III.—Traffic Expenses:			
(1) Assignable direct	Actual	71.5	28.5
(2) Joint	Same as actual	71.5	28.5
Total, traffic expenses		71.5	28.5
IV.—Transportation Expenses:			
(1) Despatching trains; station employees; station supplies and expenses; interlockers and block and other signals; crossing flagmen and gatemen—in joint service	Rev. train mileage	55.9	44.1
(2) Above-mentioned items (1) exclusively in passenger service	Actual	100.0	...
(3) Above-mentioned items (1) exclusively in freight service	Actual	...	100.0
(4) Weighing and car service associations; coal and ore docks; and loss and damage	Actual	0	0
(5) Yard expenses	Sw. loco. mileage	17.5	82.5
(6) Road enginemen	Actual, based on tests	39.4	60.6
(7) Fuel for road locomotives	Actual, based on tests	41.0	59.0
(8) Enginehouse expenses—road	Rev. road loc. mile	49.3	50.7
(9) Water for road locomotives	Actual, based on tests	41.0	59.0
(10) Lubricants for road locomotives	Road loco. mileage	49.4	50.6
(11) Other supplies for road locomotives	Road loco. mileage	49.4	50.6
(12) Road trainmen	Actual, based on tests	39.4	60.6
(13) Train supplies and expenses	Rev. train mileage	55.9	44.1
(14) Clearing wrecks (part)	Actual	...	...
(15) Damage to property (part)	Actual	...	...
(16) Damage to stock on right-of-way (part)	Actual	...	...
(17) Stationery and printing (part)	Actual	...	...
(18) Other expenses (part)	Actual	...	...
(19) Injury to persons (part)	Actual	...	...
(20) Operating joint yards and terminals		...	...
		41.2	58.8
(21) Supt.; clearing wrecks; damage to property; damage to stock on right-of-way injuries to persons; stationery and printing; and other expenses, exclusive of above items, 14 to 19, inclusive	Av. of above allocations (IV)	41.2	58.8
Total, Transportation Expenses		41.2	58.8
Grand total, exclusive of general expenses		43.8	56.2
V.—General Expenses:			
(1) Assignable direct	Actual	...	...
(2) Joint	Av. of above allocations (I-IV)	43.8	56.2
Total, general expenses		...	...
Grand total, operating expenses as reported		43.9	56.1

obtain in the hereinafter described apportionment of the investment in road and equipment seemed equitable, viz., 59.8 per cent to freight and 40.2 per cent to passenger service.

Small portions of the investment in road have been apportionable direct to each service. The remainder devoted to joint service has been divided on the same ratios of usage that were found in the case of maintenance of way and structures: 61.2 per cent freight and 38.8 per cent passenger.

Equipment has been apportioned by assigning cars direct to the services in which they are used exclusively, and by allocating the locomotive on a switching and road locomotive mileage basis respectively. Work equipment and overhead charges have been apportioned on the ratios obtained from the totals of the above described allocations.

The resulting ratios, shown in detail in Table 4, are summarized in Table 3.

Working capital has been allocated by using the last mentioned ratios of 59.8 per cent and 40.2 per cent.

TABLE 3—ALLOCATION OF INVESTMENT TO FREIGHT AND PASSENGER SERVICE

	Freight Service, Per Cent	Passenger Service, Per Cent
Road	61.9	38.1
Equipment	43.4	56.6
Total, road and equipment	59.8	40.2

TABLE 4—ALLOCATION OF COST OF ROAD, EQUIPMENT AND WORKING CAPITAL TO PASSENGER AND FREIGHT SERVICES

Item	Service	Basis of Allocation	Ratio Percentage Pass.	Ratio Percentage Frt.
Equipment	Joint	(See text)	56.6	43.4
Road	Passenger	(See text)	100.0	....
	Freight	(See text)	....	100.0
	Joint	Av. Ratio of joint main.-of-way and struct. exps.	38.8	61.2
Total, road			38.1	61.9
Total, road and equipment			40.2	59.8
Working capital (June 30, 1914)			40.2	59.8
Grand total			40.2	59.8

ALLOCATION OF RESULTS, 1914

Applying these various ratios [this is shown in great detail in exhibits in the report], the results are those given in Table 5.

It will be seen that passenger service returns a much smaller rate on the property investment than freight, the percentage, after making due allowance for the shortage of reserves, being but 1.63 per cent on book cost or 1.12 per cent on appraised cost, in contrast with 4.63 per cent or 3.15 per cent, respectively, on the portion of property assignable to freight service.

This difference is further emphasized by comparing the operating ratios. For each dollar earned in the passenger service 95.4 cents are expended in operating expenses, leaving but 4.6 cents for taxes, car hire and return to the investor; while in the freight service for each dollar earned 71.9 cents are disbursed for operating expenses, leaving 28.1 cents for the other obligations.

It is plain that the returns for both classes of service are inadequate, and that any relief should first be sought through an increase of rates in the passenger service which is not bearing its fair share of the load.

TABLE 5—APPLICATION OF PERCENTAGES TO REVENUE AND EXPENSE ACCOUNTS FOR 1914

As Reported by Company: (Insufficient amounts included in expenses for deferred maintenance, etc.)

	Freight Service	Passenger Service
Gross income	$706,242	$413,201
Outgo	565,129	390,694
Net per income account	$141,113	$22,507
Add profit and loss adjustments	43,684	29,367
Total return as reported	$184,797	$51,874
Investment—book cost	$3,577,077	$2,384,876
Rate of return, per cent	5.17	2.18
Investment—appraised cost	$5,251,696	$3,467,355
Rate of return, per cent	3.52	1.50
Operating ratios, per cent	69.1	92.2

As Revised: (Provision for deferred maintenance, etc., increased.)

	Freight Service	Passenger Service
Return as reported	$184,797	$51,874
Less shortage in reserves for deferred maintenance, etc.	19,201	12,885
Total return as revised	$165,596	$38,989
Rate of return:		
On book cost, per cent	4.63	1.63
On appraised cost, per cent.	3.15	1.12
Operating ratios, per cent	71.9	95.4

TABLE 6—ALLOCATION BETWEEN PASSENGER, MAIL AND EXPRESS BUSINESS

Revised results, including suitable provision for reserves:	Passengers	Mail	Express
Gross income	$392,400	$16,855	$33,313
Outgo	326,495	24,215	52,869
Net income	$65,905	*$7,360*	*$19,556*
Investment — book cost	$1,929,365	$143,092	$312,419
Rate of return, per cent	3.42	0	0
Investment—appraised cost	$2,805,090	$208,041	$454,224
Rate of return, per cent	2.35	0	0
Operating ratios, per cent	87.1	150.3	166

	Ratio percentage Passengers	Mail	Express
Operating revenue	88.7	3.8	7.5
Car-foot-mileage	80.9	6.0	13.1

RETURNS ON PASSENGER, MAIL AND EXPRESS BUSINESS

As there are three sources of revenue in the passenger service, viz., passengers, mail and express, an inquiry is necessary into the results from each.

The simplest and most easily applied usage method of apportioning joint revenues, outgo and facilities in connection with the three classes of traffic handled on passenger trains, appears to be space-miles, or, inasmuch as all passenger train cars are of equal width, car-foot miles. This method gives proper credit to the relative car-floor space enjoyed by each class of passenger train transportation and ignores relative weights of contents which are such a small proportion of the total gross train weights that they have a negligible effect on the cost of operation.

It will be of interest to note that the United States Senate Committee on Railway Mail Pay has endorsed car-foot-mileage as a proper measure of usage in place of the weight basis.

The ratios ascertained from estimates of comparative floor space areas, furnished by the officials of the company, are as follows:

It will be seen that mail and express enjoy a much larger share of the service and facilities than they yield in revenue.

APPLICATION TO RESULTS FOR 1914

The car-foot-mileage ratios applied in the revenues and expenses for the year ended June 30, 1914, give the results shown in Table 6.

SUMMARY AS TO PASSENGER, MAIL AND EXPRESS BUSINESS

That the oft repeated dissatisfaction with present mail and express compensation on railroads generally throughout the United States applies with equal force to the situation on the Ulster & Delaware Railroad is apparent from this showing. These two classes of transportation are operated at a distinct loss, but there is no remedy obtainable until the Government takes suitable action through Congress and the Interstate Commerce Commission.

Therefore, partial relief may be had through passenger fares only, the averages, of which per mile in 1914 were as those shown in Table 7.

TABLE 7—PASSENGER FARES PER MILE, 1914

	Cents	Cents
Gross revenue:		
Operating revenue—Fares	2.49	
Miscellaneous	0.01	
	2.50	
Other revenues	0.29	
		2.79
Outgo:		
Operating expenses, including shortage in reserves	2.18	
Other outgo	0.14	
		2.32
Balance for return on investment, additions and betterments, etc.		0.47

As above shown, this small balance per passenger-mile yields but 3.42 per cent on the investment as recorded on the books, or 2.35 per cent on the appraised cost, either of which is far below a fair return.

There being two general classes of passenger fares, mileage-ticket and straight-ticket and miscellaneous, an inquiry into each is necessary in order that any increase may be placed where it equitably belongs.

PROPOSED INCREASE OF PASSENGER RATES

The evidence given above demonstrates that the average actual cost per passenger mile in 1914, exclusive of a return on the investment, was 2.32 cents, or largely in excess of the 2-cent mileage ticket rate. Stated differently, the portion of the public that is traveling at the 2-cent ratio is carried at a distinct loss, while the revenue obtained from all passengers yields a return that is grossly inadequate.

TABLE 8—EFFECT OF INCREASE IN MILEAGE-TICKET RATE, BASED ON 1914 RESULTS

	Passenger Fares	Total Passenger Service	Freight Service	Grand Total Pass. and Frt. Service
Existing net income after making suitable provision for deferred maintenance, etc.	$65,905	$38,989	$165,596	$204,585
Proposed increase in passenger mileage-ticket rates from 2c. to 3c. per mile	53,450	53,450	0	53,450
	$119,355	$92,439	$165,596	$258,035
Rate of return on book cost, per cent	6.19	3.88	4.63	4.33
Rate of return on appraised cost, per cent	4.25	2.67	3.15	2.96
Operating ratios, per cent	75.6	84.1	71.9	76.8

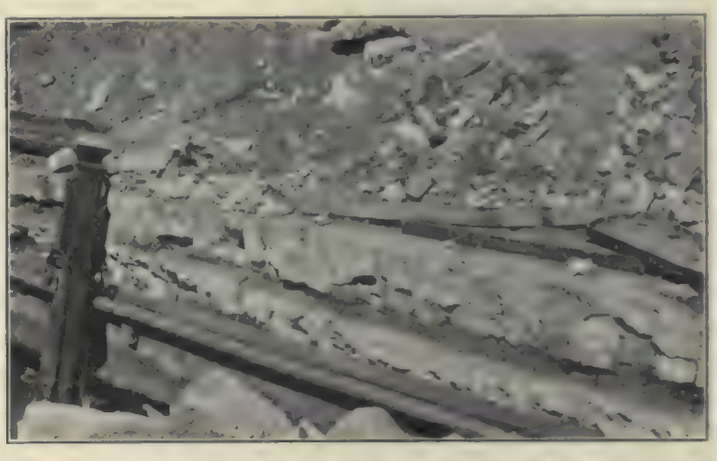
Under these circumstances the least that can be done is to raise the mileage-ticket rate from 2 cents to the straight-ticket rate of 3 cents per mile, the effect of which, based on 1914 results, is shown in Table 8 on the preceding page.

Summarizing, the increase in the passenger mileage-ticket rate from 2 cents to 3 cents per mile, based on 1914 results, would yield an additional revenue of $53,450, and this would bring down the operating ratio of passenger transportation approximately to the average for all branches of service, would place all passengers substantially on the same basis, would make the rates of return on the investment devoted to passenger and freight service more nearly alike, and would still leave the return to the owners of the property well below a fair rate.

Track Renewal Discloses Perfect Condition of 14-Year-Old Granite Pavement

Two-Thirds of the Grouted Blocks on Main Street, Worcester, Could Be Relaid, if City Ordinance Permitted

STREET railway track reconstruction at Worcester, Mass, involving the removal of grouted granite block pavement between the rails and along 2-ft. strips on either side, has disclosed the fact that the pavement is in almost perfect condition in spite of the fact that it has been in continuous service for 14 years with no expenditure for maintenance or repairs except in the case of street openings to reach subsurface structures. The work is being done by the Worcester Consolidated Street Railway on Main Street, between Lincoln Square and Chandler Street. The line is double-tracked, being in the busiest section of the city, and the renewal of rails is being accompanied by the removal of overhead wires feeding the trolley system.



LEFT — EXPANSION STRIP BREAKS BOND BETWEEN TRACK AND PAVEMENT



RIGHT — BOND OF GROUT INTACT AND SAND CUSHION IN PLACE AFTER FOURTEEN YEARS

In 1901 Main Street was paved with grouted granite block at a cost of about $3.50 per square yard. The pavement, it is claimed, is the oldest of its type on any business street in the country. At that time the company put down a track with the Pennsylvania Steel Company's Section 222 95-lb. girder rails, 8 25/32 in. high, laid on 7-ft. ties.

GRANITE SHOWS LITTLE WEAR

The small amount of wear shown by the pavement upon the removal of the grouted blocks from between the rails and from the strip outside each track is indicated by the accompanying illustrations. The joints between the granite and the grout are smooth. The blocks are well-shaped, sharp at the edges, and if desired, about two-thirds of them could be used a second time. The street surface retains enough roughness to prevent slipping of horses, and Frederick A. McClure, city engineer, states that during the entire life of the pavement the maintenance expense has been nil, except where the surface has been opened on account of other construction work. Both between and outside the tracks the pavement is in perfect condition, and only the rail wear has made it necessary to replace the granite blocks between and just outside the tracks. The blocks not to be used in paving again are transformed into crushed stone by the company and find a valuable place in the manufacture of concrete used in the reconstructed track.

NEW TRACKWORK DETAILS

The new track consists of the Pennsylvania Steel Company's section 273, 9-in. girder rail, weighing 125 lb. per yard and laid in 50-ft. lengths. The rails are of Mayri steel, rolled from special Cuban ore, and the track bolts are of the same material. The rails are laid on 6-in. treated chestnut ties, 8 ft. long, with a minimum face of 7-in., the ties being spaced 2 ft. apart on centers. Rail braces are provided on alternate ties and the joints are of the suspended type, with 12-hole plates. The track bolts, 1 in. in diameter, are provided with 1/16-in. raised threads and Harvey grips, and are of high elastic limit, having a guaranteed tensile strength of 100,000 lb. per square inch. The bolts are forced home to the above limit in putting on the plates. Each joint is provided with two compressed-terminal American Steel & Wire Company's copper bonds, one being 3 in. and the other 10 in. long, giving full rail section conductivity. A 500,000 circ. mil cable is bonded around all special work. Cross-bonding is done every 500 ft. The rail is laid mainly at night after traffic has ceased, one track being available for the use of a derrick car.

The removal of overhead feeders required the building of a conduit under the easterly track, and the excavation for the trench is 5 ft. deep and 30 in. wide at the bottom. Orangeburg fiber duct 3.5 in. in inside diameter is installed, the line carrying 30 or 36 ducts according to location. Both positive and return feeders are to be drawn in, and the duct area provides for future cables and for rentals.

No track ballast is required, an excellent gravel foundation being available throughout the work. The ties are laid upon a bed of gravel, which is leveled to within 3 in. of the top of the tie. Concrete of 1 part cement, 3 parts sand and 6 parts crushed stone is poured around the ties to a total depth of 5 in., thus surrounding the base of the rail. On top of the concrete a 1-in. cushion of sand is placed, the paving blocks being bedded upon this by the city. The blocks are laid about ¼ in. apart and are grouted with a mixture of 1 part cement and 2 parts sand until the tops of the blocks are nearly reached, when a 1.25 : 1.5 mixture is used. A dressing of pea stone is then broomed upon the granite. The job was begun July 6 and is to be completed early in September.

EXPERIMENT WITH FELT STRIP TO SEPARATE TRACK FROM PAVEMENT

Between Lincoln Square and School Street a strip of felt 6 in. wide and ½ in. thick has been placed vertically between a row of blocks laid parallel to the outer rail of each track and the heads of the other paving blocks laid on the street, the axes of the latter being at right angles to the rail. These strips are designed to reduce the noise of the cars by the insertion of a break between the track and the solid structure formed by the paving blocks and the grouting. Pending a test as to the watertightness of this construction, it has been decided to omit it in the balance of the job, as it was introduced largely as an experiment. The opinion is held in some quarters that with the felt strip in service it may be difficult to prevent water from getting between the block and the rail and ultimately reaching the ties, and the space required by the rail braces prevents the application of a continuous strip of felt between the rail and the first row of blocks.

Work is pushed day and night and the maximum number of men employed by the company is about 500. The city force engaged in laying the blocks, grouting and cleaning totals about 22. All materials are hauled to the job by the company, the prin-



OLD PAVEMENT TOOTHED READY FOR LAYING OF NEW BLOCKS



RELAYING BLOCKS BETWEEN OLD PAVEMENT AND RAILWAY TRACK

cipal storage yard being at Greendale, 3 miles north. An electrically operated side-dumping car built for the company by the Wason Manufacturing Company of Springfield, Mass., is in use for the delivery of stone, sand, etc. Very little storage of materials is required on the street, the teaming space on each side of the track being left practically free. Concrete is mixed on the street in a Standard portable mixer, gear-driven by a 5-hp. 550-volt motor supplied from the trolley by a flexible cable and contact pole, the machine having a capacity of about 15 cu. yd. per hour. A gasoline engine driven mixer prepares the grout and all water used is metered at the hydrant.

BLOCKS REMOVED WITH CHISELS AND SLEDGES

In removing the paving the joints are attacked by bull point chisels and 16-lb. sledges. Picks are then run under the paving blocks and the sand pulled out. The blocks are then broken off, singly or in groups, by sledges, and are removed to the side of the street. The grout is in excellent condition despite its 14 years' service, and is crushed and screened with the blocks used to provide ¾-in. broken stone for concrete. About 200 sq. yd. per day can be ripped up by 75 men. The blocks are hauled to Greendale, sorted, and about 50 per cent are crushed, the remainder being available for repaving of gutters or between tracks in other parts of the system. If necessary 60 to 70 per cent of the blocks could be salvaged for reversible re-paving, for their faces are practically as good as when laid. In laying, one man can put down about 50 sq. yd. per day.

The fiber conduit is laid on a concrete base 3 in. thick and each duct is surrounded by about 1 in. of concrete.

Jacks are employed to loosen the rail from the concrete base, which can easily be broken by hammers. Old spikes are sent to the scrap pile. The grouted surface is closed for one week to automobiles and teams after completion. Fred Wilkinson, roadmaster of the railway company, states that crushed stone could not be purchased and delivered on the job for less than $1.50 per ton, and the value of the old block being about 40 cents per ton, including crushing and haulage to the job, the cost of utilizing the old block is but 38 cents per ton. Good blocks can be cleaned of grout scale at a cost of 1 cent each.

In speaking to a representative of the Engineering Record Mr. McClure emphasized the importance of using a paving block of a fairly soft character, pointing out the value of Milford, New Hampshire, granite for this service. The pavement at Worcester gave no trouble to speak of, although no expansion joint was provided. Dry sand and thin grout are also essential to the best results. Were it not for a city ordinance requiring new blocks in paving many of the 14-year-old blocks taken from the present job would afford good material for a second laying.

First Train Service Over Transcontinental Railway

THE FIRST regular train schedule has just been established on the Canadian Northern Pacific Railway between Pacific tidewater at Port Mann, B. C., and Hope, 78 miles east. The ballasting of the line as far east as Kamloops is practically finished and north of Kamloops to Yellowhead Pass the work will be completed by the end of August. The entire line from the Pacific Coast to Quebec should be in operation, the chief engineer's office reports, late this summer.

The British Columbia section of the line, which was described in the Engineering Record of June 6, 1914, has involved very heavy construction and expense has not been spared in the endeavor to secure a line through the mountains on a low grade. The average cost of the 500 miles in British Columbia has been about $70,000 per mile, and in one instance grading for a mile of track, including a 548-ft. tunnel cost $326,000 and involved the removal of 250,000 cu. yd. of material.

In British Columbia there are twenty steel bridges and viaducts on this line. The one of bridge 1, shown in the accompanying view and on the front cover, spans the Fraser River 5 miles below Lytton at a point where the stream is so swift and deep that only the type of bridge that can be constructed by the cantilever method was considered practicable. The through bowstring truss shown in the background on the line of the Canadian Pacific Railway, was erected without falsework as described in the Engineering Record of Jan. 17, 1914.

HYPOCHLORITE CONVERSION TABLES, devised by the engineering department of the Denver Union Water Company for calculations after each hourly reading, disclose the fact that the amount of hypochlorite applied hourly in pounds per million gallons of water per day, the latter a nomenclature recommended by the New England Waterworks Association in preference to grains per gallon or parts per million, is nearly identical with the calculated parts per million of available chlorine when the latter is 36 per cent of the total amount of hypochlorite used. For example, when 0.30 lb. is applied hourly to a weir box on which the reading is 1,000,000 gal. daily, the equivalent parts per million of available chlorine is 0.31.



COMPLETING FRASER RIVER BRIDGE FOR NEWEST TRANSCONTINENTAL RAILWAY

Slope-Deflection Method Reduces Time for Wind Stress Analysis

Effect of Horizontal Shear in Building Frames Compared in Approximate and Accurate Computations by W. M. Wilson and G. A. Maney

THE well known inaccuracy of the usual methods used in the practical analysis of steel building frames for wind stresses has been made the subject of an extensive study by W. M. Wilson, assistant professor of structural engineering, University of Illinois, and G. A. Maney, at that time research fellow in the department of mechanics, whose findings are published in Bulletin 80 of that institution. The exact determination of all the stresses in a steel frame due to horizontal shear, the authors point out, is practically impossible, but they present an analysis based upon assumptions which are not exactly true, but which allow the application of an improved slope-deflection method which they believe is more accurate than the methods ordinarily used. A short, practical approximate method is proposed, an example given and comparisons made with the results obtained by using four usual approximate methods and assumptions. A complete discussion of results and of the effects of assumptions is a valuable conclusion to the bulletin.

It will be possible to give in this abstract only an outline of the accurate analysis used, the fundamental assumptions and the equation upon which it is based, the modifications proposed for a shorter approximate method, and the conclusions and results of the comparison with the ordinary practical methods.

CLASSIFICATION OF METHODS

Methods of calculating wind stresses in office buildings may be divided into two classes, approximate methods used in the actual design of buildings, and exact methods which are the results of attempts to make an accurate analysis of the stresses. The three approximate methods in current use are based upon the following different assumptions, but in all cases the point of contraflexure of the column is assumed at mid-height of the story:

Method 1.—A bent acts as a cantilever, the point of contraflexure of the girder is at its mid-length, and the direct stress in the column is proportional to its distance from the neutral axis of the bent.

Method 2.—A bent acts as a series of portals (each interior column acting as a member of adjacent portals will therefore have a resultant direct stress of zero), and the shear is the same on all columns of a story.

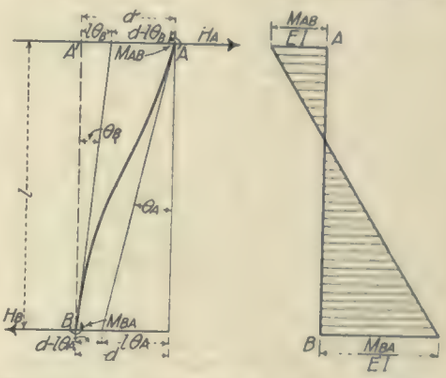
Method 3.—A bent acts as a continuous portal, the direct stress in a column is proportional to its distance from the neutral axis of the bent and the shear is the same on all columns of a story.

Prof. Albert Smith in a paper in the *Journal* of the Western Society of Engineers, vol. 20, page 341, describes a fourth approximate method which is based on the same assumption as method 1, except that the last assumption as to direct stress in the column is replaced by an assumption that the shears on the internal columns are equal and that the shear on each external column is half that on the interior columns. This is called method 4.

Three exact methods have heretofore been used. A method which takes account of the elastic curves, the deflections, and changes in length of the members is used by Dr. C. A. Melick in Bulletin 8 of the University of Ohio. A method which uses the deflections of the columns and the changes in slope of the tangents to the elastic curves of the columns and girders at their points of intersection is used by E. F. Johnson in the Transactions of the American Society of Civil Engineers, vol. 55, page 413. The method of least work is applied by Prof. Smith in the Bulletin above mentioned. All of these methods are long and difficult in application.

OUTLINE OF PROPOSED EXACT METHOD

The proposed analysis is based upon the following assumptions: 1.—The connections between the columns and girders are perfectly rigid. 2.—The change in the length of a member due to the direct stress is equal to zero. 3.—The length of a girder is the distance between the neutral axes of the columns which it connects and the length of a column is the distance between the neutral axes of the girders which it connects. 4.—The deflection of a member due to the internal shearing stresses is equal to zero. 5.—The wind load is resisted entirely by the steel frame.



FUNDAMENTAL RELATIONS AND NOTATION

Based upon these assumptions, an analysis of the stresses can be made by applying certain fundamental principles of mechanics to obtain equations from which the stresses in the frame can be determined. Consider the point of intersection of the neutral axes of a column and a girder as a free body in equilibrium under the action of the moments at the extremities of the columns and girders which intersect at that point. It is shown later that each of these moments may be expressed in terms of the changes in the slope at the extremities of the members and the deflection of one end of the member relative to the other end. A moment equation can therefore be written for each point where the columns and girders intersect, and the only unknown quantities will be the changes in the slopes at the extremities of the columns and the horizontal deflections of the columns in the story considered.

If all of the columns of a story be taken together as a free body, the sum of the moments at the two extremities of all of the columns will be balanced by a couple whose moment is equal to the total shear on the story multiplied by the story height. This added condition then makes it possible to write as many equations for each story as there are columns in the story, plus one. As the only unknown quantities in these equations are the changes in the slopes at the extremities of the columns and the deflection in a story common to all columns, there are as many equations per story as there are unknowns.

By solving these equations the slopes and the deflections can be determined. Knowing the slopes and deflections, the moments can be computed. Since the product of the shear on a member and the length of the member is equal to the algebraic sum of the moments at the extremities of the members, the shear can be computed. With the shears known, the direct stress in any column can be determined by taking the column as a free body and equating the sum of the vertical forces to zero.

By thus reducing the number of unknown quantities through the use of the slopes and deflections as unknowns instead of the direct stresses and moments, the problem is very much simplified.

DERIVATION OF FUNDAMENTAL EQUATION

The fundamental equation for the relation between the bending moment at one end and the slopes of the tangents to the neutral axes at each end and the deflection of the member is based upon the relation shown in the accompanying figure, on which the notation is indicated. Consider a member which is not acted upon by any external forces or couples except at the end. The line AB represents the neutral axis of such a member. The moment at A is represented by M_{ab} and the M/EI diagram is shown on the right of the figure. The deflection of A from the tangent at B is seen to be $d - l\theta_b$. Equating this to the fundamental deflection equation $y = \int Mxdx/EI$, as given in texts on mechanics, substituting the general equation for bending moment $M = M_{ab} + (M_{ba} - M_{ab})x/l$, integrating and solving for the deflection d, there results for E and I assumed as constants:

$$d = l\theta_b + (2M_{ba} + M_{ab})l^2/6EI$$

By analogy, with due regard for signs, the following equation can be written, based upon the deflection $d - l\theta_a$ of B from the tangent at A:

$$d = l\theta_a - (2M_{ab} + M_{ba})l^2/6EI$$

These two equations can be used to solve for M_{ab}, giving the following important equation:

$$M_{ab} = 2(2\theta_a + \theta_b - 3d/l)EI/l$$

This equation is then applied as above indicated to obtain general equations for any story of either symmetrical or unsymmetrical bents. Tables are given for cases of one to five spans for either symmetrical or unsymmetrical bents.

PROPOSED APPROXIMATE METHOD

The proposed approximate method is based upon the following assumptions in addition to those used in the slope-deflection method: 1.—The changes in the slope at the top of a column in the story above and in the story below the one in which the stresses are to be determined are equal to the change in the slope at the top of the corresponding column in the latter story. 2.—The ratio of the deflection to the length of the columns in the story above the one in which the stresses are to be determined is equal to the ratio of the deflection to the length of the columns in the latter story.

The application of these assumptions to the general equations results in a large re-

duction in the number of unknown quantities, and a corresponding simplification of the computations.

COMPARISON OF RESULTS

Application of the above exact and approximate methods and of the approximate methods 1, 2 and 3 was made to a twenty-story bent of three spans with short middle span. The tabulated results for the moments in the case of this symmetrical bent show: First, that the moments determined by methods 2 and 3 are very seriously in error; second, that the moments determined by method 1 and by the proposed approximate method agree very closely with the moment determined by the exact slope-deflection method except at points where there are sudden changes in the members of the bent; third, that the errors in the moments determined by the proposed approximate method are less for the girders than for the columns.

Application was also made to a symmetrical three-span bent with long middle span, with the result that the moments determined by the proposed approximate methods are as accurate as before, whereas the moments determined by method 1 are inaccurate, and those determined by methods 2 and 3 are very inaccurate. Other studies were made to determine the effect of the proportions of a bent upon the accuracy of method 1, and the accuracy of the approximate method when the moment of inertia of the girders is proportional to the bending moment.

A test was made of a celluloid model of a bent to compare with the results of analytical computations. The calculated quantities were found to be, in general, greater than the observed quantities. This was explained by the fact that the length of a member was taken equal to the distance between center lines, whereas the length that is actually free to bend is the distance from outside to outside of the members. In general, however, the agreement was quite close, and the test supports the theory upon which the slope-deflection method is based.

CONCLUSIONS

As a result of the investigation, the following conclusions are drawn:

1. Approximate methods 2 and 3 are so inaccurate that they should never be used; approximate methods 1 and 4 are quite accurate in some cases, but they may give results which are seriously in error.

2.—The method presented and designated as the slope-deflection method contains no approximations except those in the assumptions. It has been shown that the inaccuracies in the assumptions do not materially affect the results. Therefore the method is quite accurate.

3.—While the slope-deflection method is long, it could be used in the actual design of a building; but it has its greatest value as a standard by means of which the accuracy of the approximate methods may be determined.

4.—The proposed approximate method is short; and, except at points where there are very large changes in the size of the members, gives results which are accurate enough to be used in the actual design of a building.

A ONE-MILE Span on a 110,000-volt transmission line is used in crossing Carquinez Straits near San Francisco, Cal.

$16,000,000 Required for Los Angeles County Flood Protection—Part 2

Channel Improvement Necessary in Lower Reaches while Gravel Tracts Are Urged for Absorbing Flow at Canyon Mouths

IN PART 1 of this article the general problem of flood prevention and protection in Los Angeles, as presented in the general report of the Board of Engineers, Flood Control, was considered, while space was also given to Mr. Olmsted's special report on the use of impeding dams and rebrushing in the canyons. The second part, concluding the abstract of the report, takes up the special discussions by H. Hawgood, on flood control in the San Gabriel district; by Capt. C. T. Leeds, on control in the Coastal Plains, and by J. B. Lippincott on problems of the San Fernando valley.

Mr. Hawgood on Flood Control in San Gabriel District

In his individual report on a project for dealing with the situation in the San Gabriel district, Mr. Hawgood calls attention to the influence of the torrential storm flows from 322 sq. miles of precipitous mountain country, the highest peak of which, San Antonio, attains an elevation of 10,080 ft. above sea level. Of these 322 sq. miles of mountains, 224 discharge their floods through the San Gabriel Canyon. Below the canyon 12 sq. miles of mountain drainage reaches the San Gabriel River from the west and 49 sq. miles from the east. The Rio Hondo receives the drainage of 37 sq. miles of mountains.

The report properly starts in with a consideration of the fundamental proposition of the maximum volumes of water to be carried by the various streams and the data available for the determination of these quantities. The high-water marks of the 1914 floods place the maximum discharge rate at the mouth of the canyon at 27,000 sec.-ft., and the peak-rate reduction caused by flattening of gradient, by pondage and loss by seepage would reduce the maximum rate to approximately 22,000 sec.-ft. at the head of Lexington Wash, where the river divides. In considering the discharge of the Rio Hondo it is pointed out that a relatively high value must be given to the run-out per unit of area on account of the ever increasing concentration following upon the growth of town improvements, such as street paving and storm drains.

DISCHARGE FORMULA

Mr. Hawgood does not accept any existing formula for determining the maximum discharge rate, because many of the elements, such as porosity of soil, character and extent of vegetation, etc., do not admit of mathematical expression, other than by a coefficient more or less arbitrary. There are however certain general controlling elements which do admit of mathematical expression. These are: (1) area of drainage, (2) shape of drainage area, (3) slope of drainage area, (4) rainfall.

The shape of the drainage area and its position in relation to the outlet play an important part in the rate of discharge. A triangular area with the outlet at the apex would have its center of gravity twice the distance from the outlet, as when the same triangle is turned through 180 deg. and discharges along its base. The rate of discharge is a function of the distance which the water must travel to the outlet. The distance from the center of gravity of the drainage figure to outlet may with reason be assumed to be the main distance of travel. Changes in the position of the center of the gravity will increase or decrease that distance and inversely the associated discharge rate. Hence it is obvious that any rational formula must take cognizance of the form of the drainage area. After a critical study of the subject Mr. Hawgood has developed the following formula:

$$D = C R \frac{\sqrt{s}}{2l}\left[\frac{4\sqrt{A}}{\sqrt{l + (A/L^2)^2}}\right]$$

in which D is the maximum rate of discharge in second feet per square mile of area drained; A, the area drained in square miles; L, the extreme length of drainage in miles; l, the distance of center of gravity of drainage area figured from the outlet; S, the slope of drainage area = (fall ÷ L); R, the average rainfall in inches per hour during the time required for water to flow from the most remote part of the drainage to the outlet and during the hour of maximum precipitation; C, a coefficient determined from observation.

APPLICATION OF FORMULA

In the application of the formula to the San Gabriel tributaries, values of R have been based upon intensive rainfall at Pasadena, Feb. 18, 1914, a graph of which is presented in the report.

A value of 2000 was found to be an average for C.

The formula is not designed to include certain areas involved with questions of melting snow and of such length that the time of the flow from their uppermost points to their outlets are matters of several hours, which renders the rain question complex. To have carried these factors into the formula would have destroyed its present simple slide-rule form without commensurate benefit at this time.

A table giving a comparison of computed and observed discharge rates per unit of area shows that the computed and observed discharges are in more than fair agreement. It is not unreasonable to say that local variations of rainfall might readily have had range sufficient to cause such differences as appear in the table, as, in the computation, the Pasadena gagings had to be applied to other territory in which no gagings were taken.

WORK AT HEADWATERS

The importance of conservation of water as an economic factor in flood control work is strongly emphasized, both from the viewpoint of putting conserved waters to beneficial use and that of permitting reduction in size and cost of channels for carrying surplus waters harmlessly to the sea. The necessity of greater knowledge of rain distribution in the mountain areas through the establishment of rain gages and stream measurements is pointed out. Mention is made of the primary effect of the introduction of check dams in reducing the natural velocity of the streams and the secondary effect in reducing the erosive and trans-

porting power of the streams and, as a corollary, inducing sedimentation.

Although check-dam ponds fill with detritus, the interstices of the filling, constituting 20 to 40 per cent of the mass, form valuable storage. The raising of the streambed and its water plain will add to the sponge large masses of pervious material now above water line. The water thus stored may or may not have more than a limited effect on reduction of the flood discharge. The maximum discharge often comes after a period of gentler rains whose run-off may have already soaked the gravel beds to a large extent, but the effect of this underground storage is of the greatest importance in enhancing summer flows.

Mr. Hawgood is of the opinion that a reduction of 20 per cent or more can be accomplished by the well-studied use of check dams. To this is to be added the reduction brought about by "spreading" on the debris cones outside the mountains. Brush is better for water conservation than tree planting. Retardation work in the mountains should be prosecuted to its full practical limit and the levee and channel work which will in any event be necessary in the valleys thereby relieved as much as possible.

FLOOD-CONTROL STRUCTURES

A second section of the report is devoted to flood-control structures and work, taken up in the form of detailed discussion of the problem of each individual drainage area. In the San Gabriel a probable maximum flood rate of 45,500 sec.-ft. could be reduced 20 per cent by check dams in the higher and smaller waterways, and be further reduced by diversion of part of the flow at the canyon mouth onto spreading grounds, so as to give a maximum flow in the improved channel immediately below the canyon mouth of about 31,000 sec.-ft., which would be reduced to about 29,000 sec.-ft. at the head of Lexington Wash by percolation in the very pervious bed above this point. At Lexington Wash 12,000 sec.-ft. would be diverted into the Rio Hondo and 17,000 sec.-ft. into the old channel.

Section 3 of Mr. Hawgood's report is devoted to flood control works and estimated costs. Channel excavation costs are estimated on the use of steam shovels for the narrower channels and drag-line scrapers for the wider channels. Levee protection is based on the use of hand-laid boulders where available in the upper portion of the channels, with a mound about 10 ft. wide of loose boulders deposited along the toe of the levee to sink into and fill any cavities caused by erosion. Where boulders are not available 4-in. concrete-slab protection, ribbed on the under side to check slipping over the upper half of the levee slope, with articulated concrete mats over the lower half, and extending as an apron 6 ft. out into the bed of the channel, are recommended. For the smaller channels there is recommended a mat made by laying wire netting on the levee slope and for several feet out over the channel bed, covering the mat with cobbles and small boulders, laying on top thereof other wire netting and wiring bottom and top nets together. Mats of this type have been employed under Mr. Hawgood's direction by H. W. Hanson in Latuna Canyon, between Burbank and Big Tujunga, and are somewhat similar to some successfully used in India. Protection by living growth of bamboo is particularly promising, as the bamboo is readily propagated and is of dense growth. Where dikes are to be used, which, on account of their high cost would be rarely, Mr. Hawgood proposes a double row of braced posts of concrete for permanent and important work, and wood for temporary and less important work, carrying pole or brush screens. The space between the posts would be planted to bamboo. In the concrete structures the live bamboo growth will gradually take the place of the perishable pole or brush screen, and will entirely take the place of decayed timber structures.

Captain Leeds on Control in the Coastal Plains

The probable volumes of flood discharge to be provided for in the Coastal Plain are: Los Angeles River, 35,000 sec.-ft.; Rio Hondo, 16,000 sec.-ft.; San Gabriel, 20,000 sec.-ft. Surveys were made and maps executed giving required topographical data of the district. Channel design involves a balancing of the economic factors of channel width, riprap cost, and land cost in country worth from $500 to over $3,000 per acre. In the district where land is most valuable a narrow, deep trapezoidal channel with riprap is recommended. Where velocities will be lower, articulated concrete-block protection, and at other points a wide channel with berms, are determined by local conditions. Levees can be oiled on top and protected by plantings. Extended consideration is given to various forms of levee protection.

After treating the erosive power and debris transportation characteristics of the streams Captain Leeds dwells at length on the economic importance of protecting the harbor. Flood history, the economic importance of the harbor, and an analysis of possible plans lead to the recommendation of a diversion at Dominguez to Alamitos Bay, south of the harbor district.

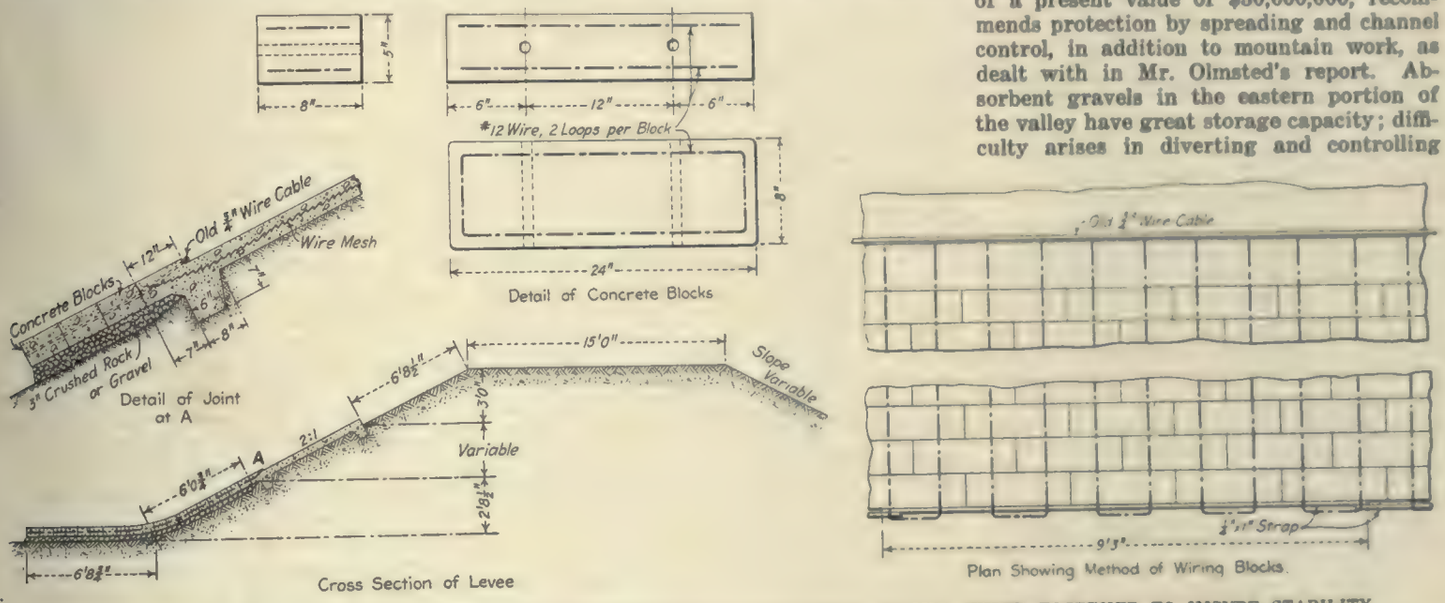
Mr. Lippincott on San Fernando Valley Problems

Mr. Lippincott, in his special report on control of waters in the San Fernando Valley, where floods menace affects property of a present value of $30,000,000, recommends protection by spreading and channel control, in addition to mountain work, as dealt with in Mr. Olmsted's report. Absorbent gravels in the eastern portion of the valley have great storage capacity; difficulty arises in diverting and controlling enormous flood peaks. The report proposes acquisition of a spreading tract of 3135 acres in the eastern portion, and control and protection of channels by levees and planting, utilizing Phoenix Canaryensis or common date palm, to be set in four rows, 6 ft. apart, trees spaced every 10 ft. The cost would be about $1,000 per mile, of planting, including care to establish growth.

The western portion of the valley can be protected by channel control of the smaller floods. Important studies deal with the control of the Los Angeles River in the lower portion of the valley. Tree growth in the channel at present offers serious obstruction, and should be grubbed out. Natural growth on the sides should be augmented by planting. Portions of the bank will require riprap protection. Estimates total $2,150,000 for protecting the district.

A second report by Mr. Lippincott is a preliminary study of the Arroyo Seco flood channel and its development as a parkway between Los Angeles and Pasadena, making a flood channel of 300 ft. minimum width, and a parkway with irregular boundaries determined by existing property lines, using many small holdings entire, rather than acquiring mere slices of land. Bank protection proposed is similar to that used by the San Pedro, Los Angeles & Salt Lake Railway, of granite fragments dumped loosely along the banks, planted with shrubs and vines to blend with the landscape.

[THE END]



DETAILS OF LEVEE CONSTRUCTION, AND CHANNEL PROTECTION BY CONCRETE BLOCKS, WIRED TOGETHER TO INSURE STABILITY

Five Examples of Cantilevered Auditorium Balconies

Several Types of Long Span Cross-Girder May Be Employed to Reduce Number of Columns, Which Obstruct the View

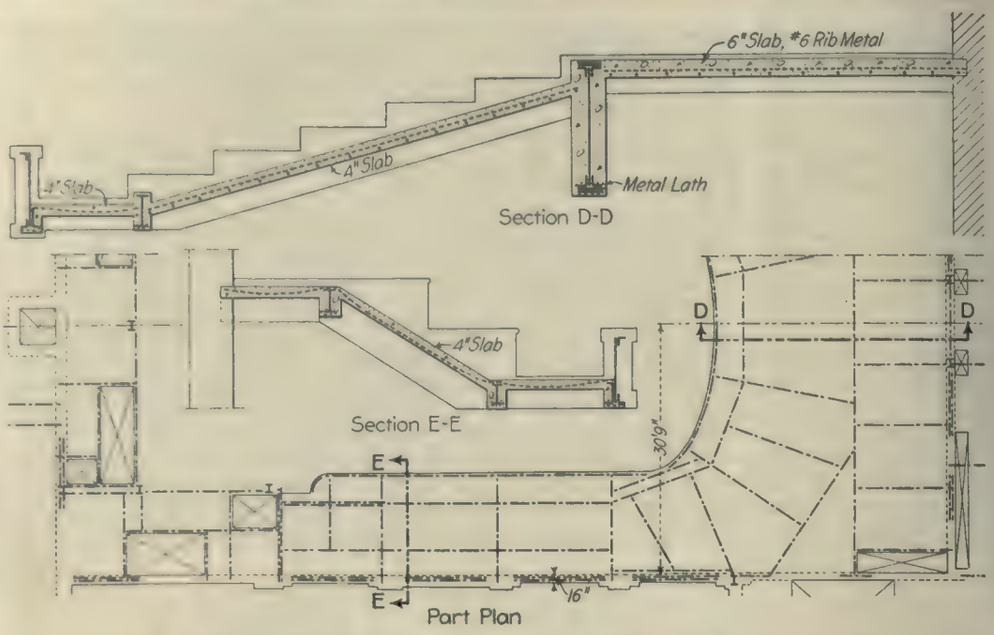
IN THE design of cantilevered balconies for auditoriums the most difficult feature is the main cross-girder. As it is desirable to use as few columns as possible this girder must generally be designed for long spans, but as the long-span girder must also be given sufficient depth to develop an adequate resisting moment, it may in cases form an obstruction more objectionable than if a greater number of columns had been used. As the depth of girders can be decreased below the economical figure by increasing the flange area, if structural steel be used, or by increasing the amount of reinforcing steel and widening the compression part, if the material be reinforced concrete, the designer must make several layouts, keeping in mind economy of design and avoiding obstructions in the form of columns or too deep girders. The five following examples illustrate various solutions of the problem.

COMBINATION CONSTRUCTION

One of the accompanying drawings shows the design of the auditorium balcony in the high school at Montclair, N. J., for which Starrett & Van Vleck were the architects. It is a typical example of construction employing a combination of structural steel and reinforced concrete. The main girder has a span of 61½ ft.

In the high school at Stamford, Conn., for which Boring & Tilton were the architects, a very light type of combination balcony construction was used. As columns were permitted at fairly small intervals 12-in. beams were used to support the steps, which were built directly on top of 10-in. 30-lb. beams, spaced 5 ft. on centers and anchored in the walls. The step construction was very light and consisted of 24-gage seven-rib Hy-Rib plastered on both sides so that the total thickness of the slab thus formed was 3 in. The Hy-Rib was fastened to 3 x 3 x ¼-in. angle bars, as shown in the detail drawing.

The combination type was also used in the high school at Mount Vernon, N. Y. The steps for the seats are supported on the exterior walls and on two steel cantilevered girders having an overhang of about 19 ft. These cantilevers are spaced 15 ft. on centers and their distances from the exterior walls are about 21 ft., so that the risers of the concrete steps are continuous beams with 21-ft. end spans and a 15-ft. center span. Here Hy-Rib has also been made use of for the building of the 3-in. slabs forming the treads, so as to save the cost of wooden forms. Such forms, however, could not be entirely eliminated, as the risers are reinforced-concrete beams, which had to be built in the usual way. The design is shown in one of the accompanying drawings. Starrett & Van Vleck were the architects.

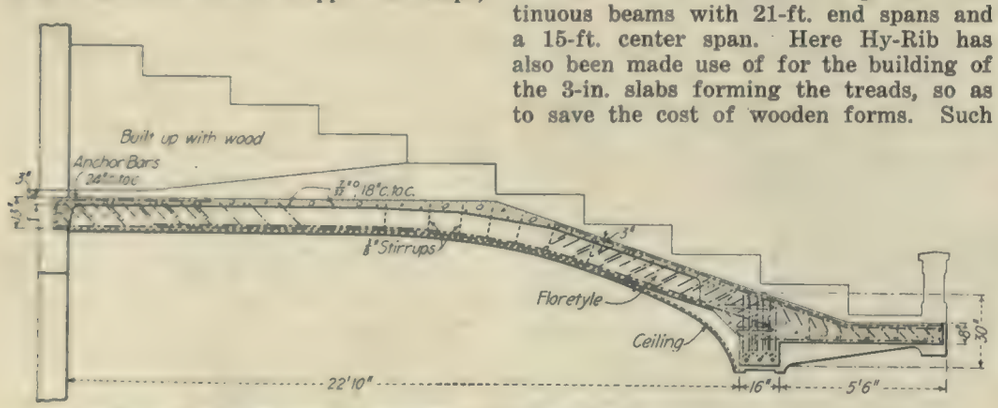


PLAN AND SECTION OF BALCONY IN HIGH SCHOOL AT MONTCLAIR, N. J.

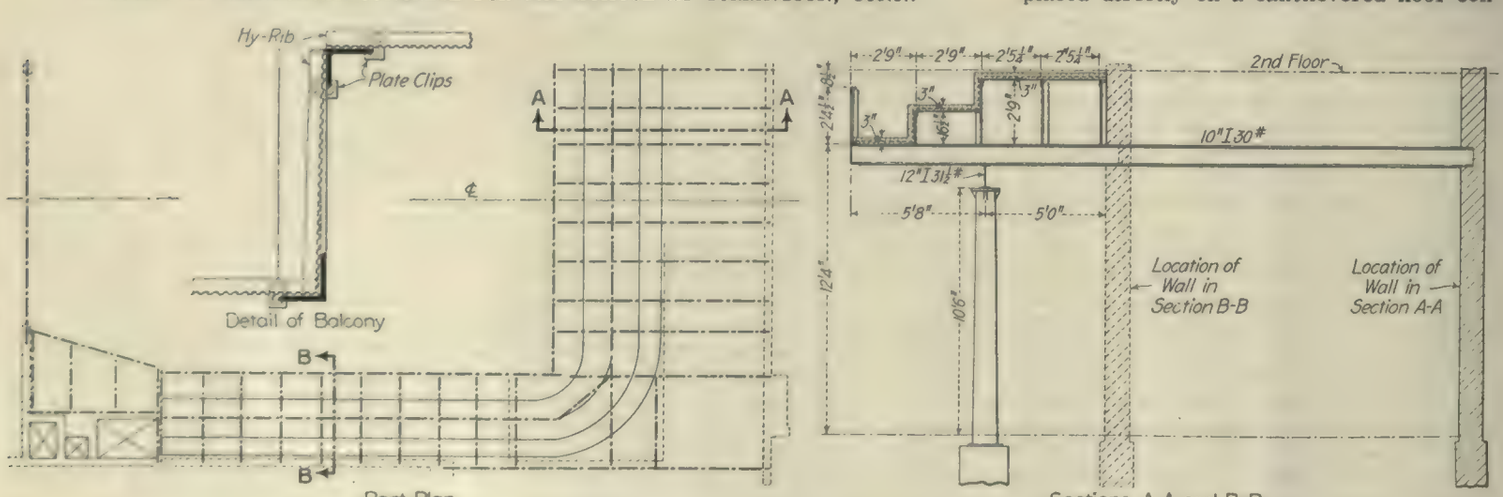
REINFORCED-CONCRETE CONSTRUCTION

In the design of reinforced-concrete cantilevered balconies the main difficulty is to find place for the widening of the compression side of the main girder, in case it is necessary to cut down its depth below the economical. An example of this type of construction is found in a school building at Southampton, N. Y., of which Hewitt & Bottomley were the architects. The girder spans 39 ft. and supports the seat tiers by means of two cantilevers, spaced 14 ft. on centers. The overhang of these cantilevers is 7 ft. and the anchor arm 13 ft. 5 in. The seat tiers are of wood. As shown in the drawing, a 6-in. slab has been built at the lower edge of the cantilevers, forming a ceiling and covering the construction.

When the balcony for the school at Torrington, Conn., was to be built the design was changed somewhat from that used at Stamford. As the total span of the main girder, 53 ft., was too long, it was divided, by using two columns, into two 11½-ft. side spans and one 30-ft. center span. The steps were made of wood and were placed directly on a cantilevered floor con-

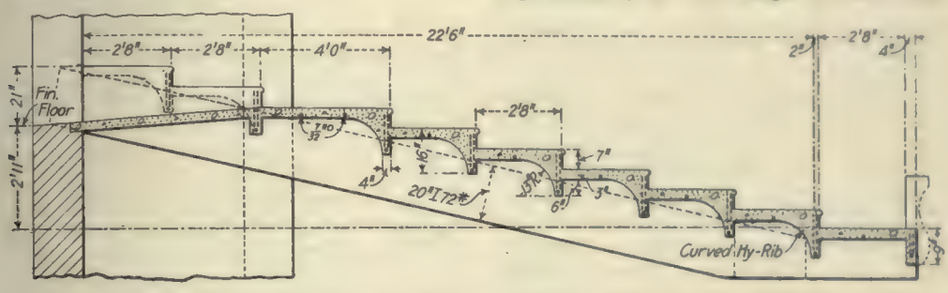


BALCONY OF REINFORCED CONCRETE FOR THE SCHOOL AT TORRINGTON, CONN.

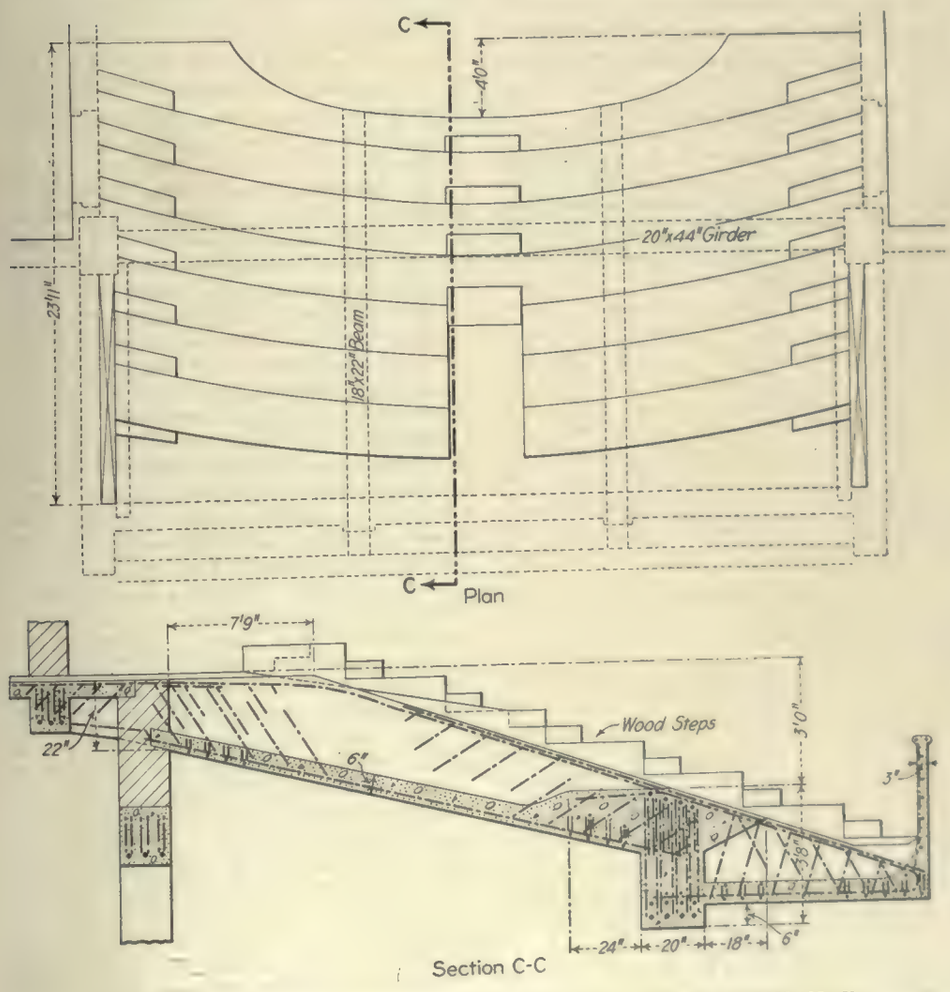


PLAN AND SECTIONS OF LIGHTTYPE COMBINATION BALCONY CONSTRUCTION AT STAMFORD, CONN.

sisting of an 8-in. overhanging slab projecting 5½ ft. in front of the girder, and a T-beam floor construction between the girder and the rear wall. The latter portion serves as the anchor arm. The T-beams were formed by 10-in. Floretyles, spacing the beams 25 in. on centers. The slab between these beams is 3 in. thick. The distance from the main girder to the wall is 22 ft. 10 in. and the total depth of the floor construction is 13 in. The underside of the structure is covered by a ceiling formed of Hy-Rib to which a coat of plaster was applied. The architect for this building was Wilson Potter.



DESIGN OF BALCONY BUILT IN THE HIGH SCHOOL AT MOUNT VERNON, N. Y.



REINFORCED-CONCRETE BALCONY CONSTRUCTION AT SOUTHAMPTON, N. Y.

The reinforced-concrete portions of the above balconies were designed in the office of Herman Fougner, New York representative of the Trussed Concrete Steel Company of Detroit.

SAFETY LANES FOR PEDESTRIANS have been painted upon the pavement at Fifth Avenue and Forty-second Street, New York, to minimize traffic accidents. The lanes indicate the proper places for crossing and strict measures are being adopted to restrict vehicles from these areas.

Pile Tests Indicate Type of Substructure for Technology Buildings

Apparently Good Spruce Piles Found to Be Broken and Broomed by Peculiar Geological Conditions and Soil Formation—Oak Piles for Hard Material

By CHARLES T. MAIN, Consulting Engineer, and H. E. SAWTELL, Boston, Mass.

VARIABLE soil conditions found by extensive investigation at the site of the new buildings of the Massachusetts Institute of Technology caused the engineers to make a very thorough series of pile tests as a preliminary to the design of the foundations. Features of the design and construction of these buildings were described in the Engineering Record of April 4, 1914, page 393, Nov. 28, 1914, page 578, and June 12, 1915, page 748. This article will describe the effects of the particular gravel and clay conditions encountered upon the piles themselves and their supporting power.

In July, 1913, Prof. W. O. Crosby submitted a report based chiefly on the results obtained from twenty-one borings in the site and just outside its limits. His report shows that the bed rock, found at a depth of 120 to 135 ft. below the surface, appears to be quite level. The overlying materials include in succession boulder clay, blue clay, glacial gravel, silt, peat and artificial surface fill. The thickness of the boulder clay varies from a few feet to 25 or 30 ft. The blue clay is 60 to 100 ft. thick. The glacial gravel ranges from 0 to 35 ft.; the silt from 0 to 18 ft.; the peat is very thin and shows in a few places only, and the artificial filling has a maximum depth of 15 or 20 ft.

CHARACTER OF SOIL

The borings made by Professor Crosby were rather widely separated. Soon after actual work was begun it was found that the character and surface levels of the glacial deposit changed frequently and rapidly. It was therefore thought necessary to make additional borings in the sites of the different buildings. A new set of seventy borings was made, and the character of the underlying soil was shown very clearly by sections through selected borings. Typical soil variations are shown in the diagram on page 236. The glacial deposit, set off by heavy horizontal lines, is seen to range through a considerable variation in thickness, sometimes tapering to practically nothing.

Three test pits were dug to a depth of about 22 ft. in order to check up the wash borings, all being near the western extremity of the plot. Ten concrete test piles and a large number of wooden piles were driven for the purpose of determining further the character, resistance and bearing power of the strata.

CAUSE OF OBSERVED SETTLEMENTS

A considerable part of Professor Crosby's report is devoted to the cause of the observed settlements of structures which surround the new site. In his opinion the settlements are only such as would be expected from a study of the foundations and the underlying earth conditions. It is his belief that, had the foundations of these structures been carried down to the glacial gravel or supported from it, the structures would not have settled to any appreciable extent.

By the term "glacial gravel" is meant that deposit found immediately above the clay, and varying in character from fine sand to coarse gravel. As this was generally well compacted and comparatively near the surface, it was decided to support the Technology foundations upon it wherever practicable. Where this deposit is extremely thin it has become necessary in parts of some buildings to depend upon the clay for support.

The clay found under the glacial gravel is of remarkably uniform character and only slightly plastic. It has been designated as "medium," being neither "stiff" nor "soft" except in a few places. Professor Crosby states that in its normal condition in the ground it is probable that all this clay is devoid of excess moisture, and fairly to be described as stiff. In only

a few locations was a hard crust found on either the glacial gravel or the clay.

How Settlement Danger Was Reduced

It has been assumed that if any settlement occurs it will be in the clay. In order to reduce this settlement to a minimum it was decided to spread out the building loads as much as practicable over the glacial gravel. This in turn would still further distribute the loads over the clay bed. It was desired to provide for a wide distribution of load on the gravel in the most uniform manner, with a resulting low pressure per square foot. For this purpose it was decided to use a large number of wooden piles, each sustaining a relatively small load, rather than a few heavily loaded piles. The accompanying figure shows a typical group of piles and the way in which the load is distributed.

This figure shows the piling under a footing resting in 12 ft. of gravel or sand and an assumed spread of the load accomplished by means of angles of distribution measuring 60 deg. with the horizontal. The building loads in this case were reduced to about ¾ ton per square foot on the surface of the clay. This, of course, is in addition to the load of the over-burden already found on the site.

A decision to distribute the load in this way precluded the use of concrete piles. It was found that wood piling would be less expensive than concrete piling. This was due to the fact that the permanent water level was high, making it unnecessary to place more concrete than that required for the foundations to meet the heads of the wood piling. Large piles do not prove economical where flexibility is required for light as well as heavy loads.

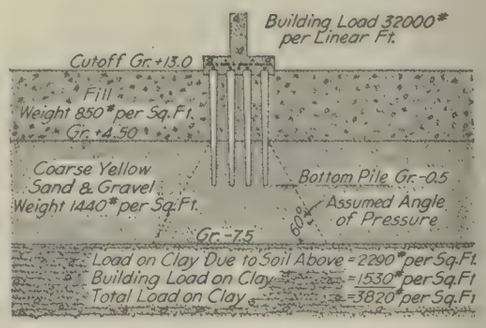
Tests of Piles

After deciding that wood piles were to be used, it became necessary to make a sufficient number of tests to determine the kind and length to use in different parts of the site. This task was rather difficult, owing to the great variety of soil conditions found, as already noted. The investigations were first carried on largely on the sites of the buildings forming the westerly part of the group, where both spruce and oak test piles were driven.

Spruce piles 1 to 10 inclusive were driven into glacial gravel. At these locations this is a well compacted and deep bed of material, commonly known as coarse sand and gravel, with varying depths. Upon being pulled, all these piles were found to be broomed or both broomed and broken. Three of them, Nos. 3, 5 and 7, assumed to be good at the time of driving, were load tested before being pulled. Because of their crippled condition, which was discovered after the tests were made, these results were of no special value except to show how these broomed and broken piles acted under load. The following brief description is given for that purpose.

Brooming of Spruce Piles

Spruce pile 3, 17 ft. long, with a diameter of 9 in. at the butt and 6 in. at the tip, was driven with a 2300-lb. hammer under short drops until the last few blows. Then an average drop of 9 ft. 8 in. was given and



ASSUMED DISTRIBUTION OF LOAD ON CLAY

a value of 16.7 tons obtained when using the so-called *Engineering News* formula:

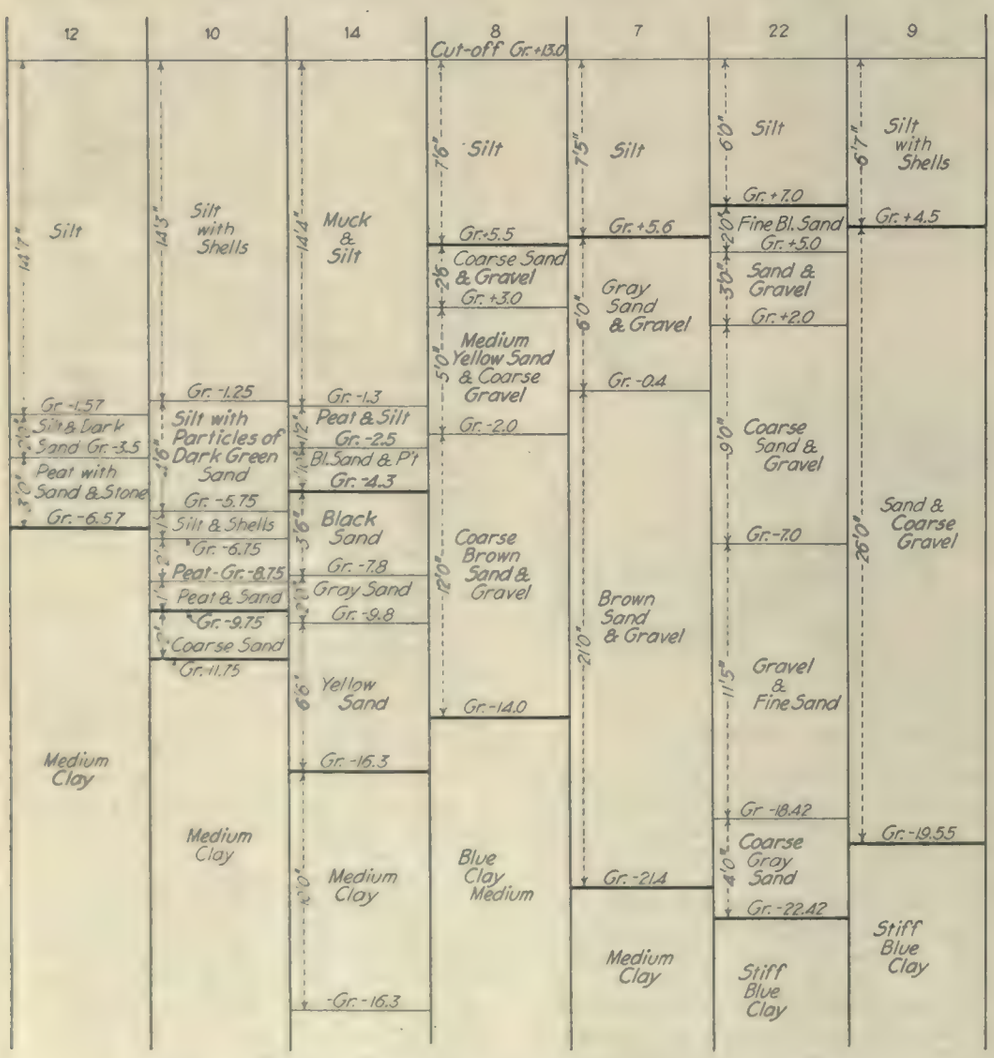
$$P = 2\,Wh/(S+1)$$

in which P is supporting power in pounds; W is weight of hammer in pounds; h is fall of hammer in feet, and S is penetration in inches. This pile passed through about 10 ft. 6 in. of loose sand, silt, shells and blue-black mud and penetrated into coarse sand and gravel about 3 ft. 9 in. When pulled after load testing it was found broken at about the surface of the gravel and badly broomed at the break. When tested with a load this pile caried 5.5 tons without noticeable settlement. When this load was doubled, however, it settled ¼ in. As would be expected, the increments of settlement after this were marked, and under a load of 48,674 lb. run from 19/32 to 1 in.

Spruce pile 5, with a diameter of 11 in. at the butt and a 6 in. tip, was driven likewise with a 2300-lb. hammer. With an average hammer drop of 6 ft. 2 in. in the last few blows, this showed an average settlement of ⅝ in. per blow, giving a formula value of 8.77 tons. This pile passed through about 9 ft. 7 in. of loose sand, silt, shells, silt and black mud, and penetrated the coarse sand and gravel about 5 ft. 1 in. When pulled, it was found broomed and broken just below the top of the gravel. When tested with the load this pile carried 6.8 tons, with a total settlement of only 1/32 in., but it settled quite rapidly for increasing loads. Under 18 tons load the settlement was 7/16 in. and the pile showed a marked tendency to get out of plumb. Under about 20 tons the total settlement amounted to more than 1 in. This pile showed great unreliability.

Spruce pile 7, 18 ft. 4 in. long, had a diameter of 10 in. at the butt and a 6 in. tip. It was driven with a 2300-lb. hammer having an average drop at the last blows of 10 ft. and an average settlement of 1¾ in. This gives a carrying value of 8.4 tons. This pile passed through 9 ft. 2 in. of loose sand, gravel, shells and mud fill, and penetrated the glacial gravel deposit about 5 ft. 9 in. When pulled, it was found broken and broomed just below the top of the gravel. When tested with a load, this pile settled 1/16 in. with 3 tons. The rate of settlement was quite rapid under succeeding increments, amounting to over 1 in. with 15 tons; over 2 in. with 26.5 tons; over 3 in. with 32.75 tons. After the load was removed, it recovered ½ in. of its settlement, showing the effect of the brooming. The typical photographs herewith show the effects noted.

It was plainly evident that spruce piles could not be driven with safety into the harder portions of this glacial deposit. After a study of the results obtained by a number of spruce piles which had been driven and pulled, it was thought best to limit the use of spruce to those places where

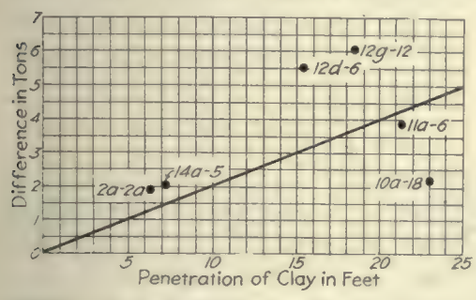


SECTION THROUGH TESTBORINGS, SHOWING TYPICAL SOIL VARIATIONS

friction was largely depended upon to give the bearing value, and very little dependence placed on point bearing. The test piles also showed that spruce piles, after driving, might appear good to the piling foreman and the inspector, and yet be found broomed and broken when pulled. This discouraged the use of spruce piles where sudden changes in the hardness of the soil were found or expected. Some of the marked and unaccountable settlements of structures noted from time to time may have been due to some extent to the practice of driving spruce piles into hard crusts, with resultant brooming.

GOOD RESULTS WITH OAK PILES

The tests also proved that first-class oak piles could be driven without injury into well compacted coarse sand or fine gravel to a resistance giving a bearing value of 18



EXCESS OF TEST VALUES FOR PILE IN CLAY ABOVE FORMULA VALUE

tons or more. Oak piles were used where the driving was hard, and where the supporting value of the pile was to be gained largely from point bearing and relatively small embedment in the hard stratum. For safety a maximum limit of 14 tons was permitted for oak piles; 10 tons was allowed for spruce, where these could be used.

From the driving records and boring sections the surface of the glacial deposit appears very uneven in places. Piles driven within a few feet of each other found bottom at levels differing by 10 to 15 ft. or even more. These conditions naturally made it difficult to get uniform pile formula values, and increased the cost of the pile driving.

EFFECT OF HARD FILL

The fill over the original mud flats consisted of mud, silt, shells and gravel. In some places this was very compact and offered considerable resistance to the piles. The friction of this material frequently entered into the final readings, and had a tendency to raise the value above its proper figure. Where a hard fill of gravel or shells was found over glacial gravel, with an intervening layer of peat, silt or mud, it was necessary to drive piles well into the glacial gravel to get their true value.

Not only will the hard fill above the peat and other material give the piles driven through it a high formula value at the time of driving, but it may afterward actually add to the real loads on the piles by reason of its friction when the peat or mud stratum becomes reduced in thickness through decay or displacement.

The varying conditions found have made it necessary to design the pile foundations on a basis of as nearly as possible uniform settlement. This uniformity is highly desirable to prevent overstress of the more or less continuous concrete floorbeams and slabs used in the superstructure of the buildings.

TABLE OF TEST RESULTS FOR PILES EMBEDDED IN CLAY

Pile No.	Length	Embedment Sand	Embedment Clay	Surface Grades Sand	Surface Grades Clay	Weight of Hammer, Lb.	Ave. Drop, Ft.	Ave. Pen. Last 3 Blows, In.	Formula Load, Tons	Test Load at 1-16 in. Settlement, Tons	Factor of Safety at ¼ in. Settlement	Allowable Value for F. S. of 2.5 Tons
14a5	35′ 10″	11′ 6″	7′ 3″	—1.5	—13.0	2,600	10	3⅝	5.50	5.5	6.5	7.5
12d6	42′ 6″	11′ 6″	15′ 4″	—1.5	—13.0	2,600	10	3	8.30	9.0	4.0+	13.0
2a2a	35′ 9″	12′ 6″	6′ 2″	—1.5	—14.5	2,150	10	2	7.16	10.0	2.3	9.0+
12g12	45′ 0″	1′ 5″	18′ 4″	.....	.....	2,600	10	3⅝	5.80	15.43	2.0	12.0
11a6	50′ 0″	0′ 0″	21′ 2″	0	—13.2	2,580	10	4¾	4.50	12.80	1.63	8.4
10a18	42′ 6″	0′ 0″	23′ 0″	0	—6.6	2,300	10	3	5.80	12.80	1.60	8.2

The working values have been taken at about 1/16 in. settlement as shown by the tests. It is believed that most piles have an initial settlement, whether noted or not, and considerable care was taken to note settlement at all times where the change was as large as 1/64 in. It is also believed that the effect of the difference in settlement of 1/16 in. in the foundations can be easily ignored. A settlement of ¼ in. was considered to be the limit of usefulness of the pile. It was assumed that settlements greater than this create conditions which might cause very unsatisfactory results. It was also considered necessary that the piling have a safety factor of not less than 2.5 on the tonnage based on ¼ in. settlement.

From the results of the test piles it is evident that in the majority of cases the piles had to be driven quite deeply into the sand to assure a satisfactory value. An effort was made to keep the piles in the glacial sand, even where it thinned up, for it was desirable to use the sand stratum as a medium for spreading the loads out over the clay under it. An effort was made to have a minimum of at least 3 ft. of sand under the points, even where the sand thinned up, in order to make the spreading of the load somewhat effective. But it was found that there were places where the sand was very thin, giving little value to the piles. To ascertain the value of the clay under working and ultimate loads, some piles driven both partly and wholly into the clay were load tested. Two of these were also re-driven, as were a number of others. The results showed in many cases a formula value over twice as great as the value obtained when originally driven.

SAFE WORKING VALUES

Regarding the safe working values, the tests showed that for the assumed limits of settlement and safety factor, piles driven into sand could be used at their formula value, but not much higher. On the other hand, piles embedded in the clay found at this site showed an ability to carry test loads in excess of the formula value, as indicated on the figure herewith, and in the table. The curve shown in the diagram indicates that the allowable increase on the formula value appears to be about 1 ton for every 5 ft. of embedment in the clay.

Full advantage was taken of this fact where the gravel and sand became either unreliable or of no practical value, or where they disappeared. Piers were frequently made in clay in which the average formula value for the piles was 6 tons or less, but owing to the high value shown by tests these were allowed a value fully 50 per cent greater, provided it was evident that the piles were well embedded in the clay.

Three piles showed a high tonnage at 1/16 in. settlement which, when compared with the tonnage at ¼ in. settlement, gave a low factor of safety. But when the allowable value was reduced to get a factor of about 2.5, there was still a very substantial amount above the formula tonnage found at the time of driving. It is interesting to note that the formula tonnage found by re-driving the piles, after they had been allowed to set thoroughly, did not represent either the value under test load at 1/16 in. settlement, or the allowable tonnage.

DESIGN TO PREVENT VIBRATION

Another feature in the problem of these foundations is the matter of vibration due to internal and external forces. It was, of course, necessary to construct the foundations in such a way as to reduce the possibility of vibration to a minimum. This was not only for comfort, but because some of the laboratories will contain instruments of special accuracy and delicacy. Special care has been taken with the foundations under heavy testing machinery, to reduce the possibility of settlement and excessive vibration. A sufficient number of well-driven piles is placed under such machines, each being allowed about one-half of the value given to the piles under the building walls.

The greatest vibration will come to the structures from external sources, such as





BROOMED AND BROKEN TIPS OF SPRUCE PILES

engines in nearby power houses, from trains, electric cars, etc. These vibrations will be conveyed to the buildings by the comparatively hard top fill which lies over the stratum of mud, silt and peat. Peat is found in some locations within the building site. It is probably general on the north and east sides of the buildings, extending through that portion of East Cambridge where a number of factories and power houses are located. Nearly the entire site of the new buildings has a stratum of silt, mud and fill above the sand and clay. The buildings have, therefore, for their entire lengths above that part embedded in sand or clay, a foundation of piles which pass through a material affording very little lateral support.

Under the action of driving the piles this material softened to such an extent that it allowed the piles to vibrate strongly, even throwing mud and water out around them. Structures which are supported on piles passing through such soft water-filled strata not only readily send out vibrations, but are strongly affected by vibrations from other sources situated along the same strata.

One method of resisting in part such a tendency is to drive the piles well into the supporting strata, rather than resting them on the surface or with a foot or two only of penetration. As the pile tests show that it was necessary, generally, to get a fair embedment in order to obtain the bearing values desired, it was unnecessary to make a large increase in that embedment in order to gain stiffness.

In general, the allowable loads per pile average 9.5 tons for interior piers and 8.75 to 9 tons for exterior piers and walls. It is believed that if settlements occur the small difference in loading will tend to make slightly greater settlements in the center of the building. This will prevent the bulging tendency of the walls, which would occur if the wall piles settled more than the interior piles.

Foundations Above Piles

Reinforced-concrete spread footings were used to distribute the wall and column loads to the piles. Such footings are permissible only when placed on a compressible surface of practically uniform resistance. This will produce bending stresses in the footings similar to those produced by a uniformly distributed load.

The permanent ground water level permitted the cut-off grade of piles to be fixed at 13 ft. above the Cambridge datum, which is 4.1 ft. below the basement floor level. With few exceptions, this difference of 4.1 ft. between the floor and the pile cut-off permitted the reinforced spread footings to be placed without lowering the cut-off. The design of these footings was based on the formulas recommended by Prof. Arthur N. Talbot of the University of Illinois, in Bulletin 67, as determined from the result of many experiments.

This work of pile testing and design was conducted by the writers as consulting engineers for the contractors, the Stone & Webster Engineering Corporation.

For Solidification of Railroad Fills H. C. Phillips, valuation engineer of the Santa Fé system, speaking for the railroads at the recent valuation conference, stated that he would allow an increase in value of 2 per cent per year for five years and 1½ per cent thereafter until the total enhancement reached 25 per cent.

Letters to the Editor

Comment on matters of interest to engineers and contractors will be welcomed

Waterworks Summary Should Show 24 Plants in Porto Rico

Sir: I note on page 13 of the Engineering Record for July 3, in the statistical summary of American waterworks, that Porto Rico is credited with seven towns as having waterworks. This figure should be 24, as there were nine on the Island when I went there in 1911, and there were constructed during my three years' stay fifteen waterworks, which I designed and of which I supervised the construction. It is possible that there are now even more, for when I left in 1914 I had prepared plans for nineteen other towns, on some of which, at least, it was hoped to start construction at an early date.

Richard M. Merriman,
Central Valley, N. Y. Civil Engineer.

Experiments on Separate Digestion of Activated Sludge Needed

Sir: The several large scale experiments on treatment of sewage by means of aeration and contact with activated sludge, being conducted in America as a result of the success of the smaller scale investigations begun in England, have aroused interest and hopes that from them may possibly be evolved a more economical method of treating the sewage of large communities than by tanks and percolating filters. The data so far published indicate the possibility of producing by the activated sludge process a clear, bright, well oxidized effluent and a high percentage removal of bacteria. It further appears that the resultant sludge is of high percentage moisture, but readily separates therefrom.

The investigations of Ardern, Lockett, and Duckworth in England show that the complete process may be divided into two parts: First, clarification and removal of putrescence; and, second, nitrification and maintenance of the sludge in an activated state. In the disposal of the sewage of large cities generally, only clarification is needed at the present time, but provision should be made in the design of works so that, with increasing population and raised standards of cleanliness required for water courses, the treatment could be increased to include oxidation. The activated sludge process seems to be particularly adapted to meet this condition, for but short periods of aeration in contact with activated sludge effect a practically complete removal of suspended and colloidal matters. The difficulty at present seems to be that unless aeration is continued until the sewage is well oxidized the sludge loses its activity.

Ardern has suggested that economy may be obtained by aeration of sewage in contact with activated sludge only to the point of clarification and aeration of the sludge without sewage to maintain its activity. The writer feels that experimenters have neglected this possibility on account of the apparent ease in carrying on aeration to the point of high nitrification. A town on the bank of a river suitable for disposal of sewage by dilution wastes its public funds in completely oxidizing artificially at considerable expense what the stream is able to do naturally at no expense.

The high percentage moisture in the sludge and the complete removal of suspended matter indicate a large volume of wet sludge per million gallons of sewage treated and, further, it is reported that while, as first withdrawn, the sludge is inodorous, if kept for a few days putrefaction sets in.

It would therefore appear that experimentation on the separate digestion of the activated sludge would be desirable in order to obtain a sludge of less bulk and free from odor as obtained at Baltimore, Md., and Birmingham, England.

W. L. Stevenson,
Assistant Engineer, Bureau of Surveys, Philadelphia.

Engineers for Public Boards and Commissions

Sir: Cognizant of the fact that boards and commissions in the service of the State of Massachusetts whose duties are chiefly civil engineering are and have been made up of men who have had no civil engineering training and experience, a concerted effort is to be made by civil engineers and others to see to it that the Governor shall be impressed with the great need for proper technical representation upon such bodies.

Too long persons whose qualifications have been chiefly political, social or otherwise have been appointed to positions on important boards and commissions of this commonwealth, where civil engineering knowledge and experience should have been essential requisites.

It is not to be presumed, however desirable it may be, that such public bodies shall be made up entirely of men possessing the aforementioned qualifications; but the present tendency toward economy and increased efficiency in public affairs demands, if advance is to be made along these lines, that bodies of the public service under consideration here, shall have among their memberships at least some one who shall possess among others the desired qualifications, viz., civil engineering knowledge and experience. It cannot be denied that this is highly desirable and necessary in the light of facts well known to civil engineers, and often all too evident.

Chas. C. Carroll.
Secretary, Public Service Civil Engineers' Association of Massachusetts.
Boston, Mass.

[This journal has repeatedly urged the desirability of engineer-members of public bodies having control of engineering works. It has endorsed heartily the efforts of engineers of New York State to impress this view on the constitutional convention now in session at Albany. To make its appeal to the Governor most effective the association sending the communication printed above should enlist the co-operation of all other societies of engineers in Massachusetts.—Editor.]

HINTS FOR THE CONTRACTOR

Details Which Save Time and Labor on Construction Work

Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

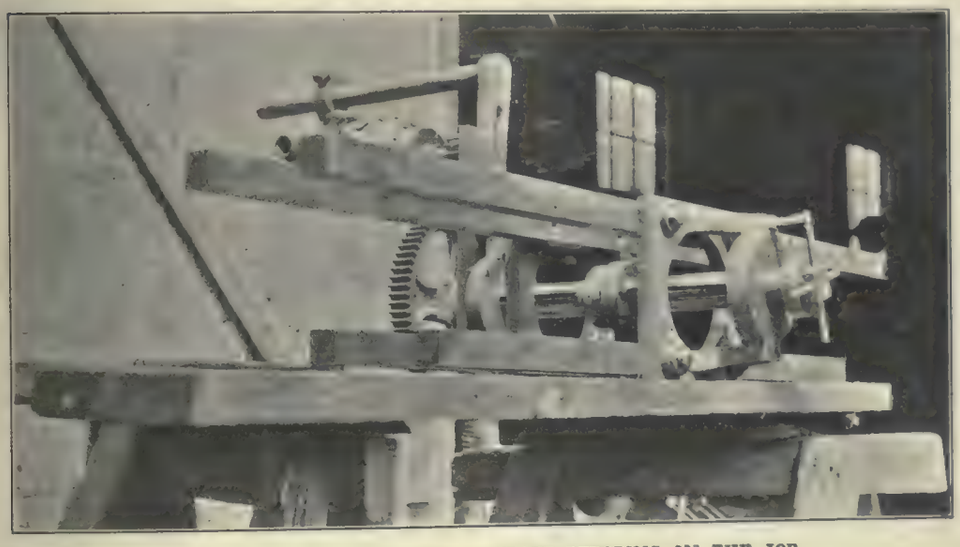
[*Contributions to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

Tool for Reboring Cylinders Run by Air Boring Machine

By WALTER BAZORE

Master Mechanic, Rapid Transit Subway Construction Company, New York City

AN AIR BORING machine is shown in the accompanying photograph geared to a small lathe used for reboring cylinders. The cutter head of the lathe, which is shown in the center, is mounted with a sliding fit on the main shaft. Through it passes the feed screw, which lies in the slot shown in the side of the shaft. At the right side of the machine is seen a bolt projecting from the top of the frame. At each revolution, as the head of the feed screw, which is, of course, eccentric with the shaft, comes on top, one of the arms projecting from the head strikes this bolt and gives the screw one-eighth turn before it is released and slips past the bolt. The shaft is driven through three gears by the air motor, which is shown at the left, on top. The spindle of the first gear in the series fits into the chuck of the air machine.



HOME-MADE LATHE DOES ACCURATE REBORING ON THE JOB

The machine is shown assembled with four long bars of chrome steel, with very carefully machined plane surfaces. These are used in attaching the machine to its job, where that method is more convenient than dismounting the part to be rebored and taking it to the machine shop. The tool was used recently to rebore a 6-in. diameter hole 7 in. long for one crank pin of a 5000-ft. air compressor. After the machine was set in position, the hole was rebored exactly true at one operation, which took eighteen minutes.

This machine was made from spare machine parts without a great deal of labor, for reboring worn cylinders of hoisting engines, etc., right on the job. It was built by the writer, and is used in the machine shop of the Rapid Transit Subway Construction Company's power plant at Forty-second Street and East River, New York City.

Rock Drills Must Be Well Maintained to Secure Efficiency

THAT CLOSER attention to renewing worn parts in rock drills and to making properly shaped shanks on the steels used results in an increase of power efficiency and in eliminating delays due to broken drills was well brought out by George T. Cousins in addressing a recent meeting of the National Lime Manufacturers' Association. The parts of the ordinary reciprocating drills which wear most quickly are the cylinder, piston and rod, and the front head, or, in drills that have them, the front head bushing. The front head is mainly depended on to keep the piston true in the cylinder. The side thrust of the piston rod, combined with particles of rock dust adhering to the rod, wears the front head after a time so that the piston is no longer held true. The result is rapid wear of the cylinder. Bushings and front heads are less expensive than cylinders, and should be renewed as soon as they begin to wear. Rough piston rods are a frequent cause of leaky packing, and care should be exercised to keep them smooth. Valves should be kept tight, as a drill will not do good work if air is flowing through all ports at the same time. A little wear on the valve will have a surprising effect in the operation of the drill.

Neglect in oiling drills until after the runner has been reminded that they use oil by having the valve stick is not unusual. Carrying oil in open cans and coffee pots with the lids gone results in pouring grit into the machine with the oil and wearing it very rapidly.

The troubles of a hammer drill are somewhat different from those of a piston drill. The feature that causes the most trouble is bad shaping of the shank of the drill steel. Using steels with broken shanks very quickly results in a broken anvil block. The end of the shank must be made smooth and true, and the larger the end, the better. Sometimes the ends are beveled around the edge until a face the size of a dime is all that is left for the piston to strike. The result is that a cup soon wears in the piston or anvil block, and a break results. If the shanks are carelessly hardened, they are apt to break in the drill and cause trouble. Even if the ends of the shanks are ground on an emery wheel, they should be tried with a square to make sure that they are true.

Broken steels and anvil blocks are sometimes caused in this type of drill by a worn front-head bushing or a worn rotating sleeve. This sleeve wears large, and allows the steel to tilt in the hammer, so that the anvil block does not strike it a square blow.

If the rotation parts of a hammer drill are worn, and back-lash exists, the rotation does not start to turn when the piston begins to move, but all of the back-lash is taken up with a snap near the middle of the stroke when the piston is moving fast. This is very hard on the rotation parts. Frequent oiling is essential with the hammer drill if good results are to be expected.

Steam Shovel Cuts Costs of Repairing Sub-Grade on Paving Contract

By ALBERT D. BLAKESLEE

Superintendent for C. W. Blakeslee & Sons, General Contractors, New Haven, Conn.

DURING the season of 1914 C. W. Blakeslee & Sons had about $500,000 worth of street paving to do for the city of New Haven, and the Connecticut Company, which operates the trolley lines in New Haven. A large part of this was wood block, some sheet asphalt, and on secondary or light traffic streets we laid bituminous macadam. In preparing the sub-grade for wood blocks we had to remove 10½ in. and for asphalt 9 in. of old macadam on a telford base.

At the beginning of the season we broke up the pavement with a 10-ton road roller, using picks in the wheels and pulling a rooter plow. It took all of the roller's time to do this, and three men to hold the plow.

After a short while we had a model 31 revolving Marion steam shovel idle so we decided to try using it. The boom was too high to go under the trolley span wires, so we spliced the hog rods about 4 ft. with some heavy chain, lowering the boom enough to clear wires. We excavated one side of a street at a time loading the teams on the old pavement on the first cut and loading on the new finished pavement on the second.

The following lists of men, teams and equipment give an idea of the saving:

COSTS OF PREPARING SUB-GRADE WITH ROLLER AND PLOW AND WITH STEAM SHOVEL

Old Method	*New Method*
1 10-ton roller (1 engineer)	1 model 31 revolving steam shovel (1 engineer, 1 fireman)
1 rooter plow (3 laborers)	1 foreman
2 foremen	6 laborers or pit men
30 laborers	9 to 11 teams
1 mold-board plow—1 double plow team (this team also did the towing out)	
13 to 15 double teams	

The difference in the number of teams is accounted for by the fact that only one team is standing loading at a time, and it only takes 2 min. to load instead of 10 to 15 min. Also there is no plow or tow team needed. Needless to say Blakeslee & Sons would not tackle a job of this kind again without a shovel.

Explosives Loosen Hard Ground for Driving Concrete Piles

BY THE USE OF explosives to break up hard ground concrete piles have been driven in the Philippines where other conditions called for a pile bridge, but where the ground would not ordinarily allow piles to be driven. Frank P. James, writing in the *Quarterly Bulletin* of the Bureau of Public Works of the Islands, tells how he employed this method on the Cabugao Bridge, Ilocos Fur.

The strata encountered included gravel compacted with sand and clay and carrying boulders up to 10 in. in diameter. From experiments on another bridge, where black powder had been used to loosen stiff clay for the same purpose, it had been determined that the ground was broken up about down to the bottom of the charge placed to make way for the piles. As nearly 20-ft. penetration was required on the piles on the Cabugao bridge, the explosive cartridges used were placed so that their lower ends were about 19 ft. below surface. There were five piles in a bent, and three shots were necessary for each bent, one each at the location of the two end and the center piles.

METHOD OF CHARGING GROUND

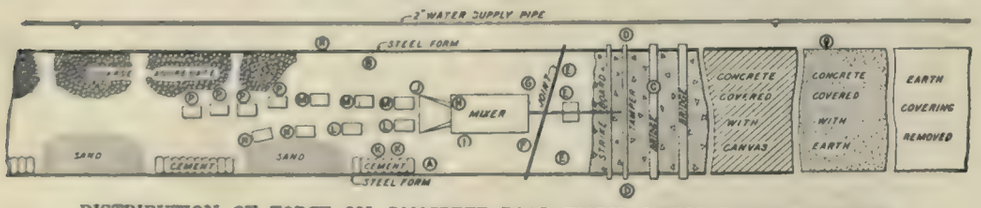
The charges were placed by driving down a 3-in. diameter galvanized length of pipe about 20 ft. long. A coupling was placed on the driving end of the pipe, and the lower end was fitted with a cap which remained in the ground. One cap was required for each hole. These caps were made of pieces of old steel plate ½ in. thick and 7 in. square. The plates were notched deeply on their four sides, and the corners thus left bent up to fit around the end of the pipe. A hole was punched in the center of each plate through which a 2-in. piece of ¾-in. round steel was driven, while the plate was hot, to form a point and guide the pipe in driving. The charge for each shot was loaded in a 2½-in. diameter tin tube about 39 in. long, in the bottom of which was tamped about 28 in. of powder. Above this were loaded two exploder sticks of dynamite, which was required to set off the type of powder used, and around these sticks was packed the contents of a third broken stick. Each of the exploder sticks had a cap and fuse of its own, to insure detonation. Above these were put more powder and a wad of thin paper such as is used to wrap rolls of fuse. The whole was sealed with asphalt or white lead, and the end of the tube was crimped slightly.

When the 3-in. pipe had been driven to the required grade, the charge was dropped to the bottom of it, and a 1-in. pipe was lowered around two fuses. The 3-in. pipe was then pulled about 6 ft. by a rope running to the engine of the driver, allowing dirt to run in around the cartridge. The 1-in. pipe was then withdrawn, and the 3-in. pipe pulled all the way out. One of the fuses was cut about a foot longer than the other to insure safety in lighting, which was done with a torch.

After the three holes for each bent were fired, the concrete piles were driven. Very satisfactory results as to grade were obtained, a few inches remaining below the disturbed ground in every case after the shot into which the tip of the pile could be driven. The bearing power developed exceeded the requirements.

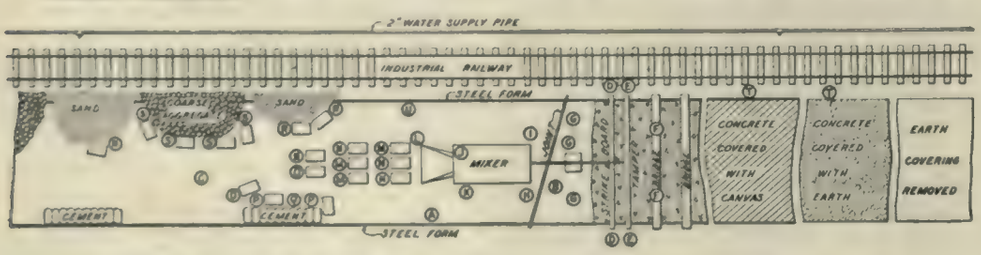
How Do You Man Your Paving Mixer?

ORGANIZING a force of laborers to operate a paving mixer efficiently requires considerable skill. The accompanying diagrams, which are taken from Bulletin 249 of the United States Department of Agriculture, written by C. H. Moorefield and James T. Voshell of the U. S. Office of Public Roads, were worked out by a contractor with wide experience in concrete road construction. The mixer in both cases is fully manned, and each laborer has definite work to perform. The diagrams cover only the men engaged in mixing and placing the concrete. Labor for preparing the sub-grade, setting forms, and covering the concrete with earth should be provided in addition. Once started, the operation of concreting should be as continuous as the weather will permit, if low costs are to be maintained.



DISTRIBUTION OF FORCE ON CONCRETE ROAD WORK, USING TWO-BAG MIXER

A, foreman; B, subforeman; C, finisher; D, 2 laborers striking and tamping; E, 3 laborers placing concrete and assisting in striking; F, mixer tender; G, laborer cleaning subgrade and setting joints; H, mixer engineer; I, fireman, also sprinkles subgrade; J, laborer assisting wheelers and cement handlers; K, 2 laborers handling cement; L, 2 laborers wheeling sand; M, 3 laborers wheeling coarse aggregate; N, 2 laborers loading sand; P, 4 laborers loading coarse aggregate; Q, laborer sprinkling pavement; R, water boy. Total, 2 foremen and 25 laborers. □ indicates wheelbarrow.



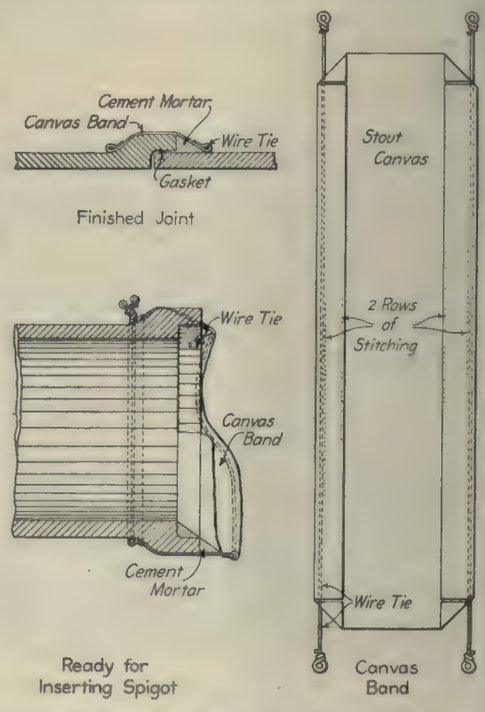
DISTRIBUTION OF FORCE ON CONCRETE ROAD WORK, USING THREE-BAG MIXER

A, foreman; B, subforeman on placing concrete; C, subforeman on charging mixer; D, 2 laborers striking; E, 2 laborers tamping; F, 2 finishers; G, 3 laborers placing concrete; H, mixer tender; I, laborer cleaning subgrade and setting joints; J, mixer engineer; K, fireman, also sprinkles subgrade; L, laborer assisting wheelers; M, 3 laborers wheeling sand; N, 4 laborers wheeling coarse aggregate; O, 2 laborers wheeling cement; P, 2 laborers handling cement; Q, laborer opening bags; R, 3 laborers loading sand; S, 4 laborers loading coarse aggregate; T, 2 laborers sprinkling pavement; U, water boy. Total, 3 foremen and 36 laborers. □ indicates wheelbarrow.

Mortar Joint Laid with Canvas Band in Wet Trench

By D. H. FLEMING
Assistant City Engineer, St. Catharines, Ontario

THE CANVAS band and the method of using it shown in the accompanying drawing have enabled good cement-mortar joints to be made in sewer pipe laid in wet



CANVAS BAND PROTECTS CEMENT JOINT

trenches. The stout canvas band is a few inches longer than the circumference of the bell of the pipe, and is of sufficient width to completely envelop the bell and its mortar joint. A small pliable wire is inserted between the double stitching along each edge, and is looped at each end to avoid its coming out. The band is fastened around the bell of the last pipe laid by twisting up one of these wires. This is done with each section of pipe before lowering it into the trench. The joint is made in the usual manner with the gasket and cement-mortar, the lower half of the canvas band being filled with mortar as well as the invert of the bell. After the spigot end of the next length of pipe is in place, the second wire tie is fastened around it. This draws the band up tight around the joint, and prevents water in the trench from washing the cement out of the mortar joint.

The joint protector is not withdrawn, but remains as a permanent part of the construction. It was devised and used with great success by E. R. Gray, at the time he was district engineer in the sewer section of the Department of Works, Toronto, Ont. Mr. Gray is now chief assistant city engineer of Hamilton, Ont.

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

Attempt to Modify Contracts After Awards Are Made

Court Order Results from Action of New York City's Board of Estimate in Striking Out Clause When Contract Is Approved

By approving several subway contracts with the omission of a clause providing for an adjustment between the Public Service Commission and the contractor of the payment for extra work ordered, the Board of Estimate of New York City has become involved in a law suit which, it is said, may delay the completion of the New York municipal lines in Manhattan. The form of contract, the same as that in force on all work on New York's subways for over two years, had been approved by the Corporation Counsel, officially representing the Board, as required by law, before bids for this work were advertised. The work was let, and the contracts awarded and sent to the Board for final approval by the Public Service Commission.

The Corporation Counsel is quoted in the press as holding that the omission made by the Board of Estimate is equivalent to a rejection of the contracts, as the Board lacks authority to modify them after bids have been received and awards made. One of the contractors affected, the Holbrook, Cabot & Rollins Corporation, has refused to accept its contract, holding that it is now void. They have secured from Justice Delehanty of the New York Supreme Court an order to the Board of Estimate to show cause why the Court should not issue a writ of mandamus compelling the Board to expunge from its record its action taken in striking the extra work clause from the contract. Such a writ, if issued, would cause the contract to stand approved in its original form, and would make an easy way out of the tangle.

Express Track "Humps" in Operation on Ninth Avenue, New York

The Ninth Avenue express trains in New York City were put into operation over the new "hump" construction at stations for the first time on Monday, Aug. 16. This is the first operation over any of the Manhattan elevated improvement work. On this line a center express track had been in operation before the improvement, but new upper-level platforms reached by the general type of hump construction described in the Engineering Record of July 31, page 138, had to be constructed at the Fourteenth Street, Thirty-fourth Street, and Sixty-sixth Street stations.

These station platforms are not completed, but the steelwork for the center track has been erected and, in addition, the grade crossing at Fifty-third Street has been eliminated. Two weeks only were required for this work, express train operation being suspended between Aug. 2 and Aug. 16. The work was done by Terry & Tench and Snare & Triest, contractors, associated with the T. A. Gillespie Company, executives.

Start Work on Big Oil Storage Reservoir in California

Work has been started on the oil storage reservoir of the General Petroleum Company near Port Arthur, Cal., which, it is said, will be the largest reservoir of its kind in Southern California. It will have a capacity of 500,000,000 barrels and will be used for export storage. Its roof, which will be of redwood, will cover 3½ acres. The reservoir will be concrete lined.

"Eastland" Righted by Cables and Water Displacement

On Aug. 14, three weeks after toppling over in the Chicago River, the Eastland was raised to an approximately upright position by the Dunham Towing & Wrecking Company of Chicago. Shifting of coal in the bow to the port side and the influx of water from holes that had been imperfectly covered caused considerable delay.

Two cables were used in raising the boat. One was attached to the iron standard streak on the starboard side of the steamer and then run around the boat and attached to the stern of the Dunham Company's tug "Favorite." The other cable was attached to the "chop" at the other end of the boat, and run around and made fast to a pontoon. Both the "Favorite" and the pontoon were filled with water until the former was dropped down to a depth of 8½ ft. and the latter to a depth of 9 ft.



TUG AND PONTOON RIGHTING THE ILL-FATED EASTLAND IN CHICAGO RIVER

The cables being attached as described, rotary centrifugal pumps were set at work pumping water out of the tug and the pontoon. As the two rose the Eastland was slowly raised and, after four hours, floated once more. A good share of the three weeks' time was spent in sealing the openings under water so that the water could be pumped out of the boat itself.

Los Angeles Aqueduct Water Goes to Hollywood District

The Board of Public Commissioners of Los Angeles, with the approval of the Railroad Commission of California, ratified, Aug. 6, a contract between the city of Los Angeles and the Union Hollywood Water Company, which authorizes taking over and operating by lease that portion of the Hollywood Company's water mains outside the limits of the latter city. The mains lying within the city boundaries were taken over by Los Angeles some time ago. The total cost of the system in and outside the Hollywood limits is $568,408 with interest at 6 per cent from June 1. The rental on the proposed lease basis is to apply on the purchase price, pending an election on a contemplated $1,000,000 bond issue to be held in the district.

Galveston Storm-Swept

Damage May Exceed That of 1900 — Conflicting Reports Received as to Condition of City's Sea-Wall and Causeway

The extent of the damage to engineering structures by the Galveston storm this week is more or less a matter of conjecture, for telegraphic communication has been so completely demoralized that no replies to this journal's despatches were received before going to press. The structures of Galveston of principal interest to engineers are the sea-wall and the causeway which connects the island upon which the city is located with the mainland. Reports state that both of these works have been damaged. One story, which it has not been possible to confirm, says that about 1000 ft. of the sea-wall has been washed out and that a section near the middle of the causeway has been demolished. On the other hand, the Concrete-Steel Engineering Company of New York, which designed the causeway, has informed this journal that reliable information has been received to the effect that the causeway is intact with the exception that portions of the earth-fill approaches have been damaged by the storm. It is claimed also that the draw-span near the center of the structure has not been destroyed. Some of the despatches report great damage to the city's water supply system.

The U. S. Weather Bureau has received from Houston a special report stating that the storm center passed south of that city about 5.30 a. m., Aug. 17, with the lowest barometer at Houston 28.21 in. and a wind velocity of 80 miles per hour and rainfall 7.18 in. in the preceding 24 hours.

Columbia River Highway Dedicated

The newly completed Columbia River highway from Portland to Gearhart, Ore., a distance of 125 miles, was officially christened Aug. 12. Forty automobiles traveled the distance in less than seven hours' running time. Many of the municipalities declared a holiday and, at Gearhart, the festivities continued far into the night. This road affords the city of Portland an easy overland route to the ocean and opens up wide tracts of land to settlement.

Seattle Completes Municipal Grain Elevator

A 500,000-bu. bulk grain elevator built, owned and operated by the municipality has just been completed and has received its first consignment of grain at Seattle, Wash. Its function is to provide storage for the local flouring mills, and to facilitate the interchange between rail and ship transportation in handling the product of the grain fields of Montana, Idaho and Washington.

The structure is entirely of concrete, 165 ft. high, and has a receiving capacity of 95 cars per 24 hr. and a bulk shipping capacity of 20,000 bu. per hour. The equipment is all electrically driven. Four railroads have access to the elevator which stands between the tracks and dock. The costs of the structure were as follows: Foundation, $25,162; superstructure, $197,900; cement, $15,800; bulk shipping galleries and equipment, $31,000; track, $10,000; miscellaneous, $2,000; total, $281,862.

Missouri Pacific System Goes Into Receivership

Benjamin F. Bush, president of the Missouri Pacific and the St. Louis, Iron Mountain & Southern Railways, was appointed receiver, Aug. 17, of the two lines. The immediate causes of the receivership are the inability of the system to meet interest payments of almost $2,000,000 due Sept. 1, and the refusal of some of the security holders to accept the reorganization plan recently announced. The system embraces 7285 miles, and ranks next to the Rock Island system, which went into receivers' hands last April, as the largest railroad system in the country to go into bankruptcy.

California Public Utilities All Go Under Commission Jurisdiction

All privately owned public and quasi-public utilities in California, together with the power for fixing service rates, became, on Aug. 7, subject to the jurisdiction of the railroad commission of that State. The only exceptions to State control are utilities owned and operated by municipalities within municipal limits. The extension by a municipality of public-utility service outside of its boundary limits, however, brings such service within the jurisdiction of the commission.

Differences Over Hetch Hetchy Valley Construction Adjusted

Differences between nature lovers and the city of San Francisco regarding the flooding of Hetch Hetchy valley to facilitate construction of the dam, have been adjusted, it is stated, and the building of the temporary diversion dam which will flood the floor of the valley, is to be commenced at an early date. Over part of the route, the grading for the railroad to the dam site has been completed, and it is hoped that work on the dam can be commenced next summer. A description of the Hetch Hetchy project will be found in the Engineering Record for Feb. 20, 1915, page 226.

Wisconsin Legislature Changes Highway Law

No longer do the State highway officials in Wisconsin have any check on the eligibility of the county highway commissioners. Formerly these men were examined and more than one might be placed on the eligible list from which the county commissioners could make appointments, but the last Legislature has eliminated this feature. By the present law a county road committee is to be appointed by the county commissioners. A member of this committee may or may not be a commissioner. The committee appoints the road commissioner and will handle all road affairs including the purchase of machinery. State-aid work is to be handled under State inspection in much the same way as at present, but appropriations have been cut practically in half. For the engineering work $65,000 annually is available instead of $100,000.

Local Firms Low Bidders on Philadelphia Transit Contracts

First Earth to Be Turned on Subway Section September 13—First Steps Had Been Taken in May, 1912

Two Philadelphia firms were low bidders on the first two sections of that city's new rapid transit lines. The bids were opened on Aug. 16 after the Pennsylvania State Public Service Commission had issued a certificate of public convenience permitting the letting to proceed. Citizens of Philadelphia voted $6,000,000 on April 29 last by an overwhelming majority to begin this work. Of this City Council has appropriated $3,000,000 for the first subway section and $3,000,000 for the first elevated section. The low bid of $1,700,000 for the first subway section was, therefore, very gratifying to the city. The other bid of $142,590 was for the construction of foundations for about four miles of the Frankford Elevated line. The subway section on which bids were opened will extend from Filbert Street to Broad Street under the Philadelphia City Hall.

Three Years' Fight for Transit Facilities

The opening of these bids marks the end of more than three years' work on the part of the Department of City Transit of Philadelphia in planning a rapid transit for the city and in educating public opinion to back the project and secure its adoption. In use and under construction New York has 633 miles of rapid transit lines, Chicago has 275 miles and Boston 36 miles, while Philadelphia's present high speed system contains less than 15 miles of track. The present population of Philadelphia is nearly as great as that of Chicago. Philadelphia's transit problem has received a most thorough and careful study under the direction of A. M. Taylor, director of the Department of City Transit. The city was divided into 113 traffic sections, and the flow of traffic from each section to the rest of the city was actually measured by observers of the Commission, and the result, with relation to the population of each district and the present and

Construction Work on Winnipeg's New Aqueduct Is Well Under Way



CONCRETE AGGREGATES WILL BE SCREENED AT CENTRAL PLANT



CONSULTING ENGINEER JAMES H. FUERTES ON AQUEDUCT RAILWAY



SHOVEL STRIPPING LINE AT MILE 43



DRAG-LINE EXCAVATING TRENCH AT MILE 71

proposed transit lines plotted on a large number of maps. The structural features of these rapid transit facilities were designed in the light of experience gained in the large cities of this country and Europe. The two lines proposed for immediate construction, the Broad Street subway and the Frankford Elevated line, will cost together nearly $42,000,000. It is estimated that they will save the traveling public 36,000 hr. per day. The cost of the lines is well within the borrowing power of the city, and it is estimated that while their operation will not be immediately profitable, the indirect benefits to the city, such as the increase in the taxable value of property, will make the investment in these lines a very profitable one.

The entire plan has been vigorously opposed from several quarters. The latest move of the obstructionists was a taxpayer's suit begun to halt the entire project. It is expected, however, that the Public Service Commission's decision of Aug. 14 authorizing the beginning of construction will foredoom this suit's failure in the Courts. On September 13 the first spadefull of earth will be turned on each contract with appropriate ceremonies.

Speakers and Papers for Engineering Congress Announced

The names of the speakers for the International Engineering Congress, to be held at San Francisco, Sept. 20-25, and the subjects of their papers have been made public. The program of the congress is as given on page 150 of the July 31 issue of this journal. Following are some of the speakers and papers of particular interest to civil engineers:

The Panama Canal

Gen. G. W. Goethals, "Introductory Chapter."
Emory R. Johnson, "Commercial and Trade Aspects of the Panama Canal."
Capt. R. E. Woods, U. S. A., "The Working Force of the Panama Canal."
F. C. Boggs, "Purchase of Supplies for the Panama Canal."
Donald F. McDonald, "Outline of Canal Zone Geology."
F. D. Wilson, "Climatology and Hydrology of the Panama Canal."

Waterways

W. H. Bixby, Brigadier General, U. S. A., retired, "The Province of Waterways in Internal Commerce and Development of a Country."
C. S. Riche, Lieutenant Colonel, Corps of Engineers, U. S. A., "Artificial Waterways Which Form Cut-Offs on Marine Routes and Waterways Consisting of Natural Channels and Bodies of Water Linked by Artificial Channels, Constituting Inside Routes."
C. A. Jolles, Chief Engineer, Diector of the Government "Waterstaat," Netherlands, "The Waterway from the Rhine Through the Netherlands to the North Sea Along the Rivers Rhine, Waal and Nieuwe Maas."
William W. Harts, Lieutenant Colonel, Corps of Engineers, U. S. A., "Natural Waterways in the United States."
H. M. Chittenden, Brigadier General, U. S. A., Retired, "Flood Control."
Charles Davis Jameson, "Flood Control in China."
Dr. Luigi Luiggi, Inspector General of Civil Engineers, Italy, "Works for the Improvement of Navigable Estuaries."
Tadao Okino, Chief Engineer Home Department, Japan, "The River Improvement Works in Japan."
Gen. G. W. Goethals, "Dry Excavation."
W. G. Comber, "Dredging in the Panama Canal."
Brig. Gen. W. L. Sibert, "Construction of Gatun Locks, Dam and Spillway."
S. B. Williamson, "Method of Construction of the Locks, Dams and Regulating Works in the Pacific Division of the Panama Canal."
Henry Goldmark, "Lock Gates, Chain Fenders and Lock Entrance Caissons."
H. F. Hodges, Brigadier General, U. S. A., "The General Design of the Locks, Dams and Regulating Works of the Panama Canal."
L. D. Cornish, "Design of the Lock Walls and Valves of the Panama Canal."
E. C. Sherman, "The Design of the Spillways of the Panama Canal."
T. B. Monniche, "Emergency Dams Above Locks of the Panama Canal."
R. H. Whitehead, "Hydraulics of the Locking Operations of the Panama Canal."

Irrigation

C. E. Grunsky, "Irrigation Enterprises in the United States."
F. H. Newell, "Economic Advisability of Irrigation."
J. S. Dennis, "Distribution Systems, Methods and Appliances in Irrigation."
Dr. Luigi Luiggi, "Italian Irrigation" and "Irrigation in Lybia (Italian Colony)."
Arthur P. Davis and D. C. Henny, "Dams."
G. E. P. Smith, "Utilization of Underground Waters."
M. Nethersole, "Irrigation in India."
William Lumisden Strange, "Earthen Dams."
Elwood Mead, "The Distribution of Water in Irrigation in Australia."
L. C. Hill, "The Co-Relation Between Demand and Supply, in View of the Variation Between Annual Demand and Supply from Natural Flow, Which Leads Up to a Study of the Amount of Storage Necessary."
J. C. Stevens, "Irrigation in Spain—Distribution Systems, Methods and Appliances."
J. C. Stevens, "Irrigation in Spain—Regulations Controlling the Use of Water, Metering Water for Irrigation and Methods of Charging."
Carlos Wauters, "The Problem of Irrigation in the Argentine Republic."
Samuel Fortier, "Duty of Water in Irrigation."
C. G. Elliott, "Drainage as a Correlative of Irrigation."

Municipal Engineering

Nelson P. Lewis, "City Planning."
Sir Albert Stanley, "London Traffic in 1913."
W. F. Reeves, "Transit Problems in American Cities."
J. W. Alvord, "Recent Progress and Tendencies in Municipal Water Supply in the United States."
Dr. E. Imbeaux, "Municipal Water Supply in France, Belgium, Algeria-Tunisia."
Rudolph Hering, "The Disposal of Suspended Matters in Sewage."
A. W. Bos, Director of Public Works, Amsterdam, The Netherlands, "Sewage for Low Countries with Special Regard to the Town of Amsterdam."
George W. Tillson, "Streets."
L. W. Page, "Rural Highways."
L. Limasset, Chief Engineer of Bridges and Highways, France, "Rural Highways."
Alfred Dryland, England, "Construction and Maintenance of Rural Highways."
Arthur Gladwell, England, "Rural Highways."
C. C. Dassen, Argentine Republic, "The Struggle Against Dust."
Dr. A. C. Humphreys, "Utilities."
Edward Willis, England, "Short paper on Public Utilities."
Dr. Ing. Fritz von Emperger, Austria, "Arch Bridges of Hopped Cast Iron."
Henry Welles Durham, "Preliminary Municipal Engineering at Panama."
George M. Wells, "Municipal Engineering and Domestic Water Supply in the Canal Zone."
Charles F. Mason, Lieutenant Colonel, Medical Corps, U. S. A., "Sanitation in Panama Canal Zone."
Dr. Luigi Luiggi, "'Boliditit' Concrete Roads in Italy."

Railway Engineering

F. Lavis, "The Status of the Railways of North and South America."
Dr. Luigi Luiggi, "Italian Railways."
Victor Bayley, "The Status of Indian Railways."
Charles Davis Jameson, "The Status of Chinese Railways."
V. A. Nagrodsky, "The Status of Russian Railways."
E. P. Wellenstein, "The Status of Railways and Tramways in the Netherland East Indies."
John F. Stevens, "Economic Considerations Controlling and Governing the Building of New Lines."
William Hood, "The Locating of a New Line."
Frederick Mears, "The Reconstruction of the Panama Railroad."
David Wilson, South Africa, "The Locating of a New Line."
Maurice E. Kernot, "Railway Construction Methods and Equipment in Australia."
J. E. Greiner, "American Railroad Bridges."
Charles S. Churchill, "Tunnels."
Dr. Luigi Luiggi, "Tunnels in Italy."
R. Winkler, "Tunnels in Switzerland."
George H. Pegram, "Track and Roadbed."
B. F. Cresson, Jr., "Railroad Terminals."
William Hood, "Electric Motive Power in the Operation of Railroads."
E. H. McHenry, "Electric Motive Power in the Operation of Railroads."
Charles Hansel, "Signals and Interlocking."

Materials of Engineering Construction

H. S. Betts and W. B. Greeley, "Structural Timber in the United States."
R. H. Campbell, "Timber in Canada."
R. S. Pearson, "Indian Timbers Used in Engineering Construction."
Mr. Tkachenko, "Timber in Russia."
Howard F. Weiss and Clyde H. Teesdale, "Preservative Treatment of Timber."
A. V. Bleininger, "Clay Products as an Engineering Material."
S. E. Thompson, "Aggregates for Concrete."
Bertram Blount, England, "Probable and Presumptive Life of Concrete Structures Made from Modern Cements."
Alfred H. White, "Volume Changes in Concrete."
Harrison S. Taft, "Use of Wood and Concrete in Structures Standing in Sea Water with Special Reference to Dock Work."
Prof. James Furman Kemp, "The Outlook for Iron."
J. A. L. Waddell, "Alloy Steels in Bridgework."
Thomas T. Read, "The Economics of the World's Supply of Copper."
Thomas T Read and H. D Hawks, "Consumption of Copper and Its Various Uses."
W. Reuben Webster, "Alloys and Their Use in Engineering Construction."
Prof. Joseph W Richards, "The Engineering Uses of Aluminum."

Mechanical Engineering

H. D. Hinman and A. L. Bell, "Permanent Shops Pacific Terminals, Panama Canal."
Dr. H. Zoelly, London, "Developments in Modern Water Turbine Practice."
Arnold Pfau, "Water Wheels of Pressure Type."
J. D. Galloway, "Hydraulic Power Development and Use."
W. A. Doble, "Water Wheels of Impulse Type."
Charles H. Mitchell, "Canadian Hydraulic Power Development."
W. L. Saunders, "Compressed Air in the Arts and Industries."

Miscellaneous

George F. Swain, "Some Considerations Regarding Engineering Education in America."
Ira N Hollis, "Technical Education for the Professions of Applied Science."

Electrical Engineering

H. F. Parshall, England, "Economics of Electric Power Station Design."
Sven Lubeck, "The Water Power of Sweden."
Charles H. Mitchell, "Electric Power in Canadian Industry."
Frank G Baum, "The Effect of Hydro-Electric Power Transmission Upon Economic and Social Conditions, with Special Reference to the United States of America."
Edward Schildhauer, "Electrical and Mechanical Installations of the Panama Canal."
David B Rushmore, "The Electric Motor as an Economic Factor in Industrial Life."

Mining Engineering

R. V. Norris, "Valuation of Anthracite Mines."
Samuel A. Taylor, "Valuation of Coal Lands."

Naval Architecture and Marine Engineering

F. H. Cooks, "Coaling Plants and Floating Cranes of the Panama Canal."
H. McL. Harding, "Cargo Handling Methods and of Appliances."
David B. Rushmore, "Some Economic Fundamentals of Freight Handling."
H. H. Rousseau, "Terminal Works, Dry Docks and Wharves of the Panama Canal."
W. F. Beyer, "Aids to Navigation of the Panama Canal."
Leonard M. Cox, "American Graving Dock Practice."
Dr. Luigi Luiggi, "Dry Docks Recently Built in Italy."

News of Engineering Societies

The Pacific Highway Association has changed the date of its annual convention to Sept. 16, so that it may co-operate in the work of the Pan-American Road Congress.

American Builders' Week at the Panama-Pacific International Exposition will be held at San Francisco, Oct. 18-23, under the management of the General Committee of the Building Industry of San Francisco.

The Arizona Association of Highway Engineers was organized at a meeting recently held at Flagstaff, Ariz. The Arizona State engineer, Lamar Cobb, was elected president and William H. Caruthers, county engineer of Maricopa County, secretary. Fourteen county engineers and several members of Mr. Cobb's staff were made charter members of the new organization.

The American Society of Sanitary Engineers held a special program at the Panama-Pacific International Exposition on Aug. 10, by way of supplement to the regular proceedings at the convention. The exposition presented the society with a commemorative medal, and at the conclusion of the program delegates assembled for a banquet at the Inside Inn as guests of Thomas J. Farrell, chief inspector of plumbing.

The Texas Good Roads Association held a joint meeting, Aug. 5 and 6, with the County Judges' and Commissioners' Association and the Texas Rural Carriers' Association, at the Agricultural and Mechanical College of Texas. James P. Nash, testing engineer of the Bureau of Economic Geology and Technology of the University of Texas, read a paper on "The Economic Road Materials of Texas," and there was a discussion of highway legislation led by A. N. Johnson of the New York City Bureau of Municipal Research.

Personal Notes

J. J. Woltmann has been appointed city engineer, of Anna, Ill.

W. S. Franklin has resigned from the professorship of physics at Lehigh University.

G. E. Byars, recently city engineer of Waco, Tex., has been appointed superintendent of buildings and grounds at the Agricultural and Mechanical College of Texas.

Chester & Fleming, engineers, of Pittsburgh, have been engaged to take charge of the operation of the plant of the Upper Sandusky (Ohio) Waterworks Company.

George J. Davis, Jr., dean and professor of civil engineering at the University of Alabama, has been retained to prepare plans for a municipal wharf at Tuscaloosa, Ala.

Albert Freitag, civil engineer, of Grand Island, Neb., has closed his office in that city to accept an appointment on the engineering forces of the Little Rock Drainage District, at Whitewater, Mo.

L. N. Hintgen has been appointed acting assistant city engineer of Sioux City, Iowa. He was formerly connected with the M. L. Thrim Paving Company of Sioux City and, previous to that, was connected with the city engineer's office.

W. E. Dozier, formerly chief engineer and general superintendent of the Northwestern & Gulf Railway and, previous to that, city engineer of Temple, Tex., has been appointed engineer in charge of street paving at Taylor, Tex.

Jerome Newman, assistant State engineer in charge of Harbor Work with headquarters at San Francisco, has been appointed chief engineer of the State Board of Harbor Commissions by the advisory board of the Engineering Department.

R. L. Sanders, formerly with the American Society of Civil Engineers, assisting in the determination of railroad track stresses, under Prof. A. N. Talbot, at Champaign, Ill., has been appointed resident engineer on the forces of the State Highway Commission of Illinois.

M. J. Cronin, formerly chief draftsman in the division engineer's office of the Delaware, Lackawanna & Western Railroad at Binghamton, N. Y., has been engaged to prepare maps for Federal valuation in the chief engineer's office of the Buffalo, Rochester & Pittsburgh Railway at Rochester.

George C. Stone, engineer for Lockwood, Green & Company, architects and engineers for industrial plants, of Boston, Mass., is representing that firm in Buffalo, N. Y., during the erection of the eleven story and basement reinforced-concrete warehouse, which is being built in that city for the Walker Building Corporation.

Arthur M. Torrey, who for the past four years has been in charge of the soliciting department of Hildreth & Company, engineers, 15 Broad Street, New York City, has resigned from that position to take charge of the engineering contract department of W. S. Barstow & Company, engineers and managers, 50 Pine Street, New York City.

R. G. Jones, assistant division engineer on the northern division of the Grand Rapids & Indiana Railroad, has been made division engineer of the southern division at Fort Wayne, succeeding C. L. Barnaby, who has been transferred to Grand Rapids. Mr. Jones has been engaged in railroad civil engineering for the past thirteen years.

The Robertson Engineering Company, of San Antonio, Tex., has taken over the engineering practice of E. A. Kingsley, whose appointment as paving engineer of the city of San Antonio was noted in these columns, July 17. Mr. Lake Robertson, who was associated with Mr. Kingsley, and who has had entire charge of his paving work at Temple, Tex., will be the head of the Robertson Company.

Gardner S. Williams, consulting engineer, Cornwell Building, Ann Arbor, Mich., has opened an office in the Corn Exchange Bank Building, Chicago, for consultation, designing and supervision of construction, in hydraulics, hydroelectric development, water power and water supply. Associated with Mr. Williams are: R. K. Holland, G. E. Ackerman, H. K. Holland, A. E. Greene and L. E. Ayres.

Robert Coe, formerly connected with the Carnegie Steel Company at Pittsburgh, has joined the forces of the International Nickel Company at Copper Cliff, Ont. His first engineering service was on the forces of the Norfolk & Western Railroad, from 1886 to 1894. From 1895 until 1907 he was with the U. S. Geological Survey, and, from 1907 to 1909, with the Isthmian Canal Commission. He entered the service of the Carnegie Steel Company in 1910.

Charles B. Cornell, formerly division engineer of the reservoir division on the waterworks improvements at Akron, Ohio, has accepted the position of resident engineer on the improvement of sewage treatment at Columbus, Ohio, for which J. J. Morgan of Columbus, is consulting engineer. Mr. Cornell received his engineering education at Ohio State University and has had considerable experience in the design and construction of sewer systems, sewage disposal plants and waterworks, mostly in Ohio and Indiana.

L. V. Reese, who recently completed a contract for constructing a system of block maps for the city of Tyler, Tex., has opened an office at Hamilton, Tex., for the purpose of practising as a civil and contracting engineer. His first engagement along engineering lines was as assistant to V. M. Ehlers, who is, at present, State sanitary engineer of Texas, on municipal and sanitary work. In 1912 he became associated with the McCoombs Engineering Company of Waco on the construction of railroads, levees, sewerage systems and waterworks. In 1913 he severed his connection with this company to accept a position in connection with the Federal valuation work on the St. Louis Southern Railroad. He left that work in the early part of the present year to construct the system of block maps for the city of Tyler.

Louis C. Fritch, assistant to the president of the Canadian Northern Railway at Toronto, Ont., has been appointed general manager of the lines east of Port Arthur in addition to his present duties. He received his engineering education at the University of Cincinnati and entered railway work in 1884 as supervisor's assistant on the Ohio & Mississippi. In 1886 he was appointed assistant engineer and served in that capacity until 1892 when he was appointed engineer maintenance-of-way. In 1893 he became a division engineer on the Baltimore & Ohio Southwestern and, in 1889, was appointed superintendent of the Mississippi division of that road. He went to the Illinois Central in 1904 and became assistant to its general manager in 1905. He was appointed assistant to the president in 1906 and consulting engineer in 1909. Later he was appointed chief engineer of the Chicago Great Western. He was appointed assistant to the president of the Canadian Northern in 1914.

Lorenzo C. Dilks, formerly connected with the Eastern Steel Company, has been elected president and general manager of Milliken Brothers of New York City, manufacturers and erecters of all classes of structural steel, including bridges, buildings and power transmission lines. Mr. Dilks' first engagement along engineering lines was as draftsman in the bridge and construction department of the Pencoyd Iron Works from 1892 to 1897. In this capacity he assisted in the design of a proposed railroad bridge for the Long Island Railroad over the East River at Blackwell's Island, New York City, and on the company's design for a proposed bridge over the St. Lawrence River at Quebec. He also had charge of making detailed shop drawings for a large portion of the arch bridge over the Niagara River between Niagara Falls, N. Y., and Clifton, Ont. In the fall of 1897 he was with L. L. Buck on the design and estimates for the Connecticut Avenue Bridge over Rock Creek at Washington, D. C. Then, after a short period in the engineer's office of the Williamsburg Bridge, New York City, he returned to the Pencoyd Iron Works, for which company he served as engineer on the erection of the New York Central & Hudson River Railroad passenger bridge over the Hudson River at Albany, N. Y. From 1900 to 1901 he was in the office of C. C. Schneider, vice-president of the American Bridge Company, and, from May of the latter year to 1903 served as one of the assistants to Alfred J. Major, president of the company. From 1903 to 1904 he was manager of its Buffalo plant. He was appointed contracting engineer for the Belmont Iron Works of Philadelphia in 1904 and contracting manager of the Eastern Steel Company in 1905.

Obituary Notes

Dennis Hayes, capitalist and contractor, died at Janesville, Wis., Aug. 10. Mr. Hayes built the Lockport dam on the Chicago Drainage Canal.

Arthur R. Pardington, vice-president and secretary of the Lincoln Highway Association, died in Detroit, Aug. 2.

Civil Service Examinations

United States.—An open competitive examination for an assistant irrigation engineer, salary from $1,000 to $1,500 a year, is announced for Sept. 22, to be held at the usual places. The duties of this position will be to investigate methods of preparing land and applying water in farm irrigation, measurement and delivery of water, irrigation channels and structures, design, installation and operation of pumping plants, and regulations and laws relating to irrigation. Applicants must have either four years' experience in civil engineering or a technical school education. Further information may be secured by applying for form 1312, stating the title of the examination, to the U. S. Civil Service Commission, Washington, D. C., or to civil service boards at the principal cities of the country.

New York.—The Civil Service Commission announces an examination for lock operator, salary from $901 to $1,200 a year, to be held Sept. 18. Candidates must be 23 years old and must have three years' experience in the erection and operation of electrical machinery in either substations or power plants. Application blanks for this examination will not be received after Sept. 8, nor will they be distributed by mail after Sept. 6. Application should be made to the Civil Service Commission, Albany, N. Y.

Philadelphia.—Notice of an examination for an assistant examiner, civil engineer, salary $1,800 a year, to be held in the near future, is made public. The duties are primarily those of an instructor for the Civil Service Commission. The requirements to compete are graduation from an engineering institution and some practical experience. Applicants must be 23 years of age and residents of the State. In applying for a form the title of the position for which it is desired should be given. All forms must be properly executed and filed with the commission, Room 875, City Hall, Philadelphia, by Sept. 11.

Examinations Previously Announced

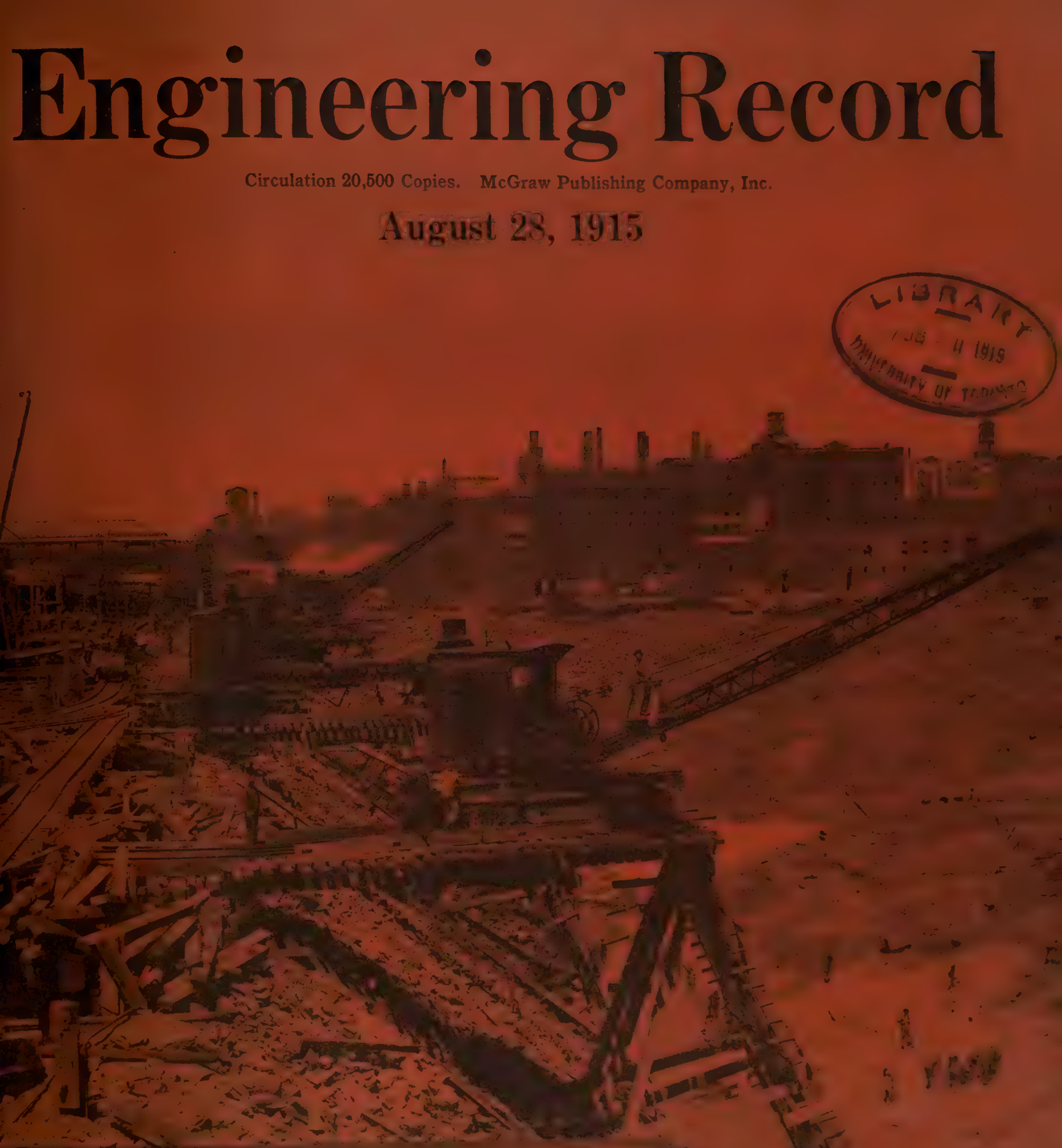
Date		See Eng. Record
Aug. 25-26	Junior civil engineer, Engineering Department, United States	July 31
Sept. 15	Aid, U. S. Coast and Geodetic Survey; draftsman and junior engineer, U. S. Engineer Department	July 3
Oct. 13	Aid, U. S. Bureau of Standards; civil engineer and draftsman, draftsman, Navy Department; engineer, Indian Service	July 3

Engineering Record

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The Engineering Works of the West

A Guide to Points of Interest for Engineers who will attend the International Engineering Congress at San Francisco, Sept. 20-25



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What the West Offers

IT will soon be time for those engineers who will attend the International Engineering Congress, Sept. 20-25, to make plans for their trip to San Francisco. Some will go by special train and others by individually selected routes, but no matter what course is chosen opportunities along the wayside should not be neglected. The cities between Maine and the Pacific Coast are filled with interesting things to see, particularly from the engineer's viewpoint, and the time spent in looking over the work in new localities will be decidedly profitable. But a man arriving in a strange city is often at a loss to know what engineering works it contains and so, unguided, he may miss the very structure which would best repay a visit of inspection. To minimize this possibility the Engineering Record presents on page 261 a guide to the more important engineering works in municipalities en route to California. The list is not complete, nor are the descriptions of the structures intended to serve any other purposes than hints as to what is to be seen. If the list can be utilized by engineers in adding to the pleasure and interest of their visit to the Exposition it will have fulfilled its object.

Employers' Rights and Responsibilities

THE court decisions indicating the trend of laws affecting labor, published by the Bureau of Labor Statistics and reviewed on page 217 of last week's issue of this journal, are merely indicative of the state of mind on the part of legislators and on the part of courts interpreting statutes enacted for the protection of labor. It will not do, however, to assume that the trend is all one way, for there is no more significant or important decision cited than that in the case of Coppage vs. Kansas. In that case, it will be recalled, Justice Pitney of the U. S. Supreme Court disposed of the statute, typical of many others, in which it was sought to prevent employers from refusing to employ members of labor organizations. This decision read again is no less inspiring than it was at the time of its announcement last year. It deserves to be considered the Magna Charta of employers as determining their rights and responsibilities in dealing with employees.

Special Building Permits

ONE of the provisions in the stairway regulations in Cleveland, noted on page 260, allows the building commissioner to issue permits governing the construction of stairways other than those required by law. The stairway must be of incombustible material and must not endanger life or create a fire hazard. Along with the other definite provisions, which have been placed in the building code only after careful first-hand investigations, this is an excellent example which might well be followed in many another code. The practice of getting one's alderman to have the City Council pass a special ordinance permitting a violation of the code, thus by-passing the official whose business it is to express an opinion on the subject, is the more usual and less satisfactory way. When matters of special design must be decided the judgment of a trained man ought to be regarded as final. Certainly the untrained layman alderman, if he is fair, would want all the honest expert opinion he could get before voting for a violation permit, so why bother the aldermen at all?

A New Philippine Road

THE abandonment of the once famous Benguet road, constructed only a decade ago at a cost of $2,000,000, in favor of the much cheaper and more useful Baguio-Bauang road, which is described on page 264, cannot fail to impress one with the quickness with which American engineers adapt themselves to new conditions. When the Benguet road was built it was thought that a very difficult problem had been solved in the most economical manner, but those who located it had very little reliable information beyond that which their own surveys revealed to them. In a country where rainfalls of extraordinary intensity are frequent, the existing data did not prove sufficient. In the course of the last ten years it has cost a million dollars to maintain the Benguet road, due in large part to flood damage. In locating the Baguio-Bauang road at a high level beyond the reach of flood waters the engineers have not only profited by the lessons learned from the old road, but have found a much better route from Baguio to the sea. The old road was, in many respects, built as an American road would be built. The new road is adapted to Philippine conditions as evolved by the engineering force of the Bureau of Public Works of the islands since the American occupation.

Foundations on Clay Strata

THE results of further careful examinations at the site of the landslip and subsidence at the plant of the Knickerbocker Portland Cement Company near Hudson, N. Y., confirm the first report of the probable cause given in this journal Aug. 7, page 179. The article by Assistant State Geologist D. H. Newland, on page 253, makes it clear that this remarkable disturbance was not a landslide of the familiar kind. Instead, the unusual sub-surface softening and flow of the deeply underlying bed of blue clay, due to an excess of water, resulted in the sudden breaking down of the harder overlying strata which were supporting the load and the squeezing out of the softened mass. Such an occurrence confirms the soundness of a policy of consulting geologists and making extensive examinations of the geological conditions whenever permanent engineering structures are to be constructed at sites known to be subject to geological disturbances, or where unusual conditions exist liable to cause failures. It is evident that piles in such a case as that at Greenport would be of little, if any, value. In fact, rows of piles had been driven on this site between the power house and creek, and showed little restraining effects. The final suggestion of Mr. Newland that a preventive measure for such conditions is thorough drainage of the subsoil is of direct value to engineers, although it might be found impracticable to apply it under existing local conditions.

An Encyclopedia of Engineering

FOR those who examined, in last week's issue of this journal, the partial list of papers to be presented next month at the International Engineering Congress in San Francisco the significance of the coming meeting needs no emphasis. The program speaks for itself. Never before has there been assembled a collection of technical papers which covered the field so completely and included in the list of authors so many of the highest authorities in various branches of engineering. In addition to the interest which the individual papers command on their own merits, the group of titles under each classification has been chosen and then assigned to the men best qualified to discuss them so that each field is adequately provided for. With the addition of such discussion as is to be expected there will be produced an encyclopedia of modern engineering practice which will be invaluable in a reference library. Nothing less than this, however, was to have been expected from those loyal workers, all men of noted engineering attainment, whose best efforts have been put into service on the various committees and to whom great credit is due for the collection of so representative a list of papers in spite of war conditions which, at first, raised the question of advisability in attempting to hold the Congress at all. All the more credit is due because this has been entirely a labor of unselfishness and has required arduous and seemingly thankless service for a period of over two years. During this time the heaviest burden has fallen upon the committee of management in San Francisco, each member of which has placed the

best interest of the Congress paramount. The list of titles and authors speaks so well for the achievement of those who selected and assigned the subjects and contains such assurance of the benefits to be derived from attending the meeting that the success of the Congress is assured.

Highway Economy

THE cost of doing what the engineer prescribes is so often pared down by someone else that it is refreshing to find the cost of a structure, on which strictest economy was necessary, left entirely to the judgment of the engineer in charge. It is notable, also, that in this case he met the requirements exceptionally well both as to cost and suitability of design. The Yolo Causeway, described on page 248, will bring one of the main trunk lines of California into the State Capital, and bridges a flood channel of the river 3 miles wide. It was acknowledged that if $1,000,000 or $1,250,000 were available for a reinforced concrete viaduct of some standard design there would have been no problem at all in building a permanent structure whose appearance would be a credit to the highway commission, but with considerably less than half a million dollars to work with the question of suitable design was another matter. However, by working out a highly economical scheme for a floor system of concrete slabs cast in a yard, and placing these on concrete piles driven as in railroad trestle construction, it was found possible to build the greater part of the structure entirely of concrete and to get the job done for a total of $393,000. Of course, it was necessary to adopt certain expedients in the construction which were more or less experimental, and probably on another structure designed along similar lines the methods would be somewhat different. But certain it is that much credit is due Austin B. Fletcher, chief engineer of the California Highway Commission, for successfully extending into the field of long highway bridges the economy for which he has already become famous in road building.

Reforms Suggested by Commerce Commissioner Harlan

CONCURRING with the minority report of Commissioner Daniels in the Western rate-advance case, Commissioner Harlan incidentally suggested several ideas that are worthy of serious consideration. He thinks that too much time and labor are expended in these recurring rate contests and that some way should be found for arriving at results more promptly. He believes the commission should have power to fix minimum as well as maximum rates. The commission should have more effective control, he thinks, over rates initiated or compelled by State authorities. An attempt should be made to establish a uniform classification upon a normal basis, applicable throughout the entire country, and with it a normal rate structure having sufficient elasticity to allow for varying operating costs, density of traffic, circuitous routes, competitive and other conditions under which transportation is conducted in different parts of the country.

All of the above suggestions are in accord with common sense, with the views of able railroad men who have given the subject much thought. The time and labor to which the railroads and shippers are put in preparing the rate cases, the impossibility of the commission more than partly digesting these assembled data, the exclusion from the careful consideration of the commission of many important minor cases because of the time required by the major cases, the utter failure of the present system to meet emergencies by emergency measures —these are all facts that argue eloquently for Mr. Harlan's first suggestion. The injustice of a regulatory system that regulates in one direction only is shown strikingly enough in the Ulster & Delaware passenger-mileage case, commented on in the Engineering Record of Aug. 7, page 154, and set forth more fully on page 226 of last week's issue, wherein the New York Public Service Commission has declared itself powerless to relieve the railroad from the necessity of carrying passengers below cost. The connection between interstate and intrastate rates is so close that it seems to be only a question of time before authority over all rates will become vested in a Federal body. And the uniform classification and normal rate structure seem to be just what would result if a system of regulation could be devised whereby the best railroad rate experts could work in complete harmony with one governmental body big enough and with broad enough powers to meet every railroad issue squarely.

Shrinkage and Time Effects on Concrete

THE EFFECT of shrinkage of concrete has been recognized, although its extent is not generally appreciated. The report of tests made by F. R. McMillan, an abstract of which is presented on page 251, will undoubtedly induce further investigation of this important subject. The results, however, may not be considered as conclusive. The number of specimens was small, and most of the tests were made on very shallow members with very long ratio of span to depth, so that the results cannot be directly applied to practice. While the conclusions seem alarming, the results are not as unfavorable as they appear at first inspection.

Other tests have given smaller values for the extent of shrinkage than those found by Mr. McMillan. Extensive tests made in Germany on concrete specimens setting in air show the maximum total shrinkage to be 0.000324 of the length. The rate of shrinkage is almost uniform for the first forty days, when it reaches about two-thirds of its total. After forty days the rate of shrinkage gradually decreases until it is almost negligible at the age of 200 days. These tests were made with concrete of the composition ordinarily used in construction, while in Mr. McMillan's tests pea-sized limestone was used. The German tests corroborate the swelling of the concrete caused by moisture.

In actual construction, as may be seen from experience, the effect of shrinkage is hardly ever serious. In most cases this shrinkage, as well as the temperature changes, causes shortening or lengthening of a reinforced concrete building as a whole without producing appreciable cracks. Of course, if the building is not properly designed and in cases where the piers or columns are not flexible and do not allow free movement of slabs and beams, cracks are apt to occur. By proper design shrinkage cracking can be reduced to a minimum, even if not wholly eliminated.

The conclusions given by the author as to the effect of shrinkage on compression members are not justified in view of tests of columns made at ages up to one year, reinforced with both vertical steel and spirals. In all cases the strength of the columns grows with age, which would not be possible if the steel, as presumed by Mr. McMillan, was under large initial stresses due to the shrinkage.

The novel part of the test is the time effect on the concrete under stress. Before any positive conclusions can be reached, however, additional tests must be made, especially on members under working conditions. In practice occasional sagging has been found, but this can usually be attributed to results in design rather than to the properties of the material. Of course, the high compressive stresses which are sometimes permitted at the supports in continuous beams and in flat slabs should be discouraged. The compressive stresses at these points should be computed and properly provided for. The use of compression steel in such cases would undoubtedly strengthen the construction and prevent any tendency to yielding, because any increased deformation would be prevented by the compression steel which usually has a large surplus of strength.

The conclusion as to the "continued yielding in the upper fibers" does not seem to be warranted, because even in the test the change in net deformation after 160 days was slight. The small differences may be attributed to other sources more than to yielding of the material. Even if the yielding continued it would rather increase stresses in steel than break the bond "from the center toward the supports."

Although the deflection continued to increase for a long time, it will be noticed that in no case was the maximum deflection excessive. In fact, it was not larger than would be expected by computations. For the beam 30 in. wide and 5½ in. deep the theoretical maximum deflection for a 12-ft. span is about ½ in. This agrees very closely with the actual deflection at 450 days. The stresses in steel, on the whole, were not any larger than would be expected from computations. The deformation of concrete was considerably larger than would be expected, but most of it did not produce any stresses because it was caused by shrinkage.

It is to be regretted that the specimens were not tested to destruction after the time tests were completed. This would have given some idea as to how much the so-called yielding affected the actual

strength of the specimens. It is very desirable that, with Mr. McMillan's tests as a basis, thorough investigations be made of the subject both under laboratory conditions and in buildings in actual service.

Erie Flood Capitalized to Discredit Coatesville Dam

WITH contracts let and construction started the new water-supply project for Coatesville, Pa., involving a concrete dam on Rock Run and a filtration plant, faces opposition which threatens to bring the work to a sudden halt. Coatesville, it will be recalled, is the town which, in February, 1912, was visited by a severe typhoid epidemic, due, according to findings of State Health Commission, to the use of polluted water which was characterized by Dr. Samuel G. Dixon as "unsafe for human consumption." The number of typhoid cases reported, more than 200, was sufficient to demonstrate the need for preventing a repetition of the water-borne epidemic and when the new dam and filter project was submitted to popular vote it was ratified by a substantial majority. Certain local interests, however, are now conducting a vigorous campaign against the much-needed improvement and an attempt has been made to have the Governor of Pennsylvania use his influence in securing the withdrawal of the permit for the work. The argument advanced is that the proposed dam will constitute a flood menace, and with the Erie disaster fresh in mind it is easy for the papers to make capital of this contention, notwithstanding the fact that the Erie catastrophe was due, not to the failure of a dam, but to the obstructions and encroachments of structures on the channel of Mill Creek. This point was made clear in the Engineering Record's account of the Erie flood published Aug. 14, page 186.

The Coatesville situation is of more than local interest for it involves methods of influencing public opinion, through the daily press, which tend to discredit the engineering profession in the eyes of the layman. It is not proposed here to discuss the relative merits of various water supply systems for Coatesville or to pass judgment upon the question of whether or not the work now under construction will curtail the supply of water drawn directly from several streams for use in the local steel mills. How potent this factor is in the opposition is beside the point. The matter of chief import to engineers is that the campaign to stampede public opinion is based upon propaganda declaring that dams are unsafe. True it is that dams have failed, but if the argument of the opponents to the Coatesville dam is sound it can be carried further. For example: Lives have been lost in railroad wrecks, therefore we should have no railroads; steamships have sunk, therefore prohibit marine traffic; buildings have collapsed, therefore live in canvas tents. The days of haphazard dam construction in Pennsylvania have passed and with the safeguards that now surround projects for impounding stream flow, involving submission of detail plans by competent engineers and their approval by the State Water Supply Commission, dangers which have been magnified for partisan purposes cease to exist. It is an old story to find that dams which have failed have been built with little or no investigation of subsurface conditions by borings and without competent engineering supervision in the preparation of the designs or the conduct of the construction work.

Coatesville's case is different. The new water supply project has been designed by a consulting engineer of long and varied experience and the plans have received the approval of the State body constituted to pass upon the safety of such structures. The scareheads concerning the Rock Run dam, therefore, tend to create distrust in engineers and their work and are a form of attack which is nothing more or less than hitting below the belt.

The solution to Coatesville's case is not in the abandonment of its work for a pure water supply, but in the vigorous prosecution of a project for preventing another typhoid epidemic such as that of 1912, along a policy which, founded upon reliance on sound engineering advice, can not fail to be a decided benefit to the community.

Galveston's Sea-Wall the City's Salvation

AMID the chaos in the wake of the Galveston storm of Aug. 17 one structure stands out in bolt relief, a monument to engineering skill and foresight—the seawall. Flanking the shore line of the island city this sturdy rampart of concrete and steel bore the brunt of the ocean's onslaught, and no higher praise can be bestowed upon it than to say that when called upon in an extreme emergency—one fully as great as the hurricane of 1900—it did its duty. Galveston's seawall was the city's salvation, and to the engineers who designed it and to the contractors who built it the Texas town owes a debt of gratitude which can never be adequately repaid. The damage done, of course, was severe, but there was no such toll in lives and property as was taken in 1900, and for this the seawall is responsible.

It takes a catastrophe like the Galveston storm to demonstrate to a public, often forgetful of those to whom it owes its safety, that the civil engineer is the foundation stone upon which the physical welfare of cities must be built. If the Galveston storm is instrumental in spreading this doctrine broadcast it will have done a lasting service. Cities elsewhere face dangers in the form of storms and floods, but disasters such as the most recent one at Erie, Pa., can be forestalled, in large measure, if the proper technical advice is secured well in advance and then acted upon. City officials throughout the country may well ponder over the Galveston lesson and take inventory of their own state of preparedness against unforeseen catastrophes which engineers can aid them in preventing.

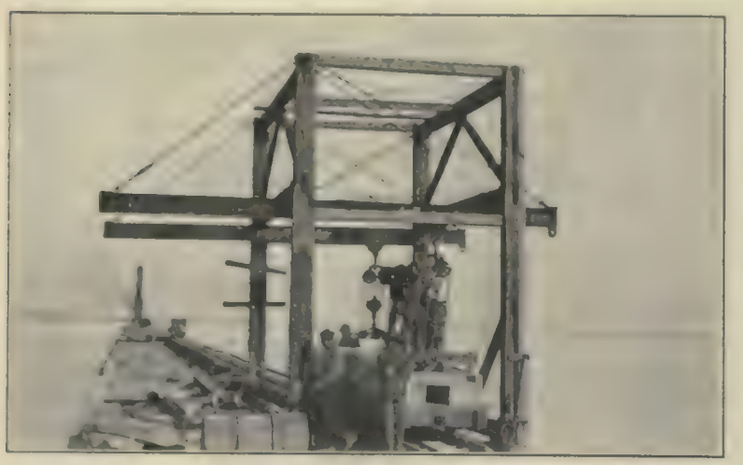
To the yeoman work which the sea-wall performed must be added mention of the part played by the United States Weather Bureau in preventing a greater loss of life than was actually recorded. Again science looms up as a protector in times of impending disaster. The hurricane which swept over the gulf was born in the region of Barbados and, gathering strength rapidly, started on its journey of destruction in a northwesterly direction across the Caribbean Sea and Gulf of Mexico. The Weather Bureau's observations foreshadowed a storm of unusual proportions and the news was flashed ahead to prepare for trouble. In fact, before the hurricane hit Galveston men were dispatched on motor cycles from the Weather Bureau's office, spreading the alarm so that people near the waterfront were able to reach places of safety. This move was certainly responsible for a great reduction in the loss of life.

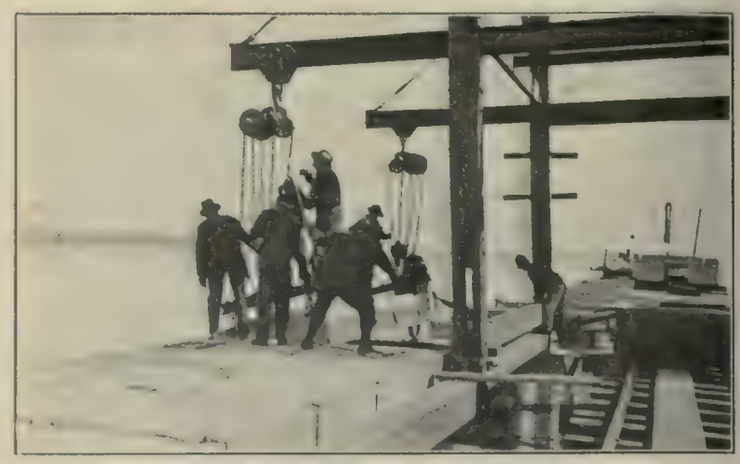
Accurate reports as to the extent of the storm's damage are just beginning to arrive in the East. None of Galveston's substantial buildings was destroyed, although many frame structures along the waterfront were badly wrecked, and the brick boulevard back of the seawall was scoured out. The face of the seawall was curved and threw huge columns of water vertically into the air. The impact of the waves was thus broken but the hurricane, blowing at velocities as high as 90 miles an hour, swept the huge volumes of water, as they hung in mid-air, back over the wall, so that the city streets were flooded to depths of from 6 in. to 2 ft. There is an opportunity for profitable study in what might be termed a secondary line of defense along the waterfront —some provision for holding back water blown inland from the sea-wall.

The damage to the causeway which connects Galveston with the mainland is, apparently, the city's greatest loss. This causeway is a viaduct about two miles long, consisting of a series of concrete arches in the central section, flanked on either end by an earth embankment retained by reinforced-concrete sheet piling and with slopes protected by concrete slabs. The arches resisted the storm's fury but the north approach and about 1500 ft. of the south approach embankment were demolished, except for the concrete sheet piling and caps. Pier 10 was shattered and one grain elevator was badly wrecked. The other elevators and wharves sustained minor damages.

A serious condition was created by the breaking of the pipe line which carries the city water supply across the bay, but the broken section is being by-passed by a new 8-in. line laid on the causeway for service until the break can be repaired. For a time water for drinking and cooking purposes was distributed by wagons from the stored supply.

Galveston has passed through a trying time but it is clearing away the storm's débris and building anew with the same pluck which marked its activities after the hurricane in 1900. In such reconstruction as there is to be done engineers will play an important part. Their work has brought the city safely through a severe ordeal and they can be relied upon to contribute their share in the further development of the southern seaport.





PLACING UNIT CONCRETE FLOOR SLABS FROM THE TRAVELING GANTRY—SLABS WEIGH 5 AND 6 TONS EACH

Unit-Construction System Applied to a Three-Mile Concrete Viaduct to Reduce the Cost

California Highway Commission Develops Scheme for Bridging Yolo By-Pass near Sacramento Within Funds Allotted, About One-Third What the Usual Structure Would Have Involved

TO COMPLETE one of the main trunk lines of the California State highway system it was necessary to bridge the Yolo by-pass, a flood channel of the Sacramento River, near the city of Sacramento, with a structure 16,310 ft. long. Because of the rigid economy which it has been necessary to practice on the entire California highway system, it was considered that a concrete structure of this length must be of the cheapest possible design to come within the sum which could be consistently allotted to this part of the work. The highway engineer's office, therefore, undertook to work out such a design, which would still be up to State highway standard. The resulting design consists of 13,889 ft. of permanent, all-concrete trestle; 2280 ft. of wooden trestle on creosoted piles; and a movable span of 80 ft. clear length with its connections to the concrete trestle to be installed in the remaining 141 ft. The wooden trestle was used on a part of the structure which, while necessary under present conditions, it is expected can be replaced by fill at the end of its useful life, since it is outside of the levee line established in connection with the project for the control of the flood waters of the Sacramento River.

The cost of the concrete section was lowered materially, it is thought, by the method of construction adopted, which provided for casting the floor slabs as separate units in a casting yard at one end of the viaduct and then grouting them in place in the structure when properly seasoned. The contract was let July 21, 1914, for the concrete and timber trestle portion of the viaduct, to be built according to the highway engineer's plans, at a total cost of approximately $393,000.

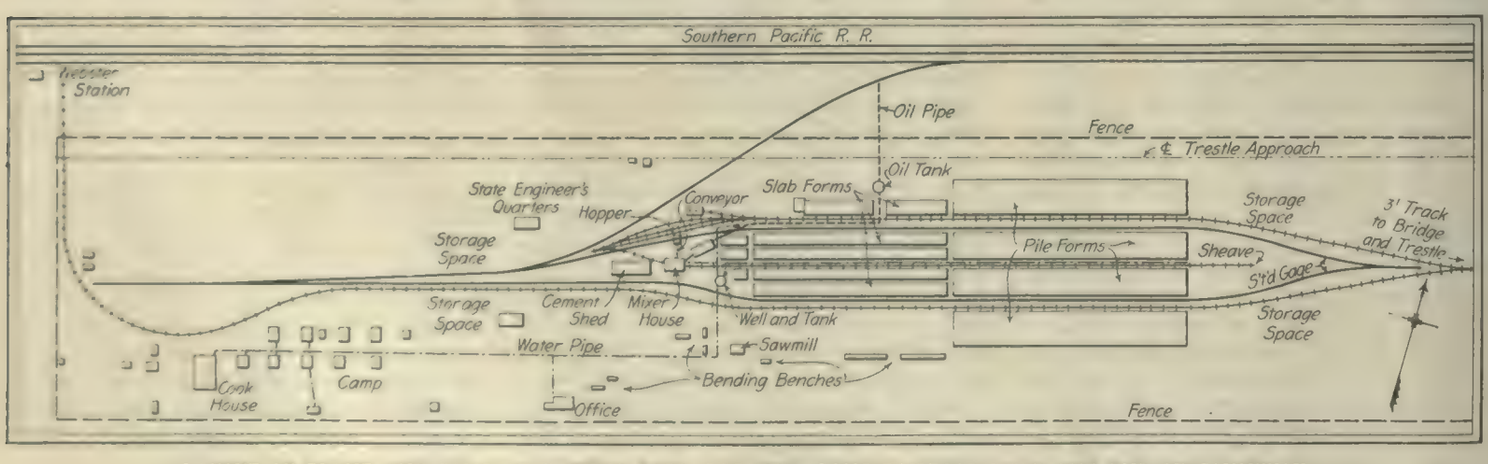
SCHEME OF CONSTRUCTION

When work on the trestle was started last August the basin was dry and the pile driver was worked from 12 x 12-in. skids laid on the ground with 2 x 6-in. greasers on top of gunnels, backing away from the trestle as the work advanced. When the high water flooded the basin in February a temporary trestle was driven, from which the driver has since been operated. A small driver equipped with a drop hammer works ahead of the large driver, driving and capping the temporary trestle. The large driver, after moving back from a completed bent of the permanent structure, pulls up the temporary bent on which it worked, and caps and piles are floated ahead to the small driver for redriving. Temporary piles are placed 9½ ft. on centers with four piles to the bent, driven from 8 to 12 ft. in the ground, or enough to keep the caps clear of water.

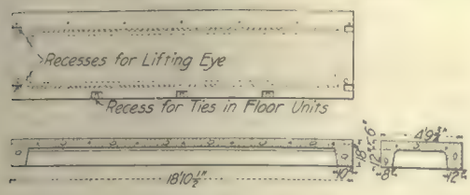
In the all-concrete section of the viaduct each bent consists of two plumb and two batter piles. The construction scheme was to drive all four piles in each bent before moving the driver, and to cast the monolithic concrete cap first on two piles of each bent, or over half the width of the structure. This made it possible to place temporary 8 x 12-in. wooden caps on the other two piles of each bent and thus provide support for a temporary track which would at all times be available for the delivery of materials, and whose extension depended only on the driving of the concrete piles. For the temporary stringers 12 x 12-in. timbers were used, lapped and drifted to the temporary caps. Ties and 48-lb. rails were then placed, the ties being nailed to the stringers with 8-in. spikes not driven quite home.

CASTING YARD

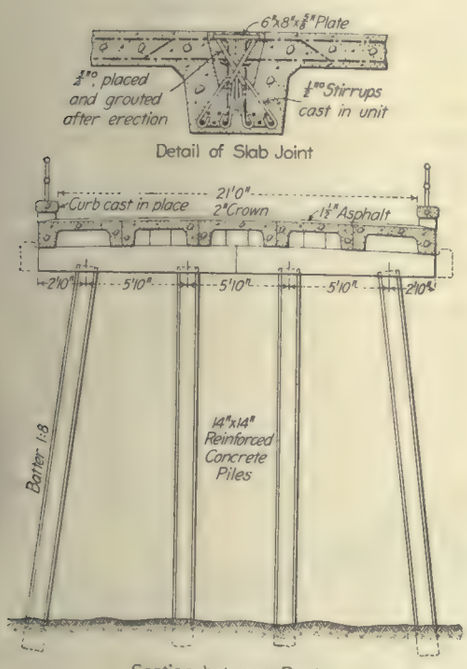
The concrete pile and floor slabs are cast in a yard laid out near one end of the trestle and adjacent to the tracks of the Southern Pacific Railroad. This location affords easy access to the yard for the delivery of materials and requires only a short haul to the work. Crushed rock and sand are delivered to the casting yard in standard bottom-dump cars which are switched by a locomotive crane over the hoppers in position for dumping. From the hoppers a chain bucket conveyor carries the material into bunkers over the mixer,



LAYOUT OF PLANT AND CAMP AT CASTING YARD, LOCATED ALONG RAILROAD NEAR ONE END OF CAUSEWAY



DETAILS OF SLABS



DETAILS OF YOLO CONCRETE TRESTLE

whose capacities are 90 cu. yd. of sand and 180 cu. yd. of rock.

Mixing is done by a 1-yd. motor-operated batch mixer. From the mixer concrete is discharged directly into the bottom-dump buckets standing on flat cars operated by cable from a hoisting engine. From the cars the buckets are handled by the locomotive crane, which dumps the mix slowly into forms at the desired point and then swings the empty bucket back to the car. The average time between dumping successive buckets is two minutes, and it has been found that a crew of seven men requires the full two minutes to spade the concrete properly in the forms. A five-sack batch of 1:2:4 mix is used. The mix is placed fairly wet, about 30 gal. of water being added to each batch when dry material is used. While in process of setting the concrete is wet down with a hose several times each day.

WEIGHT OF CONCRETE PILES

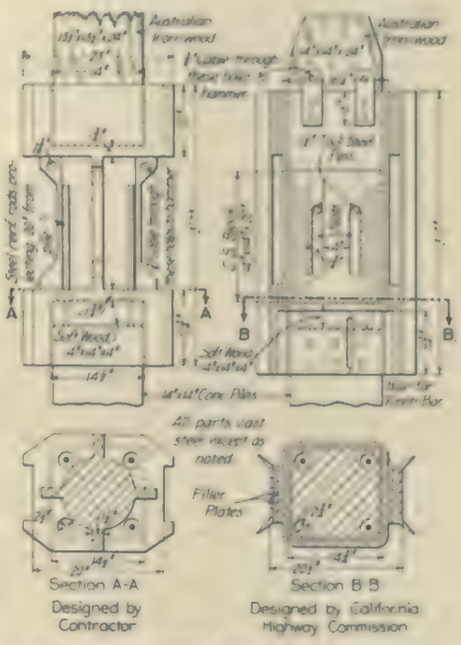
Length, ft.	Volume, cu. yd.	Weight, tons
32	1.50	3.00
35	1.65	3.34
40	1.91	3.86
45	2.17	4.39
50	2.43	4.92

The concrete crew in the casting yard includes the following: Foreman, two men at mixer, one man in cement shed, engineer on hoisting engine, locomotive crane engineer, tag man, finisher and seven spaders. This crew usually pours, in an eight-hour shift, from 90 to 120 cu. yd. The concreting crews work from 5 p. m. to 1 a. m. daily, using carbide lights for lighting. The locomotive crane, which has a capacity of 25 tons on a radius of 12 ft., works three 8-hour shifts each day—from 8 a. m. to 5 p. m., loading floor units for the bridge; from 5 p. m. to 1 a. m., handling concrete in buckets, and from 1 a. m. to 8 a. m. taking cast units and piles from forms and placing in storage piles, etc.

In both slabs and piles the reinforcement is made up and placed in the forms as a unit. This work has been very accurately done, the inspectors report, and the cost has been comparatively low. The bending, assembling and placing in forms has amounted to about $7.50 per ton of reinforcement, and at times has been as low as $6.50 per ton. The weight and yardage of piles was found to average as shown in the above table.

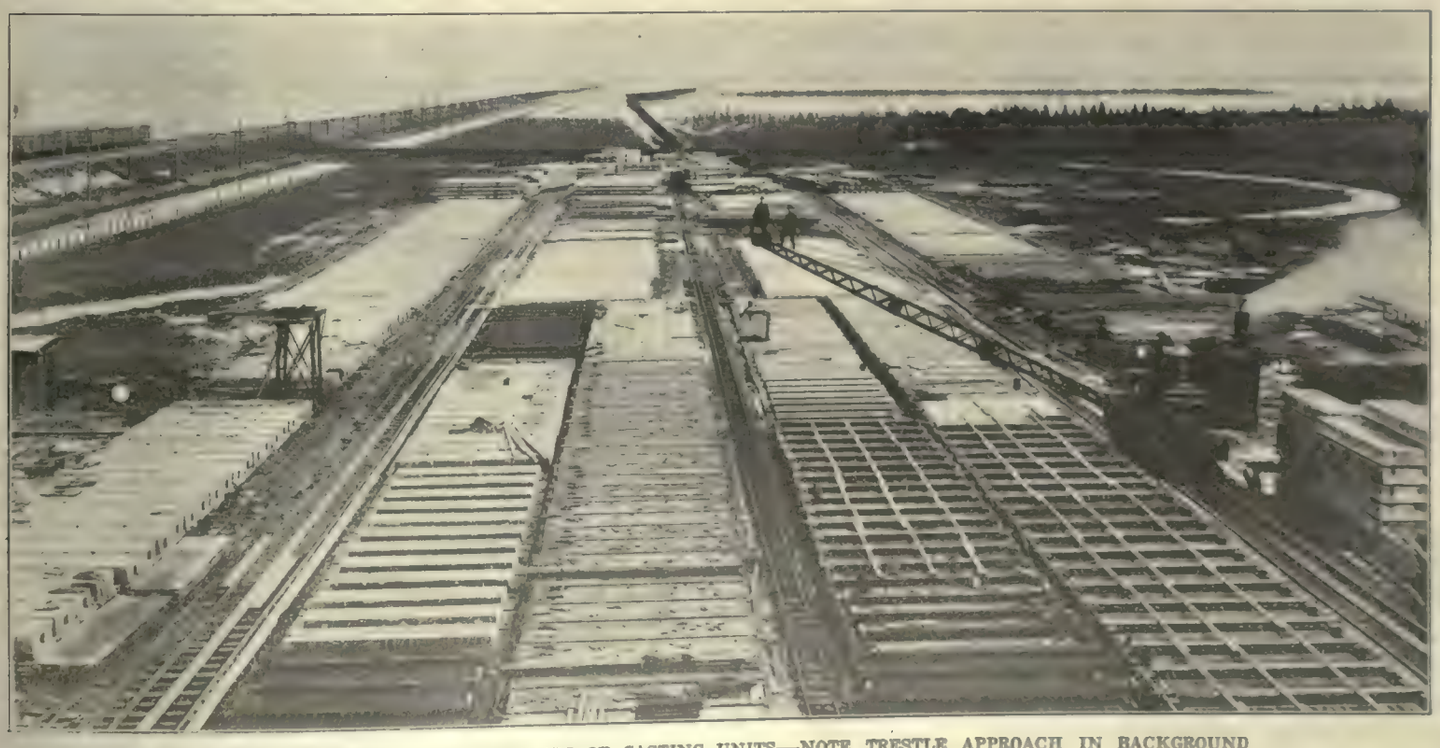
HANDLING THE CONCRETE PILES

A total of 2932 concrete piles are required in the all-concrete section of the viaduct, of which 1084 are 35 ft. long, while the others range from 32 to 50 ft. in length. The longest piles to be driven are expected to have a penetration of about 30 ft. The greatest penetration up to July 1 was 25 ft. The soil is a mixture of sand and clay and varies greatly in bearing power. In at least one instance a ledge of soapstone was encountered which prevented driving piles to grade. The piles are cut off by the hammer-and-chisel method, three men on a scaffold usually cutting two piles in an hour. The reinforcement is first cut with hack saws and the concrete is then split off with wedges.



PILE FOLLOWERS USED WITH SUCCESS

From the casting yard out upon the viaduct the materials are delivered by one 5-ton gasoline motor which ordinarily works three eight-hour shifts, and two 7½-ton steam dinkies, all 36-in. gage. The piles are hauled on standard trucks, five piles to a load. There is a single track from casting yard to viaduct over a temporary incline on a 4 per cent grade. The track on the viaduct is also a single line, but is provided with occasional sidings. Piles are hauled out by the dinky locomotives at night and lowered to two

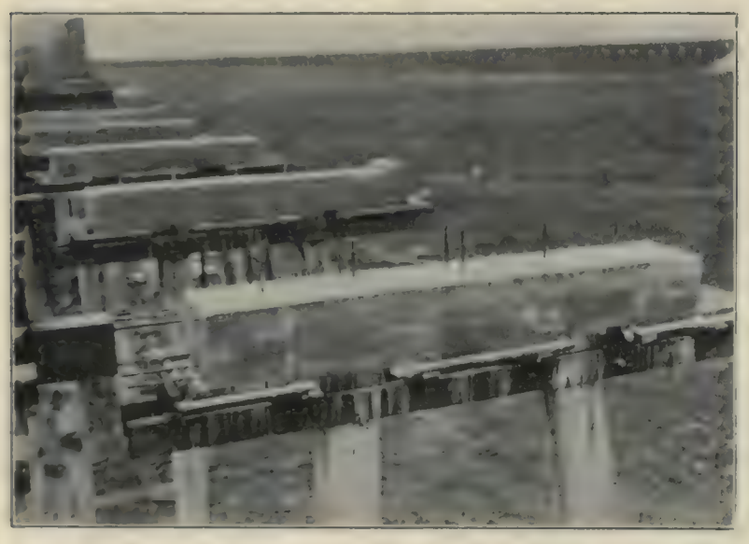


LAYOUT OF CASTING YARD—METHODS OF CASTING UNITS—NOTE TRESTLE APPROACH IN BACKGROUND

"horses" so that the piles lie parallel to the viaduct center line and rest on the supports at about quarter points. They are eased down to this position by a line from the driver and a snub line passed around a driven pile near the ground line.

The pile driver is equipped with a 12 x 12-in. boom 48 ft. long set in the foot block between the permanent leads. Swinging leads are moved to one side out of the way when piles are to be delivered to the driver; the hammer line is used as a boom line, and the pile line as a fall line. It has been found necessary to use two lines in taking up the longer piles, but when they are not more than 35 ft. long they are picked up by the pile line from the driver fastened some 6 ft. back of the head of the pile, and in this manner are dragged to the driver without difficulty. In the first part of the work it proved as expensive to deliver the piles to the driver as to drive them. The labor cost per linear foot of pile averaged 8 cents, exclusive of fuel or crew on small driver, while that for hauling and lowering the piles averaged about 6 cents.

The penetration of the piles under the final blow varied considerably, in some cases being as much as 1/3 in., while in others it was very slight, requiring twenty or even thirty blows to the inch. The average penetration for the final blow was from 1/6 to ¼ in. The total time required to drive a 32-ft. pile with a penetration of 14 ft. was from 3 to 7 min. In one extreme case the contractor preferred driving a 45-ft. pile to grade rather than cutting it off. The pile was struck for 28 min. with a final penetration of twenty-five blows to the inch. Under approximately 1600 blows the pile head remained in perfect condition.



RIGHT—TEMPORARY CAPS AND TRACK



LEFT — CAPS ARE CAST IN PLACE

Locating the Piles

To keep the bents at right angles to the viaduct and exactly 19 ft. apart a base line was first run approximately 200 ft. from the center line of the structure and parallel to it. The driver was pulled back until the transit on the base line could center the leads in position. A pile was then picked up, lowered and spudded to center as signalled by the transit man. After the pile was in position it was struck several times by the hammer and the driver was then pulled, if necessary, to center the pile at cut-off, after which the pile was driven without further moving of the driver. This base line was abandoned when the basin was flooded, a new base being then established on the Southern Pacific grade and the same general method being followed.

As the work advanced and the distance between the viaduct and the railroad grade became too great for accurate work, the piles were spotted by direct measurement and by transit on the center line of the completed structure. The distance is carried along the center line, and the measuring points for each day's work, usually seven or eight bents, are established on all four piles, right angles being turned by transit. The driver is first spotted for line, then pulled for distance, and the pile is picked up. As it is lowered to position it is plumbed with a 4-ft. mason's level. The hammer is then located and the pile struck several blows, after which the driver is pulled, if necessary, until the distance at cut-off is exact.

Two transitmen and a rodman are required for this work and the piles are spotted in a remarkably short time, it is stated, frequently 30 or 35 piles being driven in eight hours. The standard of alignment allows a 2-in. variation in the head of the pile in cap, and a comparatively few piles have to be sprung slightly; as a rule, not more than from two to four piles in a day's work. When a pile is sprung it is pulled to place with a ½-in. cable fastened to the next pile at the ground line. A twister is used to tighten the cable, which is left on the pile until the cap is poured and floor units are placed and grouted.

Special Followers

After some experimenting with various equipment for driving the concrete piles, an 8000-lb. hammer was selected which struck a 10,150-lb. blow 110 times per minute. With this hammer, however, the pile shattered considerably, due to the velocity of the blow, and very much better results were reported when a No. 1 Vulcan hammer was substituted. The latter weighs 5000 lb. and strikes a 17,500-lb. blow with a drop of 3½ ft., averaging about fifty-six blows per minute.

The piles had to be driven with four ⅞-in. reinforced rods projecting 20 in. from the head, and it was at first difficult to prevent shattering of the head by any follower which would accommodate these rods. A standard-type follower supplied for this purpose was entirely unsatisfactory, and a sand cushion head tried out by the contractor, in which the ram of the hammer struck directly on the sand resting on top of the pile, was equally destructive. The California Highway Commission meanwhile designed a follower especially for the purpose, of the type shown in the accompanying drawing. This has been used, it is reported, with great success.

It was anticipated in using this follower that the wooden block cushion would crush around the rods and jam. A sliding cast block was therefore designed to knock this cushion out. However, it was found that no matter how badly the block cushion crushed, the holes were seldom closed enough to prevent the rods of the next pile from entering. A 4-in. fir block was used as a cushion and could be used for six or eight piles, and in some cases many more, the maximum being twenty-six piles. After having been used for 488 piles this follower was discarded in favor of one which the contractor had made from cast steel as shown in the same drawing.

This cast-steel follower also worked very well, it is reported. It is equipped with a 14 x 14-in. block of Australian ironwood in a position between the follower proper and the ram of the hammer. This block, which is chamfered at the upper end and set with a heavy cast-steel cap, burns out after an average of about five days of driving, or more than 100 piles. It is believed that to prevent the head of the pile from shattering all lateral pressure should be kept from the projecting rods, and to accomplish this the followers were provided with 2¾-in. holes in the 4 x 14 x 14-in. blocks.

Slabs Handled by Gantry

The concrete caps are cast in place, monolithic with the heads of the concrete piles, only half the full length of each cap, as already mentioned, being cast at a time. When a considerable number of the bents have been thus capped and the caps sufficiently set, the longitudinal floor slabs are placed and grouted in place. These slabs, which are cast in the yard and delivered to the work ready for service, are in two sizes; those which are placed on the outer edge on either side of the roadway contain 3.08 cu. yd. and weigh 6¼ tons each, while the inner slabs each contain 2.59 cu. yd. and weigh 5¼ tons. Each 19-ft. bent is thus spanned by five concrete floor slabs,

two outer and three inner. Since only half the length of the concrete caps is poured at first, only two of the five floor slabs to each bent are placed before the track is shifted over from the temporary wooden caps to the completed section of the floor. Each of the floor slabs is provided with ring bolts embedded in the concrete at the four corners. The slab is picked up from its form in the casting yard by the locomotive crane and loaded on flat cars which are delivered in trains of two cars each to a gantry traveler spanning the full width of the trestle at the desired point.

The gantry traveler, which is shown in the illustrations on page 248, is supported on four posts, each resting on a timber dolly carried on two 12 x 12-in. timbers running from bent to bent. The traveler is moved along as desired with pinch bars. With the traveler at the desired position it is wedged and chained to prevent tipping and the cars containing slabs are spotted directly beneath it. The floor slab is then picked up by two 5-ton Yale chain blocks and lowered into position on the caps. The caps are previously wetted down and a mortar bed is placed. The weight of the unit squeezes the mortar out on all sides, showing uniform bedding. A maximum of sixty slabs has been placed in an eight-hour day with a setting crew of one foreman, a mason and five laborers. The average cost of setting and grouting joints computed after two weeks' work was 26 cents per ton. The cost of labor only in hauling from yard, including loading, was 11 cents per ton.

Expansion joints are made between slabs by using 16-gage galvanized-iron channels set in the concrete. Movement between units at the expansion joint is noticeable at the slightest rise in temperature, it is reported, but under the rise thus far experienced, from 40 deg. to 102 deg. Fahr., the action of the expansion joints has been perfect. The secret of success in this type of joint, it was pointed out, was in keeping the joints raked out as the slabs are bedded and afterward keeping them perfectly clean.

The work has been carried out according to designs prepared in the headquarters office of the California Highway Commission, R. E. Dodge, office engineer, being in charge of the design. B. G. Gerwick, resident engineer, is in immediate charge of the work in the field, under W. S. Caruthers, division engineer. The whole work is under the general direction of Austin B. Fletcher, highway engineer. The contract for the work is held by the Graff Construction Company of Seattle.

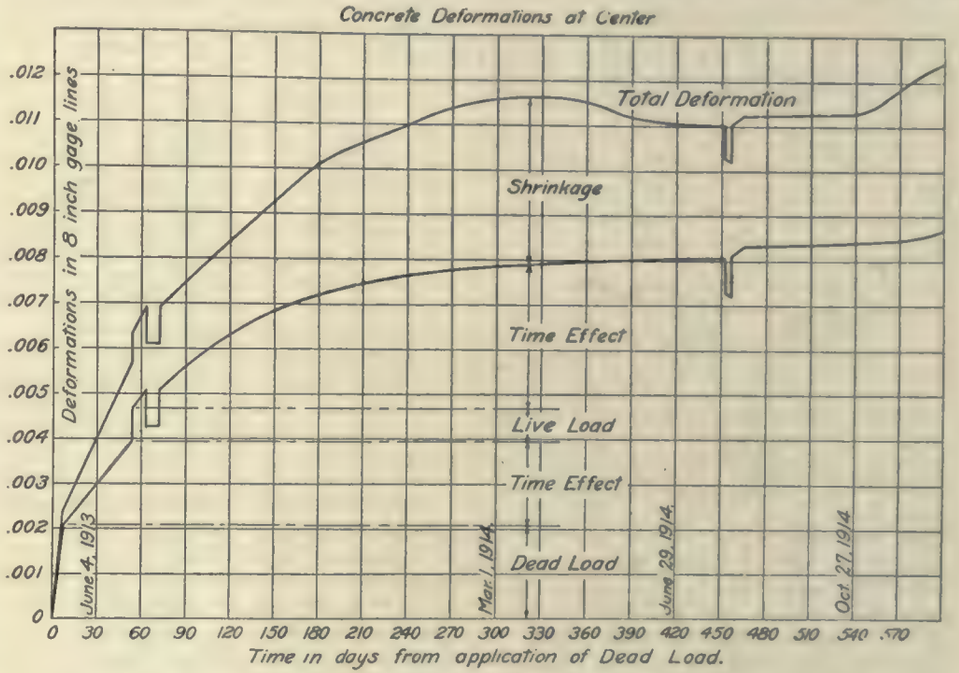
Panama Canal Handled 4,969,792 Tons During First Year

TRAFFIC for the first fiscal year of operation of the Panama Canal, ended June 30, but embracing only 10½ months, from Aug. 14, 1914, to Jan. 30, 1915, is reported in the Canal Record. During the period the canal was used by 1088 vessels, and 4,969,762 tons of cargo were moved. At this rate the movement would be 5,679,762 tons in a full calendar year, 473,313.4 tons per month or 15,530.6 tons per day. The movement was 2,125,735 tons eastbound and 2,844,057 westbound. The heaviest month was March, when 635,057 tons were moved. There were only 137 vessels moved that month, however, while in June 143 vessels carried only 603,180 tons. In May 142 vessels carried a still smaller tonnage.

Time and Shrinkage Affect Stresses and Deflections of Reinforced-Concrete Beams

Long-Continued Tests Made by F. R. McMillan Show Increase in Strains and Deflections—Compression Found in Tension Steel

THE effects of loads sustained for long periods of time have been made the subject of extensive study by F. R. McMillan, instructor in experimental engineering, University of Minnesota, who has just reported the results in a bulletin, "Studies in Engineering, No. 3," of that institution. The observation of progressive sagging and cracking led to the plans for scientific measurements of strains and deflection of beams and slabs, which have been carried on under laboratory conditions for the past nineteen months in one case and for shorter periods for several other specimens, the observations on which are to be continued in the future. The most striking features of the results given by the author are the continued yielding of beams and slabs and the possible presence in the longitudinal field of compression members of deformations from 5 to 15 times those to be expected from ordinary calculations. It is shown that the tensile steel in the lower side of loaded slabs is in compression under the action of shrinkage in concrete in the cases tested.



CONCRETE DEFORMATIONS AT CENTER OF BEAM 30 IN. WIDE BY 5½ IN. DEEP

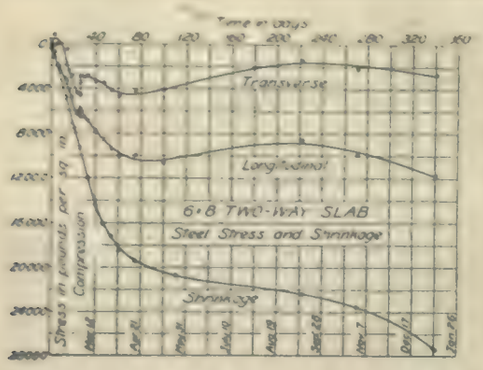
It is stated that the changes which take place are chargeable neither to poor construction nor to inadequate design, but rather to the nature of the material itself, its tendency to shrink and to yield under load. The large effects of shrinkage are emphasized, the shrinkage being obtained by measurements on gage lines made across the beams transversely, or around the edges of the slabs. The shrinkage strains are a relatively large proportion of the total strains. It is shown, as already given in an article in the Engineering Record of April 17, 1915, page 489, that the conditions of curing seemed to have relatively little effect on the final shrinkage.

RESULTS OF BEAM TESTS

A beam 30 in. wide and 5½ in. deep of 12-ft. span reinforced by 10 plain ⅜-in. round rods was tested by the application of the liveload to the one-third points. This beam was practically a 1 : 2 : 4 mixture of standard Portland cement, sand and limestone, and was poured in March, 1913; throughout the curing stage and period of test it was exposed to ordinary room temperatures from 60 to 80 deg. Fahr. Strain measurements were made by the Berry strain gage on 8-in. gage lengths located on the concrete at the top both near the center and just outside the load points. The gage lines on the underside of the beam were drilled into the reinforcing rods and located similarly. Deflections were measured by a special apparatus using an Ames gage and measuring between small steel plates on the underside of the beam and on the floor vertically below.

The most striking feature of the results, as shown by diagrams, is the magnitude of the change that takes place with time. The total deformation has been separated into its three elements, the elastic deformation, the time effects and the shrinkage. One significant feature is the ready response of the concrete to changes in the moisture content of the surrounding air, even very slight changes being sufficient to cause either an actual swelling in the concrete or a noticeable reduction in the rate of shrinkage. The effect of shrinkage is found to be much less than that of the time effect in increasing deflection, because the latter acts on both top and bottom to produce increased deformation.

In obtaining the deflection, the effect of the supports was included, the net average deflection representing the difference between average total and average of the supports. The deflection curves show an increased rate near the end due to the increased rate of shrinkage from drying out caused by heating of the building in the fall. There is a possibility that this chang-



EQUIVALENT STEEL STRESSES—TWO-WAY SLAB

ing rate will continue from season to season, each subsequent swelling being followed by a period of increasing deflection, the total steadily increasing with time.

Computations for Poisson's ratio were made and the weighted mean of all observations gave a value of about 0.2 for the concrete, the results of the determination on the steel being much less satisfactory and quite variable.

Tests were also made on 4 x 5-in. beams on 42-in. spans, using a 1 : 2 : 4 mixture with pea-sized stone. The deformation and deflection curves cover the action for about one year, and show similar results.

Results of Flat Slab Tests

In November, 1913, a 6 x 8-ft. two-way slab 3 in. thick, reinforced in both directions with 5/16-in. round bars hooked at both ends, was built of a 1 : 2½ : 4 mixture, using blue limestone of pea size and washed sand. This slab was cured for a period of ten weeks under a layer of sand kept continually wet. After being cleaned and allowed to dry for a few days a live load of 50 lb. per square foot was applied and an increase to 100 lb. three days later was made, the whole load was removed after eleven days, and reapplied twelve days later. From this time it has been continuously in place for more than ten months. The deformations and deflections were measured at the center of the slab and in both directions. The resulting continual increase in values is indicated by the diagrams. The shrinkage in this case was found to be relatively a much larger proportion of the totals than in any of the previous tests.

The rather remarkable condition that compressions of from 4000 to 12,000 lb. per square inch exist in the tensile steel of a loaded slab after nearly a year is noted. In view of the continued deflection it may seem unusual that this tensile steel should still show compression. That this is possible is claimed to be due to the fact that the slab is free to contract in all directions, which might not be the case in a series of continuous spans over a considerable area. In such a case shrinkage cracks would probably form, thus throwing on the steel the tension now being carried by the concrete.

The deflection at the end of eleven months is some 1000 per cent greater than that produced by the application of the full live load. It should be noted, however, that the absolute values of this deflection are quite small, the maximum deflection being only 1/40 in.

One-Way Slab Tested

Similar results have been obtained on a 10 x 10-ft. one-way slab of a good grade of 1 : 2 : 4 machine-mixed concrete, which has been tested for about eight months. This slab is 4¾ in. thick and is reinforced with ⅜-in. plain round bars of 5½ in. on centers longitudinally, and 5/16-in. rods 12 in. on centers transversely immediately above these. Measurements were begun when the slab was only twenty-four hours old. Deflection measurements were begun when the forms were removed at the age of 135 days.

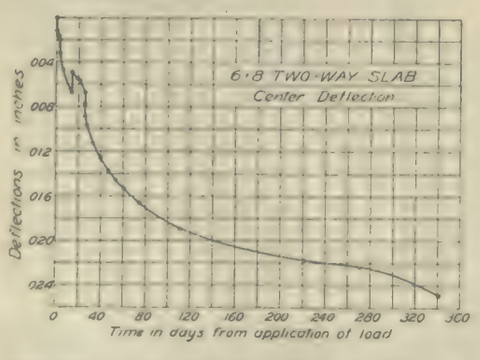
The curve of deformation for the concrete shows a continuous increase up to the time of application of the dead load, after a swelling for the first thirty days. A small sudden increase then occurs, which gradually grows greater with time, no added load being applied to the slab. The steel deformation indicates a shrinkage from the very first. A sudden drop in the steel deformation on the day the dead load was applied shows the elastic effect in the steel stress. The continued shrinkage in the next 125 days, however, carried this curve above its previous high point. It now shows a deformation of 0.00031 per inch, or a compressive stress of 9300 lb. per square inch.

Summary and Conclusions

In order to show that the progressive changes found by the author are not confined to laboratory slabs and beams, the results of some deflection measurements extending over a period of three years on three floor panels in a well-constructed reinforced-concrete building are given. Two panels so situated as to have received practically no load since casting show continuous deflection up to an average of about 0.35 in. The third panel was only partially loaded, as shown on a diagram, but the deflections were largely increased, the final deflection being nearly 1 in. Photographs of cracks in reinforced slab and in a position are also given as additional evidences of these time changes in existing buildings.

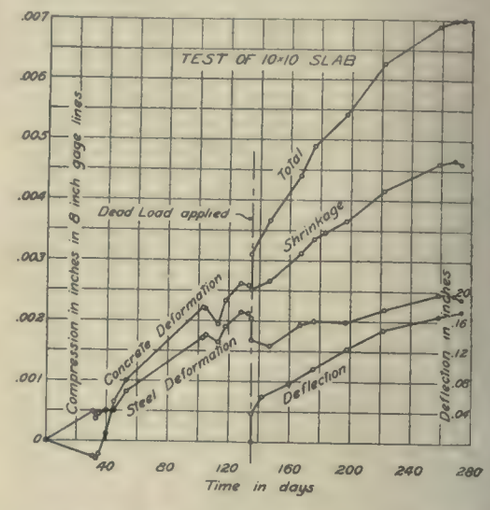
With regard to shrinkage, the author concludes that it is safe to predict a shrinkage of from ¾ to 1 in. or more in 100 ft. for concrete exposed to the ordinary dry air of a heated building. Slight changes in the moisture contents will retard the shrinkage or even cause a swelling. The yielding of the concrete under compressive stress with time, a phenomenon similar to the yielding of ductile metals when stressed beyond the yield point, is greater if the unit stress is greater and seems to go on indefinitely.

In these tests the deformation due to yielding was found to be from three to five times that produced immediately upon the application of the load. On the tension side of a beam or slab the effect of time is to cause a gradual increase in the steel stress from the breaking down of the concrete in tension or the failure of the bond. The combination of the extension at the bottom and a shortening at the top produces in beams and slabs a continually increasing deflection.



DEFLECTION OF TWO-WAY SLAB UNDER LOAD

Two possible effects, both of which might in certain instances be of serious consequence, are cited by the author as follows: First, the continued yielding in the upper fibers of a beam coupled with the gradual breaking down of the concrete in tension may result in a progressive destruction of the bond from the center toward the supports. Second, the possibility of high



RESULTS OBTAINED FOR ONE-WAY SLAB

stresses in the longitudinal steel of compression members. The time yielding of the concrete under stress combined with the excessive shortening due to shrinkage may result in deformations from five to fifteen times those expected from the ordinary calculations.

How Colorado Dam Construction Is Supervised

Failures Have Been Due to Inadequate Preliminary Investigations—State-Owned Automobiles Increase Inspectors' Efficiency

STATE RESERVOIR supervision in Colorado requires that specifications give the quantity of the material going into the construction, the expenses, the mechanical analysis of earth to be used in earth dams, the logs of test pits and borings, a report on the drainage area above the reservoir and an estimate of the maximum discharge at the dam site. These provisions and the following are outlined in the biennial report of the State engineer for 1913 and 1914. The removal of earth from the reservoir basin for the purpose of constructing dams has been almost always prohibited. The placing of the valves in the center of the dam has been preferred and the construction of wood and steel outlet pipes has been discouraged.

In the placing of riprap on the dam a substantial toe at the foot of the riprap has been insisted upon and almost always a base of gravel underneath both loose rock and concrete facings has been required. It has been necessary to return plans very often on account of both the inner and outer slopes being, in the opinion of the engineer, too steep. More adequate and a larger number of cut-off trenches underneath the dam have been insisted upon. The spillways have been required to be ample and of such a nature that they could not be obstructed. The placing of stop planks or other impediments in the spillway has been prohibited and the structure made as nearly "fool proof" as possible.

During the biennial period a number of failures have occurred in reservoir dams. These failures have been due almost without exception to inadequate investigation of the foundations of the dam and of the materials composing it.

In some cases, while the plans made ample provision for safety, the execution of the work by the contractors was of such a nature that the resulting structure was dangerous, and the engineer was impressed with the necessity in the future of having his own representative on the ground during the entire term of construction to see that the plans and specifications were complied with and to make necessary changes in the plans and specifications during the progress of the work, as the nature of the materials encountered and other matters required.

AUTOMOBILES CUT EXPENSE COSTS

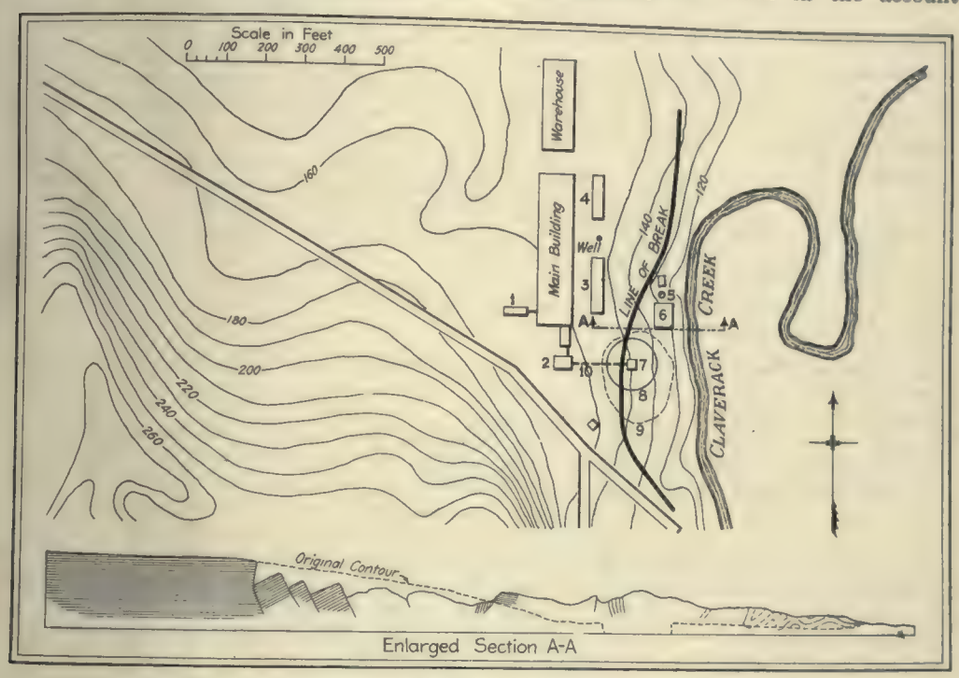
When the granting of railroad passes to irrigation officials was discontinued in 1913 the traveling expenses of the office increased beyond the available funds. Hiring automobiles and drivers as required was tried out at first, but this service, including team hire, cost about $200 per month, and was found unsatisfactory as well as expensive. As an experiment the engineer purchased an automobile on his own account in 1914. The result was that the traveling expenses were cut about 33 per cent. The number of days the automobile was used very much increased, the mileage covered averaging about 100 per day, or 2500 miles per month, at a cost of about $125 per month. Based on either a per diem or mileage charge, the cost was only about half what hiring the automobile would have been. If automobiles are provided it is the opinion of the engineer that five hydrographers instead of seven will be sufficient and that the amount of work accomplished will be increased. With such equipment the law relative to the examination of reservoirs each year can be easily complied with in connection with the hydrographic work.

Water-Soaked Bed of Blue Clay Caused Landslip at Cement Plant near Hudson

Wreck of Power House at Knickerbocker Portland Cement Company's Greenport Plant the Result of Unusual Subsurface Conditions

By D. H. NEWLAND
Assistant State Geologist, Albany, N. Y.

THE RECENT LANDSLIP on the property of the Knickerbocker Portland Cement Co., near Hudson, N. Y., described in the Engineering Record of Aug. 7, page 179, was attended by features that were quite extraordinary from the physical viewpoint and that have not been clearly or adequately set forth in the accounts previously published. In fact the occurrence finds little or no similarity with the ordinary earth and rock slides that take place on steep slopes, and so far as the writer can find has had but one counterpart in the rather long list of recorded slips in the clay terraces of the Hudson Valley. It was not caused by undermining through solution or erosion of the subsurface materials, by quicksands, or by caving of the bed rock, but was due without any doubt to a temporary condition of instability in the coherent surface stratum which at the time of the occurrence rested upon a thoroughly water-soaked mass of blue clay that under the load behaved practically as a fluid. It was this physical differentiation of the clay beds into a dryer, firmer, upper layer and a wet, mobile, underlying bed that supplies the clue to the peculiar nature of the slip and the attendant features.



SKETCH MAP OF REGION AFFECTED BY LANDSLIP NEAR HUDSON, N. Y.

Knickerbocker Portland Cement Company's plant consists of the main office, near road shown leading northwest toward Hudson, the main building and warehouse, and the smaller buildings, etc., numbered as follows: 1. Clay house; 2. Rock crusher; 3. Machine shop; 4. Coal house; 5. Chimney; 6. Power house; 7. Elevator; 8. Track of 65-ft. radius for electric crane; 9. Stone pile; 10. Underground conveyor.

GENERAL CONDITIONS AT SITE

Reference to the accompanying sketch map will assist in the explanation of the occurrence. It will be seen that the ground on which the plant is built is quite flat, except for the slight inclination toward Claverack Creek, which occupies a small trench in the clays about 40 ft. below the level of the base of the main buildings. The level ground is practically all clay with some coarse sand at the surface. The clays are 75 or 80 ft. thick as a maximum, becoming thinner toward the south and southwest where the buried rock surface rises up to join the slopes of Becraft Mountain, the limestone ridge from which the company derives its supply of rock for cement manufacture. The limestone apparently does not extend north of the highway on the map, the underlying rock on that side being the so-called Hudson River shale, which also underlines the limestone.

The slip involved a section that is now defined on the west by a vertical bank, up to 20 ft. high, which describes a broad curve opening toward the east, the center being about 225 ft. from the old creek channel. The ground between the bank and the creek as a whole shows subsidence, the vertical range of which does not exceed 20 or 25 ft. In some places within the area the level has changed only slightly, although even then the ground is usually tilted. The subsided area is divided into large blocks, which came down as units, bounded by fractures that follow more or less closely the direction of the limiting break on the west. The blocks on the western side are invariably tilted toward the bank, and are sometimes separated by open fissures 10 to 15 ft. deep. The appearance of the broken, disjointed area, with buildings shifted and upset from their foundations, trees inclined at all angles or prone upon the ground, and havoc everywhere, can hardly be conveyed in words.

CREEK BED RAISED

The subsidence when traced toward the creek gradually diminishes; at the creek itself are found the most remarkable features which help to explain the occurrence. A section of the creek bed about 600 ft. long has been raised vertically so that it now lies 20 ft. or more above its former level. The clay beds over which the water flowed may be seen to be standing on edge, having been upset in the movement, and some of the bed was shifted toward the east.

Along with the upheaval came an extrusion of the underlying blue clay which here found escape to the surface, flowing out in great masses upon the low ground to the east of the creek. The drag of this clay upon the surface stratum seems to have sufficed to overturn the latter. The blue clay when examined on the day following the slip was in a soft semi-liquid state, very greasy to the feel. In the flowage the bedded appearance which it exhibits when in place had been lost, the masses being without any definite physical structure.

CLAY FLOWED UNDER PRESSURE

Evidently the creek trench constituted a zone of weakness; it was the low spot in the area and also furnished the shortest path for the escape of the wet clay. The latter under the pressure from the higher ground on the west, and in a condition approaching fluidity, found partial compensation by upheaving the creek, which it did

so suddenly as to shed the waters in a flood and to leave fish high and dry on the bed.

With the rupture of the coherent surface clays a channel was opened for further relief of pressure by extrusion of the wet clay. Then came the subsidence which seems to have taken place block by block from east to west and to have continued without interruption until the present condition was attained. It seems to be quite clear that the trouble began at the creek and progressed to the west. According to some of the witnesses the ground rocked like an earthquake while the adjustment was in progress, a period of two or three minutes.

INITIAL CAUSE AND TEST BORINGS

The exact impulse that started the disturbance is difficult to find, if there were any single factor responsible. It seems probable that the wet condition of the clays, the lack of balance in the weight of the overlying surface stratum with the artificial load upon it, and the trench of the creek were all contributory to the accident, with the first as the most essential feature.

To establish the condition of the ground in the vicinity of the subsided area, a number of test borings were made which showed in fact that the blue clay at varying depths from the surface was thoroughly water-soaked. The water could hardly come from surface seepage alone; most of it probably is traceable to an underground flow from the north end of Becraft Mountain which admits the water along the edges of the clays as they overlap upon the rock slope. The few weeks preceding the occurrence were characterized by an extremely heavy rainfall, and the condition of the ground when tested was exceptionally wet.

LOADS ON FLUID LAYER

The main load upon the fluid layer was of course the overlying coherent stratum which had a thickness of from 15 to 30 ft. Its weight altogether greatly preponderated that of the artificial load represented by the buildings and the stock pile of crushed stone, which latter amounted to about 25,000 or 30,000 tons according to the most reliable estimate. The extent of the subsidence beyond the artificially weighted region appears to argue against the direct influence of the added load in disturbing the balance.

With the heavy rains in the month of July the wet zone in the lower clay must have raised considerably above the normal level for ordinary seasons, and the thickness of the overlying coherent layer correspondingly diminished. This of itself may have been the potent factor in upsetting the equilibrium. The rainfall also produced a flooded condition of the creek which at the time, no doubt, was cutting more or less into its bed.

PREVIOUS SLIP SIMILAR

A slip very similar to this occurred in March, 1908, near Stockport, a few miles north of Hudson. The displaced area in this case was part of a forested strip along a small ravine which drains into Stockport Creek. There were no buildings or other works within the area, and the disturbance was not connected with any artificial impulse, so far as could be established. A section of the bank of the ravine broke away along a nearly vertical fracture and dropped 40 ft., while the bottom of the ravine was raised as a separate block, the adjacent edges of the two blocks being disjoined by an open fissure 15 ft. across at the top. The slip occurred right after the spring rains.

There is little doubt that such balanced adjustments have happened repeatedly in the Hudson River region, although they have not been recognized in their true character. From ordinary slides of earth they differ so markedly, however, as to deserve special attention both from an engineering and geological standpoint. It is peculiar of their occurrence that they take place suddenly, if not without previous warning, and that the condition leading up to the final disruption probably develops very gradually. The fact that the seat of trouble—the wet substratum—is concealed below many feet of firm and coherent material renders it doubly difficult to forestall their occurrence. The only safeguard for structures built upon the clays in such circumstances seems to be thorough drainage of the ground.

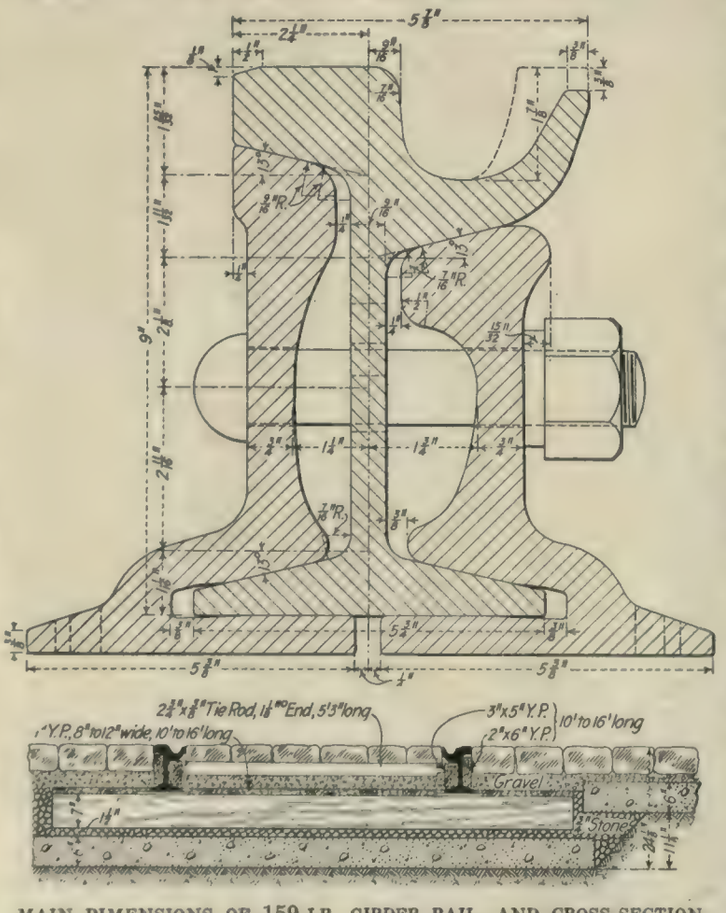
159-Pound Girder Rail for Philadelphia Streets

Adaptability of Type of Construction First Tested in Street Carrying Heavy Traffic

THE South Philadelphia improvement, now being carried out by the city of Philadelphia and the Pennsylvania and Baltimore & Ohio Railroads, involves, among other things, the laying of several miles of permanent track at grade in Delaware Avenue. In this connection the railroads and the city have worked out a design for a 159-lb. girder rail for general use in the city streets. Cross-sections of the rail and splices and of the approved form of track construction are shown.

Each joint is held with four 1¼-in. bolts, passing through 1 7/16-in. holes in the rail web, 1 5/16-in. round holes in the inside splice, and 1 5/16 x 1⅝-in. elliptical holes in the outside splices. The spacing of the four holes is 7½, 5½ and 7½ in., and the splice bars are 26 in. long. Each bar has two slots and two holes for spikes. The rails are laid on four-hole tieplates 10¾ x 7 x ⅝ in., with a ⅜-in. shoulder on top and a ¼-in. shoulder on the bottom. The ties are spaced 18 to a 33-ft. rail, and for each 33-ft. length the rails are connected with six tie rods, consisting of 2¾ x ⅜-in. forged bars threaded at the ends and held by a standard square nut each side of each rail web.

The adaptability of this type of rail for tracks laid and operated in a public street used intensively by all classes of vehicles was carefully considered before a conclusion was reached. A track was laid with this type of rail at the intersection of two of the most heavily traveled streets in the city, and it was found that there is no difficulty or any objectionable jolt in crossing at an angle. Teamsters using the street longitudinally frequently drive with one wheel on the rail and find no difficulty in turning out. Wagons with all widths of tires, both loaded and unloaded, were driven on and off the track and there was no objection in any case.



MAIN DIMENSIONS OF 159-LB. GIRDER RAIL, AND CROSS-SECTION OF TRACK IN STREET

Cincinnati to Sell All Water by Meter in Four Years

METERED service in Cincinnati is so satisfactory to the water department and to the consumer that Dawson J. Blackmore, administration superintendent, in his annual report to J. A. Hiller, superintendent, states that compulsory installation has been found both advantageous and necessary. At the present rate of installation every service should be metered within the next four years.

Tests were carried out on 8071 meters, and repairs made on 1872 meters in 1914. The average charges for repairs, including the test charges, were $2.22½ for ⅝-in. meters, $2.60½ for ¾-in. meters and $2.74 1/3 for 1-in. meters.

Water metered in 1914 amounted to 45.9 per cent of that pumped. During the year 4828 meters were added, increasing the total to 35,201. This number is 61.1 per cent of the number of services. Consumers using metered water furnish 72.3 per cent of the revenue.

The average daily consumption was 125.2 gal. to each one of the 406,000 estimated persons served. In 1913 it was 125.6 gal., in 1912, 131.3 gal., and in 1911, 125.6 gal.

The cost of supplying 1,000,000 gal. was $28.40 on ordinary expenses or $66.83 adding interest and sinking-fund charges.

New York Subway Tapped for New Connections While Carrying Heavy Traffic

Arched Concrete Tunnel Lining Cut Into to Join Lexington Avenue Line with Existing Tubes at Forty-Second Street

WHILE a million passengers are being carried every day through the New York subway under Park Avenue below the Grand Central Station, a connection between the existing tubes and the new Lexington Avenue line, involving the removal of the arched lining of the old tunnels where the new tracks cut into them from the sides, is proceeding without interrupting traffic. Instead of removing the whole arch roof, which is under a constant and heavy external load, only that half of the arch on the side where the new tracks enter is being taken out. The thrust from the other half of this arch, which remains in place, is transmitted to the rock flanking the new cut by horizontal roofbeams bridging the new track and the old one into which it turns. The work also includes tunneling beneath the present tubes for two express tracks and one local track, and replacing the existing subway floor at these points by new steel work. Another feature is a very deep rock cut in the Grand Union lot, from the bottom of which the street decking on Park Avenue is supported on "stilts." This decking is unusual, in that it consists of timbers and plank floorings supported on latticed girders taken from elevated lines being rebuilt in the city.

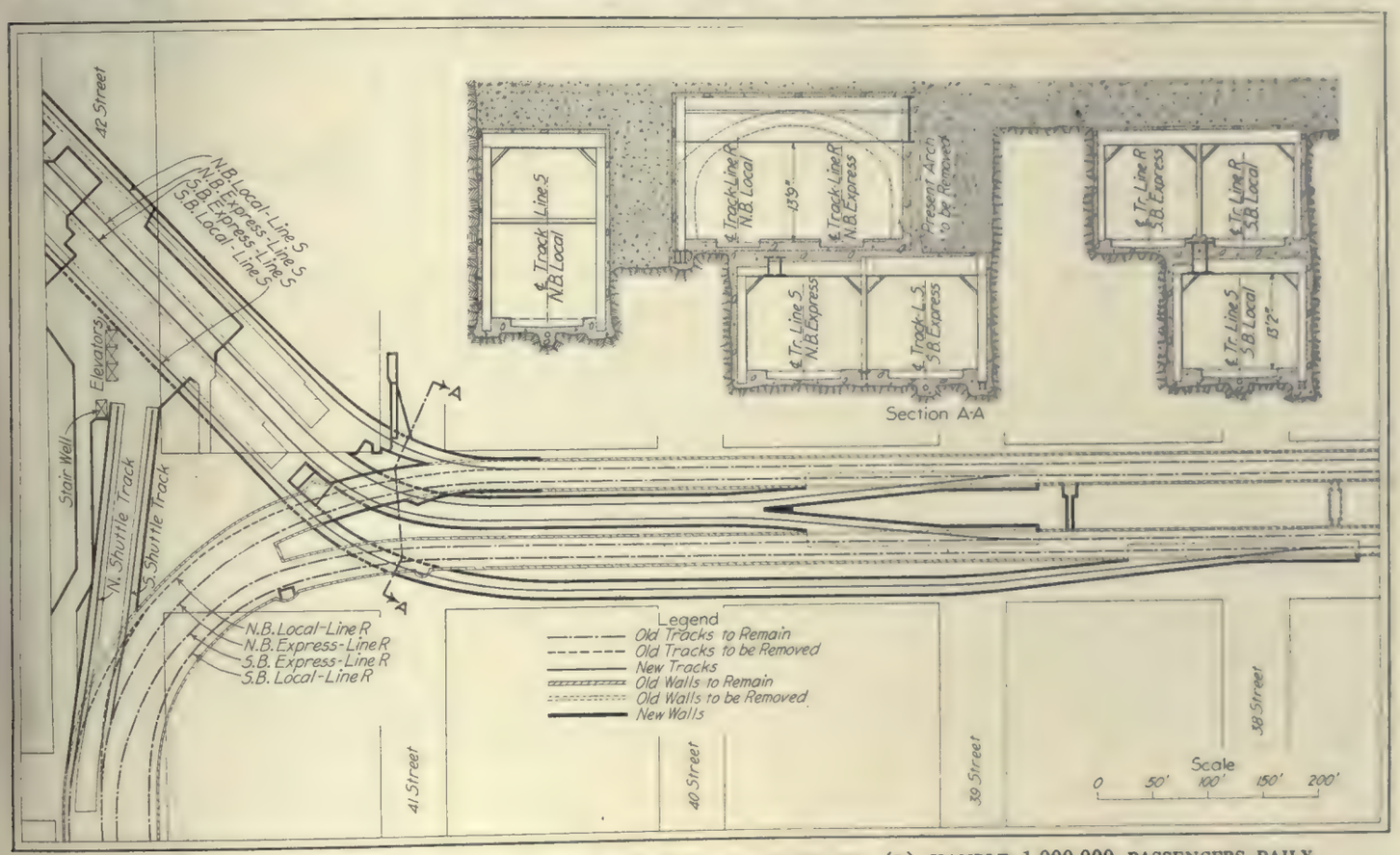
The work at this point includes two contracts, known as section 1 of route 43, and section 1 of route 26. Both are being carried on by the same contractor as one job, though the contract on route 26 is for constructing the Steinway tunnel on the lower level from the present temporary station to a point where it can be connected with the present tracks under Forty-second Street after operation on the Lexington Avenue line is begun.

The contract on route 43 extends through the Grand Union lot and down to Thirty-eighth Street on Park Avenue, where the southbound local cuts into the present tubes.

General Plan of Connections

As will be seen from the accompanying drawings, the northbound local track enters the east side of the present northbound tunnel on a rising grade. The present northbound tunnel, which carries both express and local tracks, is separated by a wide space from the present tunnel carrying the two southbound tracks. The future express, or center, tracks dip under the existing northbound tunnel and come up in this space on a rising grade. When they reach the level of the present tracks they break right and left into the old tunnels and connect with the existing express tracks. The southbound local track passes under both existing tunnels, turns down Park Avenue and penetrates the west side of the old southbound tunnel at Thirty-eighth Street. Here, and where the new express tracks break into the old tunnels, are the points at which only half of each old roof arch is removed. At the junction of the old and new northbound local tracks the load has been taken off the old tubes by decking the street, and the old concrete will be entirely removed and replaced with new construction.

At this section, which is entirely cut out, and at other points where the old tunnel is broken into, angle-iron ribs bent to the shape of the tunnels and lagged with wood plank were placed inside the old tubes to enclose the tracks and safeguard operation while the old concrete is being removed. This lining was made flat on top to give room for setting the new steel. It was placed at night, during the hours when express traffic is suspended and local trains run on 7-min. headway. The old concrete is drilled in blocks about 2 x 3 ft., and split off with plugs and feathers. A wire rope is passed around each block, on which a small hoist, mounted under the decking, takes a strain before the block is broken loose, to prevent its falling on the temporary tunnel lining. The first block, at the crown of the arch, taken out in each 2-ft. wide ring has to be broken out with bull points, after which the concrete can be broken off in large chunks.



DIFFICULT CONSTRUCTION OF NEW LAYOUT CARRIED ON WHILE FOUR TRACKS (R) HANDLE 1,000,000 PASSENGERS DAILY

Connecting Northbound Local Track

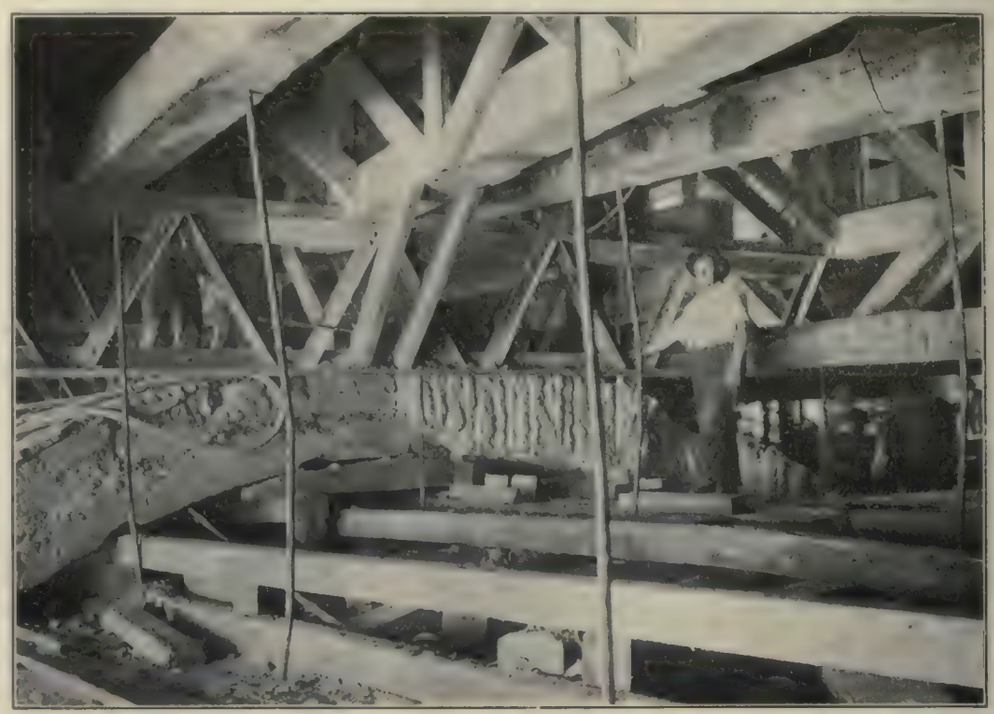
The floor under the northbound local track will be cut out and the track supported on trestles, through which the new track will be laid on a rising grade to within one rail-length of its connection with the old track. When all is ready for diverting traffic up Lexington Avenue the old track and the trestles under it can be removed by a large crew in a few minutes, and the last two rails, cut to the right length beforehand, inserted.

New Methods Used for Cutting Into Old Roof Arch

Where the express and southbound local tracks come into the old tubes there is a thick cover of rock over the construction which prevented decking the street and taking the load off the old subway tubes. The first step after the arch is exposed is

to cut into the old roof arch of the subway at 6-ft. intervals, removing strips of roof in which two beams can be set. These are placed in each niche and wedged up to transmit thrust from the remaining half of the old arch to the rock behind. The alternate strips of the old arch left between these niches are then removed, and more beams inserted in these spaces. Meanwhile, the conduits for the old subway, which were located in a trench under the center of each tunnel, are removed and replaced at the side of this structure, the trench left being filled with concrete. On this concrete are set steel columns, one under each new roof beam. These columns are, of course, set at night, while express trains are not running. The side wall next to the new tunnel is removed as fast as the roof beams are set, and the new roof concreted.

Where the new express tracks rise between the old tubes the rock has been removed until the sides of the old lining were exposed. It has not been necessary to shore the old tunnels at the spring-line of their arches, as the rock on the haunches of these arches has held them until the new roof steel was in place. The new express tracks are separated by a concrete wall, with embedded steel columns. This wall is being placed in advance of the new roof.

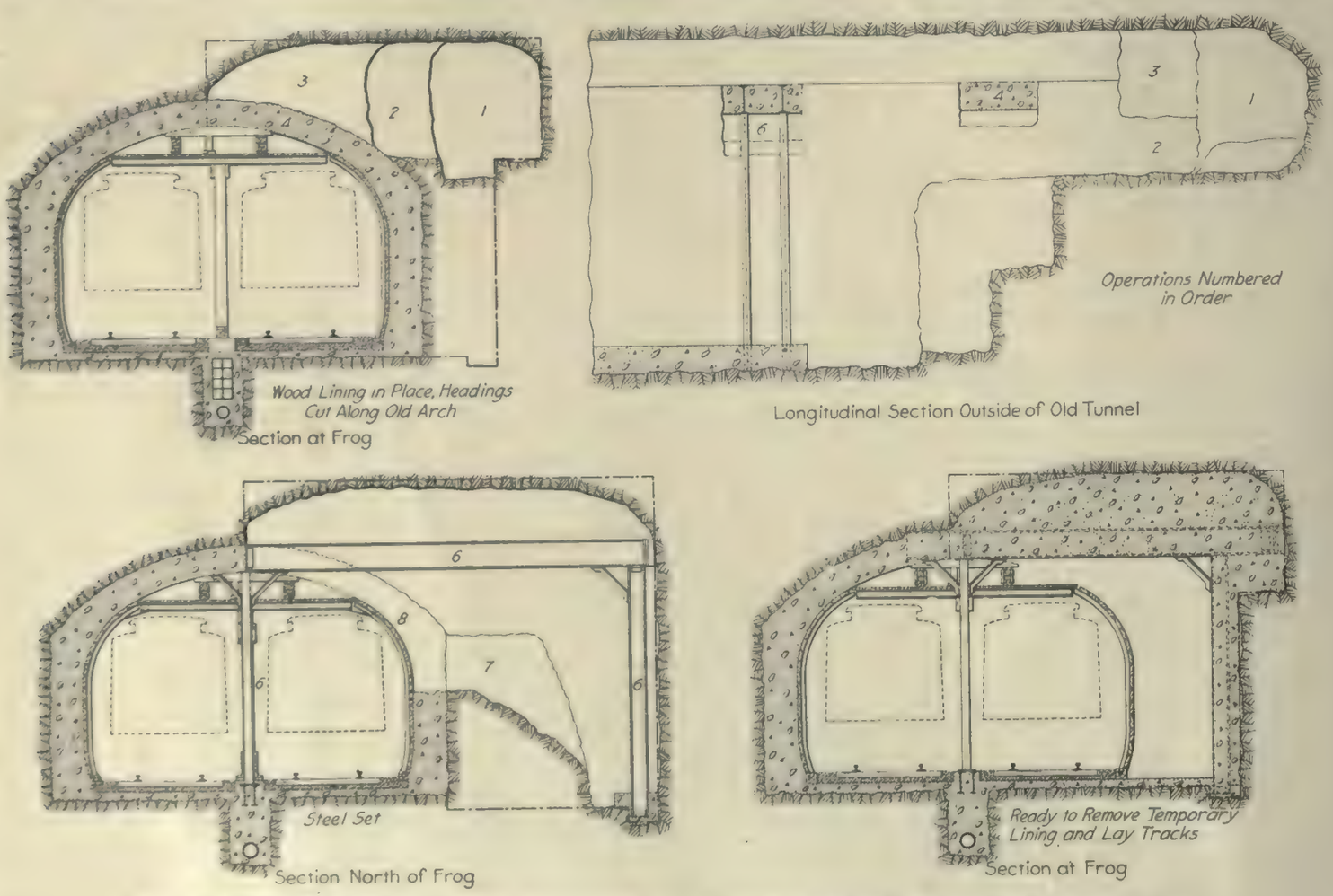


CUTTING OUT OLD ROOF ARCH UNDER WIDE-SPAN STREET DECKING

TALL SUPPORTS FOR STREET DECKING

The four Lexington Avenue tracks cross under Forty-second Street over the Steinway tunnel, but below the level of the present tubes, which are themselves well below the street at this point. The rock excavation on the site of the old Grand Union building was, therefore, carried to 35 ft. below street level. The end of Park Avenue next to Forty-second Street was decked where the northbound local turnout occurs, the decking being supported on transverse latticed girders taken from rebuilt elevated lines. The ends of these girders next the lot rest on unusually tall posts made of two 12 x 12-in. timbers bolted together. Each timber is butt-spliced, breaking joints with the other timber in the post, and no scabs are used. When the cut is extended under Forty-second Street, the decking on that street will be similarly supported.

With one exception all muck for the two sections is handled by derricks, and either dumped directly into wagons or into bins from which wagons are loaded. The exception is the elevator shaft north of Forty-second Street at the East River, up which muck is brought in tunnel cars from the lower end of the Steinway section. A derrick at the Forty-second Street corner of the Grand Union lot hoists muck from a shaft which serves the upper end of the



OLD ARCH TUNNELS REPLACED BY NEW CONSTRUCTION AT TURNOUTS WITHOUT ENDANGERING PRESENT TRAFFIC

Steinway section, and this derrick also covers part of the lot. Two other derricks on the east side of the cut through the Grand Union lot handle excavation from the cut and from the drifts under the present subway. These drifts are served by small cars carrying skips. These cars are pulled on narrow-gage tracks by small hoisting engines in the lot and near tunnel headings.

The mixer plant that will be used for this section is set under the east sidewalk on Park Avenue, near Forty-second Street, and is fed by gravity from the street. It is now being used to line the upper end of the Steinway section, by spouting concrete down the shaft referred to. A tower spouting system will be used for the work in the Grand Union lot.

A shaft and derrick at Fortieth Street take care of the express track tunnel between the old tubes, while the southbound local tunnel will have to be driven entirely from the lot. Concrete for the express tunnel is mixed at the Fortieth Street shaft, and spouted down it.



LATTICE GIRDERS SUPPORT PARK AVENUE—LEFT HEADING IS FOR EXPRESS TRACKS, RIGHT IS FOR WEST LOCAL TRACK

AIR FROM TEN-YEAR-OLD PLANT

The old plant that supplied air for the Steinway tunnels, which is located above Forty-second Street on the East River, is being used to supply the drills on both these contracts and also for the subway section north of Forty-second Street on Lexington Avenue. The supply is carried through Forty-first Street underground in a 10-in. air main under 100 lb. pressure. The pressure lost in transmission does not exceed 1 to 2 lb. The plant contains two steam-driven compressors, one of 4500 ft. and one of 5000-ft. capacity, both run condensing, and an 1100-ft. electric compressor, as reserve. The steam is furnished by four water-tube boilers aggregating about 1000 hp.

The Rapid Transit Subway Construction Company, of which George H. Pegram is chief engineer, and Robert A. Shailer tunnel engineer, is contractor for these sections. The work is being done under the supervision of the Public Service Commission for the First District, of which Alfred Craven is chief engineer and Robert Ridgway, engineer of subway construction. It is part of the work under the second division, of which John F. Meyers is division engineer. The design of the connection was made under the direction of Sverre Dahm, principal assistant engineer, and Charles E. Conover, designing engineer of the commission.

Costs of Electric Pumping for Irrigation Tabulated

South Side Unit of Minidoka Project of U. S. Reclamation Service Uses Electricity at Cost on Largest Pumping Scheme

INASMUCH as success in irrigation projects depends directly upon annual cost of operation and maintenance as well as on original construction cost, figures which give some idea of such costs are of value, even though these annual costs depend upon many factors. When the water must be pumped the number of these factors is much increased, the principal among them being cost of power, height of lift and size and type of pumping plant. Some figures showing the cost of pumping on the largest pumping scheme yet undertaken—that of the U. S. Reclamation Service known as the South Side Unit of the Minidoka project—may prove of value. Data furnished by Barry Dibble, electrical engineer in charge, from a paper prepared for the Idaho Society of Engineers, are here given in part.

The water is raised by large pumping stations up three 30-ft. steps; at each level some water is taken for use on lands at that level. The resulting power necessary is about equal to that required to lift all of the water an average height of from 66 to 69 ft. Electricity supplied from a power plant utilizing a 46-ft. fall in the Snake River at Minidoka dam is transmitted about 11 miles to the pumping stations over 33,000-volt transmission lines. Power house and transmission lines are operated as part of the project and energy is supplied to the pumping station at cost. In winter a large amount of energy not then needed for irrigation is used in the towns for heating stores and houses, and the sale of this energy tends largely to reduce the charges that are placed against the pumping load.

On the Minidoka project depreciation has not been collected, and interest is not included, because no interest is charged on the money invested. It can readily be calculated by applying to the investment of $1,000,000 in the South Side Unit any rate of interest desired. About one-half of this cost is in the pumping stations and the other in the proportionate cost of power house and transmission lines.

TABLES OF COSTS

Table 1 gives the annual cost at the power house, which has a rating of 10,000 hp., for each year from 1910 to 1914. Although more than 30,000,000 kw.-hr. was generated in 1914, less than 25,000,000 kw.-hr. was accounted for in useful service; the rest was lost in transmission lines and transformers. The transmission lines now form a system of about 65 miles, on which two linemen do most of the work. The total power-house cost per kilowatt-hour deliv-

TABLE 1—POWER HOUSE—OPERATION, MAINTENANCE AND DEPRECIATION CHARGES

Year	Kilowatt-Hours Generated	Gross Cost: Operation and Maintenance	Gross Cost: Depreciation	Gross Cost: Total	Per Kilowatt-hour Generated: Operation and Maintenance	Per Kilowatt-hour Generated: Depreciation	Per Kilowatt-hour Generated: Total
1910	10,000,000	$8,949.00	$8,805.00	$17,754.00	$0.00090	$0.00088	$0.00178
1911	18,202,000	10,156.00	12,856.00	23,012.00	0.00055	0.00072	0.00127
1912	20,092,800	12,613.00	14,057.00	26,669.00	0.00063	0.00070	0.00133
1913	25,661,420	16,028.00	14,100.00	30,128.00	0.00062	0.00055	0.00117
1914	30,069,993	15,191.00	14,615.00	29,806.00	0.00051	0.00048	0.00099

ered at the South Side pumping stations is $0.0014, of which $0.0012 is power-house cost and $0.0002 is transmission cost.

The gross cost of the peak load of 6300 kw. in 1914 was $2.88 per horsepower. If interest on the investment in power-plant and transmission lines ($500,000) at 6 per cent be added, it would increase the cost by $3.58 per horsepower, making a total of $6.46 per horsepower of peak demand.

Since 1910 the amount of land irrigated and water pumped has very greatly increased. Table 2, however, shows that the cost of operation and maintenance has not materially changed, although the depreciation item has increased with the addition of new machinery. For ready comparison with other plants the unit of cost has been taken as an acre-foot lifted a height of 1 ft., designated as a "foot-acre-foot."

TABLE 2—SOUTH SIDE PUMPING STATIONS—OPERATION, MAINTENANCE AND DEPRECIATION CHARGES

				Gross Cost			Cost per "Foot-Acre-Foot"		
Year	Acre-Feet	Average Lift, Feet	"Foot-Acre-Feet"	Operation and Maintenance	Depreciation	Total	Operation and Maintenance	Depreciation	Total
1910	69,900	65.7	4,582,430	11,404	10,226	21,630	$0.00250	$0.00223	$0.00473
1911	98,200	65.6	6,441,920	10,668	13,955	24,623	0.00165	0.00220	0.00385
1912	99,500	66.0	6,567,000	14,849	17,400	32,249	0.00226	0.00265	0.00491
1913	118,688	68.0	8,070,984	12,494	17,428	29,922	0.00155	0.00216	0.00371
1914	147,212	69.2	10,187,070	14,239	17,993	32,232	0.00140	0.00177	0.00317

In order to obtain the amount by which the running costs of this project are increased because pumping is necessary, all the items due to this feature, using the year 1914, have been combined in Table 3.

TABLE 3—EFFECT OF PUMPING ON RUNNING COSTS

Item	Operation and Maintenance	Depreciation	Total
Power house	$10,570.00	$10,169.00	$20,739.00
Transmission lines.	1,103.00	2,372.00	3,475.00
Pumping stations .	14,239.00	17,993.00	32,232.00
Total	$25,912.00	$30,534.00	$56,446.00
Cost per foot-acre-foot	$0.00254	$0.00300	$0.00554
Cost per acre-foot	0.176	0.207	0.383
Cost per acre in project (48,000)	0.54	0.636	1.176
Cost per acre irrigated (35,788)..	0.725	0.854	1.579

The annual cost of operating and maintaining the canals and laterals carrying the water for the land amounts to about $0.75 per acre of irrigable land in the project. About 12,000 acres included in the project were not irrigated last year, but it is not thought that they will materially affect the costs. In general, however, it is to be expected that the cost of pumping will be greater per acre-foot with smaller plants.

WATERWORKS BOILER-ROOM EFFICIENCIES IN ST. LOUIS are promoted by a system of posting in the boiler houses the amount of coal consumed and water evaporated during each watch of eight hours, and of posting each week in each station the plant efficiencies of the various stations. E. E. Wall, water commissioner, states in his annual report that the method has resulted in a marked improvement in plant conditions throughout the water division. The engineers take hourly readings of the percentage of carbon dioxide in the flue gases, which at once gives them absolute information as to combustion conditions in the furnaces, and enables them to regulate the firing in closer accordance with the steam consumption. That the city profited is shown by the 14.2-per cent reduction in coal consumption over the previous year.

Elastic Curve Applied to the Design of the Sciotoville Bridge

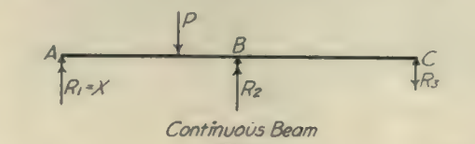
Influence Lines Aid in Simplifying the Analysis of 1550-Foot Continuous Truss Spans—Exact Method Compared with Approximate

By D. B. STEINMAN
Special Assistant to Gustav Lindenthal, Consulting Engineer

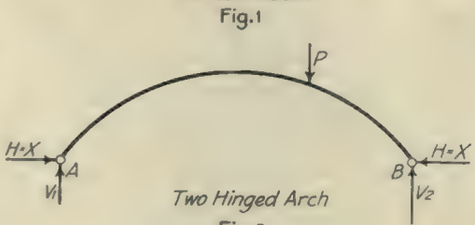
BRIDGE engineers have been more or less familiar with the decisive advantages of indeterminate systems of construction, but only in recent years has there been a tendency in this country toward the adoption of such structures and, with it, a greater familiarity with the methods of designing them. One of the cardinal features in the newer methods of designing indeterminate structures is the application of the "elastic curve." Notwithstanding the striking usefulness of this device, it is but little known to American engineers. The writer has therefore prepared the following outline of the construction and properties of the elastic curve, using, for concrete illustration, the application of this method to the design of the 1550-ft. continuous trusses of the Sciotoville Bridge described in the Engineering Record of June 26, page 799. Center-bearing swing truss spans, when acting as continuous trusses, can be computed by the exact method here developed.

THEORY OF THE ELASTIC CURVE

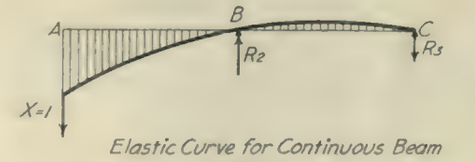
A beam or truss continuous over two spans, Fig. 1, or a two-hinged arch, Fig. 2, is statically indeterminate in the first degree, as there are only two equations of condition, $\Sigma V = 0$, $\Sigma M = 0$, for the determination of the three reactions. One of the reactions, X, must therefore be determined from the relations governing the elastic deformations of the structure. For this purpose, a unit load ($X = 1$) is considered substituted for the desired reaction and the resulting curve of deformation determined, Fig. 3. As this deflection curve is independent of the actual loading to which the structure may be subjected, but depends only upon the elastic relations within the structure, it is appropriately named the "elastic curve."



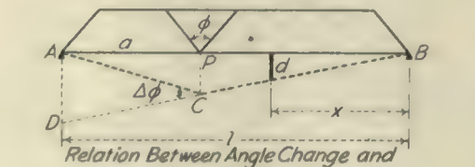
Continuous Beam
Fig.1



Two Hinged Arch
Fig.2



Elastic Curve for Continuous Beam
Fig.3



Relation Between Angle Change and Elastic Weight
Fig.4

The elastic curve has a three-fold significance. By its construction, it is primarily a deflection diagram, i.e., the ordinates of the curve represent the deflections at the respective panel points produced by a unit load applied at A. Applying Maxwell's principle, the same values must also represent the deflections at A produced by a unit load applied at the respective panel points. In other words, the elastic curve is an influence line for deflections at A. As the end A is constrained, however, these indicated deflections cannot actually take place. Instead the reaction X is evoked to resist these deflections, so that, finally, the elastic curve is an influence line for the reaction X.

CONSTRUCTION OF THE ELASTIC CURVE

To construct the elastic curve we consider a unit load applied at A and proceed to find the deflections at the various panel points of the structure. This may be done graphically, using a force polygon to get the stresses in the members and then combining the resulting strains in a Williot displacement diagram to get the deflections. An analytical procedure, however, proves more expeditious. For this purpose we apply the principle that the deflection curve for any structure is identical with the moment diagram obtained by applying the angle-changes w as "elastic weights" at the respective panel points of the structure. This exceedingly useful principle may be simply demonstrated as follows:

At any point P of a span AB, Fig. 4, assume an angle change or rotation of $\Delta\phi$. The straight line AB will then deflect to the position ACB, with the deflection angle $ACD = \Delta\phi$. If $\Delta\phi$ is measured in radians, we have $AD = a \cdot \Delta\phi$. The vertical deflection d at any section x is then given by the simple proportion

$$d : AD = x : l$$

Hence

$$d = \frac{AD \cdot x}{l} = \frac{a \cdot \Delta\phi \cdot x}{l} \qquad (a)$$

Next assume a weight w applied at the point P of the span AB. The resulting moment diagram will be a triangle ACB. The bending moment at any section x will be

$$M = wax/l \qquad (b)$$

Comparing equations (a) and (b), we see that if we take $w = \Delta\phi$, then $d = M$, and the vertical deflections d produced by an angle-change $\Delta\phi$ are equal to the moments

ELASTIC CURVE AND GENERAL RELATIONS

M produced by a weight w assumed equal to $\Delta\phi$ and applied at the same point. In other words, the deflection curve produced by the angle-change $\Delta\phi$ is identical with the moment diagram for the weight w.

The quantity w, equal to the angle-change $\Delta\phi$, is called an "elastic weight." By summation, the above principle may be extended to any number of angle-changes and corresponding elastic weights. Since the elastic curve is a curve of deflections, we have proved that the elastic curve is the moment diagram for the angle-changes applied as elastic weights. The angle-changes ($w = \Delta\phi$) must therefore be calculated before the elastic curve can be constructed.

Computation of Angle-Changes

If the contribution of the web stresses to the deflections is neglected, the angle-changes w (measured in radians) are very simply figured by the formula

$$w = \Delta c/r \qquad (1)$$

where Δc is the elongation or compression in each chord member due to unit X, and r is the lever arm of the member about its center of moments, Fig. 5. For greater precision, the effect of the web-members is included by using the formula

$$w = \pm\,(\Delta^1 c - \Delta^1 d_1 - \Delta^1 d_2)/h \qquad (2)$$

where $\Delta^1 c$ is the elongation of the chord member multiplied by the secant of its inclination to the horizontal, $\Delta^1 d_1$ and $\Delta^1 d_2$ are the elongations of the two web members multiplied by the secants of their respective inclinations to the horizontal, and h is the vertical altitude of the triangle formed by c, d_1 and d_2, Fig. 5. In this formula the plus sign is used for angle-changes at the upper panel points and the minus sign for angle-changes at the lower panel points; elongations are taken as positive and compressions as negative.

The values thus found for the angle-changes w between the two web members meeting at each panel point are then treated as "elastic weights" applied at the respective panel points. In order to get zero moments at B and C, the beam AC, with reactions at A and C, is considered hinged at B and C but anchored at A, Fig. 6. The moment diagram is found either by calculation of moments or by construction as a funicular polygon for the weights w. The ordinates of the resulting polygon are then all reduced in a uniform ratio to make the initial ordinate scale unity. We then have the elastic curve of the structure, or influence line for the end reaction X, Fig. 7. The curve shows that the reaction changes sign as the load passes across the middle pier.

Application to Sciotoville Bridge

To illustrate the actual simplicity of the above method of design, the complete work for determining the exact elastic curve for the Sciotoville Bridge is given in the following two tables. Since ratios, not absolute values, are required, the labor is minimized by calling the length of a panel unity, $E = 1$, etc. In Table 2 a method of summations is used as the most expeditious method of figuring the moments. In this method, after figuring the simple-beam reaction at the free end, all the shears are obtained therefrom by successive addition of the panel loads, and the moments are then obtained by successive summation of the shears (see Table 2). Ordinarily the results would have to be multiplied by the panel length to give the true moments, but in the present case this factor is unity and the operation otherwise unnecessary. The entire work of figuring the elastic curve with the above devices, as illustrated below, is a matter of only two or three hours at the most. After the elastic curve is determined, the remainder of the design is essentially the same as for a simple structure.

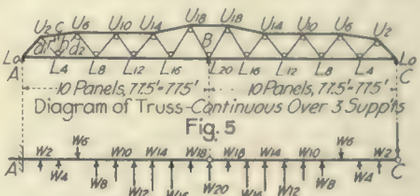
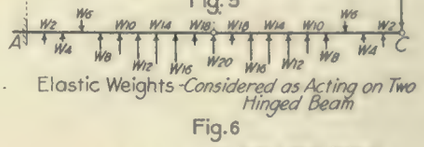
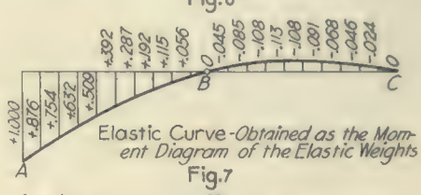


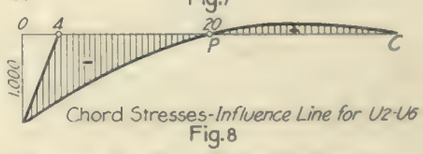
Diagram of Truss-Continuous Over 3 Supports
Fig. 5



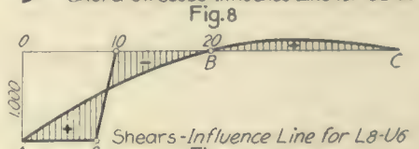
Elastic Weights-Considered as Acting on Two Hinged Beam
Fig. 6



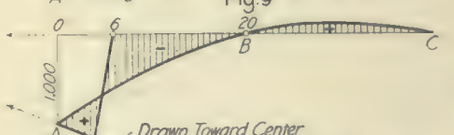
Elastic Curve-Obtained as the Moment Diagram of the Elastic Weights
Fig. 7



Chord Stresses-Influence Line for U2-U6
Fig. 8



Shears-Influence Line for L8-U6
Fig. 9



Web Stresses-Influence Line for L4-U6
Fig. 10

DIAGRAMS FOR SCIOTOVILLE BRIDGE

Table 2—Calculation of Elastic Curve

Panel Point	Elastic Weight (w)	Shear	Moment	Ordinate
0	0	—502.4	0	0
2	— 36	466.4	— 502.4	—.024
4	— 22	444.4	— 968.8	—.046
6	+ 43	—487.4	—1413.2	—.068
8	—142	—345.4	—1900.6	—.091
10	—225	—120.4	—2246.0	—.108
12	—229	108.6	—2366.4	—.113
14	—378	486.6	—2257.8	—.108
16	—354	840.6	—1771.2	—.085
18	— 90	930.6	—930.6	—.045
20	—227	1157.6	0	0
18	— 90	1247.6	1157.6	.055
16	—354	1601.6	2405.2	.115
14	—378	1979.6	4006.8	.192
12	—229	2208.6	5986.4	.287
10	—225	2433.6	8195.0	.392
8	—142	2575.6	10628.6	.509
6	+ 43	2532.6	13204.2	.632
4	— 22	2554.6	15736.8	.754
2	— 36	2590.6	18291.4	.876
0	0		20882.0	1.000

Elastic Curve for Three Different Assumptions

The above exact method is the one to be used for the final computation of important structures. For less important or preliminary designs, simpler approximate methods may be used. In the case of the Sciotoville Bridge, three successive designs were made: 1. Preliminary design (approximate); the truss was treated as a beam with constant moment of inertia. 2. The above-outlined method was used, but with the influence of the web members neglected, using equation (1). 3. Final design (exact); the effect of all the members was included, using equation (2) and Tables 1 and 2.

For the first approximation (assuming I = constant), the ordinates of the elastic curve are given directly by the general formula

$$y = 1 - 5x/4l + 1/4(x/l)^3 \qquad (3)$$

where l is the length of span AB and x is the abscissa measured from the end A. The sections obtained in this approximation are used as a basis for the succeeding designs. The elastic ordinates for the three assumptions are compared in Table 3.

Table 1—Calculation of Elastic Weights

Panel Point	Member	1 Bending Moment M	2 Lever Arm r	3 Stress for $X=1$ S (1 ÷ 2)	4 Length l	5 Gross Section A	6 Elongation $10{,}000\Delta l$ (3 × 4 ÷ 5)	7 Secant	8 Product $\Delta^1 l$ (6 × 7)	9 Altitude h	10 Elastic Weight w (8 ÷ 9)
	L0U2	1	0.71	+1.41	1.41	361	56	1.41	+ 79		
U2	L0L4	1	1.00	—1.00	2	315	63	1	— 63	1	— 36
	U2L4	—5	4.95	—1.01	1.41	189	75	1.41	—106		
L4	U2U6	5	1.15	+1.74	2.03	361	98	1.01	+ 99	1.17	— 22
	L4U6	—5	5.60	+0.89	1.67	138	108	1.67	+180		
U6	L4L8	3	1.33	—2.25	2	474	95	1	— 95	1.33	+ 43
	U6L8	..	..	—1.25	1.67	105	199	1.67	—332		
L8	U6U10	4	1.33	+3.00	2	413	145	1	+145	1.33	—142
	L8U10	..	..	+1.25	1.67	121	173	1.67	+288		
U10	L8L12	5	1.33	—3.75	2	374	158	1	—158	1.33	—225
	U10L12	..	..	—1.25	1.67	238	88	1.67	—146		
L12	U10U14	6	1.33	+4.50	2	317	284	1	+284	1.33	—229
	L12U14	..	..	+1.25	1.67	278	75	1.67	+125		
U14	L12L16	7	1.33	—5.25	2	270	389	1	—389	1.33	—378
	U14L16	—1	7.20	—0.14	1.67	391	6	1.67	— 10		
L16	U14U18	8	1.48	+5.40	2.03	208	526	1.01	+534	1.50	—354
	L16U18	—1	7.71	+0.13	1.94	381	7	1.94	+ 13		
U18	L16L20	8	1.67	—5.40	2	479	226	1.	—226	1.67	— 90
	U18L20	..	..	—1.17	1.94	499	45	1.94	— 88		
L20	U18U20	10	1.67	+6.00	1.	596	101	1.	+101	1.67	—113

TABLE 3—COMPARISON OF ELASTIC CURVES

Panel Point	$\frac{x}{l}$	1 Assumption I=constant	2 Web Members Neglected	II All Members Included
0	0	1.000	1.000	1.000
2	0.1	.875	.871	.876
4	0.2	.752	.744	.754
6	0.3	.632	.623	.632
8	0.4	.516	.505	.509
10	0.5	.406	.393	.392
12	0.6	.304	.287	.287
14	0.7	.211	.193	.192
16	0.8	.128	.114	.115
18	0.9	.057	.053	.055
20	1.0	0	0	0
Area AB		4.381	4.283	4.312
Area BC		0.619	0.717	0.688
Sum of areas		5.000	5.000	5.000

The ordinates for only one-half of the elastic curve are listed in the above table, as those for the other span are quickly obtainable by the check method explained above, i.e., by subtracting the given ordinates of the curve from those of the chord *AB*. The above table is useful inasmuch as its values can be adopted for the preliminary designs of other structures, thereby saving considerable time and labor. For a structure similar in general outline to the Sciotoville Bridge, the values in column 3 should be used. For girders and trusses with parallel chords, the values in column 1 would be a closer approximation.

A comparison of the areas of the three elastic curves as given in Table 3 indicates that the results of the first assumption may be in error by + 2 per cent to — 10 per cent, and those of the second approximation by — 1 per cent to + 4 per cent. In lateral systems, where the web members have relatively small sections, the error of neglecting these members may be much greater; on the other hand, the great uncertainty of lateral forces does not warrant a refined calculation of lateral stresses. For important structures, however, the writer recommends the use of the exact method (3), as the greater reliability of the results is easily worth the slight additional work required.

CONSTRUCTION OF INFLUENCE LINES

After the elastic curve is plotted to any convenient scale, the influence lines for all the members of the truss are constructed by simply drawing straight lines across the curve as illustrated in Figs. 8, 9 and 10. A single plotting of the curve is therefore sufficient for the entire design. The various influence lines are drawn and used in the same manner as for a simple truss, with the single difference that the elastic curve replaces the straight line *AB* which would ordinarily represent the influence line for the end-reaction.

The customary method of using the above influence lines consists in trying different positions of the specified loading, and comparing the sums of the products obtained by multiplying the scaled ordinates by the respective wheel loads. In the design of the Sciotoville Bridge, however, a great economy of time and effort was effected by the use of equivalent uniform loads. These were taken from a chart, invented by the writer, giving the exact equivalent uniform load for any point of any span. This uniform load value is simply multiplied by the corresponding influence area to give the maximum stress in any member of the structure.

DEAD LOAD STRESSES

For dead load stresses, all the panel dead loads are multiplied by the respective ordinates of the elastic curve and the algebraic sum of the products constitutes the end reaction. This determined, the stresses are figured exactly as in a simple truss, using the method of summations for shears and moments.

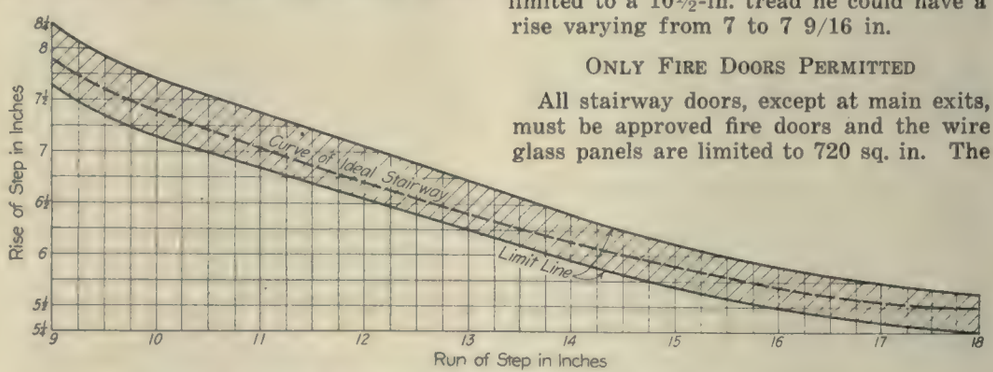
After the details for all connections are worked out, a final adjustment of sections is made for the actual dead load weights determined from the detail drawings. On the close agreement of these actual weights and sections with the values initially assumed depends, to a great extent, the efficient solution of the design.

As outlined above, the elastic curve formed the basis for the design of the Sciotoville Bridge, the longest continuous truss in the world. It was also employed in the design of the Hell Gate arch, another record-breaking structure. Both of these bridges were designed under the direction of Gustav Lindenthal, consulting engineer, to whom the writer is indebted for permission to publish this article.

Cleveland Bases Stairway Regulations on Studies

New Provisions of Building Code Definitely Fix Dimensions, Construction, Maintenance and Egress Facilities

NEXT to the actual structural strength of buildings no question regarding them is of more importance than the means of egress therefrom is the conclusion of V. D. Allen, commissioner of buildings of Cleveland, after making a systematic study of the subject of getting out of buildings by means of stairways. He found little reliable data bearing on the question and for that reason the building-code ordinance embodying his findings is here reviewed. There are five sections, general in application, referring to all stairways hereafter constructed, and seven sections dealing with stairways for public and semi-public buildings. School buildings and theaters are not included, since they are regulated by the State code.



LIMITING DIMENSIONS OF STEPS, WITH CURVE OF IDEAL STAIRWAY

Some of the more important features in the regulations are as follows: Under definitions the words flight, stair and stairway each have a distinct meaning, whereas in most codes and in most literature these words are used indiscriminately. Flight is defined as an unbroken succession of steps between landings, stair as all the flights and landings between two successive floor levels, and stairway as all the flights and landings together with the inclosing walls and partitions and the doors leading thereto and therefrom, extending from the exit level to and including all stories served by such stairs.

In the regulation of treads and risers winders are prohibited and no more than twenty risers are permitted in any flight. Landings must be at the same level as the floors they serve. The length shall be not less than 3½ ft. and the width not less than the width of the flight. Quarter-space landings must be not less in width and length than the width of the widest flight connected to them. The length of half-space landings shall be seven-eighths of the required width of the narrowest flight connected to it. Four feet is the minimum length of floor landing at the exit level of any stair.

STAIR WIDTHS LIMITED

Both maximum and minimum widths of stairs are fixed, a single-width flight from 2 ft. 3 in. to 2 ft. 9 in. being intended for the use of one file of persons, a double width, from 3 ft. 6 in. to 4 ft. 6 in., for two files, and a multiple width for four or six persons abreast. Handrails, constructed to withstand a pressure of 60 lb. per linear foot, are provided for each file of persons, since it is believed that every person descending a stairway should have a handrail to hold to in case of necessity.

The control of the run and rise of steps is given in the accompanying diagram. The dotted line is the ideal stairway, the limits being worked out from data given by H. Law Olmstead. To use the diagram assume that a 7-in. rise works out best with the floor levels under consideration. The designer could then use a tread ranging from 10½ to 12 3/16 in., or if he were limited to a 10½-in. tread he could have a rise varying from 7 to 7 9/16 in.

ONLY FIRE DOORS PERMITTED

All stairway doors, except at main exits, must be approved fire doors and the wire glass panels are limited to 720 sq. in. The width is to be the same as the stair width. Exit doors swing out, and others in. At least one stairway in every building shall be continuous from the exit level to the roof. Whenever four or more stairways are required, at least two, located as far apart as practicable shall extend to the roof.

Under the maintenance provision the stairs must be kept in perfect repair. No goods may be stored in the lighted stairway. No stairway or exit door is to be locked when the building is occupied, except with approved panic hardware, and all but main doors are to be kept closed.

One section provides for special stairways of a monumental nature, or service stairways connecting one or more floors, so that the department may issue a permit without violating the regulations. This is to give a degree of elasticity which is desirable and at the same time protect the public.

TO INCLOSE the Ashokan Reservoir, a part of New York City's new water supply, nearly forty-one miles of wire fence on concrete posts were erected at a cost of $67,600.



CONCRETE VIADUCT OVER SPOKANE RIVER, SPOKANE, REPRESENTS ONE OF THE LARGE IMPROVEMENTS RECENTLY COMPLETED THERE

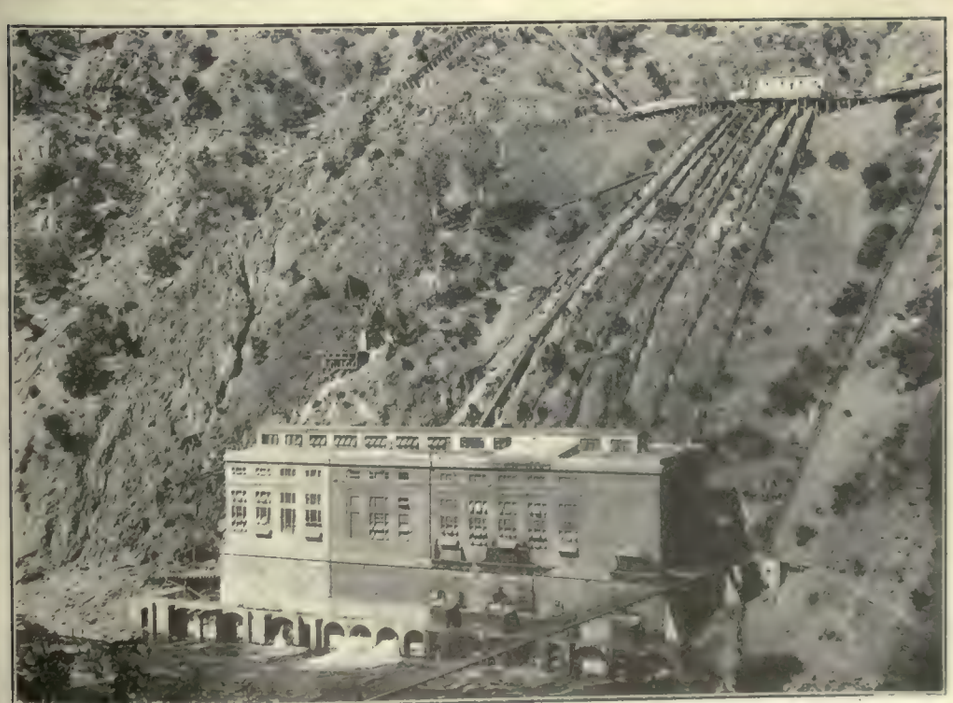
The Engineering Works of the West

Brief Notes on Engineering Structures Designed to Serve as a Guide to Engineers Who May Wish to Inspect Works in Cities En Route to or from the International Engineering Congress at San Francisco

ENGINEERS from the East and the Middle West, who will attend the International Engineering Congress at San Francisco, Sept. 20-25, and the conventions of the national technical societies, Sept. 16 and 17, will have an opportunity of inspecting, either on the outward or the homeward-bound trips, many engineering works of interest in the cities en route. In order to furnish to these men a convenient guide to the more important works, the Engineering Record presents herewith brief notes prepared from replies to requests for information along these lines. No attempt has been made to give anything more than a suggestion as to the nature of the structures and their location. From the list published, however, the engineer can select those works which are of particular interest to him and which, in his opinion, would warrant inspection. It may aid him in selecting his railway route and planning a trip of maximum usefulness.

Along the Railroads

Atchison, Topeka & Santa Fé.—Missouri River Bridge, near Sibley; length 4082 ft.; east approach steel viaduct, length 2592 ft.; three 396-ft. spans; base of rail 55 ft. above water. Horse-shoe curve 25 miles west of Las Vegas; central angle 200 deg. Raton Tunnel, at an elevation of 7600 ft., length of bores 2789 ft. and 2038 ft. respectively. Opposing grades over Raton range; west bound 185 ft. per mile, east bound 175 ft. per mile. Embankment more than 2 miles long and 50 ft. high just west of Vaughn, N. M.; contains 860,000 cu. yd. of fill. West of Dalies, N. M., line crosses continental divide at elevation of 7259 ft. At points between Albuquerque and Barstow line traverses extensive lava flows, and, east of Barstow, runs near numerous volcanic craters.



HYDROELECTRIC PLANT AT LAS PLUMAS HAS CAPACITY OF 50,000 KILOWATTS

Northern Pacific.—Grade revision west of Staples, Minn. U. S. Irrigation project at Huntley, Mont.; line runs directly through it. Double-track bridges across Columbia River, north of Portland, Ore. Construction of terminals in Spokane.

Western Pacific.—Near Salt Lake City, road built through and across Great Salt Lake for distance of 11 miles, with solid rock embankment containing 625,000 cu. yd. Arnold's Loop; 147 miles west of Salt Lake City; built in order to hold maximum grade; 10.6 miles long. Largest and longest cut on road; on Arnold's Loop; 2.2 miles long, 600,000 cu. yd. of material. William's loop 6 miles west of Portola; makes complete circle, crossing over itself; 4842 ft. around.

Great Northern.—Double-track stone arch bridge across Mississippi River, entering Minneapolis from St. Paul; three arches, 40-ft. spans; sixteen arches, 80-ft. spans; four arches, 100-ft. spans; only structure entirely of masonry across Mississippi River. Snow sheds in Cascade Mountains, Washington. Timber, concrete and combination drawspan of Willamette River bridge; longest double-track swing in the world.

Chicago, Burlington & Quincy.—For those who are desirous of seeing Yellowstone Park en route to the coast the "Burlington" takes one via Omaha to Cody, Wyo. At Cody, on the west side of the park, the "Wylie Way" overland wagon trip may be taken through the Park to the Northern Pacific Railroad's terminus at Gardiner, Mont. En route to Cody, between Casper and Thermopolis, Wyo., a 800-ft. summit

tunnel has recently been completed in connection with the construction of the Big Horn Basin line extension of the "Q." See Engineering Record of Oct. 31, 1914, page 493. Those desiring to go through a virgin country may go via Denver and Orin Junction to Cody, over the newly constructed line.

Denver & Rio Grande.—The Royal Gorge with its original hanging bridge. Surmounts the continental divide at an elevation of 10,239 ft., from an elevation of 4672 in a distance of 171 miles. Road crosses six distinct mountain passes, over 9000 ft. in elevation; four over 10,000 ft. and one over 11,000 ft.

Denver

Lookout Mountain Drive.—Part of State Road system. Rises 1500 ft. in six miles.

Cherry Creek Improvements.—Include concrete bridges of mushroom type of reinforcement and one of hinged arch type.

Colfax-Larimer Viaduct. — X-shaped structure; length of arms 2937 ft. and 5544 ft. respectively; extends across several railroad yards and the South Platte River. Long spans are of steel, others of reinforced concrete. Estimated cost $800,000. Now under construction.

Galveston

Concrete Seawall.—Length 4 1/3 miles; cost $1,800,000.

Rock Jetties.—Total length 11 2/3 miles; cost $10,000,850.

Concrete Causeway.—Connects Galveston Island to mainland; length over 2 miles; cost, about $2,000,000.

Cotton Compresses and Warehouses.—Said to be largest in world; reinforced concrete construction.

In view of the recent storm the condition of Galveston's engineering works is of timely interest.

Houston

Ship Channel.—From Galveston Bay to Houston, 50 miles. Dredged to 25 ft. depth and 100 ft. bottom width.

Concrete Bridges. — Capitol Avenue Bridge; girder type; reinforced concrete construction; 870 ft. long and 62 ft. wide; cantilever supported sidewalks on each side. Cost $164,332. San Jacinto Street Bridge; 500 ft. long and 70 ft. wide; reinforced-concrete arch, skewed 25 deg. from right angle, span of arch 110 ft. on skew. Cost $113,307. Franklin Avenue Bridge; girder type, reinforced concrete; triangular, conceals unsightly banks of dirty bayou. Cost $129,843.



CONCRETE STADIUM AT TACOMA HAS SEATING CAPACITY OF 30,000

Kansas City

Terminal Railway Improvements.—Aggregating over $35,000,000 in cost; including heavy cuts and fills, 13 street subways, 26 street viaducts, retaining walls, and freight stations.

Twelfth Street Viaduct.—Reinforced-concrete double-deck structure described in the Engineering Record, Feb. 6, page 164. Cost $595,000. Recently completed.

Drainage Improvements.—Several miles of levees along Kaw River. Some riprapped, other portions protected by concrete and concrete slab mattress, made of concrete blocks strung on galvanized wire cables.

Waterworks. — Missouri River water treated by settling basins and hypochlorite, and mechanical filtration and lime.

Los Angeles

Los Angeles Aqueduct.—Largest of engineering projects of city.

Municipal Harbor Work.—Dredging and construction of docks and warehouses.

Flood Control Work.—Studies for rectification of stream courses and construction of protective structures.

Arroyo Seco Bridge.—Of reinforced concrete; between Los Angeles and Pasadena; short trolley ride.

Minneapolis

Reinforced Concrete Bridge. — Five spans, 211 ft. in the clear and several smaller spans 80 ft. width. Now under construction across Mississippi River.

Filtration Plant.—Nearing completion. Capacity 60,000,000 gal.

Great Northern Passenger Station.—Cost $2,500,000. In course of construction. Put into service last year.

Track Depression Work.—In course of construction by Chicago, Milwaukee & St. Paul Railway. Thirty-seven concrete bridges for carrying streets across tracks.



LAKE WASHINGTON CANAL LOCKS AT SEATTLE SHOWN UNDER CONSTRUCTION

New Orleans

Cotton Warehouses and Dock Improvements.—Work to the value of $1,000,000 under construction. Described in the Engineering Record, May 27, page 402. Eventual expenditure of $3,000,000 contemplated.

West End Lake Shore Park Improvement.—Dredging and filling work in progress. Extensive landscape work projected. To cost $350,000.

Drainage and Land Reclamation.—Numerous large canals being constructed. Thousands of acres of low lands already reclaimed.

Railroad Terminals and Track Work.—Trans-Mississippi Terminal Company constructing new terminals. Louisville & Nashville has considerable track rearrangement under construction.

Portland, Ore.

Columbia River Scenic Highway.—Follows bluffs along gorge where Columbia River breaks through the Cascade Mountains.

Westover Terrace Regrade.—High hillside, regraded by sluicing, to form stepped residential section.

Railroad Bridge Across Willamette River.—Upper deck for street traffic. Lower for railroad. Vertical-lift type drawbridge Lower deck can be raised to pass low clearance boats without disturbing upper deck.

Dalles-Celilo Canal.—Cost $5,000,000; overcomes series of falls and rapids in Columbia River.

Hydroelectric Developments.—Bull Run plant; 11,250 kw. capacity, 320 ft. head, 30 miles from city. White Salmon; 12,000 kw. capacity, 160 ft. head, 1½ miles of largest wood-stave pipe line ever built; 72 miles from city.

Salt Lake City

Parley's Canyon Intake Reservoir.—Capacity 2,000,000 gal.



LEFT — COLFAX-LARIMER VIADUCT, DENVER, TOTAL LENGTH 8400 FT.

Distributing Reservoir.—Capacity 10,000,000 gal. Concrete lined. In course of construction.

Intercepting Sewer Pumping Station.—Capacity approximately 35 sec.-ft. Head 48 ft.

Fourth South Street Viaduct.—Steel and reinforced concrete, approximately 1800 ft. in length, crossing track of Denver & Rio Grande Railroad.

Jordan Narrows Dam.—Twenty miles from city. Reinforced concrete and provided with measuring weirs. Height 20 ft., length 90 ft.

St. Louis

Filtration Plant.—Largest rapid sand filter in the world. Cost $1,300,000. Capacity 160,000,000 gal. per day. Has 40 filter units 50 x 28 ft. Illustrated in Engineering Record, May 8, page 578. Buildings of reinforced concrete.

Mill Creek Relief Sewer.—Estimated cost of project $3,000,000. Now under construction. Concrete lined pressure tunnel in rock. Excavation under way from nine shafts. Reinforced concrete work in progress in open cut section.

Municipal Bridge.—Work under way on east approach of Municipal Bridge over Mississippi River involves at present reinforced-concrete work and caisson sinking. Steel work to be started in summer.

Viaducts.—Twelfth Street Viaduct; reinforced-concrete structure 2049 ft. long and 79 ft. high. Spans vary in length from 30 to 54 ft., cost $380,000. The Tower Grove viaducts, built by railroad companies to eliminate grade crossings. Reinforced concrete. Estimated cost $650,000.

Municipal Buildings.—Jail building to accommodate 288 prisoners with space for cells for 192 in addition. Cost $300,000. Isolation hospital to consist of group of twelve buildings and cost $1,000,000. Two under construction will cost $135,000 each. Mullanphy Playground. Comfort station and open air swimming pool. Cost $27,000.

St. Paul

Lock and Dam Project.—Ambursen type dam; 30 ft. head. Across Mississippi River. To be used as aid to navigation and for power development. Now being constructed by U. S. Government.

New Union Depot.—Estimated cost $15,000,000. Construction under way. Work



RIGHT — CANTILEVER SUPPORTED SPAN OF COLFAX-LARIMER VIADUCT

involves reconstruction of number of bridges and changing channel of Mississippi River.

Seattle

Concrete Structure 172 Feet High.—Grain elevator 172 ft. high built of reinforced concrete, said to be highest reinforced concrete structure in the world.

Harbor Works.—Docks, warehouses and storage plants to the value of $5,000,000 have been constructed within the past three years. Further expenditure of $3,000,000 is comtemplated in projects already approved.

"Sanitary Fills."—City has developed method of depositing mixed refuse upon low areas and subjecting it to special treatment which renders it innocuous and inoffensive. New method saves at least $150,000 a year and should prove of interest to municipal engineers.

Drydock.—At Bremerton navy yard. Completed in 1913. Cost $2,300,000.

Lake Washington Canal and Locks.—Project estimated to cost $3,500,000. Main lock one of largest in country. Dimensions over upper sill 80 x 825 x 37 ft.

Dams.—Cedar River, 200 ft. high, 1000 ft. long. Seepage conditions that have developed in it have aroused widespread interest among engineers. Keechelus, 170 ft. in height and 6500 ft. long, estimated cost $1,350,000.

Stampede Tunnel Ventilating System.—Installed in Northern Pacific's 2-mile tunnel through Cascade mountains.

Hydroelectric Developments.—Five high head plants within easy reach of city: Snoqualmie, Lake Tapps, Puyallup, the city of Tacoma's Nisqually plant and Seattle's Cedar River plant. These range from 284 ft. to 878 ft. in head and aggregate about 75,000 kw. in installed capacity.

Spokane

Reinforced-Concrete Bridges. — Monroe Street Bridge. Central span 281 ft.; total length 786 ft.; total height 140 ft.; 24,000 cu. yd. of concrete used in this structure, cost of which was $500,000. Latah Bridge, 1043 ft. long and 140 ft. high, contains 42,000 cu. yd. of concrete and cost $440,000.

Railway Bridges.—Three railway bridges having height of from 125 ft. to 175 ft., presenting conditions exceptional in this country.

Municipal Water Supply.—Source in underground river, pumps driven by power from an adjoining stream. Reservoir of concrete slab construction, capacity 24,000,000 gal.

Hydroelectric Plants.—Five in number, one of which has spillway dam approximately 180 ft. in height. They develop 90,000 hp.

Railway Grade Elimination Work.—Approximate cost $2,000,000. Construction, now in progress, consists of elevation of six track terminal layout over a mile long, described in Engineering Record, Feb. 20, page 235.

Tacoma

Port Defiance Tunnel.—Length 4391 ft. Inside dimensions 28 ft. by 27 ft. Construction described in Engineering Record, Feb. 27, page 272.

Stadium.—Reinforced concrete. Seating capacity 30,000.

Vancouver

Sewer System.—Total cost will be $5,000,000. Vary in diameter from 11½ ft. to 15 ft. Interceptor and outfall.

Viaducts. — Georgia-Harris: Reinforced concrete; 2860 ft. long; cost $500,000. Under construction. Kingsway: Cost $950,000; completed.

Longest Tunnel in America.—Rogers Pass Tunnel: 26,400 ft. long. Said to be longest in America. Concrete lined. Under construction for Canadian Pacific Railway. Described in the Engineering Record, Dec. 5, 1914, page 604, and progress records noted on page 209 of Aug. 21 issue.

Hydroelectric Plants.—Coquitlam-Buntzen: hydraulic fill dam; height 99 ft.; length 950 ft.; capacity of lake in electric energy, 60,600,000 kw.-hr. Stave Falls plant; two dams; reservoir area 18 square miles, continuous capacity 28,000 hp.

Victoria

Breakwaters.—Cost $3,000,000. Four piers to be constructed; each 250 ft. wide and 800 to 1000 ft. long. Reinforced concrete cribs. Under construction.

New Water Supply System.—Sooke Water Supply System. 27.3 miles of gravity flow concrete pipe to carry 16,000,000 gal. daily. Balancing reservoir and 10 miles of steel main. Completed.

Jordan River Power Development.—Hollow reinforced-concrete dam of Ambursen type, 891 ft. long and 126 ft. high. Reservoir capacity 940,000,000 cu. ft.

Hydroelectric Plants in California

Great Western Power Company.—Big Ben Power Station; said to be largest on Pacific Coast; located directly on line of Western Pacific Railroad at station of Los Plumas; comprises five 10,000 kw. turbo-generators, operating under 450-ft. static head.

Pacific Gas and Electric Company.—Colgate power house; head 716 ft.; installed units total 14,860 kw. Plant located one day distant from San Francisco. De Sabla power house; one day distant from San Francisco; head 1531 ft.; capacity 19,400 kw. Electra power house; located in Amador County; development of a great many small lakes in upper Sierras; static head, through one pipe line, 1267, through a second, 1195; capacity 20,000 kw.

Southern California Edison Company.—Santa Anna River and Mill Creek plants; among first hydroelectric plants built in the United States; both located at Redlands; head at first, 760 and 304; capacities 4000 hp. and 1350 hp.; head at second 510 and 1960; capacities 1000 hp. and 5550 hp. Lytle Creek Plant; located at San Bernardino; head 483 ft.; capacity 650 hp. Kern River; capacity 30,000 hp.; head 874; located at Bakersfield.

City of Los Angeles Plant.—San Francisquito, No. 1; under construction; 14,000 hp. capacity per unit. Located 45 miles from Los Angeles.

U. S. Reclamation Projects

Elephant Butte Dam.—Fourteen miles west of Engle, N. M., on Santa Fé. Rubble concrete; gravity type; maximum height 290 ft.; crest length 1200 ft. Volume about 500,000 cu. yd. Nearing completion.

Roosevelt Dam.—Rubble masonry arch, of gravity type. Maximum height 280 ft. Length at crest 1125 ft. Contains 342,325 cu. yd. of masonry. Completed. About 20,000 hp. of electric energy are developed by plants at the dam and at drops in the valley canals. Change on Southern Pacific at Maricopa for Phoenix, or at Bowie for Globe.

Laguna Dam.—Height 40 ft. Length 4780 ft. Concrete and rock structure. Contains 441,732 cu. yd. Levee system of levees along Colorado River. Reached by Southern Pacific.

Lahontan Dam.—Earth and gravel fill structure. Height 129 ft. Length 1700 ft. Volume 770,000 cu. yd. 31 miles of concrete lined canal. Stepped spillways curving from each end of dam to a pool below. Leave Southern Pacific at Hazen, Nev.

Strawberry Dam.—Built in mountains at elevation of about 7500 ft. May be reached from Salt Lake City by rail to Provo, Utah. Earth fill with concrete core. Height 72 ft. Length 488 ft. Volume 108,415 cu. yd.

Grand River Dam.—Roller crest extending across. Six rollers each 70 ft. long and 10 ft. high, and one 60 ft. long and 15 ft. high. Masonry ogee weir; 546 ft. long and 24 ft. high. Nearing completion. In Grand Valley, Col., along Denver & Rio Grande Railroad. Described in Engineering Record, Aug. 14, page 209.

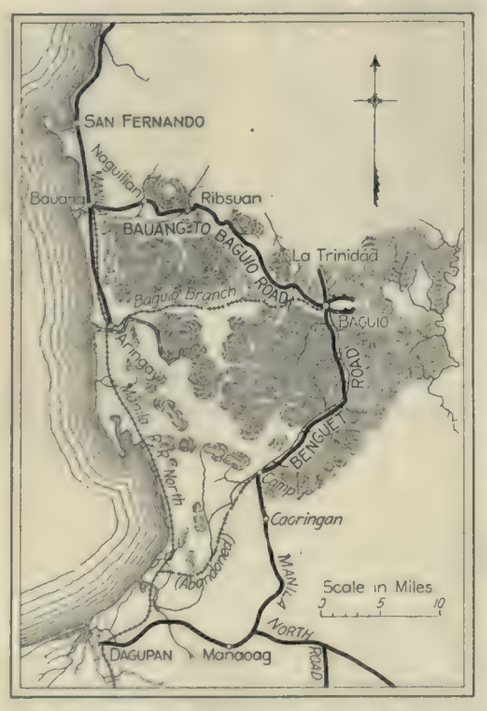
Arrowrock Dam.—20 miles up river from Boise, Idaho. Rubble concrete arch, 350 ft. high 1075 ft. long. Will contain about 600,000 cu. yd. Under construction.

Minidoka Dam.—10,000 hp. hydroelectric plant. Largest power installation of the kind used for irrigation pumping. Pumping plants. Rockfill dam with concrete core; 86 ft. high; 937 ft. long; contains about 242,500 cu. yd. Located near Boise, Idaho.

Philippine Road Built at High Level to Escape Flood Damage

Baguio-Bauang Route Replaces the $2,000,000 Benguet Road Which Involved Excessive Maintenance Charges

LOCATED near the summits of mountain ridges so as to minimize the possibility of damage by floods, the newly completed Baguio-Bauang road in the Philippines, which links the sea-coast with the health resort at Baguio, will practically supersede the old Benguet road, built at a cost of $2,000,000, and ravaged to such an extent by floods from a watershed 6000 ft. above it that a million dollars has been spent on its maintenance during the last 10 yr. The old Benguet route was described in the Engineering Record of Dec. 23, 1905, page 702, while the following notes on the new road are from an article by A. D. Williams, district engineer, published in the April *Quarterly Bulletin* of the Philippine Bureau of Public Works.



NEW HIGHWAY REPLACES BENGUET ROAD

In the vicinity of the Benguet road excessive rainfalls have been recorded and complicate the road problem. The resulting damage to the surfacing was so severe that maintenance costs were excessive. The Baguio-Bauang road, on the other hand, is located near the summit of the hillside in the mountain section and ridges that it follows and consequently will be subject to rainfall discharges from a very limited watershed. Another important advantage in the location of the new road is in the lesser number of bridges required.

General Route Followed

The new road leads out of Baguio in a westerly direction for 5 miles along the old Spanish Naguilian trail, improved by the city of Baguio so as to be classed as a second-class road, and, thence, over 17.4 miles, improved in 1914, to the village of Ribsuan. From this point, 5 miles west to Naguilian, it follows along a section of first-class road, replacing a section of the Naguilian trail, and from there to Bauang over another section of 5 miles of first-class road. The latter city is on the road leading to Manila and to the harbor of San Fernando, where extensive harbor improvements are contemplated. It is also on the railroad to the former city. The total distance from Baguio to Bauang along the road is 31 miles. From Bauang to San Fernando the distance is 6.2 miles. The lower sections of the road represent, for the most part, a new location.

Between Bauang and Naguilian the old Spanish road was, for practically the whole distance, in the high water channel of the Bauang River. The new road is located on the bank, well above high water. It passes through a typical foot-hill section broken by numerous drainage courses and low ridges, necessitating frequent adverse grades and curves. In the location of the Naguilian-Ribsuan section little value was attached to the trail and the present road coincides with it in about two places through villages. From the low level surrounding Naguilian and crossing a number of low line ridges necessitating adverse grades, the road is in side-hill cuts bordering the Ribsuan River to the crossing at the village of Ribsuan.

Location and Construction

The location of the mountain section from Ribsuan to Baguio consisted mainly in revising the alignment and grade of the old trail. In the mountain section of the road it was placed as near as possible to

the top of the ridge, passing over a series of saddles or low connecting ridges for the entire distance to Baguio. This eliminated large drainage areas above the road and the necessity for placing large drainage openings under the road. Construction work on the lowland sections was done during the dry season of 1912 and 1913 without the necessity of haste or the employment of large forces. The cost of this portion of the road compares favorably with the average cost of lowland construction elsewhere in that locality. Construction work on the Benguet section was started Jan. 20, 1914, and continued through the rainy season. Grading was completed Dec. 20, and the surfacing, March 25, 1915. The largest labor organization at any time during the work was seven foremen, fourteen sub-foremen and about 2500 laborers. A total of 8.6 miles of the road was graded by force account at an average cost of about 15 cents per cubic meter for moving earth and $1 per cubic meter for moving rock. The road is in side-hill cut for practically the whole distance and grades and curvature of the old trail were reduced by heavy cutting and filling. Solid rock work was encountered on 1.4 miles of the road and approximately 16,000 cubic meters of rock were moved from cuts and side hills. The road was then laid out and constructed with a 20-ft. roadbed both in cuts and fills, except on two sections where heavy rock was encountered, where there is a 15-ft. roadway.



LEFT — ROAD WAS CONSTRUCTED NEAR CRESTS OF RIDGES ALONG ROUTE



RIGHT — NATIVES DISPLAYED GREAT SKILL IN DRY RUBBLE WORK

DID NOT CUT HIGH SLOPES TO STAND

On the upper section of the road, graded before the 1914 rainy season, no attempt was made to cut high slopes to stand, the idea being that it would cost less to move the material brought down by the rain. The result was that the first heavy rain and later rains caused a large amount of sliding from the upper banks. This material was moved to advantage with two-mule drag scrapers at a cost of about 5 cents per cubic meter or a total cost of $11,404.20, which represented the saving in excavation of $22,808.40. A portion of the road, 7½ miles long, was graded by contract at a total cost of $8,342, or at an average cost of 8 cents per cubic meter. Parts of the road were done by contract, practically all the contractors being natives. The system proved not only very satisfactory but about 50 per cent cheaper for excavation than for that done by force account. Excavation was done by contract during the rainy season where water was available for sluicing as low as 4 cents per cubic meter, the contractors being familiar with this method of excavating as it is the usual practice in constructing hillside rice paddies in the mountain provinces.

NO LARGE STRUCTURES REQUIRED ON MOUNTAIN SECTIONS

It was often necessary for contractors to build ditches over 1600 ft. long to secure a sufficient amount of water for sluicing heavy cuts. Material required for making fills was sluiced into place and held by dry rock walls or sheet piling made tight with banana leaves or grass. The sections of the road graded by contract were left with slopes varying from ¼ on 1 to 1 on 1, according to the materials encountered. No large structures were required in the mountain sections, but a large amount of dry-rubble masonry was used in constructing retaining walls and end walls for drainage openings. The use of this class of masonry proved very economical, as the natives were found to be good masons and the cost of cement was excessively high in that locality, due to transportation.

All material used in surfacing the road was contracted for and broken by hand along the roadside. The cost of breaking and quarrying varied from 30 to 55 cents per cubic meter, for the first course, and from 45 to 60 cents for the second course and finishing material, the government furnishing the tools and dynamite. The breaking and delivering of rock was contracted for on 15 miles and the price paid was from 90 cents to $1. The maximum haul in the upper section was about 1¼ miles with an average haul of 650 ft. The maximum haul was 2.2 miles on the lower sections. Two 8-ton and two 10-ton road rollers were used in preparing the subgrade and rolling surfacing material into place. A 6-ton roller was used in rolling fill.

PROTECTION OF SLOPES

Special attention was given to the protection of fills by placing banks on the outside of the roadbed to keep drainage from going over the slope of fills and by planting grass on the slopes of high fills so as to form a cover against rain. The maximum gradient used was 9 per cent and the minimum radius of curvature 50 ft. In several places where it would have been necessary to resort to heavy cutting and filling to correct the grade of the old trail the minimum radius of curvature was reduced to 33 ft. Wherever a radius of curvature less than 50 ft. was used the roadbed was widened and the gradient compensated by reducing the gradient on the curve. The maximum grade was on the section near Ribsuan, where the road makes an ascent of 765 ft. The total ascent from Ribsuan to Baguio aggregates 0.94 mile and the total descent ½ mile.

There are 303 minor structures on the mountain section of the road with openings for drainage aggregating 750 ft. total span, as compared to a total of 234 structures on the Benguet road having a total length of 7450 ft. For small drainage openings where rock was easily obtainable dry rock box culverts were used instead of pipe drains. The cost of building these culverts was about half the cost of concrete or galvanized iron pipes. In locations where it would have been necessary to place pipe culverts under high fills to take care of drainage and natural water courses the ravines were filled so as to divert the drainage and the pipes placed in cuts. This necessitated larger fills that eliminated high end walls on culverts. The only bridge and timber structure on the mountain section is a 60-ft. pony truss bridge, with girder approaches, across the Irisan River. This bridge was built during 1912 by the city of Baguio. It was designed for a maximum load of 8 tons but has been strengthened to carry 10 tons and will be serviceable for several years longer. Timber collapsible bridges are used at the Ribsuan and Naguilian River crossings. A good bridge site, however, is available at the Ribsuan River and it is proposed to replace the present collapsible bridge with a 300-ft. steel structure during the coming year.

WIDTHS AND KINDS OF METALING

The metaling on the road has been placed 13 ft. wide in sections and increased in width on curves depending on the radius of curvature. In order to effect a saving in the construction the width of metaling

was reduced to 10 ft. on one section. The depth of metaling varied from 6 to 9 in. and different classes of material were used. City sections of the road were of a good quality of limestone rock, some sections were gravel and others of rock easily obtainable along the route and varying from a diorite or andesite to a fair quality of sandstone for first course material, and the best grade material was used for the finishing courses. In order to provide a better wearing surface for the heavy traffic to which the road will be subjected it is proposed to resurface the entire road later and to widen the section with 10 ft. of metaling of an excellent quality of hornblende and andesite and with limestone from the city of Baguio. This class of material will also be used to make country roads.

The total cost of the road was less than $320,000. What will ultimately be done with the Benguet road is as yet uncertain. At present it is being used as a toll road for lighter traffic, and the receipts have been ample to pay for maintenance. If this continues it will probably be kept open for such a purpose, but otherwise it will probably be abandoned altogether.

The location and construction of the Bauang-Naguilian and the Naguilian-Ribsuan sections of the Baguio-Bauang Road was under the supervision of E. D. Smith, district engineer. The section from Ribsuan, kilometer 32, to kilometer 34 was located and constructed by Dana A. McComb, also district engineer. The mountain section of the road from kilometer 32 to Baguio was under the supervision of A. D. Williams, district engineer, assisted by J. E. Evans. E. A. Eckman had charge of the work of converting the old Naguilian trail into a cart trail.

RAILROAD DEVELOPMENT IN NIGERIA, states a recent consular report, has been as rapid in the last few years as in any part of West Africa. The railroad system, which is controlled by the British Colonial Government, now extends nearly 800 miles into the interior. The ocean terminus is at Lagos, the main seaport of the colony. The main line runs northeasterly 712 miles to Kano, the principal town in the Mohammedan States of northern Nigeria. From Minna Junction is a branch south to Baro at the head of the permanently navigable section of the River Niger, while a second branch, opened last December, runs from Zavia to Bukeru, reaching rich tin deposits. The entire system is of 3½-ft. gage.

Central Plant at Chicago Will Handle Repairs to All City Equipment

All Municipal Shops to Be Consolidated at Site in Heart of City—Construction Features Described—Concrete Is Sent 400 Feet through Chute to Caissons

CHICAGO'S new Marshall Boulevard municipal plant, located in the geographical heart of the city at Thirty-first Street and South Sacramento Avenue and designed to replace the various overcrowded municipally owned shops scattered throughout the city, is rapidly nearing completion. The buildings, which include a machine shop, a foundry, a blacksmith shop, a garage and office building, a warehouse and a combined carpenter, pattern and paint shop, and a pattern warehouse will have complete facilities for making repairs to any of the city's property.

WHERE REPAIRS WERE MADE HERETOFORE

In the sixty-two years that have elapsed since Chicago's first pumping station was constructed in 1853 the pumping equipment of 8,000,000 gal. per day has had to be increased until to-day the city has nine pumping stations with a capacity of 840,750,000 gal. per day from forty-two pumps. These pumps, all but two of which are steam-driven, are served by sixty-two boilers with a rating of 15,344 hp. The distribution system now includes 2524 miles of pipe of all sizes, 26,984 fire hydrants and 22,716 gate-valves. As the system grew it became necessary to build repair shops, which were developed at different locations as space could be obtained.

In the same manner as the water department the fire and police departments have, as they grew, developed shops for repair work. The shops, aside from being scattered, were compelled to increase their output each year until each was so badly crowded that the city decided in 1913 to erect a central compact municipal plant which could handle all types of repair work. Land was purchased and the erection of buildings started toward the end of 1914.

LAYOUT OF THE NEW PLANT

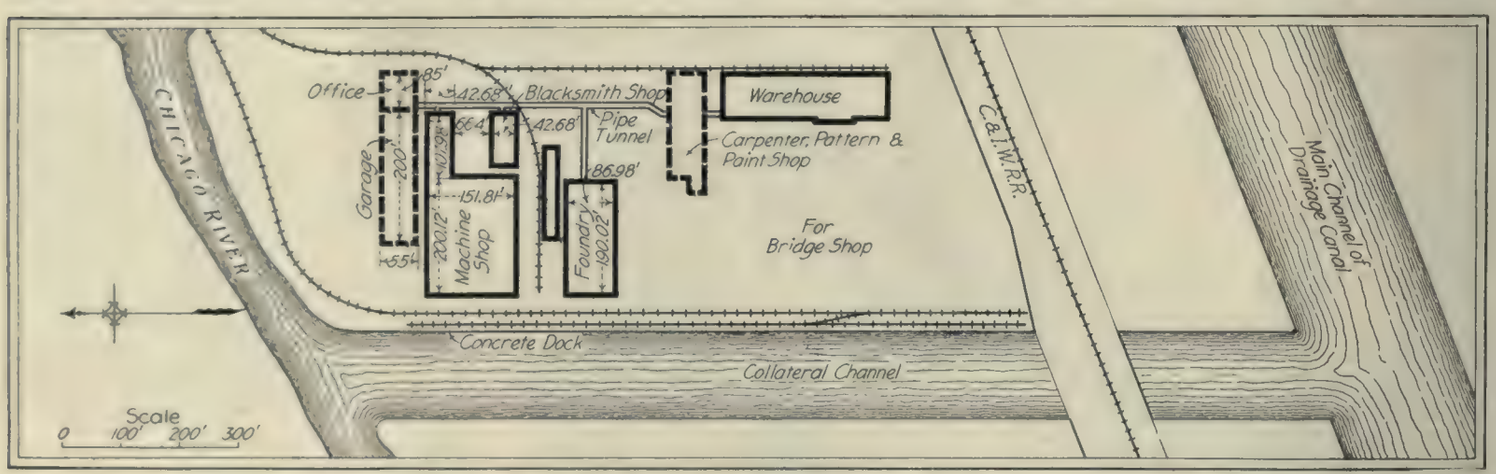
The accompanying diagram shows the general layout of the plant. The buildings are so designed and arranged that extensions can be made easily. A concrete dock 1100 ft. long is being built for that portion of the grounds along the collateral channel, thus allowing the fire tugs to tie up for repairs within a few feet of the machine shop. The tugs heretofore could not get closer to their repair shop by water than ½ mile, which made tug repairs costly. Two railroads have spurs running to the shops which will aid in handling materials to and from the work. A complete sewerage system for both sanitary and storm purposes has been installed.

The shops and railroad tracks have been laid out so as to facilitate the work and make the minimum amount of handling of patterns from the pattern shop to the foundry and the castings from the foundry to the machine shop and through the assembly rooms.

CONSTRUCTION FEATURES

Of the various buildings being erected the four-story reinforced concrete warehouse, which is now nearing completion, and its near neighbor of similar design, the carpenter shop, present the most interesting construction problems. Conforming with what has been declared to be good practice since the Edison fire, the round columns supporting the Acme flat-slab system predominates. The warehouse has seventy-five piers all but eighteen of which are round. The few square columns are used at the stair wells. Concrete work for the entire building above the basement foundations, including stairways, elevator pits and tower, was poured by chutes. The cement shed is located next to a ½-cu. yd. Chain Belt mixer, thus doing away with the wheeling of cement. Stone and sand are unloaded by a Browning crane from railroad cars directly into a hopper located over the mixer. Water is obtained from a barrel provided with a water gage which enables the operator to supply the exact quantity needed for each batch. The mixer averaged 200 cu. yd. per 8-hr. day, although it frequently reached a maximum of 230 cu. yd.—a batch a minute.

The floor forms were made of sectional panels which were used many times on the different floors. The first floor of the warehouse was poured when the temperature ranged from 2 to 7 deg. Fahr. below zero. From thirty to forty salamanders were kept 4 ft. below the floor which was covered above with canvas with an air space of 6 in. between the floor and the



CHICAGO'S NEW MUNICIPAL REPAIR PLANT IS LOCATED NEAR THE GEOGRAPHICAL HEART OF THE CITY



CHUTING CONCRETE 400 FEET TO CAISSONS FOR CARPENTER BUILDING

canvas. No frost action whatever was encountered.

CAISSON CONCRETE CHUTED 400 FEET

Owing to its accessibility to the railroad tracks a few feet away, and as steam was furnished the mixer from a small power plant nearby, it was deemed unnecessary to move the mixer plant in building the carpenter shop. As a result the unusual method of pouring caissons by chute was arranged. The concrete is thus spouted from mixer tower approximately 400 ft., this includes a vertical drop of 50 ft., directly into the forty-two caissons of the new building. The entire carpenter shop, with the exception of the roof, will be poured by the same plant. Unusual soil conditions were encountered in placing the caissons as in nearly every one of the forty-two which were sunk the stratum was found to vary. Quicksand varying in depth from 1 to 11 ft. added to the difficulties.

Bayley metal sash and wire glass as well as sprinkler systems will be used in the buildings as fire preventive measures.

ELABORATE EQUIPMENT TO BE INSTALLED

The machine shop and blacksmith shop are so constructed that when it is necessary to enlarge the machine shop the bay separating the machine shop and blacksmith shop can be filled in and the area between the blacksmith shop and north wing extended can be roofed over, making a complete machine shop 308 ft. long. As planned at present, when such an extension is made a new building will be constructed for the blacksmith shop. The main part of the machine shop will contain the heavy machine tools for working on large castings. All the modern tools in the present shops will be moved and about $25,000 worth of new tools added. A 25-ton Pawling & Harnischfeger crane with a 5-ton auxiliary hoist will handle all heavy castings and machines in the main shop. The south wing first floor will contain the tools for manufacturing hydrants and valves, small jib cranes being provided to facilitate handling. The north wing first floor will contain the hydrant and valve assembly room and automobile and fire-fighting apparatus repair room. The second floor south wing will contain the meter shop for repairing and testing meters. The second floor of north wing is unassigned at present.

The foundry will have a capacity of 20 tons of iron and 3000 lb. of brass per day. Two outside cranes are provided, one for handling flasks in the flask storage yard, and one for unloading and handling iron and scrap metal. Two cranes are provided in the iron foundry and one in the brass foundry. The welfare of the employees is taken care of in ample locker rooms provided with shower baths and modern lavatories.

To the north of the machine shop an administration, laboratory and garage building will be constructed. The main offices for the plant will be located in this building and 8000 sq. ft. will be assigned to the testing laboratory. The testing laboratory tests all the coal used by the city, also lubricating oils, cements, steel and any other materials entering into construction that are bought on a test basis. The garage will have a capacity of forty trucks, and will contain a vulcanizing plant and room and equipment for making repairs that do not require the machine to go to the machine shop.

POWER PLANT

Owing to the location of the plant adjacent to the city prison, and as a contagious disease hospital is being constructed on the eastern part of the new piece of property, it was decided to combine the power houses of the shops and prison and to furnish heat, light and power to all the buildings from the one plant, using prison labor for construction and to a great extent for operation. The details of this plant have not been worked out yet, but will be completed in the near future. The plant will operate as a division in city work, all departments now operating repair shops ceasing to maintain their shops. Requisitions will be made by all departments for all new work or repairs, as it is the aim to eliminate all duplicated shops and have one shop under a well-organized efficient management.

All the work, with the exception of the dock, is being done by city day labor under the direction of H. W. Clausen, engineer of water works construction, and W. H. Dean, assistant engineer in charge. The design of the buildings was made by M. B. Reynolds, engineer of waterworks design, under the immediate direction of H. S. Baker, assistant city engineer. John Ericson is city engineer in charge of all work of the Bureau of Engineering.

The total estimated cost of this complete improvement, not including the contagious disease hospital, is $1,755,000.

ROAD PATROLMEN to the number of 116 were appointed Aug. 11 by the Pennsylvania State Highway Department.





CHARACTER OF CONSTRUCTION IS SHOWN BY THE INTERIORS OF TWO OF THE BUILDINGS OF THE NEW PLANT

Literature

For the Civil Engineer and Contractor

New Publications

EARTH WORK DIAGRAMS. By C. A. Jones. Paper; 10 x 15 in.; 5 plates and set of 60 scales for scaling quantities from a profile. Buffalo. The Yardage Scale Company, $1.

PORTLAND CEMENT CONCRETE PAVEMENTS FOR COUNTRY ROADS. By Charles H. Moorefield and James T. Voshell, senior highway engineers. Bulletin 249, U. S. Department of Agriculture. Paper, 6 x 9 in., 34 pages; illustrated. Washington, Government Printing Office.

CHART OF EQUIVALENT UNIFORM LOADS FOR SHEAR AND MOMENT. By D. B. Steinman, C.E., Ph.D. Linen, 27 x 32 in., complete with sketches and formulas. New York, D. B. Steinman, 68 William Street, $1.

This chart makes possible rapid computation of maximum stresses, either with or without influence lines, for all kinds of bridges designed for Cooper's live loadings. It is constructed for Cooper's E 60 loading.

GUIDEBOOK OF THE WESTERN UNITED STATES—Part A. The Northern Pacific Route with a Side Trip to Yellowstone Park. By Marius R. Campbell and others. Bulletin 611, U. S. Geological Survey. Paper, 6 x 9 in.; 212 pages, illustrated. Washington, Superintendent of Documents, $1.

This is part A of the excellent popular guide book issued by the government and reviewed in our issue of July 17, page 85. It describes the route (by the Northern Pacific Railway) from St. Paul to Puget Sound in the State of Washington.

WIND STRESSES IN THE STEEL FRAMES of Office Buildings. By W. M. Wilson and G. A. Maney Bulletin 80, Engineering Experiment Station, University of Illinois. Paper, 6 x 8 in., 88 pages, illustrated, tables and diagrams. Urbana, Ill., University of Illinois, Engineering Experiment Station.

Presents an accurate and an approximate method for analysis of the stresses in a steel frame due to wind pressure or horizontal shear, and compares results with four other approximate methods now in use by application to a 20-story building of three bays. The analysis is based upon assumptions which are not exactly true, but it is claimed to be more accurate than the usual methods.

Books Reviewed

Water Purification Plants and Their Operation

Author, Milton F. Stein, assistant engineer of design, Cleveland Filtration Plant. Cloth, 6 x 9 in.; 255 pages; 95 illustrations and 11 charts. New York, John Wiley & Sons, Inc. $2.50 net.

Reviewed by Weston E. Fuller

Consulting Engineer, New York City.

In his preface the author says that his primary object in writing the book was to give instructions for the operation of purification plants. While there is much of interest to experienced operators and water engineers, the book will prove of the greatest use to the many persons who are endeavoring to operate plants under the heavy handicap of insufficient training and experience.

The book cannot be said to be in any way a complete manual, for many important matters connected with filter operation are not even mentioned. There are also many statements made with which some of the most experienced designers and operators of filters would be inclined to take exception. In his endeavors to present the subject simply the author has perhaps generalized too much and may mislead some in that way.

A considerable portion of the book is given up to descriptions of purification plants, which might, perhaps, better have been omitted and the space devoted to operating matters. The descriptions, at the best, cover only a limited field and methods are described which are only a few of the many which are in use. A short but interesting chapter is devoted to the causes of various impurities in the water. The principal tests required in filter operation, the determination of the quantities of chemicals to be used, the methods of washing filters, the handling and application of chemicals, the keeping of records, and other matters of routine filter operation are dealt with in a simple and clear manner.

Charts to aid in making computations are also presented.

Vitrified Brick Pavements for Country Roads

Author, Vernon M. Peirce, chief of construction, and Charles H. Moorefield, senior highway engineer, U. S. Office of Public Roads. Paper, 6 x 9 in.; 88 pages, illustrated. Washington, D. C., Bulletin 246, U. S. Department of Agriculture. Copies may be had from the Superintendent of Documents, Government Printing Office, Washington, D. C., for 10 cents.

This bulletin contains information relating to brick roads and supplies suggestions for aiding engineers in preparing specifications under which such work may be satisfactorily performed. In order that the varying physical characteristics of brick may be understood the raw materials and processes of manufacture are first discussed. Then follow sections on construction, cost and maintenance. Two appendices deal with specifications and with methods of inspection and test.

The authors deal only with sand as a cushion for the brick. In view of the increasing use of a sand and cement bed it would have added to the discussion if a few paragraphs had been devoted to this subject.

Purchasing

Author, C. S. Rindsfoos, C.E., president of the United States Purchasing Corporation. Cloth, 7 x 10 in.; 165 pages. New York, McGraw-Hill Book Company, Inc. $2 net.

Reviewed by Elihu Cunyngham Church

Correct purchasing is probably one of the most important business problems of the present day, and it offers many opportunities for careful study and analysis along broad scientific lines. As has been frequently pointed out in the past, purchasing is but one part of the larger question of stores control and involves the correct preparation of specifications, the exact determination of the quantities needed, and the inspection, storage, issue and use of the materials bought no less than the mere buying itself—and these are all matters so closely interrelated that no one of them can be properly considered except in its bearing on the others. Unfortunately this book does not give any attention to the larger aspects of the case. Consequently it is incomplete and not well balanced. It is a book mainly of glittering generalities. It is loquacious, discursive and superficial. There is little in it that one can take hold of and apply in one's own business. It is a pity that when there is so much that can be written that would be new and useful that this book should be so lacking, not only in its text, but in procedure and organization charts, in diagrams, and examples of the various forms, cards, and records that would prove helpful from a statistical and accounting standpoint.

The first chapter is entitled: "How to Obtain the Right Article." In pointing out the usefulness of a knowledge of the article to be purchased we are gravely informed that "a man who is thoroughly versed in the subject of electric motors is in a better position to buy motors than the man whose knowledge is confined to dress goods, and vice versa." The second chapter relates to "price"—and other matters. It is full of such phrases as: "When the housewife instructs the greengrocer by telephone to send a dozen ears of corn and he says 'all right,' —", etc. It is too bad that the book could not have been edited before being put into type, and all the irrelevant, immaterial and inconsequential matter blue-penciled. Chapters on "Delivery," "Favorable Terms" and "Personal Characteristics and Qualifications" follow. In the latter the advice about broadmindedness is good, but, when the author, in advising the purchasing agent to be tactful, says, "This does not mean that he should be a 'mollycoddle,' nor that he should always be on the defensive. As we shall see later, it is sometimes necessary to display anger—to show one's teeth," he is silly.

It sounds strange to hear the admiration for "cunning, acumen, acuteness or shrewdness" expressed in the chapter on "Strategy" in a day when progressive business men not only refuse to stoop to their use themselves, but regard them as most undesirable characteristics in every sense of the word. "Matching wits" and much of the quibbling and bargaining advocated approaches very closely to disgraceful tactics of a variety sometimes found in a horse trade, but never in reputable business.

There is a good but brief chapter on "Some of the Legal Aspects of Purchasing"—written by another man. A chapter on "Departmental Organization" comes next, and contains many positive assertions that are open to question, for instance, the statement that "the storehouses and materials therein should be under the accounting department or else under whatever department will use the stores." Now, at the present time, most men agree absolutely that, except in small quantities, supplies should never be in the custody of the men who use them. Here also is reprinted in part the report which Comptroller Prendergast made to the New York Board of Estimate a few years ago concerning his proposed plan for the central purchase and distribution of supplies for the city.

The latter part of the chapter is taken up in amplifying the statement that: "The author believes there are many reasons why the ideal purchasing department of the not far distant future will be in the form of a separate company." Incidentally the author is president of such a company himself. Q.E.D.

The book ends with some fifty odd pages of so-called forms or form letters running all the way from a simple letter asking for a bid to a blank form of agreement to buy real estate.

HINTS FOR THE CONTRACTOR

Details Which Save Time and Labor on Construction Work

Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

[*Contributions to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

Excavator Hitches to Its Own Platform to Move Over Soft Ground

TO MOVE a dragline excavator over soft material where the bucket would not hold, the Winnipeg Aqueduct Construction Company turned the machine around, hitched the bucket to a chain run through the bed of the excavator and fastened to the front edge of the advance platform section, and moved the excavator by backing it up. According to the *Excavating Engineer*, the machines that were moved in this fashion were being operated in muskeg swamps. To pull them ahead in the usual way by casting the bucket out in front of the machine required digging away 4 to 6 ft. of this soft vegetable mold before the underlying clay, in which the bucket could get a firm hold, was reached. In principle the method is the same as that often employed to move traveler derricks, where the load line is attached to the track, and the engineer booms down and picks up his load, backing up the traveler. In each case the weight on the track or platform of the rig being moved furnishes sufficient anchorage to hold the pull needed to make the move.

Wire Rope Clips Should Be Put On with Saddle Next Main Part

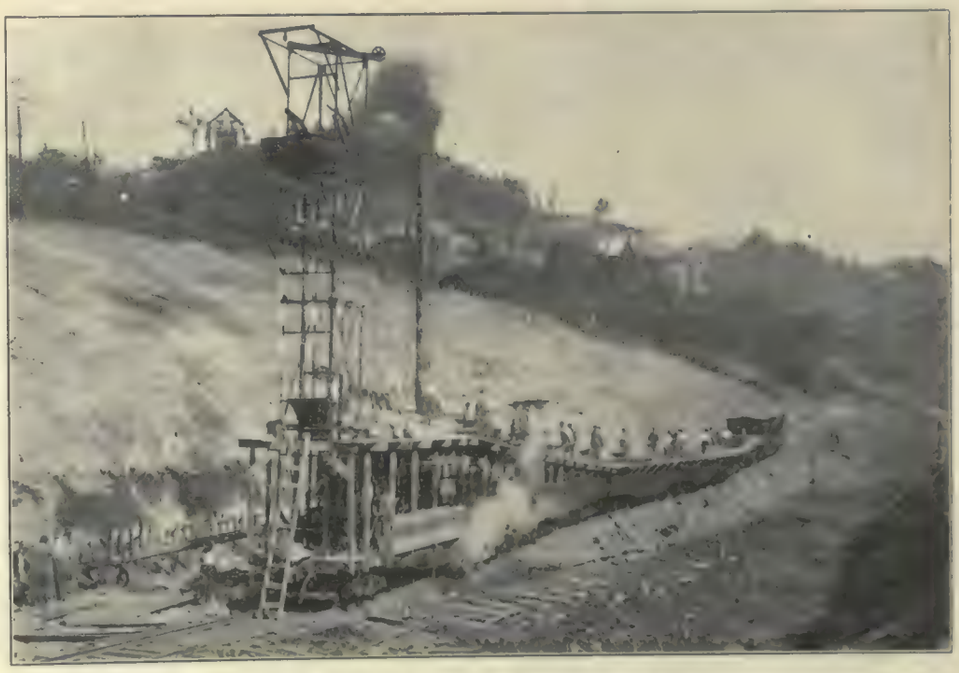
IN CLAMPING the end of a wire rope around a thimble all the clips used should be put on with the saddle next the main part of the rope. The obvious reason for this is that the saddle of the clip develops a much better grip on the rope than does the U-bolt. Most of the strain in a fastening of this kind is on the main part of the rope, and very little pull exists in the end part. If the saddle of the clip is clamped against the main part, the clip holds this part against sliding past the saddle and past the rough surface of the other part. If the clip is reversed, its grip on the main part of rope is reduced to the friction of the main part against the end part of the rope, and to the grip of the U-bolt on the main part. This grip is comparatively slight unless the clamp is tightened so much as to flatten the strands of the rope.

Users of Hercules wire rope have recently been advised of a convenient way of making an eye at the end of the rope. The length of the end beyond the center of the eye is determined by the number of clips required by the load, allowing several inches to each clip. This length is measured back from the end of the rope, and the round part of the thimble is tied to the rope at this point with wire. The rope is then bent around the thimble and tied at the point of the thimble with another wire. The first clip put on is the one farthest from the eye. This is tightened, and the other clips required put on loosely. A strain is then taken on the rope, which equalizes the rope around the eye, before the remaining clips are tightened up. It is bad practice to tighten a clip entirely with one nut. This twists the grip of the clip on the cable, and is liable to bend the clip and make it worthless. The nuts should be screwed up a few turns at a time alternately. After a rope has been in use a short while, it is necessary to go over all the clips and tighten them up. As strain on the rope pulls it out straight and slightly reduces its diameter, serious trouble has been caused by the clips becoming loose and slipping when this precaution has been neglected.

Nearness of Railway Tracks Aids Concreting of Retaining Walls

By KENNETH C. CARDWELL
Cincinnati, Ohio

GOOD use was made of the proximity of railroad tracks by the Marquette Construction Company of Chicago, in handling concrete, materials, and equipment for the heavy concrete walls of the underpass and track-supports required in separating the grades of Eastern Avenue, Cincinnati, and the Pennsylvania railroad tracks, which parallel them for a considerable distance. Practically the same mixing equipment was used for the entire job.



RUNWAYS BRACKETED OUTSIDE CARS OF MIXER TRAIN ON RAILROAD WORK

The work in question was in progress for about a year. A great part of the time consumed was required by the large amount of excavation and filling necessary, the placing of the concrete by the use of the equipment and methods referred to being in all cases comparatively rapid after the preparation of the grade. The cost of the work, about $500,000, was shared by the railroad company and the city. Undoubtedly, the cooperation of the railroad company, by reason of its immediate concern in the work, contributed largely to the facility with which the material-handling plan, involving the use of the tracks and of the cars containing the materials, was carried out.

The typical layout of the equipment used for any given piece of concrete work on this job consisted of two ordinary gondola cars bearing the concrete machinery and a sloping platform leading from other cars in the rear. The rear cars included a car of gravel, three cars of sand, and, at the extreme end of the row, a car of cement in sacks. The two front cars, besides bearing the platform and equipment described, were also used for storing coal and miscellaneous supplies, such as shovels and wheelbarrows.

TOWER FOR CONCRETE DISTRIBUTION

The concreting equipment consisted of a steel tower built at the extreme end of the foremost car, 30 ft. in height above the floor of the car, and a mixer of 1-yd. capacity, with a 42-hp. engine to operate it. The tower was used in handling concrete to be placed at comparatively distant points. All of this equipment, excepting, of course, the tower, was covered over with the platform referred to, which was built over the two front cars, of 2 x 6-in. lumber, to a width of 12 ft. The photograph indicates the height to which the platform rose at the end of the front car, only the smoke-stack appearing above it.

RUNWAYS HUNG OUTSIDE OF CARS

The hopper of the mixer was set in this platform, flush with the surface, and immediately under a metal water-tank. This tank had sufficient capacity for a maximum batch of concrete, with an automatic device to measure the water. A tender at the hopper operated the tank and also took care of the cut-off which regulated the admission of the materials to the mixer.

The platform over the two front cars, level at its higher end, sloped down a length

of about 80 ft. to the material cars behind. Running along both sides of these cars, and forming a smooth connection with the platform, were movable running-boards for the use of the men wheeling material up to the mixer. These running boards were each built up of a pair of 2 x 12-in. boards, upon 2 x 6-in. pieces as a framework. The framework was so arranged, with heavy cleats, as to enable the complete running-boards to be hung on the sides of the cars, firmly supported by their own weight against the cleats and the car structure.

This method of supporting the running-boards, by cleating to the sides of the gondola cars containing the sand and gravel, was, of course, impracticable for use with the box-car in which the cement was loaded, and the boards were therefore supported to the door of this car on trestles.

SIXTEEN MEN IN WHEELBARROW CREW

A crew of sixteen men, with wheelbarrows, was used to keep the material moving, eight men moving down on each side in turn; and several men in each material car shoveled the sand and gravel into the barrows as they were wheeled down empty. As these two strings of eight wheelbarrows each came down alternatively, no congestion occurred either at the cars or at the mixer. The men in the cars were kept shoveling, while the mixer was supplied regularly with the required material for the batch.

All of the concrete placed was in mass, the construction being very heavy retaining walls. A 1:2:5 mixture was used throughout. The number of material cars placed in the working train at any one time, therefore, was regulated by this fact, and usually worked out very accurately, the hand and gravel cars being emptied very nearly at the same time. It was not possible, however, to regulate the supply of cement this closely, as it was necessary to use the box-cars in which it was shipped in order to protect it from the weather, and the relative capacity of the cars could not be worked out as nicely with a box-car as with the gondolas. The value and availability of railroad co-operation was fully utilized by Superintendent J. J. Casey, who was in charge of the work, and there was the least possible delay between the arrival of a car of material and its use in the mixing of concrete and placing in the work. A large part of the work being close to the tracks, the use of the tower on the front car was not always necessary, chutes direct from the mixer being employed satisfactorily. When the tower was used the concrete was dumped from the mixer into a bucket on the tower, hoisted by a cable connected with the engine, and emptied in the usual manner into the steel chutes.

Safety First in Road Building

THAT THE RECENT improvements in tools and methods on road construction have not resulted in any corresponding increase in the safety of the workman engaged in this class of construction is forcibly brought out in the *Travelers' Standard* for August. Accident prevention is of the greatest importance to road contractors, as well as to others. It is well recognized that freedom from accidents, aside from the money saving and reduced premiums, enables the contractor to build up an organization that is more efficient because it has confidence in itself and in the construction methods that are being used.

One of the principle sources of accidents on road work—and many of them are fatal—is blasting. Dynamite requires extreme care in handling, and should be placed in the exclusive charge of a safe and competent man. This man should see that the charges are of the proper size, and that fuses and caps, or blasting machines and wiring, are in first-class condition. The foreman should select a place of safety and see that all the workmen reach it before allowing the blast to be fired. Men should be assigned to warn persons passing near the work. Heavy rope mats and logs bound together by chains are absolutely necessary to prevent flying debris in work near cities and towns, and their use often pays in more open country. In one instance, a man standing in his own yard a quarter of a mile from where blasting was being done on road work without such a mat was struck by a small piece of rock and instantly killed.

The most serious accidents are often caused by men returning to work too soon after a misfire. Numerous cases have demonstrated that, where fuses are used, it is not safe to venture near a misfire for several hours. In one instance several workmen were killed by a blast fired with a defective fuse which did not go off for half an hour after it had been decided that all danger was over, and the men had been sent back to work.

Felling trees in clearing for road work is another fruitful source of accident, and this work should be done carefully by experienced men. Constant vigilance must be employed to prevent accidents from landslides in making cuts for road work. Especially is this true where men work on the top edge of the cut.

Care should be exercised by men working around a steam shovel, and the foreman should see to it that the men keep in the clear, and that the shovel is properly handled and kept on a solid foundation. Many wagon drivers become too lazy or careless to get down from their seat while their carts are being loaded. Drivers should be compelled to do this by the foreman; if they remain in their seats, they are in danger of being struck by material falling from the dipper, or of being brushed off by the dipper itself.

Handling the materials used in road making is also a prolific source of accident. Caution should always be exercised to pile cement bags, paving blocks and other material solidly so that they will not fall over and injure some one. Loading and unloading oil barrels and other heavy objects should not be attempted with a green crew, as lack of co-operation by the men, or the misunderstanding of an order is almost certain to result in the injury of some one.

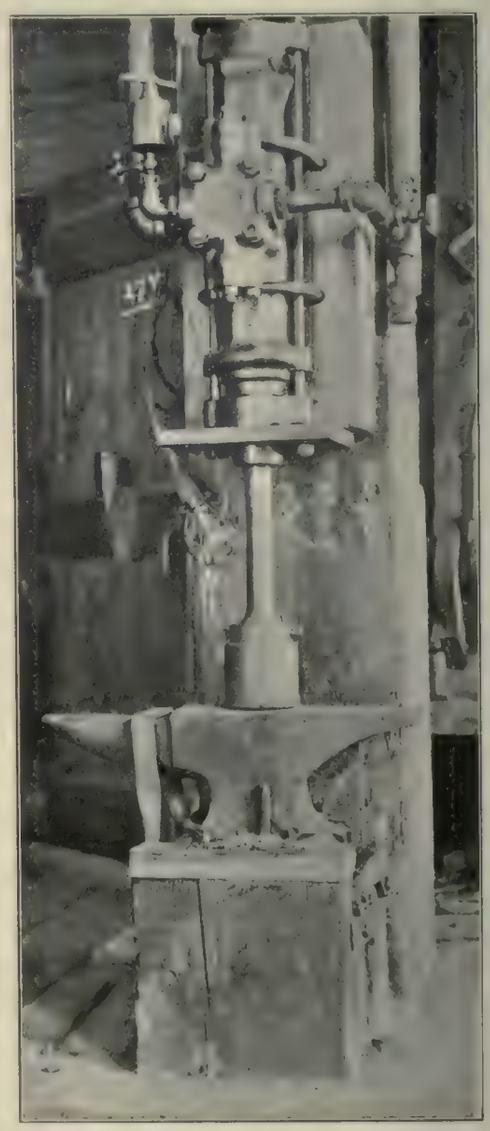
Many accidents are reported each year from over-crowding of the men at work, or from the carelessness of the men where there is plenty of room. The men will always go to the point indicated by the foreman, and will crowd themselves together without regard to the danger of striking each other, if they think they have been ordered to do so. It is well known that the man in charge can get more work out of his men by placing them so that they will not interfere with one another, and care should always be taken to see that this is done.

Many accidents have been caused by reckless automobile drivers rushing at high speed past points where road work is going on, and either striking some of the workmen or throwing in the air tools that have been left in the roadway. The roadway should at all times be kept clear, and the Travelers Insurance Company suggests that contractors who suffer from the acts of drivers of this class erect solid barriers at each end of their work, forcing such men to come to a dead stop before they are allowed to proceed.

Air Drill Does Duty as "Steam" Hammer in Blacksmith Shop

By WALTER BAZORE
Master Mechanic, Rapid Transit Subway Construction Company, New York City

BY REMOVING the rotating pawls and ratchets from the air drill shown in the accompanying photograph and clamping a heavy ram in the drill chuck it was converted into a power hammer for a contractor's blacksmith shop. Before being used for this purpose the drill had been mounted in a frame of steel rods, with its rotation removed and a rod, with a dolly-plate welded to its lower end, inserted in the chuck, and used as an air hammer for driving sheeting.



AIR DRILL AS BLACKSMITH'S HAMMER

This hammer, made by the writer, is in the blacksmith shop of the Rapid Transit Subway Construction Company's power plant at Forty-second Street and East River, New York City.



1.—THE STRUCTURE THAT SAVED GALVESTON FROM THE SEA'S TERRIFIC ONSLAUGHT—THIS VIEW OF THE SEA-WALL, TAKEN AFTER THE STORM, INDICATES HOW WELL IT SURVIVED THE ORDEAL OF AUGUST 17

Galveston's Sea-Wall Checks Hurricane's Devastation

Concrete Structure Along Waterfront Saves Texas City from Repetition of Catastrophe of 1900, Although Damage Done Is Severe—Causeway Approaches Demolished—Water Supply Cut Off—Houston Also Suffers

By E. B. VAN DE GREYN
Consulting Engineer, Houston, Texas

THE sea-wall at Galveston, Tex., was the city's salvation during the hurricane of Aug. 16-17. This is the outstanding feature, from the engineering viewpoint, of the effect of the recent storm, which rivalled in intensity, but not in loss of life and damage to property, the one of 1900. But while the concrete works which flank the waterfront did noble service the city suffered considerable damage. The causeway, the 2-mile concrete viaduct which links the island city with the mainland, suffered heavily, its earth embankment approaches having been washed out, although the concrete arches forming the central portion of the structure withstood the impact of huge waves, lashed into fury by a 90-mile-an-hour gale. The city's water supply was cut off by the breaking of the pipeline across the bay and the demolition of frame houses within striking distance of the sea was general, although none of the city's more substantial buildings was wrecked. The pavement back of the sea-wall was badly scoured and one wharf was destroyed.

WIND VELOCITY 100 MILES PER HOUR

A trip through Galveston gives one some idea of the power of the storm. The effects of wind and water are shown in the accompanying pictures. The storm center swept 25 miles to the west of Galveston and passed west of and closer to Houston on its way north. The Weather Bureau at Galveston gave out the following information: The velocity of wind passed 32 miles per hour at 4 a. m. Monday, Aug. 16. From 3 p. m. Monday until 10 a. m. Tuesday it blew 60 miles per hour or more. The maximum velocity for 5 min. was 93 miles per hour, occurring at 2.37 a. m. Tuesday, Aug. 17. During that period the records show a velocity of 120 miles per hour, lasting 30 sec.; in many of the gusts 100 miles per hour was reached. The lowest barometric reading was 28.6 in. at 2.40 a. m. Tuesday, Aug. 17. On Tuesday, midnight to midnight, 9.05 in. rain fell. At about 2 p. m. Monday the direction of wind began to shift from north to east and to south, being east at 3 a. m., Aug. 17.

SEA-WALL INTACT

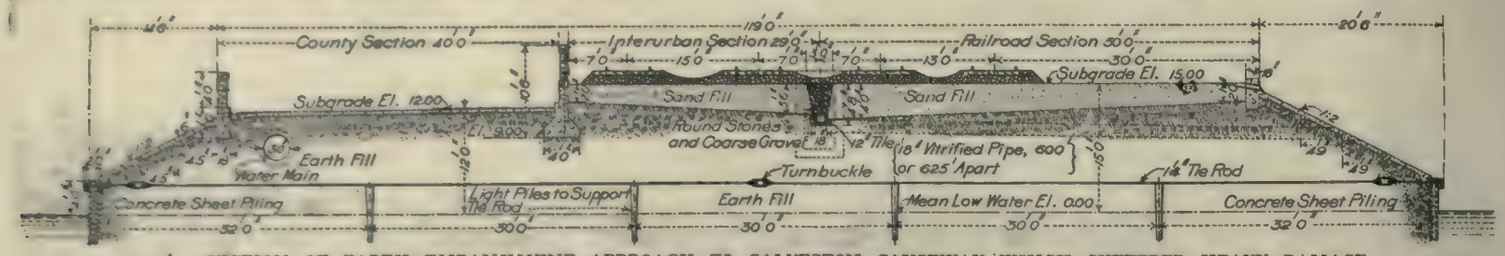
A general view of the situation at Galveston may thus be stated: The sea-wall held intact throughout and undoubtedly saved the city and vindicated the confidence of Galveston people in the wall. The causeway suffered heavily, the only portions left intact being the movable span at the



2.—THE BOULEVARD PAVEMENT BACK OF THE SEA-WALL WAS WASHED OUT BY WATER BLOWN INLAND BY WIND



3.—IN ONE PLACE THE UNDERMINED BRICK PAVEMENT HUNG AS A CANTILEVER 9½ FEET LONG



4.—SECTION OF EARTH EMBANKMENT APPROACH TO GALVESTON CAUSEWAY WHICH SUFFERED HEAVY DAMAGE

center, the concrete arches on each side of span and a portion of about 2000 ft. at the southerly end of the protected approach at the Galveston end.

The water supply of the city from Alta Loma is cut off by a break in the submerged pipe line crossing the bay west of the causeway. The docks and wharves and elevators might be considered to be damaged to a minor extent compared to other damages. Some docks have only had a few planks ripped off. The conveyors from some elevators were destroyed. One or two piers were reported destroyed.

The city was unprotected from the onslaught from the Gulf and the less substantial frame houses were swept entirely away.

The sea-wall, built in 1903, is 3½ miles long and is of concrete reinforced with 1¼ in. steel rods as shown in the cross-section on page 274. The concrete is carried by a wood pile foundation and the outer or exposed face is curved to throw the sea vertically upward. The concrete base is 3 ft. thick and the wall proper rises 13 ft., giving a total height of 16 ft. to the concrete work. The toe of the wall is protected by a mass of heavy granite rip-rap and the wall itself is backed by an earth fill brought to the level of the top of the wall and formed into a driveway about 70 ft. wide. The wall was designed by George W. Boschke of Galveston, and built by J. M. O'Rourke & Company of Denver, Col., whose contract price was $1,198,000. The sea-wall was described in the Engineering Record of July 4, 1903, page 14, and the causeway in the issues of Oct. 15, 1910, May 27, 1911 and July 13, 1912.

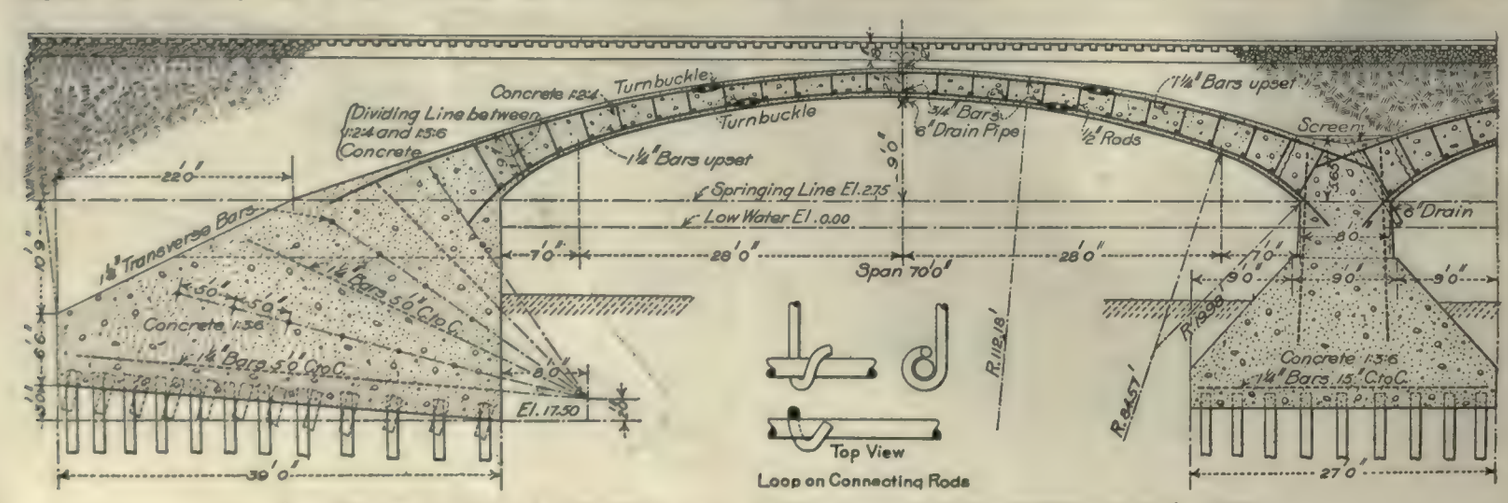
An eyewitness at the sea-wall during the storm stated that the curved face of the wall caused the water to shoot straight into the air and the wind would then throw the sheet of water onto the pavement behind the wall. Photograph 1 shows the concrete walk and brick pavement back of wall uninjured. The piling at the left is the remains of the bath-houses. In front of the buildings on the left two cubical granite blocks, each 4 ft. on a side, were moved about 70 ft. by water and wind. Photos 2 and 3 show where the water washed out the pavement and walk back of sea-wall. The fill under these pavements was of sand. The boulevard walk and pavement were washed out from about Seventh Street westerly for



5.—THE CENTRAL PORTION OF THE CAUSEWAY, CONSISTING OF CONCRETE ARCHES, WAS PRACTICALLY UNINJURED

A very great damage resulted from the water rising up in the stores in the business section and ruining the goods within. The height of the water in the city, as reported by different persons who were there in 1900, places it at from 6 in. to 2 ft. higher than in 1900.

In general the frame houses along the sea-wall boulevard facing the beach and for a little distance back were demolished or overturned. Substantial structures like the Galves Hotel were apparently uninjured, except for roofing metal torn off by the wind. Beyond the westerly end of the sea-wall ten blocks and from Thirty-eighth Street westerly along practically the entire length of the military reservation to the westerly end of sea-wall. The break at Thirty-eighth Street was probably caused by the pounding of a three-masted schooner which broke against the wall at that point and pounded to pieces. In some places where the pavement was washed away the sand backing was washed 7 to 9 ft. below the top of the wall. In many cases the 3½-in. brick pavement overhung 4 to 5 ft. and in one place it overhung as a cantilever 9½ ft. Along the military reservation much of the



6.—TYPICAL SECTION OF CAUSEWAY ARCH CONSTRUCTION WHICH SURVIVED STORM'S FURY

Causeway Approaches Were Galveston's Greatest Storm Loss



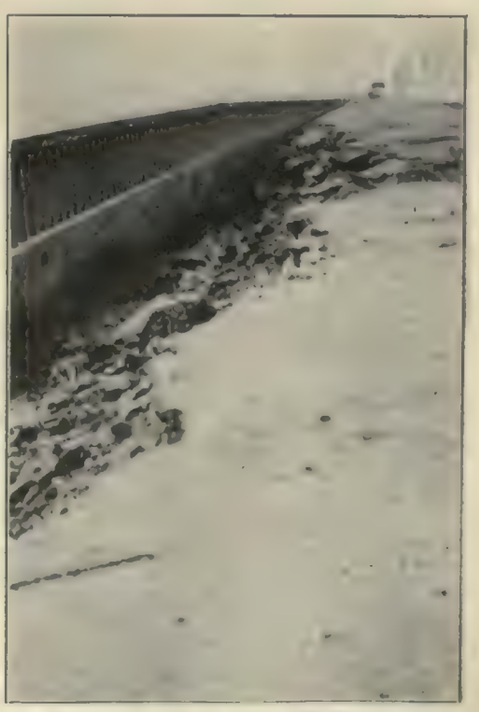
7.—DEMOLITION OF CAUSEWAY EMBANKMENT WAS COMPLETE—VIEW TAKEN LOOKING NORTH TOWARD MAINLAND, SHOWING, NEAR TOP CENTER, OVERTURNED STREET RAILWAY CAR



8.—ANOTHER PICTURE OF CAUSEWAY APPROACH—THE CONCRETE SLABS WHICH COVERED THE SLOPES WERE DISPLACED BY WAVES BUT THE SHEET PILING RETAINING STRUCTURE HELD



9.—FIRST BREAK IN CONCRETE SLAB SLOPE PROTECTION ON CAUSEWAY



10.—PARAPET WALLS UNDERMINED

smaller rip-rap was tossed from the toe of the wall up and over top of wall to a distance of 50 ft. One such stone measured 4 x 2½ x 1 ft.

Photo 11 shows how the storm treated some of the cottages and small frame houses near the sea-wall boulevard. Where the sand was scoured out behind the sea-wall it was carried inland for some distance covering fences and car tracks.

The sea-wall itself was not injured seriously at any point along its length. That it saved the city great damage, if not destruction, is sure. Beyond its westerly end where there was no obstruction to the force of the waves the country was swept clean of the frame houses which occupied that section.

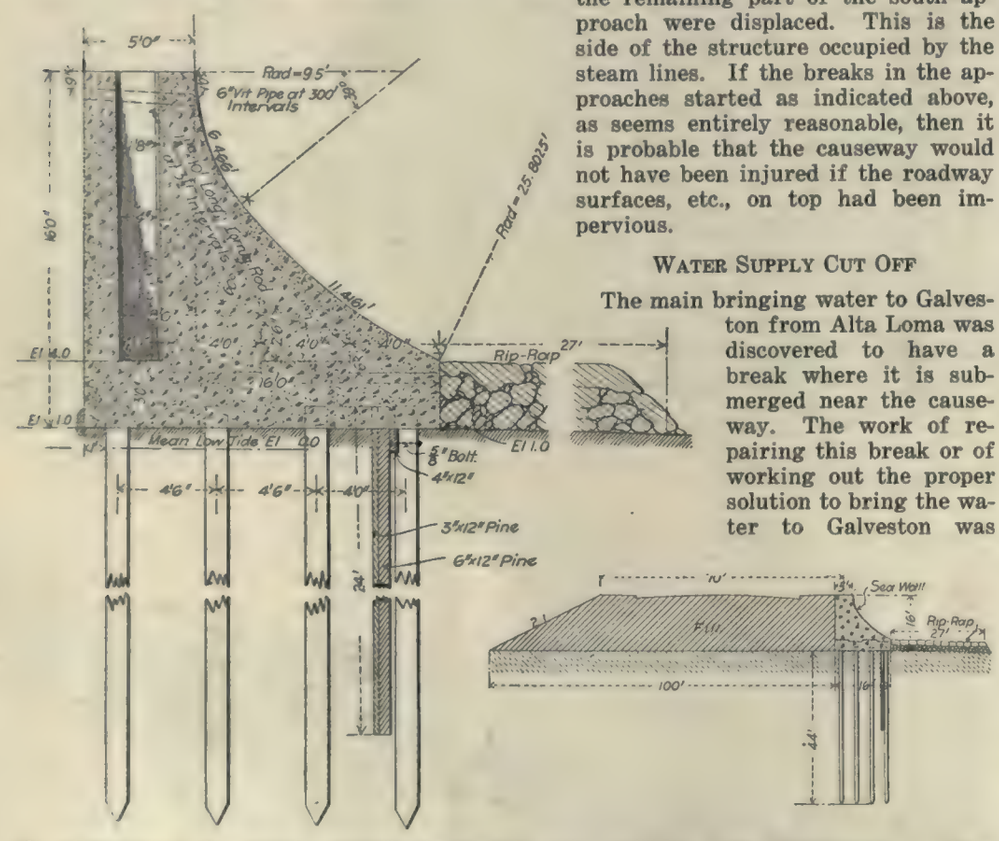


11.—FRAME HOUSES ALONG WATERFRONT WERE TOSSED LIKE JACK-STRAWS INTO A TUMBLED HEAP, BUT CITY'S LARGE BUILDINGS STOOD UP

APPROACHES TO CAUSEWAY WASHED OUT

The moveable span of the causeway and the concrete arches at each end of the span are intact. The north protected fill approach is demolished except for the toe walls on each side at the foot of the slopes, the toe walls being concrete sheet piling with concrete cap cast on top of piling. The south protected fill approach also is demolished except for about 2300 ft. at the south end, which is partly destroyed.

Photo 7 was taken at the north end of the arches looking north to the mainland.



12.—SECTION OF SEA-WALL WHICH GALVESTON CAN THANK FOR PREVENTING A REPETITION OF THE STORM DAMAGE OF 1900

This view shows practically utter destruction of the approach. In the foreground is an interurban car which was marooned on the causeway. The passengers escaped. On each side can be seen many of the concrete slabs which protected the slopes of the fill from wash and which are lying on the concrete lap of the sheet piling toe wall.

Photo 8 shows the section of the south protected fill approach destroyed.

Since it would be of interest to attempt to figure out how the destruction of the approaches began, photos 9 and 10 are shown as especially important. Photo 9 shows the first break, about 100 ft. long, in the concrete slab slope on the west side of the south approach. This break occurred about 850 ft. from the island end. Photo 10 shows where water coming over the top of the causeway would dig a hole and undermine the parapet wall and slabs, opening up a breach for the water to finish the work of destruction. Very probably it was in this way that the destruction of the approaches started and progressed to completion.

Attention should be brought to the fact that the concrete slabs on the east side of the remaining part of the south approach were displaced. This is the side of the structure occupied by the steam lines. If the breaks in the approaches started as indicated above, as seems entirely reasonable, then it is probable that the causeway would not have been injured if the roadway surfaces, etc., on top had been impervious.

WATER SUPPLY CUT OFF

The main bringing water to Galveston from Alta Loma was discovered to have a break where it is submerged near the causeway. The work of repairing this break or of working out the proper solution to bring the water to Galveston was placed in the hands of the railway engineers. In the meantime drinking water was being distributed in city sprinklers from the supply that was on hand within the city. Some water is supplied by an artesian well and cistern water is being used.

The merchants are busy cleaning out their stores and citizens are at work on repairs. The city is well policed by soldiers and civilians.

Telegraph and telephone connection was re-established into Galveston Friday night, Aug. 20. The steam line and electric line engineers are busy planning and starting work in getting connections for transportation between the mainland and the island. A single track temporary trestle is to be built as rapidly as is possible.

STORM'S AFTERMATH AT HOUSTON

Considerable damage resulted in Houston from the wind of the hurricane. When more reports are available it will in all probability be shown that the center of the storm passed near Houston. The storm struck Houston Monday night, Aug. 16, and on Tuesday morning the lowest barometer reading was 28.21 in. at 4.30 a. m. The velocity of the wind passed 32 miles per hour at 6 p. m. Monday. The instrument did not register from 4.35 a. m. to 5.55 a. m. Tuesday and the maximum velocity was probably not recorded. When a new instrument was put in at 5.55 a. m. Tuesday it recorded a maximum velocity of 80 miles per hour for 5 min. A velocity of 105 miles per hour lasting about 40 sec. was recorded. The total rainfall from noon Monday, Aug. 16, until 5.40 a. m. of Aug. 19 was 9.08 in. Wires were down Tuesday and no trains ran on that day. The city was completely isolated. With wires going down power and electric light were cut.

In the downtown section the damage consisted of plate glass windows breaking, signs, awnings and similar protections being blown down. Stocks of goods in show windows were of course damaged. Many tin roofs peeled and were rolled up and dropped onto the street below. In the residence sections the greater part of damage consisted of broken windows, uprooted or broken trees, fences blown down, and the collapse of flimsy shacks. A brick church was partly demolished. All buildings which were at all substantially built stood the shock of the storm, but light, unbraced construction was blown down by the wind as might be well anticipated.

At the present writing conditions in the business sections appear normal and have little appearance of having passed through a storm. Street car service, etc., is established, also train service, etc.

HOW STORM DATA WERE SECURED

[With Mr. Van de Greyn's article on the Galveston storm was received a letter, dated Aug. 22, in which he described some of the difficulties encountered in getting the facts for his story. While it treats of conditions of no particular technical interest it pictures so clearly the human side of a great disaster that it is published in part below.—Editor.]

"Train service is still demoralized in certain quarters. Galveston and Texas City, through which I had to go to get boat to

Galveston, have been under martial law. I had no time before leaving Houston to get a permit from the Mayor of Houston to pass me through, but I managed to slip through with two other people who had permits.

"Went by auto from Houston to Texas City, where martial law prevails, as that place was badly swept by water. Dead cattle are lying all about and are being burned by soldiers after crude oil was run over land. Got to Galveston by boat from Texas City, arriving there about 10 p. m.

"Found Galveston lighted by lanterns and candles and soldier guards at almost every corner. There had been trouble I was told from niggers looting show cases, etc., and some had been shot—you can believe only what you see yourself in many things during these times. Found hotels full, with no running water for washing. Did not wash until I returned to Houston. Some intelligent people were somewhat alarmed for fear of typhoid breaking out. There is of course that danger, but the authorities are getting matters in hand and will, I think, keep down any outbreak—these things are not for publication, as citizens would resent any talk likely to hurt the city.

"Up to date there has been sufficient water and the prices of foodstuffs at restaurants are the same as during normal times. The greatest concern of the city of Galveston at the present time is to get its water connection with Alta Loma hooked up. I. J. Cottingham of the S. P. R. R. has taken charge, on request of the city, of getting the water connected. While I was at the causeway yesterday he was on a boat with divers and had located one end of the broken water main and was trying to locate rest of trouble. As I did not get to his boat to see him personally I cannot speak with much authority on exactly what was found, or exact plans.

"After getting pictures of the sea-wall I found it possible to get only within about 2 or 3 miles of causeway and was informed that permit from Mayor Fisher was necessary to pass guards. So trip was made back to town for permit and after securing that I went back and then walked to the causeway. The walking was bad since the road and tracks leading to causeway for 2 or 3 miles were badly damaged by the storm, and pole lines of all kinds were down. After taking pictures at causeway and examining situation I made my way across to mainland and got back into Houston finally.

"It seems certain to me and others that if there had been an impervious pavement covering the top surface of the roadways the approaches would not have been demolished, as it seems evident that the destruction started by the water gouging out the filling between the parapets.

"As regards the sea-wall it certainly demonstrated its strength since the pavement and sand were washed out for long stretches behind the wall to depths ranging from 3 to 9 ft. below top of wall and wall was subjected to hard hammering. For example where a three-masted schooner hit wall and battered itself to pieces the wall must have been subjected to terrific blows. This boat hit the wall at easterly end of the military reservation and all I could see left there were spars, etc. Sergeant who escorted me about reservation told me that a sergeant and two corporals rescued captain of vessel who was lashed to wheel and had both legs broken. He was still alive, but unconscious. Whether he has recovered I could not find out. One reliable person said the captain could still lie since he stated that where it took him ordinarily two days to get out to sea he came back in 45 min. in the gale to the sea-wall.

"I was told that one of the piers was destroyed and that other piers were damaged little. The piers I saw had only a few planks ripped off. The new Southern Pacific elevator was uninjured, according to all reports."

Meteorological Analysis of Storm Indicates Similarity to Hurricane of 1900

Disturbances First Noted in Barbados—Track of Storm Crosses Gulf Following Route Taken 15 Years Ago—Weather Bureau Active in Sending Out Warnings

THROUGH the courtesy of C. F. Marvin, chief of the U. S. Weather Bureau, the Engineering Record is enabled to present the following report on the tropical storm of Aug. 10-23, prepared by Prof. H. C. Frankenfield, the forecaster on duty at the time:

The tropical storm of Aug. 10-23, 1915, was the first great tropical storm to visit the Texas coast since the equally famous storm of Sept. 1-8, 1900. It first came within the field of observation on the morning of Tuesday, Aug. 10, when the barometer at Bridgetown, Barbados, and at Roseau, Dominica, read 29.80 in., a fall of 0.14 in. in 24 hr. On the morning of Aug. 11, the storm center was apparently south of the island of St. Croix, at about latitude 16 deg. N, longitude 66 deg. W.



TRACK OF THE HURRICANE WHICH STRUCK GALVESTON AUGUST 17

It followed almost the same course as the storm of 1900. The figures on the path lines indicate dates of month for August, 1915, and September, 1900.

The lowest barometer reported during the first 24 hr. of the storm was 29.46 in. at Roseau, Dominica, at 4 p. m., Aug. 10. On the morning of Aug. 11 the lowest barometer reported was 29.76 in. at San Juan, P. R., with a wind blowing 60 miles an hour from the northeast, indicating a much lower barometer reading to the southward. On the morning of Aug. 12 the storm was central a short distance south of Haiti. The barometer reading at Port au Prince, Haiti, at that time was 29.60 in. The highest wind velocity reported at Port au Prince was 32 miles an hour from the east, but according to the reports of damage over the lower portion of the republic a severe gale must have occurred with much lower pressure. During the next 24 hr. the storm passed over, or very near, the eastern portion of the island of Jamaica, and on the morning of Aug. 13 it was central a short distance to the northwest of that island at about latitude 19 deg., longitude 79 deg. On the morning of Aug. 14 the storm was over extreme western Cuba, moving a little more north of west. Havana reported a barometer of 29.72 in., with a maximum wind velocity of 56 miles an hour from the east. By this time the wind had reached 38 miles an hour from the east at Key West, and a radio report from a vessel only a short distance southwest of Key West reported a wind of 65 miles an hour from the east. During Aug. 14, as the storm center passed over extreme western Cuba, a wind velocity of 68 miles an hour from the northeast was reported from Pinar del Rio and the meteorological station at Cape San Antonio, Cuba, was put out of commission owing to the destruction of the radio apparatus.

On the morning of Aug. 15 the storm center was in southeastern Gulf of Mexico, at about latitude 23 deg., longitude 89 deg. This location was determined largely from radio reports from the east and northeast Gulf. The storm was now moving in a northwesterly direction, and at 8 p. m. of Aug. 15 a radio report from latitude 26.5 deg. and longitude 88 deg. reported a barometer reading of 29.48 in. and a wind velocity of 64 miles an hour from the east. A radio report at noon of the same day at latitude 27 deg. longitude 86 deg., gave a barometer reading of 29.54 in. and a wind velocity of 74 miles an hour from the east. On the morning of Aug. 16 the storm center was apparently at about latitude 26.5 deg., longitude 93 deg., and during the night moderate east and southeast gales had occurred on the middle Gulf coast with tides from 1 to 2 ft. above normal. At the same time the barometer reading at Galveston was 29.62 in., with a maximum wind velocity of 38 miles an hour from the northeast. Very rough seas were reported at Gulf stations west of Mobile.

HURRICANE REACHES GALVESTON

During the night of Aug. 16-17 the storm passed into Texas just south of Galveston, and at 2.45 a. m. of Aug. 17 the barometer reading at that station was 28.63 in.—0.21 in. higher than the lowest reading during the storm of 1900. The maximum wind velocity was 93 miles an hour from the east at 2.37 a. m. and the tide was 6 in. higher than that during the 1900 storm. The hurricane winds continued for 19 hr. at Galveston. At 5.30 a. m. of Aug. 17 the barometer reading at Houston was 28.21 in.—0.21 in. lower than any reading reported during the storm of 1900—and the wind blew at the rate of 80 miles an hour from the southeast and northeast. At 8 a. m. of Aug. 17 the

storm was central a short distance west of Houston with a tendency toward a more northerly direction. The storm now moved northward with steadily decreasing intensity, and on the morning of Aug. 18 it was central over the central portion of east Texas with a barometer reading of 29.50 in. or a little lower. There was then a recurve to the northeastward, with a slow velocity of progression, and on the morning of Aug. 19 the storm was central over the northeast portion of east Texas, with a barometer of 29.58 in. at Dallas.

During the night of Aug. 19-20 the storm again began to increase in intensity, with a northeastward movement, and on the morning of Aug. 20 it was central over southeast Missouri with a barometer reading of 29.42 in. at Cairo, Ill., and with a wind from the southeast. At 8 p. m., Aug. 20, the barometer reading at Evansville, Ind., was 29.40 in., and on the morning of Aug. 21 the storm was central over Indiana, with a barometer reading of 29.52 in.

Torrential Rainfall

The rainfall accompanying the storm was torrential over east Texas, northwest Louisiana, Arkansas, east and south Missouri, and southern Illinois. Complete reports of precipitation from Texas stations are not yet available, but the total fall during the storm probably ranged between 5 and 15 in. At St. Louis the rainfall for the 24 hr. ending at 8 p. m., Aug. 20, was 7 in., and moderate gales occurred over east Missouri, the lower Ohio valley, and west Tennessee. There were also severe northerly gales over the interior of east Texas on Aug. 17, the wind velocities ranging from 44 to 60 miles an hour, the latter at San Antonio.

In the vicinities of Galveston and Houston, and from thence northward, enormous losses were reported, some of the figures reaching as high as $60,000,000, of which $40,000,000 was in crops. These figures, however, must be a gross exaggeration. Another result of the storm was the floods in the Texas and Arkansas, and the middle Mississippi rivers. These, however, do not promise to become of great importance, except in the White River of Arkansas.

Track of Storm Follows Course of Hurricane of 1900

The track of the storm is shown in the chart herewith and there is also included the track of the storm of September, 1900. It will be seen that the two tracks are very similar as a whole and, so far as can be determined at present, the storms were of about equal intensity. The highest 5-min. velocity at Galveston during the 1900 storm was 84 miles an hour, while during the 1915 storm it was 93 miles an hour. However, during the 1900 storm the anemometer blew away immediately after the wind reached the velocity of 84 miles an hour, and the official in charge of the Weather Bureau station estimated that the wind later reached a velocity of 120 miles an hour.

Weather Bureau's Warnings

The first warnings were issued by the U. S. Weather Bureau at 9.45 a. m., Aug. 10, when the storm was noted near the island of Martinique, and they were issued regularly thereafter to all ports on the Atlantic and Gulf coasts and distributed by radio from Arlington and Key West twice or thrice daily.

On the morning of Sunday, Aug. 15, northeast storm warnings were ordered on the Gulf coast from New Orleans to Apalachicola, Fla., and at 5 p. m. warnings were changed to hurricane at New Orleans, and hurricane warnings were also ordered displayed at all places from New Orleans to Brownsville, Tex. These warnings were continued at 5 p. m., Aug. 16, for another 24 hr. An inspection of the charts in connection with this statement will indicate the accuracy of the warnings so far as the direction and movement of the storm were concerned.

Motor-Cyclists Spread Alarm

During the storm of 1900 it was estimated that over 6000 persons lost their lives at Galveston and vicinity, and that this horror was not repeated during the present storm was undoubtedly due to the magnificent sea-wall erected by the citizens of Galveston shortly after the storm of 1900, as well as to the fact that the heaviest winds in 1915 did not come directly from the south or Gulf quarter as they did in 1900. It should be added also that the personal efforts of W. P. Stewart, in charge of the local office at Galveston, Tex., certainly saved the lives of many of the residents of Galveston Island. Mr. Stewart upon receipt of the first warnings sent out men on motorcycles to all parties that could be reached on the island within a radius of 30 miles from the city. These persons were warned that unless they immediately left for places of safety they would surely lose their lives. From press despatches it is apparent that hundreds of lives were saved by these warnings.

John B. Hawley Confirms View That Sea-Wall Saved Galveston

THE following telegram was received from John B. Hawley, consulting engineer, of Fort Worth, Tex.:

"The city of Galveston was saved on Aug. 16 and 17 by a concrete sea-wall that encircles the city Gulf front. This wall was built after the 1900 storm as a protection against the Gulf waves, and has fulfilled its mission. In the whole structure there is not a single break. The sea-wall has reduced the storm loss to a minimum.

"To the United States Weather Bureau is due great credit for their warnings. The loss of life in the city, back of the sea-wall was less than a dozen, mostly people who in attempting to get to places of safety were either drowned or struck down by flying missiles. The loss of life in the bay, and in the small towns unprotected on the mainland will aggregate not to exceed 100.

"The property loss has been variously estimated. Mayor Lewis Fisher, in a statement to the press, estimates the damage to property at $2,500,000. The loss has been variously estimated from the mayor's figures up to $10,000,000. The heaviest loss is in the causeway that connects Galveston Island with the mainland. This was partly demolished during the storm and railroad and interurban traffic cannot be resumed until temporary structures on which work is now progressing are serviceable. Individual losses were sustained by many persons who owned cottages and bungalows near the Gulf front. Back of the sea-wall the loss to merchants in salt-water damage to stocks is also large.

"The city was without water for several days after the storm, owing to the destruction of the pipes across the bay. A temporary system of piping the water from the city plant several miles up the mainland has been built, and is now in use pending the reconstruction of the main pipe line.

"Galveston citizens on the day after the storm announced that no outside relief would be necessary. A central committee composed of representatives of business, labor and religious organizations are furnishing temporary relief in all cases."

Builders of the Causeway Tell of the Storm's Effect

FURTHER information as to the damage to the causeway is contained in the following extracts from a letter received from the Blodgett Construction Company, of Kansas City, who built the structure:

"Referring to your letter relative to the Galveston Causeway, we quote below our first information relative to the damage. This information was in a wire from our representative, John Springer, at Galveston, dated Aug. 21 at 8.45 p. m.

" 'The protecting slabs and handrails on the protected roadway did not stand the force of the waves, which went over the top of the protection and scooped the sand out, letting the slabs collapse. Every sheet pile and the sheet-pile caps, including all the rods, are in place so perfectly that the water is standing 2 ft. higher between the concrete pile walls than outside. The arches are all in perfect condition, including the sand fill on the arches. There is no damage at all to the handrail on the arch bridge, and no damage to the lift bridge.'

"We quote the following extracts from Mr. Springer's personal letter of Aug. 19:

" 'The storm was more severe than in 1900; the water was higher and lasted longer. There was very little loss of life and property damage was not so heavy as in 1900. The bath houses at the beach washed away, and the casino building was wrecked. All the larger buildings here weathered the storm in fine shape and there was less damage at the Galvez than there were at the Rice in Houston.'

"We have not received any photographs as yet from Mr. Springer, but shall forward any that we may receive. We are, however, sending three construction views [space did not permit showing them] which show a little of the protected roadway, of which there are 3696 ft. on the mainland end and 4523 ft. on the Galveston end. The concrete slabs extended on the side slopes from the concrete caps on top of the concrete piles up to the roadway, but it was from the top of this roadway that the sand was scooped by the waves, allowing the concrete slabs and handrail to collapse."

PLOWING UP THE SUBGRADE and re-rolling to get an even compactness on country roads on which concrete is to be laid is a practice recommended by J. H. Mayne, consulting engineer, of Council Bluffs, Iowa. Many specifications call for non-disturbance of the original earth when shaping the subgrade. On many country roads the wheel-track area has been compacted for years much more than the sides. Mr. Mayne is of the opinion that it is impossible to compact the sides by rolling to the same degree as the center space, and that there is a likelihood of future settlement under load at the sides and consequent longitudinal cracks.

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

Draw Span of Harlem River Bridge Floated to Place

On Sunday morning, Aug. 22, the new double-deck 1100-ton draw span for the bridge which carries the Second and Third Avenue elevated lines in New York City across the Harlem River was floated into place. The old span was removed, after being lifted on two barges, at 5.45 a. m. The first train was run over the new span at 12.42 p. m. Four barges were used to float the new span, and twenty-four sand jacks were used to help the tide in lowering it into place. The entire operation was carried out to schedule without mishap. The placing of the two new approach spans for this bridge was described on page 341 of the Engineering Record for March 31, 1915. An account of the operation of putting in the draw span will appear in an early issue of the Engineering Record.

Train Derailed in Tunnel Knocks Lining Down on Itself

A section of the timber lining of a short tunnel near McCorkle, W. Va., on the Coal River Railway, a branch of the Chesapeake & Ohio Railway, connecting with the main line at St. Albans, W. Va., was knocked down Aug. 17 by a derailed passenger train, crushing through part of the train and killing five people. The accident was caused by a broken rail outside the tunnel, 90 ft. from the portal; the rail was piped through the center of the head, in such a way that it could not have been detected by ordinary inspection. The tunnel is 360 ft. long, on an 8-deg. curve, and is lined with timber except for short distances at each end.

The train consisted of an engine, express car, mail and baggage car and three coaches. The engine and forward truck of the express car passed over the broken rail safely, but the rear truck left the track and the derailed coaches knocked down 23 lin. ft. of the timber lining, allowing the timber arch and packing above to fall and crush through one end of one of the coaches.

Plans for Hetch Hetchy Railroad Almost Completed

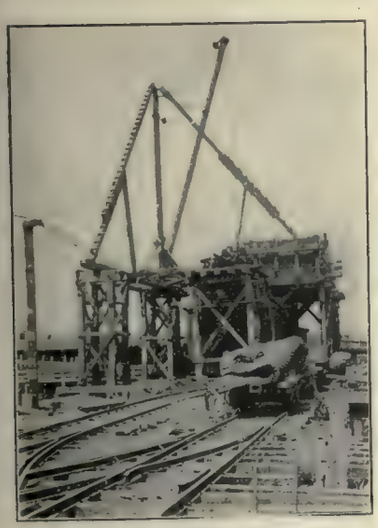
Plans are almost completed by the city engineer's forces in San Francisco for the remaining 58 miles of railroad to connect the Hetch Hetchy dam site with the Sierra Railway, and it is expected that contracts for construction will soon be let.

Court Orders New York Board to Approve Subway Contract

A peremptory writ of mandamus, issued Aug. 23 by Justice Shearn of the New York Supreme Court, orders the Board of Estimate of New York City to "reconvene forthwith" and approves in its original form the contract awarded to the Holbrook, Cabot & Rollins Corporation for the construction of the section of the Broadway subway at Times Square. The Board, as noted on page 241 of the Engineering Record for Aug. 21, had omitted a clause relating to payment for extra work by supplementary agreement between the contractor and the Public Service Commission and had then attempted to approve the contract in its modified form. The contractors refused to accept the modified contract on the ground that it was invalid, and brought the court action referred to. The Court agreed that the Board of Estimate had no power to alter the contract after bids had been received. In commenting on the action of the board, the Court said in part:

"The course that has been pursued in respect to this contract is, to say the least, most unbusinesslike. If it were to prevail, no bidder for city work could ever know where he stood. There must be some reasonable certainty in

Work Now in Full Swing on New York City's Forty-sixth Street Pier



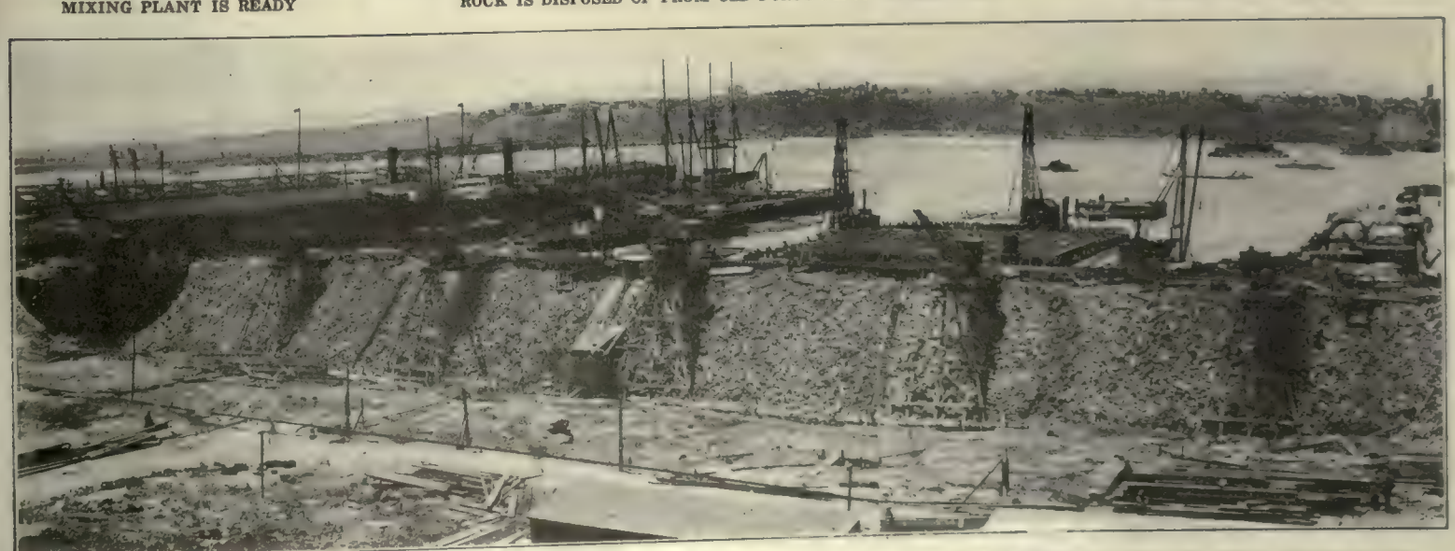
MIXING PLANT IS READY



ROCK IS DISPOSED OF FROM OLD FORTY-FIFTH STREET PIER



DRIVERS BUSY ON NEW PIER



NEW PIER IN RIGHT CENTER, DISPOSAL PIER TO LEFT OF IT—DERRICK BOAT BETWEEN TWO CRANES AT RIGHT STARTING TO ERECT MIXING PLANT

these large matters, and in the end the city would be the loser by having the courts approve such methods as are here disclosed, where, after public hearings on the form of contract, advertisement of its terms, invitations to bid thereon and an award to the lowest bidder, an attempt was made to coerce the contractor into accepting a materially different contract."

Referring to the merits of the alternative method of paying for extra work to which the Board objected, the Court said:

"It is true that an alternative provision in the contract also furnishes an opportunity for favoritism and jobbing. The new policy attempted to be put into effect by the Board of Estimate may be wise, in spite of the fact that the alternative plan has worked well and has been generally considered most satisfactory. But this would have no bearing on the legal question, many times decided, that the contract cannot be materially changed after advertising. It cannot be seriously contended that the Board of Estimate has the power to attach to a contract a condition that will invalidate the contract."

The Justice ordered that the contract be delivered and that work go forward at once. He pointed out that under the terms of the original contract, the contractor was bound to accept payment for extra work under the clause stricken out by the Board, or under another clause which the Board approves, providing payment at cost plus 10 per cent, at the option of the Public Service Commission. The Justice held that the Public Service Commission could agree to exercise that option in favor of the cost plus 10 per cent clause pending a settlement of the case in the higher courts, in case the Board of Estimate decided to appeal from the court's decision.

Proposes City-Owned Tunnel for All Baltimore Railroads

A plan for a municipally owned and electrically operated system of tunnels and approaches connecting with the Pennsylvania, Baltimore & Ohio and Western Maryland railroads and the proposed city belt line on Key Highway, was submitted Aug. 19 by Mayor Preston of Baltimore to the City Planning Commission of that city. The plan contemplates a union station at Biddle Street and the Fallsway. The tunnel would have easy curves and a maximum grade of 0.5 per cent, as compared with 1.2 per cent for the Pennsylvania and 1.5 per cent for the Baltimore & Ohio. It would also shorten these lines a mile and half a mile respectively, and afford an entrance for any new railroad coming to the city. The total estimated cost of tunnel, approaches and equipment is given as $17,369,000.

New Mexico Water Board Upholds Rights of Irrigators

A decision recently rendered by the New Mexico State Water Board declares that the using of the upper waters of the Rio Grande for irrigating purposes will not affect the efficiency nor work to the detriment of the Elephant Butte dam and other water rights which depend for their supply on the lower waters of that stream. The action of the board is the result of an appeal by the Arlington Land Company of Rio Arriba County, from an earlier ruling by the State engineer, and confers upon the areas drained by the upper waters of the Rio Grande privileges which, under former State and Government rulings, it was claimed, had been curtailed or restricted, to the detriment of users in the district.

In its decision the board declared in part: "There is water in the Rio Grande sufficient for supplying the needs of the United States under its projects and also sufficient to provide the amount desired by the Arlington Land Company under its applications, the amount covered by such applications being less than one-third of the average yearly surplus of water. We see no reason why the beneficial use of this surplus water should be either prevented or delayed." The decision also states that if the Government "considered that the applications of the Arlington Land Company were detrimental to its proposed appropriations of waters of the Rio Grande, it was under obligations to file a formal protest in the office of the State engineer and set up and define the grounds on which it believed its right to rest, the same as any individual appropriator of water would be obliged to do under the same conditions."

New England Waterworks Convention Will Visit Kensico Dam

The program for the thirty-fourth annual convention of the New England Waterworks Association, to be held at the Waldorf-Astoria Hotel, New York City, Sept. 7, 8 and 9, was made public this week. Twenty papers are scheduled for presentation, among them one on "The Present Status of the Catskill Water Supply for New York City," by J. Waldo Smith, chief engineer, Board of Water Supply. Two sessions are to be devoted to matters of interest to waterworks superintendents. There will be a boat ride up the Hudson River on the afternoon of Sept. 8, and a trip to the Kensico dam of the Catskill aqueduct is scheduled for Sept. 9. The convention arrangements have been made by a committee consisting of Alfred D. Flinn, chairman, Charles W. Sherman, William W. Brush, Francis F. Longley, Henry B. Machen, Fred S. Bates and Dennis F. O'Brien.

Chicago Excursion Boat Tested

Sand bags, equivalent to the weight of 4687 passengers, 1000 more than permitted by law, were piled on one side of the Christopher Columbus, a whaleback pleasure steamer in the Chicago River, without tipping it over. The test was made, Aug. 5, as an experiment in stability, under the direction of Capt. James Lee Ackerson, U. S. naval constructor, and Edward C. Gillette of the U. S. Lighthouse Bureau. After the sand weighing 375 tons was transferred to the three decks the vessel steamed out into the lake with its load of 250 persons including city and federal officials. It was announced that the boat listed at an angle of 10 to 12 deg. The ballast tanks were empty and the metacentric height of the vessel was lowered from 64 to 36 in.

Personal Notes

First-Lieut. Joseph C. Mehaffey, Corps of Engineers, U. S. A., has been detailed as a member of the Board of Road Commissioners for Alaska, succeeding Capt. Glen E. Edgerton, relieved.

J. H. Lendi, formerly assistant to A. G. Carlson, mechanical engineer of the Universal Portland Cement Company, 208 South La Salle Street, Chicago, has been appointed electrical engineer in the engineering department of the company.

E. S. Mudge, formerly division engineer for the Atchison, Topeka & Santa Fé Railway at Wellington, Kan., has been appointed assistant engineer in charge of valuation of the company's Western lines, with headquarters at Amarillo, Tex.

Harvey C. Miller, consulting and constructing engineer specializing in reinforced concrete, who represents the "American System of Reinforcement," has moved his offices from 1 Madison Avenue to 40 West Thirty-second Street, New York City.

J. Borge, formerly chief engineer of the National Incinerator Company of New York City, and of Lewis & Kitchen of Chicago and Kansas City, has organized and is president of the Borge Incinerator Corporation, with office in the Flatiron Building, New York City. In addition to contracting for the installation of incinerators and industrial furnaces the corporation will engage in practice as consulting engineers in these branches.

The Harrisburg Water Laboratories have been organized at Harrisburg, Pa., for the chemical and bacteriological examination of water, sewage, trade wastes and other associated substances. The organization consists of Leslie McCreath, junior member of the firm of Andrew S. McCreath & Son, analytical and consulting chemists, Harrisburg, who still retains his interest in that firm; Dr. George R. Moffit, city chemist and bacteriologist, pathologist to the Harrisburg Hospital and head of the Moffit Bacteriological Laboratory, and Farley Gannet, whose resignation from the office of engineer to the State Water Supply Commission of Pennsylvania to engage in private practice as consulting engineer was noted in these columns July 24.

G. R. G. Conway, whose resignation from the office of chief engineer of the British Columbia Electric Railway Company, Ltd., and the Vancouver Power Company, was noted in these columns July 10, has opened offices at the Royal Bank Building, Toronto, Canada, for consulting practice in civil and hydraulic engineering. Mr. Conway was educated in Great Britain and practised engineering in that country until 1907, when he was appointed chief engineer of the Monterey Waterworks & Sewer Company, Ltd., and of the Monterey Railway, Light & Power Company, Ltd., in Mexico. His term of service with the Canadian companies covered a period of very rapid development of their properties. The Lake Coquitlam dam was constructed under his direction, as was the 130-ft. dam on the Jordan River, Vancouver Island.

Obituary Notes

J. Edward Bering, who constructed the Horseshoe Curve and the first long tunnel on the Pennsylvania Railroad, in Western Pennsylvania, was killed in an automobile accident at Decatur, Ill., Aug. 19. He was 86 years of age. Mr. Bering began his professional career on the engineering forces of the Pennsylvania Railroad in 1848. He attained the grade of principal assistant in the civil engineering department, in which capacity he laid out the Horseshoe Curve, previous to his resigning from that company's service to become associated with the Erie Railroad. During his lifetime, he also served in engineering capacities on the Bald Eagle Valley, the Sterling Mountain, the St. Croix & Lake Superior, the Allegheny Valley, the Boston, Hartford & Erie, the New York Central & New Haven and the Pekin, Lincoln & Decatur lines. He was one of the first promoters of the oil industry in the United States and was directly responsible for the discovery of coal in the vicinity of Decatur in 1876.

Mendes Cohen, past president of the American Society of Civil Engineers and for many years a prominent railway engineer, died in Baltimore, Aug. 13, at the age of 84. His first railway service was in the locomotive works of Ross Winans at Baltimore. In 1851 he was appointed assistant engineer on the forces of the Baltimore & Ohio Railroad, in which service he remained for about 4 years, when he was appointed assistant engineer on the Hudson River Railroad. He was appointed superintendent of the Ohio & Mississippi Railroad in 1861. He left this company to become connected with the Philadelphia & Reading. In 1872 he was appointed president of the Pittsburgh & Connellsville Railroad. He became a member of the American Society of Civil Engineers in 1867 and was elected president of the society in 1892. He served as chairman of the Baltimore Sewerage Commission from 1893 to 1894 and was a member of the board appointed by President Cleveland, in 1894, to examine and report on a route for the Chesapeake & Delaware ship canal.

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ENSICO DAM, CATSKILL AQUEDUCT

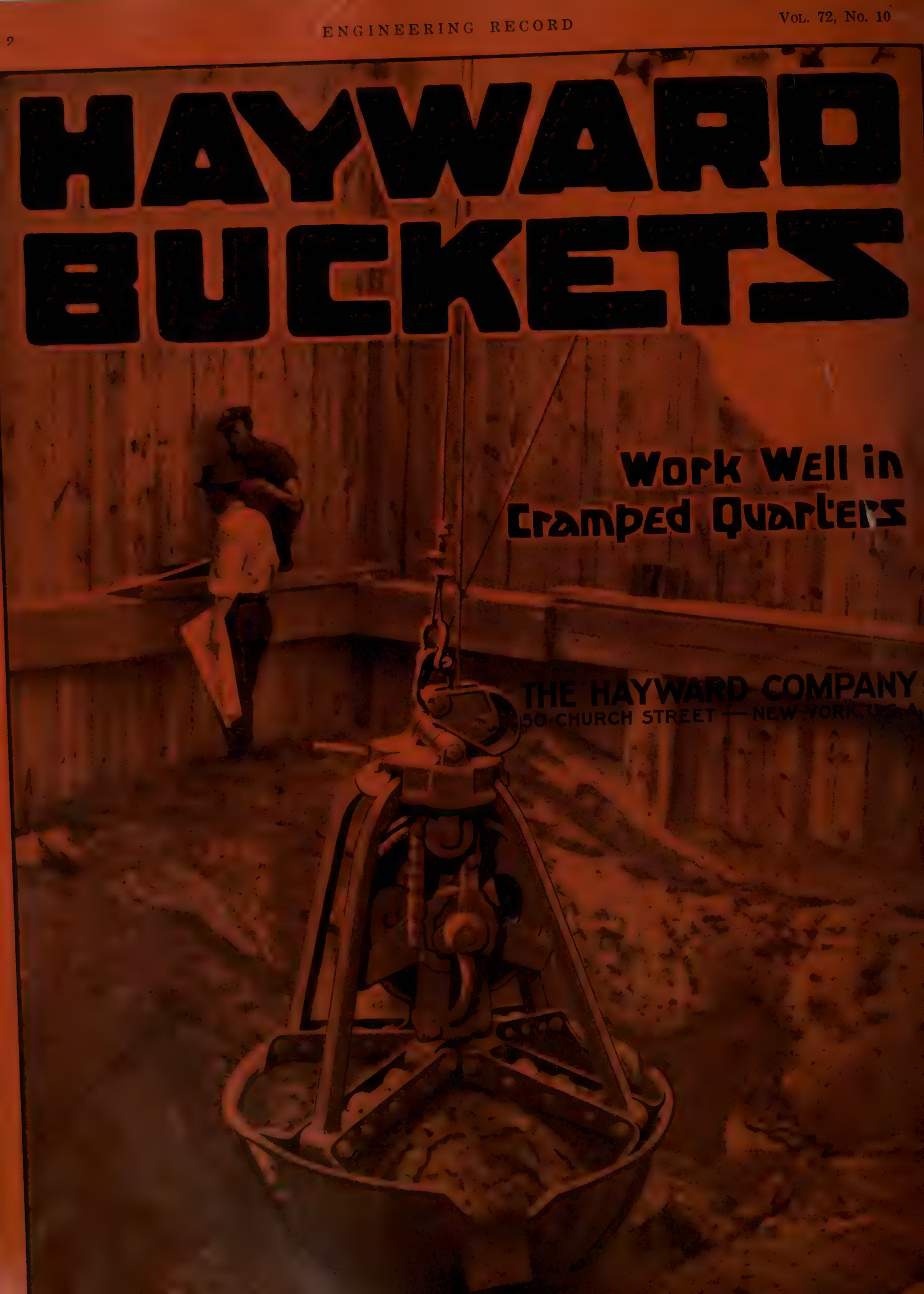
To Be Inspected by New England Waterworks Association at Convention in New York, Sept. 7, 8 and 9

Views Show Construction at Its Height and During Final Stages

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Waterworks Articles

IN an effort to reflect the general interest in the subject of waterworks, occasioned by the thirty-fourth annual meeting of the New England Waterworks Association in New York next week, the Engineering Record has devoted more than the usual amount of space in this issue to the topic which is uppermost, at present, in the minds of many of its readers. The salient features of several of the articles are commented on elsewhere in these columns, so that any further review is unnecessary. It is hoped that waterworks men will find in the following pages something of interest and value.

Baltimore Filters Completed

ANOTHER important municipal filtration plant is ready for service. With the news that Baltimore's water purification works will be formally opened Sept. 13, St. Louis loses the distinction of owning the newest large-scale plant of its type in the country, although it will still retain title to the largest mechanical filtration plant in the world. One by one the big cities are abandoning the use of unfiltered surface water supplies. New York, however, is still using unfiltered water but plans for purification were prepared several years ago, bids were received for the construction of filters and the work was almost placed under contract when a sudden decision of the municipal administration consigned the project to a pigeon-hole in some desk down at City Hall. The Baltimore plant, which has been described in several articles in this journal, represents some of the latest ideas in filter plant detail, and the city has been fortunate in having had an engineer of the caliber of James W. Armstrong to control the destinies of its Lake Montebello water purification project.

Fine Screens for Drinking Water

ADAPTATION of processes and methods in successful use in one industry to another field is one of the results of the broadening of the field of the engineer. In the article on page 291 there is described the use of a screening plant, common in the paper mill industry, adapted to the removal of the lower organic life from lake water. Various schemes for the removal of these macroscopic plants and animals from western waters have been tried for twenty-five years. Most of the screens have been of the vertical lift type, two screens, one ahead of the other, being the usual form. At Oakland, Lake Chabot water was formerly strained horizontally through cheese-cloth stretched over vertical frames placed in the side of a long flume. At present a screen plant on the side of Marston Lake opposite to the one described consists of shallow square wood tanks with a second square of screen frames set in vertical slots. In all of these plants the method of washing the screens was not considered seriously by the designers. It very soon becomes a burdensome process, particularly when the "moss begins to run" in large quantities. An automatically washed screen, whose operation involves only the opening of a valve and the starting of a motor, is a desirable advance in the treatment of a lake water subject to the larger growths which cannot be kept down with copper sulphate. Growths can be removed by filters, but the difficulties from short runs and high counts are by no means to be minimized. There is no question here of hygienic purity; the hypochlorite plant takes care of the bacteria. At some future date, perhaps, the adaptation will go still farther to the sewage disposal field. Such a plant, with compressed air substituted for wash-water, is worth investigating.

Strength of Field Concrete

TWO very definite conclusions can be drawn from the results of the extensive and continued testing of the concrete going into New York's subway construction, reported on page 296. First, the average strength at 28 days of 1:2:4 Portland cement concrete poured on the job in standard cylinders is only about 1500 lb. per square inch. This is 25 per cent lower than the recommended value of 2000 lb. made by the Joint Committee for the required strength of this mixture. Possibly the method of curing by sprinkling in the moist room may have decreased the strength of these specimens, as it is evident from the results in Table 2 that many cases of lower values for such curing conditions were obtained. Second, the strength of concrete specimens from the actual structure exceeds the strength of similar specimens cast on the work or made by hand in the laboratory. One cause of this strength is probably the greater chemical action in setting which occurs in the mass concrete, due to higher interior temperatures from chemical heat longer retained. The high heads of 3 to 15 ft. acting on the concrete in the structures and the resulting consolidating pressure in the forms may have produced a denser and stronger concrete, although there seems to be no direct law of increase in strength for higher heads. The comparisons given for variation of strength with other variables, while not claimed to be of much value because not independent, seem to agree, in general, with the usual results. Perhaps the most important work being done by the Public Service Commission in its influence on the contractors is the continuous testing of the aggregates, combined with these tests of field concrete.

Pan-American Road Congress

FOR the first time in their histories the American Highway Association and the American Road Builders' Association will hold this year a joint convention—the Pan-American Road Congress—which will open at San Francisco, Sept. 13, and continue in session for five days. In the past these two organizations have held separate meetings, involving a duplication of effort for which the Engineering Record can see no justification. The joint meeting, therefore, will be worth watching, and the opinions of those who attend it will be valuable as indicating whether one road convention is preferable to two meetings, both of National scope. From the program containing the list of papers to be presented the Pan-American Road Congress will be well worth while. The committee has very wisely set aside ample time for discussion and selected engineers particularly well qualified to lead the speaking from the floor. This augurs well for the success of the joint convention, for discussion of papers is always one of the most interesting features of engineering meetings. The joint congress will probably establish between the two associations closer relations than have previously existed. Whether this meeting will be the means of effecting the organization of a single National association in the highway field the future only will determine.

Making the Little Filter Work

TO MAKE the little filter plant work is usually a much harder problem than to get results from a large metropolitan system. When unforeseen difficulties arise in the large plant trained experts are easily available. With the 1,000,000 to 5,000,000-gal. systems any unusual condition must be met by the superintendent. If the alum fails to produce a floc because of a colloidal turbidity his only chance is a prayer for the rain to cease and the river water to clear up. Robert Spurr Weston presented an excellent paper on difficulties from colloids in waters to the American Society of Civil Engineers several years ago. The theory was explained in detail, but it relates more to a comparatively clear colored water than to the milky fluid that flows in some of the southwestern streams. When these conditions arose at the little town of Burlington, Kan., the engineers who had installed the plant initiated a series of experiments, described on page 292, to find out what was

happening and what could be done to cut down the enormous amount of coagulant required to maintain a high standard of excellence in the effluent. The test rigs used, ordinary butter-churns for the laboratory tests and a many-baffled mixing box made by the village carpenter for the basin tests, can be duplicated at any small plant that encounters difficulties. As in most experimental work some things, not anticipated, eventually led to practical results. The whipping idea produced good results which were duplicated in practice by the mixing box. The idea of over-treating a small proportion of the water is the one adopted in many softening plants. The ability of lime to assist materially in settling certain turbid waters has long been known, but learning just how it could be used to advantage in connection with alum in the Burlington plant was worth the cost of the experiments. Perhaps a word of warning is necessary—lime may not give the same result when applied to every colloidal water. Then, too, the constituents must be known and the resulting combinations kept from producing any incrusting effect.

Municipal Prosperity Depends on Adequate Water Supply

THE COLLAPSE of municipal prosperity is not often laid at the door of the waterworks fraternity, but many citizens of Council Bluffs feel that the failure of the old plant to furnish adequate fire protection and clean water was one of the largest factors in driving away business in the late eighties. It is probably true that several real estate holdups, such as compelled the South Omaha stock yards to abandon their original intention to locate in Council Bluffs, had no small share in forcing a decline in the population curve.

After the city's implement-manufacturing houses were burned out twice and had suffered numberless individual losses, mainly because they had to rely on one 6-in. water main which they were unsuccessful in having reinforced or enlarged, a general exodus of these firms took place, leaving the main street as deserted as a village church-yard. Boom-day prosperity, however, like a supersaturated chemical solution, is readily crystallized into stableness. On the other hand, a small amount of acidulated discord and greed may disassociate and dissolve what has already been crystallized into an indifferent watery solution of distrust, depreciation and insolvency. The water controversy furnished the acid.

Council Bluffs was once, and had the chance to continue to be, the great city of the plains. From a railroad standpoint it is unequaled in location as a distribution and gathering point, but its citizens chose discord rather than harmony and its neighbors grabbed the prize while they haggled. It is not the intention to discuss the merits of the waterworks controversy, for few outsiders are interested, but the fact remains that once this property was rehabilitated the city as a whole began immediately to regain some of its former prosperity.

The downward dip of the population curve has now been reversed. Few deserted business buildings exist. Dwellings by the score are going up in many parts of the city and the beautiful bluffs for which the city was named are gradually becoming populated. No one could build on the higher levels so long as water was unobtainable, but that condition of affairs is now changed and, as stated in the article on page 286, the waterworks officials have gone so far as to spend $30,000 to furnish water to only seventy families, in the belief that this bluff territory will be built up rapidly. To Denver, San Francisco and a number of other cities bickering over the water question, the experience of Council Bluffs certainly ought to be illuminating. To waterworks officials whose duty it is to serve their customers efficiently the responsibility of municipal welfare is defined in no uncertain terms.

Help for the Make-It-Work Man

A CLOSE relation between the technical data-taking force of a waterworks system and the operators is gradually becoming the rule rather than the exception. Piling up records for the chief engineer's files does the man who is actually running the plant no good. That the latter must have the information or receive orders based on the latest tests at the earliest possible moment, if it is to be of any use in most of the adjustments around a purification works, was long ago conceded though not always lived up to.

In the boiler room of many plants carbon-dioxide tests are now made and immediately posted, so that the fireman can know the condition of his furnace at all times. Such a system, carried out at St. Louis last year, effected a saving over the previous year of 14.2 per cent in the amount of coal consumed. There are still a few places where such a valuable test as a turbidity reading is not made frequently. Even on such an erratic river as the Missouri this simple determination is not made in one plant more often than twice a week, yet an analyst is in charge of the purification process and doubtless carries out regularly tests for free and albuminoid ammonia, when the same time put on the field tests would prove far more profitable. In Denver bacterial results are telephoned to the operators as soon as the counts are made, and turbidity readings are made daily by the filter attendants.

On-the-spot tests are best if practicable. Take, for instance, the road inspector's problem. If sand and gravel of doubtful character for concrete should be delivered on the job, any immediate condemnation depends on judgment, and there may be a wide variation in what different inspectors will pass. If the inspector has means at hand to make his tests on the job, his own moral fiber is strengthened and he has something tangible on which to base an opinion in doubtful cases. On a recent inspection trip with a highway engineer the question of accepting a sand, obviously finer and more ungraded than that specified, was under discussion. The sand was not of marked inferiority, so it was hard to explain to the contractor why this kind of material would not make a good concrete, whereas if an adequate test could have been made on the spot no further argument would have been necessary. Fortunately for road construction, as well as for waterworks operation, there is now available field apparatus which will give the man on the job the necessary information to sustain his decisions. It only remains for the man in the field to make use of what is available, and for the man in charge to see that he is supplied with the proper tools and instructed how to use them.

Air-Bound Filters

THE CLOGGING of water filters by air entrained in the interstices of the sand bed is a normal phase in the operations, from time to time, of many municipal plants. The output of a filter between cleanings can be markedly reduced by entrained air, even to an extent exceeding that produced by clogging with silt and clay as found in most river waters. The removal of air-binding and its effects should be an important function of filter-cleaning arrangements, which differ materially at different places.

Unusual experiences with air-bound filters at Wilmington, Del., are described by Edgar M. Hoopes, Jr., chief engineer of the Wilmington Water Department, in an article appearing on page 282 of this issue. The Wilmington data deal with the performances of a so-called slow sand filter plant, the upper portions of the sand layers of which are cleaned hydraulically by a Blaisdell washing machine. Wash-water under pressure is forced through perforations in the hollow vertical teeth of the horizontal stirrer wheels which penetrate into the sand for some distance below the surface. The dirty wash-water with the accumulations detached from the sand is confined to the lower compartment of the moving machine, whence it is pumped into suitable outlet troughs. The revolving stirrer wheels, with their teeth penetrating the sand to any desired depth, are located in the moving lower compartment which is sealed to the sand surface with special shoes, and from which more water is pumped than is delivered through the perforated teeth.

The Wilmington data are of particular interest in that they represent five years' experience at a sizable plant with a Blaisdell washing machine operating on slow sand filters, the yield of which has been at a rate somewhat higher than is the ordinary practice with slow sand filters elsewhere, which are cleaned by draining the sand bed and scraping off the upper portion. The Wilmington plant thus occupies, in some respects, a somewhat intermediate position between an ordinary slow sand filter and a mechanical or rapid filter.

Air-binding is not a new development in the field of water filtration. It was observed by Mr. Kirkwood to be a feature of the sand filters of Europe upon putting the filters back into service after they had been drained for scraping, and he suggested fill-

ing them with water applied from below in order to drive out the air. It is believed that this suggestion of Mr. Kirkwood's, contained in his classical report on the filtration of river waters for the city of St. Louis in 1869, was quite generally adopted abroad where construction arrangements so permitted. It was also known then that sand filters should be cleaned before the loss of head became excessive, although it is doubtful if the operators appreciated fully the complications arising from the formation of a partial vacuum within the pores of the sand bed and the consequent liberation of air, as explained by Mr. Hoopes.

Liberation of air was a characteristic of the water filters of the Lawrence Experiment Station, and at the Lawrence city filter the complication of released air was added to by the presence in the pores of the sand of air trapped there as the result of operating the city filter intermittently, that is, draining it each day and filling the sand with water applied from above.

Mechanical filters in their earlier days, when relatively coarse sand was employed with fairly low acting head, as in the case of the old Warren filters, did not give serious trouble from air-binding. This complication developed, however, with the advent of fine sand and the utilization of a greater acting head than the depth of the water above the sand surface. Undoubtedly there are mechanical filters which have suffered from unequal and inadequate arrangements for cleaning the sand bed by applying wash-water from below. The problem has been complicated through patent litigation until to-day the subject is in need of a comprehensive review of available evidence.

Wilmington's experiences are striking as regards the increase in the initial loss of head noted with the local filters as they have continued in service, and the reduction in the yield of water filtered between cleanings. The leaky filter bottom and inability to displace air by applying water to the bottom of the filter when most needed is, of course, an abnormal feature, but the extent to which the compacting of the sand bed through changes therein is normal to that process of filter cleaning is a problem of much practical significance.

The speed with which a water filter may be cleaned hydraulically, as compared with the time-consuming task of draining slow sand filters, scraping them and refilling them from below to displace the air and thus guard against vertical channels through which a part of the applied water may pass at abnormally high rates of filtration, is an advantage that filter operators will always appreciate. The Blaisdell washing machine gives to the slow sand filter some of the advantages of a mechanical filter and modifies and lessens some of the disadvantages of the slow sand filter. In the final analysis of the proposition of selecting a method of filtration data should be compared on the basis of relative costs by the different methods of producing filtered water uninterruptedly of satisfactory quality in each instance. Further data from Wilmington will be awaited with interest.

The New England Waterworks Association's Development

SCIENTIFIC and professional societies, like individuals, have their periods of youth, manhood and senility, but the New England Waterworks Association is perpetually young. Some associations have been through periods of buoyancy and depression, but this one seems always to be prosperous. The gray hairs of the old leaders appear to be no deterrent to enthusiasm, while they add to solidarity. The convention which, according to a long established custom, is held during the week of Labor Day, this year in New York, brings to mind the fact that the association is now a third of a century old. It will not be out of place, therefore, to call attention to its growth and influence.

At the end of its first year it had 27 members; after ten years, 338; after twenty years, 522; after thirty years, 666; and now, in round numbers, about 700, exclusive of honorary and associate members. During its three decades it has maintained a quarterly journal, modest in form, substantially uniform from year to year, well edited and well printed, containing a long series of scientific papers, practical articles and committee reports of a high order of merit. It is hard to find a journal more uniformly satisfactory. The association's financial policy has been sound, the dues have been relatively low, $3 a year, and there is a contented feeling among the members, for they realize that they are getting their money's worth.

What lessons can these wise men of the East, in waterworks convention assembled next week, teach the scientific men of the country in the way of organization? In the first place the object of the association is definite and limited. It concerns water supply, a broad subject to be sure, but one which, nevertheless, has a central idea and exerts a centripetal force. A large percentage of the members live near enough to the headquarters in Boston to be able to attend the meetings with regularity. Thus business acquaintances have ripened with the years into firm friendships, and the superintendents attend the meetings, not merely to hear a paper by some noted engineer, but to meet some other superintendent and learn what he thinks about the subject, feeling sure that, though the paper itself be highly technical, some informal practical discussion will arise which will make up for an overdose of science. Within the little section of New England the water supply problems are much alike so that feelings of mutual interest naturally arise.

Wisdom has been shown in keeping the management very largely in the hands of the active waterworks men, and neither the professional engineers nor the supply men have been unduly prominent. Yet it has been recognized that all three classes of men have a necessary part to play—the engineer to design, the manufacturer and salesman to furnish supplies, the superintendent to build and operate. Then, too, there are the waterworks clerk, the contractor and the water analyst.

Wisdom has been shown again in making the journal a quarterly, for a monthly is too expensive for a small association, while an annual is too unresponsive. It is difficult to get authors to prepare manuscripts in time for monthly issues, and authors naturally dislike to have their papers remain unprinted for perhaps a year. Generally speaking, it is a good rule for societies which meet monthly to maintain a monthly journal, for societies which meet quarterly to maintain a quarterly journal and for societies which meet but once a year to publish but one volume of proceedings a year.

Again wisdom has been shown in arranging the times of holding the regular meetings—that is, during the winter months, when the superintendents' duties are less active, although no superintendent will admit that his work ever stops.

The association has been fortunate in having several sources of influence concentrated in Boston, the State Board of Health, now known as the Department of Health, the Metropolitan Waterworks, and the Massachusetts Institute of Technology. These have been training schools for waterworks men, who, although now scattered over the country, still retain their membership in the association and occasionally drop in at the meetings, sure to find old acquaintances. In future meetings, however, they will fail to find one who has just departed, Dexter Brackett, the chief engineer of the Metropolitan Water Board and past-president of the association. His tall form, his genial smile and his helping hand will be sadly missed.

The New England Waterworks Association has never maintained standing scientific committees, yet it has done a great amount of excellent committee work. Recent examples are the reports of the committees on yield of drainage areas, meterrates and statistics of filtration plants. Another important report on service pipes is to be presented at the New York meeting, next week. Subjects are taken up for committee study when they are fresh and when the need of concerted action is obvious. The result is that when a report is issued it becomes a mile-stone for that particular subject.

Thus from a small beginning the association has reached a period in its development at which it is one of the dominating influences in the waterworks field. It may well be taken as a model of what such organizations should be. There exists among the members an esprit de corps which means everything for the success of the association. A good example of the loyal spirit which pervades the organization is furnished by the decision of its president, Leonard Metcalf, to make the trip from San Francisco to New York and then back again for the express purpose of being present at the convention next week.

Air-Bound Filters the Chief Difficulty in Operating Wilmington's Water Purification Plant

Negative Head Induces Liberation of Air in Beds During Winter—Cracks in Floor of Filter Complicate Problem—Dynamite Used to Break Ice on Beds—Effects of Sand-Washing Machine Discussed

By EDGAR M. HOOPES, JR.
Chief Engineer, Water Department, Wilmington, Delaware

ONE of the principal difficulties encountered in the operation of water purification plants is due to the liberation and entrainment of air within the filter beds. This phenomenon, which occurs in filters of both the rapid mechanical and the slow sand types, has become a subject of great interest to sanitary engineers. Especially is this true as regards slow sand filters, where the action of collected air is of serious moment, frequently preventing the passage of water through the beds. Before describing a most unusual condition of air-binding which occurs at Wilmington, Del., under certain conditions of temperature in the applied water, a brief review of the theory of the subject may be of interest.



FILTER SAND IN THE LONG, NARROW BEDS OF THE WILMINGTON PLANT IS WASHED BY MACHINE

NEGATIVE HEAD IN FILTERS

The amount of air absorbed by water under atmospheric pressure varies almost inversely as the temperature. If the latter remains constant any decrease in pressure will tend to decrease the absorption coefficients of the two principal gases composing air—oxygen and nitrogen. If the pressure remains constant these coefficients will increase as the temperature decreases, complete saturation of water occurring at about 0 deg. C. When the loss of head through a filter becomes greater than the depth of water over the sand a negative head is formed and the pressure in the interstices of the sand and gravel becomes less than atmospheric. The effect of this reduction of pressure is to permit a portion of the air to escape from the water in process of filtration.

This point clearly indicates that negative heads cannot be successfully employed in the filtration of waters containing large amounts of air in solution. Of further interest is the fact that at summer temperatures water is cooled in the process of filtration, while in winter a slight rise of temperature occurs. Although the actual temperature difference between the applied and filtered water may not be great, it follows that the tendency of water is to absorb air from filter beds in summer and to release it within the beds in winter. This in turn explains why air-binding troubles are severest at low temperatures—the question of negative head being neglected. Ordinarily water will contain about twice the volume of air in solution during winter as compared with summer temperatures. During the latter period filters may frequently be operated under a considerable negative head before the release of air is evidenced in objectionable quantities, while such a procedure in winter, when water is about at its saturation point, is immediately followed by disastrous results. So much for the physics of the problem—the results of actual experience are far more interesting.

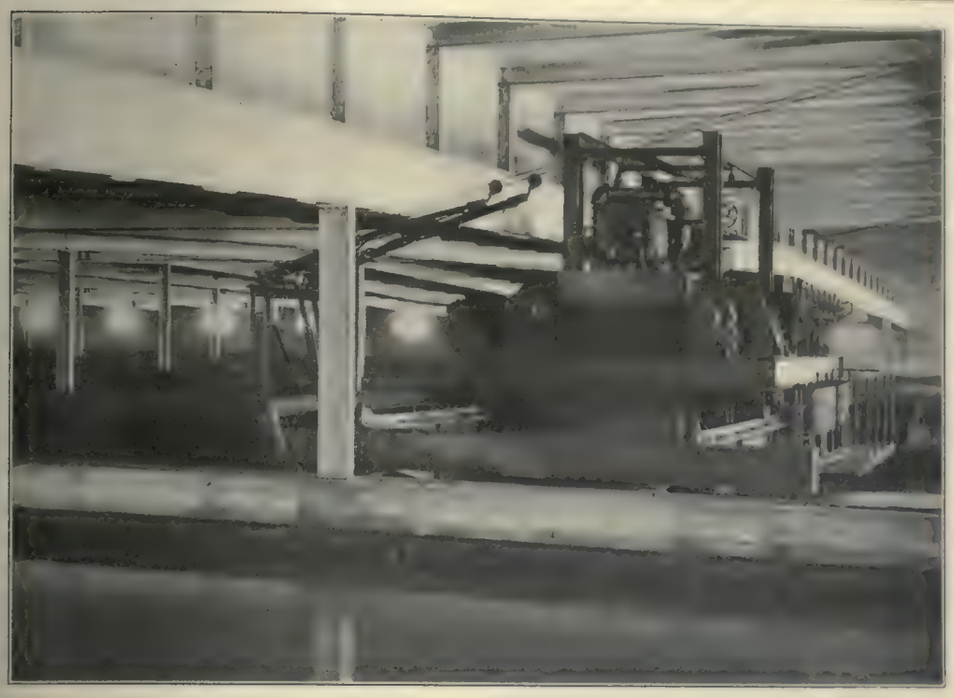
FEATURES OF THE PLANT

The slow sand filter plant at Wilmington, Del., described in the Engineering Record of Nov. 20, 1909, page 564, embodies many radical departures in points of design. Six covered sand beds of ⅛ acre each in area are superimposed upon a filtered water reservoir of 6,000,000-gal. capacity. The complete structure, therefore, is two stories high, the reservoir or lower story having a groined arch roof which also serves as the floor of the filters. The beds are 40 ft. wide by 362 ft. long and are constructed to accommodate a Blaisdell sand-washing machine. The underdrainage system consists of one row of Brossman tiles laid longitudinally down the center of each bed, the collected filtrate passing through holes in the floor under the underdrains into a discharge pipe hung close to the roof of the filtered water reservoir. Each discharge pipe is equipped with a Venturi meter through which the filtrate passes into the main effluent collecting pipe and thence into the filtered water reservoir. Reference to the illustration will make the design clear.

The filtering material consists of 9 in. of crushed stone, 5 in. of graded gravel and 24 in. of sand, the latter having an effective size of 0.23 mm. and a uniformity coefficient of 1.83. Water enters the filters by gravity through a chamber where the head on the beds is controlled by a manually regulated disc valve. The depth of water on the beds is maintained at 52 in., while the rate at which the plant is operated varies from 4,000,000 to 6,000,000 gal. per acre per day.

FILTER FLOOR CRACKS

The plant was completed and placed in operation Jan. 16, 1910, and immediately it was found that longitudinal cracks had developed in the floor of the filters or roof of the filtered water reservoir, thus allowing the effluent to pass directly into the reservoir underneath instead of taking the intended route through the underdrains and effluent pipes. Before final payment on the plant was made the contractor was required to calk these cracks with lead wool, the calking being done from the inside of the reservoir against the direction of pressure. This



SAND-WASHING MACHINE DISCHARGES DIRTY WATER INTO LONGITUDINAL GUTTER

method was the only one available without removing the filtering material and was apparently successful. For the first two years' operation the beds remained tight and the effluent delivered was at all times of satisfactory sanitary quality and appearance.

In January, 1912, air-binding trouble was experienced for the first time, and the successful operation of the beds was seriously impaired. Beginning on the fourth day of this month the temperature dropped to 5 deg. below zero and remained below freezing almost continuously until the middle of February. Heavy ice formed upon all of the filters, rendering the operation of the Blaisdell washing machine impossible. During this period the water was completely saturated with air and as the beds could not be washed, they became so badly bound that filtration was completely arrested. Under this condition it was evident that the plant would either have to be abandoned entirely or radical measures adopted to break the ice and permit the washing machine to be used.

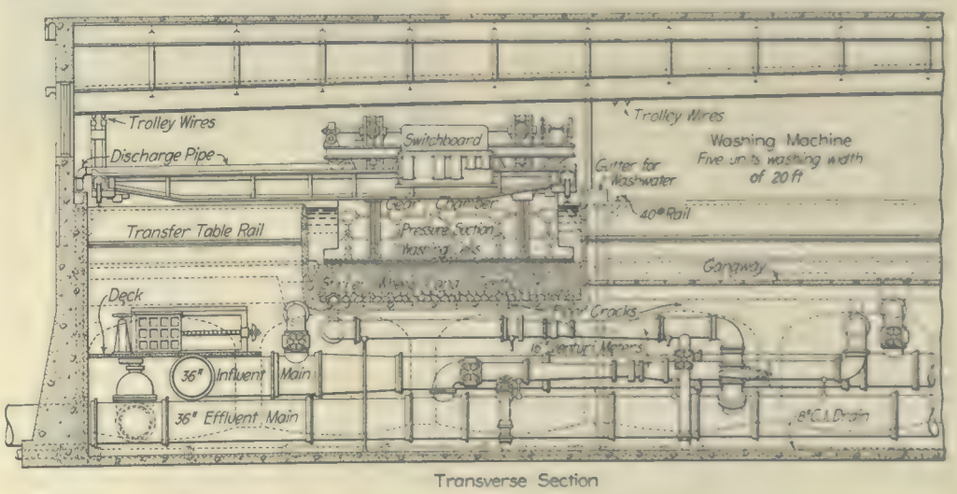
Ice Dynamited

Efforts to remove the ice by ordinary means having failed, 40 per cent dynamite was employed, four ¼-lb. sticks being placed below the surface of the ice on each bed and exploded. This method was successful in shattering the ice, which by this time was from 6 to 10 in. in thickness. The washing machine being again in operation, it was found that the delay in cleaning the beds had permitted an excessive negative head to form and that air-binding and compacting of the sand existed at a depth below the reach of the washing machine teeth. This condition was relieved by backfilling under pressure with the applied water for a period of about two hours, during which time unfiltered water was delivered to the city.

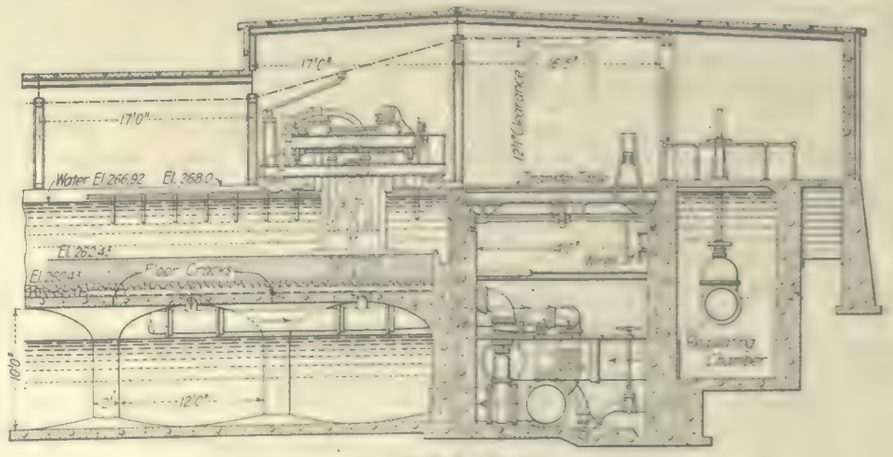
Following the use of dynamite, which was certainly justified under the circumstances then existing, the calking in the floor cracks became loosened and at least one-half of all water filtered (about 11,000,000 gal. per day) passed through this route to the reservoir underneath. The result of this occurrence was the loss of control of the rate of filtration on those beds where leakage was of any amount, the rate being excessively high in the area over the cracks and low over the remaining portion of the bed. The following winter, 1913, being much milder in temperature, a recurrence of the trouble appeared in a decidedly less severe form. It was found during this period that repeated expansion and contraction of the concrete filter building had seriously aggravated the cracks in the filter floor which in some cases were from 1 to 2 in. in width, running practically the entire length of the bed, 362 ft. Lateral hair line cracks also developed, running completely across the filters at intervals of about 40 ft. A careful inspection of the cracks established the futility of attempting any further efforts at calking. It was found during this winter that a definite relationship existed between the intensity of air binding and the leakage through the beds, the worst disturbances always occurring on those beds in which the leakage was greatest. Around the establishment of this point hinges a most interesting condition.

Effects of Leakage

The usual method of operation at Wilmington is to wash or rake each bed when the loss of head reaches 72 in. This, it will be seen, embodies the use of a negative head of 18 in., since the depth of water on the bed is but 54 in. No liberation of air will occur during the average spring, summer or fall under such operating conditions if the loss of head is not allowed to exceed this experimentally determined maximum. It is of extreme significance to note that the leakage through the beds during periods of warm or mild weather is negligible, the entire filter structure having expanded until the fissures in the concrete filter floors are nearly closed. At such times a negative head slightly greater than 72 in. may be employed as a matter of operating economy, the air which collects in the beds being easily expelled by draining the water down and backfilling under a slight pressure with filtered water from one of the full beds immediately adjoining. This method of operation has been repeatedly employed without injury to the filtering material or affecting the quality of the filtrate. During periods of low tem-



Transverse Section



Longitudinal Section

RELATION OF FILTERS, UNDERDRAINS AND FILTERED WATER RESERVOIR

perature, when the maximum contraction has taken place in the concrete flooring of the beds, a similar backfill is dissipated as leakage through the cracks, and it is impossible to establish a pressure sufficiently great to expel the collected air.

At this point the true significance of the situation becomes evident. When the full flow of water is not maintained through the leaks, which occurs when the head becomes slightly negative and the pressure within the filter falls below atmospheric, air is drawn through the cracks from the filtered water reservoir below and stops the process of filtration completely. This action cannot occur in warm weather since the fissures are almost completely closed by expansion, as has already been stated. It will thus be seen that the location of the filter beds over the filtered water reservoir has resulted in a condition which is in many respects unique. The behavior of air in the Wilmington filters is evidenced by a high initial loss of head after cleaning or scraping, the air collecting in the gravel directly below the sand layer. The location of the air is the same, whether it be liberated from the water in process of filtration or drawn up from the filtered water reservoir through the cracks in the beds.

BACKFILL WITH PUMP TO EXPEL AIR

During the past two winters excessive air-binding, due to the conditions described, has been partially overcome by attaching a centrifugal pump to the effluent pipes from each bed and backfilling under a pressure just sufficient to expel the air. The pump takes its suction from the filtered water reservoir and the rate of backfilling is varied from 1,500,000 to 3,000,000 gal. per acre per day, depending on the amount of leakage through the bed under operation. A pressure of 3 lb. has been found sufficient to expel the air from a bed which has been drain down, while 6-lb. pressure is required when the full depth of water exists. As the magnitude of the cracks in the flooring is becoming progressively worse with repeated expansion and contraction of the building, plans are now under preparation to remove the filtering material and waterproof each bed with asphalt and felt.

It has been suggested to the writer that part of the trouble at Wilmington might be due to the mechanical washing of sand by the Blaisdell machine. As this method of cleaning is of fairly recent introduction a brief account of its operations is necessary. The washing machine may be described as a traveling crane spanning a filter unit and supporting a watertight rectangular chamber containing the essential washing machinery and further provided with means of lowering this chamber to the sand surface and traversing over the filter while the operation of washing the sand is proceeding. The washing chamber may be raised to clear the rim of the filter, and the machine removed to another unit by the transfer carriage. The washing chamber is subdivided into two compartments, the lower or suction chamber, from which the dirty wash-water is withdrawn, containing five horizontal stirrer wheels supported on vertical shafts. The upper or dry chamber contains the driving mechanism for the stirrer wheels and also the pressure and suction pump. The stirrer wheels are equipped with numerous hollow perforated teeth which can be varied in length for the purpose of washing to different depths. Water for the pressure pump is taken from the raw water of the filter and supplied to the perforated teeth while the suction pump withdraws not only all water discharged through the teeth, but a slight amount in excess, which is drawn from the filter bed. In operation, the teeth scour the sand and the wash or pressure water drives the dirt up into the suction chamber where it is withdrawn and discharged into a wash-water gutter before the machine passes a given point. As the suction is always in excess of the pressure supply a certain amount of clear water is drawn into the area being washed, thus preventing the dirty or wash-



DURING AIR-BINDING SIPHON DREW WATER FROM TOP OF BED

water escaping from the chamber. The chamber is sealed to the sand surface by wide hinged shoes extending in the front and rear.

RESULTS OF SAND-WASHING

The result of thus washing the sand in place has been found to increase the clogging effect when the beds are slightly air-bound. This is undoubtedly due to compacting of the sand under the combined influence of leakage and negative head. No evidence of sub-surface clogging has ever been discovered, a point which might be suggested from the possibility of forcing the finer particles below the upper surface of the sand through the action of the stirrer wheel teeth. As a matter of fact, the tendency of the Blaisdell machine is to increase the effective size of the sand, the finer particles passing out with the wash-water. This action may be controlled with fair accuracy by increasing the duty of the pressure and suction pumps until a velocity is reached sufficient to hold the finer particles of sand in suspension.

Table 1 clearly shows the results obtained at Wilmington, the samples of sand being collected from the top of the bed immediately after washing.

Sand analyses were not made during the missing years. Contrasted with this gradual change from a finer to a coarser sand, the average results of the entire plant, in Table 2, are of interest.

TABLE 1—ANALYSES OF SAND FROM WILMINGTON FILTERS

Year	Filter Bed	Effective Size, mm.	60 Per Cent finer than, mm.	Uniformity Coef.
1910	E	0.24	0.39	1.63
1911	E	0.22	0.36	1.64
1914	E	0.29	0.43	1.48
1915	E	0.33	0.375	1.44

TABLE 2—AVERAGE RESULTS OF ENTIRE PLANT

Month	Av. initial loss of head at a 3 mil. gal. rate after washing, in.	Average yield after washing, gal.
July 1910	3.8	13,082,000
1911	7.25	12,719,000
1912	14.67	7,538,000
1913	11.17	6,228,000
1914	22.8	3,920,000
1915	20.67	5,782,000

A summer month is selected for the purpose of illustration, since the behavior of the filter is normal, leakage through the beds being at a minimum. From Table 2 it will be seen that the average initial loss of head at a 3,000,000-gal. rate has increased with but two exceptions, from 3.8 in. in 1910 to 20.67 in. in 1915, while the yield after washing has decreased from 13,000,000 gal. in 1910 to about 6,000,000 gal. in 1915. The figures representing the average yields, give the amount of delivery from the time a bed is washed until it is first raked. The exact cause of this condition has not as yet been determined but is being studied with great interest.

St. Louis Engineers Test Filter Controllers

Results on Two Types Were Checked by Three Methods—a 6-Inch Disc Meter, a Venturi Meter and a Standard Weir

TESTS on two types of 24-in. filter rate-controllers for use in the plant of St. Louis were made previous to equipping the filters with them. Specifications called for the maintenance of a rate of flow not to exceed 3 per cent from the average between the limits of 1,500,000 and 2,500,000 gal. daily, with a variable head on the controller ranging from 1 to 14 ft. Between 2,500,000 and 5,000,000 gal. the variation was not to exceed 1½ per cent. Reports of the test are given in the 1914 annual report of the water department, from which the following notes are taken:

ARRANGEMENT OF APPARATUS

The tests were conducted in the filter house then under construction. The water used in the test was pumped from basin 5 by a motor-driven centrifugal pump with a capacity of about 3200 gal. per minute installed on the edge of the basin under a temporary cover. The pump discharged into a 12-in. cast-iron pipe line in which were placed two 6-in. disc meters connected in parallel. After passing the meters the line branched into two 12-in. pipes leading to two adjoining filter boxes, from which the rate of flow was governed by the controllers. The area of each filter box is 1578 sq. ft., including the central gutter. No filtering material has been placed in either box so that a total variation of static head of 8.5 ft. could be obtained in each test. The elevation of the water in the basin was measured with a rod

resting on the strainer system. The 24-in. effluent pipes of these filter boxes were each connected to a 24 x 10-in. horizontal Venturi tube, which operated the controlling device of each apparatus, and with a vertical ell connected to a flume leading to a measuring weir built under the groined arches supporting the filter boxes. The weir channel was 25 ft. long, 7 ft. wide and 2½ ft. deep below the crest, the sides and ends extending 2 ft. higher. The weir was a rectangular notch 44 in. wide, cut out of a steel plate ⅛-in. thick. Seven feet back of the weir a stilling box 5-in. square was built, in which was placed a hook gage equipped with a vernier, controlled by a micrometer adjusting screw, and reading to 0.001 ft. The weir channel contained two baffles, the first made of 2-in. lumber containing 100 holes 2 in. in diameter; being placed 5 ft. from the upper end of the channel and the second baffle, made of ordinary fly screening, 3 ft. ahead of the first. The baffles practically broke up all wave motion due to the incoming water and gave a smooth flow in the channel above the weir.

Rates Checked Three Times

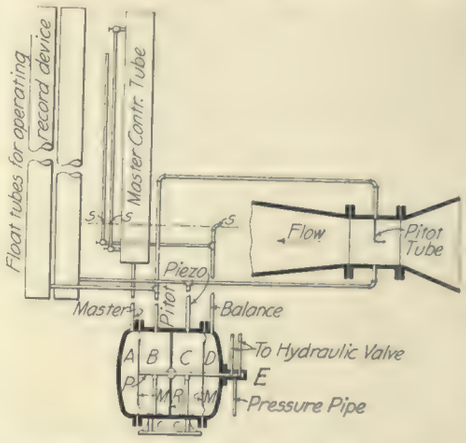
Three measurements of the rate of flow, one by the 6-in. disc meters, one by differential glass tubes connected to the Venturi meter and one by the weir, gave checks on the controller's record. The disc meter indicated about 2 per cent greater quantity of water than the weir and the differential readings from the Venturi tubes indicated the same quantity as the weir if a coefficient of 0.995 for small flows to 0.975 for the larger flows were chosen in the Venturi meter formula. The weir measurements are based on Fteley & Stearns formula for all heads on the weir under 0.5 ft. and Francis' formula for heads greater than 0.5 ft.

The method of operation was as follows: Starting with the filter box full or empty, as the case might be, giving a head of 12.5 ft. or 4 ft. on the controlling Venturi meter, the water was gradually lowered or raised in the filter box producing a gradual variation of head similar in the first case and opposite in the second to variation of head actually produced in filtration, but more rapidly than would likely occur in practice.

Both controllers tested utilized the principle of the Venturi tube for regulating the throttling valve on the 24-in. effluent pipe. Controller *A* had a small pitot tube in the center of the throat of the Venturi tube and passing out through the wall at the top, and a piezo tube connected to the bottom of the throat. Both of these tubes (¾-in. pipe) were connected to a cast-iron cylinder about 24 in. long and 20 in. in diameter called the "controller," located on the floor under the groined arches. This cylinder contained four compartments. Compartments *A*, *B*, and *C*, *D* were separated by two 16-in. circular plates, *MM*, connected by a small rod, *P*, and both plates connected to the walls of the cylinder by a thin fiber diaphragm. The rod connecting the plates, *MM*, passed through the bulkhead *R*, and connected to it by a small diaphragm to eliminate friction or leaks which might be caused by a stuffing box. This rod connected to a pilot valve *E* and with a very small movement allowed water from a pressure line to operate the hydraulic lift gate valve connected to the ell beyond the controller on the effluent pipe. Branch lines from the piezo and pitot tubes were connected to separate 6-in. float tubes, where floats in connection with a clock operated a recording device showing the rate of flow. Compartments *A* and *D* were connected each to a 6-in. tube called the "balance" and "master" tubes.

Master and Balance Tubes

To operate the controller the master and balance tubes were filled to some arbitrary height, *SS*. Water was then allowed to enter the Venturi tube, raising in connection float tubes to the height of the water in the filter box. The water in the master tube was then raised to a point above *S*, equal to the calculated height the water in the pitot tube would exceed the water in the piezo tube for the desired rate of flow. This excess head in the master tube would move plates *MM* and pilot valve *E*, allowing the water from the pressure line to open the throttling gate-valve in the effluent line until the excess head in the pitot tube over the piezo tube would equal or slightly exceed the difference in head of the "master" over the "balance" tubes and move plates *MM* and pilot valve *E* back to neutral position.



DETAILS OF CONTROLLER SET UP FOR ST. LOUIS TEST

Controller *B*, which is manufactured by the Builders Iron Foundry Company, consists of the same size of Venturi tube with the down stream converging section changing to a 12 x 24-in. rectangular section connecting to a butterfly throttling valve, consisting of two 12 x 12-in. vanes hinged in the middle and operated by spur gears engaging a double ratchet direct connected to a 10-in. hydraulic cylinder. The head and throat of the Venturi meter were each connected to a 6-in. float tube with ¼-in. pipe. The floats in these tubes operated a set of differential gears and cam which in turn operated a lever connected to a small pilot valve. Like valve *E* of controller *A* this pilot valve allowed water to enter the hydraulic cylinder operating the throttling valve on the effluent line. The differential gear also operated another cam which moved a pointer over a graduated scale, showing the rate of flow and also moved a pen over a chart which was moved by clock-work recording the rate of flow. A third 6-in. float tube connected to the filter box also operated a differential gear in connection with the tube connected to the head of the Venturi tube, which moved a recording pen over the chart showing the loss of head and also the elevation of the water in the filter box. The recording apparatus was not put in operation, as no doubt existed as to its reliability.

C. M. Daly, assistant engineer in charge of the tests, made the following comments: The accompanying tables show controller *B* superior in controlling the rate of flow, except in the nominal 5,000,000-gal. rate, where the variation is 0.35 per cent more than controller *A*. The tables also show that controller *B* has a nearly uniform decreasing variation in rate, from 1,500,000 to the 4,000,000-gal. rate and an increasing variation in the succeeding rates above the 4,000,000-gal. rate. Controller *A* shows a decreasing variation from the 1,500,000-gal. rate with the erratic action, as in test 5, that characterized the device throughout the entire time of preliminary testing for two weeks preceding the final test. Controller *B* presents a distinct advantage in having all the delicate parts on the operating floor easily accessible and also better proportioned piping and float tubes with an efficient throttling plug on the pressure line near the pilot valve, which, in a large degree, accounts for the better results obtained. Controller *B*, while more desirable than Controller *A*, has several features which should be corrected and probably will be in the machines furnished. Among them is the lack of positive closing action of the pilot valve and lack of any scale for setting the rate of flow.

In Tables 1 and 2 the average rate was obtained by multiplying each observed rate by one-half of the time interval between the preceding and following observed rate, and dividing the sum of these products by the total time.

TABLE 1.—CONTROLLER *A*

Test No.	Rate of Flow, Million Gallons Per Day. Maximum.	Minimum.	Average.	Per Cent Variation. •Max.-Min. Average.	Max.-Av. Average.	Av.-Min. Average.
2	1.640	1.395	1.563	15.67	4.93	10.74
4	1.690	1.483	1.610	12.86	4.97	7.88
3	2.140	1.957	2.093	7.31	2.24	5.06
6	3.070	2.990	3.035	2.63	1.15	1.48
5	3.775	3.292	3.457	13.85	8.28	5.59
8	3.965	3.865	3.916	2.55	1.25	1.30
7	5.020	4.955	4.978	1.30	0.84	0.48

•Maximum less minimum rate divided by the average rate.

TABLE 2.—CONTROLLER *B*

Test No.	Rate of Flow, Million Gallons per Day. Maximum.	Minimum	Average.	Per Cent Variation. •Max.-Min. Average.	Max.-Av. Average.	Av.-Min. Average.
13	1.575	1.470	1.520	6.91	3.62	3.29
12	2.087	1.987	2.040	4.90	2.30	2.60
6	2.975	2.907	2.942	2.31	1.12	1.19
7	2.975	2.915	2.937	2.04	1.29	0.75
8	4.020	3.957	3.987	1.58	0.83	0.75
10	4.987	4.905	4.959	1.65	0.55	1.09
11	6.155	5.890	5.999	4.42	2.60	1.82

•Maximum less minimum rate divided by the average rate.

The work was carried out under the direction of Gurdon G. Black, engineer in charge of the supply and purifying section, reporting to E. E. Wall, water commissioner.

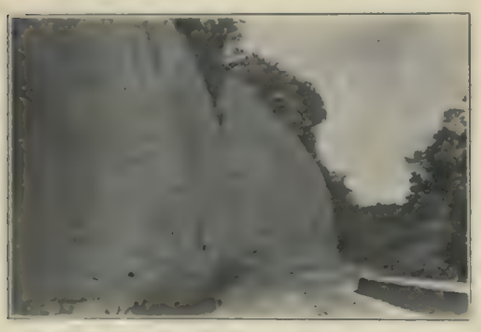
WISCONSIN'S HIGHWAY COMMISSION planned and supervised $8,870,000 worth of road construction for the three years ended June 30, 1914. More than 3000 sections of road were surveyed, plans were issued for 2800 sections of road, about 2100 separate road construction jobs were actually completed, and 1569 county and State-aid bridges were surveyed.

Council Bluffs Waterworks Regeneration Reverses Slump in Population Curve

How Municipal Ownership for 3½ Years Has Provided Adequate Fire Service, the Lack of Which Drove Away the Great Implement Business

BOOM DAYS for Council Bluffs, the period from 1863 to 1890, following Abraham Lincoln's designation of that city as the eastern terminus of the Union Pacific Railroad, might have been crystallized into permanency so far as many businesses were concerned except for the water problem. On Main Street several solid blocks of Eastern farm implement companies made Council Bluffs their distributing point for the rapidly developing contiguous country. The city was connected with Chicago on the east by six railroads, to the north by two, south by three and to the west and northwest by three lines, all of which had exceptionally good trackage facilities. The companies were reluctant to move elsewhere, but were compelled to do so from the inadequate waterworks fire service (one 6-in. main) which permitted practically the whole section to be burned out twice. Insurance rates became prohibitive and the companies moved away.

In the 21 years previous to 1912, 3 miles of pipe, mostly 6 in., were laid. Since that time under municipal ownership, the 6-in. main on Main Street, which has gradually become again a good general business street, has been paralleled with a 12-in. main and reinforced with 8-in. lines on parallel streets. During a recent underwriters' test the hydrant pressure showed a drop of but 9 lb. with nine 2½-in. and one 4½-in. streams flowing, the final pressure being 83 lb. per square inch compared with about 10 lb. obtainable with like tests under the old condition. The reinforcement was easily accomplished simply by laying the 12-in. main along the 6-in. and cross-connecting into it at intervals of at least 300 ft. By doing this few service taps needed to be made into the feeder main, which is laid about 6 ft. from the 6-in. line and on the opposite side of the street from a 12-in. gas main to prevent careless plumbers from tapping the gas mains for water, a not infrequent occurrence in Council Bluffs in the past in streets where both service pipes lie close together.



LOESS FORMATIONS HAVE STOOD FOR 30 YEARS WHEN CUT VERTICALLY

PUMPING EQUIPMENT IN BAD SHAPE

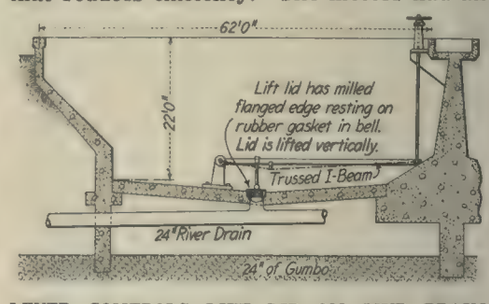
The vital part of the system is the main pumping engine. When the present officials took over the plant two Knowles direct-acting pumps of 3,000,000-gal. daily capacity each were being worked to the limit. They were 30 years old, had a duty of about 40,000,000 ft. lb. per 1000 lb. of steam, and the three 200-hp. marine boilers, one used as a reserve, were barely able to supply the enormous demands. Furthermore, the boilers, although officially tested regularly, were found nearly rusted through and the steel shells under the saddle supports entirely so. A new 8,000,000-gal. Snow horizontal, compound engine was installed on the site occupied by the boilers, the latter being of abundant capacity for the new unit were transferred to a setting in a new building to the west of the old one. The new pump has now been running for 3 years without a shutdown for repairs. Even the original metallic packing in the water pistons is still doing duty, the leakage being no more than the required amount for lubrication. This was the condition when the plant was visited by a representative of this journal in July.

Simultaneous with the installation of the new pump an auxiliary 16-in. force main was laid to the city, tying in with a cross-line feeding the Union Pacific transfer yards, consumers of 500,000 gal. This enabled that railroad to scrap a 500,000-gal. softening plant built in 1902, taking water from Spoon Lake. It also relieved the main line to the business section so that three 6-in. mains could be extended to the Chicago & North Western yards and replace a 500,000-gal. softening plant for well water which the company was more than willing to abandon. In both of these cases quality as well as quantity was of importance. The supply under the old regime could rarely be delivered with a suspended matter of less than 100 parts per million, while this year for fifty-two days the turbidity of the river water averaged 7000 and that of the effluent after 24 hours' storage was always less than 25. The maximum turbidity was 12,000, 1.2 per cent.

To effect these turbidity reductions the three reservoirs, described in the Engineering Record Jan. 11, 1913, page 39, were constructed near the river. The old reservoirs, referred to in a description of the first hypochlorite of lime plant to operate in turbid water in this journal Sept. 17, 1910, page 334, could not be cleaned often enough to keep the mud from passing into the clear water basins because of the small area of the slough into which the mud was drawn off. No sewer to the river was available, and only after the surplus water drained away or evaporated could the basins again be cleaned. The recently installed 8,000,000-gal. receiving basin at the river accumulated 1 ft. of mud every day during the fifty-two days noted above. It was flushed out clean every week. Coagulant, 3½ grains per gallon, was added as the water passed in a sheet of 3-in. depth over a 45-ft. weir into basin 2. A special 6-in. concrete overhang on the incoming side prevents the mud from following up alongside the wall to the weir and a vertical under-baffle of galvanized iron forces the water to take a downward course. Entering basin 3 the water passes over a 50-ft. notch in the wall with the top 3 ft. under water, giving a velocity of 0.15 ft. per second so as not to break up any floc that remains. Most of the work done by the coagulant is accomplished in basin 2. In basin 1 the mud is quite evenly distributed, being slightly deeper at the inlet end. In basin 2 the reserve takes place, as much as 7 ft. being found at the outlet end when a depth of but 5 ft. was noted at the inlet. This is due to the downward turn given to the water on entering. One-half the turbidity was removed in basin 1.

PUMP EFFICIENCY UNIMPAIRED BY MUDDY WATER

The intake is placed on a cantilever frame 5 ft. above the river bed and about 40 ft. from the shore line. The former low-lift steam-driven plant was replaced when the reservoir was completed by two motor-driven centrifugal units, each capable of delivering 13,000,000 gal. daily under 40-ft. head. Although pumping this muddy water for 2½ years a recent test showed an overall efficiency of 73.6 per cent, which would indicate little wear or at least no wear that reduces efficiency. The motors had an original efficiency of 88 per cent and the pumps 83½ per cent.



LEVER CONTROLS LIFT LID ON MUD DRAIN

The old reservoirs at the main station were lined originally with 2 ft. of gumbo and brick laid up dry. Every year frost and ice loosened up the lining and leaks started. These basins have all been relined over the gumbo with reinforced concrete 10 in. thick, the slabs being laid horizontally 4 ft. wide up and down the slopes. No expansion joints were used, except in the coping where ½-in. joints were placed at P. C.s and P. T.s at all corners and at 75-ft. intervals on tangents.

CRAYFISH CAUSE BASIN LEAKS

A similar procedure was carried out on the Glendale storage reservoir located on the bluffs in the heart of the city. Here the trouble came each fall from crayfish which burrowed through the gumbo layer into the loess to get away from the cold water. Loess is a peculiar formation found only in the bluffs of the Missouri, on the Rhine and along the Yellow River in China. Cut vertically it has stood along the Fairmont Park road above the reservoir for over 30 years, while on the slopes it melts away like sugar. It is made of extremely finely-divided granite particles, cemented together so well that some of these vertical walls are sheer for 45 ft. Geologists claim the ridges are wind blown from South Dakota. In repairing the reservoir the area around the 16-in. riser pipe was apparently in good condition, but to take no chances the gumbo was excavated away and a cavern under it found fully 4 ft. across and 3 ft. deep where the loess had been washed away, through holes of the crayfish with which the cavern was literally alive. Some of the larger ones were 5 in. long. No trouble has been experienced with leaks since placing the 8 to 10-in. concrete lining. The crayfish have disappeared. The trouble with the crustaceans was anticipated by the superintendent when



WATER POURING INTO BASIN 2 BEHIND GALVANIZED-IRON UNDER-BAFFLE, WHICH FORCES IT TO TAKE A DOWNWARD COURSE

he learned of their existence, because some years previous in constructing an ice pond 8 ft. deep on the flats, he found so many crayfish holes that the entering water, after the pond was completed, ran away as fast as it came in. By plowing the bottom of the basin, disk harrowing and dragging to pulverize the gumbo the holes were filled. When water was again turned in none was lost and no further trouble was experienced with leaks. The crayfish were apparently drowned out.

DEVELOPING HIGH AREAS

In addition to these improvements the city has recently installed a high-service system consisting of two motor-driven multi-stage centrifugal units taking their supply from the riser feeding Glendale reservoir and forcing it through a 4400-ft. main to a 125,000-gal. steel stand pipe with the high-water level 401 ft. above the river. While the improvement cost $30,000 and will furnish water for seventy families only at the present time, it will develop rapidly the most sitely portion of the city's area.

While all of these improvements have been carried out the department is living within its income of $150,000 per year and not incurring any additional bonded indebtedness. Five-sixths of the taps are metered and the consumption, including 2,000,000 gal. daily used by the railroads, is 100 gal. per capita based on a population of 31,000. There are 600 families using wells and cisterns, but as fast as main extensions reach them the Health Department officials are using their influence to get city water installed.

In spite of the fact that the operating costs of the pumpage have been decreased 44 per cent (to $21.85 per 1,000,000 gal.) in the last 3 years, the salary of every employee has been raised. The Board of Water Commissioners is composed of three members, one of whom is appointed every two years by the mayor. While the council approves the choice they have no further authority over the board, which is headed by J. Chris Jensen, an architect and contractor. S. L. Etnyre is superintendent and has charge of all design and construction.



COAGULANT APPLIED THROUGH ORIFICES IN LONG PIPE OVER WEIR OUTLET OF BASIN 1

Small Waterworks Revamped Under Service

Rapid Sand Filters and New Pumping Station Constructed at Painesville, Ohio, to Replace Lake Shore Infiltration Galleries

By G. W. KNIGHT and R. F. MacDOWELL
Of Staff of R. Winthrop Pratt, Consulting Engineer, Cleveland

PAINESVILLE, OHIO, needed more water, a supply free from contamination and sufficient storage to equalize the draft. All of these improvements had to be built around, over and adjacent to the existing plant during its operation. The work was accomplished in 1914 without a shut-down longer than 3 hr.

BEACH GALLERIES UNSATISFACTORY

Painesville, a town of 5500 people, is located 30 miles east of Cleveland and 3 miles from Lake Erie. It has had a public water supply since 1889. Peculiarly constructed infiltration galleries consisting of wooden frames covered with a wire mesh and surrounded by gravel were placed just under the water surface at the beach line so that the wave action would keep the sand clear. For emergencies a direct intake extended 500 ft. into the lake but, as happens too often, the town got water much of the time through the emergency intake, which was near the mouth of Grand River, a stream carrying the sewage of Painesville and two other towns. The beach built up and the lake receded, thus decreasing the available water obtainable through the galleries. Additional galleries suffered a similar fate. Complaints brought investigators from the State Board of Health in 1910 and finally in 1913, through the Bense act, the city received a mandatory order to install filters.

Two 1,000,000-gal. horizontal, direct-acting, Knowles pumps forced water into the town mains from the circular brick well, 25 ft. deep and 30 ft. in diameter, and located on the beach 100 ft. from the pump house. Three 100-hp. boilers, a 60-ft. brick stack, brick station building and outlying frame structures for coal, stores, oil and tools completed a rather dilapitated plant.

Including the village of Fairport and Richmond the present daily water consumption averages 1,000,000 gal., but with an improved supply it was expected that the consumption would increase largely. Therefore the new plant was designed to supply 3,000,000 gal. per day.

Considerations of economy in the preliminary design established the desirability of combining the proposed filter plant with such of the old station structure as would lend itself to a unit type of plant. It was accordingly recommended by the engineer that the new filtration plant be built as a unit with such of the old plant as should be salvageable, that all the operating features be placed under one roof and that such remodeling be done on the old station as would suit the needs of a new installation. The old pump house was accordingly converted into a low service pump room, where the turbine-driven centrifugal pumps could be operated, and the old boiler rooms and chimney space were converted into one large room to serve as the new high service pump room and main entrance.

Of the old outlying structures, none but the storehouse was worth saving and it was moved to a new location, there to serve during the period of construction as general storehouse and office for the contractor.

The improvement consists of an intake and crib, low service pumps, high service pumps, boilers, stack, filters and filter equipment, coagulation basins and a 100,000-gal. clear water basin.

LATTICED TIMBER CRIB INTAKE

The intake consists of 1500 ft. of 24-in. riveted steel pipe, imbedded in at least 3 ft. of sand, and terminating in a crib located in 21 ft. of water. The crib was

made up of two latticed timber frames, constructed of 4 x 12-in. timbers, drift-bolted together and placed one inside the other. The 6 ft. of annular space between the two frames was filled with one-man and two-man stone and the outside was rip-rapped. On the intake end of the pipe, in the center of the crib, is a conical shaped screen containing a total of 590 1-in. round openings.

The two low service De Laval turbine-driven centrifugal pumps, each have a capacity of 3,000,000 gal. in 24 hr. The high service pumps consist of one new Canton-Hughes crank-and-flywheel, horizontal pumping engine of 3,000,000-gal. capacity, and one overhauled Knowles pump reassembled as a unit for emergency use.

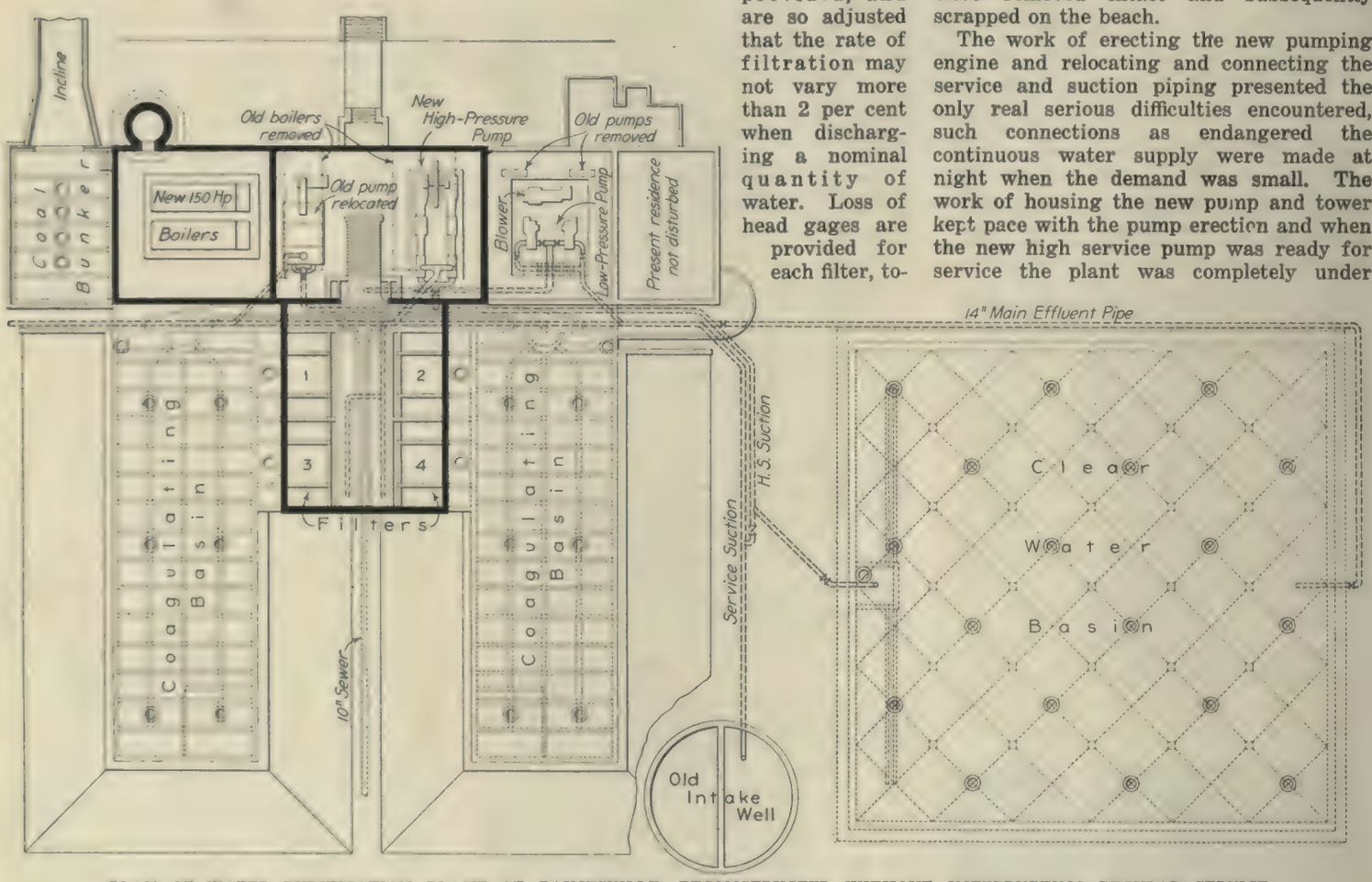
Two 150-hp. Erie return-tubular boilers are erected in the new extension to the pump building. They form a battery facing the new coal bunker, which latter was designed to carry five months' supply. A new Heine 100-ft. radial brick stack was also erected just south of the boiler room.

The two coagulating basins are each 28 x 90 ft. in plan and 16 ft. in average depth to the flow line, giving a 2.4-hr. retention period each when operating at full capacity. Each basin is divided into two parts by a concrete baffle wall running longitudinally through the center of the basin and across one end. The water enters the basin at the bottom of the end walls, and, after passing down one side and across the end, flows over a weir in the transverse baffle wall and thence returns to the inlet end. From this point it is conducted through a concrete flume to the pipe gallery between the filters. The equipment for one of the four 750,000-gal. filters has been omitted for the present. The filters contain 8 in. of selected beach gravel, overlaid with 34 in. of quartz sand having an effective size of 0.35 to 0.40 mm. and a uniformity coefficient not greater than 1.5.

The underdrain system consists of a manifold of special design with galvanized wrought-iron lateral pipes grouted in place on the flat floor of the filter. Hodkinson strainers are secured into the laterals at intervals of 6 in.

Air is used for agitation through a manifold system placed immediately over the main strainer system, the laterals being perforated with 1/16-in. holes spaced on 6-in. centers. These holes are staggered with the strainers on the water pipe laterals.

All valves are hydraulically operated. Rate controllers of the "Venturi" type are provided, and are so adjusted that the rate of filtration may not vary more than 2 per cent when discharging a nominal quantity of water. Loss of head gages are provided for each filter, together with an automatic signal bell and circuit, arranged so that the circuit may be closed at any desired loss of head.



PLAN OF WATER PURIFICATION PLANT AT PAINESVILLE, RECONSTRUCTED WITHOUT INTERRUPTING REGULAR SERVICE

Aluminum sulphate is used through 2-in. phosphor bronze and 1½-in. lead pipes to the points of discharge at either end of the coagulation tanks. Wash water is supplied from a wood stave tank of 12,000-gal. capacity located in the tower above the chemical solution tank room. The supply to the tank is replenished from the service main and controlled through operation of a balanced float valve. Pressure in washing the filters is adjusted to suit varying conditions, and the range is established between 1 and 10 lb.

Maintain Service During Construction

Considering the problem of construction from the point of non-interference with water service to the city, it was early decided by the engineers and the contractor to erect as much of the new work as possible before dismantling the old plant and to install all independent features, such as the clear-water reservoir, during the early period of the work of improvement. Accordingly work upon the coagulation basins, filters, coal bunkers, stack, boilers and boiler room housing was attacked simultaneously and carried well forward before any wrecking was attempted.

When the boilers, stack and coal bunkers were completed steam connections were made to the old pumps and the demolition of the old steam generating plant and housing was begun. The old stack was taken down piecemeal and the good brick found in the old stack and all boiler settings were cleaned and set aside for subsequent use in backing for new walls of the remodeled part of the old plant. The old boilers were removed intact and subsequently scrapped on the beach.

The work of erecting the new pumping engine and relocating and connecting the service and suction piping presented the only real serious difficulties encountered, such connections as endangered the continuous water supply were made at night when the demand was small. The work of housing the new pump and tower kept pace with the pump erection and when the new high service pump was ready for service the plant was completely under roof. After the initial tuning up, the new high service pump took its suction from the old intake well through temporary connections and by this service enabled the contractor to remodel the old pump room, remove the old pumps and install the new low service pumps and air blower. Simultaneously with the remodeling work in the old pump room the work of filter equipment, chemical feed equipment, wash-water tank erection and filter piping, including the flumes and drains, was proceeded with and factors in the filtering, pumping and storage of water were in shape to perform their functions.

The plant was designed in the office of R. Winthrop Pratt, consulting engineer Cleveland, Ohio, built by the Pitt Construction Company of Pittsburgh, and the work was carried on under the supervision of Mr. Pratt, with G. W. Knight in direct charge and R. E. Garvin as resident engineer.



HAULING WAS MOSTLY OVER SOFT ROADS AND THROUGH WOODS AND FIELDS

Addition to Hartford Waterworks System Augments Daily Supply by 30,000,000 Gallons

Pipe Line, Tunnel and Conduit Through Exceptionally Rough Country Links 9,000,000,000-Gal. Reservoir with Existing System

BY MEANS of a 42-in. cast-iron pipe line, 36,660 ft. in length, 3667 ft. of concrete conduit and 2333 ft. of tunnel, already completed and in operation, the city of Hartford will link its new 9,000,000,000-gal. reservoir with its existing waterworks system at West Hartford, thereby making available, from a drainage area of 39 sq. miles, an additional daily yield of 30,000,000 gal. of water.

The reservoir is a natural basin, situated on high ground near the town of Collinsville. Two dams, one across the Nepaug River and another across Phelps Brook, which are the direct feeders, will impound the flow of these streams and complete the closure of the basin. Construction on both of these dams was started in the early summer of last year, and, at present, is well under way.

CAST-IRON PIPE LINE

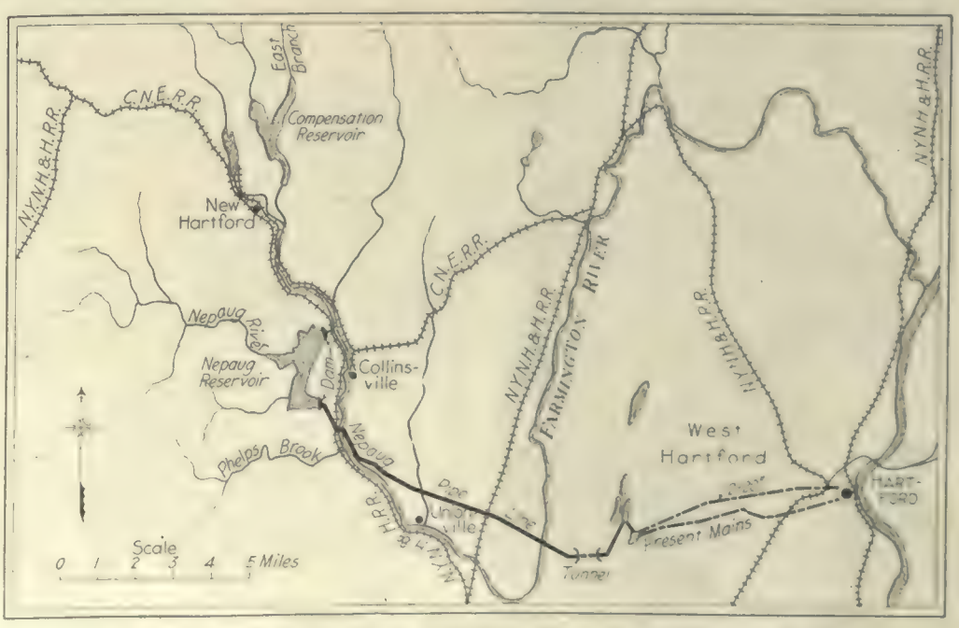
The cast-iron pipe line connects with the reservoir at the Phelps Brook dam and runs in a generally easterly direction across very rough country, and twice under the Farmington River, for a distance of 39,660 ft., discharging, at length, through a transition section into the concrete conduit. The big problem in connection with the pipe-line construction was the hauling and distributing of the pipes. The line, in general, ran perpendicular to the existing roadway, through wooded country and up and down very steep hills. The trucking was done by a sub-contractor who used two 3-ton and one 5-ton motor trucks and three horse-drawn trucks with four horses for each. It was the original intention to have the motor truck carry the pipe from the railroad to the points where the line intersected the established roadways, and log platforms were built at these points so that they could be unloaded from the motor truck and taken up by the horse-drawn trucks with a minimum expenditure of labor and a complete avoidance of delay to either. The motor trucks, however, showed up so well on a few tryouts, when they were driven over the soft meadow lands and the cleared passages through the woods, that they were used almost exclusively. The motor trucks generally carried the pipe all the way from the railroad tracks to the points along the line at which they belonged.

Although apparently a very simple proposition, the work of carrying the pipe line across the Farmington River at the two points where it intersected proved a very expensive and time-consuming operation. At the upper river crossing, near Burlington, the bed of the stream is composed of boulders, nigger-heads, smaller stone and gravel. As the pipe was to be laid at a bottom grade of about 8 ft. below the bed of the river, cofferdams were necessary for carrying on the work. It was considered inadvisable to attempt the driving of piles, so two parallel cribs of round logs, cut from a site near the work, were thrown out from the west bank to a point about 100 ft. into the stream and bulkheaded. These cribs were about 6 ft. wide and were spaced with an inside clearance of about 7 ft., then weighted down with stone. The guides for the sheeting were fastened on to these, a sheeting of 2-in. plank was set up ready for driving, and the interior of the dam was unwatered. A gang of excavators sufficient in number to cover the whole length of the trench, was put to work inside and, as the trench was sunk, the sheeting was driven down with mauls behind it. No difficulty was experienced until a depth of 3 ft. was reached. Then the diggers ran into a bed of fine, running sand which greatly resembled quicksand in its action and proved very difficult to handle. As fast as the material was removed, new sand would rise up from the bottom and refill the space that was made.

FIRST COFFERDAM WASHED OUT

Later developments showed that the flowing sand was caused by the weight of the cribs resting so close alongside, which pressed the material out under them and up into the trench. At first it was attempted to deal with this troublesome condition by keeping about 1 ft. of water on the bottom all the while, but, though successful to a certain degree, this method was soon abandoned, and the slow but certain method of keeping it weighted down with sand bags and digging over very small sections at a time adopted. By such means the trench was lowered to grade and made ready for the pipe. The bottom was not considered stable enough for a foundation for so heavy a pipe, so it was decided to stiffen it or to confine the sand. The river, however, after less than 24 hours of rain, rose to flood height and carried the cofferdam out.

By this time it was already late in the fall and, as the Farmington is a very uncertain stream during the winter months, no further work was done on the crossings until the following spring. Then, the upper crossing was attempted again in exactly the same manner as before, with the exception that the cribs were built wider, were more heavily weighted, and were spaced farther apart. The sheeting used in this dam was 4-in., tongued and grooved, and was driven by steam-hammers instead of by mauls. After very nearly six months of work, two sections of the crossing, each about 100 ft. in length, were completed. On the third, and remaining section, which was somewhat under 100 ft. in length it was decided to try a different method. Instead of parallel cribs, close alongside, it was decided to run the cribs off at an angle, on both sides, from the completed section so that, at the points where the shore was reached, the upstream crib would be about 70 ft. away from the trench and the downstream crib about 40 ft. away. This method proved entirely satisfactory. Once unwatered, the wider area was easily kept dry to as great a degree as was desira-



WATER FROM NEW RESERVOIR IS CARRIED TWICE UNDER FARMINGTON RIVER

ble and the sinking of the trench and the carrying on of the construction work was no more difficult than would have been the case had the work been carried out through similar conditions on dry land. For a foundation under the pipe at this crossing a floor of reinforced concrete was placed over the whole bottom between sheeting, and the sheeting was left in place up to the bottom of the river, with the walings also in place and cross-braced.

LOWER RIVER CROSSING

The work at the lower crossing, near Farmington, was a comparatively simple matter. The stream at this point is about 200 ft. in width and the upper stratum of the bed is of a stiff, self-sustaining clay. Two rows of piles were driven at this crossing on 8-ft. centers and about the same distance apart. The guides for the sheeting were bolted to these and the line carried across in two sections. A single row of 4-in. tongued and grooved sheeting, driven by steam hammer, was used for these cofferdams. Loose, running sand was encountered at this crossing also, but it was deeper down and not of so troublesome a nature, owing, doubtless, to the fact that there was no great weight on each side forcing it into the trench. A foundation, similar to the one at the upper crossing, was placed across the bottom at this crossing and the same height of sheeting was left in place.

CONCRETE CONDUIT

The concrete conduit was built in an open cut which reached a maximum depth of 30 ft. before suitable material for the tunnel headings was uncovered. The structure itself is horse-shoe shaped, 5 ft. high and 4.75 ft. in width, with a thickness at invert and arch, at its crown, of 6 in. Expansion joints were placed every 30 ft. and water stops of ingot iron, 6 in. wide by 5/16 in. thick. were embedded at the end of each section. The arch was built on collapsible steel forms and the outside was formed with ribs and wooden lagging. The concrete was mixed by a gasoline power mixer. Proportions were 1 to 6.

TUNNEL

The tunnel excavation was undertaken from each end and from a shaft sunk about 600 ft. east of the west portal. The material encountered consisted of sandstone for about 700 ft. and trap rock for the remainder. Considerable water was encountered, mostly from seepage and continuous dripping, but in several places considerable inflows came in through crevices in the rock.

As the inflow generally came from the entire length of the tunnel, it was found possible to put in the invert without an underdrain. The bottom was kept rather low and filled to subgrade with broken stone. Rather soft concrete was placed on this and worked into it. On top was placed, to the required depth, the invert masonry of rather stiff mixture and kept about half an inch below finished grade. After this had had a chance to stiffen, it was floated with a finished coating wall compacted with wooden screeds and worked to a smooth finish. To keep water from the invert during construction permanent sand bag dams were placed upstream from the work and the inflowing water backed up and forced out through the conduit above. The concrete work was started from the shaft so that, by backing the water above out through the conduit, the concrete work on



CONDUIT FROM PIPE LINE TO TUNNEL

the invert proceeded downstream, forcing all water ahead.

Arch construction was first started on narrow lagging laid against ribs placed as near together as necessary to prevent bulging. The face of the concrete, however, was found to be quite rough, due to the spaces between the lagging, and also to the mortar running out and leaving voids. To obviate this the sections of lagging were covered with thin sheet iron with satisfactory results. Concrete was mixed in the proportion of 1 to 8 except in the key where a 1 to 6 mixture was used.

At one point in the tunnel the rock in the northerly side suddenly ended and instead there was found a pocket containing a mass of loose, coarse and well washed gravel. This pocket extended about half way across the tunnel and to a length of about 32 ft. Exploration of the deposit showed that it was undoubtedly a pot hole in the shale formed by a preglacial stream and subsequently filled with glacial detritus. On account of this condition it was necessary to timber the section heavily and the side walls of the tunnel were made thicker.

This work was done for the Board of Water Commissioners of the city of Hartford, for which Caleb M. Saville is chief engineer. The pipe line was constructed by the Hanover Contracting Company of New York City, and the conduit and tunnel by the Stobough Contracting Company of New York City. Work on the Nepaug dam is being done by Fred. T. Ley & Company of Springfield, Mass., and that on the Phelps Brook dam by the Pierson Engineering & Construction Company of Hartford, Conn.

Marysville Filters Handle Excessively Turbid Water

By C. C. YOUNG
Director, [Water] and Sewage Laboratory, State Board of Health, Kansas

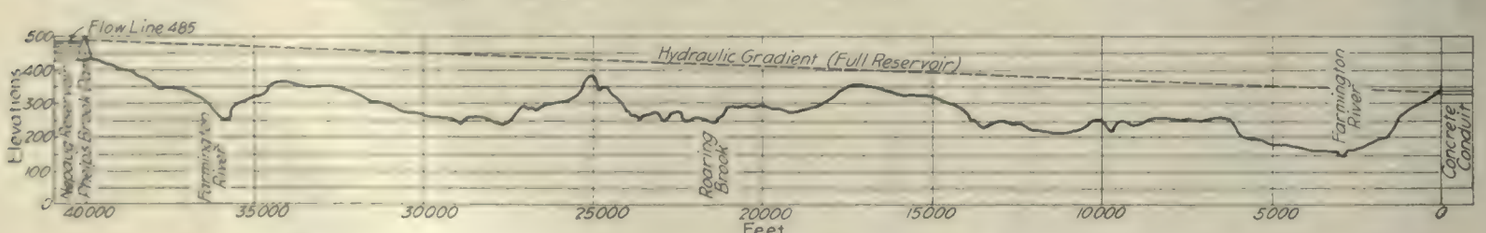
DURING the high water of June a most unprecedented burden was put upon the filter plants of Kansas. As extreme conditions of operation are always of interest to engineers I believe that the condition of the Blue River at Marysville, Kan. and the results of operation of the purification plant owned by the Marysville Light, Power & Water Company on the date of June 21, 1915, should be reported.

The plant was designed by Worley & Black, consulting engineers, Kansas City, Mo. There are two concrete filtering units, each of 110 sq. ft. area, designed to operate at 2 gal. per square foot per minute. Standard Pittsburgh filter equipment was used throughout in the construction of this plant. The two settling basins have a capacity of 63,000 gal. each and can be operated in series, or parallel, as desired. At that time they were being used in series, and the coagulant was introduced at the raw water inlet and the outlet of the first basin. The total dose of 8 grains of aluminum sulphate per gallon was divided, 5 grains at the raw water inlet and 3 grains at the outlet of basin 1. As the alkalinity was reduced only 36 parts per million, it is evident that one-half of the chemical was absorbed by the mud.

The day these samples were taken 180,000 gal. of water were filtered in about 8 hr.,

REPORT OF THE WATER AND SEWAGE LABORATORY OF THE STATE BOARD OF HEALTH, ON MARYSVILLE FILTER PLANT, JUNE 21, 1915

Source	Bacteria per cc. Agar 37 deg. 24 hr.	Gelatin 20 deg. 48 hr.	Lactose Peptone Bile Number of Positive Fermentations 1–10 cc. sample	5–1 cc. sample	5–0.1 cc. sample	5–0.01 cc. sample	5–0.001 cc. sample	Alk. p. p. m. ($CaCO_3$)	Turb. silica std p.p.m.	Suspended solids p.p.m.	Turb. coef.
Raw Water	27,000	Liq.	+	5+	5+	5+	5+	40.	75,000	98,000	1.3
Coag. & Settled	350	1,000	+	3+2—	1+4—			4.	80		
Filtered	15	100	+	1+4—				4.	clear		
Tap	13	80	—	5—				4.	clear		



PROFILE SHOWS GRADES FOLLOWED BY PIPE LINE FROM NEW RESERVOIR TO CONDUIT

thus allowing 6.3 hr. for the deposition of the mud in the basins. This condition of the river continued for 5 days and during the whole period the turbidity was less than 100 parts per million when delivered to the filters. The filtered water was clear and always contained some alkalinity. At one time it was necessary to dose 11 grains per gallon of aluminum sulphate with alkalinity of raw water less than 40 parts per million, yet 4 parts per million of alkalinity was the least amount recorded in the filtered water.

This plant has only been in operation since last November, and as this is the first bad water it has had to handle I think it is remarkable that it succeeded in removing this suspended matter at a rate of approximately 400 tons per million gallons.

THE FIRST WHOLE CARGO OF STEEL to be shipped through the Panama Canal in the United States coastwise trade passed through the canal, July 5, on board the steamship George Hawley from New York to San Francisco and Portland. The shipment amounted to 3849 tons.

Rotary Screens Remove Macro-Organisms from Denver's Lake Water Supply

New Plant and 6 Miles of 48-Inch Wood Stave Pipe Increase Conduit Capacity to 400 Gallons per Capita Daily

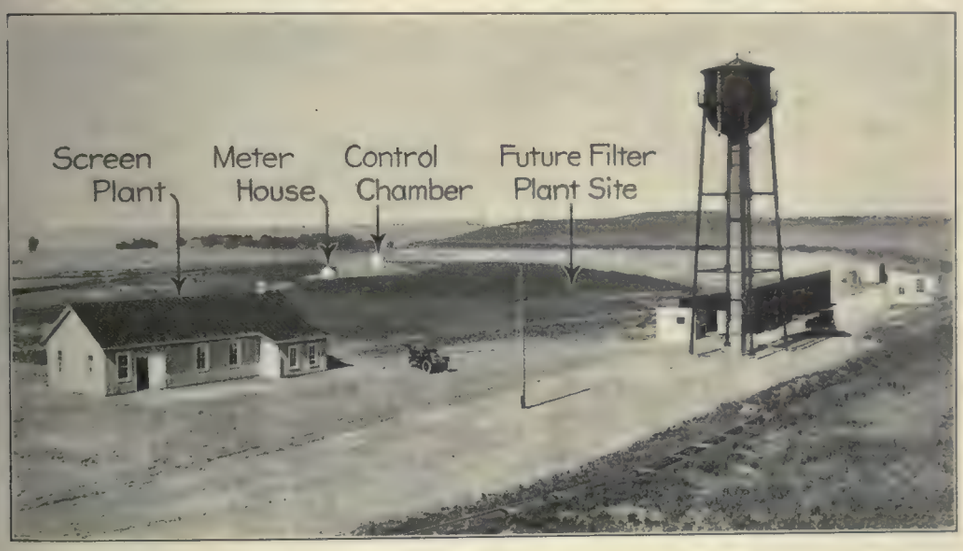
FOUR cylindrical water screens, motor driven and water washed, were put in operation by the Denver Union Water Company at Marston Lake in July to remove algae, crustaceae, and larger vegetable growths from Marston Lake water. Avarice for water in Denver has been increasing so rapidly this season that the consumption touched the 75,000,000-gal. daily mark in July. The 48-in. wood stave pipe, 6 miles long, from Marston Lake to the distribution system, making any consumption over 65,000,000 gal. possible, has just been completed and enables the company to maintain the head in all the distributing reservoirs so that no complaints of low pressure are made in any part of the city.

All waters entering the city are filtered or collected from underground galleries, but for the supply to this conduit it was concluded to install the screening and sterilization plant, at least for the time being, as an additional supply. The removal of the crustaceans, larger forms of algae and "moss," mostly chara, is practically a necessary preliminary treatment for filters. Marston Lake has been the great distributing storage reservoir for Denver, for many years receiving water from Bear Creek during the non-irrigation season and from Lake Cheesman and the Platte River continually. From the south end through rapid filters 20,000,000 gal. are drawn and from the north end, nearest the city, it had always been the intention to lay a main to the city. In 1892 when the embankment at that point was raised to 40 ft. height an outlet tower was erected for future use and is now connected up to the screening and hypochlorite sterilization plant. The new conduit was briefly noted in the Engineering Record June 5, page 715.

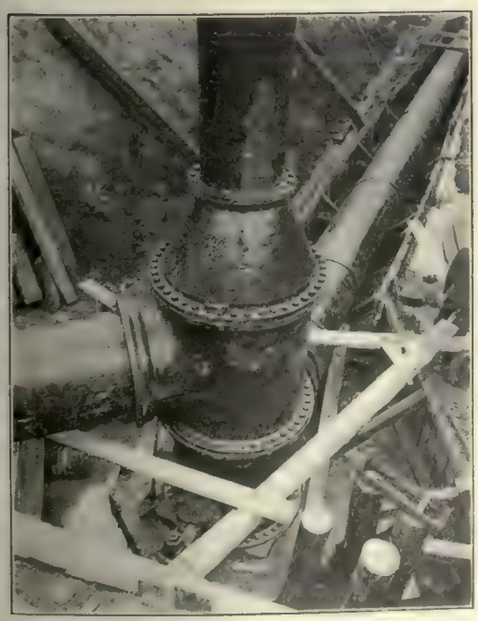
SCREEN PLANT

Built to screen 20,000,000 gal. of water daily this unique installation, which is a partial adaptation of screens used in the paper mill industry, consists of a concrete basin 25 x 50 ft. in plan by 7 ft. deep. Longitudinal division walls near the center of the basin form four 5 x 14-ft. 9-in. compartments for the screens. At the inlet end a float-controlled 42-in. shutter valve maintains a constant head of water between this point and a controlling well at the head of the 48-in. conduit, 1800 ft. away. A screen of 1-in. mesh prevents fish from getting to the rotary screens.

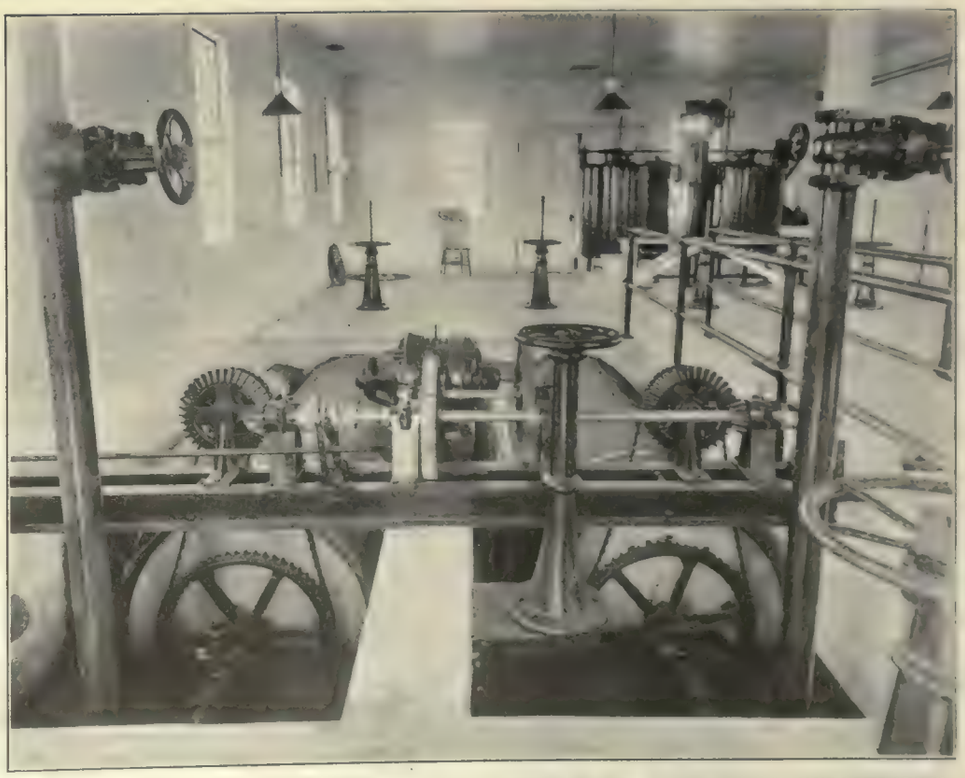
The rotary screens, each 10 ft. in length, consist of structural steel frames of six



GENERAL RELATIONSHIP OF STRUCTURES FOR SCREEN AND STERILIZATION PLANT AT MARSTON LAKE



COMBINED RISER AND ANGLE SPECIAL FOR CONNECTING STEEL AND CAST-IRON PIPE



TWO OF THE FOUR ROTARY SCREENS—WASH TROUGHS ARE AT LEFT AND HYPOCHLORITE PLANT IN FAR END OF ROOM

2 x 2 x ¼-in. horizontal tees and six ½ x 2-in. bands of 42-in. diameter around which 40-mesh brass wire cloth is secured. The upstream end is bulkheaded and the lower end is open. Water enters outside the screen, passes through and out the end, about one-half of the surface only being submerged. A water-tight joint at the lower end is formed by a felt packing strip riding on a brass bearing band. By means of individual clutches one or all of the screens can be rotated by the 3-hp. motor. It is the intention to revolve the screens only for washing, but it is possible to gear down the motor and rotate the screens continually. A sterilization plant is located beyond the screens.

Wash-water enters the inside of the screen through the hollow bearing of the bulkheaded end. A 2-in. pipe perforated with 3/16-in. holes spaced on ¾-in. centers is located close to the screen about 10 in. above the normal water surface. The orifices discharge through the screens into a longitudinal hooded trough. This feature enables the screens to be cleaned without removing the water from the compartment or stopping operation.

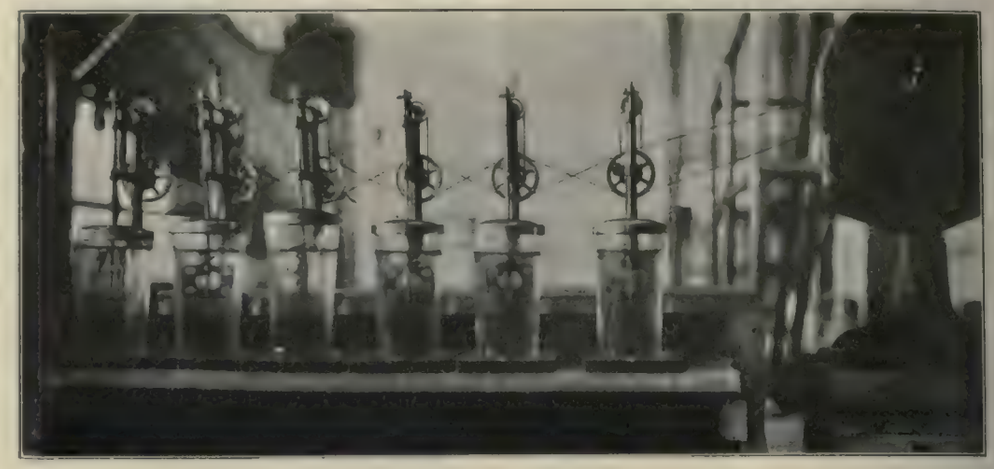
Although the screens are designed primarily to remove the relatively large vegetable forms like chara, some experiments with fine mesh sieves indicate that cyclops will pass through an 80-mesh screen and will be retained by a 100-mesh screen. One or two of the screens will be fitted with these fine screens while the amount of water passed through the plant is so much below the designed capacity. The loss of head, now practically nothing, would probably be too much to put through the entire 20,000,000 gal. daily, particularly when the "moss" is running.

Bacterial efficiencies obtained by the screen and sterilization plant follow:

Date		Lb. av. cl. used per million gal.	Bacteria per cc. after 48 hr. Raw		Bacteria per cc. after 48 hr. Treated	B. Coli in 10 cc. Raw	B. Coli in 10 cc. Treated
July	13	2.54	[illegible]	—	13	—	—
	14	2.62	500	—	1	—	—
	17	2.57	2000	—	11	+	—
	21	[illegible]	850	—	16	—	—
	29	2.69	650	—	15	—	—
	31	2.42	450	—	11	—	—
Aug.	3	2.48	300	—	7	+	—
	4	2.44	350	—	14	—	—

When the dike was raised in 1892 a tunnel was driven through the ridge out into the lake so that the future pipe could draw water from the lower levels. The outer end or intake was like a manhole and was sealed by a 300-lb. cover, 4 ft. in diameter with a lifting ring. The ring, made of 1-in. metal, was found rusted off and a diver from Chicago had to be summoned to raise the cover. He did this in a very few minutes by prying it off with a crowbar. The cover was under no pressure as water was pumped from the gate house into the conduit to equalize the pressure from the outside. The location of the intake, 1100 ft. from the gate house in the center of the dike, was so accurately determined by means of two transits set at the opposite ends of a base line that the diver landed on the intake the first time down.

All of the work was carried out for the Denver Union Water Company under the direction of D. G. Thomas, chief engineer. The Roberts Filter Company furnished the plans and built the screen and sterilization plant. The American Bridge Company erected the 20,000-gal. wash-water tank, and the work incidental to the pipe connections was done by company forces.



PADDLE-WHEEL CHURN MIXING MACHINE FOR LABORATORY TESTS

Whipping Chemicals Into a Colloidal Water Increases Efficiency

Six Paddle-Wheel Churns and an Intricate Chemical Mixing Box Aid Kansas Engineers in Study of Proper Preliminary Treatment

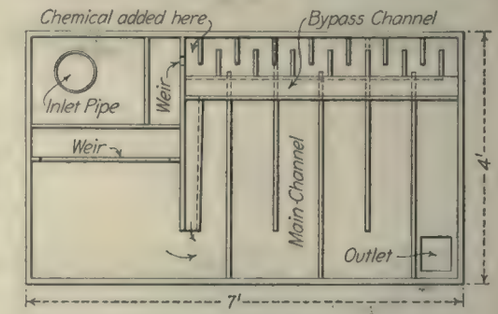
COAGULATION experiments on the colloidal Neosho River water pumped to the rapid filter plant at Burlington, Kan., indicate that whipping the chemicals into the water materially reduces the amount necessary to obtain a satisfactory flocculation. Tests covering a month's time were made at this 1,000,000-gal. daily filter plant, built in 1913, to get specific data as to the proper preliminary treatment to give the water, which is subject to sudden and extreme turbidity changes. A reduction in cost of chemical was also sought. The Burlington plant was chosen because of the flexibility of the layout from an operating standpoint and because, in previous tests made by State Board of Health officials, the efficiency of the chemicals was shown to be very low, the reduction in alkalinity being only 2 parts per million per grain of alum fed instead of the theoretical value, 8.3 parts. This condition occurred at times when it could not be accounted for altogether by the turbidity content. The plant is manned by competent operators and these tests were not made as a result of poor work by the plant but to promote economy and efficiency.

DIFFICULT TO GET GOOD FLOC

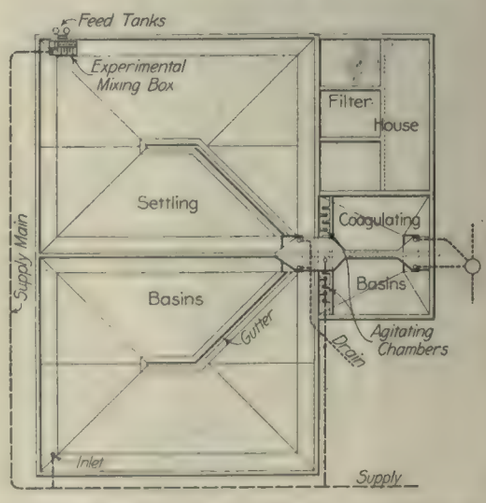
The plant consists of two settling basins, 66 x 70 ft. in plan and 12 ft. in depth, operated in parallel; two coagulating basins holding 32,500 gal. each; and two gravity filter units 12 x 14 ft. in plan equipped by the New York Continental Jewell Filtration Company. The special feature is in the design of the mixing box and agitating chambers. The latter are 4 ft. deep, 3 ft. wide, and have concrete baffle-walls 18 in. apart, extending within 1 ft. of either wall. The rapid passage of the water by the baffles after the violent mixing in the agitation chambers usually resulted in an excellent floc before the water passed half way through the agitating chambers. The wash-water average has been 5.1 per cent of the total amount. On the average 1.23 grains per gallon of aluminum sulphate have been used, varying from 0.5 to 3.5 grains. However, Mr. Whistler, the superintendent, reports that at times it was difficult to get a good floc regardless of the amount of coagulant used. The tests indicated that this was probably due to the suspended clay cutting down the efficiency of the alum and to the high CO_2 content, characteristic of this water. Other than this difficulty with the alum the complete tests made in 1914 by the State Board of Health reported the plant to be in excellent condition.

BUTTER CHURN AGITATOR

To solve any further difficulties extended tests were carried out in July and August of this year. For the laboratory tests a mixing machine, made up of six paddle-wheel churns, was arranged, as shown in one of the photographs, to be turned by one



DETAIL OF THE BAFFLED MIXING BOX



RAPID FILTER PLANT, SHOWING LOCATION OF EXPERIMENTAL MIXING BOX

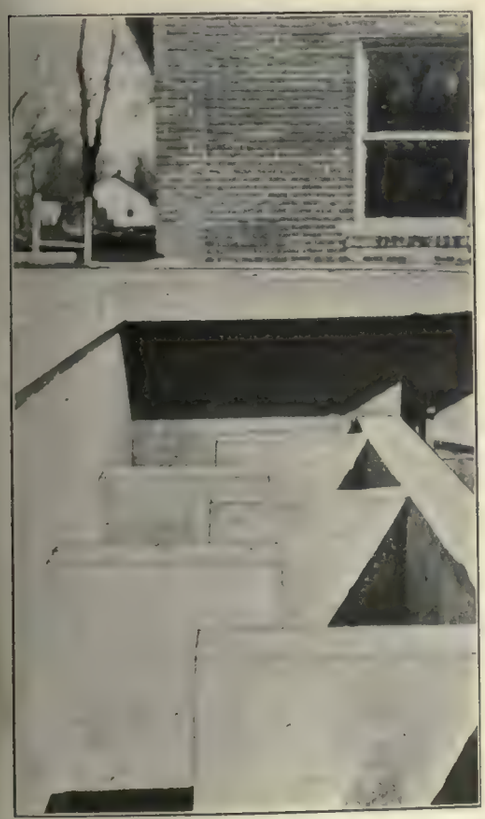
belt from a water motor. Any paddle speed and any length of mixing period could be applied to six samples at one time.

For tests on chemicals in the basins a wooden mixing box, also shown in one of the photographs, was built to mix the chemicals thoroughly before reaching the settling basin. The box consists of an entrance well with a stilling box enclosed in it and outlets formed by Cippoletti weirs, a large baffled channel leading to the basin and a small baffled channel leading to the entrance to the main channel.

In using the box a portion of the water was by-passed through the small baffle chamber and treated with the entire dose of chemical, thus securing the extra time of mixing and also securing a more dilute solution of chemicals. It was the idea that the more dilute the form in which the chemicals were fed into the water, the more complete would be the reaction with the alkalinity in the water. The time of mix in the small channel was about 25 sec. and in the large channel it was about 20 sec. The velocity was 1.5 ft. per second in the small channel and 1 ft. per second in the large channel.

Turbidity readings were taken over the basins after tests with each system of coagulation, and charts were made showing the distribution of turbidity.

Any change in the level of the river was



CONCRETE BAFFLES IN AGITATING CHAMBER OF COAGULATING BASIN

quickly noticeable in the character of the water pumped. The water dealt with had the following average chemical content for factors most important for this test: Alkalinity, 76 to 224 parts per million—all bicarbonate, $CaCO_3$; CO_2, 6 to 8 parts per million. The calcium content was approximately five times the magnesium content.

Alum and Lime and Iron Expensive

Potash alum and aluminum sulphate were used in tests with the mixing machine, but aluminum sulphate only was used on tests on the basins. In the laboratory tests no advantage could be found in using the more expensive potash alum. The smaller amount of available alumina easily accounts for this fact.

It was found that on using sufficient amounts of alum, excellent results could be obtained in holding down the sediment in the basins, but the efficiency of the alum was low. At times of excessive turbidity it was difficult to get desired results. The cost of feeding large amounts of alum into the very turbid water was the thing that was desired to be overcome. The plan of feeding a large amount of alum at the entrance to the settling basins and then a minimum amount at the entrance to the coagulating basins was tried, but the results were not good. A reasonable amount of alum did not hold down the sediment in the settling basins, and the reduction in alkalinity showed plainly that much of the alum was not taking effect. In addition to this the relatively high amount of CO_2 in the raw water is not beneficial to the quick forming of floc from alum.

Tests with lime and iron were run in the hope of forming a coagulant with a greater specific gravity than alum floc, and one which would go further toward holding the sediment down when being fed in small amounts. The system had the disadvantages of requiring two separate feeding devices and constant attention, as well as incurring the risk of corrosion of the filter strainers and incrusting of the sand grains in the filters. It was intended to feed a small amount of alum just before the water reached the filters to prevent as far as possible the latter action from taking place.

As in the case of the alum the lime and iron did good work when used in sufficient amounts, but to keep within a reasonable cost of chemical it would have been necessary to add such small quantities that practically no benefits would have been obtained.

In this test, however, it was noted that on adding lime in excess of the theoretical amounts, much better results were obtained. In fact the reduction in turbidity seemed to depend more on the excess of lime added than on the amount of ferrous sulphate used.

Lime Alone Efficient

Tests were run with plain lime treatment both on the basins and with the mixing machine. The results of the tests indicate, that for this particular water the plain lime treatment followed by a minimum dose of alum to form a floc and to form enough CO_2 to decompose what carbonates had been bound, gives best results. In the settling basins it was found that, considering cost, the lime was as efficient as the alum, or lime and iron, in the removal of turbidity, and in addition left the water in better condition for the final addition of alum. Lime, however, would not remove color.

The bicarbonate alkalinity of the water would not be changed until the CO_2 was used up, then it began to drop on the addition of more lime until it was completely removed. The carbonate alkalinity rose steadily until the saturation point, approximately 30 parts per million, is reached. In practice it was not unusual to find 40 to 50 parts per million carbonate showing a super-saturated condition. This was probably due to the formation of magnesium carbonate along with the calcium carbonate.

In the addition of alum the CO_2 set free on the formation of the aluminum hydrate, reacted with the carbonates in the water to form bicarbonates, and the water going on to the filters was found to be devoid of CO_2 and carbonates. The bicarbonate alkalinity was reduced from 15 to 20 parts per grain of alum added. In the presence of carbonate and in the absence of carbon dioxide the floc formed more quickly and more completely, thus the alum dose could be reduced materially.

One grain of alum at Burlington costs approximately the same as 2 grains of



APPLYING CHEMICAL TO SMALL BAFFLED CHAMBER OF MIXING BOX

lime, which will allow this treatment to be used generally at the same cost as alum alone. The results will be better in that (1) the CO_2 will be removed; (2) the water will be partially softened; (3) the danger from incrusting the sand grains will be avoided as all the carbonate is removed before the water enters the filters.

The general significance of the results obtained, as set forth by the engineers making the tests, is that it is possible by the use of lime to prepare a similar colloidal water for treatment with alum, so that the amount of alum necessary is small, and the total chemical cost is much less than when alum alone is used. The lime itself does not remove the colloidal condition in the water, but it prepares the water so that the only duty for the alum to perform is to remove the colloidal condition, the color and to form the necessary floc for proper filtering.

The tests were made by Black & Veatch, consulting engineers, of Kansas City, designers and builders of the plant.

THE EARTH WORK DIAGRAMS mentioned under "New Publications" in last week's issue were prepared by C. A. James, resident engineer of the Lehigh Valley Railroad at Buffalo, and not by C. A. Jones, as stated in the announcement.

California Oil Pipe Line, 200 Miles Long, Built in Record Time of 15 Months

Route Crossed Mountainous Country at Great Altitudes—Pipe-Screwing Machine Aids Rapid Progress—Sixteen Pumping Stations Installed

BREAKING all California records for speed of construction, an oil-carrying pipe line 8 in. in diameter and 150 miles long, with a 54-mile branch, to Mojave, has been built in 15 months from the oil fields of the San Joaquin Valley to San Pedro, the newly completed seaport of Los Angeles. The conduit reaches altitudes never before attained by lines carrying heated California oils and is served by sixteen pumping stations, the larger ones having a capacity of 1000 bbl. of oil per hour against a pressure of 800 lb. per square inch. Twenty-five miles of the line crosses mountainous country, where heavy snow impeded progress. Water was scarce in the dry season and roads had to be built to deliver materials to the work from railroad stations 60 miles distant. Added to these troubles of a purely construction nature was the difficult task of obtaining right-of-way franchises in the vicinity of Los Angeles and San Pedro. Oil pipe lines in California now occupy a conspicuous place on account of the recently enacted laws clothing them with all the duties and responsibilities of common carriers. The line described in this article is owned by the General Pipe Line Company, and while not the largest line in the State, is one of the most important.

The line was not built as a custom line or a common carrier, but to carry the oil of the General Petroleum Company to a seaboard and market. If required, it will have to comply with the conditions the new laws impose and accept other producers' oil for transport under such rates and rules as may be approved by the Railroad Commission of California.

The General Petroleum Company and its early subsidiaries had been acquiring and developing oil lands in the Midway, Sunset, Belridge, and Lost Hills oil fields, and was rapidly coming to the front as an oil producer. In 1911 it found that when the development work then under way was completed it would be producing probably more than 15,000 bbl. of crude oil daily and that steps should be taken to provide independent means of oil delivery from fields to market.

San Pedro had just been annexed to Los Angeles and was attaining prominence because of the probable favorable influence of the Panama Canal, the excellent railway facilities, the expenditure of millions of dollars by the U. S. Government for a breakwater, and the construction of wharves by the city of Los Angeles and private interests. A pipe line terminating at San Pedro would open up to the company the markets of the Orient, Alaska, Puget Sound, Columbia River, San Francisco, Mexico, and the west coast of South America, and upon the completion of the Panama Canal the markets of Europe and east coast of North and South America would give new opportunities.



ROUTE OF OIL PIPE LINE AND LOCATION OF PUMPING STATIONS

In addition, there are large manufacturing industries and electric power stations around Los Angeles, with an active growing local market accustomed to the use of oil fuel supplied partly from other parts of California and partly by several small local oil fields, some of which were apparently approaching exhaustion.

SURVEYS OF ROUTE MADE

Reconnoissance surveys, therefore, were made to determine the feasibility of a pipe line route from the oil fields to San Pedro. A line was finally located through the Tejon Pass, which lies 16 to 20 miles east of a direct line, and which crosses two summits, one of 4222 ft. and the other of 2716 ft. The line, as located, ascends the Tenyo Creek from the San Joaquin Valley to Tejon Pass, El. 4222, descending the valley of Piru Creek and then boldly crossing the divide, El. 3716, between Piru Creek and Castiac Creek, and following Castiac Creek to Sangus, from which point the main highway was followed to Los Angeles. At the summit in San Fernando Pass a short tunnel was used. Through the city of Los Angeles a right-of-way was obtained on the property of the Atchison, Topeka & Santa Fé Railway, and after considerable difficulty and expense franchises were obtained permitting the laying of pipe alongside the county roads in Los Angeles County and through San Pedro, a part of Los Angeles City. Careful study indicated that with pumping stations properly located, a pipe line could be satisfactorily operated over the route laid out.

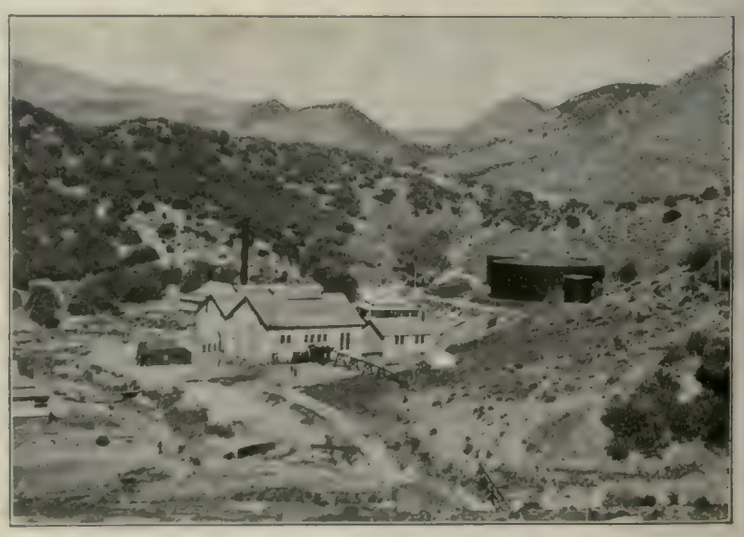
The final located line commences at North Midway pumping station in the north end of the Midway oil-field and runs southwest through the Midway and Sunset oil-fields to Pentland, thence east to the Tenyo Creek and over the line previously described to Los Angeles and San Pedro. It is 152 miles long and laid with 8-in. pipe. A 54-mile 8-in. branch line runs from Lebec pumping station to Mojave for the purpose of delivering oil to the Atchison, Topeka & Santa Fé Railway for locomotive fuel and for shipment to points in Arizona and New Mexico, by this means avoiding the expensive railroad haul from Bakersfield up the Tehachapi heavy grade and over Tehachapi Pass to Mojave.

PIPE LINE CONSTRUCTION

The pipe used on the main line is standard lap-welded, open-hearth steel, weighing 29.213 lb. per foot. The steel has



PIPE CROSSES ALAMOS CREEK ON SUSPENSION BRIDGE



ONE OF THE SIXTEEN OIL PUMPING STATIONS



TWENTY MULES AND SPECIAL EQUIPMENT OF TWO WAGONS WERE REQUIRED TO DELIVER BOILERS TO PUMPING STATIONS

a tensile strength of 45,000 to 55,000 lb. per square inch. The branch line from Lebec to Mojave was laid of similar pipe, made, however, of Bessemer skelp.

The pipe received two coats of California asphaltic paint and was covered with a high grade roofing paper secured in place with wire. The average trench depth was 32 in., but in cities the trenches were made 40 in. deep. Through irregular country where many draws and ravines are encountered small trestles were installed and the pipe provided with an extra covering for mechanical protection. At some stream crossings the pipe was supported on the existing bridges. At other streams with intermittent flow where no bridges existed or permission to use existing bridges could not be obtained, a row of piles was driven, cut off below the surface of the gravel wash, and the pipe laid in a trench 4 ft. deep dug on the upstream side of the line of piles. The pipe was then surrounded by a concrete casing 22 in. square, and bolted to each pile with long stirrup bolts.

An existing highway tunnel was utilized at San Fernando Pass to reduce the summit elevation and save distance, and another short tunnel was driven to avoid a slide.

Sixteen Pumping Stations

There are sixteen pumping stations, of which fourteen are on the main line and two on the Mojave branch. Eleven stations are standard main line pumping stations, and are capable of pumping about 1000 bbl. of oil per hour at 800 lb. per square inch pressure. The remainder of the stations are fitted for special duties, such as serving refineries, loading tank cars, ships, etc.

Each main line pumping station is designed to deliver oil through a section of the pipe line, which is long or short, depending on the degree the grade of the pipe line retards the flow of the oil. The sections vary from 6 miles, ascending the mountains, to 21 miles, descending.

At least one 37,000-bbl. tank is installed at each station, which when kept full, provides for 18 hr. operation of the pumps in the event of repairs being undertaken on the pipe line back of that point. Water is stored in a 500-bbl. tank, and two 100-bbl. tanks are used to store and measure the oil taken for fuel purposes.

The high duty pumping unit consists of a 26 and 42 x 36-in. cross-compound Corliss engine manufactured by the Allis-Chalmers Manufacturing Company, connected by a Scotch yoke to a special design 6½ x 36-in. four-plunger oil line pump, manufactured by the Dow Pump & Diesel Engine Company. The reserve unit is a duplex compound direct-acting 22 and 38-in. 9½ x 36-in. oil line pump, manufactured by the Jeanesville Iron Works.

The oil ends of both units are identical except as to diameter of the plungers; the interchangeability of cylinders, valves, valve fittings, discharge piping and other parts, necessitates only a small stock of spare parts. All cylinders, valve fittings and discharge piping are made of cast steel and were shop tested at 2000 lb. per square inch. The machinery was all erected by company engineers, many of whom were later made operating engineers.

The pipe line is continuous past the stations, which may be by-passed if desired. Normally a branch line leading to the storage tank is used. The oil delivered into the station tank is drawn out again from any level by means of a swing pipe and after being conducted through two heaters to the pumps, is forced through the next section of the line. A branch line is provided so that the oil can be conducted directly to the heaters and pumping station without entering the tank.

Each station consists of a 54 x 100-ft. steel frame building covered with corrugated iron, containing the boilers and pumping machinery. In the engine room are two large pumping engines, one being an economical high-duty, cross-compound crank-and-flywheel pumping unit, and the other a direct acting duplex compound unit. Normally the first unit is operated and the second unit reserved for emergency service, but either can operate the line to full capacity. The exhaust steam from the main pumping engines is conducted to heaters and raises the temperature of the oil sufficiently to increase its velocity to the required degree by increasing the fluidity of the oil.

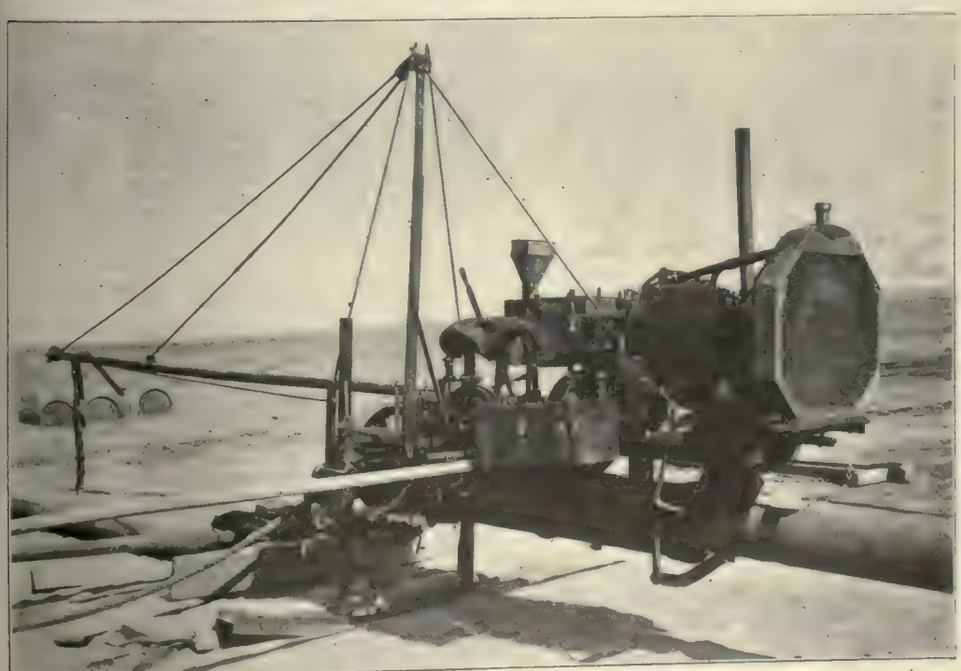
Construction Difficulties

The construction of the line presented many difficulties due to rough country, absence of roads, sandy soil, scarcity of water, and hot summer climate. Practically all supplies needed were brought in by mule teams from the railroad—lumber, brick, food, camp equipment, cement, feed for stock, and gasoline for auto trucks. A contractor was engaged to do the hauling and pipe laying. On the main line work he started hauling with auto trucks, which quickly cut the unsurfaced roads so as to make their further use impracticable. Nearly all of the hauling had to be done by mule teams, over 600 animals being used for several months. On the Mojave branch line, motor trucks were successfully used as this work was done almost wholly during the summer season.

As far as possible trenching machines were used to dig the ditch for the pipe, and on the long desert stretches very rapid progress was made. Hand work was necessary only in the mountainous part of the line.

Machine Screws Pipe Sections

A very ingenious pipe-screwing machine was developed by the contractors, and consisted of a frame supporting a 40-hp. four-cylinder automobile engine, which rotated



AN INGENIOUS MACHINE, INVOLVING A FOUR-CYLINDER AUTOMOBILE ENGINE, SCREWS JOINTS OF 6000 FEET OF PIPE DAILY

a pipe gripping chuck, in some respects similar to the chuck of a pipe machine. The whole machine, as shown in one of the illustrations, was mounted on rollers resting on the pipe along which it was moved by power from coupling to coupling of the pipe line as the pipe screwing progressed. The finished pipe was supported on skids laid across the pipe trench until coated. A friction drive in the transmission mechanism between the engine and the clutch insured against screwing the pipe too tight. Each machine when well handled was capable of screwing daily an average of about 6000 ft. of 8-in. pipe.

Fifteen months elapsed from the date of commencing work to the delivery of oil at San Pedro, which is a record performance on California pipe line construction. The right-of-way and pipe laying operations were handled by R. E. Maynard. David Dorward, Jr., mechanical engineer, had charge of all pumping stations and their equipment. Sanderson & Porter were the consulting engineers and members of the advisory committee of the interests that financed the project.

St. Louis Does Not Need to Increase Its Water Rates

ALTHOUGH the water consumer in St. Louis has paid $92.73 per 1,000,000 gal. for water that has cost $103.37 for the last eleven years, E. E. Wall, water commissioner, in his annual report, estimates that the decreased expenditures required for the next seven years will be sufficient to more than make up any deficit. Each year for the last eleven years the expenditures exceeded the collections by $98,227.72, the loss being made up from accumulated surplus. This is the period during which purification has been a factor of expense in supplying water to the city. Heavy construction expense will decrease and an average of only $888,902 for new construction, including interest and sinking fund, will be required, an average decrease of $332,133.53 per year. This will reduce the average cost of supplying water by $12.59 per 1,000,000 gal. below the $103.37 cost during the last eleven years, and produce a revenue of $1.95 in excess of the past cost.

San Diego Has Second Largest Pressure-Type Filter Plant

SAN DIEGO'S filter plant is the second largest of the pressure type in existence, having a capacity of 10,000,000 gal. daily. The twenty filters are of the horizontal Continental Jewell type. Ten of the twenty filters are new and the remainder have been rebuilt from existing filters removed from Chollas Heights to the Lower Otay reservoir, according to H. A. Whitney, hydraulic engineer, as stated in his latest annual report. An air wash and hydraulic valves have been installed in the new plant and the wash-water is pumped back into the storage reservoir.

PERMITS TO USE WATER FOR IRRIGATION or Power in Oregon are summarized in a report recently issued by the State Engineer's office. In the last quarter 196 permits were issued which involved the construction of a total of 248 miles of canal, the irrigation of 21,164 acres of land and the development of 4254 hp.

Concrete Cut from Actual Structures Stronger than Field-Sample Specimens

Relatively Low Averages for Many Test Cylinders Poured on Subway Construction Work Reported by R. E. Goodwin

CONTINUOUS testing of field samples is being carried out on the New York subway construction work by the materials testing laboratory of the Public Service Commission of the First District, New York. Regular standard methods have been adopted and put into practice in the testing of the aggregates and of the field samples poured on the work, and laboratory specimens made for comparisons. Results based on about 800 test cylinders have been averaged, and figures are given for 1:2:4 concrete at the ages of 28 and 90 days, classified in terms of various aggregates, both coarse and fine, of the consistency, and of machine versus hand mixing. It is noteworthy that the average value for these standard 8 x 16-in. cylinders at the age of one month is only about 1500 lb. per square inch.

TABLE 1—TESTS OF 1:2:4 FIELD CONCRETE IN 8x16-INCH CYLINDERS MADE BY N. Y. PUBLIC SERVICE COMMISSION, FIRST DISTRICT

(The same tests are shown tabulated under different headings to show the effect of various conditions. There were three specimens in each test.)

	20 DAYS OLD		90 DAYS OLD	
	Average, lb. per sq. in.	No. of tests represented in average	Average, lb. per sq. in.	No. of tests represented in average
Average of all tests	1560	149	1850	119
Coarse Aggregate				
Hudson River dolomite	1760	8	1980	8
Long Island beach gravel	1650	33	2040	24
Hudson River trap rock	1570	27	1910	23
Hudson River limestone	1490	5	1830	5
Long Island bank gravel (washed)	1490	72	1810	60
Fine Aggregate				
Long Island beach sand	1710	39	2040	27
Long Island bank sand (washed)	1590	76	1850	64
Sand excavated on the work	1370	27	1790	25
Consistency				
Medium	2670	1	....	....
Wet (stiff enough to keep coarse aggregate from settling to bottom)	1880	60	2100	52
Very wet (coarse aggregate settles to bottom)	1470	82	1790	63
Extra wet (soupy)	1200	11	1520	8
Mixer				
Machine	1590	124	1880	104
Hand	1450	19	1790	16

In addition, field samples have been cut from the actual structures, dressed and tested. The results exceed the values for the same concrete poured in cylinders, apparently confirming the claim sometimes made that concrete in the structure is stronger than concrete in the form of test specimens.

SPECIMENS AND TESTS

The regular standard 8 x 16-in. cylinders were poured from the concrete going into the work, sometimes even being taken from the concrete in the forms. A simple form of mold was made by splitting an ordinary 8-in. iron pipe longitudinally on one side (to allow removal after the concrete had set) and using two iron bands with bent ends and bolts for tightening. The specimens were left two days on the job, then stored in the moist room and sprinkled every few days.

The specimens cut from the structure were finished to 6 x 6 x 12-in. dimensions on the rubbing table of a stone-cutting yard. They were cut out when the structure was two months old from designated parts, selected before the concrete had been placed in the forms. From the same batches of concrete other test specimens were cast in molds of the same size and some were stored in moist sand on the work, others in the moist room. In addition, samples of the cement and aggregates were taken to the laboratory and similar specimens were there mixed in the same proportions used in the field. These specimens were all tested at the age of 90 days. Those that were made on the work were machine mixed, and those made in the laboratory were hand mixed. The average weights in pounds per cubic foot were: Concrete cut from structure, 147; concrete from the same batch cast in molds, 150, and concrete made in laboratory from the same materials, 151.

RESULTS FOR CYLINDERS

Table 1 gives the averages of the results to date for the compression tests on standard cylinders of concrete poured on the work, and includes only the tests made under satisfactory conditions in accordance with standard practice. In general, each test is the average of three specimens, and the result of any test which differed more than 50 per cent from the average was excluded. The averages including erratic values were slightly in excess of the averages given.

Since a large number of variables existed to affect the strength of each test, and no series was run in which only a single factor was the controlling variable, the averages shown for different conditions are not conclusive, but are at least suggestive. It is apparent from this large series of results that at the age of 28 days standard cylinders of field concrete averaged only about 1500 lb. per square inch compressive strength. The relative values for coarse and fine aggregates are given in the order of strength, Hudson River limestone and the washed gravel giving the same low values, and sand excavated on the work rating lower than the Long Island sand. The low values for very wet and extra wet consistency should be noted. The results for the relatively small number of hand-mixed specimens average 10 per cent below the machine-mixed values. However, the variations above mentioned make relative percentages of little value. The increase of the general average at 90 days over that at 28 days is 18.5 per cent.

EFFECTS OF FROST

The above averages include specimens made in cold weather. With the exception of specimens which were frozen, these were found to be as strong as specimens made in warm weather. Specimens which showed frost marks in the interior when broken averaged 730 lb. per square inch at 28 days (ten tests) and 1170 lb. per square inch at 90 days (ten tests). These frozen specimens are not included in the averages given.

Investigations were made to determine what relation exists between strength and weight per cubic foot. Specimens of different aggregates showed no general increase of strength with weight, and it seems impossible to predict the strength

from the weight. Even among specimens of the same materials, the heaviest was the strongest in not more than 50 per cent of twenty-five tests examined.

FIELD-CUT CONCRETE STRONGER

Table 2 gives the results of the test of 1:2:4 standard cement, sand and gravel concrete specimens 6 x 6 x 12 in. in size tested at the age of 90 days. The curing conditions are given, and the results are seen to average considerably higher for the concrete cut from the structures than for the test specimens—8 per cent higher than specimens of the same concrete stored in moist sand on the work and 26 per cent higher than those stored in the moist room, while 30 per cent and 40 per cent higher respectively than laboratory specimens stored similarly.

The head of concrete above the specimens cut from actual structures, while they were setting, varied from 3 ft. to 15 ft., and the superiority of these specimens over those cast in molds may have been partially due to this circumstance. The specimens which were subjected to the greatest heads were not the strongest, however.

Results are given in Table 3 for some tests of miscellaneous concrete pieces cut from structures and tested at various ages. It is seen that one rough-dressed specimen gave a relatively low value at the age of fifteen months. The smooth dressing of the field-cut specimens probably influences favorably the test results.

Alfred Craven is chief engineer, Robert Ridgway is engineer of subway construction, and George L. Lucas is general inspector of materials for the Public Service Commission. R. E. Goodwin, who furnished the foregoing data, is in charge of tests of concrete and concrete aggregates.

TABLE 2—COMPRESSION TESTS OF CONCRETE CUT FROM ACTUAL STRUCTURES AND CONCRETE CAST IN MOLDS
(Size of specimens 6x6x12 in.; 1:2:4 concrete, 90 days old; all strengths in pounds per square inch)

Cut from 12-in. wall	Same batch poured in molds and stored on work	Same batch poured in molds and stored in moist-room	Consistency	Same materials mixed in laboratory and stored on the work	Same materials mixed in laboratory and stored in moist-room	Consistency	Fine aggregate	Coarse aggregate
4 av. 3095	4 av. 2880	4 av. 2870	Wet	4 av. 2135	4 av. 2080	Wet	Long Island beach sand*	Long Island beach gravel
4 av. 2410	.....	4 av. 1720	Very wet	4 av. 2225	4 av. 1930	Wet	Long Island washed bank sand	Long Island washed bank gravel
4 av. 2415	2 av. 2585	3 av. 2060	Wet	4 av. 1980	4 av. 1705	Wet	Long Island beach sand*	Long Island beach gravel
4 av. 2760	4 av. 2020	4 av. 1775	Very wet	4 av. 1900	4 av. 1910	Wet	Logn Island beach sand*	Long Island beach gravel
16 av. 2670	10 av. 2480	15 av. 2110		16 av. 2060	16 av. 1910			

If concrete 90 days old be assumed to be 25 per cent stronger than the same concrete 28 days old the corresponding totals for 28 days would be approximately as follows:

2150	2000	1700	1650	1550

*Coarse and well graded, not the very fine sand usually described as "sea-beach sand."

TABLE 3—TESTS OF CONCRETE CUT FROM ACTUAL STRUCTURES

Strength, lb. per sq. in.	Proportions	Age	Description	Fine aggregate	Coarse aggregate	Consistency
1=4250	1:2:4	127 days	6-in. Cube	Sand	Gravel	Wet
1=1870	1:2:4	15 months	8½x8½x17 in. rough dressed, not polished	Long Island washed bank sand	Long Island washed bank gravel	Very wet
3 av. 3340	1:2½:4½	30 months	6x6x12 in.	Cow Bay sand	Gravel	.....

FUNDS FOR IMPROVING AND MAINTAINING ROADS in California totaling $1,793,680 have been turned over to State and county authorities by the State motor vehicle registration department. This money represents receipts from automobile and motorcycle registrations during the fiscal year just ended. The apportionment of expenditures from the fund in the various counties will be made in accordance with the amount each has contributed. The widely different conditions are shown by the variations in revenue; the amount contributed from Alpine County was $87, while Los Angeles County's share was $604,443.

Frost 16 Feet Deep Found Under Refrigerator Plant

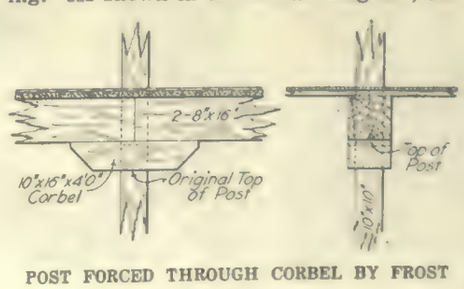
Continuous Operation of Refrigerating Machines for 19 Years Lowered the Frost Line Many Feet and Caused Floor Upheaval

By J. NORMAN JENSEN
Architectural Engineer, Chicago

SOME REMARKABLE RESULTS of continuous refrigeration and frost action have recently been brought to the attention of the writer or revealed during investigations into the causes of noticeable upheavals of building floors. The most unusual case occurred in a refrigerator plant in which the apparatus had been in operation for about nineteen years. At one footing near large coils of ammonia pipes the depth of frozen earth was found to be 16 ft., while a frost depth of 7 or 8 ft. was commonly found throughout the investigation.

The case in question is that of a building in the produce section of Chicago. About a year ago the owner was notified by the building authorities to strengthen the floors of the building. These floors were very much out of level, being bowed up around the columns as much as 10 in. in some cases. It was a puzzle to know how the floor was supported, as some of the girders seemed to be without visible means of support. The conditions found in one case are shown in the accompanying figure. The posts, girders, and corbel were all of yellow pine. Originally the bottom of the corbel rested on the top of the post. The post had been forced upward into the corbel, so that it came within an inch of the post above, almost shearing off the corbel.

An investigation was made to determine how it was possible for a post of this size to be forced through 9 in. of yellow pine. The old basement floor was uncovered to obtain information in regard to the footing. As shown in the second diagram, this floor consisted of a number of layers of flooring with strips between, and a concrete and asphalt sub-base.

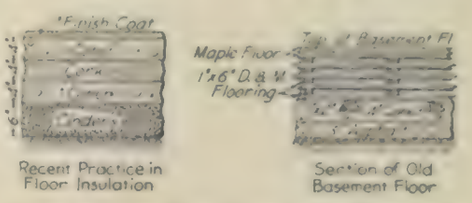


POST FORCED THROUGH CORBEL BY FROST

RESULTS OF INVESTIGATION

The earth beneath the old basement floor was thoroughly frozen, and filled with small ice crystals. It was decided that the upward movement of the post could only have been caused by the heaving of the frozen ground underneath the footing. Orders were issued that new footings would have to be put in beneath the frost line under each post.

Excavating for these new footings showed that the frost line was anywhere from 1 to 16 ft. below the bottom of the old basement floor. The extreme depth of 16 ft. was encountered under a post which was alongside a partition in the basement.



Recent Practice in Floor Insulation — Section of Old Basement Floor

PROGRESS IN FLOOR INSULATION PRACTICE

The basement was partitioned off into a number of small rooms, in which were stored butter, eggs, apples, and other commodities. The temperature in these rooms varied with contents, but was only about 15 deg. Fahr. at the time of the investigation. A search was made for the cause of the great depth of frost encountered, and it was learned that immediately above the footing where the greatest depth occurred were especially large coils of ammonia pipes, so that the temperature at this point was much lower than anywhere else. It was also learned that there had been an old well about 7 ft. deep adjoining this footing.

EFFECTS ON WALLS

As a result of the unequal frost action underneath the wall footing, the walls had been heaved more in the middle than at the ends, and were badly cracked. They had to be anchored and thoroughly tied to prevent them from falling into the street.

It seemed strange that the earth should be frozen even 7 or 8 ft. as commonly found throughout this investigation. The temperatures had never been extremely low, as even in the coldest weather it had never been below zero in the rooms. This frozen condition of the ground, winter and summer, could only be accounted for by the fact that the refrigerating machines providing the low temperature in the store rooms had been in continuous operation for nineteen years.

In conclusion, it is of interest to note recent practice in the insulation of the basement floors of refrigeration plants. The bad design used in the old basement floor represents too big an inroad on the coal pile of this plant. The left figure of the accompanying diagram gives the practice of architect B. H. Jillson of Chicago. This detail has been used in the construction of a number of cold storage plants throughout the country.

THE FIRST STEEL RAILS FOR ALASKA'S new Government railway are en route to Anchorage, Alaska, where they will be used in the construction of yard tracks.

Draw Span of Harlem River Bridge Floated to Place

Old Span Removed at 5.45 A. M. and New 1100-Ton Double-Deck Four-Track Span Floated In and Put in Service by 12.42 P. M.

ON the high tide at 8 a. m. Sunday morning, Aug. 22, the new double-deck 1100-ton draw-span of the rebuilt bridge which carries the Second and Third Avenue elevated lines across the Harlem River in New York City was floated in place on four barges and lowered with twenty-four sand jacks. The first train was run over the new span at 12.42 p. m.

The two double-deck approach spans were placed in the same manner on Feb. 22 and March 7, as described on page 341 of the Engineering Record for March 31, 1915. On the same falsework used to erect the approach spans end to end, the new draw span was built. Its erection was practically finished last May, and it was first planned to place it at that time. The use of the upper deck for the new express service, however, depended on the completion of other improvements in the elevated roads, which will not be ready for train service until next month. As it was found that several changes in the operating machinery of the new span would be desirable, these changes were therefore made without any delay to the operation of the new system, and the draw span was not put in place until they had been completed.

On Saturday afternoon four large barges were floated into four bays in the falsework, two under each end of the draw span. On them had been erected timber bents carrying sand jacks, the 3-ft. square timber pistons of which were fastened to the grillage of 24-in. I-beams which capped the falsework and on which the span had been erected. As the tide rose this grillage and the bridge with it was picked up. Several tension members of the span had been stiffened with wood, as the operation of raising the span by its ends put them in compression.

The barges were started out at 6 p. m. by sets of falls pulling from the falsework and the shore ends of the barges, and operated by hand. Several snub lines were used, these precautions being needed because of the scant clearance between the barges and the falsework, and the very narrow channel into which the span was floated between the falsework and the fender pier of the Willis Avenue bridge. As soon as the span was clear, it was towed upstream and tied



NEW SPAN BEING LOWERED TO PLACE

up for the night at the company's dock on the Manhattan side of the river just below the elevated railway bridge.

TWO BARGES LIFT OLD SPAN

With the next rising tide, shortly after 2 a.m., two barges were set, one under each end of the old draw span. The bents erected on them came to a bearing as the tide rose, when the scows were jacked down to an additional displacement of about a foot, with eight hydraulic jacks. The final lift which cleared the old span from the piers was made with the tide. The old span was floated and towed out at 5.45 a. m. It was tied up temporarily to the New York, New Haven & Hartford Railroad's dock opposite the company's dock. It was removed to the company's dock later in the morning. Here it will be dismantled by two derrick boats working from the ends in.

The new span was swung across the steam and towed up into place as soon as the old span was tied up. While these operations were going on, two "jinny-winks," one mounted on the upper deck of each of the approach spans, set the wedges and shoes on the end piers. The ring segments for the center pivot had been previously installed inside the rim bearing of the old span on the center pier, which bearing was supported on a steel frame from the rim of the pier while this work was done. The new pivot casting and discs were assembled on the deck of a derrick boat which was tied up west of the center pier. As soon as the old span was out this derrick boat removed the old rim spider and its temporary support, and set the new pivot casting.

NEW SPAN ADJUSTED

The new span was adjusted in exact location with wire ropes and steamboat ratchets, and timber guides were bolted from its end posts to those of the approach spans. At 8.55 a. m. the first sand was let out of the jacks. Lowering with the jacks and the tide continued until about 11 a. m. When the 5½-ft. drop of the jacks was exhausted the span had been landed and the barges had risen almost to their light displacement. The falling tide permitted the removal of the scows in a short while, the north pair, the last to be removed, being towed clear at 11.45 a. m.

The bridge was then swung for the first time, when it developed that an angle on the end wedge failed to clear the shoes at one end of the bridge by the specified amount. This angle was readily removed and trimmed. The operating mechanism of the bridge worked perfectly, and 12.42 p. m., as soon as the track crew and electricians had completed the last end connections on the lower deck, the first train was allowed to pass over the bridge.

The walkway on the east side of the bridge, the end panels of which had been removed on all the spans to lessen the chance of interference, were replaced during the day by crews working with the jinny-winks.

A feature of the operation was the precision with which the three tugs handled their unwieldy tows in the cramped quarters of the Harlem River. There was no interference, no bumping and no loss of time. The spans and barges moved exactly as it was intended they should, and the whole change went through as planned, without anything that could be called a hitch.

Construction on the section of the Manhattan elevated improvements in which the bridge is located is being carried on by the forces of the Terry & Tench Company, Inc., under H. D. Robinson, engineer, and W. L. Cline, superintendent. The entire work on the elevated lines is being designed and supervised by the Interborough Rapid Transit Company, of which George H. Pegram





TIDE ABOUT TO LIFT NEW SPAN FROM ERECTION FALSEWORK—OLD SPAN FLOATED OUT, THE NEW SPAN IS BEING PLACED

is chief engineer, F. W. Gardiner, principal assistant engineer, and S. Johannesson, general assistant engineer. Bernard O'Rourke is assistant engineer in charge at the bridge. E. J. Govern, vice-president of the T. A. Gillespie Company is in general charge of construction on the Manhattan elevated improvements for the contractors, who are the two companies mentioned and the Snare & Triest Company.

Increased Radius of Curb at Street Corners Aids Traffic

AT most street intersections the radius of the curb at the street corner is such that a motorist desiring to turn the corner finds it impossible to describe an arc of turn that will enable him to maintain a moderate rate of speed and still keep his machine on the proper side of the pavement while turning into the cross street. The radius of the curb curve is usually but little over 1 ft.; hence the driver cannot commence to turn until he has practically passed the corner. Increasing the radius of the corner curve to 12 or 14 ft. will permit most types of cars to turn a corner at the same distance from the curb as when driving down the street.

Changes such as suggested by the accompanying pictures have been made at several street intersections in Chicago, notably at Lincoln Parkway and Diversey Boulevard, and at Devon and Evanston Avenues. Without such construction a driver turning into an intersecting street would have to cross its center line and could not pass two cars coming toward him. Increasing the radius of the curve permits the driver to follow the arc of the curb and thus keep to the right of the center line of the street where he properly belongs. Such an improvement is particularly desirable on boulevards or where other streets intersect with boulevards. It is likewise desirable at intersections of narrow streets.



LEFT — INCREASED CURB RADIUS ALLOWS EASY TURNS



RIGHT—SHORT RADIUS CURVES HINDER TRAFFIC

ADMINISTRATION EXPENSES of the Board of Water Supply of New York City, to the end of 1914, had amounted to nearly 1.07 per cent of the cost of constructing the city's new water supply. The total sum spent for administrative purposes since the projects were launched in 1905, according to the Board's annual report for 1914 has amounted to $1,313,419.57. This does not include engineering expenses for surveys, plans and immediate supervision of the work.

Missouri Utility Commission Requires Pure Water

Filtration, Sterilization and Technical Analysis Recommended—Meter Accuracies and Periods of Service Limited

SPECIAL RULES regulating gas, electric and water utilities laid down by the Missouri Public Service Commission will go into effect Oct. 1. They apply to municipalities as well as to private plants. The special references to water contain strict provisions as to the quality, meter accuracy and test limits, fire service and pressure. All water for domestic use must be free from disease-producing organisms or injurious chemical or physical substances, and must be agreeable to the eye and nose. Water which rarely shows the presence of members of the B. coli group and which has a reasonably low bacterial count under the usual standard test methods will ordinarily be considered safe from the standpoint of disease-producing organisms.

Filtration of surface waters is recommended and sterilization is considered advisable for all water furnished. Utilities are urged to employ water analysts in a consulting capacity to make frequent tests. When this is not feasible tests are to be made at least twice yearly, preferably in the late spring and early fall. The commission reserves the right to require an extended examination at any time. Results must be kept on file for public inspection.

In all towns of 2500 inhabitants or more a graphic recording gage must be maintained. Dead ends in mains are to be avoided. Meters may show no more than 5 per cent error. Tests must be made on ⅝-in. meters at least every ten years or after passing 100,000 cu. ft., ¾-in. after eight years or after passing 150,000 cu. ft., 1-in. meters after six years or after passing 300,000 cu. ft. All meters above the 1-in. size must be tested every four years. Upon request the utility must make a test free provided the meter has not been tested within the previous twelve months. The laboratories of the State University school of engineering are made the referee. Tests cost $2 each for sizes under 1 in. In case the meter is fast beyond the regulation the utility pays the fee; otherwise the consumer settles. Meter testers are to be maintained by each utility furnishing cities of 3000 people or more.

Chicago Autotruck Service Reduces Hauling Charges

Transportation Section in Water Department Maintains General Delivery Service—Monthly Average Costs Per Ton-Mile Given

AUTOTRUCK hauling costs have averaged 13 cents per ton-mile with a 5-ton truck and have varied from 14 to 32 cents per ton-mile with a 2-ton truck, in the Department of Public Works, Chicago. Under contract by teams in 1914 the average was 26.9 cents per ton-mile, and hauling by teams hired by the day was still higher, according to the latest annual report of John Ericson, city engineer. He concludes that motor trucks are economical and efficient when properly handled, that hauling of certain materials by contract is advisable, and that teams hired by the day are not efficient.

The departments equipment consists of one 5-ton and three 2-ton Pierce-Arrow trucks operated under the direction of the superintendent of pipe yards.

A system of delivery of material has been

COST OF OPERATING AUTOTRUCKS

	Mileage	Ton-miles	Operating expense	Cost per day	Cost per ton-mile
5-Ton Truck No. 1					
July	824	1931	$259.28	$9.97	$0.134
August	838	1914	257.05	9.88	0.134
September	723	1744	237.96	9.91	0.136
October	902	2045	267.19	10.28	0.13
November	1014	2299	300.78	13.07	0.13
December	950	2339	293.52	12.33	0.125
2-Ton Truck No. 2					
July	911	926	210.16	8.40	0.227
August	934	1017	209.89	8.40	0.205
September	800	948	197.69	8.98	0.201
October	1091	1044	225.79	8.36	0.216
November	1111	1256	189.54	7.90	0.15
December	589	536	159.69	11.41	*0.31
2-Ton Truck No. 3					
July	721	770	192.74	9.13	0.25
August	930	908	208.78	8.70	0.23
September	725	631	191.94	9.14	0.30
October	1038	864	218.97	8.11	0.25
November	1039	470	162.32	7.06	*0.345
December	778	651	254.79	10.62	*0.40
2-Ton Truck No. 4					
July	816	478	201.34	9.15	0.42
August	973	792	221.04	9.21	0.27
September	948	778	211.69	8.82	0.272
October	891	769	217.99	9.08	0.283
November	1097	1155	187.19	8.14	0.16
December	974	983	182.56	7.02	0.186

* The high ton-mile cost on Truck 3 for November and December is due to the character of service, which consisted of small loads, long hauls and an excess of loading time. The same is true of No. 2 truck for December.

instituted so that it was unnecessary for the district foreman to send to the yards for material. Regular deliveries are made to the district yards and the cost of hauling such material has been greatly reduced. As far as possible all pipe and material are delivered directly to the job on which it is to be used. The efficiency of this system of deliveries has been made possible by the use of the motor trucks which were purchased early in the year. The costs of operating the trucks have been reported monthly and a summary of this data is given in the accompanying table.

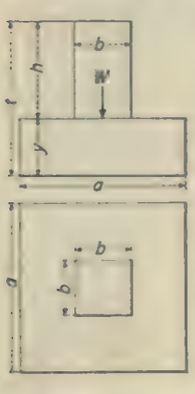
Reinforced-Concrete Footings Economically Designed

Equations Derived for Computing Dimensions of Single Slab and Pedestal to Give Minimum Volume When Shear Governs Design

By N. M. STINEMAN

Engineering Department, Chicago, Milwaukee & St. Paul Railway, Chicago

IT IS very seldom, perhaps, that any attempt is made to proportion column footings so that they will contain the minimum quantity of concrete required for the work to be done. Reinforced-concrete footings consisting of a bottom slab and a pedestal occur quite frequently in practice. The depth of the bottom slab is usually determined by the punching shear induced by the tendency of the pedestal to "punch" through the slab. Formulas 1 and 2, when the value of the allowable punching shear is inserted, will give at once the dimensions required for the minimum quantity of concrete in the entire footing, without the necessity of resorting to the usual cut-and-try method.



The following notation will be used in the derivation of the formulas: W = total load at base of pedestal; p, unit soil pressure in pounds per square foot (the weight of the bottom slab being disregarded); v, allowable punching shear in pounds per square inch; h, height of pedestal in inches; t, total height of footing in inches; y, computed depth of bottom slab in inches, giving the minimum quantity of concrete in the entire footing, for selected values of v; a, one side of square slab in inches; b, one side of square pedestal in inches; $4by$, punching shear resisting area (hence $v = W/4by$ and $b = W/4vy$); Q, quantity in cubic inches of concrete in slab and pedestal.

In the above notation, W and p are known in any given case; t is known in any given case, since the elevations of the top of the pedestal and the bottom of the slab are likely to be established by outside considerations; $h = t - y$; a is determined from the required slab area, and b can be found after y is computed.

The total quantity of concrete in the footing may now be written

$$Q = b^2h + a^2y$$

But $b = W/4vy$ and $h = t - y$; hence

$$Q = W^2(t - y)/16v^2y^2 + a^2y$$

Differentiating this equation with respect to y and writing the first derivative equal to zero, the result is

$$y^3 + (W^2/16a^2v^2)y = W^2t/8a^2v^2$$

But $a^2 = 144W/p$, so that the equation may be written in the convenient form

$$y^3 + (Wp/2304v^2)y = Wpt/1152v^2 \quad (1)$$

And as previously stated,

$$b = W/4vy \quad (2)$$

After the selected value of v is inserted, equation 1 may be readily solved by trial, with the assistance of a table of cubes and a slide-rule.

Equation 1 shows that the bottom slab may be either square or rectangular. If the pedestal is rectangular, it should have a perimeter equal to $4b$.

EXAMPLE

The following example illustrates the use of equations 1 and 2:

Given a column load of 245,000 lb., an allowable soil pressure of 5000 lb. per square foot, an allowable punching shear of 90 lb. per square inch, and a total depth of 7 ft. 6 in., find the dimensions of a footing of the type shown, so that the quantity of concrete will be a minimum.

In this case $W = 245{,}000$, $p = 5000$, $v = 90$ and $t = 90$. Substituting these values in equation 1, the value of y is found by trial to be 21.8 in.; and from equation 2, the value of b is 31.2 in. Actually, the values of y, b and h may be taken at 22, 32, and 68 in. respectively.

The bending moment in the bottom slab must also be computed, but in this case, as usual, the depth of the slab is determined by the punching shear, even though the latter has been taken at a high value.

Thirty Miles of Chesapeake & Ohio Northern Begun

First Link of Chesapeake & Ohio Extension to Columbus Runs Northward from Parent Road and Includes Sciotoville Bridge

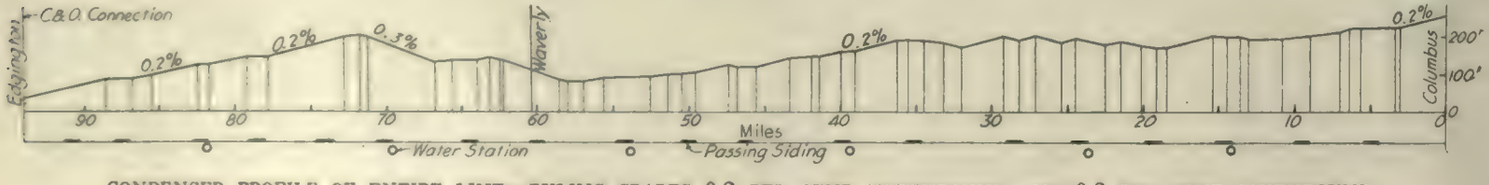
THE GENERAL FEATURES of the bridge being built over the Ohio River at Sciotoville, Ohio, were described in the Engineering Record of June 26, page 799. This bridge is the principal structure on the Chesapeake & Ohio Northern Railway, the 94-mile subsidiary of the Chesapeake & Ohio Railway to be built from Columbus, Ohio, to a junction with the main line of the latter system on the Kentucky bank of the Ohio River. At present only 30½ miles are under construction—from a temporary connection with the main line 1½ miles north of the ultimate junction at Edgington, Ky., to a temporary connection with the Norfolk & Western Railway at Waverly, Ohio.



WORK NOW UNDER WAY, AND ULTIMATE EXTENSION TO COLUMBUS

The route and condensed profile of the work now under construction and the continuation north to Columbus are shown in the accompanying drawings. The section now being built opens up new territory from 6 to 8 miles east of the Norfolk & Western, but from Waverly north the new road will closely parallel the latter line, remaining, however, on the east side of the Scioto River for the entire distance. With the exception of steeper temporary run-off grades at the ends of the line the ruling gradients will be 0.2 per cent northbound and 0.3 per cent southbound. The sharpest curves will be 2 deg. and the total curvature will be 1098 deg., for entire line of 94 miles. As the profile shows, the line is laid out with 6000-ft. passing sidings averaging 4½ or 5 miles apart. Of the six water stations contemplated, two come on the 30-mile section now being built.

Apart from the Ohio River bridge, the



CONDENSED PROFILE OF ENTIRE LINE—RULING GRADES 0.2 PER CENT NORTHBOUND AND 0.3 PER CENT SOUTHBOUND

present work involves fourteen railroad bridges and six overcrossings for highways. One of these is a 1080-ft. viaduct over the Little Scioto River. Culverts will be reinforced-concrete box structures.

The main quantities involved are as follows: Earth excavation, 3,000,000 cu. yd.; rock excavation, 590,000 cu. yd.; concrete, 52,000 cu. yd.; reinforcing steel, 500,000 lb.; timber piling, 40,000 lin. ft.; cast-iron pipe, 700 tons; structural steel, 33,000,000 lb. All but 4,000,000 lb. of the steel is required for the Ohio River bridge.

The grading work, including the masonry for the smaller structures, was let to four contractors. It is expected that tracklaying

The Chesapeake & Ohio Northern Railway Co.

_____ Division

MONTHLY SUMMARY SHEET

Mile _____ to _____ Incl.

Estimate No

Total work done to date including month of _____ 191_

Correct _____

	CONTRACTORS							
	Dollars	Cents	Dollars	Cents	Dollars	Cents	Dollars	Cents
Total amounts								
Retained percentage								
Balance								
Former payments								
Amount due								
EXTRA WORK NOT INCLUDED IN ABOVE								
Total to date								
Previous estimate								
Current estimate								

BACK OF MONTHLY SUMMARY FORM

will begin about August, 1916. Creosoted ties, 100 lb. rail and crushed stone ballast will be used.

ACCOUNTING FORMS

In the accounting the company is conforming to the latest requirements for valuation purposes of the Division of Valuation, Interstate Commerce Commission, and keeping the records for each mile. This involves the use of three forms, the "Monthly Current Estimate Sheet," the "Monthly Total to Date Sheet" and the "Monthly Summary Sheet." The first two are filled out by the three resident engineers on the work. The current-estimate form lists the quantities, mile by mile, on the given section; in this case there are twenty-two designated items and six blank spaces for other items. This information is then transferred by the resident engineer to the total-to-date form, which also contains in the upper right-hand corner a summary of the quantities with the unit prices applied. It also contains space for summaries of extra work.

These sheets are then sent to the general offices, and from them the accountants fill out the monthly summary sheet. The upper part of this form is reproduced in the accompanying cut. The form serves the double purpose of recording the amounts to be paid to the contractors, and the total amounts, mile for mile, chargeable to the work—the latter information being required by the Government. Below the part shown, the quantities recorded on the monthly current estimate sheet are reproduced. On the back of the form the retained percentages are accounted for in the manner shown. The company retains 10 per cent until the final settlement, setting the retainers aside each month as they become due.

The four general contractors on the work are the Rinehart & Dennis Company, Charlottesville, Va.; Winston & Company, Richmond, Va.; the Robert Grace Contracting Company, Pittsburgh, and W. W. Boxley & Company, Roanoke, Va. The work is being done under the direction of W. Michel, chief engineer of the Chesapeake & Ohio Northern Railway, Columbus. The three resident engineers are H. B. Watters, J. W. Holman and W. L. Roller, located respectively at Sciotoville, Waverly and Scioto P.O., Ohio.

Letters to the Editor

Comment on matters of interest to engineers and contractors will be welcomed

Asphalt Production in United States During 1914

SIR: A recent advance bulletin of the U. S. Geological Survey states that the output of "natural asphalt" in 1914 amounted to 77,588 tons. As the term "natural asphalt" is, in the language of the industry, exclusively applied to native bitumens such as Trinidad Lake Asphalt and Bermudez Lake Asphalt, it seems desirable to explain that as used by the Geological Survey natural asphalt includes only gilsonite, elaterite, grahamite, bituminous limestone and bituminous sandstone. In other words, the total of 77,588 tons of "natural asphalt" does not include the production of Trinidad and Bermudez, or any other natural asphalt, as this phrase is understood in the industry.

BARBER ASPHALT PAVING COMPANY.
Philadelphia.

Promoting Engineering Work

SIR: During the past month I have noticed several letters in the Engineering Record concerning the promotion or supervision of engineering projects by members of the faculties of State educational institutions. There are times undoubtedly when such work does interfere with the practice of engineers in private work, but there are also times when the failure of men in the employ of State educational institutions to step forward and look after engineering projects that concern the public would cause heavy financial loss if nothing worse.

Texas is one of the few States in the Union that has no State highway commission, and consequently road construction and maintenance in this State are in charge of local officials. In some of the counties these officials employ competent engineering advice and good work is done, but in a vast majority of the counties in Texas, the road work is carried on with little or no regard to engineering principles, and the resulting waste is little short of criminal. It is very well to sit back and tell the engineers in the employ of the State educational institutions "to mind their own business" (to quote one of your correspondents), but until the Highway Department of the Texas Agricultural and Mechanical College stepped into the breach there was absolutely no organization in the State to which county road officials could turn for advice regarding even so important a matter as the employment of a competent engineer.

It is not now, and never has been, the policy of this department to do work in competition with engineers in private practice; in fact, there are so many calls for the time of the men in this department, that we welcome any opportunity to turn work over to competent parties, but there are many cases where this is not possible. Many communities with only a few hundred dollars to spend find the overhead expense of engineering out of all proportion to the benefit received, and these we try to reach by bulletins or letters. Some county officials look with suspicion on any stranger who offers his services regardless of what his credentials are, but will gladly avail themselves of the opportunity to secure the services of a

THE CHESAPEAKE & OHIO NORTHERN RAILWAY CO
MONTHLY SUMMARY SHEET

Mile ____ to ____ Estimate No. ____ Residency Nos. ____ Division Total work done to date including month of ____ 191_

Rec.	Sec.	Mile	CONTRACT WORK AMOUNTS Current Estimate	CONTRACT WORK AMOUNTS Total to Date	EXTRA WORK AMOUNTS Current Estimate	EXTRA WORK AMOUNTS Total to Date	GENERAL CONTRACTOR	ITEMS	RATE	TOTAL TO DATE Quantities	TOTAL TO DATE Amounts	PREVIOUS ESTIMATE Quantities	PREVIOUS ESTIMATE Amounts	CURRENT ESTIMATE Quantities	CURRENT ESTIMATE Amounts
								1 Common Excav. incl. overhaul cu. yds.							
								2 Loose Rock " " " "							
								3 Solid Rock " " " "							
								4 Unclassified " " " "							
								5 Rip Rap " "							
								6 Slope Wall " "							
								7 Clearing and Grubbing 100 ft. sta.							
								8 Concrete Plain cu. yds.							
								9 Concrete Reinforced " "							
								10 Concrete Rubble " "							
								11 Steel Reinforcing in Concrete lbs.							
								12 Foundation Excav. Dry cu. yds.							
								13 Foundation Excav. Wet " "							
								14 Foundation Timber M. B. M.							
								15 Foundation Steel lbs.							
								16 Piles Railroad Heart Grade lin. ft.							
								17 Piles Railroad Yellowwork Grade " "							
								18 Iron in Pile Work lbs.							
								19 Cast Iron Pipe Tons of 2000 lbs.							
								20							
								21							
								22							
								23 Lumber Creosoted M. B. M.							
								24 Lumber Without Creosote " "							
								25 Steel and Iron in Place lbs.							
		Total													

PART OF MONTHLY SUMMARY FORM, WHICH RECORDS BOTH AMOUNTS DUE CONTRACTOR AND COST OF ROAD PER MILE

man from this department for a few days; in this case we give them the best general advice we can, but no detailed plans or specifications, and before leaving we give the names and addresses of some engineers in that part of the State with the hint that in the future some one of them will prove available.

In many instances county officials have spent road money year after year without securing any permanent results, and what is worse, have no idea that there is any better manner of carrying on the work. Private engineers have neither the time nor the money to do the necessary missionary work, but this department by bulletins, letters, road meetings and personal visits does what it can to arouse these communities and get them in step with the march of progress.

One of the most important fields covered by the engineers of this department is the preparation of preliminary reports regarding the cost of road construction in the various counties or road districts. Practically all the highways built in the State are financed by bond money, but since this money is not available until the bond election is carried and the bonds are sold, there is no money for the brief preliminary survey which is necessary in order to determine approximately how large the bond issue must be to secure the desired results. This preliminary report does not include any detailed plans or specifications, but it does give the approximate cost of grading, bridges, surfacing, etc.

To illustrate, I recently made a preliminary report for a road district in south Texas, where it is the intention to spend $75,000. After dealing at some length with local conditions of soil, climate and present road conditions I made the following recommendations regarding the spending of the money:

For engineering and supervision	$5,000
For widening right-of-way, relocation, fences	8,000
For grading	15,000
For permanent bridges and culverts	22,000
For sand-clay construction	5,000
For gravel surfacing	20,000
Total	$75,000

I further stated that this would give an adequate right-of-way on all the roads, would build all the bridges of permanent material, would grade all the roads, would put a sand-clay surface on all the stretches of sand, and would put a gravel surface on 8 miles of road that was in heavy soil.

It may be said that this report will tie the hands of the engineer that may be in charge of the actual construction, and there is some truth in that, but when an engineer goes to that community and charges them from 5 to 7 per cent for engineering and supervision, these people will not "drop dead with surprise"; when he tells them that wooden bridges and culverts are not economical he stands a fair show of being believed, and when he demands the condemnation of a new right-of-way through "Tom Jones' field or Bill Brown's pasture" in order to get the road out of a creek bottom he will find the sentiment of the community behind him. I might further state that there were three months last winter when the roads in this community were impassable, that last March a bond issue for road improvement was defeated, but that the good-roads advocates in this district by using the report mentioned as campaign material carried this bond issue in June for $75,000 by a vote of 200 for to 72 against.

There is no question but that it is hard to tell just where State aid of this character should stop, but that some such aid is needed is evidenced from the fact that within the past twelve months I have personally covered sixty-seven assignments in fifty-one different counties in this State. We further believe that our system of working is getting results and is doing no injury to anyone. I have yet to hear any real adverse criticism from an engineer, while many engineers in the State have expressed their hearty approval.

B. K. COGHLAN,
Associate Professor of Highway Engineering, Agricultural and Mechanical College of Texas.
College Station, Tex.

Freak of Tornado Near Lebanon

SIR: In passing through Lebanon, Pa., I picked up the accompanying photograph showing a freak of the tornado at Annville on Aug. 21. Trees were blown flat, many houses lost their roofs, one house had the front blown off and much local damage was done. The barn shown was completely overturned and now rests on one side of its roof.

CARL P. BIRKINBINE.
Philadelphia.



BARN RESTING ON ITS ROOF AS RESULT OF TORNADO NEAR LEBANON

How Is Glass Graded?

SIR: The writer had occasion the other day to inquire into the grading of sheet glass, as usually used in buildings in the United States in this year of enlightenment, 1915, and he finds many different descriptions of glass in architect's specifications, some referring to thickness, others to quality, but, so far, has been unable to find any architect, testing laboratory, engineer, manufacturer or manufacturer's agent who could give any written description as to what the various qualities covered. AA is AA, and a better quality than A. A is A glass; it is a better quality than B. It should be reasonably free from defects. B is a B-quality glass, and is subject to some defects. This is about as far as the information goes.

We should be very glad if you or your readers could put us wise to any recognized grading on either sheet or plate glass, either plain, factory ribbed, wired or other varieties. It would seem that those who deal in it the most are as innocent of what constitutes first quality as those to whom they sell.

ABERTHAW CONSTRUCTION COMPANY,
By J. Arthur Garrod,
General Superintendent.
Boston.

[The Engineering Record would be glad to hear from its readers on this matter.—EDITOR.]

Use for Waste Clay Products

SIR:—We have eight clay plants here and are interested in finding some way to utilize the waste products, consisting of broken brick, sewer pipe, etc., all of which is vitrified.

We have been making some inquiries with a view of crushing this waste and using it for building construction, etc. Have you any data covering experiments of vitrified clay, crushed and used in concrete instead of crushed stone? Kindly put us in touch with any experimenters who have reported their investigations along this line. Our people are dumping hundreds of carloads of this annually which should be turned into a profit, especially in sections of the country where suitable stone is not to be had. Any information or assistance in this matter will be thankfully accepted.

CHARLES W. COLLINS,
Secretary, Chamber of Commerce.
Brazil, Ind.

[Suggestions might be made direct to Mr. Collins.—EDITOR.]

CINCINNATI FACES A WATER RATE INCREASE.—The net increase of the cash balance was only $26,115.30 during 1914, making a total of $215,673.13, an amount positively needed to tide over periods of large interest and sinking fund payments, according to J. A. Hiller, general superintendent, in his latest annual report. The revenues have been used only for operation, maintenance and interest and sinking fund. No improvements have been made directly from receipts, but Mr. Hiller recommends that when the rates are raised the increase be such that a large proportion of the betterments can be paid for from current revenue rather than from borrowed money.

HINTS FOR THE CONTRACTOR

Details Which Save Time and Labor on Construction Work

Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

[*Contributions to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

Wrecked Dredge Raised from Timber Bridge Between Dump Scows

By O. S. PROCTOR
Camden, New Jersey

THE STEEL hull of a dredge boat sunk in the Delaware River at Trenton, N. J., was recently raised to the surface in halves by tackle suspended from timbers which rested on two dump scows and straddled the wreck. The dredge was a one yard machine, with a steel hull 17 x 70 ft. in plan and 5 ft. deep, made up in seven 10-ft. sections. The dipper, dipper stick, boom and boiler were first removed by a derrick boat. One diver reported the hull broken near the center and the stern portion buried in silt and covered by the wreckage of the superstructure. The bow, which was upstream, had caught logs and brush, but not much silt.

We planned to raise the boat with what scows we had available, by hitching on at low tide and floating into shallow water at high tide. The barges used were two 60-yd. dump scows and a large deck scow used to carry coal. First we located the backstays, which were attached to the hull at the stern corners. These were hitched to long U-bolts straddling the door logs of the dump scows near the center, thus getting the full lifting capacity of the scows. We allowed the stern to rise and fall with the tide several times, thus clearing the way to sweep a line under the dredge to near its center. When this line was in place, the hitch to the stern of the dredge was moved near one end of the scows, and the line which had been dragged under the scow was hitched near the other end of the scows. These hitches were straight up through the pockets, the scows riding over the wreck.



TIMBERS SPREAD DUMP SCOWS SO WRECK CAN BE RAISED BETWEEN THEM

The bow of the wreck was picked on timbers projecting over the end of the coal scow. With this arrangement the wreck was moved about 500 ft. upstream and landed on the slope of the channel. Here the dump scows were separated to straddle the wreck, and the hitches transferred to long timbers which reached from one scow to the other and bore on the door logs near the center of each boat. All the hitches were made with blocks and falls, so that the small derrick boat used could take up on the load line and raise each corner a few feet at a time in turn. The wreck was brought to the surface in this way and landed in shoal water at high tide.

When the wreck was landed on the slope of the channel, the break in the hull was completed, so that each half of the hull was taken out separately in the manner described. The wreckage and mud have been cleaned out of the two halves, and bulkheads are to be built in their open ends so that they can be floated together and the hull rebuilt.

Turntable Aids Road Contractor in Solving Hauling Problem

CONFRONTED with the problem of unloading industrial cars into an end loading mixer with track and mixer both on subgrade, an Illinois highway contractor building a State-aid concrete road north of Chicago on Milwaukee Avenue successfully solved his difficulty by placing a turntable in front of the mixer skip. About 1000 ft. from the mixer a switch is placed affording a double track to the turntable at which point the tracks are joined again by means of a frog. As a result one track can be used for loaded cars and the other for sending back empties.

As the contractor has only one engine on the job, cars are pulled to and from the turntable by a horse, the engine being used to bring the material from the railroad to the switch. Upon arriving at the switch the engine is detached and run onto the siding, picking up its train of empties. The loaded cars are then pulled by the horse to the turntable. The turntable is attached to the mixer by means of a steel strut.

At the railroad each hopper car is loaded by hand with enough sand and gravel for a batch for the 1-yd. mixer. Cement is placed on flat cars in sufficient quantities to allow six bags per car for each hopper car in a train, and is transferred at the lower end of the switch from flat cars on the siding to the hopper cars on the main track. As a rule six bags are used per batch but this is changed according to the condition of the stone. The average train consists of from fifteen to twenty cars. About sixty-five cars and 4 ¼ miles of track are in use. The dead haul is 1.6 miles and the average haul 3.85 miles.



SIDE DUMP CARS FEED END-LOADING MIXER FROM TURNTABLE

W. I. Sieber is the foreman in charge for Walter & Windes, of Glencoe, Ill., the contractors. A. F. Keehner is the resident engineer for the State, reporting to H. B. Bushnell, divison engineer.

Dynamite Safely Removed from Missed Holes with Air

BY INSERTING the end of a hose, or short length of pipe, in a blast-hole that has failed to go off, turning on a light pressure of air through a valve from the drill line, and withdrawing the pipe with the pressure on, the unexploded dynamite may be removed with safety. The work should be done with care, and too much air pressure should not be turned on. This method was advocated by Jacob S. Langthorn, in a paper read at a recent meeting of the Brooklyn Engineers' Club, in preference to attempting to drill a new hole alongside the unexploded one. The latter practice is compulsory in New York City, under section 188 of the rules of the Municipal Explosives Commission.

The paper, which outlined the effective methods used in handling explosives on the Catskill Aqueduct tunnels, and the discussion which followed, dealt with tunnel practice, where the holes in the heading are all drilled at an angle. No one can be sure where the end of such a hole, 8 or 10 ft. from the face, is located, and when one of them has missed, it was asserted, it is dangerous to drill another hole anywhere near

it. That the practice of attempting to drill a new hole in a tunnel heading where one or more holes of a round have missed is much more dangerous than withdrawing the unexploded charge with care, especially where compressed air is used, was unanimously asserted by several tunnel engineers of wide reputation, who took part in the discussion of the paper. John R. Healy, inspector of combustibles of the Bureau of Fire Prevention, stated that where compressed air was used as described the charge followed the pipe out of the hole as if it were a piece of iron and the pipe a powerful magnet. Others who advocated withdrawing a missed charge in tunnel work instead of drilling a new hole were Robert Ridgway, engineer of subway construction for the Public Service Commission, and formerly a department engineer on the Catskill Aqueduct, and F. J. McIsaac, of Grant, Smith & Company and Locher, contractors for a large part of the New York City tunnel of the aqueduct.

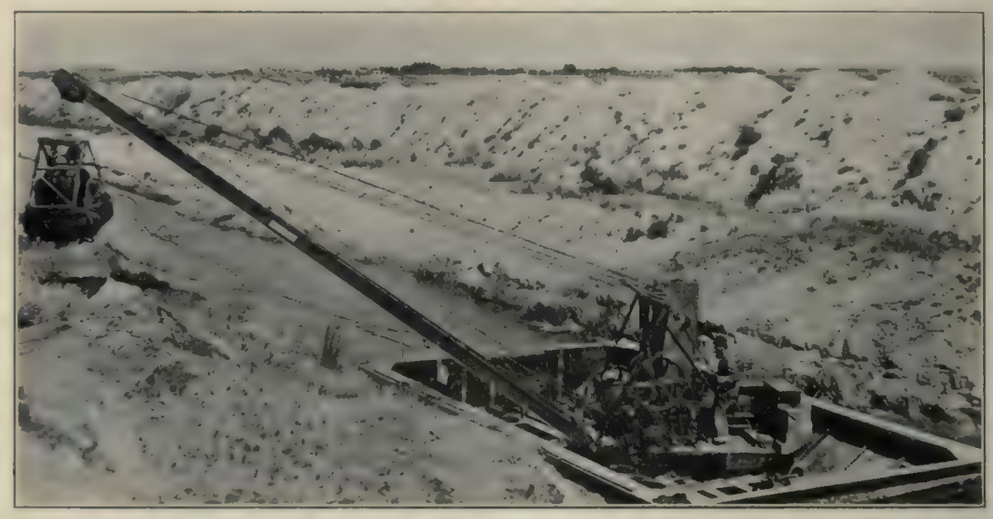
Large Sand Jacks Work Well in Lowering 1100-Ton Span

THE SAND JACKS illustrated herewith lowered successfully a load of more than 45 tons apiece, at a pressure of 92 lb. per square inch, for a distance of more than 5 ft. in landing the 1100-ton draw span of the Harlem River elevated railroad bridge, described elsewhere in this issue. The jacks as originally built to handle the approach spans had a total drop of 5 ft. This was increased by building up the timber casing with three more courses of 6 x 8-in. timber, as the draw span submerged the scows deeper than the approach spans did. The angles on the casing were extended by straps bolted in line with them. After the first drop had been exhausted, the bridge was landed, but all the load was not off the scows. The bolts in the top section added to the casing of each jack were then removed, the timber taken out one course at a time, and the remaining sand let out. This allowed the scows to rise until they were free.

As seen in the drawings, the casings were a part of the timber falsework erected on the scows that lifted the span. The pistons, each made of nine 12 x 12-in. timbers, were bolted to the I-beam grillage on which the span was erected. The casings were filled with dried sand, and the barges spotted under the span at low tide and allowed to float up until the pistons engaged the casings and came to a bearing on the sand. As the weather was rainy, canvas was tied around the top of each casing and tar paper tacked over the outside to keep the sand from getting wet.

The gates, though simple in detail, were very effective, and gave close control over the lowering. A man was stationed at each gate. Each gate consists of a hole in the timber floor of the casing, blocked by a lever made of a flat steel bar, to which is riveted a square steel plate which fits over the hole. The lever is moved aside to let sand escape, and back to shut it off.

Credit is given in the article mentioned to the men connected with moving the span. The jacks were designed by H. D. Robinson, chief engineer on the Manhattan elevated improvements for the Terry & Tench Company, Inc.

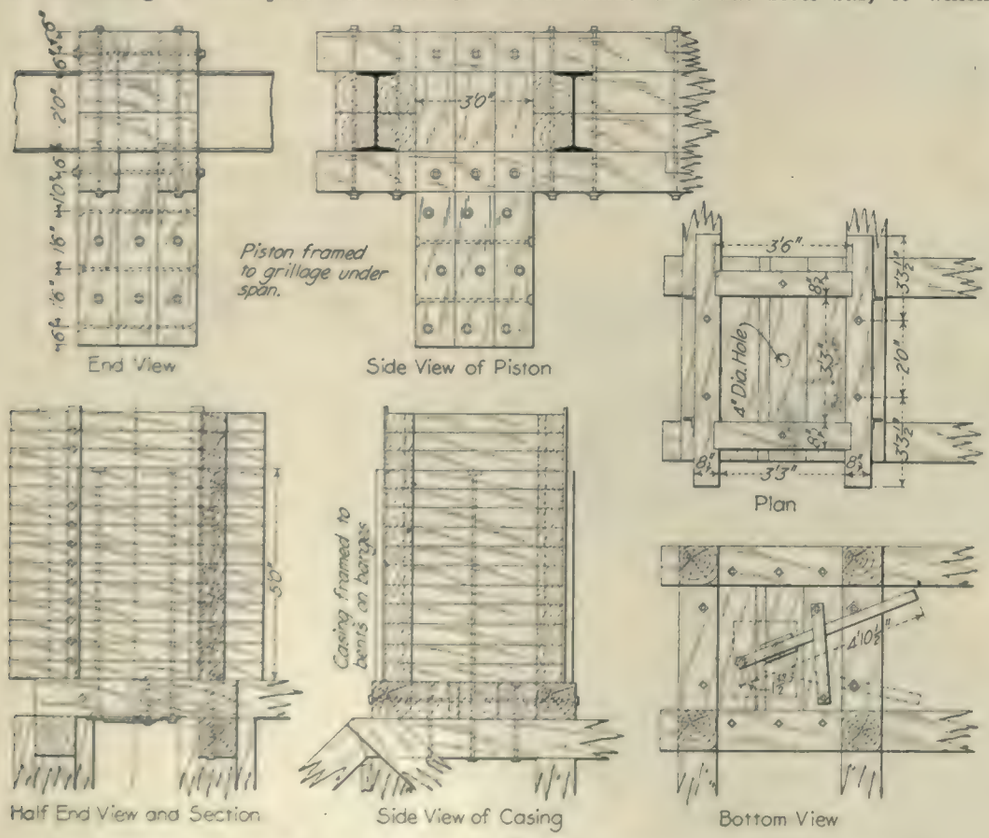


NOVEL TOOL DOES WORK OF FLOATING DREDGE ON SMALL DITCHES

Locomotive Crane Mounted on Boat to Clean Irrigation Ditches

TO REMOVE silt from waste-water ditches on the Minidoka irrigation project in Idaho the U. S. Reclamation Engineers purchased a Brownhoist locomotive crane and mounted it, without trucks, under-frame or cab in a steel barge built to fit the cross-section of the ditches. The crane operates a grab bucket, and is run by a 40-hp. gasoline engine. This novel tool has replaced hand labor and scrapers on ditches which are too small to allow the use of an ordinary floating dredge. It is said to have effected a great saving. It draws only 3 ft. of water when in operation. As it fits the cross-section of the ditch closely, and as the rotating parts of the crane are of course balanced, it is used without spuds.

The barge is pulled along by running out a line ahead from a hand crab, one of which is located in each end of the hull. Work on this project is being carried on by the U. S. Reclamation Service, for which F. N. Cronholn is superintendent of construction.



TAKING TOP TIMBERS OFF CASINGS DURING LOWERING ALLOWS FULL DROP

THE ROOF CONSTRUCTION of a small demonstration building that remained undamaged through the severe tornado of March 27, at Adel, Iowa, is described in the July number of the *Brick and Clay Record*. It is of hollow brick construction and self-supporting, the load being carried by bricks which were keyed to form a complete arch. The walls of the structure were carried up to the top course in the usual manner, after which a special cornice block was laid. An extra heavy band of plow steel was carried around this and a single row of brick was tamped in against it, firmly embedding it into the wall, as a reinforcement against the thrust at the heel of the arch formed by the roof. The bricks were then laid in concrete, each course being completed before the next one was laid.

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

Government Engineers Study Los Angeles County Problem

Seven members of the United States Rivers and Harbors Board of Engineers arrived in Los Angeles on Aug. 16 to spend a week in making an official inspection of the harbor and an examination of waterways to serve as a basis for a report to congress on the diversion of flood waters in Los Angeles County. The party included Col. W. M. Black, Col. Lansing H. Beach, Col. Henry C. Newcomer, Major Edward N. Johnston, Col. Frederick V. Abbott, Lieut.-Col. E. E. Winslow and H. W. Webber, secretary of the board.

Major Robert R. Raymond, U. S. A., stationed at Los Angeles, conducted the party on its local tour of inspection. After visiting the harbor itself the proposal to build a direct channel to connect it with Long Beach harbor was considered. The proposed widening of the entrance channel of the harbor to a minimum of 1000 ft., the deepening of the entrance channel and turning basin to 35 ft. and widening of the east basin channel and the dredging of the area south of Reservation Point were also considered.

The present inspection was the result of a request made by the Los Angeles Harbor Commission to the Congressional Rivers and Harbors Committee that a general survey of the harbor be made as a basis for considering further improvement. The Harbor Commission called attention to the fact that in the past forty-four years the Government has spent less than $6,000,000 in improvements for Los Angeles harbor, while in the six years since the harbor has been under the jurisdiction of the city, Los Angeles has voted bond issues aggregating $5,500,000 for harbor improvements, of which sum $800,000 is still unspent. And the city stands pledged to vote $4,500,000 more bonds for the same work before 1920.

Dexter Brackett Dies

Dexter Brackett, for the past eight years chief engineer of the Metropolitan Waterworks, Boston, Mass., died at his residence in Brighton on Aug. 26. Mr. Brackett was widely known as a hydraulic engineer and was recognized as an authority in many branches of waterworks engineering. He was born at Newton, Mass., in 1851, was graduated from the Brighton High School in 1868, and soon after entered the employ of the city of Boston, being attached to the waterworks branch of the engineering department. For forty-six years he served in the engineering departments of the city and State, and took a very prominent part in the development of the water supply of Boston and of the Metropolitan water district. His work for the city related mainly to the piping system and other distribution equipment, and the system which developed largely under his direction was noted for its adequacy and the excellence of its various parts. After twenty-six years of service with the city of Boston, Mr. Brackett was called to take charge of the distribution department of the Metropolitan Waterworks, which included the piping system, pumping stations and reservoirs within the Metropolitan district, and he was largely responsible for the excellence of these works. The pumping stations at Chestnut Hill and Spot Pond have been visited by engineers from all parts of the country, and are regarded as models of efficiency.

In 1907 Mr. Brackett became chief engineer of the Metropolitan Waterworks, and in this capacity he has had charge of the maintenance and operation of the system and of the construction of additions, including the successful hydroelectric plant at the Wachusett dam in Clinton, Mass. He was also responsible for the design of a similar plant now under construction at the Sudbury dam in Southborough. One of the important reforms which have taken place since he held the position of chief engineer, and largely through his efforts, is the introduction of water meters into the municipalities of the Metropolitan district, which has reduced the water consumption to such an extent that the district now has a supply of water adequate for many years to come. It was recently estimated that the water consumption with the use of meters is somewhat less than two-thirds of what it would have been if meters had not been introduced. Without these, an additional supply would have been necessary, and at great cost. Mr. Brackett was a member and for three years a director of the American Society of Civil Engineers, and had been president of the Boston Society of Civil Engineers and of the New England Waterworks Association. He contributed papers of value upon waterworks topics to the proceedings of various engineering societies.

Chief Engineer of Boston's Metropolitan Waterworks Whose Death Ends Long Service



DEXTER BRACKETT

Alaska Engineering Commission Moves Seattle Offices

The Seattle offices of the Alaska Engineering Commission have been moved from the L. C. Smith Building to the Port of Seattle's new Bell Street warehouse, at the foot of Bell Street.

Montana Dam Dedicated

The completion by the Montana Power Company of the Great Falls dam on the Missouri River near Great Falls, Mont., was celebrated quietly by informal dedication ceremonies, Aug. 11. President John D. Ryan and a small party of officials and invited guests were present at the initial passage of the waters over the crest of the dam.

Boston Port Directors Approve High Pressure Pumping Station Site

The Port Directors of Boston approved the proposed site at the corner of Dorchester Avenue and the Summer Street Bridge as a suitable location for the high pressure fire service pumping station at a hearing held in that city, Aug. 31, and the matter now goes before the War Department for whatever recommendation its engineer, Col. William E. Craighill, Corps of Engineers, U. S. A., may decide to make. Corporation Counsel Sullivan stated that the Federal engineer had already expressed his willingness to consider this site. Mayor Curley of Boston and other public officials are anxious that this matter be settled promptly as several miles of high pressure mains were laid last year and as many more have been put in this season.

Illinois Engineers Examining Board on Licensing Is Named

Governor Dunne has appointed the following engineers on the examining board in accordance with the recently enacted structural engineers license law: E. N. Layfield, assistant secretary, Western Society of Engineers; J. W. Musham, of the Condron Company; Frank T. Hanley, of the Corrugated Bar Company, all of Chicago, and C. C. Stowell, consulting engineer and formerly city engineer of Rockford. The fifth member is Professor Ira O. Baker, of the State University. These men have been named from a large list of names submitted to the governor by the legislation committee of the Western Society of Engineers. Mr. Layfield was designated president of the board and Mr. Hanley secretary.

Ten-Car Special Train to Carry Engineers to San Francisco

Up to noon of last Wednesday 128 passengers were assured for the special train which will carry engineers to the International Engineering Congress at San Francisco. At that time reservations were coming in faster than cancellations, and it was believed that the eight Pullman cars then in the train would likely be increased to nine or ten. Reservations at Chicago insure the adding of at least one car to the train there. In addition to the Pullman equipment there will be the usual complement of dining and baggage cars. G. S. Harner, passenger agent of the New York Central Railroad, who has charge of the arrangements, will accompany the train to the coast.

Association of Engineers to Hold Chicago "Booster" Dinner

Invitations have been sent by the recently organized American Association of Engineers to the engineering departments of all the principal railroads, corporations and firms in the City of Chicago to attend a booster dinner to be held at the Hotel La Salle, Sept. 14, 1915. Prof. F. H. Newell, head of the department of civil engineering at the University of Illinois, and who, until recently, was director of the U. S. Reclamation Service, will speak at this dinner on the "Needs of Organization Among Engineers."

A 30 per cent increase in membership, drawn from all parts of the United States as well as from all branches of the engineering profession, has been registered by this organization during the past two weeks. Local chapters are being formed in St. Louis, Milwaukee, Indianapolis and many of the larger cities. A National convention is to be held at

the La Salle Hotel, Chicago, Dec. 10 and 11. All engineers are invited and the engineering societies and clubs of the United States are urged to be represented by engineering delegates. Further information may be obtained by addressing Arthur Kneisel, secretary, 29 S. La Salle Street, Chicago, Ill.

May Lease Chicago Garbage Plant to Private Firm

A plan to lease part of the Chicago municipal garbage reduction plant to a private firm is being fostered by Dr. John D. Robertson, Chicago's new health commissioner. The city purchased the old plant of the Chicago Reduction Company Feb. 1, 1914. For it and its reconstruction the city has paid to date $742,922 and it contemplates a further expenditure of $371,000. The plant has been operated for a year at a loss, but in a sanitary manner. Instead of taking the grease out of the garbage—the valuable product—it has sold the tankage at $5.77 per ton. To extract the grease it would be necessary to use the millhouse and naphtha plant, both of which have remained idle. For the tankage the best price obtainable for the ensuing year is $3.27 per ton.

Dr. Robertson proposes to rent the old millhouse and degreaser to a contractor, who shall pay a certain price for the tankage that will be turned out by the remainder of the plant. He recommends that scheme to the finance committee for a period of ten months.

"From the information I have collected," he said, "I believe that, from each 4 tons of garbage, a ton of tankage can be had. With grease at 3 cents a pound and fertilizer at $4.50 or $5 a ton, a ton of tankage will bring in about $10. I understand that it costs about $3 a ton to get the grease out." Last year the city's garbage, hauled by municipal teams, totaled 129,211 tons. That would mean about 32,000 tons of tankage. At $10 a ton the income is $320,000 a year.

Dr. Robertson's plan was described by Oscar E. Hewitt in the *Chicago Herald* for Aug. 16. In Mr. Hewitt's words it is as follows: "The city will operate the end of the plant where most of the jobs are. The contractor will operate the money-making end of the plant."

Professorship Established as a Memorial to Joseph A. Holmes

As a memorial to the late Dr. Joseph A. Holmes, director of the Bureau of Mines, of the Department of the Interior, the Colorado School of Mines has established the Joseph A. Holmes Professorship of Safety and Efficiency Engineering.

Total Asphalt Production in 1914 Shows Increase

Although there was a decrease in the market production of natural asphalt and of manufactured or oil asphalt derived from domestic sources in the United States in 1914, the decrease was more than offset by the greatly increased output from American refineries, of oil asphalt derived from crude petroleum imported from Mexico.

The decline in asphalt production from domestic sources is attributed by J. G. Northrop of the U. S. Geological Survey to the increasing use of the product manufactured from Mexican oils. The production of oil asphalts from domestic petroleum amounted to 360,683 tons, valued at $3,016,969, and the output from the American refineries of oil asphalt from Mexican petroleum amounted to 313,787 tons, valued at $4,131,153. Compared with 1913, the output of natural asphalt in 1914 declined 16 per cent and that of domestic oil asphalt 17 per cent, but the output of Mexican oil asphalt increased 174 per cent. In California there was a notable increase in the output of oil asphalt derived solely from domestic petroleum, which resulted largely from an increase in the use of asphalt in highway and pavement construction in that State. In Texas and Utah the output of certain varieties of naturally occurring asphalt required for special purposes showed an increase. Asphaltic material and products to the value of $186,142 were imported for consumption during the calendar year. Exports during the same period amounted in value to $1,247,020, leaving a balance of $1,060,878 to be credited to the domestic asphalt industry.

Gooseneck on Derrick That Lifted 37 Tons Breaks Under 21½-Ton Load

Mystery surrounds the breaking on Aug. 19 of a 2½ x 12-in. steel gooseneck, which held the 16 x 16-in. 50-ft. Oregon Fir mast of a derrick used in the construction of the west end of Chicago's new Jackson Street lift bridge. The gooseneck broke at the joint as the 4-ft. square laced steel boom, 118 ft. long, was lifting a 21½-ton top section chord. The back stiff leg of the derrick is made of 12 x 14-in. timber and is uninjured. The boom, in falling, hit the partly erected leaf and was crushed near the center. Four sheave blocks were used, two at the top of the mast and two at the bottom. A ⅞-in. cable was used at the drum and a ⅝-in. cable for the lift.

Engineers for the contractor, the Strobel Steel Construction Company, Chicago, have as yet been unable to determine the cause of the failure. The gooseneck has been examined by the Pittsburgh Testing Laboratories and found to be made of best quality steel. To add to the mystification of the engineers, the derrick, which is designed to lift many more than 21½ tons, had lifted 37 tons the day previous without apparent distress to the gooseneck.



Courtesy Chicago Daily News

LIFTING A 21½-TON TOP SECTION CHORD CAUSED THIS DERRICK FAILURE

Loss in Galveston Probably from Three to Four Million Dollars

Later advices, received from John B. Hawley, consulting engineer, of Fort Worth, Tex., in regard to the damage done by the hurricane of Aug. 16-17 at Galveston, which was described in this journal last week, indicate that the property loss, public and private, will probably be from $3,000,000 to $4,000,000.

The 30-in. water main from Alta Loma lost several hundred feet at different points through erosion of the bay bottom. A temporary 8-in. main connects the island with the mainland, but its capacity is too small to give an adequate supply and water is being doled out in small quantities. The total loss of life on the island may reach 100. A careful examination of the sea wall showed it to be wholly uninjured and, according to Mr. Hawley, "indicated that its designers provided for every necessary element of strength."

The arch portions and bascule of the causeway are practically intact, but that part which is of retaining-wall and earth-fill type is largely destroyed. A temporary trestle is being built to serve traffic needs until the arch construction can be extended to both shores.

Lieut.-Col. Charles S. Riche, Corps of Engineers, U. S. A., in charge of the Galveston district, is authority for the statement that the great jetties, which made Galveston's deep water channel, are practically unharmed and that soundings show that the channel itself suffered no filling or accumulation of sand bars.

The city, aided by the U. S. Army, is cleaning up the streets and alleys. The citizens are working on their own premises.

The Aftermath of the Galveston Storm



THE 30-INCH WATER MAIN FROM ALTA LOMA WAS UNDERMINED AND BROKEN AT SEVERAL PLACES



PART OF THE CAUSEWAY WHICH IS OF THE RETAINING-WALL AND EARTH-FILL TYPE WAS LARGELY DESTROYED



PHOTOGRAPH SHOWS CEMENT SIDEWALK AND PAVING WHICH REMAINED INTACT AND SAVED FILLING FROM WASHING OUT



THE ONLY PLACE WHERE SAND WAS WASHED FROM BEHIND SEAWALL—WHERE MEN STAND A SHIP WAS CARRIED OVER WALL

American Society Rescinds Licensing Action of 1911

Announcement was made Sept. 1 at the meeting of the American Society of Civil Engineers that the canvas of votes relative to rescinding the society's action of several years ago in the matter of licensing engineers showed that the society had rescinded that action by a vote of 2024 to 594. This leaves the board of direction free to act in the matter as the occasion may demand.

News of Engineering Societies

The Missouri Valley Public Health Association will meet at the Coates House, Kansas City, Sept. 28 and 29.

The San Francisco Association of Members of the American Society of Civil Engineers heard M. O. Eldridge, engineer, U. S. Bureau of Roads, speak on "Types of County Roads," at a meting held in that city, Aug. 20. On unanimous motion of those present a motion was referred to the board of management of the local association providing that a course in public speaking for engineers be provided for members who desired it.

The American Society of Civil Engineers held its first meeting of the 1915-1916 season in New York City, Sept. 1. E. E. Howard presented a paper on "The Twelfth Street Trafficway Viaduct, Kansas City, Missouri," and H. R. Stanford presented a paper on the "Pearl Harbor Drydock."

Personal Notes

W. A. BOUVÉ, formerly engineer for the General Chemical Company, at Bay Point, Cal., has been appointed assistant engineer at the mines of the Mountain Copper Company near Keswick, Cal. Mr. Bouvé has been engaged in engineering work since 1907. Among the companies he has been connected with are the Southern Pacific Railway System, the Associated Pipe Line Company and the Associated Oil Company. He entered the service of the General Chemical Company in 1914.

BRUNO PIZZIMENTI, general contractor, formerly of Seneca Falls, N. Y., has entered into partnership with Martin & Miller, engineering contractors and sanitary experts, of Caldwell, N. J. The firm name of the new organization will be Martin-Miller & Pizzimenti.

MARK F. BOYD, formerly bacteriologist of the State Hygienic Laboratory of Nevada and associate professor of bacteriology in the State University at Reno, has resigned to become epidemiologist in the laboratory of the Iowa State Board of Health.

ALBERT J. HIMES, formerly valuation engineer of the New York, Chicago & St. Louis Railroad, at Cleveland, has been reappointed engineer of grade crossing elimination, with headquarters in the same city. He was graduated from Cornell University in 1887 and entered railway service as assistant engineer with the Burlington & Missouri River in the same year. After two years in this position he went to the Fall Brook Railway as assistant engineer on maintenance. He served from 1891 to 1893, as city engineer of Corning, N. Y., organizing meanwhile, the contracting firm of A. J. Himes & Company. From 1894 to 1897 he was resident engineer on the eastern division of the New York State Canals, after which he was with the U. S. Board of Engineers on deep waterways. He entered the employ of the New York, Chicago & St. Louis as bridge engineer in 1901 and was appointed assistant chief engineer in 1907. He served as engineer of grade elimination from 1909 to 1913. In the latter year he was appointed valuation engineer.

J. H. HOSKINS, formerly chief engineer of the Dickson County (Tenn.) Highway Commission, has been appointed chief engineer of the Rhea County Highway Commission, with headquarters at Dayton, Ohio.

E. E. EAST, formerly inspector for the California State Highway Commission, has been promoted to the grade of assistant division engineer.

MAJOR HORTON W. STICKLE, Corps of Engineers, U.S.A., who is at present in charge of the river and harbor works in Baltimore and vicinity, has applied for retirement from active service under the special act of Congress authorizing retirement with advanced rank for all officers who served at least three years on the construction of the Panama Canal. He was graduated from West Point in 1899 and served in the Philippine Islands until 1901, in charge of road work and bridge construction. He was instructor in civil and military engineering at West Point from 1904 to 1905, and from the latter year until 1907, served as assistant to the officer in charge of construction at the academy. He was assigned to service in connection with the Panama Canal in November, 1907.

COL. JOHN BIDDLE, Corps of Engineers, U. S. A., who was recently military observer for the United States in Austria, will succeed Major Horton W. Stickle, whose application for retirement from the active list of the army is noted elsewhere in these columns, in charge of river and harbor works in Baltimore and vicinity. Colonel Biddle was graduated from West Point in 1881 and was a student at the Engineers School of Application at Willet's Point, N. Y., from then until 1884. From 1884 to 1887 he was on surveys in the Dakotas and Montana. He served as instructor in engineering at West Point from the latter year until 1891, and was in charge of lock and dam construction and open channel work on the Tennessee and Cumberland rivers from then until 1898. He spent two years in the Philippine Islands, in charge of road construction, and harbor improvements at Manila, leaving there in 1901 to take charge of bridge and building construction in the District of Columbia, including the construction of the Connecticut Avenue Bridge. In 1907 he was detailed in charge of works in the Sacramento and San Joaquin rivers in California. He was appointed military observer to Austria in November, 1914.

FREDERICK J. CELLARIUS, consulting engineer of Dayton, Ohio, and H. J. Dressler have been appointed sanitary engineers in charge of the establishment of a new sanitary sewer district at Harrison Township, Ohio.

E. A. MORITZ, engineer U. S. Reclamation Service, formerly located at the Washington, D. C., office has been appointed office engineer of the recently established executive office at Denver, Col.

JAMES BURTON has resigned from the office of superintendent of waterworks of Fort Scott, Kan., and has opened an office in that city to engage in a general engineering practice, specializing in water service problems.

CHARLES E. HEWETT has resigned from the office of architect for the Iten Biscuit Company to engage in a contracting business at Omaha, Neb.

G. J. POYSKY has been appointed engineer and superintendent in charge of Diking District 1 in Cowlitz County, Washington, with headquarters at Kelso. This enterprise involves the reclamation, by a system of diking and drainage, of 3000 acres of land that is, at present, subject to overflow during the June freshets.

RAYMOND GLADDING, of Albuquerque, N. M., has received an appointment as junior engineer on the forces of the United States Engineer, and has been assigned to the Rivers and Harbors division of the service. Mr. Gladding was graduated from the University of New Mexico two years ago, and took a post graduate course at the Massachusetts Institute of Technology which he finished last June.

E. W. HESS, consulting engineer, of Clearfield, Pa., has been retained by the borough of Punxsutawney to prepare estimates and other information for submission to the Public Service Commission of Pennsylvania, in the borough's effort to obtain permission to install a municipal waterworks system.

EARL TALBOTT has resigned from the office of resident engineer in charge of the New York City residency of the New York State Barge Canal.

EDWARD ANDERBERG, formerly assistant engineer in charge of bridge and lock construction on the New York State Barge Canal, at Lockport, will succeed Earl Talbott, whose resignation is noted elsewhere in these columns, in charge of terminal work in New York City and vicinity.

E. C. CHURCH, formerly chief of the Bureau of Supplies of the Department of Water Supply, Gas & Electricity, New York City, and later assistant manager of the Marconi Company, has been appointed deputy warden of Sing Sing Prison, New York, as assistant to Thomas Mott Osborne, whose revolutionary methods of handling the prisoners at that institution have attracted widespread interest through the East. Mr. Church will give special attention to the organization of the prison and to placing the administration of the shops on a business basis. He has been engaged in organization work of this character, in a consulting capacity, for some years. His work in organizing the Bureau of Supplies of the department of water supply was described in a remarkable report, which was reprinted in large part in this journal, issues of Jan. 3, 10, 17 and 24, 1914.

OTTO A. STELLER AND W. L. SCHWALBE have become associated as consulting civil engineers under the firm name of Steller Engineering Company, engineers and contractors, Loan & Trust Building, Milwaukee, Wis. Mr. Steller was formerly associated with N. H. Smith in consulting practice at Oshkosh, Wis. Previous to that he was on the engineering staff of the Chicago, Milwaukee & St. Paul Railway and of the railway and highway commissions of the State of Wisconsin. Mr. Schwalbe has been on the engineering staff of the Milwaukee Electric Railway & Light Company of Milwaukee, and the engineering staff of the city of Milwaukee.

FARLEY GANNETT, consulting engineer of Harrisburg, Pa., with whom is associated Theodore E. Seelye, has been employed by the city of Erie, Pa., to investigate and report upon methods of preventing a repetition of floods in Mill Creek. This work is the result of the disastrous flood of Aug. 3 which caused the loss of 34 lives and $2,000,000 in property. A force of 24 engineers is at work on a topographic survey of the creek through the city and of reservoir sites and deflection schemes in the upper water shed.

R. T. CHILDS, editor of the construction news department of Engineering News for the past six years, has resigned in order to engage in the development of several large real estate tracts at Mineola, Long Island. He will be associated with the Shawmut Realty Company and with the Mineola Homes Company. Mr. Childs was graduated from Rensselaer Polytechnic Institute in 1903.

WILLIAM C. COFFIN, formerly structural engineer of the Jones & Laughlin Steel Company, has been elected vice-president of the Knox Pressed & Welded Steel Company, manufacturer of all classes of steel plate construction and welded steel specialties, of Pittsburgh. He was connected with the Jones & Laughlin Company since 1908. Previous to that he was vice-president of the Riter-Conley Manufacturing Company. His new office will include the duties of general sales manager of the Knox Company.

B. GRANGER, formerly inspector in the Bridge Department of Cuyahoga County, Ohio, has been appointed field superintendent for Albert Kahn, architect, 58-60 Lafayette Boulevard, Detroit, Mich.

HOWARD K. BELL, engineer and contractor, of Lexington, Ky., who has been located at Campbellsville, Ky., where he designed and constructed a waterworks system for the town, for the past year, has removed to Eminence, Ky., where he has a contract to build three concrete bridges on the Eminence Road in Shelby County under State aid. Previous to taking up private work, five years ago, Mr. Bell was, for more than eight years, chief engineer and general manager of the Lexington waterworks.

AVERY J. PRATT, who was engaged on United States Navy survey of American Samoa, has returned to this country, the field work of the survey having been completed, and will go to Washington within the next week or so to work up the notes.

GEORGE W. RICHARDS, who has been connected with the bridge and construction department of the Pennsylvania Steel Company of Steelton, Pa., has resigned to accept a position in the Cleveland office of the bridge department of the New York Central Railroad.

RICHARD K. MEADE, chemical, mechanical and industrial engineer, of 202 North Calvert Street, Baltimore, Md., has been retained by the D. M. Bare Paper Company, Roaring Springs, Pa., to prepare plans for and superintend the construction of a lime recovery plant.

BEERS BUILDING COMPANY, Pittock Block, Portland, Ore., has opened offices in the L. C. Smith Building, Seattle, Wash. This concern was recently awarded the contract for the construction of the superstructure of the Fremont Avenue bridge across the Lake Washington Canal in Seattle.

R. K. HALLET, formerly civil engineer with the Brookings Timber & Lumber Company at Brookings, Ore., is now engaged as civil engineer for the Hercules Powder Company on the construction of a new plant at Hercules, Cal. While with the Brookings company Mr. Hallett was engaged in the construction of a modern lumber mill and several miles of standard-gage railroad, which included the first railroad bridge ever built in Curry County, Ore.

W. H. COGGESHALL, formerly superintendent for the Cummer Lumber Company of Jacksonville, at Colee, Fla., has entered into a partnership with George R. Foster, Jr., to engage in a contracting business at Bradentown, Fla. For the present they will engage in drainage canal construction.

RAFAEL GONZALEZ, formerly assistant engineer in the Department of Sanitation of Porto Rico, has been engaged by the Fajardo Sugar Company for work in connection with the location and construction of about 5 miles of canals to irrigate about 2000 acres of that company's property at Fajardo, P. R.

RAY PALMER, formerly commissioner of gas and electricity of Chicago, has resumed his consulting engineering practice, with offices in the Hartford Building, Chicago. His lines are the general supervision of reorganizations, valuations, rates, lighting and industrial problems, requiring engineering and accounting service.

W. D. BEARDSLEY, formerly connected with Vielé, Blackwell & Buck, consulting hydraulic engineers, 49 Wall Street, New York City, has formed a partnership with J. A. Dougan and F. A. Beardsley to engage in an engineering and contracting business under the firm name of Beardsley, Dougan & Beardsley, with offices in the Macbain Building, Roanoke, Va. The firm will specialize in land and topographic surveys, preliminary surveys and estimates for railways, hydroelectric and other engineering developments, superintendence and engineering on construction and, as contractors, in concrete work.

A. S. HUNTSMAN, formerly assistant engineer on the primary roads of the State of Washington, is now in charge of the construction of the "Vancouver North" link of the Pacific Highway, at Ridgefield, Wash.

THOMAS C. ATWOOD has opened an office in the Chamber of Commerce Building, New Haven, Conn., where, in addition to his work on the Yale Bowl, he will engage in general practice as a consulting engineer, making a specialty of water and sewerage works, power development, private estates and athletic fields. He was graduated from the Massachusetts Institute of Technology in 1897, and was for three years employed on the Metropolitan Waterworks of Boston and, for a year, on the harbor works of that city under the United States Engineers' Office. In 1901 he went to Philadelphia and was engaged upon the construction of the filtration works there until 1904, when he went to Pittsburgh to engage in similar work. In 1907 he was appointed designing engineer on the Catskill Aqueduct work and, later, as division engineer in charge of the Bronx Division, including some ten miles of aqueduct within the city limits. This position he resigned in order to accept that of division engineer on the Jerome Park filter plant for the filtration of the Croton Supply of New York City at a cost of about $9,000,000. In 1914 he resigned this position to take charge of the construction of the Yale Bowl, the major portion of which has been finished, the remaining work now occupying but a part of his time.

Obituary Notes

EDWARD B. PLEASANTS, chief engineer of the Atlantic Coast Line Railroad, died in Washington, D. C., Aug. 22.

MAX HEBGEN, vice-president and chief engineer of the Montana Power Company, of Butte, Mont., died in Chicago, Aug. 24, at the age of forty-six years. He was born in Milwaukee and began his career in the hydroelectric development of this country with the Standard Underground Cable Company and the Westinghouse Electric Company about twenty-nine years ago. He located in Butte in 1886 as a lineman with the old Butte Electric Light & Power Company and remained continuously in its employ through its various absorptions, attaining, previous to his death, the office of vice-president and chief engineer of the Montana Power Company, which has water-power developments on the Big Hole River; the Missouri River, at Great Falls; the Yellowstone River, at Billings, and two large developments on the Madison River. This company, according to H. M. Byllesby, of H. M. Byllesby & Company, engineers, of Chicago, who was formerly its president, is a monument to the creative genius of Mr. Hebgen.

JOHN W. EBER, until recently general manager of the Toronto, Hamilton & Buffalo Railway, died in Hamilton, Ont., Aug. 18. He was born in 1871 and entered railway service in 1890, as rodman with the West Shore Railroad. In 1896 he was appointed assistant roadmaster and in 1899 supervisor of track. He became connected with the New York Central & Hudson River Railroad, in 1902, and was appointed division engineer in that service two years later. In 1905 he attained the grade of engineer of track and, in 1905, was appointed assistant superintendent of the company's stock yards at Buffalo. He reached the grade of superintendent of the Adirondack division in 1910, from which office he resigned to go to the Toronto Hamilton & Buffalo as general superintendent in 1912. He was appointed general manager in 1913.

J. C. METCALFE, former president of the Mexican International Railway and recently consulting railway expert for Speyer & Company, bankers of New York City, died at Pocono Summit, Pa., Aug. 31, at the age of sixty-seven years. He was general manager of the Denver & Rio Grande from 1900 to 1901 and general manager of the Evansville & Terre Haute from the latter year until 1902 when he was appointed president of the Mexican International. He served as vice-president of the Manila Railway Company and made extensive investigations in railway problems in Peru, Chili and Ecuador. He also aided in solving the transportation problems of the London Underground Railway Company, of which he was a director.

JOHN H. WARDER, secretary of the Western Society of Engineers for the past 15 years died in Chicago, Aug. 30. Mr. Warder was born in Cincinnati, Jan. 21, 1846. He was graduated in mechanical engineering from the Polytechnic College of Philadelphia in 1867. During the first several years out of college he was employed by the Cincinnati Southern Railway System. He then went with the Phœnix Iron Works, Detroit. He was engaged in 1893 as construction engineer by the Illinois Electric Forging Company and others in planning power and electric plants. He also planned in the same year the West Pullman, Ill., waterworks. From 1893 to Jan. 10, 1901, when he assumed his last position, Mr. Warder was in charge of sewer construction in various parts of Chicago.

J. C. W. GRETH, manager of the water purifying department of Wm. B. Scaife & Sons Company, Pittsburgh, died Aug. 7. He was graduated from Cornell University in 1897 and was first engaged with the Snow Steam Pump Works, Buffalo, designing special machinery. He entered the service of the Wm. B. Scaife & Sons Company in 1902 and remained in it continuously up to the time of his death.

CHARLES T. WILLS, president of Charles T. Wills, Inc., contractors and builders, 286 Fifth Avenue, New York City, died in Greenwich, Conn., Aug. 31, at the age of sixty-four. He started his life's work as an apprentice bricklayer and worked along subordinate lines until he became a partner in the firm of Sinclair & Wills in 1873. Among the buildings erected by his company are such structures as the Emigrant Industrial Savings Bank Building, New York City, the New York Stock Exchange, and the American Banknote Building.

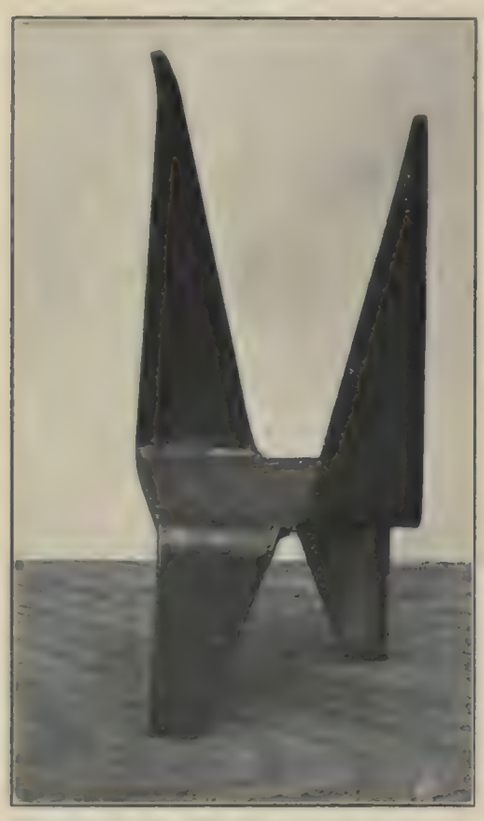
Civil Service Examinations

Examinations Previously Announced

Date		See Eng. Record
Sept. 11—	Assistant examiner, Civil Service Commission, Philadelphia	Aug. 21
Sept. 15—	Aid, U. S. Coast and Geodetic Survey; draftsman and junior engineer, U. S. Engineer Department.....	July 3
Sept. 18—	Lock operator, New York...	Aug. 21
Sept. 22—	Assistant irrigation engineer, United States.....	Aug. 21
Oct. 13—	Aid, U. S. Bureau of Standards; civil engineer and draftsman, draftsman, Navy Department; engineer, Indian Service	July 3

Chair for Reinforcing Bars Insures Exact Placing of Steel

A new chair for holding reinforcing bars in place, which apparently goes against what has hitherto been considered good practice insomuch as its prongs are driven into the wooden form, yet which, on actual work, has given no



PRONGS IN WOOD HOLD LOAD RIGIDLY

trouble from this source and which, according to the manufacturers, holds the reinforcement permanently in its proper position, has been placed on the market by the Shop-Fabricated Reinforcement Company of Cleveland, Ohio. This chair, known as the "Staple Chair," which is shown in the accompanying illustration, is made from extra stiff sheet steel, cut and bent to develop two pairs of pointed prongs, projecting in opposite directions. It is placed before the steel is and driven into the form work as far as is desired, and in the exact position the steel is to occupy. Then the rod is placed and the upper prongs bend down over it with a blow of a hammer. The chair has been used on actual work and no trouble was experienced in form removal due to the driven-in points.

Factograf Camera Photographs Meter Readings

The Factograf camera which has been developed by the Eastman Kodak Company of Rochester, N. Y., not only reads water, gas and electric meters, but prevents disputes by recording the meter reading just as it was when taken. The reading is made by placing the front of the camera against the meter dial and pressing downward on the exposure lever. This automatically turns on a light, which is a part of the device, opens and closes the shutter and turns off the light. The shutter locks automatically with each exposure, and remains locked until the film for the next exposure has been wound into place, when it automatically flies back into the "set" position. This prevents the possibility of taking two records on one section of film. In the same manner there can be no blanks, for the film cannot be wound off until the exposure has been made.

The camera measures 4¼ x 5¾ x 12¼ in. and is made from selected mahogany, specially treated to stand severe moistures. Light is furnished from two dry batteries stored in either side of the camera. By pressing a small button, the lights may be turned on to assist in locating meters or finding one's way through dark cellars. The combined cost of films and chemicals for developing does not exceed fifty cents per hundred readings.

Carnegie Structural Beams

The second edition of the small booklet on "Structural Beams" has just been issued by the Carnegie Steel Company, Pittsburgh, Pa. It supersedes and cancels the first edition, and the data on supplementary beams in the sixteenth and seventeenth editions of the Pocket Companion and the fifth edition of the Shape Book.

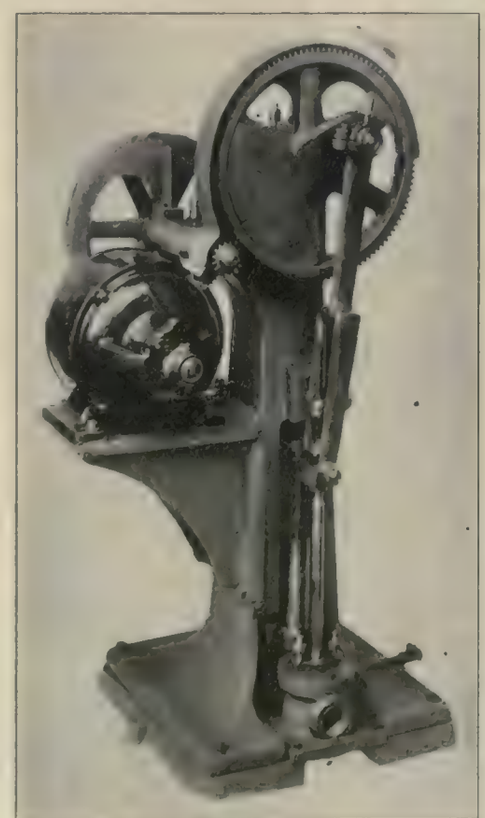
In addition to the profiles of these deeper, wide-flange beams rolled by the company, the booklet gives the usual tables of properties and safe loads. The beam sections vary by 3 in. in depth from 24 in. to 12 in., and are rolled with thin webs and wide flanges. The slope of the flanges is uniformly 1 in 11. The theoretical carrying capacities are somewhat less than the corresponding minimum weights of standard sections, but the metal has equal or greater efficiency pound for pound, with the added advantage that the new sections have greater lateral stiffness.

New Pumping Head That Is Wholly Self Contained and Very Compact

The new Hill pumping head, manufactured by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., which is wholly self-contained and very compact, will raise water to heights of 180, 125 and 90 ft. respectively, when operating 2-in., 2½-in., or 3-in. single acting cylinders. It can be used in connection with open or elevated tank systems or with closed tank pneumatic pressure systems.

Westinghouse Electric, ¾-hp., single phase, type AR motors are used. The motor is mounted rigidly on an extension of the pump support and is capable of starting the pump under full load. All gears are machine cut and well protected. When used with the pneumatic pressure system, an air pump furnishes air to the tank through the water discharge. Water is raised on the upstroke while air is forced in on the downstroke, thus equalizing the pressure.

It is claimed that the outfit can be operated twenty-four hours every day, and that it requires practically no attention.



THIS UNIT IS ADAPTED FOR ELEVATED AND PNEUMATIC PRESSURE SYSTEMS

Business Notes

The Independent Concrete Pipe Company, State Life Building, Indianapolis, of which Howard Schurman is general manager, has opened a branch office in Columbus, Ohio, at the Lazarus Building.

The Virginia Bridge & Iron Company has opened a branch office in Denver, Col., to cover the territory embraced in the states of Kansas, Colorado, Arizona, New Mexico and Utah. A. R. Payton, who has been associated with the company for some years as contracting engineer, will be in charge of the new office, which is located in the First National Bank Building.

The Penn-Allen Cement Company of Allentown, Pa., has opened a general sales office in the Commonwealth Building in that city for the sale of its product. For the Philadelphia district, a district sales office has been opened in the new Widener Building, in charge of Edward E. Krauss, formerly secretary of the American Concrete Institute. The selling of Penn-Allen cement by the William G. Hartranft Cement Company, Inc., of Philadelphia, has been discontinued.

The General Waterproofing Company, Inc., Century Building, Pittsburgh, has been organized and placed under the management of H. E. Hollingsworth, chief engineer, for the purpose of specializing in waterproofing and damp-proofing materials, waterproofing engineering and construction. Its sales department will carry a complete line of membrane and integral waterproofings, concrete floor hardener, concrete floor paints and interior and exterior wall paints. Its contract department is organized to execute work under contract or undertake supervision and is fully equipped to handle all classes of waterproofing construction on general building operations.

Trade Publications

George A. Boyden Pump Company, Maryland Casualty Building, Baltimore, Md. Booklet, 4½ x 7¼ in., 16 pages, illustrated. A prospectus of the business of this company, briefly outlining the pumping industry and its growth.

Gardner Governor Company, Quincy, Ill. Bulletin A-C 12, 6 x 9 in., 16 pages, illustrated. The salient features of air-lift pumping are forcefully presented in concise technical form in this publication. Gardner standard types of air compressors are illustrated and briefly described, and suggestions for their installation for water pumping given.

Busch-Sulzer Bros.-Diesel Engine Company, St. Louis. Booklet, 6¾ x 10 in., 20 pages, illustrated. Describes the Appleton, Wis., Waterworks, which recently installed a new mechanical filtration plant, an elevated distributing reservoir, and a pumping station equipped with two Diesel engines. Unusual features of intake, filtration results from a bacteriological standpoint, economical power operation, efficiency charts, sectional perspective views, and operating plant records are included in the description. Comparing the cost of operation of the new station for April, 1915, with that of the old for its average for 1914, there is shown the startling saving of 11.9 mills per 1000 gal. in fuel cost and 10.3 mills per 1000 gal. for total cost. The systems of analysis and recording explained in this booklet should be interesting and valuable to waterworks men.

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September 11, 1915

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HAYWARD BUCKETS

THE Hayward Class "E" Clam Shell Bucket is a most efficient machine for digging such materials as crushed stone, broken slag, gravel, packed sand, etc., and may be equipped with steel teeth for excavating in hard or rock filled soil. The illustration below is one of four machines used for changing the grade on the Long Island Railroad, East New York. The Bucket is a Hayward Class "E" with Ore Bowl equipped with teeth. This type of bucket is particularly serviceable when the material to be dug contains a large percentage of gravel or boulders. Write for Catalogues.

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Builders of Digging Machinery



Engineering Record

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The Day of the Engineer

WHEN this issue reaches its readers many of the members of the International Engineering Congress will be on their way to the Coast, since most of them will have planned to attend the society conventions held during the previous week. It is to be hoped that the delegations will be very large, for seldom has it been given engineers to participate in a more momentous occasion. Deprived by the war of the thrilling ceremony that was planned at the Canal itself, the great work must rest for its inaugural with the splendors that San Francisco has piled up alongside the Golden Gate. Since February the world by its participation in the exposition has been giving testimony to its appreciation of what has been wrought in Panama. But the next two weeks mark in reality the climax of the celebration, for those who have made the canal—the engineers—and thus given warrant for the exposition will gather at San Francisco to bear their part in testifying to the mightiness of the achievement. In a subtle way the ten-months-long celebration in San Francisco has been America's proclamation of its pride in its engineers, and cold indeed must be the member of the profession who will not thrill with the significance of the occasion when the International Engineering Congress opens a week from Monday. The program befits the occasion. For its complete success there is needed only a large and enthusiastic attendance.

Panama Canal's First Year

ANNOUNCEMENT was made in the Engineering Record of Aug. 28, page 251, of the tonnage moved through the Panama Canal during its first fiscal year, ended June 30. This fiscal year was only 10½ months, however, as regular service did not begin until Aug. 14. The full calendar year is now reported in the *Canal Record*. The canal was used by 1317 ocean-going vessels, carrying a gross tonnage of 6,494,673 tons and a net tonnage of 4,596,644 tons. The net toll collections for the year aggregated $5,102,063.37. The movement and tonnage was about 25 per cent of that of the Suez Canal during 1914. As the receipts for the new ditch in July, 1915, were more than double those of September, 1914, and 50 per cent more than those of December, January or February, the growth in traffic may be expected to continue, and it may not be long before the new ditch rivals the old.

South Philadelphia Improvement

LAST April actual construction work was begun on one of those widespread urban improvements which, because of the number of beneficiaries, and the number and complexity of the advantages to be obtained and concessions to be made, never get to the construction stage except after years of conference and compromise. The improvement referred to is that at South Philadelphia, outlined on page 327. For $24,000,000 the parties to the project acquire advantages that can hardly be estimated—far more valuable, certainly, than any of them could obtain by spending money independently. A popular error would be to suppose that the work for the engineer has just begun, and that the negotiations that have gone before belonged to the politicians, the trade organizations and the business men and manufacturers. This is far from the truth. Feasibility, efficiency and cost are all points to be considered with regard to each change proposed, and all can best be rated by the man technically trained. This is city planning, and it deserves more recognition, both by the engineers who might be doing it, and the general public, whose appreciation is necessary before it can bring material results. In the South Philadelphia work, the engineers, through the city's Bureau of Surveys and the railroads' engineering departments, played a material part in the preliminary studies.

Straws in the Wind

SURPRISING indeed has been the interest in the use of a mortar bed for brick pavements since the Engineering Record on July 10 published Mr. Blackburn's article describing the road built under his advice and that of Mr. Parrish at Paris, Ill. This pavement, it will be remembered, was all—base, cushion and brick—laid at one time, securing a monolith from sub-base to top. As a result of the publicity given to this type of construction, the Illinois town has recently been a Mecca for highway engineers. Some time ago a party numbering twenty-seven came up from St. Louis in a special car to see it, and found on the road at the time seven other inspection parties. Certainly this is a straw showing how thought on pavement construction is tending. And well may the Paris type be given most serious consideration. If the explanation vouchsafed by Mont Schuyler of St. Louis, be accepted, that breaking down of brick pavements is due to local hollow spots left by the shrinking of the sand—and if the danger of shifting cushion be conceded, the use of the mortar cushion is in the present state of the art the only alternative. But beyond this the immediate laying of cushion and brick on the wet base gives an element of strength, through the monolithic action of the deep slab, that is absent in the ordinary type, and even in that where a mortar cushion is used but is placed after the base has set. Furthermore, the securing of a monolith should permit the reduction of the thickness of the base or of the brick or both. This journal believes that a much smaller total thickness, using this type of construction, will give results equal to those obtained with the customary 6-in. base and 4-in. block, using a sand cushion. If the brick thickness be reduced, freight charges will be lessened and this type may thus be in a better position to compete with the thicker concrete road. When Mr. Blackburn's article was published this journal expressed the opinion that the Paris example would surely be followed elsewhere. In view of the extent to which the road is being inspected that prediction can safely be repeated with decided emphasis.

Inland Water Transportation

JUDGED by the success of river transportation abroad one would feel justified, offhand, in predicting a big future for conveying bulk shipments by water in this country. On careful consideration, however, one must evaluate several factors which must make the development conditional. The railroads have robbed the Mississippi, in particular, of its former large traffic. Whether under better river conditions—an improved type of barge and good terminal facilities—the railroad will still be able to dominate remains to be seen. Theoretically the advantage is all in favor of river transportation, when the freight is of a bulky nature. Nevertheless, one cannot feel that the trade on the Mississippi would have slumped so badly, by comparison with the traffic of the railroads, had the argument been entirely one-sided. Few men in this country, however, are better qualified to champion water transportation than Capt. John H. Bernhard, and his extremely readable 48-page discussion of the subject in the "Proceedings" of the American Society of Civil Engineers is bristling with arguments that are not easily answered. He also gives much interesting information about the barge trip he made up the Mississippi and back a year ago, and about the line of barges which a company organized by him proposes to put into service between New Orleans and St. Louis. Considerable space, therefore, beginning on page 332 of this issue, is given to an abstract of his discussion, and even then it is possible only to skim over many points he treats at length. On the question of rates, while the Engineering Record believes within certain limits in the doctrine "Charge what the traffic will stand," on the ground that where much profit is not possible it is justifiable to get a little and even up to some extent elsewhere, it, of course, deplores hauling goods below cost to starve out water com-

petitors, or for any other reason; and apparently the widely variable rates quoted by Captain Bernhard would bear investigation. As to terminals and their effect on time and cost of transportation, it is perhaps worth noting that while river terminals are crude in the extreme, rail terminals also are susceptible of improvement that would make for cheaper and faster transit, and that although the railroads do now fail to move a freight car a daily average of anything like 72 miles, the figure is not unbelievably high for the future. It is not the purpose here, however, to concur with or dispute Captain Bernhard's arguments in detail, but to present them as fairly and completely as possible in the limited space available, trusting that his paper will stimulate interest in the subject and draw discussion from well informed proponents on both sides.

The Algae Problem

SURFACE water supplies stored in reservoirs are apt to become foul at this season of the year because of the growth of microscopic plants known collectively as "algae." Warm water, sunlight, plenty of food supply in the form of carbonic acid, oxygen, nitrates and organic matter contribute to their growth. Currents of the water, both horizontal and vertical, are also vital factors. These and a few other things have been learned about algae during the forty years since the study of these organisms was begun in Massachusetts by Dr. W. G. Farlow of Harvard University and Prof. William Ripley Nichols of the Massachusetts Institute of Technology. But, after all, are we not a long way from knowing what every waterworks man wants to know—why the growths appear in one reservoir and not in another? why one year and not the next? how their growth may be anticipated and checked? So many different factors are involved that, as Hazen and Whipple have recently pointed out, their occurrence in reservoirs seems to follow the well-known laws of probability, or chance.

Considerable progress has been made in methods of destroying algae by the use of chemicals, and of removing them and the odors which they produce by aeration and filtration, but the fundamental biological problem still remains unsolved, and it is too important a problem to be passed over as it has been passed over in recent years. The discussion as to the benefits of soil stripping—that is, the removing of soil rich in organic matter from the bottoms of newly built reservoirs—still continues and is likely to continue until some of the fundamental reasons for the growth of algae have been better established. Engineers need the further assistance of well-trained biologists. Of late years the subject has been considered almost exclusively along practical lines. What is needed now is more theory, more pure science.

One reason, doubtless, why progress has been slow, is that the microscopic organisms have been considered together as a group, the one thing in common being that they are small. As a matter of fact they differ most widely. Some are animals, some are plants; some are heavy, some are light; some are attracted by light, and light repels others; some have chlorophyl, some do not. In all sorts of ways they differ. It would appear that what is now needed is concentration of study. Let some one confine his study to Anabaena, let us say, and he will find work enough for several years. Another need is field work. The continued counting of the number of organisms in samples of water sent to the laboratory will never lead to a discovery of the laws of their growth, because their life history may include phenomena which take place along the shores or on the bottom of a reservoir as well as in the water itself. A closer study of the subsurface topography of reservoirs is needed, a study of the relation of bottom area to volume, and particularly a study of the bottom area exposed to the circulating waters as contrasted with that in contact with stagnant water. Yet along with this concentrated study must go its complement, the study of the inter-relations between different classes of organisms.

In Europe the science of limnology has been pursued to greater lengths than in this country. Fifteen years ago the American Limnological Commission was organized, but after a feeble existence it died through lack of proper support. It is time that a new limnological commission was created and that the algae problem was taken up by new minds, and in new ways, with the hope of a better understanding of the subject. Such a study, to yield results, must be extended in time and space, and that would involve an expense of several thousand dollars annually. But to remove the soil from a large reservoir may cost hundreds of thousands of dollars. For a reservoir like the Ashokan of the Catskill supply for New York City it would have been a matter of several million dollars. The poisoning of algae with copper sulphate is an unsatisfactory and, at best, only a palliative process, while the filtration of algae-laden water introduces problems not otherwise encountered. In these days of preventive medicine, engineers ought not to be content to use methods of cure. Surely the algae problem is worth studying anew.

The Militia Engineers

OF the different branches of the army, the engineer corps probably receives the least attention from the public, although it has done splendid work in Panama, Cuba, the Philippines, and in our own river and harbor work. Even the importance of the engineer in the present European war has not directed general interest toward the work of the army engineer. This is even more the case in respect to the engineer corps of the National Guard, many engineers not even knowing that such a corps exists. It is numerically small, and the companies are widely scattered, many States having no engineer companies at all, and few States having more than one. These conditions increase the difficulties of developing and training the organizations, and it is seldom that several companies can be brought together for drill.

The description on page 314 of the work of the engineer companies of the militia this summer at their camp near Washington shows the opportunity that the militia offers engineers for practical work in National defense. The work in camp covers a wide range and is as thorough and complete as the time permits. It is of value not only to the Government in training a body of engineers for active service, but to the men as well, in health and in lessons that apply to their civilian occupations. The mobilization of several engineer companies at once is invaluable, because it schools the officers in handling larger bodies of men, permits of work on a bigger scale and introduces a friendly rivalry between companies.

In the past the engineer companies of the National Guard have struggled along in obscurity, with little support from the States or the Federal Government, and even less from the engineering profession. As a result there is but one company in many places where there should be several, while cities well able to recruit one or more companies have none. Chicago, the engineering center of the Middle West, has but one company, and that is only three years old. It has been growing rapidly, however, and with the co-operation of the engineering profession, which now seems assured, should develop into a battalion. New York has but one. Pittsburgh, Boston, St. Louis, Detroit and many other large cities have none. An opportunity exists in all these places for engineers to prove their patriotism and to prepare to place their ability, training and knowledge at the disposal of the country.

Engineers and the Constitutional Convention

NOW that the work of the New York State Constitutional Convention is drawing to a close, it is fitting to estimate what has been accomplished by the committee of engineers which suggested certain plans to the convention. Constitutional revision on a wholesale scale is possible in New York only every twenty years. The committee of engineers was formed, therefore, to bring to the attention of the convention the advisability of certain changes involving engineering matters.

Officially there were represented on the committee the American Society of Civil Engineers, the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, the New York Section of the American Institute of Mining Engineers, the American Institute of Consulting Engineers, the Municipal Engineers of the City of New York and the Brooklyn Engineers' Club. Through participation of some of their members in subcommittee work several other societies were indirectly represented. The Rochester Engineering Society studied the matter independently and its recommendations to the convention closely paralleled those of the committee.

The chief recommendations were:

1. That all engineering functions of the State—the design, construction and operation of canals, highways, water conserva-

tion works, parks and public buildings—be placed under a State department of engineering and public works, with a commission of three members in charge, one member being an engineer.

2. That there be a single public service commission, composed of five members, at least two of them being engineers.

3. That one-third of the membership of the Court of Claims be made up of engineers.

Of these recommendations, only the first was, in any measure, adopted. Canals, highways and public buildings are to be consolidated under the Department of Public Works. Conservation is to be handled by a large non-salaried commission. A single head will control the Department of Public Works. There will be—if, of course, the people accept the new constitution, which seems likely—two public service commissions as in the past, while there will be no opportunity for the appointment of engineers to the Court of Claims.

Thus, there has been but meager accomplishment. It can be accounted for in various ways. Weighing most strongly against the suggestions of the committee was the fact that they ran counter to the spoils system—and the convention was run by the politicians. In the second place, much of the detail presented by the committee was believed by the delegates to the convention to be valuable, but to have a place rather in the statutes than in the constitution. This the committee realized when it framed the recommendations. The details were included, however, so that if the convention departed from making provisions for only the broad outlines, the views of the engineers would be advanced.

Finally, for success in matters of this kind the accepted tactics must be employed; that is to say, there must be a persistent lobby—not a lobby in any discreditable sense, but constant solicitation of the delegates by someone whose business it is to present the merits of the proposal it is desired to have accepted. The value of this method of handling its work was fully appreciated by the committee, but the high cost of such services and the danger of unintelligent, but nevertheless weighty, criticism of such use of the funds allotted resulted in a decision not to adopt the plan. Appearances before committees, circularization of the delegates on each of the main proposals and personal letters by such members of the committee as had acquaintance with delegates had, therefore, to form as good a substitute as might be.

The experience, however, is not without decided value to the engineering profession. In the first place there have been formulated some excellent plans, the value of which need not be lost. Presented suitably to the Legislature, much may ultimately be accomplished. The work has resulted in putting engineers before the convention, before the political powers and before the State at large. The newspapers printed considerable material regarding the plans proposed by the profession, and this publicity should insure a still better hearing for proposals made by engineers in future. On the other hand, it has been clearly demonstrated that for results the lobby method is the only one that is effective.

One other lesson it seems possible to draw, and yet its nature is chimerical. If, instead of only one engineer delegate to the convention there had been half a dozen, all strong men, the result might have been quite otherwise. Obviously it is not easy to have them elected to such bodies. While the proportion of men of high caliber was very much larger than one would find in a legislature, the convention was political, and, as experience shows, engineers do not enter much into party caucuses and conflicts. Yet the thought is worth while bearing in mind, and when the first moves are made toward the selection of delegates to such an important body the engineering societies might well take under advisement ways and means of securing satisfactory representation.

The effort demonstrated that representatives of the various engineering societies could work together for a common end. Joint activities are multiplying. Of permanent organizations came first the Fritz Medal Board, then the Engineering Foundation and recently a number of activities of a more or less temporary order. The welding of the bonds between the various National societies more strongly is worth a great deal to the profession at large, and this, certainly, the work of the committee of engineers on the constitutional convention has helped to accomplish.

Forceful Writing and Its Place in Engineering Publicity

IT is said that "any fool can write a book, but it takes a wise man to write a paragraph." Equally true, any engineer can write a report, but few can write a paragraph characterizing the work, or, at least, write it in such a way as to make it attractive and readable to the general public. Most engineers have lost—or perhaps never acquired—the news instinct. They will argue that there is nothing of news in the work which is being carried on about them by their fellow engineers. They insist that there is little of popular interest and that nothing can be said that is worth saying, unless it is embodied in a voluminous report with tables and diagrams.

Yet we have only to glance over the carefully considered and well arranged paragraphs of many of the best-edited newspapers to see again and again references to works which are no more interesting or important than those being carried on in our own immediate vicinity. The news value is brought out by a clever, concise handling of the subject, by bringing into the foreground some one conspicuous item, one which may be well known to technical men, but is practically unknown to the general public.

The Japanese in their houses select out of a store of ornaments a single piece, placing it in what we would consider a bare room. This single piece attracts the eye, stimulates the interest, and is infinitely better appreciated than the fifty or hundred equally valuable works of art which crowd the reception room of the wealthy American. A photograph of the single mountain peak, standing out alone, with its companions in the distant background, rivets the attention, while the view embracing the entire horizon is vague and monotonous. It is this ability to be able to select a single important fact and arrange it with reference to its true value or perspective which constitutes one of the best elements of news.

Novelty is not necessarily news, nor is it the sole requisite for attracting attention. A clearly expressed statement regarding an invention made three thousand years ago, when given briefly and in its relation to modern affairs, may have greater reading value than the description of the latest patent issued.

There is an awakening on the part of engineers to the fact that they have not in the past diffused information regarding the work of their profession. To-day they are suffering to a certain extent because of the ignorance of the public regarding the work which has been done and which can and should now be done in all of the lines of improvement of public health, of better roads and of innumerable conveniences. What is everybody's business is nobody's business. While every engineer is to blame, no one in particular regards himself as culpable for not having done anything in particular to diffuse necessary information. We are awakening to the fact, however, that the responsibility must be located. The nearest and most obvious way is in the local engineering society or the group of engineers which exists in every considerable community. There is a duty first in organizing, and second in taking intelligent action toward diffusing information regarding the engineering achievements, the opportunities, and the needs of the locality.

The first step is to find that rare man who has the sense of news—the man who can write a paragraph which is really readable. While he is rare, he can usually be found in a body of a hundred engineers or men interested in engineering, or at least he can be developed to be a fair substitute for the needed man.

Of course, it means hard work to the young man who is thus designated to be the leader of the local engineering organization in publicity, but the reward to the man who can do it is well commensurate with the effort, not only in the appreciation which properly comes to him, but in the broadening of his education and in his contact with men of affairs.

In considering any work of this kind, there is always one danger which must be clearly kept in mind and on which many a fair publicity scheme has been wrecked. It must be kept free from personal advertisement or even suspicion of it. At all times the action by the local engineering body and by its representative must be kept on a high altruistic plane of benefit to the whole engineering profession and to the community, and not to any one person or clique. If well done, the benefit to the public and to the engineering profession, while not immediate nor showy, will be lasting and substantial.



BUILDING BOMB-PROOFS IS NOT CHILD'S PLAY WHEN THE TEMPERATURE IS AROUND 90 IN THE SHADE

Mobilizing the Engineer Companies of the Militia

National Guard Corps in Encampment at Washington Barracks, Belvoir Tract, Virginia, Build and Demolish Railroads, Bridges, Field Fortifications and Roads

By D. A. TOMLINSON
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THIS SUMMER the War Department has been mobilizing the engineer companies of the militia from the Eastern and Central States, a battalion at a time, at the summer camp of Washington Barracks, at Belvoir tract, Virginia, about 25 miles below Washington on the Potomac. The companies remain there between ten and twelve days, depending on the distance traveled to reach camp, it being the aim of the War Department that the total time required be limited to two weeks. Early in August companies from Chicago, Calumet, Mich., Philadelphia and Scranton, Pa., were there, together with two companies of army engineers. Practically no infantry drill is required of these companies at camp, the entire time being given to practical instruction in military engineering under the direction of officers of the regular army. The work is very similar to civil-engineering construction and preliminary surveys, the chief difference being that it is conducted under army rules and discipline and that simplicity and speed are more important than precision, permanence or appearance.

The camp consists of several hundred acres of wooded hills and ravines on the Potomac River, far enough from the nearest farm house so that the dynamite used by the "wrecking crew," as the men call the demolition squad, breaks no windows. It affords an opportunity for almost every phase of military engineering; bridge building (both timber and pontoon), field fortifications, road building, camp sanitation, reconnaissance and demolition.

CAMP LIFE STRENUOUS

The regular army routine of camp life is strictly followed. Reveille is at 5.45 a. m., breakfast shortly after 6, and the men are at work before 7. Field instructions and practice in the morning last until noon. After mess the non-commissioned officers "go to school" for two hours, where they are given a series of lectures on army engineering, maneuvers and tactics. In the afternoons the men clean up camp, wash their cloths, clean their guns and equipment and do the other work necessary to maintain themselves and the camp in proper condition. Supper is at 5 p. m. and inspection at 6, when every man must appear in place spick and span. A rusty gun, muddy shoes, tardiness or other offense means duty on the "provost guard" the next day, which requires the cleaning of the officers' tents, digging refuse pits and drainage ditches, disposing of garbage, work in the stables, and other duties which everybody wants to wish upon someone else.

As the camp is 6 miles from the nearest trolley line (the one at Mount Vernon), and 7 miles from a railroad, outside attractions are dimmed by the long hike, and the work receives the men's undivided attention. All the incoming troops are required to march that 7 miles from train to camp, carrying their full equipment—blankets, poncho, extra clothing, tent, haversack, canteen, bayonet and rifle—weighing 60 lb. It is lighter than the marching equipment of most European armies, and the weight is well distributed, but 7 miles, "packing" 60 lb., is a pretty stiff proposition for militiamen only a few hours removed from desks and blueprints, and the memory of that march takes away all desire to see the sights. On leaving camp, after ten days of hard work in the open air, what first seemed like 20





THE BRIDGE SQUAD ASSEMBLES CANVAS PONTOONS, ANCHORS THEM IN POSITION AND BUILDS A BRIDGE ON THEM



DYNAMITING THE RAILS IN A FEW PLACES PUTS THE RAILROAD OUT OF COMMISSION



ONE WORK OF THE FIELD FORTIFICATION SQUAD IS PLACING BARBED-WIRE ENTANGLEMENTS

miles and an unnecessary hardship, assumes proportions nearer the truth, and there is keen competition between the different companies for the distinction of making it in the shortest time.

PRACTICAL INSTRUCTION IN MILITARY ENGINEERING

The men are divided into sections—a bridge section, a field fortification section, a demolition section and a reconnaissance section—the personnel of each remaining intact during camp and each section handling its own work only, it being impossible to give everyone satisfactory training in everything in the time available. As most of the men are engineers and college graduates, a large amount of ground is covered and every hour is made to count.

The bridge sections construct "single-lock" and "double-lock" spar bridges and trestles over ravines, clearing away the underbrush and trees and utilizing them in the bridges. The only material that is not available in the immediate vicinity is rope for lashings, no nails or spikes being used. Canvas pontoons are assembled, launched in the Potomac and anchored in position, and a bridge is laid across them. Similarly, wooden pontoons are launched and anchored, and a pontoon bridge is built. A short piece of railroad roadbed is graded and track is laid. A wagon road is cut through the forest and graded. Each day is given to a different problem and each problem is explained and studied in detail.

The field fortification section digs several different types of trenches, and constructs bomb-proofs, barbed wire entanglements, abbattis and other protective works, both temporary and permanent. This is real work, under a hot August sun, with the thermometer at 90 deg. in the shade and no breeze. Shirts and hats soon come off, and new blisters appear hourly.

THE WRECKING CREW

The demolition section blows up the railroad in several different ways, merely dynamiting the rails in a few places when time is short, or, when possible, blowing up a whole section of track. Similarly the bridges built by the bridge section are destroyed, the pontoons are sunk, and the bomb-proofs are reduced to a mass of wreckage, for the rapid and complete destruction of anything that might be of use to the enemy is as important as its construction for an army's own use.

The reconnaissance sections make a rapid survey, partly on foot and partly on horseback, of the surrounding country, the lithographers taking the sketches as they are brought in each day, combining and copying them, etching the final map upon a zinc plate and taking off as many copies as may be wanted. The first copy is ready within a few hours after the sketchers return with the information. This work is important and hazardous. In actual war the sketchers work ahead of the main army, behind the cavalry screen, and must cover ground rapidly, for information about the country to be covered in the march the following day. Surveys on from 20 to 30 miles must be secured each day, and the maps given to the officers before midnight. The sketchers work in small isolated groups, and are in constant danger of surprise, attack and capture.



NO NAILS ARE USED IN THE BRIDGES, WHICH ARE BUILT OF NATIVE TIMBER AND ROPE



AFTER THE BRIDGES HAVE BEEN BLOWN UP THE WRECKAGE HAS TO BE CLEARED AWAY

Refuse Dumped from Cart to Scow Without Scattering

New York City's New Dumping Board at Seventy-second Street and East River Eliminates Dust and Other Objectionable Features

SHEET-STEEL CHUTES, into the tops of which ash and refuse carts dump, and the bottoms of which reach nearly to the deck of the scow being loaded, prevent scattering of refuse and reduce the dust to a minimum at New York City's new dumping dock, recently commissioned. This dock, located at Seventy-second Street and the East River, is thought to be an improvement over anything of the kind yet constructed, and is believed by the Department of Docks and Ferries to be the only one ever built on this principle, either here or abroad.

CHUTES RAISED AS ASHES PILE UP

As ashes pile up on the scow being loaded, the chutes are raised by chain blocks. These blocks run on a crane rail consisting of an I-beam carried by the roof trusses, so that each of the three chutes provided may be moved 20 or 25 ft. laterally in loading a scow. The vertical motion provided for is about 8 ft. This range requires two doors, one above the other, which allow opening the full height of the inshore side of

the chute, except 2 ft. 4 in. at the bottom.

Each door is made of an upper and a lower leaf. The upper leaf is hinged to the shore face of the chute, and the lower leaf is hinged to the lower edge of the upper leaf, and swings free from it. Two pipe handles, made up of a straight piece of pipe, with a coupling, a nipple and a cap on the lower end, are attached, one on each side, at the hinge between the leaves, and are thrust inward to open the door. The upper leaf swings up into a horizontal position across the chute, and the lower leaf hangs from its edge against the river side of the chute. When in this position each pipe handle is caught by the coupling made up in its lower end, which shoulders against a slotted bracket at the corner of the chute into which the lower end of the handle drops. When the doors are shut the handles hang vertically against the inshore face of the chute.

The chutes are made up of light angles and sheet steel of No. 14 gage. They are 3 ft. 6 in. x 7 ft. in plan and 17 ft. 10 in. high, and accommodate a standard two-wheel dump cart.

Construction of Dumping Board

The wood wagon-floor of the dumping board is carried on timber bents, and cantilevers out 15 ft. over the bulkhead line. This floor is a few feet below the level of the end of Seventy-second Street, with which it connects by a bridge. A shutter door is provided at the river end of this bridge, so that the dumping board may be entirely inclosed while carts are discharging, or when not in use.

The deck superstructure, shown in the photographs, consists of a steel-frame roof carried on I-beam columns, which cantilevers out 19 ft. 6 in. over the water. From the roof truss hangs the river wall of the superstructure, and in the slot, 3 ft. 8 in. wide, between this wall and the floor of the dumping board are the steel chutes. The timber underframing is about 21 x 187 ft. in plan, and the steel roof is the same length by about 40 ft. in width. The timber bents, cantilever beams and the under side of the wooden floor are protected against fire with plaster boards.

The dumping board was designed and built under the direction of the Department of Docks and Ferries of New York City, R. A. C. Smith, commissioner, R. C. Harrison, first deputy commissioner, and C. W. Staniford, chief engineer. An earlier installation on the same general plan was designed by Mr. Staniford in 1914 for the dumping board at Seventy-seventh Street and the North River, but has not yet been completed.



DUMPING CHUTES MINIMIZE SCATTERING OF REFUSE



CHUTE VISIBLE UNDER OVERHANGING STRUCTURE

Committee Outlines Best Methods for Sewage Works Operation

American Public Health Association Report Urges Skilled Supervision and Adequate Records of Plant Performance

In its report to the sanitary engineering section of the American Public Health Association, presented at the convention in Rochester, N. Y., this week, the committee on sewage works operation and analytical methods, after outlining the data which should be included in reports of operation, made an urgent plea for competent supervision and laboratory facilities at sewage treatment works, centralization of authority to control stream pollution and approve plans for new sewer systems and treatment works in State boards of health, uniform methods of reporting results of operation, and measurement of the rate of flow of sewage to the plant. If the system for obtaining data, as recommended by the committee, were put in force, State officials, according to the report, would be in possession of a fund of information which could be used to good advantage in advising operators of sewage works as to methods for securing the best results in sewage treatment. The committee is headed by W. L. Stevenson of Philadelphia, chairman, and includes L. I. Birdsall, F. E. Daniels, C. A. Emerson, Jr., C. B. Hoover, H. C. McRae, and Richard Messer. The report, in part, is as follows:

Reiterating the recommendations in its 1914 progress report (see Engineering Record, Dec. 19, 1914, page 674) the committee advocates the tests in Tables 1 and 2 as being most useful for the operating control of sewage treatment plants.

Table 1—Tests Recommended for Works Designed Primarily to Prevent Nuisance

A. Works consisting of preliminary processes only, such as fine screens or sedimentation.
1. Crude sewage:
   a. Nitrogen as organic and as free ammonia.
   b. Suspended matter (called Test Y).
   c. Chlorine.
   d. Avidity for oxygen.
2. Influent and effluent:
   a. Avidity for oxygen (Test X).
   b. Suspended matter (Test Y).
3. Sludge drawn from tanks:
   a. Specific gravity.
   b. Percentage moisture in wet sludge.
   c. Percentage of dry residue that is volatile.
   d. Reaction of wet sludge (for two-story tanks only).
4. Final effluent:
   a. Avidity for oxygen (Test X).
   b. Suspended matter (Test Y).
5. Sufficiency of treatment as indicated by receiving body of water:
   a. Dissolved oxygen.
   b. Avidity for oxygen (Test X).

B. Works consisting of preliminary and oxidation processes, such as contact beds or percolating filters. (All tests given under heading A, above, and the following additional ones).
1. Effluent of oxidation process:
   a. Nitrogen as nitrates.
   b. Avidity for oxygen (Test X).
   c. Dissolved oxygen.
   d. Relative stability.
2. Final effluent:
   a. Nitrogen as nitrates.
   b. Dissolved oxygen.
   c. Relative stability.

Pollution Beyond Safe Limits

The natural growth of cities and towns, and the general demand for complete sewerage facilities add steadily increasing loads upon the water courses while their ability to receive the sewage does not increase and in some cases actually decreases, consequently, the pollution of water courses is becoming more evident and in many instances has gone beyond safe limits.

Incompetent Supervision

It is therefore surprising to learn how few sewage works in America are under competent supervision and provided with laboratory facilities. In fact only a few of the larger plants receive such attention. Municipalities frequently employ expert engineers to study local conditions and to design sewage treatment works, but when such works are put in service their operation is intrusted to an untrained employee, transferred from some other branch of the service, who is totally lacking in knowledge of the complex forces which must be controlled in order to produce the results which the designers intended and for which the funds were invested. This is poor business policy. A municipality or private owner would not attempt to operate a power plant or other installation involving complicated machinery without the services of trained engineers because they know it would not be economical to do so.

Need for Laboratory Control

Where sewage treatment works are of sufficient size to warrant it, laboratory control will allow improvements in methods of operation whereby failures may be averted and the capacity of the plant maintained to an extent which will more than pay for the small expense involved. In the case of a small works the expense of an individual laboratory will usually be prohibitive. However, if there are several such plants in the same neighborhood, it may be possible to obtain the services of an expert operator, provided with a laboratory, to look after all of them, and the expense divided among the

TABLE 2—TESTS RECOMMENDED FOR WORKS DESIGNED PRIMARILY TO PROTECT SOURCES OF WATER SUPPLY

A. Works consisting of preliminary processes and disinfection.
1. Crude sewage:
(Same as in Table 1.)
2. Influent and effluent:
(Same as in Table 1.)
3. Sludge drawn from tanks:
(Same as in Table 1.)
4. Final disinfected effluent as discharged:
a. Presumptive test for B. Coli.
b. Test for avidity for oxygen (Test X).
c. Test for suspended matter (Test Y).
5. Sufficiency of treatment as indicated by receiving body of water:
a. Presumptive test for B. Coli.
b. Dissolved oxygen.
c. Avidity for oxygen (Test X).

B. Works consisting of preliminary and oxidation processes and disinfection. (All tests given under heading A, above and the following additional ones.)
1. Effluent of oxidation process:
a. Nitrogen as nitrates.
b. Avidity for oxygen (Test X).
c. Dissolved oxygen.
d. Relative stability.
2. Final disinfected effluent:
a. Nitrogen as nitrates.
b. Relative stability.
c. Dissolved oxygen.

several communities would be very small. It is recommended that designing engineers call the attention of their clients to the necessity and economy of such operating control.

CENTRAL AUTHORITY ADVISABLE

As the great majority of sewage treatment works in America are small and frequently widely separated, it is apparent that the needed expert supervision cannot be obtained locally and that efficiency of operation can only be obtained through some central authority. In several States the legislatures have vested the State boards of health with authority to control the pollution of water courses and their approval is required before sewerage works can be constructed. The State board of health, in its uniform relation to all the municipalities of the State and with similar boards in adjacent States, is in a position to perform such a service to better advantage than any other body now existent in the usual organization of the various State governments of the country.

For the State boards of health to act intelligently they should know the methods of operation and results accomplished in all the sewage treatment works in the State. They would then be able to act as clearing houses, applying to one works the information obtained from several others operating under similar conditions.

The State is interested in seeing that the existing works accomplish the best results possible and the separate communities are naturally anxious that the works shall meet the requirements at the minimum expense for operation, additions and renewals.

DATA REQUIRED

To obtain these data, information is required on the following:

1. The purpose of the works, i.e., are they primarily intended to protect sources of water supplies or to prevent the creation of nuisance.

2. The construction of the works, i.e., the details of each process which influence operating methods, rather than the stability of the structure.

3. The quantity and character of the sewage to be treated.

4. The methods of operation and results accomplished.

The data concerning the construction of the works should be obtained by the State board of health, either through plans submitted for approval, supplemented by record plans after the works are constructed, or, in cases where the board is not yet clothed with such authority, by means of inspection and measurement. Any changes from the original contract drawings or alterations after the plant is in service should be especially noted, as these may be vital information in connection with operating policies. It presumes that in those States where the law does not require approval of sewerage works before construction, the number of plants is small and hence there should be no difficulty in obtaining the needed data. The records of operation and results accomplished should be furnished the State by the town or owner upon blank forms prepared by the town officials or the owner in conjunction with the State officials.

REPORT FORMS

In preparing such forms it should be borne in mind that the small works are generally operated by employees lacking a technical education, and therefore clearness and simplicity should be obtained by having as much as possible printed, leaving only figures to be filled in. The reports should be printed on sheets either 8½ x 11-in. or of such size as to conveniently be folded to 8½ x 11-in., so as to facilitate filing in standard letter files. It would be desirable to have the sheets made up in the form of pads, so that the operator by placing carbon paper beneath the top sheet could obtain a copy. The record sheets should be signed by the operator and mailed at monthly intervals to the office of the State Board of Health.

FLOW SHOULD BE MEASURED

It is again desired to call attention to the importance of recording essential data. In the majority of sewage treatment works no provision is made to obtain a record of the rate of flow to the plant even though such information is vital to proper operation. The committee strongly recommends that engineers, in designing new works, provide means for easy measurement of the flow, and that measuring devices be installed in existing works not now so equipped.

RESULTS OBTAINABLE

If this system of obtaining data were to be put in force, in a short time the State officials would be in possession of a fund of information which could be used in advising operators of sewage works, and this would not only aid the local communities but also the commonwealth. It would be of further advantage if the State boards of health would use the information so gathered to prepare pamphlets written in clear, popular style, to call to the attention of town officials the need for, and value of, sewage treatment not only as a local matter but in its broader effect upon the commonwealth.

HEALTH EXPENDITURES in 600 Illinois municipalities average 15 cents per capita per year, according to returns to the State Board of Health. The State spends 1½ cents more, but the total is only about 17 per cent of the amount deemed necessary for the purpose by competent authorities. Towns of less than 10,000 people spend 8.1 cents per capita; those from 10,000 to 25,000, 8.6 cents; from 25,000 to 50,000, 15.5 cents (exclusive of garbage disposal), and those from 50,000 to 70,000, 14.9 cents (exclusive of garbage).

W. C. Cushing Discusses Special Steels for Track

Believes Manganese Steel Has Proved Its Worth — Would Continue Trials of Nickel Steel— Urges Other Experimenting

SPECIAL STEELS for track and track appliances are discussed at considerable length by W. C. Cushing, chief engineer maintenance of way, Pennsylvania Lines, Southwest System, in the July *Bulletin* of the American Railway Engineering Association. The paper, which was prepared for the ninth session of the International Railway Congress Association, to have been held in Berlin this year, occupies 193 pages. With its numerous appendices it contains a mass of miscellaneous information on special alloy and special process steel, much of which is uncolored presentation of the experiences and views of others. He also draws certain conclusions of his own, however, which are as follows:

1. Cast manganese steel has been proved by long experience, under exacting conditions, to be a satisfactory and safe metal for the manufacture of frogs and switch points.

2. The trials of rolled manganese steel for rails, and for the manufacture of frogs and switches have not been so extensive as with the cast product, but have been continued to a sufficient degree to enable us to conclude that it will ultimately be entirely suitable for those uses at locations where great strength, toughness and a maximum abrasive resistance are desirable.

3. The experiments with nickel, and nickel and chromium in certain proportions, in rail steel have not, up to the present time, been entirely satisfactory; but the accepted employment of nickel steel in bridge construction, and the trials of nickel and chromium in other proportions in rail steel, especially when incorporated as two of the natural elements of the iron ore, justify continued use.

4. The use of high carbon (over 0.80 per cent) in rails weighing 85 lb. per yard, in combination with 0.92 to 1.00 per cent of nickel, and 0.24 to 0.29 per cent of chromium, has not been satisfactory. The conditions with rail sections of greater weight might be entirely different.

5. Further study of the qualities possessed by high silicon rails, that is, steel with over 0.30 per cent of silicon, is advisable.

6. The value of the use of ferro-titanium in rail steel manufacture as a "physic" for improving the condition of solidity of the metal is conceded, but at the same time steps should be taken to overcome its injurious effect in deepening the "pipe" in the ingot.

7. Heat-treated rails, and those manufactured with the assistance of the electric process, are at present in experimental use only, but the possibility of future value is promising, and the study should be continued.

A COLLAPSIBLE WATER-STERILIZING APPARATUS weighing 12 lb. and capable of sterilizing 5.2 gal. of infected water per minute at a nominal cost, is said to be the recent invention of a doctor in Milan, Italy. It is announced that the apparatus will soon form part of the baggage equipment of Italian troops, thus making immediately available pure drinking water for soldiers in the field.

Decoloration of Stored Water Is Due to Bleaching by Sunlight and Oxidation

Conclusions Reached by Ralph H. Stearns as Result of Study of New England Reservoirs Are Cited at New England Waterworks Convention

BASING his conclusions on studies made on New England reservoirs and particularly those of the Wachusett watershed Ralph H. Stearns of Boston, in a paper read before the New England Waterworks Association at its convention in New York this week, declared that the decolorizing agencies at work are sunlight and oxidation. He cited the records kept at Wachusett and argued from the local conditions that no other agencies could be at work. His studies show that the decoloration at the bottom was about 30 per cent less than at the top in the Wachusett reservoir and that at the Hopkinton and Ashland reservoirs, whose waters are highly colored, the decoloration at the bottom is about one-half that at the surface.

Mr. Stearns' paper, in part, follows:

The results here cited apply to New England river waters, colored with a vegetable stain which originates largely in swamps, from the peat and decaying vegetable matter. There is generally only a very slight turbidity in the water, the sedimentation of which would have but a small effect on the color.

IRON

Iron plays a peculiar part as a coloring agent in reservoir water. A study of the relation of iron to color, made in Boston about 1892, revealed the following facts:

Where there is plenty of dissolved oxygen in the water the iron is kept in its insoluble ferric state and is therefore precipitated and remains on the floor of the reservoir. When the oxygen in the water becomes exhausted this ferric iron may be reduced to its ferrous state by the surrender of its oxygen to the organic matter, and may then be taken up by the water. A lack of oxygen often obtains during the warmer months at the bottom of deep reservoirs, below the plane reached by the circulation of the upper waters, where organic matter is abundantly supplied either by the bottom or the influent water. The colorless ferrous iron upon oxidation imparts a high color to the water, which is gradually reduced to normal again by precipitation of the iron. Iron has appeared on occasions in the Hopkinton and Borden Brook reservoirs, and frequently in Milham Brook, but not in the other reservoirs listed in the table.

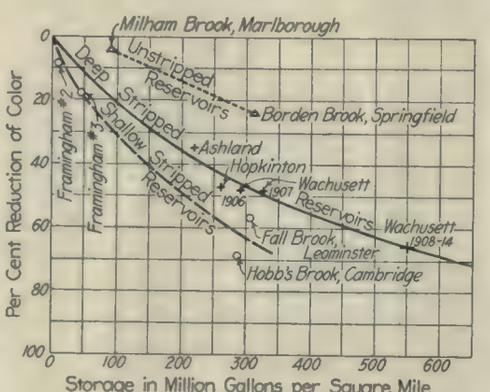
BLEACHING AGENTS

It has frequently been stated that the bleaching of water was due entirely to the agency of sunlight. That sunlight is a bleaching agent was conclusively proved by exposing colored waters in bottles to the sunlight, while similar samples were kept in the dark. The former were in time completely decolorized, while the latter were practically unchanged. Also, by placing bottled water at different depths in a reservoir, the effective bleaching was found to be confined to the upper few feet, while at a depth of 10 ft., in a reservoir water having a color of 40, no appreciable reduction was found after a month's exposure.

The conclusion that bleaching is the result of sunlight alone is, however, not borne out by the actual observations in deep reservoirs. In such reservoirs a complete mixing occurs in the early spring, after which the surface water becomes warmer and of less specific gravity than the lower waters, and vertical circulation between the upper and lower strata ceases entirely until the fall overturn occurs. In this bottom water, thus left stagnant and beyond the reach of sunlight, decolorization goes on, and at a considerable rate.

Taking, for example, the Wachusett records for 1907-1914, the maximum color reached at the dam after the spring overturn averaged 18.6, and this was reduced before the fall overturn to 14.4 at the bottom, as against 12.6 at the surface. In other words, the rate of reduction was about 30 per cent less at the bottom.

At the Hopkinton and Ashland reservoirs, with their highly colored waters, the decolorization at the bottom appears to have been



COMPARISON OF DEEP-STRIPPED, SHALLOW-STRIPPED AND UNSTRIPPED RESERVOIRS

about one-half of that at the surface. It may be urged that the reduction of color at the bottom is due to dilution by ground water, but this is of no such quantity near the dams as to dilute the water of these reservoirs even when drawing them down.

OXIDATION

The only other explanation of decolorization at the bottom is slow oxidation without sunlight. As the dissolved oxygen in the water at the bottom of a stripped reservoir supplied with good water does not become exhausted, this seems the rational explanation. The failure of bottled water to bleach was probably due to lack of oxygen and insufficient time.

The decolorization of water by storage, then, is apparently pure bleaching, brought about by sunlight and by oxidation, and taking place at the bottom of deep reservoirs in cases where there is plenty of dissolved oxygen in the water as well as at the surface. The bleaching action, while always going on, is greatly accelerated during the summer months, and becomes a minimum when the reservoir is covered with ice.

It appears that the reduction in color is proportional to the initial color—that is, the percentage reduction is independent of the initial color. Also, it has been shown that decolorization will continue to completion, both in bottles and in large natural lakes.

RESULTS AT WACHUSETT

The reservoirs which were studied, as seen in the table below, were mainly those of the Metropolitan Water supply, but a few others were added where reliable records of influent and reservoir colors were available. The results are based on averages of from five to fifteen years, which tend to neutralize any anomaly of a single month or year.

Reduction of color is not only a function of the storage per square mile, which is the base used in the accompanying diagram, but also of the run-off per square mile. The number of days that the average yield is held in storage would be the more logical base, but the one used shows the results closely enough and is definite.

The results appear in the accompanying table and diagram. The diagram shows as abscissæ the storage capacity of the reservoir per square mile of watershed, and as ordinates the percentage reduction in color of the inflowing river water resulting from its passage through the reservoir.

It will be seen that the curves determined by the points plotted show a progressive reduction in color as the storage per square mile increases. This reduction in the case of the Wachusett amounts to 66 per cent. The line for unstripped reservoirs is added only to indicate the general position on the diagram, as the data are too limited and too variable in this case to justify any analysis.

The maximum color of the influent of the Wachusett for any month was 70, while the maximum of the reservoir near the dam for any month was 29. This color resulted

DECOLORIZATION OF WATER BY STORAGE

Name of Reservoir and Supply	Years Used in Average	No. of Years Used	Area of Watershed, Sq. Mile	Storage Capacity Total	Storage Capacity Sq. Mile	*Yield Per Sq. Mile Mil. Gal.	Length of Storage Days	Average Depth of Res'r, Ft.	Color of Influent Water	Color of Water at Dam	Per Cent Color Reduction
Stripped Reservoirs											
Wachusett	1908–1914	7¼	118	65,000	550	0.894	615	48	43.5	14.7	66
Wachusett	1907	¾	118	38,600	327	0.920	355	39	45	23	49
Wachusett	1906	1	118	34,500	292	1.043	280	38	46	24	48
Hopkinton, Sudbury	1895–1897; 1899–1903	8	5.86	1,520	260	1.111	234	25	113	60	47
Ashland, Sudbury	1891–1897; 1899–1903	12	6.43	1,416	220	1.066	206	26	100	65	35
Reservoir No. 3, Sudbury	1891–1896	6	27	1,180	45	1.012	45	15	84	69	18
Reservoir No. 2, Sudbury	1900–1903; 1905–1914	14	47	530	11.3	0.863	13	12	76	69	9
Fall Brook, Leominster	1898–1903; 1905–1913	15	1.26	386	306	1.075	285	14	36	15.5	57
Hobbs' Brook, Cambridge	1900–1913; 1905–1914	14	7.25	2,097	289	0.863	335	14	59	18	69.5
Unstripped Reservoirs											
Borden Brook, Springfield	1910–1914	5	8	2,500	312	0.925	338	36	75	57	24
†Milham Brook, Marlborough	1901–1903; 1905–1913	12	3.56	315	88	0.853	103	15	47	45	4

*Based on Machusett or Sudbury records for the years given. †Stripped to 10 ft. below flow line, but oxygen becomes exhausted in deep portion.

from the 1907 floods, before the reservoir had filled for the first time. In 1911, as a result of very small inflow, the bleaching action went on until the color was reduced to 7, which color obtained from the surface to the bottom of the reservoir. This color was maintained for a period of three months, while the color of the influent for these same months, which was of considerable quantity, averaged 45.

Results in Other Reservoirs

The color of the influents of the Ashland and Hopkinton reservoirs on a few occasions exceeded 200 during the months of small run-off of the years above noted, while the maximum recorded color of the reservoir water near the dam was 107 for the Ashland and 96 for the Hopkinton reservoir.

The colors for the month of each year in which the color was a maximum were averaged in the case of the Wachusett, Ashland and Hopkinton reservoirs, and the reduction in color was found to be about five-sixths of the average reduction for the year shown in the diagram, when compared with the same influent colors. This indicates the insurance against the highly colored water reaching the distribution system.

Evidence, other than the bottle experiments, which points to the effect of sunlight in accelerating the bleaching, is found in the shallow Fall Brook and Hobbs' Brook reservoirs. These have an average depth of 14 ft., and show a much greater percentage reduction in color than the Ashland and Hopkinton reservoirs of about the same storage per square mile but of higher color and almost twice the depth. The bleaching which takes place in the upper few feet of the reservoir is apparently many times as rapid as that which occurs beyond the range of the sunlight, but, due to intermixing with the waters just below, complete decolorization at the surface of reservoirs is never accomplished. These considerations would indicate the advantage of shallow reservoirs in this respect.

The results at Borden Brook and Milham Brook reservoirs show the effect of leaving the soil, etc., on all or a large part of the reservoir bed. For a period of years color is absorbed from the reservoir bed, and this in a measure offsets the normal decolorization due to storage. There are instances where for this reason the reservoir color exceeds that of the influent streams.

Point of Withdrawal

In order that advantage can be taken of the bleaching effect, it is, of course, necessary that the supply be taken from the lower end of the reservoir and that the greater part of the inflow shall be at the more distant points. In such a case, a somewhat imperfect piston action takes place, and the raw river water travels but slowly toward the outlet. To obtain the best results the reservoir capacity should exceed the maximum run-off of the winter and spring months, in which case most of the influent would be subjected to a summer's bleaching before using.

Where a large portion of the inflow comes in near the lower end of the reservoir, a more general mixture of the water occurs. Even if it all comes in at the upper end, it is conceivable that an abnormally cold or warm inflow, having a greater or less specific gravity than the reservoir water, might run along the surface of, or beneath, the reservoir water and later become generally mixed with it. In the last two cases the reduction would be the result of dilution and would yield a less desirable effluent. There is evidence of a slow circulation in all reservoirs, due to winds and temperature changes, together with the piston action.

It should be noted that the great capacity of the reservoir otherwise improves the quality of the water, but the reduction of the color to an inappreciable amount is one of the requisites of a satisfactory supply. The Wachusett reservoir seems to have performed this function acceptably.

Longleaf Pine Distinguished Visually from Loblolly or Shortleaf

Size of Pith in Conjunction with Diameter of Second Annual Ring Found to Give Reliable Test Without Aid of Microscope

By ARTHUR KOEHLER
Expert in Wood Identification, U. S. Forest Products Laboratory, Madison, Wisconsin

A DETAILED study of the wood of longleaf, loblolly, and shortleaf pines has recently been made at the U. S. Forest Products Laboratory, Madison, Wis., for the purpose of determining whether differences could be found by which the botanical species can always be distinguished. Previously no absolutely reliable means of identification had been known. A number of characteristic features were discovered in each species and, as far as observations have been made, they bid fair to distinguish positively between the species. Although the grading of structural timbers has lately been placed on a basis of density (shown by rate of growth and percentage of summerwood), irrespective of species, yet it is often desirable to know the botanical name of a specimen.

Size of Pith and of Second Annual Ring

The pith of longleaf has been found to be more than 0.10 in. in diameter in all normal specimens examined, while in loblolly and shortleaf it was found to be less, except in specimens of vigorous growth. The vigor of the tree at the time the pith was formed in any part of the stem is indicated by the diameter of the first few annual rings surrounding the pith at that point. Therefore, it was found that by taking the diameter of the second annual ring into consideration, together with the diameter of the pith, longleaf can also be separated from shortleaf and loblolly even when the latter have a pith more than 0.10 in. in diameter. So far no exceptions have been found to the rule.

Fig. 1 shows the diameter of the pith of each species plotted against the diameter of the second annual ring. Each circle represents a separate tree. From the diagram it will be seen that whenever the pith in loblolly or shortleaf was found to be more than 0.10 in. in diameter the diameter of the second annual ring was considerably larger than that found in longleaf having the same sized pith. The line *AB* was drawn so that these points which fall above the line represent longleaf and those which fall below it represent loblolly or shortleaf.

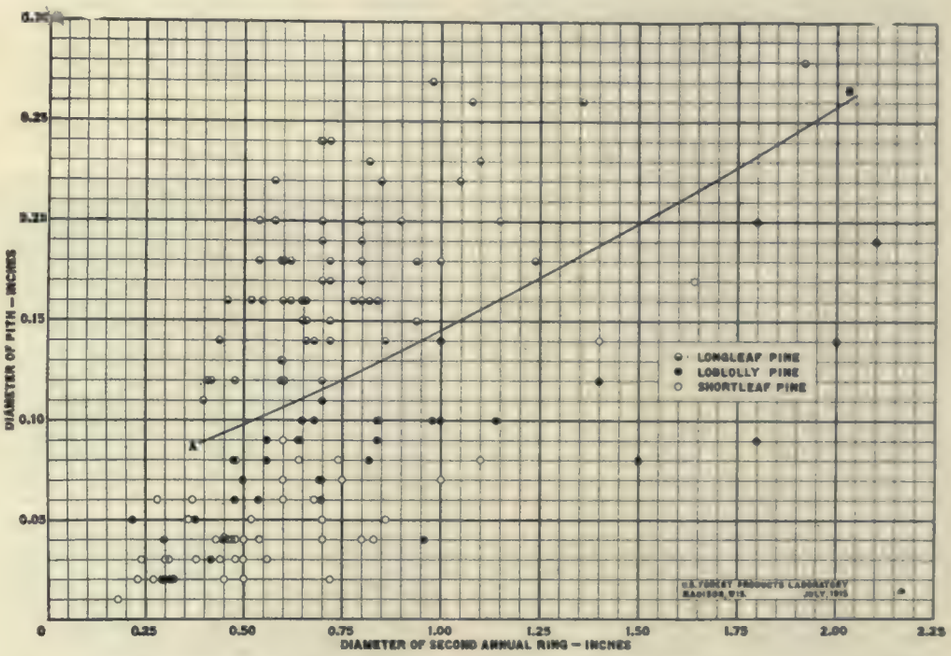


FIG. 1—RELATION OF PITH DIAMETER TO DIAMETER OF SECOND ANNUAL RING

The diameter of the second annual ring was chosen for these measurements because it gave more satisfactory results in separating the species than the first annual ring alone. In longleaf, even in slow-growing specimens, the first annual ring is comparatively large (see Fig. 3). This is evident from the fact that the yearly shoots are nearly always coarser in this species than in loblolly and shortleaf. Therefore, in specimens having a pith of 0.11 in. or a little more in diameter the first annual ring of shortleaf or loblolly (fairly rapid growth) is only slightly larger than the first annual ring of longleaf (slow growth). The second annual ring in such specimens, however, is quite narrow in longleaf and fairly wide in the other two species, thus

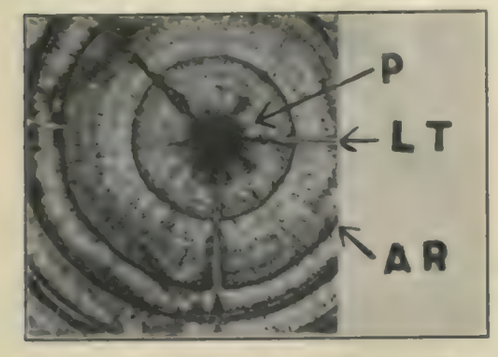


FIG. 2—SECTION OF LONGLEAF PINE
P, pith. A.R., limit of second annual ring; L.T., leaf trace

adding to the degree of separation. (It will be noticed that the diameter of the second annual ring includes the first also and is not the difference between the two.) Rings farther out were not considered, because they do not indicate as well the vigor of the tree at the time the pith was formed.

A careful analysis of the data obtained shows that out of 127 specimens of longleaf, representing eighty-three different trees, no pith was found less than 0.11 in. in diameter except in two specimens cut at a point where a whorl of branches joined the stem. Out of 110 specimens of shortleaf, representing sixty-six different trees, only fifteen had a pith more than 0.10 in. in diameter. Out of sixty-four specimens of loblolly, representing forty-seven different trees, twenty had a pith more than 0.10 in. in diameter. Usually the pith in shortleaf and slow-growing loblolly was about 0.08 in. or a little less in diameter. In general the pith is smallest at the stump, becomes rapidly larger upward and decreases again in the crown. All of the specimens studied were botanically identified by the leaves or cones.

How to Measure Pith and Second Annual Ring

The pith of the pines can be readily recognized as a small, darker and softer core in the structural center of the stem. The second annual ring is clearly defined by a distinct darker line (see Fig. 2) but sometimes the first annual ring is rather faint and care must be taken not to mistake the third annual ring for the second. Occasionally dark bands, or false rings, are found in the wood (see first and second rings of Fig. 4), but these can be distinguished from true annual rings by the fact that their outer limit is not defined by a sharp line, as is always the case with true annual rings. Measurements made on a section where knots join the center of the stem are not reliable for identification. At such points the pith may be unusually small or the rings irregular, and the other end of the specimen should be examined.

To measure the pith and second annual ring properly it is first necessary to cut with a sharp knife a smooth surface showing these structures. Moistening the wood often brings out the structural features more clearly. With a rule graduated in twenty-fifths or fiftieths of an inch, the average diameter of the pith not including small projections can be measured. A reading glass or low-power hand lens is helpful but not essential in making this measurement.

If the intersection of the lines on the diagram representing the diameter of the pith and of the second annual ring of a specimen falls below the line *AB* it indicates that the specimen is not longleaf and may be either loblolly or shortleaf. Should the point of intersection fall close to the line *AB* a measurement on the other end of the specimen may result in more definite indications.

Obviously this method of identification can be used only on timbers, ties or other pieces containing the pith, but it is, as a rule, only regarding large pieces that the lumberman or contractor is anxious to know the exact species. Furthermore, this method does not exclude the minor Southern pines, which, however, are comparatively rare in the lumber markets. Occasional pieces of Cuban pine might be classed as longleaf by this method.

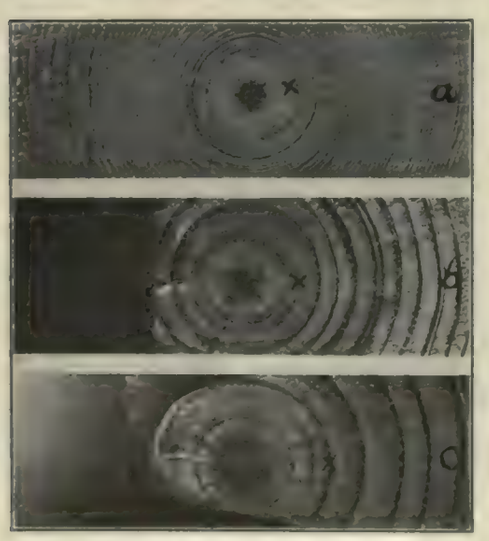


FIG. 3—LONGLEAF PINE
a, slow; b, medium; c, rapid growth near center; x, second annual ring

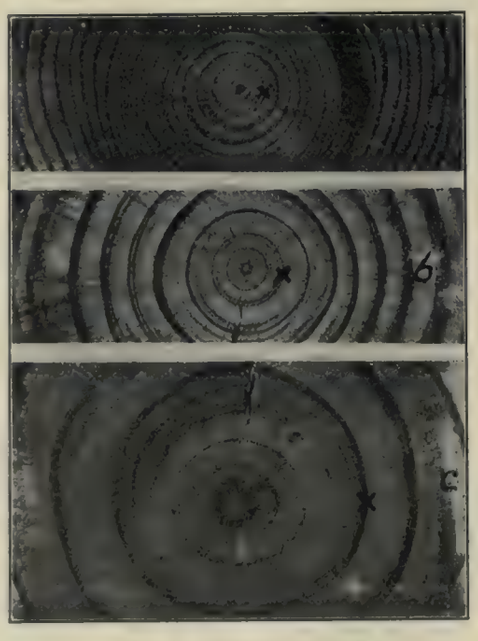


FIG. 4—LOBLOLLY PINE

Microscopical Differences

The more minute microscopical distinctions found for these three species can not be given in detail here. Briefly it may, however, be said, that the leaf traces, vertical resin ducts, medullary rays, especially those containing resin ducts, and the ray tracheids afford helpful and dependable criteria for identification of the species.

The leaf traces can be seen but not measured with the naked eye in the first and second annual rings, where they appear as

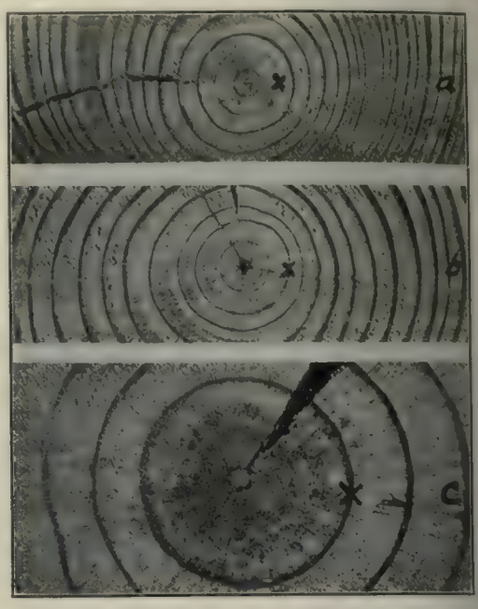


FIG. 5—SHORTLEAF PINE

numerous miniature "knots" (Fig. 2). They are a continuation of the woody part of the leaf clusters that clothe each year's new growth and persist for several years. The leaf traces, like the leaf clusters, are largest in longleaf and smallest in shortleaf. In loblolly they are intermediate and overlap the other two species in size.

The vertical resin ducts and the medullary rays containing the horizontal resin ducts also were found to average considerably larger in longleaf than in the other two species. The projections on the walls of the ray tracheids were found to be less reticulate in loblolly, as pointed out by Penhallow in *North American Gymnosperms*, but this feature was found to be influenced to some extent by the rate of growth.

Summary for Visual Method

1. See if pith is present at the ends of the stick. (If not present the specimen can not be identified without a microscope.)
2. With a sharp knife smooth the pith and surrounding wood. If knots are present at that point try the other end.
3. If the pith is not clear try moistening the smoothed surface.
4. With a finely graduated rule carefully measure the average diameter of the pith. Use a reading glass or low-power hand lens if available.
5. If the pith is 0.10 in. or less in diameter the specimen is not longleaf.
6. If the pith is more than 0.10 in. in diameter also measure the diameter of the second annual ring. Be careful not to mistake the first or third annual ring for the second.
7. On the chart find the point of intersection of the line representing the diameter of the pith with the line representing the diameter of the second annual ring.
8. If this point is below the line *AB* the specimen is not longleaf.
9. If this point is above the line *AB* the specimen is longleaf, or, in rare instances, it may be Cuban pine.
10. If the point of intersection is close to the line *AB* make measurements on the other end of the specimen.

THE PRODUCTION OF PIG IRON for the first half of 1915 is reported in bulletin 6 of the Bureau of Statistics of the American Iron & Steel Institute as 12,233,791 gross tons.

Proposed Government Testing Flume for Hydraulic Turbines Not Needed

Holyoke Flume Is Ample for Purposes of Research, and Acceptance Tests for Purchasers Should Be Made Only on Actual Installations

By H. BIRCHARD TAYLOR
Hydraulic Engineer, I. P. Morris Company, Philadelphia

THERE appeared in the Engineering Record of March 20, page 379, a canvass of opinions on the desirability of a new testing flume for hydraulic turbines. This canvass was prompted by the report of a committee of the Boston Society of Civil Engineers recommending that the Government undertake the construction of such a flume. An abstract of the report appeared in the Engineering Record of March 7, 1914, page 273. The American Society of Mechanical Engineers has recently appointed a committee to investigate the same subject. In view, therefore, of the renewal of the effort to promote this project, the writer is prompted to record a few comments regarding some aspects of the question, and to explain the answers which he submitted to the canvass mentioned above.

Some of the reasons stated for urging the project are, in the words of the Boston committee, as follows—quoting from the abstract mentioned:

"Waterwheels have increased so much in size in recent years and are operated under so much higher heads, that there is no place in the United States where they can be adequately tested before their final installation.

"The Holyoke testing flume . . . is no longer large enough, nor does it have sufficient head to meet all of the present-day needs. . . .

"The art of waterwheel design is still in rather a crude state and needs such authentic and reliable information as the proposed flume will furnish. . . ."

Two Purposes of Flume

In considering the questions involved, there are certain facts, some of which are not as generally recognized as they should be by engineers or by the non-technical public, which bear upon the question and should be kept clearly in mind. There are two purposes for which such a testing flume may be used. These two uses are entirely distinct from each other and should not be confused. The first and more important is the use of such a flume for experimental research of the turbine designer; the second, the testing of waterwheels for acceptance by the purchaser.

In considering the first use of the flume, it should be understood that it is not in general necessary to carry out experimental research on full-sized turbine units of the dimensions used in actual installations, but, on the contrary, for much of this work, turbines of moderate size, but constructed so as to be geometrically similar to installed units, may be used much more conveniently. A testing flume need not be large enough to admit full-sized turbines under the full operating head expected in a plant, and there are many advantages in keeping the experimental head low. Since the power increases rapidly with the head, the difficulty of absorbing large amounts of power would add enormously to the expense of testing. The testing in a flume of full-sized turbines, such as are installed in large modern plants, would of course be impossible, even if it were necessary or desirable on account of the enormous dimensions of many of these turbines.

Research on Small Models at Holyoke Satisfactory

In spite of the imperfect knowledge of many of the laws of hydraulics, there are a few relations which are not open to question and which do not need experimental verification. One of these is that variation of size alone of a turbine has slight effect on its efficiency or characteristics, and the comparative tests can be made just as well on small sizes of units as on large. A change of head has a similar slight effect on the efficiency and performance, so that within reasonable limits tests can be made as well under low heads as under higher heads. The power and speed of turbines are changed according to known laws when either size or head is altered. Therefore, for the purpose of research, while a greater range of head and the opportunity to install larger apparatus might be a benefit in some cases, in the majority of investigations these advantages would not be important, and much of the experimental work required in the present and future development of turbines can be done about as well at the existing flume at Holyoke as in such a new testing flume as is proposed. The Holyoke flume is open for general use, and has been engaged in testing turbines for the past thirty years. Although the flume is subject to a few limitations when used for present requirements, it nevertheless has been in the past, and is at the present time, an exceedingly useful resource for American turbine builders.

There are certain modifications which could be made in the flume at moderate cost, and it is undoubtedly desirable that some of the apparatus installed should be replaced by more modern equipment. But in spite of these limitations, the flume is eminently satisfactory for the majority of tests which are required in experimental research by the builders. There are, of course, a few questions, such as the effect of a great increase of head on turbine operation, the gain in efficiency due to a very great increase in size of unit, and the probable life of high specific speed turbines under moderate or high heads, which are waiting for experimental solution. Some of these problems, however, could scarcely be solved in any testing flume, and all of them can be best worked out in actual installations.

New Flume Would Not Pay

Considering the limited field of work available and the restrictions of the expense which engineers are usually able to incur in connection with tests, there is small likelihood that any new testing flume would be even approximately self-supporting, so that no privately owned or Government owned competitor of the Holyoke flume would be in any position even to pay expenses. There are, however, reasons for many manufacturers preferring a private flume to a publicly owned one for such tests, in order that tests be not given publicity during the development period of new apparatus.

It may be urged that the conservation of our National resources is of such vital importance to the economical welfare of the country that it would justify the Government incurring a considerable amount of expense in measures to increase the efficiency with which our water powers are developed. In this connection, however, it should be recognized that the weak and inefficient features of the great majority of existing plants are not the turbines proper, but the general arrangements of the plants and the design of the water passages outside of the turbine runner and guides. The only portion of this system of water passages capable of being tested in a flume is the turbine itself. When the wonderful improvement which has been made in the last few years in the performance of turbines tested at the Holyoke flume is taken into consideration, it must be granted that American engineers have carried the development of the turbine itself to such a point that only slight further gains in efficiency are possible. On the other hand, the designs of turbine settings and other parts of the power plant exterior to the turbines are grossly defective in a great number of installations in this country. But this part of the installation cannot be adequately investigated in a testing flume.

Should Not Be Used as Test for Acceptance or Rejection

In regard to the second use of the flume, it will be recalled that a number of years ago it was common practice for American engineers to have turbines tested out at Holyoke before installation in a plant, acceptance or rejection being made on the basis of the Holyoke test. Many of the older installations in New England were contracted for in this way. This practice was found to lead to such great discrepancies between the actual results in place and the Holyoke tests that it has become generally discredited. If it is intended that the new Government flume shall be again used for such a purpose, then the writer is most strongly opposed to the entire project. Such a return to a discredited system of testing would be a decided retrogression in engineering practice. The spectacle of engineers of power companies accepting turbine equipment on the sole basis of tests made at Holyoke is a sorry one indeed, and this practice has had much to do with the delay in adopting scientific methods in waterwheel construction. It is safe to state that neither the Holyoke testing flume nor any other testing flume could be made adequate for acceptance tests of turbines.

The greatest handicap which American turbine development has had to contend with has been the dearth of tests on completed plants. It is a fair statement that the great majority of American water-power installations have been accepted without any attempt to measure the water consumption or to compute the operating efficiency. This ill-advised policy is in line with a popular notion that water available for power purposes is free to anyone and is of no value. If we had to include in our accounts an actual charge for every cubic foot of water used, in the same way that coal or other fuel is charged, all would appreciate the importance of efficient apparatus. The charge for water actually exists, whether it is specifically entered on the accounts or not. The policy of omitting

tests entirely or limiting them to Holyoke tests has not been due only to the engineers in charge of plants, but has been encouraged by the builders of stock turbines, to their own ultimate injury.

EFFICIENT WHEELS IN DEFECTIVE SETTING

An efficient runner may be installed in a casing of such design, or may discharge into such a form of draft tube, or may be located at such a distance above tailwater, that the experimental results obtained at Holyoke will have no relation to the performance after installation. A recent case, for instance, has come to light where one of the American stock builders obtained an efficiency of 90 per cent on a runner tested at Holyoke, while the same design of runner installed in a defective setting in the case of a large unit developed in place under operating conditions a maximum efficiency of 76 per cent. The present agitation for a new testing flume is, perhaps, the result of experiences of this kind, of which there have been many, in connection with the output of the builders of the cheaper sort of machinery. Such occurrences will, however, not be made less frequent by the construction of any sort of testing flume, since the errors result, not from incorrect tests but from improper designs of the turbine setting in the final installation.

A new testing flume could do little to bridge the gap between experimental results and actual performances. As the modern form of the American turbine unit, especially in low-head installations, is almost invariably of the vertical shaft, single-runner type, with volute casing usually molded in concrete, and a long, curved draft tube, the high results obtained in a number of recent plants are due, not to the runner alone but to the design of the entire system of water passages. These could not be duplicated, except at prohibitive cost, in an experimental flume. There is, besides, no reason for attempting to duplicate them. Is not the rational solution of this whole matter a general adoption of a practice which is now confined to a few of the larger plants; namely, the testing of the actual full-sized plant after its completion and before the machinery is accepted by the owners of the plant? Whether tests made at an experimental flume are made on models or full-sized wheels, and regardless of the head used in the experiments, results of such tests should never be accepted by the purchaser as equivalent to the efficiencies which will be secured in the final installation, although it is of course possible to predict the final result when sufficient data are available from tests on existing plants.

MORE NEED FOR OTHER RESEARCH

In almost every line of engineering there are certain unexplorable fields calling for experimental investigation, some of great importance, justifying a large expenditure of money in an effort to obtain reliable data on which new construction can be based, and others involving points which are already covered by satisfactory data. In selecting lines of experimental investigation and research, those problems should be attacked in which the need of information is the greatest. The question is not simply whether it would be desirable, in the interests of enlarging our scientific knowledge, to have available such a flume as suggested, but whether the need of this installation is a sufficiently vital one to justify the very heavy expense which would be involved, and whether the same expenditure would bring more valuable returns in this application than if applied to other lines of experimental work. If the statement of the committee, that the art of waterwheel design is still in rather a crude state is true, will the proposed flume necessarily remedy this condition?

It may be further pointed out that it is necessary, in the case of the builders of the better class of machinery, to use the Holyoke flume only when experimental data are required on new departures in design, for conditions which extend beyond the range of theoretical data of known reliability, or in cases where it is desirable to insure the success of an important installation by checking the design experimentally. In view of the remarkable success secured in a number of very notable developments carried out by American engineers in the last few years, it is surprising to meet the statements quoted above, that the art of waterwheel design is still in "rather a crude state." This is certainly not a fair statement of conditions, and is a reflection on American turbine construction which is no longer deserved in the case of the work done by the best turbine builders, although, as mentioned, there has been a certain class of machinery to which it applies.

CONCLUSION

Summing up the above, it is believed that the practice of the past in accepting turbines on the sole basis of results secured in an experimental flume has no proper place in modern engineering; a large part of the work available for a testing flume is, therefore, eliminated. For purposes of research of turbine builders, the testing of small models under low heads is eminently satisfactory when supplemented by comparative data obtained from tests in place of full-sized plants, and the existing Holyoke flume can still be satisfactorily used.

Two other points may be appended; first, the fact that the Holyoke flume has value on account of the excellent basis of comparison between different experiments derived from the use of unchanged methods of testing through a long term of years; and, second, the inadvisability of giving undue weight to experimental results secured at Holyoke, or any other testing flume, since the experimental wheels of various builders may vary considerably in workmanship and finish, and may bear no close relation to the type of construction furnished in actual turbine installations.

In conclusion, the writer believes that, while a new flume would be desirable for experimental research, there is not sufficient demand to justify the expense of its construction for that purpose alone; and he warns against the other possible use, or rather misuse, of a flume—that is, for the purpose of replacing the testing of the actual performance of completed plants. The latter practice has taken years to overcome, and its re-adoption would be a misfortune.

New California Road Overcomes Mountain Barrier

Ridge Route to Connect Bakersfield and Los Angeles, a State Trunk Line of Great Economic Importance

By N. D. DARLINGTON
California State Highway Commissioner

ALMOST interesting section of the California State highway system now under construction is the Ridge Route road, 115 miles in length, connecting Los Angeles with Bakersfield. The latter city is located in the upper end of the San Joaquin valley and is separated from Los Angeles by the Tehachapi Mountains, along whose ridges the new road winds for many miles at an average elevation of approximately 3000 ft. The new route between the two cities will be 60 miles shorter than that via Tehachapi Pass and 35 miles shorter than the Tejon Pass road.

ECONOMIC ADVANTAGES

Tremendous economical importance attaches to the new road because the San Joaquin valley, lying immediately north of the Tehachapi Mountains, is the largest and most productive valley in the State and will undoubtedly sustain at some future time a population of four or five million people. On the other hand, the district lying south of the Tehachapi Mountains, of which Los Angeles is the center, is a thickly populated and rapidly growing community, important as the terminus of such a road because, as a distributing center, it is vitally interested in having close connections with large agricultural areas. These two sections of the State with widely different interests, which make them all the more important to each other, have



DRY RUBBLE WALL CARRIES THE ROAD AROUND A SHARP NOSE

been heretofore separated by a mountain barrier through which no direct route has been provided, and now that a thoroughfare representing the best engineering practice of the day is being constructed it is well worth while to observe what interest on the investment in this road will accrue to the State, especially as that investment is rather heavy compared with average highway costs. Much of the territory does not and cannot contribute much toward the cost of the traffic of the road.



RIDGE ROUTE WINDS OVER MOUNTAINS AT AN AVERAGE ELEVATION OF 3000 FEET

It is difficult to compute the economical value of saving in distance which it has been possible to effect, and the value of this highway will become more and more apparent as the years go by. Los Angeles is to-day the headquarters for most of the oil companies operating in the San Joaquin valley fields, and it is natural to suppose that she will always maintain her position as the oil center of California. A tremendous traffic has been built up in recent years in the use of motor trucks and trailers in serving this interior district, and with the new highway completed it will be possible to deliver truck loads of oil supplies from Los Angeles to the oil fields in one day.

This new route obviates the necessity for passing through Antelope valley or the Mojave desert, with their intense heat and high winds. Going from Los Angeles to Bakersfield via either of these routes means a long, hard day's journey, but over the new road it will be one of the most pleasant and beautiful trips on the State highway system. At almost every turn panoramas of mountain scenery are presented. Over the Ridge Road it will be possible to leave Los Angeles in the morning, lunch at Bakersfield and return to Los Angeles in the evening without breaking the speed laws.

Heavy Construction

Recognizing the importance of this road the State Highway Commission has prescribed a type of construction which makes it in every respect representative of the best California highway practice. In most cases throughout the State where highways are constructed in mountainous districts, the widths of the roads have been reduced, but in this particular instance the full width of from 21 to 24 ft. has been maintained. The maximum grade is 6 per cent and no reasonable expense was spared in eliminating sharp curves.

The total cost of the highway now under construction by the State between the two cities will probably approximate $1,500,000, or about $17,000 per mile. Some parts of the road involve very heavy construction. On one contract about 14½ miles in length the estimated excavation necessary amounted to 635,000 cu. yd. and in order that the road might be opened in time to serve the public during the Exposition the contractor was obliged to move this yardage within a period of six months. To accomplish this two steam shovels were kept in operation on this section for twenty-four hours a day, making shifts of eight hours each or the equivalent of six shovels on ordinary eight-hour-per-day runs. This section is now being rushed to completion by a force of between 300 and 400 men and 250 teams. The road was to have been completed and thrown open to through traffic on Aug. 20, 1915.

Course Which Gives Broad Training in Business and Economics

Massachusetts Institute of Technology's Experience Shows It to Meet a Great Demand

REFERENCE has been made several times in this journal to the course in engineering administration started last year at the Massachusetts Institute of Technology, and recently (see Engineering Record, July 17, 1915, page 64) there was editorial comment on the first year's work. Because of the interest displayed in the subject a fuller explanation of the course than heretofore made in this journal is given below.

Purpose of Course

The course in engineering administration provides a training for men who expect to enter positions concerned with the management or administration of manufacturing, construction and transportation enterprises which demand a knowledge of scientific and engineering principles. It combines with instruction in general engineering, studies in the methods, economics, and law of business.

The course includes (1) the instruction common to all courses in the institute in literature, language and history, and in chemistry, physics and mathematics; (2) a choice of engineering studies classified under three options: civil engineering, mechanical and electrical engineering, chemical engineering, and (3) a selected group of subjects in business and economics. While the amount of time assigned to engineering subjects is less than that prescribed in the other courses of the institute, the fundamental subjects have been retained which will enable graduates to fill many of the positions open to engineers.

Table 1—Studies for Second Year

First Term	Hours Ex	Hours Prep.
Mathematics	45	90
Physics	75	60
Physical Laboratory	15	15
Political Economy	45	45
German	30	45
English Literature	30	30
History II	30	30
Options		
1. Mechanism	30	60
Descriptive Geometry	45	0
2. Mechanism	30	60
Descriptive Geometry	45	0
3. Quantitative Analysis	120	15
Second Term	**Ex.**	**Prep.**
Accounting	45	45
Banking	45	60
Physics	75	60
English Literature	30	30
Options		
1. Applied Mechanics	45	90
Surveying	30	0
Mathematics	45	90
Physical Laboratory	5	5
Precision of Measurements	10	10
2. Applied Mechanics	45	90
Mathematics	45	90
Physical Laboratory	20	20
Precision of Measurements	10	10
3. Quantitative Analysis	120	15
Mechanism	30	60
Foundry Work	45	0
Physical Laboratory	20	20
Precision of Measurements	10	10

Table 2—Studies for Third Year

First Term	Hours Ex.	Hours Prep.
Industrial Organization	30	60
Statistics	60	0
Report Writing	30	30
Heat Engineering	45	90
Physics: Heat	15	20
Physical Laboratory	15	10
Options		
1. Applied Mechanics	60	90
Railroad Engineering	20	40
Elements of Electrical Engineering	30	30
Electrical Engineering Laboratory	15	30
2. Applied Mechanics	45	90
Elements of Electrical Engineering	45	75
Machine Drawing	60	0
3. Theoretical Chemistry I	45	75
Theoretical Chemistry Laboratory	27	18
Organic Chemistry	30	30
Mechanical Engineering Drawing	45	0
Metal Turning	45	0
Second Term	**Ex.**	**Prep.**
Industrial Organization	45	45
Transportation	30	45
Securities and Investments	45	45
Heat Engineering	45	60
English Composition and Literature	45	75
Options		
1. Structures	45	90
Railroad Engineering	20	20
Materials	30	35
2. Applied Mechanics	45	90
Mechanical Engineering Drawing	105	0
3. Theoretical Chemistry I	45	75
Theoretical Chemistry Laboratory	27	18
Organic Chemistry Laboratory	75	0

Time Given to Business Subjects

Approximately one-fourth of the total time of the curriculum is given to business subjects which are primarily chosen so as to train students to analyze commercial and industrial problems. In this group special emphasis is placed upon accounting, business law, the industrial organization of society, and business management.

The course in accounting is designed to be of service to administrative officers in the analysis of accounts and financial reports, rather than to make bookkeepers, auditors or accountants in a technical sense. Cost accounting includes methods of determining costs of material, processes, labor, and machines; distribution of indirect costs and overhead expenses; cost data to secure economy, and inventories. Business law treats of contracts, agency, negotiable instruments, sales and patents. The two extended subjects of industrial organization and business management deal with the

TABLE 3—STUDIES FOR FOURTH YEAR

Option 1—Civil Engineering

First Term	Hours Ex.	Hours Prep.	Second Term	Hours Ex.	Hours Prep.
Cost Accounting	45	45	Business Management	60	110
Business Management	45	75	Business Law	30	60
Business Law	30	60	Structures	45	90
Taxation	15	15	Structural Design	75	0
Structures	45	90	Hydraulic Engineering	30	60
Railroad Engineering	30	60	Hydraulic Laboratory	15	5
Theoretical Hydraulics	30	60	Sanitary Science	15	0
Testing Materials Laboratory	30	0	Thesis		125
Foundations	15	30			

Option 2—Mechanical and Electrical Engineering

First Term	Hours Ex.	Hours Prep.	Second Term	Hours Ex.	Hours Prep.
Cost Accounting	45	45	Business Management	60	110
Business Management	45	75	Business Law	30	60
Business Law	30	60	Machine Design	60	0
Taxation	15	15	Hydraulic Engineering	30	60
Machine Design	90	0	Engineering Laboratory	90	0
Theoretical Hydraulics	30	60	Central Stations	30	60
Testing Materials Laboratory	30	0	Thesis		130
Electric Light and Transmission of Power	30	60			
Electrical Engineering Laboratory	45	45			

Option 3—Chemical Engineering

First Term	Hours Ex.	Hours Prep.	Second Term	Hours Ex.	Hours Prep.
Cost Accounting	45	45	Business Management	60	110
Business Management	45	75	Business Law	30	60
Business Law	30	60	Industrial Chemistry II	105	15
Taxation	15	15	Elements of Electrical Engineering	30	30
Industrial Chemistry	45	90	Electrical Engineering Laboratory	45	45
Applied Mechanics	60	105	Thesis		190
Engineering Laboratory	60	30			

financial operations of corporations and the conduct of business from the standpoint of the individual employer. They include a treatment of the organization of the executive force, departmental functions, factory efficiency, standardization of goods, stock keeping, routing of orders, management of labor, efficiency methods, marketing of goods, publicity and advertising, credit department, insurance and business ethics. Among other subjects included in the group of business studies are banking, statistics, report writing, transportation and securities and investments.

The studies for the first year of the course are the same as those in the regular engineering courses. Differentiation starts in the second year. The studies after the first year are shown in Tables 1, 2 and 3. The hours indicated show the amount of time assigned to exercises and that estimated as necessary for outside preparation. In addition to the studies shown there is certain prescribed reading during the summer vacations.

ELECTROLYTIC TESTS, made by the engineers of the New York Board of Water Supply to determine the danger of corrosion to the Bryn Mawr siphon of the Catskill Aqueduct, indicated that the steel pipe carried several volts from trolley tracks at Tuckahoe Road to the Bryn Mawr connection chamber. Here the current left the steel pipe through a 2-in. line supplying the hydraulic cylinders of the valves, returning through the Yonkers water mains to the railway company's sub-stations. As electrolytic action always takes place where the current leaves the conductor, and as the current passes directly from the siphon to the 2-in. pipe without passing through any earth, it was decided that the steel siphon was safe from electrolytic corrosion.

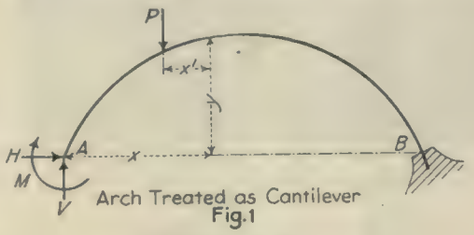
Graphical Analysis of Arches with Fixed Ends Greatly Simplified

Influence Lines for Reactions and End Moment Easily Constructed —Simple Method for Obtaining Deflections Under Loading

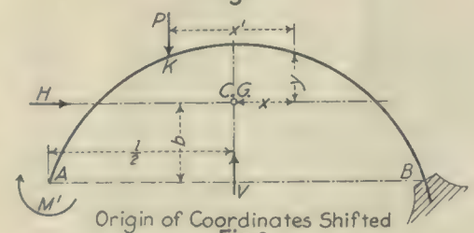
By C. S. WHITNEY

Steel Inspector for Gustav Lindenthal, Consulting Engineer, New York City

THE GRAPHICAL method to be explained in this article is probably the simplest and most direct method possible for determining the reactions of an arch rib with fixed ends under moving loads, and the effect of displacements of the abutments. Graphical methods are sufficiently accurate for practical design, because no great refinement in the solution of such problems is warranted; the solutions all depend upon the fundamental assumption of rigid supports, which is well known to be inexact. Although this method is in wide use in Germany it is comparatively unknown in this country. All the advantages of graphical methods in simplicity and ease of checking are inherent in the solution given.



Arch Treated as Cantilever
Fig.1



Origin of Coordinates Shifted
Fig.2

FIGS. 1 AND 2—FUNDAMENTAL RELATIONS

FUNDAMENTAL THEORETICAL ANALYSIS

Applying the theory of virtual displacements, the rib may be treated as a simple cantilever fixed at the right end as shown in Fig. 1. The external forces acting on this cantilever are the horizontal reaction H, the vertical reaction V, the moment M at the left end and the superimposed vertical concentrated load P. If there is no displacement of the abutments, the x, y and angular displacements of the left end of the cantilever produced by these external forces must be equal to zero. If $\Delta_R x$ is the horizontal displacement of the left end produced by the reactions, $\Delta_P x$ that produced by the load P, and $\Delta' x$ the horizontal displacement of the abutment which it is desired to consider, and analogous symbols to represent vertical displacements, settlement and angular changes, the following expressions may be written:

$$\left.\begin{aligned}\Delta_R x + \Delta_P x + \Delta' x = 0\\ \Delta_R y + \Delta_P y + \Delta' y = 0\\ \Delta_R \varphi + \Delta_P \varphi + \Delta' \varphi = 0\end{aligned}\right\} \qquad (1)$$

Taking the left-hand end as the origin of co-ordinates, the moment M_R produced at any point by the reactions is $M + Vx - Hy$. Using the three fundamental equations for displacement as derived in textbooks on mechanics, there can be written

$$\Delta_R x = \int_A^B \frac{M_R y ds}{EI} = \int_A^B (My + Vxy - Hy^2)\frac{ds}{EI}$$

$$\Delta_R y = \int_A^B \frac{M_R x ds}{EI} = \int_A^B (Mx + Vx^2 - Hxy)\frac{ds}{EI}$$

$$\Delta_R \varphi = \int_A^B \frac{M_R ds}{EI} = \int_A^B (M + Vx - Hy)\frac{ds}{EI}$$

It will be seen that if the origin of co-ordinates be moved to the "center of gravity" of the arch rib the values of the three terms

$$\int_A^B y ds, \int_A^B x ds \text{ and } \int_A^B xy ds$$

will be zero, and if the rib is divided up into small lengths so that $\Delta s/EI$ is constant (C) the above equations become, since M, V and H are constants,

$$\left.\begin{aligned}\Delta_R x &= -HC\sum_A^B y^2\\ \Delta_R y &= VC\sum_A^B x^2\\ \Delta_R \varphi &= nM'C\end{aligned}\right\} \qquad (2)$$

In the last equation the term n is the number of divisions of the arch ring and M' is no longer the true moment M at the left end; the true moment is

$$M = M' + Hb - Vl/2$$

in which b is the vertical distance from the ends to the "center of gravity" of the arch ring and l is the span of the neutral axis. The moment M_P of the superimposed load is equal to Px'. Hence

$$\left.\begin{aligned}\Delta_P x &= \int_A^B M_P y ds = -PC\sum_K^B yx'\\ \Delta_P y &= \int_A^B M_P x ds = -PC\sum_K^B xx'\\ \Delta_P \varphi &= \int_A^B M_P ds = -PC\sum_K^B x'\end{aligned}\right\} \qquad (3)$$

Then substituting formulas 2 and 3 in 1, dividing by the constant C and solving, there is found

$$\left.\begin{aligned}H &= -P\frac{\sum_K^B yx'}{\sum_A^B y^2} + \frac{\Delta' x}{C\sum_A^B y^2}\\ V &= P\frac{\sum_K^B xx'}{\sum_A^B x^2} - \frac{\Delta' y}{C\sum_A^B x^2}\\ M' &= P\frac{\sum_K^B x'}{n} - \frac{\Delta' \varphi}{Cn}\end{aligned}\right\} \qquad (4)$$

From these equations the reactions produced by superimposed load, temperature change, rib shortening or displacement of the abutments can be determined. For instance, the shortening of the arch rib chord due to temperature change or rib shortening may be substituted for $\Delta' x$ and then

$$H_t = \Delta_t / C\sum_A^B y^2 \qquad (5)$$

In this case V and M' are zero. The moment in the arch rib at any point due to

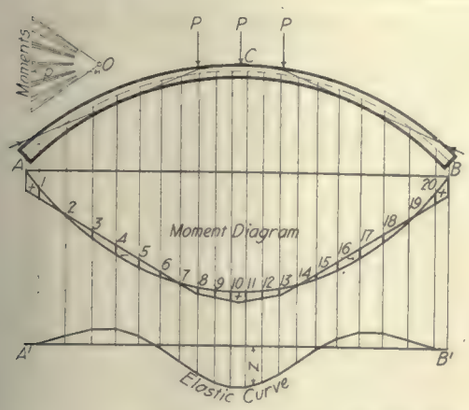


FIG. 4—ELASTIC CURVE FOR DEFLECTIONS

temperature change or rib shortening is therefore equal to $H_t y$.

GRAPHICAL CONSTRUCTION FOR SINGLE LOAD

The reactions produced by any load P acting at any point are given by equations 4, with the omission of the last terms. The graphical solution of these three equations is extremely simple. As an example, the arch treated in Turneaure and Maurer's "Principles of Reinforced Concrete Construction," page 354, will be analyzed and the results compared with the analytical values there obtained. The arch has a span of 100 ft., rise of 20 ft., crown depth of 30 in., and depth at haunch of 42 in. The arch ring is divided into twenty parts of such length that $\Delta s/EI$ is constant. The complete graphical analysis is given in Fig. 3.

It will not be possible in this brief treatment to explain the construction and properties of funicular polygons, but that may be found in any book on graphics. In this case the funicular polygons are all drawn just as though the values laid off on the load lines were forces acting at the centers of the divisions of the arch ring.

APPLICATION TO EXAMPLE

Since the value of y in equation 4 is measured from the gravity axis of the arch ring, the center of gravity must first be located. This is done by considering the values of $\Delta s/EI$ (which were made equal) to be forces acting horizontally, and finding their center of gravity by the ordinary graphical method as shown by the force diagram and funicular polygon 1.

The division of the arch rib to make $\Delta s/EI$ constant is usually accomplished graphically by the well-known method of similar triangles plotted on a diagram for moments of inertia.

DETERMINATION OF H

After the gravity axis has been located the values of y are measured and laid off algebraically on the load line of the force diagram (pole at $O_{2\&3}$). The pole distance p' is arbitrary. The value of $\sum_A^B y^2$ is obtained from the funicular polygon 2 which is drawn with its sides normal to the rays of the force polygon 2, and

$$\sum_A^B y^2 = z_1 p'$$

Funicular polygon 3 is drawn with its sides parallel to the rays of the force diagram and

$$\sum_K^B yx' = -z_K' p'$$

The horizontal thrust at the left end, by equation 4, is therefore

$$H = Pz'_K/z_1$$

The value of H for a concentrated load at any point is thus equal to a constant P/z_1 multiplied by the ordinate of the funicular polygon 3, and hence the smooth curve tangent to this funicular polygon is itself the influence line for H.

DETERMINATION OF V

The reaction V is the vertical reaction at the left end and is obtained by the construction of the funicular polygon 4. The values of x are laid off in order algebraically on the load line of force diagram 4 and the pole O_4 is located at an arbitrary distance p''. Funicular polygon 4 is drawn with sides parallel to the rays of the force diagram. Then

$$\sum_A^B x^2 = z_A'' p''$$

and

$$\sum_K^B xx' = z_K'' p''$$

or, by equation 4,

$$V = Pz_K''/z_A''$$

The smooth curve tangent to the polygon A"B" is the influence line for V.

DETERMINATION OF M

The summation $\sum_K^B x'$ is given by the ordinate of the funicular polygon $A'''B'''$, which has its sides parallel to the rays of the force diagram 5. The load line is composed of n equal division and the pole distance may very conveniently be made equal to $2n$. Then

$$\sum_K^B x' = z_K''' p''' = 2nz_K'''$$

or by equation 4

$$M' = Pz_K''' p'''/n = 2Pz_K'''$$

The moment M at the left end is equal to $2Pz_K''' + Hb - Vl/2$ when $p''' = 2n$, and the moment M_c at the crown is $2Pz_K''' - H(h-b) - Px$, in which h is the rise of the neutral axis. Px is the moment of the load P about the crown, and is zero when the load is on the right of the crown.

Turneaure and Maurer give the final and preliminary divisions of the arch ring, the former considering the effect of the steel reinforcement and the latter neglecting it. The writer analyzed both cases graphically and it is interesting to note that the maximum error due to neglecting the steel was about 2½ per cent, although the divisions themselves were quite different. There is, however, only about 1.1 per cent of steel. In spite of the small scale of the drawings, the greatest difference between the graphical and the analytical results was 2.3 per cent, all the values for V being within 0.15 per cent. The V line, which checked the closest, was drawn to the largest scale. All of the polygons should be drawn to about the same scale, so that the accuracy will be uniform, and their construction should always be checked.

DEFLECTION OF ARCH RIB

The elastic curve of a fixed arch under any load can be drawn by the simple construction shown in Fig. 4, and the deflections computed from it. The vertical deflection at any point K, relative to the tangent at A, due to any loading is given by the fundamental equation

$$\Delta y = \int_A^K Mx \frac{ds}{EI} = C \sum_A^K Mx$$

The summation is obtained by the usual graphical construction of a funicular polygon, using a "force" diagram in terms of moments M.

The three central panel points have been loaded in this example, and the reaction lines first determined from the influence lines for H, V and M. The bending moment diagram is then drawn as shown. The arch rib is divided so that $\Delta s/EI$ is constant and the center points of these divisions are projected downward in parallel lines. The intercepts on the moment diagram are approximately the average moments for the different divisions of the ring, and these intercepts are laid off to scale vertically on the load line of the "force" diagram, positive moments downward and negative moments upward. The pole length (p) is arbitrary. The funicular polygon $A'B'$ drawn with sides parallel to

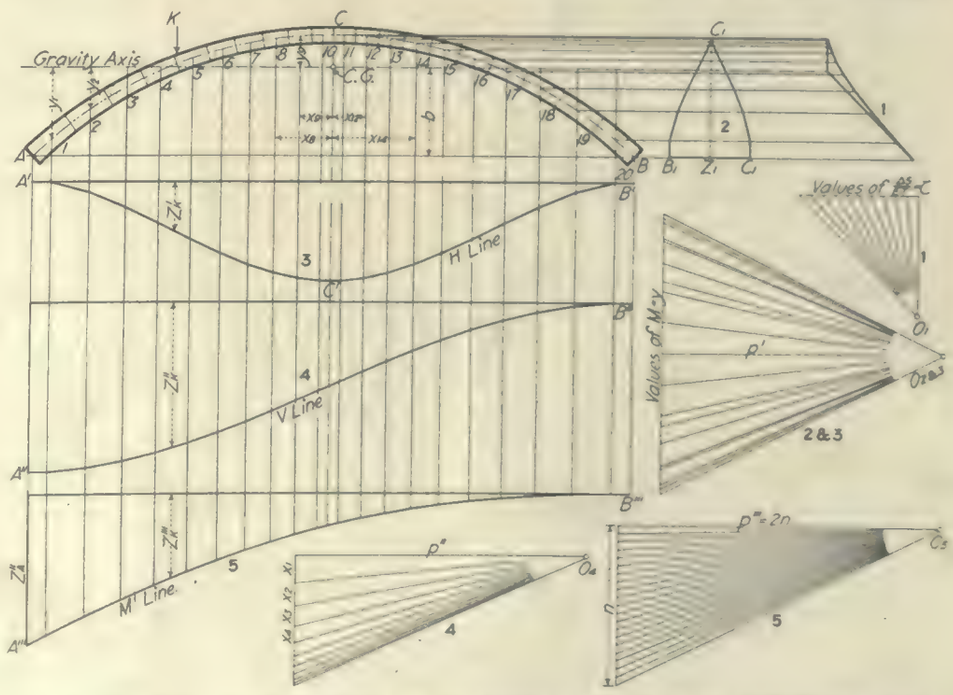


FIG. 3—GRAPHICAL DETERMINATION OF RELATIONS H, V AND M BY INFLUENCE LINES

the rays of the "force" diagram is the elastic curve of the rib for the assumed condition of loading. From the elastic curve the vertical ordinate z of any point may be sealed, and the displacement is equal to zpC.

Influence lines may be drawn for moments and stresses at any section of the arch ring by analytical methods, using the influence lines for H, V and M' and noting that with the origin at the center of gravity, calling y minus below and x minus to the right, the bending moment at any point due to the left reactions is

$$M_R = M' - (Hy + Vx)$$

Only the case of the symmetrical arch under vertical loads has been considered here, because that case is the simplest and the one which most commonly occurs in practice. In its general form the method is a little more elaborate, but it may be applied to unsymmetrical arches and to horizontal or oblique loading. When an arch rib bears a permanent static load, a direct graphical analysis may be made for the one condition of loading and the true pressure line located without the use of trial equilibrium polygons. The method of making such an analysis will be explained in a second article, which will discuss the conduit given by W. M. Smith in the Engineering Record of May 22, page 648.

Experiences in Calking Joints of Water Mains

Leadite After Ten Years of Use Declared by Speaker at Waterworks Convention to Be Far Superior to Lead

AFTER using leadite for calking water-main joints for ten years, W. C. Hawley, chief engineer and general superintendent of the Pennsylvania Water Company, Wilkinsburg, Pa., has concluded that it is far superior to lead, and can be used in place of the latter in every instance except occasionally in a street when a joint immediately under some pipe or other obstruction is inaccessible, and would thus be troublesome to reach in case it leaked and could be repaired by a little calking. His reasons for favoring leadite were given in detail in a paper read before the convention of the New England Waterworks Association in New York this week. Mr. Hawley finds also that for ease in application, for resistance to shock and to the passage of electric current, and cost, leadite has decided advantages over lead.

The following paragraphs give the chief points made by Mr. Hawley:

WATERTIGHTNESS

When leadite joints have been properly made, a large percentage of them when tested should be found to be practically tight. There may be a small amount of seepage, and in a very few cases even an appreciable leakage indicated by water dropping from the joint or small spray. Practically all of these will take up tight within twenty-four hours, and such as do not become tight are readily made so by cutting out the portion which is leaking and rerunning with leadite, or in case there is too much water the portion of the joint which has been cut out can be filled with lead wool. If more than 1 or 2 per cent of the joints made show leakage after twenty-four hours, it is an indication that the joints were not properly made. In a line of 12, 10 and 8-in. pipe, 5 miles long, laid several years ago and tested in the open trench, there was but one leaking joint. This was repaired by cutting out part of the joint and rerunning.

Lead has but one advantage over leadite, namely, that after having been run the joint can be calked. The calking adds materially to the expense of the joint, but there will be occasionally in a city street a joint immediately under some pipe or otherwise inaccessible, where it may be advisable to use lead so that in case of the joint being disturbed and leaking in the future it can be readily repaired by calking, whereas if it was leadite it might be necessary to run a new joint or to cut out part of it and replace with lead wool.

ADVANTAGES

In practically all other respects leadite has the advantage over lead. Leadite costs about 10 cents per pound, lead about 5 cents; but leadite weighs about one-fifth as much as lead, and hence its cost per unit of volume is about two-fifths that of lead. Leadite requires no calking, and this, as will be shown later, is a material saving, not only in the cost of the labor of calking but in the digging of large bell holes. In addition there is the saving in cost of inspection in order to insure well-calked joints. There is the further saving in the maintenance of the ditch and bell hole during the time that the joint is being calked and inspected. This is an important item in bad ground or in wet trenches.

In a case where there is limited room for calking, leadite has marked advantage over lead. Some years ago I had a 30-in. pipe burst, the bell of which was very close to a concrete wall. It was barely possible to yarn and run the joint with leadite. Had we been compelled to use lead it would have required hours of time to have cut out sufficient concrete to have permitted the calking of the joint. It was imperative that the pipe be repaired quickly, as a large community depended upon the line for its supply.

Leadite has another advantage over lead in the fact that it is so much lighter and hence more easily carried to the joint. When lead is at a temperature suitable for pouring it oxidizes rapidly, and in spite of the utmost care the oxide and dross which gathers on the surface will sometimes be poured into the joint. There is no trouble of this kind with leadite.

ELASTICITY

Since lead has practically no elasticity, any movement of pipe laid with lead, or any continued shock or vibration to the pipe tends to loosen the lead in the joints, or in many cases to squeeze it out altogether. Leadite being elastic, is not so affected. In one case a 20-in. cast-iron pipe laid with lead passed under a main line of a railroad on which the traffic was very heavy. For years it had been necessary to periodically uncover that pipe and recalk the joints. About ten years ago the lead in these joints was replaced with leadite, and I am advised that there has not been a leak in these joints since.

Considering the brittle nature of leadite, it is surprising what a leadite joint will stand in the way of movement without serious damage. This has been illustrated in my own experience several times by side hill slips, and in one case where it was necessary to lower a line of 8-in. pipe for a distance of nearly 300 ft. and to a maximum depth of about 2 ft. The pipe had been laid with leadite and it was not supposed that it could be lowered without damage to most of the joints, which would probably require them to be remade. It was decided, however, to try the experiment, and the pipe was lowered and to our surprise the joints remained tight.

Since leadite melts at such a low temperature (240 deg. Fahr.), there is no danger of an explosion, should it be necessary to run a wet joint. Among leadite's good qualities is the fact that it offers a high resistance to the flow of electricity, thereby reducing materially the danger of damage by electrolysis.

SAVING

Last but not least of leadite's good qualities is the saving by its use compared with lead. Roughly speaking, on the ordinary sizes of pipe and under average conditions, this amounts to at least one-half of the cost of lead joints. In my own experience, since leadite was a new material and our pressures unusually high, I have made leadite joints with a depth of from 2⅛ to 2½ in., whereas with lead the joints would be made from 1¾ to 2 in. in depth. Used in this way we find on the average that the amount of leadite and lead required for joints of different sizes is as shown in the accompanying table.

AVERAGE QUANTITIES OF LEADITE AND LEAD REQUIRED FOR JOINTS OF VARIOUS SIZES OF CAST-IRON PIPE

Diameter, in.	Leadite, lb.	Lead, lb.
4	2 = (Diam./2)	7 = 2 Diam. — 1
6	3 "	10 = 2 Diam. — 2
8	4 "	13 = 2 Diam. — 3
10	5 "	17 "
12	6 "	21 "
14	7 "	25 "
16	8 "	29 "
20	10 "	37 "
24	12 "	45 "
30	15 "	57 "
36	18 "	69 "

On this basis, assuming the cost of leadite at 10 cents per pound and lead at 5 cents, lead costs from one and three-quarters to nearly twice as much as leadite.

Labor costs vary according to the length of pipe laid and the difficulties encountered, but we have found on the average the labor in making leadite joints, including the melting of the material, the preparation and placing of the roll, yarning and pouring the joint, is one-half of the corresponding cost of making lead joints, including the calking, this without making any allowance for the extra cost of inspecting lead joints or for digging bell holes large enough for calking. As an example of what can be done under good conditions, we have had three men yarn, melt and pour ninety-five joints of 8-in. pipe in one day, at a total cost for labor of $6.60, or a cost of 7 cents per joint. The total cost including leadite was $49, or an average cost per foot of pipe of 4.3 cents. In this case the saving is well over 50 per cent of the cost of making the same joints with lead.

A CAMPAIGN AGAINST TYPHOID FEVER will be conducted by the new California State sanitary engineering department, recently established for the purpose by the State Board of Health at Sacramento. Prof. Charles Gilman Hyde, of the University of California, has been named consulting engineer and Chester G. Gillespie will be chief engineer of the new department.

$24,000,000 South Philadelphia Railroad Improvement Now Well Under Way

Elimination of Grade Crossings, Consolidation of City-Owned Waterfront and Opening of Large Undeveloped Tract Are Main Objectives

ACTUAL construction of the $24,000,000 South Philadelphia railroad improvement was started last April, and while comparatively few of the details have as yet been worked out, surveys and plans are being made, and at several points the changes are well under way. The improvement affects an area of nearly 4 miles square, bounded by Christian Street on the north, the Delaware River on the east, the Philadelphia Navy Yard on the south and the Schuylkill River on the west. When the work is completed all grade crossings within the area, except in the waterfront district adjoining Delaware Avenue, will have been eliminated; the railroad tracks in Oregon Avenue, which form a natural barrier to development south of that avenue, will have been removed, together with the other potential barrier of tracks north of Packer Street; and, perhaps most important of all, the Pennsylvania and Baltimore & Ohio Railroads, in exchange for extensive tracts for water-terminal and yard development just north of the navy yard, will have turned over to the city waterfront property farther up the Delaware River, giving the city its first ownership of enough continuous waterfront to permit a definite and adequate plan of development. In addition, the two railroads will have equal rights to a belt line skirting the entire tract, and at the same time any other railroad at any future time may connect to and use the belt line on fair terms.

WHAT THE PROJECT INVOLVES

Referring to the general map, the essentials of the project are as follows: The line of the Pennsylvania (Philadelphia, Baltimore & Washington) across the city in Washington Avenue is to be elevated as a two-track structure; the other two lines across the city, that of the Baltimore & Ohio (Schuylkill River East Side Railroad) in Oregon Avenue and that of the Pennsylvania (Delaware Extension) north of Packer Street, together with the Girard Point and navy yard branches, are to be abandoned and removed; to replace them a single belt line will be built inclosing a much larger area and reaching the entire Delaware River waterfront from Christian Street south, as well as the Philadelphia Navy Yard, the Girard Point grain elevator and the large industries along the Schuyl-



GENERAL MAP OF THE TERRITORY AFFECTED, AND ITS LOCATION WITH REFERENCE TO THE CITY HALL

kill River; all grade crossings in the district will be eliminated, except in the waterfront section adjacent to Delaware Avenue; the Baltimore & Ohio Railroad will release to the city its waterfront property between McKean and Jackson Streets, a frontage of 900 ft., and the Pennsylvania Railroad will likewise surrender its Greenwich coal terminals on the waterfront at Packer Street, a frontage of 2500 ft., with which combined frontage of 3400 ft. as a nucleus the city hopes to acquire the intervening 3500 ft. of mostly undeveloped waterfront and thus secure a continuous frontage of 1 1/3 miles, and the city will begin at once construction on the site of the Greenwich terminals of the first of a series of 300 x 1200-ft. piers, to be known as the Moyamensing development; in substituton for the frontage given up by the railroads, provision is made for acquiring land for more adequate developments, side by side, between Hoyt Street and the navy yard; both railroads will have the unrestricted right to use the belt line at all times, without in any way surrendering the exclusive use of their yards, piers or other terminal facilities, and will be further protected by individual vested ownership in two tracks each, and the right-of-way therefor; and finally, the "belt line" principle is made of general public application by provision that the Philadelphia Belt Line Railroad, a railroad controlled by Philadelphia trade organizations, or any other railroad, may at any time become users of the main tracks of the system by paying a suitable rental as provided in the agreement, with authority to lay two additional tracks, under the Philadelphia Belt Line Railroad franchise, if necessary. On the west side this belt-line privilege will run north only to Passyunk Avenue. The agreement also separates the Delaware Avenue line from the rest of the work, and affords the third railroad an opportunity to use part of the system without paying rental on all of it.

History and Evolution of Plan

In order to analyze the project more fully and discover why the particular streets chosen were selected it is necessary to go into the history of the improvement. The improvement had its inception in 1898, when an attempt was made to work out a plan for eliminating the grade crossings on the three lines across the city. Nothing constructive was settled at that time. In 1904 plans were prepared for elevating the two lines of the Pennsylvania to points east of Broad Street. Even at that time the city's Department of Wharves, Docks and Ferries was not in existence, and the possible unification of the waterfront did not figure in the changes contemplated—changes which, like those of 1898, failed to materialize.

The Bureau of Surveys, Department of Public Works, continued its studies, however, enlarging their scope, and in 1910 a plan was produced which would combine all of the through lines on one right-of-way in Twenty-fifth Street, crossing the city just north of the navy yard. This scheme contemplated elevating the Washington Avenue line and also the new line. It also recognized the possible benefit to both city and railroads of exchanges in waterfrontage. The railroads indicated willingness to enter into it in part.

Once again, in 1913, the matter was taken up, and this time it was pushed to an agreement. Instead of keeping the line in Twenty-fifth Street all the way from Washington Avenue to Girard Point, it was decided to swing west to Twenty-ninth Street at Point Breeze Avenue, thereby making the inclosed area larger and bringing the line nearer the large industries along the Schuylkill River. Most of the Twenty-ninth Street line will be on an embankment on private right-of-way, but because of the high cost of such right-of-way through the property of the Atlantic Refining Company, the line at this point will swing over to a viaduct in the street.

Broad Street Bridge

The 1910 scheme, again, contemplated keeping the line elevated all the way east to Broad Street, but this had the double objection that it would have placed an unsightly structure between League Island Park and the navy yard, and that, with the line only getting down to grade at Seventh Street, it would not have left room from there east for economical train-length terminals for the two railroads. The new plan, therefore, brings the line 600 ft. north of the navy yard at Broad Street, which thoroughfare is being carried over the tracks and brought down to grade at the entrance to the navy yard. The bridge, which is already well under way, will be a reinforced-concrete structure 360 ft. wide, with park spaces on the approaches and bridge itself to shut out the view of the railroad, and a belvidere will be built just north of it. Thus the railroad, instead of being an eyesore, becomes the justification for a fitting and artistic monument to mark the end of Philadelphia's principal thoroughfare and the entrance to the navy yard.

From this point east the new belt line is consigned to industrial purposes, and will therefore be kept on the ground. Delaware Avenue will be extended from Bigler to Hoyt Streets, and farther north it is already being widened. Only running tracks will be allowed in it, however. Plans have already been worked out for an entire rearrangement of the local freight yards just south of Washington Avenue. As a convenience for switching the existing line

PRELIMINARY ESTIMATE OF COST OF SOUTH PHILADELPHIA IMPROVEMENT

Item	Total estimated cost	P. R. R.'s portion	B. & O. R. R.'s portion	City's portion
Washington Avenue Branch, P. B. & W. R. R.				
Washington Avenue Elevated Railroad:				
Thirtieth St. and Gray's Ferry Ave. to west side of Broad St., 2 tracks 30th to 25th Sts., 3 tracks 25th to 17th St., and 2 tracks 17th to Broad St	$2,350,000	$1,175,000	.....	$1,175,000
West side of Broad St. to 5th St. (2 tracks)	1,294,000	647,000	.....	647,000
New freight station and elevated yard tracks between Broad and 17th Sts	1,755,000	877,500	.....	877,500
Car storage yard south of Washington Ave. between 18th and 19th Sts	600,000	300,000	.....	300,000
	$5,999,000	**$2,999,500**	**$.....**	**$2,999,500**
Delaware Extension, P. R. R.				
Two-track elevated railroad (steel viaduct) on 25th St. from Arsenal Bridge to McKean St., thence along Point Breeze Ave. to 29th St., thence embankment to Passyunk Ave.	$2,151,000	$1,075,500	$.....	$1,075,500
Three yard tracks from Magazine Lane to Penrose Ave. to replace tracks on Girard Point Branch	338,200	169,100	.....	169,100
Girard Point Storage Co.'s tracks and elevation to connect with joint line	604,600	302,300	.....	302,300
Two tracks on Delaware Ave. from Bigler to Swanson Sts., to be relaid with girder rails, paving Delaware Ave. from Reed to Queen Sts., purchasing Reed St. property and rebuilding yards and tracks to compensate for tracks removed from Delaware Ave., to permit widening of Reed and Front Sts. and Washington Ave	734,000	367,000	.....	367,000
New terminal yards between Broad St. and Delaware Ave., not including pier development, portion to be paid jointly by city and P. R. R. to replace present facilities and provide for dredging	1,500,000	750,000	.....	750,000
	$5,327,800	**$2,663,900**	**$.....**	**$2,663,900**
Joint Four-Track Line, 29th St. and Passyunk Ave. to Bigler St and Delaware Ave.				
Four-track elevated railroad, 29th St. and Passyunk Ave. to Magazine Lane, thence embankment to Broad St., including Broad St. bridge and approaches	$3,280,300	$1,021,090	$1,021,090	$1,238,120
Four tracks at grade from east side Broad St. to Bigler St. and Delaware Ave	647,000	194,100	194,100	258,800
Right-of-way for 6-track railroad from Magazine Lane to Bigler St	228,000	45,600	45,600	136,800
Connecting Atlantic Refining Co.'s and City's Point Breeze gas works' sidings and tracks to elevated joint line	100,000	30,000	30,000	40,000
	$4,255,300	**$1,290,790**	**$1,290,790**	**$1,673,720**
Schuylkill River East Side R. R., B. & O. R. R.				
Two-track railroad on embankment from Schuylkill Ave. to Wolf St., thence on Wolf St. to 29th St. and Passyunk Ave.	$476,000	$.....	$238,000	$238,000
Two-track railroad on Delaware Ave. from Bigler to Vandalia Sts	130,000	.....	65,000	65,000
	$606,000	**$.....**	**$303,000**	**$303,000**
Total cost of work shared by Department of Public Works	**$16,188,100**	**$6,954,190**	**$1,593,790**	**$7,640,120**
Additional yard facilities required by P. R. R., Reed St. and Washington Ave	$273,000	$273,000	$.....	$.....
Additional facilities to be constructed entirely at P. R. R.'s expense	2,000,000	2,000,000	.....	.....
To replace waterfront facilities on property owned by P. R. R. south of Hoyt St	1,300,000	1,300,000	.....	.....
	$3,573,000	**$3,573,000**	**$.....**	**$.....**
Additional yard facilities required by B. & O. R. R.—new terminal yards between Broad St. and Delaware River (approximate estimate)	**$1,500,000**	**$.....**	**$1,500,000**	**$.....**
Purchase by city of Section 1—piers, tracks, etc., Delaware Ave. to pierhead line and Bigler St. to Hoyt St. (approximate estimate). (Department of Wharves, Docks and Ferries)	$2,300,000	$.....	$.....	$2,300,000
Purchase by city of piers, tracks, etc., Delaware Ave. to pierhead line and Jackson and McKean Sts. (approximate estimate)	1,000,000	.....	.....	1,000,000
	$3,300,000	**$.....**	**$.....**	**$3,300,000**

Pennsylvania		*Baltimore & Ohio*		*City of Philadelphia*	
Total cost to Pennsylvania	$10,527,190	Total cost to Baltimore & Ohio	$3,093,790	Cost to Dept. of Public Works	$7,640,120
Less credit by city, present waterfront property	2,300,000	Less credit by city, present waterfront property	1,000,000	Cost to Dept. of Wharves, Docks and Ferries	3,300,000
Net cost to Pennsylvania	$8,227,190	Net cost to Baltimore & Ohio	$2,093,790	Total cost to city	$10,940,120
TOTAL COST OF WORK					$24,561,100

of the Baltimore & Ohio in Vandalia Street from Oregon Avenue to Delaware Avenue may remain, and may be extended as a single-track line, at the railroad's expense, to a junction with the new line south of Hoyt Street.

In general the details of the improvement, such as the railroad terminal yards, the exact location of the main tracks and the design of the bridges and elevated structures have not yet been worked out. As already stated, however, the question of main trackage was carefully worked out in the agreement itself to protect the interests of both city and railroads, and it is definitely stipulated that four tracks shall be laid, and operated as a joint four-track line, although the Pennsylvania and the Baltimore & Ohio will each own and maintain two of the tracks.



FIRST CONSTRUCTION ON SOUTH PHILADELPHIA WORK, BROAD STREET BRIDGE

Estimated Cost

The accompanying table shows the complexity of the distribution of the expense of the improvement, as well as the estimated cost of the entire project and its component parts. Except for the water terminals, the work in which only one of the railways is concerned will be paid for half and half by railroad and city. Where both railroads are involved they each pay 30 per cent and the city pays 40 per cent, but in the acquistion of right-of-way from Passyunk Avenue to Delaware Avenue, because the city acquires space for the two future tracks to be laid under the franchise of the Philadelphia Belt Line Railroad, it assumes 60 per cent and the railroads pay only 20 per cent each. The water terminals surrendered by the railroads are treated as separate propositions, and the city buys them outright at appraised values; while the railroads pay the entire costs of the facilities they expect to build on their new terminal sites. In general the sense of the agreement is joint participation in the replacement of all existing facilities, and assumption of the entire cost by the beneficary of any new facilities.

As the general agreement was executed in July, 1913, most of the foregoing information has been public property for two years. A knowledge of it is necessary, however, to understand the problems in which the Bureau of Surveys and the engineering departments of the railroads are involved. The Bureau of Surveys is at present making a minute appraisal of the property affected. The territory is divided into convenient sections a quarter of a mile or so long, and every item of railroad property within the district is noted in the field and recorded in a table on a large-scale map of the district. Ties, rails, switches, signs, signals and poles are taken account of, and in the case of buildings to be replaced the usable volume governs. Where the building code requires a more expensive type of construction than that existing, the city pays a proportion of the difference in cost. Three men from the office of assistant engineer of grade crossings, Bureau of Surveys, have been engaged in the appraisal work for more than three months, and up to middle of August had covered the territory along Delaware Avenue from Christian Street to the Greenwich coal terminal.

Personnel

All plans and specifications of the railroads are subject to the approval of the director of the Department of Public Works, and the chief engineer of the Bureau of Surveys. The assistant engineer of the Grade Crossing Division has general supervision of the preparation of plans and specifications, the letting of contracts and the construction work itself. Morris L. Cooke is director of the Department of Public Works; George S. Webster is chief engineer and surveyor of the Bureau of Surveys; George E. Datesman is principal assistant engineer and J. W. Phillips is assistant engineer of grade crossings. For the Pennsylvania Railroad, A. C. Shand, chief engineer, is represented by Edward B. Temple, assistant chief engineer, and H. A. Lane, assistant engineer of surveys, acting for F. L. Stuart, chief engineer, represents the Baltimore & Ohio Railroad. Arthur McMullen Company of New York City has the contract for the bridge and approaches already under construction at the foot of Broad Street.

Small Granite Blocks Laid on Cement-Sand Cushion

Paving at Mail Service Building, New York City, Was Then Flushed, Turning Cushion Into Concrete—Asphalt for Joints

LACK of native workmen skilled in the laying of small, machine-cut granite blocks in the mosaic pattern characteristic of Durax pavement necessitated the employment of foreign laborers on the driveways flanking Forty-fifth and Forty-sixth Streets in the Mail Service Building, between Park and Lexington Avenues, New York City. The methods followed in European countries where this type of pavement has been used extensively were followed by the Metropolitan Paving Company on the New York work, which has just been completed. The small blocks were laid on a concrete base, with a cushion of dry sand and cement, which was flushed with water and allowed to set. Then the joints were filled with asphalt.

Perhaps the oldest paving of the kind in this country is that laid two years ago at the Brooklyn Navy Yard, where a cushion of limestone chips was used. This work was described in the Engineering Record of Aug. 16, 1913, page 181. It is said that a block of this paving will be laid soon on Second Avenue as an experiment by the city of New York.

Paving Process Outlined

The concrete base for this paving is laid in the usual way. On it, in advance of laying the blocks at the Mail Service Building, was spread 1 to 1½ in. of a dry 1 : 2 sand-cement mixture. In this, using a paver's hammer, the workmen embedded the granite blocks. At the Brooklyn Navy Yard these were laid, except for a small patch, in straight courses. The more approved way, used abroad and in the Mail Service Building, is to lay the blocks on intersecting arcs of circles, forming a fan-shaped mosaic. The blocks vary in size and are not perfect cubes, yet it is rare that the experienced workman has to lay one aside; selections of the right block from the pile are made quickly and accurately by eye. A skilled worker can lay 20 sq. yd. of these blocks in an 8-hr. day.

As soon as the section of blocks is laid it is sprinkled thinly with fine gravel. This



SMALL GRANITE BLOCKS LAID IN MOSAIC PATTERN IS EUROPEAN PRACTICE

is broomed into the joints, filling them about three-quarters full. A 5-ton roller is next used, which leaves the work with a surprisingly even surface. The pavement is then flushed with a hose, washing about one-third of the gravel out of the joints, and thoroughly wetting the cement-sand cushion. As soon as this cushion has taken a firm set a thin mix of hot asphalt is poured over the pavement and broomed into the joints. Some asphalt remains on the surface of the pavement, but soon wears off.

DURABLE SURFACE FORMED

This pavement was laid to carry heavy traffic. The blocks make an even surface with a low coefficient of rolling friction, but having, owing to the crystalline structure of the granite, a high coefficient of sliding friction.

Since the Durax pavement at the Brooklyn Navy Yard was put down, others have been laid in Louisville, Ky.; Danville, Va.; Salisbury, N. C.; Cleveland and Columbus, Ohio.

St. Louis Gives Object Lessons of Water Waste

TEN FAUCETS, opened to give streams varying from 5/8 to 1/32 in. in diameter, were tapped into a large main and the arrangement was shown in the office of the St. Louis Water Department to indicate to patrons the rate of flow. The accompanying table gave the following amounts

WATER WASTE FROM FAUCETS OF DIFFERENT SIZES

Size of stream, in.	Flow, gal. per min.	Daily cost, cents
5/8	4.86	63.0
1/2	4.16	54.0
7/16	3.24	42.0
3/8	1.90	24.7
5/16	1.50	19.5
1/4	1.29	16.7
3/16	1.10	14.2
1/8	0.86	11.2
1/16	0.44	5.7
1/32	0.13	1.7

wasted and the cost at 9 cents per 1000 gal. The smaller streams represent an ordinary leak and the larger ones careless or willful waste due to allowing faucets to remain open.

THE FRENCH GOVERNMENT on Aug. 3 is reported to have made inquiry in the Chicago lumber market for 6,000,000 white oak railway ties, calling for over 173,000,000 ft. board measure of timber. This order, if placed, would almost exhaust the stock of white oak for ties in this country. This wood is specified because of its long life, untreated. The supply of creosote, it is said, has been so reduced by the blockade of Germany that treated ties in this quantity are not to be had.

Simple Construction Reclaims 7000 Acres of Rich Land at Low Cost

Dike Prevents Periodic Flooding, While Flood-Gates Normally and Pumping Plant in Times of High Water Handle Rain and Seepage Water

By H. M. BURWELL, C.E.
Of Hermon & Burwell, Vancouver, B. C.

PERIODIC flooding of 7000 acres of rich meadow land has been prevented and its use for agricultural purposes made possible by construction costing only $109,000. This territory, known as Pitt Meadows, is situated along the Pitt River and Pitt Lake in the lower Fraser River Valley, about 20 miles east of the city of Vancouver, B. C.



DIKE PREVENTS HIGH WATER FROM BACKING UP AND OVERFLOWING MEADOWS

CHARACTER OF PROJECT

The site of the meadows was, no doubt, originally an arm of the sea, which has been filled up by sediment carried down by the Fraser River. Pitt River is a large, deep-water channel connecting Pitt Lake with the Fraser River. All are tidal waters, having a daily average rise and fall of about 3 ft.

During the flood season of the Fraser River the water is backed up over the meadows for a period of from two to two and a half months, in May, June and July, which made necessary the construction of a dike around the land to prevent its flooding, flood-gates to drain off the water at low tides, and a pumping plant to relieve it from the accumulated rainfall and seepage during the period of high water.

The land is a rich alluvial deposit with a depth of about 2 ft. of clay loam on the surface, under which is a depth of about 10 ft. of yellowish clay, and under this, in places, as much as 1200 ft. of river silt and clay, ascertained by recent boring operations.

RECLAMATION WORK

The reclamation work consisted principally of 11 miles of dike, with an average height of 10 ft., a set of flood-gates, and a pumping plant.

The dike was built a safe distance away from the river bank, on a carefully selected site, which was cleared of all timber, brush, roots, grass and rubbish. A key ditch was excavated and over it the embankment placed. This ditch extended down to the clay subsoil so that when the filling was placed puddle was formed under the dike that cut off seepage.

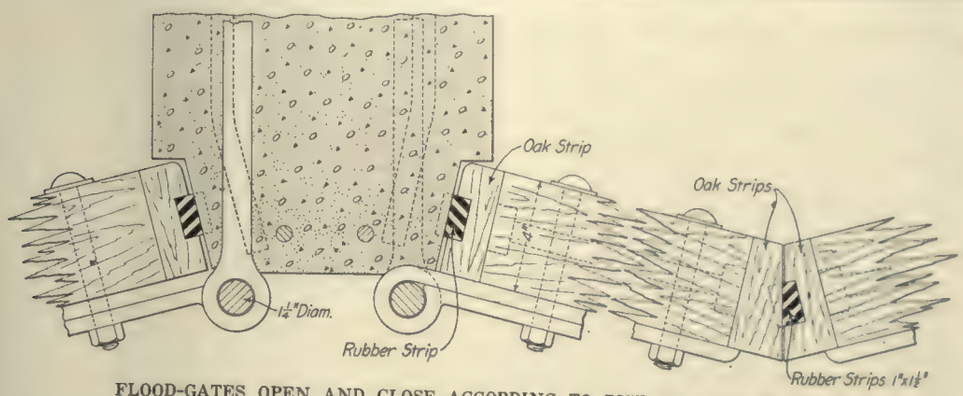
The dike was constructed with dipper dredges, the material being taken from the land side in order to provide a ditch for drainage purposes, which was, in this case, a very important consideration; otherwise it probably would have been advisable to have taken the material from the outside.

The dike has a top width of 6 ft. and side slopes of 1½ horizontal to 1 vertical. Between the inside toe of the bank and the ditch is left a berm 6 ft. in width. The ditch averages about 35 ft. in width and 7 ft. in depth. The extra material required for low places was secured by widening the ditch instead of deepening it.

The adopted level for the top of the dike was fixed by the highest known water level of the Fraser River, which occurred in 1894.



FERTILE SEDIMENT DEPOSIT MADE AVAILABLE FOR FARMING PURPOSES BY INEXPENSIVE CONSTRUCTION



FLOOD-GATES OPEN AND CLOSE ACCORDING TO RISE OR FALL OF TIDE

The finished top being 2 ft. above this level, gives it an average height above the land of about 10 ft.

Piles Driven to Retain Banks Across Two Deep Sloughs

Across two deep sloughs which intersect these meadows, the dike was constructed in a manner similar to the rest of the work, except that in addition to the earth bank, a quantity of brush and a row of closely driven piles were placed to retain the slopes and protect the dike against the wave action of the adjoining ponds.

One of these sloughs, known as Sturgeon Slough, extends through the central part of the meadows. It has a total length of about 3 miles, a width of from 100 to 150 ft. and a depth of about 20 ft. It was thought advisable to dike around this slough for a distance of 1 mile inland from its outlet, thereby keeping open a deep waterway into the central portion of the reclaimed land.

Along the portion of the dike adjoining Pitt Lake a protection banquette outside of the dike was constructed of surface soil and sods to protect the dike from the wave action of the lake and moving driftwood. This bank extends to within 3 to 4 ft. of the top of the dike, and has a width of from 12 to 15 ft., the material being placed by a dipper dredge operated during high water along the outside of the dike.

In addition to this protection work, fences were placed outside of it by all exposed points. These were built by driving cedar piles on 8-ft. centers, to which were spiked 1½-in. fir lumber, leaving 2-in. openings between the boards.

The flood-gates are located at a point near the crossing at Sturgeon Slough, this being the most central place available. They are directly connected with the slough channel, which acts as an equalizing reservoir about 35 acres in area, giving a quicker discharge than could otherwise be had if they were fed only from the ditch.

The flood sluiceway has four 5 x 8-ft. openings, and is constructed of reinforced concrete, except the floor, which is built of fir timber. As this floor will always be covered with water the timber will be durable and satisfactory and the cost much lower than for concrete. The gates are hung at a slight angle, and open and close automatically with the fall and rise of the tides.

Pumping Plant

The pumping plant is located near the flood-gates, and consists of one 30-in., double-suction, horizontal, centrifugal pump having two suction inlets, each 22 in. in diameter at the pump, tapering to 24 in. in diameter at the suction end. The 30-in. discharge pipe is also enlarged to 36 in. where it passes through the dike.

This pump is driven by a 100-hp. Westinghouse motor, transmitting the power to the pump shaft through a Reynolds silent chain drive. It is set on a concrete foundation, resting on a group of piles, at a level sufficiently low to discharge under water at all stages during the flood period.

The maximum lift is 9 ft. and the capacity of the pump is 25,000 gal. per minute, which, estimated from all the available data, is sufficient to provide for the rainfall over the whole drainage area plus the seepage during the months mentioned.

The land was granted by the Dominion Government to the Pitt Meadows Land Company in the name of W. R. Rannie, at a nominal price per acre, and with the provision that the whole reclamation work would be completed before May, 1913. The work was performed, under contract, by Messrs. W. A. Rannie and J. W. Pile of Vancouver, B. C., at a total cost of $109,000 or about $15 per acre.

The unit prices were: Dikes, 14½ cents per cubic yard; dams, 24 cents per cubic yard; protection banquette, 10 cents per cubic yard; clearing, $50 per acre; grubbing, $75 per acre; piling in place, 25 cents per foot, and lumber in place, $24 per foot b. m.; flood-gates complete, $575; pumping station, $9,689.

The whole work was performed under the direct supervision of the writer, with H. St. J. Montizambert acting as assistant.

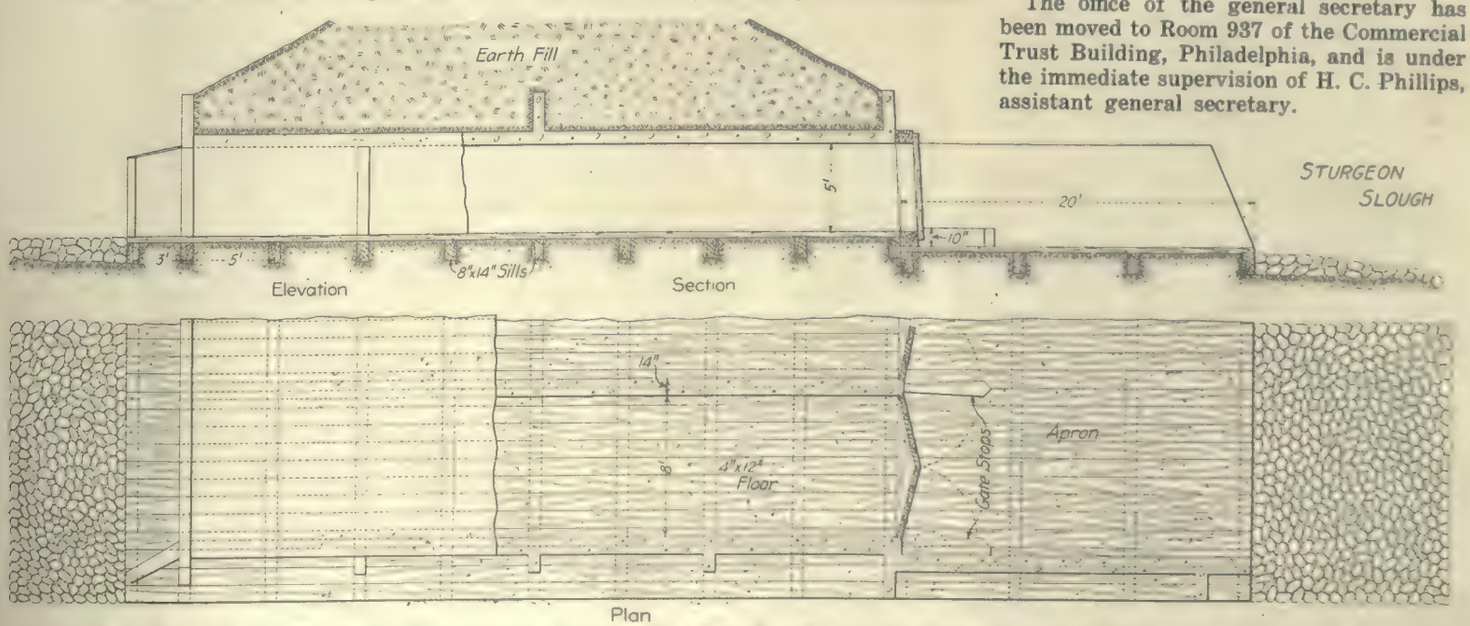
Recent Developments in Federal Evaluation of Carriers

THE Interstate Commerce Commission has assigned Sept. 30 and Oct. 1 and 2 for the hearing of oral argument on some of the fundamental principles involved in the evaluation of common carriers, states a bulletin issued by Thomas W. Hulme, general secretary of the Presidents' Conference Committee. The committee of counsel has filed a brief with the commission on behalf of the Presidents' Conference Committee.

Order 19, issued by the Division of Valuation May 21, requires from certain railroad companies information with reference to the purchase of telegraph and telephone materials and compensation paid for telegraph labor. Order 20, dated May 13 and issued Aug. 24, requires the preparation of a statement and chart showing the carrier's corporate history, including that of all predecessor companies. The order requires every carrier upon whom it is served to furnish the information within six months after such service.

The carriers' organization is giving special consideration to the compilation of rulings made by the Division of Valuation in connection with orders it has issued; also with reference to the treatment of overhead bridges, industrial side tracks, and the methods by which "condition per cent" is being determined and noted.

The office of the general secretary has been moved to Room 937 of the Commercial Trust Building, Philadelphia, and is under the immediate supervision of H. C. Phillips, assistant general secretary.



SLUICEWAY CONSTRUCTED OF REINFORCED-CONCRETE WITH TIMBER FLOOR DRAINS TRACT AT PERIODS OF LOW TIDE

Captain Bernhard Urges Development of Inland Water Transportation

Disputes Assertion That It Is Not Needed—Attributes Its Decline Mainly to "Rate-Anarchism," Obsolete Boats and Poor River Terminals

DISAGREEING entirely with the opinion expressed by Col. W. W. Harts, Corp of Engineers, U. S. A., in his paper on "Rivers and Railroads in the United States," presented before the American Society of Civil Engineers Feb. 3, that river development for transportation purposes has gone too far in the United States, and that inland water transportation will not be needed until some time in the future, Capt. John H. Bernhard, discussing the paper at length in the August "Proceedings" of the society, page 1539, avers that on the contrary not nearly enough money has been spent on these inland streams and that the trouble with water transportation in the United States is merely that it is as yet unappreciated. The present decline in the traffic he attributes to "rate-anarchism," poor river terminals, obsolete boats, the absence of proper connecting links between existing routes, and poor navigation laws and regulations, Government assistance, banking facilities and insurance rates. He deplores the present "pork-barrel" method of carrying out waterway improvements, and urges the saner policy of having each project weighed on its individual merits and, when adopted, pushed without interruption to completion. He advocates the creation of a Federal waterways department headed by a cabinet minister, and would have the commercial value of a project passed upon by water-transportation experts instead of by army engineers not specially trained for such problems. He urges an educational campaign for the building of inland water terminals. He holds that water transportation can be both cheaper and faster than rail transportation, and offers numerous figures in support of his contention. In illustrating some of his points he describes the trip made by his 1000-ton barge from New Orleans to St. Paul a year ago, and also gives some information about the line of barges to be put on the Mississippi River by the company which he has organized.

The following notes are taken from Captain Bernhard's discussion. As the discussion occupies 48 pages of the "Proceedings," it is impossible in the limited space available here to bring out all of the phases of the subject covered by him.

"RATE-ANARCHISM"

The rate situation in the United States is based on two faulty foundations: (1) "Charge what the traffic will stand"; and (2) "Any rate to meet water competition." In the preliminary report just published by the Interstate Commerce Commission for the fiscal year ended June 30, 1914, the average receipts were 0.733 cents per ton mile. The rail distance between New Orleans and St. Louis is 700 miles, which would give, as the average charge, based on the above figure, $5.13; yet the following are some of the rates in effect between those two cities: Bridge material, $3.50; cement, $2.50; flour, $2.80; grain, $1.80; lumber, $4; vehicles, $5. The railroads haul freight to river points at a loss, and then recoup themselves by exorbitant charges to off-river points.

First-class freight is shipped from New Orleans to Memphis, 396 miles, for $9 per ton, or 22.8 mills per ton-mile. To ship the same commodities from New Orleans to Amite, La., 68 miles, the cost is $10.40 per ton, or 153 mills per ton-mile. Although the distance from Birmingham to Tuscaloosa, Ala., is about one-eighth of that from Birmingham to New Orleans, the average freight rate is about one-half of that to New Orleans; but Tuscaloosa is on a navigable water, by which New Orleans, Mobile or other cities may be reached.

Flour for domestic use moves from St. Paul to New Orleans for $5.50 per ton; from New Orleans to St. Paul (same routing), for $9.80 per ton. The higher rates are up stream. Had this flour been moved by water, and had it been meant for export, it would have been more cheaply loaded from barge to ship than to warehouses in the city; therefore the railroads have a third rate, which is the "export rate," and this, from St. Paul to New Orleans, is $3.90.

OBSOLETE BOATS

The second reason for the decline of water transportation is the obsoleteness of the river craft, as shown by comparative data between a modern self-propelled steel barge which operated on the Mississippi River between New Orleans and St. Paul, and the prevailing type of Mississippi River boats. The 1000-ton, self-propelled, twin screw, shallow-draft steel barge, operated by two gas-producer engines, had a crew of seven men and a speed of 8 miles per hour when loaded with only 1000 tons of cargo. It consumed fuel at the rate of 30 cents per hour. Its cost complete was $32,000. The average cost of a Mississippi River boat of like capacity is from $60,000 to $70,000. Such a boat has an average crew of 54. Insurance on the barge was 4 per cent for fire and marine; on the steamboat it is from 12 to 15 per cent. Fuel consumption on the barge was 30 cents per hour, while on the steamboat it is $4 per hour, both boats traveling at a speed of 8 miles per hour. The total cost of operation of the barge, including overhead expenses, was $2,100 per month; on the steamboat it is $8,100 per month.

Another trouble on our alluvial streams is the so-called "aids to navigation." Great difficulties are caused by the tardy adjustment of the Government channel lights, which adjustment, as a rule, is so much behind the actual changing of the channel that the Government marks do not show where the channel is, but where it was.

BANKING AND INSURANCE HANDICAPS

Another obstruction to economical navigation is caused by the total absence of banking accommodations. Bills of lading are frequently considered as bank securities unless they happen to be for freight on inland water craft, then the bank refuses them. With a blind mule or an automobile as security, one can get at least a certain percentage of its value as a loan, but with the cheapest tool of transportation—a river boat—one might well have to sift the entire United States in order to find a single man or bank willing to furnish reasonable banking accommodations.

Another important obstacle is the insurance rates. A barge carried from New Orleans to St. Paul, 1921 miles, 90 tons of coffee, on which the freight rate of $4.25 per ton was paid. The insurance rate was $2.70 per ton and the terminal charges were 43 cents, leaving a net total of $1.12 for carrying the ton 1921 miles. This rate of insurance is actually several times larger than insurance on the same commodity from Brazil to St. Paul, provided it is moved by rail from New Orleans to St. Paul.

There are three reasons for this flagrant injustice: (1) The small inland waterborne traffic makes it no fair average risk; the laws of average are hardly applicable for this limited movement. (2) The insurance companies, like most of the people in the United States, do not take water transportation seriously; they do not care to foster it, because they only see possible losses, and not even the promise of a future. (3) Most of the insurance companies have invested their securities in railroad bonds, which circumstance seems to strengthen their belief that water transportation should not be taken seriously.

INEFFICIENT TERMINALS

The greatest handicap to inland navigation in the United States to-day, however, is the absence of terminals. This is especially true of the Mississippi River, where we are still content with mud levees, slippery and cumbersome. So important is the terminal question that it may be said that the problem of inland transportation is more a shore than a water problem. Almost invariably the shore expenses are higher than the actual cost of transportation from harbor to harbor. With the present river terminals, the height of inefficiency seems to have been reached. The shipper must carry his freight by wagon over poor roads, move it somehow down a poorly paved and usually very steep bank, laboriously unload it by hand, roll it to the edge of a muddy levee, and watch it until the steamboat may arrive, when it is carried piece by piece and stowed away under the towering superstructure of an American steamboat, amid a forest of deck supports; and the process must be reversed at the other end of the voyage. The only exception to these conditions is the city of New Orleans, where covered sheds are provided, and where mechanical loading and unloading devices are now tried.

The excessive terminal cost often offsets the advantage of the low river rate. There is no port in the Mississippi valley at which freight can be transferred directly from car to boat, or vice versa, except with a heavy shifting arbitrary, or by an added labor cost equal to from 10 to 50 cents per ton. For shipments originating or consigned, locally, drayage cost and the inconvenience of the present landings are such that each alone is sufficient to divert to rail routings a large volume of freight which otherwise would move by water at a distinct saving to the shipper. These river terminals lack even the most commonplace necessities, such as decent streets, trolley-car connections, telephones and the telegraph.

TRIAL BARGE TRIP UP THE MISSISSIPPI

The 1000-ton self-propelled barge which went to St. Paul from New Orleans in August, 1914, brought this matter of high

terminal expenses forcibly to light. The New Orleans freight was received, watched and loaded for a total of 26½ cents per ton. At Jeffries, La., 544.6 tons of lumber took 91 hr. for loading. The entire cost of loading and unloading to the shipper, together with the time loss to the barge, was $807.35, as compared with the transportation of the entire lumber cargo for $998.37—or $1.80 per ton to carry the lumber 1000 miles and $1.46 to carry it to and from the barge. With any proper semblance of an opportunity this lumber should have been loaded in 12 hr., saving 79 hr. or $305. The total cost of loading and unloading the barge on the entire trip was $1,733.12, or 63 per cent of the gross freight receipts.

The quarantine regulations which have to be contended with are worthy of a few remarks. This steel barge, which was in New Orleans only six hours, during the day time, and had been officially declared "absolutely rat-proof," was frequently detained by the various health officials along the route until the very end of its journey. At St. Paul, 1921 miles from New Orleans, 35 days after its departure, it received its last health inspector, although it had lain five days off Jeffries, three at St. Louis, and shorter periods at various other places, had been officially fumigated, and had had hundreds of visitors.

The barge left July 6 and returned Aug. 29, being gone a total of 54 days and 8 hr., including loading and unloading; and during that time it covered 3843 miles, spending 240 hr. and 45 min. in loading and unloading 1183 tons. She lost 8 hr. and 4 min. on account of engine trouble, was grounded for 174 hr. and 10 min., or waiting for the pilot to ascertain the location of the channel.

The barge carried coffee, rice, sugar, cement, molasses, lumber, flour, paper and chemicals. Out of the total of 1,921,000 ton-miles capacity each way it delivered 1,066,986 ton-miles upstream and 183,181 downstream, or a total for the round trip of 32 per cent of the barge's capacity. The total gross receipts were $2,762.57, or 2.21 mills per ton-mile; the same freight moved by rail would have cost $4,932.98.

What the Trip Showed

The total expenses of the barge were high, and some items were out of all proportion on account of the lack of organization and other consequences of this "isolated" trip. For instance, the extra pilots, needed because the crew was totally unfamiliar with the routes, received for this single trip in wages $1,014.13. Heavy expenses incurred through slow loading were to a large extent caused by the fact that this was an isolated trip. Under usual conditions, with a regular service and more boats than one to carry all the overhead and administration charges, the total expenses would have been less than $3,500, but the total expenses for this 3842-mile journey were $5,740.42, or a total of 1.65 mills per ton-mile of carrying capacity.

Had the barge been fully loaded both ways the gross receipts would have been $8,491, at a rate of 2.21 mills per ton-mile, yielding a profit of $2,750.78 even under the adverse conditions of this single trip—and this notwithstanding the fact that, in mills per ton-mile, the freight rate of the barge was 37 per cent of the rail rate.

With the exception of some through freight, transportation by water is faster than by rail. A barge entirely inadaptable for Mississippi River service, having only 150 hp. for 1000 tons carrying capacity, and spending 18 days for loading and unloading and other delays along the river, on account of the poor terminals and channel lights, averaged on its round trip, inclusive of all delay, more than 72 miles per day. What railroads to-day can show such a speed in their average shipments?

Water Transportation Cheaper Than That by Rail

It can be shown that water transportation can be made cheaper than railroad transportation. From the Pacific Coast through the Panama Canal to the Atlantic Coast, inclusive of canal tolls, the average rate is $6 per ton. The average rail rate from coast to coast, in a more direct line, not paying canal tolls, is $22 per ton. Nowhere in the world are coal and ore moved more cheaply than on the Great Lakes, where the average is 0.4 mill per ton-mile. General package freight on the Great Lakes would still be handled at a great advantage over the rail rate were it not for the fact that water competition has been throttled by the railroads. As to rates on canals, with the old Erie Canal fallen into disuse, the average rail rate between Buffalo and New York paralleling it is 4½ mills per ton-mile, while the average cost in the United States is 7½ mills per ton-mile. The old canal is hardly a ditch, yet to-day freight is moving through it, with the same old methods of a century ago, at a charge of 3 mills per ton-mile. The New York State Barge Canal will reduce the cost considerably more.

Can boats be built that will give as low rates on the rivers? Most decidedly, yes. The writer knows of no more difficult route in the United States than that from Tuscaloosa, Ala., to New Orleans. To-day barges are movng coal at a cost of ¾ mill per ton-mile over this route and returning empty. Just such a barge, entirely unfit for the Mississippi service, was used by the writer in August, 1914, the trip to New Orleans to St. Paul and back.

Proposed Mississippi Barge Line

To illustrate how cheap and profitable is inland navigation in general, and Mississippi navigation in particular, the writer gives some figures which he compiled recently for a group of financiers, who, on the strength of them, have agreed to furnish the needed capital of $5,000,000 for the Inland Navigation Company. This company, by May, 1917, will place on the lower Mississippi, between New Orleans and St. Louis, five barges (one reserve barge), each of 3000 tons carrying capacity and an upstream speed of 15 miles per hour, so that a schedule may be maintained of a 3000-ton barge leaving New Orleans and St. Louis every Tuesday, Thursday and Saturday.

These barges will have a maximum draft of 7 ft. and will be propelled by four propellers. The power will be furnished by four gas-producer engines, with a total of 2400 hp. The barges, entirely of steel, 310 ft. long, of 56-ft. beam and 9-ft. depth, will have a weatherproof cargo box. Each barge will be equipped with wireless apparatus, motor launch, watertight bulkheads, searchlights and many important factors of economy. Each will be manned by 21 men, with a combined monthly payroll of $1,970.

The complete cost of each barge will be $312,000. The estimated cost of operation based on an open season of 8½ months to St. Louis, 9 to Cairo, 10 to Memphis and 12 to Vicksburg, is $56,160 per year. The total fixed charges are $280,800 per year. With a working capital of $240,000 a total needed capital of $1,800,000 for five barges is needed. To this should be added auxiliaries, such as fast and powerful inspection tugs, each costing approximately $45,000, three of which are needed; two fast inspection launches, at a total cost of $15,000, and a number of smaller launches. There will be wireless stations at Memphis, St. Louis and New Orleans, the total cost of these stations to be $40,000. This, with $10,000 for office equipment and extras, makes $200,000 for extra equipment, or a total of $2,000,000.

Time and Cost of Trip

In theory the barge will make the trip from New Orleans to St. Louis in 80 hr. running time, but in practice, when fog, wind, engine troubles and grounding play an important part, an upstream trip of 4½ days should be estimated. The loading and unloading of each terminal should not take more than 12 hr., so that the round trip may safely be based on 9 days, estimating a speed for the downstream trip at an average of 17½ miles per hour. On this basis the five barges will make 187 trips per year, so that the fixed charges with the profits amount to a total of $3,640.60 per trip.

The expenses per trip figure as follows:

Fixed charges, including interest and profits	$3,640.60
Wages, including insurance	639.00
Subsistence	102.47
Fuel	840.00
Supplies	400.00
Extras, at 3 per cent	291.00
Total	$5,913.07
Or, in round numbers, $6,000.	

With the barge fully loaded on each trip, freight could be moved from New Orleans to St. Louis for $1 per ton, which would give a yearly dividend of 26 per cent and establish a 100-per cent sinking fund within 12 years. It seems safe to estimate that the barges will soon be loaded to 80 per cent of their capacity, or $1.25 per ton from New Orleans to St. Louis. The rail rates are such that during the winter the company should be prepared to stand an estimated loss of $180,000, because, in many cases, the rail rate from Vicksburg, Memphis or Cairo, East St. Louis is more than the water rate from New Orleans to St. Louis. This makes an additional total charge of 17½ cents per ton over the entire year, and the administration, soliciting and advertising is estimated at about 7½ cents per ton. Thus, outside of loading and unloading, or switching charges, the total rate per ton from New Orleans to St. Louis should be $1.50 per ton.

Special Terminal Barges

The cost of loading and unloading includes only the removal of freight to and from the barge. The value of the barge is $32.22 per hour, so that every hour's delay means a tax of 1.34 cents per ton, and economical transport with the greatest despatch is of the utmost importance. It is the intent to make stops only at cities where there are proper modern terminal facilities, or which, either as a community or through individual shippers, have signed for sufficient freight to and from to justify the company in establishing its own river

terminals at such cities. The loading and unloading are to be taken care of by a separate company.

It is proposed to build some of these terminals as floating terminals, so that they may be removed. The deck of such a terminal can always be at the same height as that of the barge deck; and the terminal is to be connected by tracks, running over the roof of the terminal barge cargo box, over a hinged apron, to the belt railway, if there is such, or otherwise to the various railroad tracks. This floating terminal collects and disburses the freight, and care will be taken that it is ready for loading on the arrival of the barge, and also that preparations are made to have the loading and unloading proceed simultaneously. Such a terminal will always have a little more than twice the capacity of the barge which it serves; the terminals will be equipped with wireless apparatus, two 10-ton traveling cranes with 40-ft. booms, and also telphers, conveyors and electric trucks.

The main deck of the terminal barge will connect directly with the street by a roadway 40 ft. wide, running through the center of the barge from end to end. The height of the transfer barge will be regulated by water pumped out or let in, as necessary, so that the transfer and transportation barges will always be at the same height during the loading and unloading.

It is assumed that the total crew on shore will necessitate a combined yearly payroll of $125,000, plus insurance, or about 14 cents per ton received or delivered. The transfer barge complete with all its appliances will cost $300,000; and interest, depreciation, insurance, repairs and harbor dues will amount to 15 per cent per year, or 4½ cents per ton. Thus the total shore expenses, outside of switching charges or car hire, will be 20 cents per ton, and estimating the profits at 20 per cent the charge would be 25 cents per ton.

Hence, the total charges from New Orleans to St. Louis are 10 cents for switching charge and car rental, 25 cents for loading, $1.50 for transportation, 25 cents for unloading and 20 for car hire and switching charges in St. Louis, or $2.30 per ton. This charge will be reduced to $1.92 as soon as the Interstate Commerce Commission has readjusted the present switching and rate arbitraries. This rate covers receiving in cars at warehouse and delivery at warehouse of consumer. When received and delivered at the river terminals the charge will be reduced to $1.82 per ton, and if it is guaranteed that the barge will be loaded to full capacity the charge will be reduced to $1.45 per ton. This latter should be the ultimate and total charge, and it is the company's aim to be able to make a rate of 1.2 mills, water distance, or 2 mills per ton-mile, rail distance.

Not Smaller, but Saner, Expenditures Are Needed

The writer does not believe that we need to look forward to smaller expenditures on our waterways, but believes that saner methods of spending money on them are required. Instead of making yearly haphazard appropriations, each project in itself should be approved or condemned, and, if approved, authority should be given to carry out the work, a lump sum—based on the estimate of competent engineers—being set aside for the purpose, instead of as it is now done, on the installment plan, with frequent intervals of idleness on account of some filibuster or change in politics.

We are still employing as engineers for our waterways the army engineers of the Government, trained as army engineers and not as water or transportation engineers. They have given ample proof of their efficiency, but this is rather a tribute to their brains than to their training. Long ago there should have been in the United States a separate department (with a cabinet minister at its head) for waterways. It is a decided error in judgment to have the army engineers pass upon the commercial value of a project presented for their consideration, as their training and experience do not make them proper judges of the commercial value of such projects. How frequently have they stated that certain needed links between waterways were of no commercial value because there was at that date no actual freight moving over that route!

Since 1875 $680,552,501, or about $17,000,000 per year have been spent on rivers and harbors in the United States. This is only 4 per cent of the total amount spent on railroads, and is less than has been spent on the waterways of Holland. The United States has not spent enough by far for waterways, and much more will have to be expended.

The general assertion that our railroads move freight at greatly less charges than those of Europe is incorrect. The low-class commodity and bulk freight in Germany, France, Belgium and Holland moves by water. If all such low commodities as moved by water in these countries, with their low rates, were eliminated from the figures for the United States, the general average cost of transportation would be considerably higher. To get a fair comparison there should be omitted from the American figures all those pertaining to the movement of coal, ore, lumber, grain, oil and steel.

Conclusion

The great trouble with water transportation in the United States is its absence. There are very few people in the country familiar with the problems of water transportation, and its almost total absence makes the number of its competent champions small. In lieu of these, it has an army of politicians who fight for "water improvement" for the sake of the spoils; a large number of well meaning, poorly led and frequently ill-advised citizens, and a considerable legion of highly trained and experienced transporters who can regard water transportation only from their standpoint in life—that of railroad men.

Inland water transportation is sadly needed, and the writer believes that it can be revived through the following measures:

1. Waterways, harbors, bridges and quarantines should be combined in a new department with a cabinet officer as head, the department employing engineers specially educated for this at West Point, but not under direct charge of the army officials while engaged in the waterway department.

2. The decision as to which of the new waterways, if any, are a commercial necessity, should not be made by such engineers, but by a group of transportation experts, specially employed by the Government.

3. A definite, concise, uniform plan—a system of waterways improvement and development—should be prepared by this department for the entire United States, Congress to modify or improve this and appropriate a yearly lump sum to be spent in approaching this ideal.

4. All States and communities should be in duty bound to build inland water terminals, just as they now feel obligated to build sea terminals.

5. An educational campaign, in municipalities, for the building of belt railroads, warehouses and other facilities of communication to the harbor, should be instituted.

6. The riverfront should be under public ownership.

7. It is an absolute necessity that the abuse of the rail rates to meet water competition shall be stopped; successful water transportation means rail rates tied down to fixed charges per ton-mile, plus terminal charges, and enforced exchange of freight between water and rail terminals.

8. This measure is opposed to the licensing of pilots, or to the compulsory employment of licensed officers.

9. It provides for uniform and federal quarantine law.

10. Our waters and coasts should be open for navigation to any nationality or trade.

Oil-Mixed Concrete Found Generally Damp-Proof

Recent Tests Under Service Conditions Reported by Logan Waller Page Show Good Results for Waterproofing Purposes

THAT oil-mixed Portland-cement concrete is a cheap and effective solution of the problem of producing damp-proof or waterproof structures under low heads is confirmed, in general, by the results of actual service conditions reported by Logan Waller Page, director, Office of Public Roads, in Bulletin 230 just issued as a revision of the previous Bulletin 46 of the U. S. Department of Agriculture. Previous experiments and results were abstracted in the Engineering Record of Oct. 14, 1911, page 445. The following abstract gives the results reported for some actual structures built according to the specifications and directions issued as a result of applications to the Office of Public Roads.

Results of Service Tests

The use of oil-mixed concrete on five different sections of road surfaces laid in 1910 in widely separated cities and towns seem to show, to date, that no apparent advantage has been gained by the addition of 10 per cent of oil. Several tanks constructed of oil-mixed concrete in the testing laboratory of the Office of Public Roads have remained absolutely watertight since their completion more than a year ago. One of these tanks was made of 1:2:4 mixture, using 10 per cent of oil, based on the weight of cement in the mixture. It is 4½ ft. deep and is used for storing concrete test specimens, the bottom being 4 in. thick and being deposited on the cement floor of the laboratory. The sides are 6 in. thick and are reinforced with ½-in. deformed steel bars. A second tank was built merely by plastering oil-mixed Portland cement mortar against expanded metal of ½-in. mesh. Although the sides and bottom of this tank are only 1 in. thick, it is absolutely watertight against about 2 ft. head of water.

A number of firms, corporations and individuals applied to the Office of Public Roads for information in regard to using this oil-cement concrete in various structures. Specifications and directions for

mixing and using the materials were supplied. Later, inquiries were made relative to the success met with. Many inquiries were not answered, but of the twenty-nine replies received, only three were wholly unfavorable, while a fourth was partly so. The following favorable and satisfactory results are worthy of note:

1. Retaining wall, 1:3:5 concrete with 10 per cent oil; satisfactory in every way.

2. Swimming pool with 20-in. wall under 5-ft. head, original results with "ceresit" unsatisfactory, covered with scratch coat ½ in. thick on which flat tile were laid. It is now two years old and has never leaked since.

3. Eighteen-inch cellar walls 5 ft. high of 1:2:4 concrete with 10 per cent of oil, waterproofed against supersaturated earth filling with excellent results.

4. Mortar mixed 1:2 with 5 per cent oil used to plaster inside of various water tanks of different sizes. Mortar "works" better than plain mortar. Results satisfactory.

5. Eight-inch foundations and a cistern 12 ft. deep made of 1:3:4 wet concrete with 5 per cent oil are perfectly damp-proof.

6. Floor of grain bins covered with 1:1 mortar with 15 per cent oil is perfectly hard and waterproof.

7. Paving block 12 x 14 in. 5 ft. with 1:3 mortar and 2 per cent oil used as facing. Gave hard smooth surface, impervious to moisture.

8. Facing of soffit of concrete arch, 1:2 mortar with 10 per cent oil. Waterproofed concrete is in excellent condition, non-waterproofed concrete badly disintegrated.

9. Basement walls of buildings subject to ground water action; 1:1:3 concrete with 2 per cent oil is absolutely waterproof, while stone wall above continually admits water.

10. Cellar walls subjected to 4-ft. head of water. Wall 6 in. thick, of 1:2:4 concrete and 10 per cent oil, showed only a slight sweating through the joints.

The following results were unfavorable:

1. Cement blocks for track paving of 1:2:4 wet concrete with 10 per cent oil were not successful; blocks were never used. Oil was added for toughness.

2. Tank to hold 1 per cent solution of sulphuric acid at 150 deg. Fahr. Not successful, acid dissolved concrete.

3. Floor of cellar coated with 1:3 mortar 2 in. thick with 6 per cent of oil. As much water as before coating was applied.

These experiments, on the whole, give very encouraging results and point to the use of oil-mixed mortars and concrete as a cheap and effective solution of the problem of waterproofing for a great many types of concrete construction under low pressure.

Algae Growths Cover Atlanta Sewage Filters

From 2.5 Acres of Beds Laborers Removed About One Ton of Leathery Material

By CHARLES C. HOMMON
Chemist and Bacteriologist in Charge, Atlanta, Ga.

DURING the first part of October, 1914, there began to appear on the upper surface of the stones in the sprinkling filter beds at the Peachtree Creek sewage treatment works in Atlanta (Engineering Record, July 3, page 4) a growth that was later classified as blue-green algae belonging to the Oscillatoria family. The growth was first noticed forming around the risers and nozzles, but soon spread in a fine green film over the whole surface of the filter bed. It appeared that the nozzles formed a sort of nucleus, or starting point for the growth, which gradually became thicker and thicker over the whole bed until in March of this year it was ½ in. thick in places. The heaviest growth extended approximately 3 ft. from each nozzle.

The top surface of the growth was dark green in color, while the middle and underneath portions were dark brown. It was leathery in texture and quite firm. When the growth was in a healthy condition it clung very tenaciously to the stones, and sometimes when picking up a piece of it six or eight stones would be so firmly bound together by it that they could be carried from the bed without dropping off. In places it caused considerable pooling of the sewage, but at no time was this serious.

GROWTH DRIES IN APRIL

In the middle of April, however, the growth began to dry up in places, break loose from the stones, and apparently was going to sluff off and pass through the beds. Some of the pieces were 6 in. square, and fearing they might clog up the lower layers of the filter medium or the underdrains, an attempt was made to remove the growth by raking it off. This was not found practical, so laborers were set to work picking it off by hand. It was found that by letting the growth dry from four to five hours it practically freed itself from the filter medium, and pieces as large as 3 ft. square could be picked up.

The filter effluent contained considerably more suspended matter for a few days after the beds were cleaned, but they soon went back to normal and the stones in the beds at the present time are practically as clean as they were before the beds were put into service two years ago. Except for the first few days after the beds were put back into operation there was no apparent difference in the quality of the effluent after the growth was removed. The excellent condition of the filter beds during the spring and summer months suggests the possibility that the matted growth over the surface during the winter held the suspended matter back and thus prevented the usual clogging that takes place in filters during the colder months. The underneath portion of the growth of algae appeared to contain material filtered out of the sewage, and there is no doubt that a great deal of suspended solid matter was held back and much of it oxidized by the algae, which are known to consume a considerable quantity of nitrogen. This class of algae does not give off oxygen to the same extent that some of the other algae do, but the oxygen they did give off and the suspended solids held back and partly oxidized must have been beneficial to the filters during winter.



LEFT—TWO TONS OF DRY ALGAE FROM TWO AND A HALF ACRES OF BED



RIGHT — LABORERS PICKING UP THE DRY COATING ON FILTERS

EFFECT OF COLD WEATHER

The writer believes that these growths ought not to be disturbed during cold weather, or as long as they remain in a healthy growing condition and cling tightly to the surface of the stone, but when they threaten to break up and pass on through the filters it is time to put the filters out of service, allow the growth to dry out, and remove it.

Ten laborers cleaned 2.5 acres of filter beds in four days and removed approximately 2000 lb. of material. Allowing $1.50 per day per laborer and $3 per day for a foreman, made a total cost of $72 for cleaning 2.5 acres of filter beds, or $28.80 per acre.

Cost of Bituminous Surfacing for Roads Analyzed

California Highway Department Itemizes Figure of 8.46 Cents Per Square Yard Paid for Typical Surfacing on Concrete Base

BITUMINOUS surfacing has recently been completed on an 8-mile stretch of highway near San Luis Obispo, Cal., in Division V of the California highway system. Carefully itemized costs have been kept by the division engineer on each part of the work, and they have been summarized in the following cost data. The figures are based on two coats of oil, each applied at the rate of ¼ gal. per square yard. The concrete base was 15 ft. in width and the stretch to be surfaced 43,660 ft. in length, making a total area of 72,766 sq. yd.

In Table 1 the cost of oil is based on the price paid by the State when buying oil in 5000-bbl. quantities and includes delivery to the siding nearest the work, unloading from the cars and heating ready for use. The price of broken-stone screenings includes delivery in piles along the pavement as desired by the contractor. The total cost in the table divided by the area gives a unit cost of 7.69 cents per square yard, to which it was considered fair to add 10 per cent for division superintendence and headquarters overhead, thus bringing the total unit cost up to 8.46 cents per square yard.

An analysis of the cost of handling the oil shows that on this particular stretch of highway 1191.6 bbl. were unloaded and heated at a total cost of $405.31, or 34 cents per bbl. This sum was made up as shown in Table 2.

The oil was hauled in a 5-ton motor truck an average of 8.5 miles from the railroad siding, one truck supplying an average of 2000 lin. ft. of 15-ft. pavement per day. The truck and operators cost $20 per day and the cost of applying the oil was therefore 0.6 cent per square yard. The concrete was cleaned by a horse-drawn broom assisted by laborers with hand brooms. The crew of three laborers and a double team, the latter being required only half time in order to keep up with the laborers, could average about 4020 lin. ft. of 15-ft. pavement per 8-hr. day at a total cost of $9 per day, or 0.134 cents per square yard of surface. The laborers were paid at the rate of $2.25 per day and the team at $4.25 per day.

Screenings were unloaded by hand, being shoveled from cars into patent loading chutes in a 5-ton motor truck, and were then hauled to the desired points along the road. The average daily cost of unloading was therefore 16 cents per ton. The trucks made trips averaging 1.6 miles in length over excellent roads, and handled 1727 tons at a cost of $944.69 or 12.2 cents per ton-mile.

TABLE 1.—MATERIAL AND LABOR COST

Materials	
Oil, 1191.6 bbl. at $1	$1,191.60
Screenings, 1078.8 tons at $1.16	1,202.74
Screenings, 690.14 tons at $1.12	772.96
Incidental tools and supplies	217.99
Interest and depreciation on oil plant and equipment	96.00
Labor	
Total payrolls and truck rental	2,113.01
	$5,594.30

TABLE 2.—COST OF OPERATING OIL HEATING PLANT

Total materials	$88.46
Total labor	184.00
Interest and depreciation	96.00
Overhead and supervision (10 per cent)	36.85
	$405.31



APPLYING ROAD OIL ON A CONCRETE BASE IN CALIFORNIA

This, however, does not include interest or depreciation charges.

After the oil had been applied, a suitable amount of crushed rock screenings were spread so as to absorb all surplus oil and take up the "bleeding." The work of spreading the screenings cost 0.405 cents per square yard, this item including five laborers at $2.25 per day, accompanied for a time by a double team and driver at $4.50 per day. On the total area of 72,776 sq. yd. there were used 50,047.2 gal. of oil, or 0.689 gal. per square yard, and 17,227 tons of screenings, or 0.0238 tons per square yard.

The work was done under the general supervision of Austin B. Fletcher, State highway engineer. W. C. Howe was division engineer in immediate charge of the work.

EIGHT TUNNELS, seven of them double-tube, and five bridges, costing collectively probably $150,000,000, will connect Long Island with the west bank of the East River when the facilities now being built or proposed for immediate construction in New York City are finished. The bridges, from the upper bay to the sound, are the Brooklyn, Manhattan, Williamsburg, Queensboro and Hell Gate bridges. The tunnels, counting the same way, are the present subway tubes, the Whitehall-Montague Street tunnels, the Old Slip-Clark Street tunnels, the Fourteenth Street-Eastern tunnels, the Pennsylvania tunnels, the Queensboro or Steinway tunnels, the Sixtieth Street tunnels, and the Consolidated Gas Company's Astoria tunnel.

Cincinnati Plant Has Eliminated Water-Borne Typhoid

Annual Report of Water Department Shows High Efficiencies of Settling Basin and Low Operating Costs

TYPHOID statistics of Cincinnati for 1914 show an enormous reduction in the number of cases—fewer cases, according to the latest annual report of the water department, than were ever reported before since the municipality became a real city. For the four years, beginning with 1904, previous to the construction of the filter plant, the number of cases was 1646, 746, 1940 and 1252. The deaths for these years were 279, 155, 239 and 157. For the seven years since the plant has been in operation cases each year are reported as follows, the last year being 1914: 235, 218, 183, 238, 187, 266 and 128. For corresponding years the number of deaths was 67, 46, 21, 43, 28, 23 and 23. The population is about 406,000.

PLANT EFFICIENCIES

The efficiency of the settling basin in removing turbidity has been 9 per cent greater than ever before, 74.1 per cent of the sediment-producing turbidity being settled out. The average turbidity was 120 parts per million, as compared with 204, the average of the preceding six years. The median turbidity was one-half of the average.

Entering the coagulating basin the water contains an average of 31 parts per million, 62 per cent less than in the preceding six years. These basins removed 21.7 per cent, the lowest record since the plant was started. The water went to the filter with one-fourth the usual amount of turbidity, 5 parts only.

Sulphate of iron was applied at the average rate of 170 lb. per million and the lime at 95 lb.

Wash-water to the extent of 2.24 per cent was used, as compared with 2.65 per cent in 1913. The average period of service of the filters was 19.5 hr., or 2.24 hr. longer than for the preceding year. This was due principally to less trouble with microscopic plant growths in the river and settling basin.

Bacterially the filtered water contained an average of 36 germs per cubic centimeter and the median number was 20. In the river there were 16,500 bacteria per cubic centimeter on the average, but the median number was only 2900. For 54.54 per cent of the time the numbers ranged from 1000 to 100,000 bacteria per cubic centimeter. Liquid chlorine, equal to 0.82 lb. per million gallons, was applied to the filtered water, reducing the numbers of bacteria 83.6 per cent. During 95 per cent of the time the filtered water had less than 100 bacteria. The B. coli index indicates that approximately 15,000 bacilli of this species were present in every liter of river water, while only two or three could be found in the same amount of filtered water.

COST OF OPERATION

The total cost of operating and maintaining the plant was $3.38 per 1,000,000 gal. of filtered water delivered into the service mains. Of this amount $0.39 was for maintenance and $1.21 for coagulating chemicals. The chlorine cost was 8.6 cents per million gallons. Total costs per million gallons for the six years previous to 1914 were $4.24, $4.26, $4.19, $4.12, $3.84 and $3.92, and for chemicals, $1.72, $1.89, $1.93, $1.86, $1.78 and $1.67.

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

Arkansas City Fights Losing Battle to Save Its Levee

Five thousand sand bags used in reinforcing the city levee at Newport, Ark., proved of no avail in saving the levee when the Mississippi reached an unprecedented stage during the heavy storms and rains of the last two weeks in August. In regard to the exact extent and nature of the damage to the levee at Newport, A. S. Madding, city engineer, in a letter to the Engineering Record, says:

"Owing to the fact that the water is still very high, it would be impossible to give anything but a rough estimate of the damage done, but the new causeway across Newport Lake, connecting Newport and East Newport, seems to be damaged more than any of the levees in this immediate vicinity. This causeway was completed last spring at a cost of approximately $30,000. Its surface was temporarily made of shells, as the engineer, Major W. J. Parks of Pine Bluff, was contemplating paving it this winter. Owing to the depressed financial conditions in this county at present, due to the damage done by the overflow, it is probable that the causeway will be rebuilt at once, but will not be paved this winter. The present estimated damage to the causeway is placed at $5,000.

"Newport is built in a triangular shaped area and is surrounded by levees built by the Iron Mountain Railroad, the Rock Island Railroad and the city. The city levee despite its sand-bag reinforcing broke early in the flood. Most of the water, however, came in through the Rock Island dump from Newport Lake. When the water started receding the city levee was dynamited in several places in order to let the water go out that way. The Iron Mountain Railroad Company's engineers estimate their damage at $100,000, the greater portion of which is in this county.

"The Village Creek levee, which is about 9 miles below this city on White River, is reported to have broken in six places, but the engineers have made no estimate of the damage.

"The sanitary work is being conducted under the direction of Dr. J. H. White, senior surgeon of the United States Public Health Service, and Dr. C. W. Garrison, State health officer, who were joined Sept. 3 by J. A. La Prince, chief sanitary engineer for the United States Government. Large forces of men are working under these officials, and every effort is being made to restore things to normal conditions. It is reported that work will be begun on all levees immediately."

Texas Law Will Compel Building of Many Sewage-Disposal Plants

Many sewage-disposal plants will be built in Texas within the next year or so due to the going into effect, Jan. 1, 1917, of the new anti-stream-pollution law, which prohibits the emptying of raw sewage into the streams of the State.

Los Angeles Garbage Controversy

The Board of Public Works of Los Angeles has arranged temporarily to sell to ranchers and stock raisers in the vicinity the city's accumulation of garbage—about 274 tons a day—pending settlement of a controversy between the city and the Pacific Reduction Company over the question of water rental. The reduction company contends that the city should furnish free of cost all the water necessary for the operation of the reduction plant. The city admits its obligation to supply water but claims it is entitled to charge for the service. A necessary contemplated increase in the capacity of the reduction plant is being delayed by the company until the water question has been adjusted. The city plans, in the meantime, subject to the approval of the Los Angeles City Council, to apply the revenue from the sale of the refuse toward the purchase of automobile trucks for hauling garbage from Hollywood to the reduction plant in Los Angeles. If the water question is settled shortly, however, the reduction company expects to be able to handle the entire garbage accumulation of the city by the first of the year.

Survey Looking to Improvement of Colorado River Recommended

The Chamber of Commerce of Austin, Tex., has received information to the effect that Lieut.-Col. Charles S. Riche, Corps of Engineers, U. S. A., in charge of the Galveston District of the Gulf Division, has recommended that a survey looking to the improvement of the Colorado River be made. It is estimated that the cost of making this river navigable would amount to $8,000,000.

Colorado Branch of American Society to Entertain Visiting Engineers

Sightseeing trips from Colorado Springs to the Garden of the Gods by four different routes have been arranged by the Colorado association of members of the American Society of Civil Engineers, for the benefit of members of the various National engineering societies en route to the International Engineering Congress at San Francisco. The association will not hold any formal meeting in September.

Pennsylvania Has Made No Move to Enter Detroit

Newspaper reports that the Pennsylvania Company, which operates the Pennsylvania Lines West of Pittsburgh, would spend $20,000,000 to effect an entrance into Detroit, are entirely without foundation, writes a representative of that company. Vice-President Atterbury, who, it was alleged, had given out the information, was not in Detroit the day he was said to have made the statement there.

Milwaukee May Spend $2,000,000 a Year on Sewerage System

At the last minute the State Legislature of Wisconsin passed a bill enabling Milwaukee to issue bonds to the extent of $2,000,000 per year for a sewerage system and disposal works. The City Council must exercise its judgment as to how much shall be issued each year. An ordinance for a part of the $2,000,000 for this year's needs is now before the Aldermen.

The 2,000,000-gal. activated-sludge plant, which was started in July, is well under way, bids for the machinery being received Aug. 19. This is the first activated-sludge plant built for service in this country. It will have a 4-hr. period of aeration, a 25-per cent sludge content and 25-min. sedimentation. The plant is to be completed by Nov. 15 so that it may be operated throughout the winter to determine the effect of low temperatures on the continuous-flow method. No time will be lost in starting. Activated sludge with which to seed the new plant is being manufactured at the testing station. The sewerage work in Milwaukee is being carried out under the direction of T. Chalkley Hatton, chief engineer of the sewerage commission.

New England Men Plan Memorial for Dexter Brackett

Committee Named to Raise Fund at Thirty-fourth Annual Convention of Waterworks Association in New York This Week

Members of the New England Waterworks Association at the thirty-fourth annual convention held at the Waldorf-Astoria Hotel, New York, Sept. 7, 8 and 9, have completed plans for perpetuating the memory of Dexter Brackett, past-president of the association, who died August 26. By a resolution proposed by Charles W. Sherman of Boston a fund is to be raised and its interest devoted to a prize for the best paper each year or to research work, the final arrangement being left to the executive committee of the association. President Leonard Metcalf appointed Frederic P. Stearns, Alfred D. Flinn and Allen Hazen as a committee on the Brackett memorial.

The convention opened on the morning of Sept. 7 with an active membership of 965, the largest in the history of the association. On the morning of Sept. 9 the secretary's records showed a registration of 586, of which 213 were members, 261 guests and 112 associate members.

President Metcalf's Message

In acknowledging the good wishes for the convention's success, expressed by New York City officials on Sept. 7, President Leonard Metcalf said in part:

"There is manifest throughout the country a tendency toward progressive development based upon a policy of placing in charge of large works men whose abilities have steadily been proved in smaller tasks. This policy of promotion on merit augurs well for the future of the waterworks profession. Another factor which will surely contribute to larger things is the spirit of co-operation which exists among waterworks men in the United States. It is unparalleled the world over, and I say this after having observed conditions in the principal European countries. It is attributable in large measure to the work of such associations as ours. The Catskill aqueduct, now nearing completion, is a convincing demonstration that municipal waterworks on a large scale can be constructed efficiently, economically and honestly if responsibility is placed upon engineers of tested ability."

Status of Catskill Aqueduct

At the first session J. Waldo Smith, chief engineer of the New York Board of Water Supply, told of the present status of the Catskill aqueduct work. The aqueduct proper, 92 miles long, will be completed next month and more than half of it has been carefully tested. Recent hydraulic experiments have disclosed that its capacity, making a reasonable allowance for loss due to growths which accumulate in years of use, is about 650,000,000 gal. per day. Tests at two of the deep pressure tunnels have disclosed a surprisingly small amount of leakage. The Ashokan reservoir is substantially completed and at the present time contains about 80,000,000,000 gal. of a total of 128,000,000,000 gal. of water.

Studies for a filtration plant in connection with the Catskill supply are under way, but, if built, it cannot be completed before 1920.

It is confidently expected, Mr. Smith stated, that by Jan. 1, 1916, the aqueduct will be in a condition of a large machine with many working parts which have just been assembled for the first time and which have not been adjusted or tested. Some of the parts of the machine are necessarily of new and untried design to satisfy conditions never before met with. The problem that will then confront the Water

Board on Jan. 1, 1916, is the adjustment and test of this machine, the training of the operating force and the "tuning-up" and synchronizing of the entire plant. It is believed that this may require all of the year 1916.

Water Supply Across Swamp

How the cities of Beverly and Salem, Mass., have united forces in a plan to deliver an auxiliary water supply from the Ipswich River through a canal crossing two miles of swamp land to an existing reservoir was explained by Francis F. Longley of the firm of Hazen, Whipple & Fuller. Although the design of the work was comparatively simple there were complicating factors relating to the time at which water might be taken from the river, its quantity and the minimum flow of the stream. The scheme of delivery by the open canal proved to be far more economical than the pipe line and after the swamp had been cleared during winter a dredge cut a new channel.

In his paper delivered Tuesday evening H. W. Clark of the Massachusetts State Department of Health told how the water supply of South Norwalk, Conn., was improved both physically and bacteriologically by double sand filtration. At this plant the algae problem was solved without resort to the use of copper sulphate.

In the discussion Allen Hazen characterized the South Norwalk work as the most complete for removing tastes and odors ever built. "We have devoted a great deal of attention to the removal of disease-producing bacteria from water supplies," Mr. Hazen said, "but have given scant attention to the betterment of water's physical properties. There is an opportunity for much useful work along this line."

In response to President Metcalf's request for a few words from the president of the American Waterworks Association, Nicholas S. Hill, Jr., of New York City, made an urgent plea for the amalgamation of all waterworks interests in the United States in a single National body. This question, it will be recalled, arose at the Cincinnati convention of the American association last year and George G. Earl, then president of the American association, made the suggested merger the chief topic of his presidential address.

New Committee on Leakage

A new committee on leakage and pipe joints was appointed at this week's convention. It is the outgrowth of the discussion which followed the paper on "A Test of Leakage from Lead Joints," by Arthur H. Smith, engineer, Associated Factory Mutual Fire Insurance Companies of Boston. The committee consists of Frank A. Barbour, Carleton E. Davis, S. E. Killam, Caleb M. Saville, Henry B. Machen and A. H. Smith.

Three of the association's past-presidents were elected to honorary membership this week. They are Edwin C. Brooks, formerly superintendent of the Cambridge water department; George A. Stacy, superintendent of the Marlboro (Mass.) waterworks, and Robert J. Thomas, superintendent of waterworks at Lowell, Mass.

The nominating committee to select officers to be balloted on next year was named by President Metcalf as follows: F. A. McInnes, of Boston; E. W. Kent, of Newport, R. I.; J. Waldo Smith, of New York; E. E. Lochridge, of Springfield, and A. E. Blackmer, of Boston.

Discuss Valves

At the superintendent's session Wednesday morning, interest centered upon the subject of valves, but no agreement was reached as to the relative merits of valves of the solid wedge or the double disk type. The topic was introduced by papers read by George H. Finneran, of Boston, and J. M. Diven, of Troy, N. Y. In the Boston Water Department, which manufactures all of its own valves, a decided preference for the solid wedge type is manifest. This opinion was also concurred in by A. O. Doane, of the Metropolitan Waterworks, Boston. Many of the other speakers, however, favored the double-disk valve.

A valuable paper for anyone who is contemplating the construction of wire fences with concrete posts was the one by Ralph N. Wheeler, department engineer, Board of Water Supply, New York City.

Excursions

On Wednesday the convention went by boat down New York Harbor and up the Hudson River, while for Thursday, the last day, a trip to the Kensico dam of the Catskill aqueduct was scheduled.

Program for Pan-American Road Congress Issued

The official program of the Pan-American Road Congress, to be held at Oakland, Sept. 13-17, has been issued. The official hotel headquarters will be at the Hotel Oakland. The congress will be opened at 10.30 a. m., Sept. 13, with addresses by governors from four States. There will also be addresses by the Mayor of Oakland; James A. Barr, director of congresses at the exposition; Fairfax Harrison, president of the American Highway Association, and G. W. Tillson, president of the American Road Builders' Association, and consulting engineer to the borough president of Brooklyn.

There will be morning and afternoon sessions throughout the congress. Papers will deal with the history and future of highway improvements, highway legislation, National, State and local responsibility for road conditions, location, drainage, foundations, bridges and structures, limitation and regulation of highway indebtedness, surfacings and resurfacings, accounting, engineering supervision, justifiable outlay, convict labor, equipment, traffic, maintenance, dust suppression and cleaning.

Among the speakers there will be G. W. Tillson; A. N. Johnson, highway engineer, Bureau of Municipal Research, New York City; Col. E. A. Stevens, State commissioner of public roads, New Jersey; William R. Roy, State highway commissioner, Washington; Paul D. Sargent, chief engineer, State Highway Commission, Maine; George W. Cooley, State engineer, Minnesota; W. S. Gearhart, State engineer, Kansas; Clifford Older, bridge engineer, State Highway Department, Illinois; Nelson P. Lewis, chief engineer, Board of Estimate and Apportionment, New York City; A. B. Fletcher, State highway engineer, California; H. R. Carter, highway engineer, Arkansas; Prof. L. S. Smith, department of highway engineering, University of Wisconsin; A. D. Williams, chief road engineer, West Virginia; W. A. McLean, chief engineer, Ontario Highway Commission; F. F. Rogers, State highway commissioner, Michigan; W. D. Uhler, chief engineer, State Highway Department, Pennsylvania; J. C. Little, chief engineer, Roland Park Company, Baltimore; Curtis Hill, city engineer, Kansas City; M. M. O'Shaughnessy, city engineer, San Francisco; A. R. Hirst, State highway engineer, Wisconsin; H. E. Breed, first deputy State highway engineer, New York; W. W. Marr, chief highway engineer, Illinois; T. H. MacDonald, State highway commissioner, Iowa; Lamar Cobb, State engineer, Arizona; Prevost Hubbard, chief, U. S. Division of Road Material Tests; Henry Welles Durham, consulting engineer, New York City; G. P. Coleman, State highway commissioner, Virginia, and J. E. Maloney, engineer, State Highway Commission, Colorado.

Artist's Conception of Rock Excavation Wins Prize

The accompanying illustration is reproduced from an artist's conception of "Labor." The painting was a prize picture resulting from a movement described in the *Literary Digest*.



Courtesy, Literary Digest

ROCK EXCAVATION UNDER THE ARTIST'S BRUSH

The European war has driven to this country many young artists, who, without connections or plans, have been unable to turn their art into a means of livelihood. To encourage them to continue their efforts rather than enter other fields, a movement was launched for establishing competitions with cash prizes. The subject of the painting competition conducted early this summer was "Labor," and many of the paintings had to do with civil engineering endeavor, such as the construction of skyscrapers, and the digging of the Panama Canal. The picture shown was by Martinus. Anderson, and was considered particularly American.

General Goethals Urges Revision of Panama Toll Rules

Maj. Gen. George W. Goethals, speaking before the San Francisco Commercial Club Sept. 8, expressed the need for uniform rules for measuring vessels and charging tolls at Panama Canal. The present system lacks such rules, and he thinks the basis of charges should be carrying capacity, including deck loads.

Russia Places Large Rail Order in United States

The Russian Imperial Railways Commission has placed orders for 115,000 tons of rails and accessories, which will be furnished by the Cambria Steel Company, the Pennsylvania Steel Company, the Illinois Steel Company and the Tennessee Coal, Iron & Railroad Company. Robert W. Hunt & Company have been commissioned to make what is known as their "special inspection" of these 115,000 tons of rails and accessories.

Northwestern Highway Men to Meet in Cedar Rapids

Plans for the second annual meeting of the Northwestern Road Congress, to be held at Cedar Rapids, Iowa, Oct. 4 to 7, have been completed and the advance program issued. Twenty-one papers dealing with various phases of road work are scheduled for presentation. Among the papers to be read are those by W. W. Marr, Illinois State highway engineer, on "The Value of a Traffic Census in Determining the Type of Road to Be Constructed," and Dean A. Marston, Iowa State highway commissioner, on "The Highway Engineer—His Present and Future Field."

News of Engineering Societies

The Northwestern Association of Members of the American Society of Civil Engineers will hold its annual meeting at the St. Paul Commercial Club, St. Paul, Sept. 17. Dinner will be served and officers for the coming year will be elected. The subject of discussion will be "Foundations for Buildings and Engineering Structures." The discussion will be led by W. E. King, C. R. Sheply, W. L. Darling, C. F. Spaldy, A. S. Cutler and F. W. Cappelen.

Personal Notes

GLENN A. GRAY, district engineer of the water resource branch of the U. S. Geological Survey, will have charge of the office which will be established at Austin, Texas, for the purpose of working in conjunction with the State Board of Water Engineers on stream measurements in that State.

JOHN H. LEWIS, State engineer of Oregon, was relieved of all duties and responsibilities in connection with highway work done by the State Highway Commission, Aug. 27, by vote of the commission. This action was taken at the request of Mr. Lewis and puts an end to the controversy as to whether Mr. Lewis or E. I. Cantine, chief deputy State engineer, was the actual highway engineer.

DR. J. A. L. WADDELL, consulting engineer of Kansas City, has entered into partnership with his son, N. Everett Waddell, to continue practice as consulting engineer under the firm name of Waddell & Son, Graphic Arts Building, Kansas City. The firm of Waddell & Harrington, with which Dr. Waddell was previously connected, was dissolved, except insofar as relates to certain unfinished work, July 14. N. Everett Waddell was graduated from Rensselaer Polytechnic Institute in 1908 and was connected with Waddell & Harrington, on bridge work until 1909, when he was appointed draftsman for the McClintic-Marshall Construction Company. He left this firm for a few months in 1910 to engage in special work for the Grand Trunk Railroad and returned to it as resident engineer on the $2,200,000 Missouri River bridge at Kansas City. In 1911 he rejoined the forces of Waddell & Harrington, in which service he remained until the firm was dissolved, his latest assignment being that of assistant to the resident engineer on the construction of the Twelfth Street Trafficway, Kansas City, Mo.

B. H. TONG, formerly assistant to C. H. Young, city engineer of Muscatine, Iowa, is now engineer for Elmer L. Gochanour, general contractor of Grandview, Iowa. He is engaged, at present, on concrete pavement construction at Burlington, Iowa.

F. G. COOK, formerly assistant engineer maintenance-of-way of the Northern Pacific Railway at Jamestown, N. D., has been appointed roadmaster at Mandan, N. D.

F. L. BIRDSALL has resigned from the office of superintendent of the Rocky Mountain division of the Northern Pacific Railway.

T. F. LOWRY, formerly superintendent of the Minnesota division of the Northern Pacific Railway, has been appointed superintendent of the Rocky Mountain division, succeeding F. L. Birdsall, whose resignation is noted elsewhere in these columns.

J. R. HOLMAN, chief engineer of the Oregon-Washington Railroad & Navigation Company, will go on an indefinite leave of absence about Sept. 15, in an effort to recover his health, which has been failing for some months past.

KENNETH A. HERON, for some time in charge of the irrigation investigations for the Modesto Irrigation District, has been appointed chief engineer for the Goose Lake Valley Irrigation Company of Lakeview, Ore., which recently took over the irrigation system of the Oregon Valley Land Company. Mr. Heron received his professional education at Cornell University and George Washington University. His first service was as assistant engineer for the water department of the Colorado Fuel & Iron Company at Pueblo, Col., from 1906 to 1910. From the latter year until 1911 he served as field engineer for the Amity Canal Company of Holly, Col. He left this work to become designer and office engineer for Ford, Bacon & Davis on the Valier project in Montana. He was also with the same firm later on irrigation work in California. He left the company to take up the Modesto work. His new work will consist of extending the Goose Lake Valley Irrigation Company's system to water all the irrigable lands in the Goose Lake Valley in Oregon. The first unit of 15,000 acres will be placed under laterals this fall.

CHARLES M. DILL, formerly estimator and salesman in the main offices of the Witherow Steel Company, manufacturer of reinforcing steel, structural steel and building products, of Pittsburgh, has been appointed sales engineer in charge of the company's newly opened branch office, Builder's Exchange Building, Philadelphia.

VANNOY H. MANNING, assistant director of the U. S. Bureau of Mines, has been appointed director of that department to succeed the late Dr. J. A. Holmes.

J. D. MACK, for many years professor of mechanical engineering at the University of Wisconsin, has been appointed State engineer of Wisconsin by the State Railway Commission, under the law recently passed in that State creating such an office. The appointment requires the Governor's approval before becoming effective. The salary connected with the position is $6,000 per year.

WILLIAM C. PICKERSGILL, assistant engineer of the New York Board of Water Supply, has been retained as designing engineer by the Water Supply Board of Providence, R. I.

D. T. CORNING, formerly assistant to the mining engineer of the Cambria Steel Company, Johnstown, Pa., and manager of its subsidiary concerns, the Cambria Inclined Plane Company and the Manufacturers' Water Company, has been appointed assistant engineer in the Bureau of Highways of the Department of Public Works of the city of Philadelphia.

J. W. REAGAN, minority member of the recently disbanded Board of Flood Control of Los Angeles County, was appointed chief engineer of the Los Angeles County flood control district at a meeting of the board of supervisors, Aug. 30. The salary fixed upon was $8,000 per year.

ROBERT A. ZENTMYER, of Tyrone, Pa., has been appointed a member of the Pennsylvania State Water Supply Commission.

R. D. STARBUCK, formerly special engineer on the staff of J. H. Bernet, resident vice-president of the New York Central Railroad at Chicago, has been appointed special engineer on the staff of A. T. Hardin, vice-president in charge of operation at New York City.

HARVEY C. SHAW, superintendent of waterworks at Warren, Pa., has been transferred by the American Waterworks & Electric Company, to Joplin, Mo., where he will be superintendent of the Joplin Waterworks Company.

Obituary Notes

JAMES O'BRIEN, who was identified with the early hydraulic mining operations of Central California and a pioneer builder of irrigation and power projects in that State, died at Marysville, Cal., Aug. 29, at the age of 83 years.

JAMES F. KEON, of the firm of Ryan & Keon, railway contractors of Boston, died in New York City, Sept. 1.

SIDNEY T. EMERSON, a retired railroad civil engineer, died at his home in Chicago, Aug. 28. Mr. Emerson was born in Saratoga County, New York, in 1827. He came to Chicago in 1869, when he joined the engineering corps of the Illinois Central Railroad. Mr. Emerson served as a consulting engineer for the Government and a number of railroads, including the Pennsylvania, Missouri Pacific and Northern Pacific.

EDWARD F. MCCREA, division engineer of the Pennsylvania Lines West of Pittsburgh, at Cleveland, died in Logansport, Ind., Aug. 29.

FRANK E. JOHNSON, who was for fifteen years instructor in civil engineering at the University of Washington, died in Seattle, Aug. 25.

EDWARD B. PLEASANTS, chief engineer of the Atlantic Coast Line Railroad, whose death was noted in these columns last week, started in engineering work on the U. S. Coast and Geodetic Survey, in which service he remained five years. He entered railway service as assistant engineer on the Baltimore & Ohio. In 1878 he was appointed assistant engineer on the Baltimore & Lehigh, of which he subsequently became chief engineer. In 1886 and 1887 he was engineer in charge of the construction of the Baltimore, Annapolis & Sparrows Point, from which service he resigned to go to the Norfolk & Carolina, now the Atlantic Coast Line System. He was appointed chief engineer of this system in 1902.

WILLIAM L. ZIEGLER, engineer of construction for the Pennsylvania Railroad, died Aug. 6. He was 48 years in the service of the Pennsylvania, entering it in 1867 as chainman in the office of the division engineer, and continuing in up to the day of his death. He was promoted to the grade of assistant engineer in 1873 and to that of engineer of construction in 1877. Subsequently he was in charge of some of the most important improvements made by the company in the vicinity of Philadelphia, including the Market Street slip and ferry house, pier work and the new West Philadelphia station and tunnels.

Barrow Designed for Measuring Concrete Ingredients

The Sterling Wheelbarrow Company, of West Allis, Wis., has placed a new barrow on



the market for the measuring of concrete ingredients. The barrow, which is shown in an accompanying illustration is built in 2 ft. and 3 ft. sizes.

Gasoline Shovel Has Tapered Hoisting Drum

Run by a four cylinder, four cycle gasoline engine, operating at constant speed, and connected through a shaft having a heavy fly-wheel with the operating mechanism, the Marion gasoline shovel is designed with a tapered hoisting drum to give low speed and heavy pull while the dipper is digging and higher speed with a lighter pull when the load is being hoisted. This feature, combined with the fly-wheel, relieves the motor from sudden strain when the dipper begins to dig. The shovel is operated by band frictions controlled by levers banked and operated exactly as in the Marion steam shovel. It is made only in the revolving type, as the chief field for gasoline shovels is on city work, where smoke is objectionable, or where it is desired to replace hand-labor.

The shovel, being driven entirely from the main shaft, can be converted into an electric shovel by simply substituting an electric motor of the proper size for the gasoline engine. The shovel is self-propelling.

The reversing motion necessary for propelling is obtained by means of frictions and a reversing shaft on which the right-hand friction turns in one direction, while the left hand friction turns in the opposite direction. While the primary purpose of the reversing gears is to impart propelling motion to the shovel, power for the hoisting, swinging and crowding motions must be transmitted from the same shaft. It is evident, therefore, that further means must be provided for throwing the propelling motion in and out of gear. This is done by a friction and gear mounted on the end of the hoisting-drum shaft. The gear meshes with a gear keyed to a horizontal shaft running directly over the rotating center. The opposite end of this shaft has a bevel pinion which engages the bevel pinion on the vertical propelling shaft, the lower end of which is designed exactly as on a steam shovel. To operate the swinging mechanism the reversing shaft also carries a spur gear engaging a gear on the swinging or bull-pinion shaft. On each end of this shaft is mounted a driver keyed to the shaft and a friction housing which is keyed to a gear mounted loosely on the shaft and fitted with bronze bushings. This gear is operated by an outside band friction, and engages a gear keyed to a shaft directly below and forward. On the other end of this last shaft is keyed a bevel pinion meshing into the swinging crown gear, which, in turn, is keyed to the vertical swinging shaft. On the other end of this vertical swinging shaft, which is exactly like that on a steam shovel, is keyed a spur pinion, which in turn meshes to the large rotating gear on the lower frame of the shovel. Since the same mechanism is applied at each end of the bull pinion shaft, and since the bevel pinions engage the swinging crown gear at opposite sides, a reversing motion is obtained, as in the case of the propelling mechanism, by throwing in the opposite friction.

Forward of the hoisting drum shaft, and connected to it by means of an intermediate shaft, is another set of reversing frictions. These frictions control the crowding of the dipper handle. These frictions are both controlled by a single lever arranged so that when it is in central position both frictions are released and a brake is set to hold the dipper handle in any position. The shaft leading from the frictions to the boom is provided with a telescopic joint to allow for the variation in the height of the boom. It carries beveled pinions on each end, engaging bevel gears. The rest of the boom is exactly the same as on a steam shovel.

Business Note

William Graver, president of the William Graver Tank Works, East Chicago, Ind., died at his home in Chicago, Aug. 25. Mr. Graver was born at Chambersburg, Pa., in 1842. When 15 years old he entered the tank works of his uncle. In 1884 he came to Chicago and immediately secured a contract for field tanks at Lima, Ohio. The contract was larger than his plant, and in order to be near the point of delivery he moved his plant to Ohio. In 1888 he formed the company which bears his name. From a plant employing 20 men it has increased until to-day it employs from 500 to 750.

Trade Publications

The following companies have recently issued trade literature:

Thomas Method of Reinforced-Concrete Construction, by William M. Thomas, consulting engineer, Los Angeles, Cal. Pamphlet, 9 x 12 in., 20 pages, illustrated. This publication deals with the Thomas method of bridge design for three-hinged reinforced-concrete arch and girder bridges.

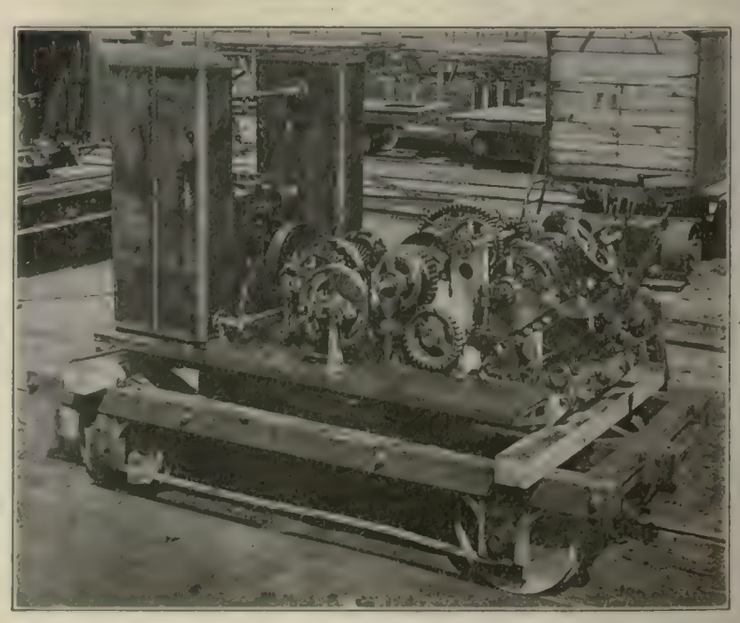
Burd High Compression Ring Company, Rockford, Ill. Catalog, 4½ x 6¾ in., 134 pages, illustrated. A comprehensive directory of piston ring sizes, which are coded, for automobiles, cycle cars, trucks, tractors and engines, giving the date of model, make, class, rings per piston and cylinders, is printed in the first part of this book. A second part describes the Burd high compression ring, its manufacture, its adaptability to resist carbonic destruction and the manner in which it is applied to cylinders. And a third, and last, section contains an alphabetical list of makes of cars, trucks, tractors, etc., for which Burd rings are supplied, with references to the directory in which their sizes are listed, and tables for decimal and millimeter conversion.

Sherwin-Williams Company, Cleveland, Ohio Booklet, 4½ x 6 in., 32 pages, illustrated, entitled, "Protective Paints for Metal Surfaces." This publication explains in a concise and practical manner metal corrosive troubles and essential characteristics of paints that are protective. It relates the history of Sherwin-Williams Company's experimentations on this subject and describes the resulting products; carbon paint, Red Diamond brand and Metalastic brands, red leads, iron primer and stack and acid resisting paints. The illustrations reproduce photographs of structural steel painting on high buildings and bridges. Instructions on applying protective paint are also included in the booklet.

Bausch & Lomb Optical Company, Rochester, N. Y. Catalog, 6½ x 9¾ in., 36 pages, illustrated. Describes chemical, metallurgical, measuring and comparative miscroscopes, photomicrographic and metallographic apparatus for the microscopical inspection of structural metals, concretes and paints, and appurtenances elaborating these equipments. The Johnson photomicrographic outfit for concrete, designed with the assistance of Nathan C. Johnson, concrete consulting engineer, New York, whose series of articles on microscopical examinations of concrete appeared in the Engineering Record in the early part of this year, is an important addition, as is also the Stormer viscosimeter, a measuring device for the viscosity of liquids. This latter instrument is especially recommended for testing road oils.



REVOLVING GASOLINE SHOVEL HAS TAPERED HOISTING DRUM



MECHANISM OF SHOVEL ASSEMBLED AT SHOP, ENGINE AT LEFT

Engineering Record

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Philadelphia's Subway Begun

THE city of Philadelphia, Mayor Blankenburg and A. M. Taylor, director of city transit, are to be congratulated on the opening of construction work on the first section of new subway, noted elsewhere in this issue. The work done by Mr. Taylor on this project is of a sort too rarely found and sorely needed from the engineer. Not only has a modern high-speed transit system, which is the last word in economic city transit development for the third city of the continent, been planned under his direction, but he has shown the ability and the courage to use proper publicity methods in educating the population of that city to see what is needed, and how it is to be secured. The result is a large public engineering project that seems happily destined to be carried to a logical and scientifically proper conclusion by the active help of the public. That this success had been solidly achieved was told the country in unmistakable terms last April, when the citizens of Philadelphia voted the money to begin the new project by a ten-to-one majority. In sad contrast to this admirable achievement stands the long wrangle over the completion of the St. Louis Free Bridge, only recently ended, and the political troubles of many another public engineering project. Mr. Taylor took the daily press into his confidence. He and his colleagues have improved every opportunity to speak at public gatherings. The need for the project, and the great benefit the public will derive from it have been driven home till everyone in that great city is familiar with it, and practically every one is actively in favor of it. Mr. Taylor's methods command the close attention of every engineer who has charge of public improvements. They point the way to better public understanding of the engineer and his work, and to the general clearing up of many difficulties that have arisen from misunderstanding in the past.

Road Building Economics

THE GOSPEL of good roads has been so generally preached throughout the country that it is now much easier than formerly to convince people of the economy of building good roads. Even in rough and mountainous regions where the first cost of a road of any kind is high, steep and narrow highways are being avoided, and in fact extremely heavy grading is done to secure good alignment with easy grades. Expensive brick and concrete pavements have appeared where any sort of a crooked road was considered good enough a few years ago. In recent years California has taken the lead in not a few phases of road construction, and it is not surprising to find the Highway Commission of that State adopting such a policy as that indicated by Commissioner Darlington in his article on the "Ridge Route," on page 322 of last week's issue. The 115-mile stretch Mr. Darlington refers to runs through territory that is not expected to be productive of tributary traffic at all commensurate with the cost of the road. It has been built, rather, for the sole purpose of shortening the distance between two important centers in southern California. This means that the expenditure is to be considered an investment, without guarantee of returns other than the confidence which the Highway Commission has in the future of the two centers connected by the road and the extent to which such connection will encourage and increase traffic between them. Road building on this basis is comparable to railroad construction, where an unproductive and highly expensive stretch must be built in order to complete the system between important terminals. Such projects require faith in the section of the country being developed. They require backing by vigorous and imaginative minds, and it is only men of broad gage who dare undertake them.

Condition of Aqueduct Bronze

FROM stories published in some of the New York papers early this week it would have appeared that the nearly completed Catskill aqueduct for the city's additional water supply was about to end in a "fiasco." The accounts were colored with exaggerated statements concerning the failure of the bronze (more correctly brass) fittings in the deep pressure tunnels. On a work of this magnitude it is not to be expected that every detail, especially where there is little or no precedent to serve as a guide, will be perfected at the first trial. There has been trouble with the so-called bronze parts, as described in this journal by Alfred D. Flinn, deputy chief engineer of the Water Board and Ernest F. Jonson, engineer of tests, but the difficulty will not retard the delivery of Catskill water beyond the time estimated, the fall of 1916. Mr. Flinn was asked to make a brief statement giving the facts in the case and his reply follows: For certain bolts, ladders, pipe fittings, valves and similar parts which would be exposed to moisture and difficult of replacement, the engineers of the Board of Water Supply sought a material highly resistant to corrosion and of sufficient strength to replace cast iron and steel, commonly used for such purposes. After careful inquiry, manganese bronze, Tobin bronze and naval brass were adopted. In the course of time some bolts were found cracked, and, as time progressed, this trouble with rolled and drawn material proved to be so extensive as to necessitate replacement in a great many instances. The large forgings, principally for valve and sluice gate stems, have developed no defects. Most of the castings have continued to be sound. Recently, however, a number of castings, especially parts of large bronze gate valves, have developed fine cracks. Apparently, these cracks result from repairs of foundry defects made by the process of "burning in" or welding, which has long been practised in most, if not all, brass foundries. These valves are in chambers near the surface of the ground where they are accessible for removal, for replacement or such repairs as may be decided upon. The trouble mentioned is annoying but will not delay the introduction of Catskill water beyond the time expected, the fall of 1916. The expense will be but a small part of the figures stated by some of the daily papers.

Road Legislation and Finance

IF the cause of good roads is not to be checked in the remarkable progress it has made during the last few years, immediate action must be taken to correct two fundamental difficulties of the complex problem. In the mad rush of planning State-wide highway systems and placing work under contract the basic questions of legislation and of finance have been sadly neglected. It is time to start unsnarling a tangle which is complex enough now, but which will be drawn tighter and tighter as time goes on. As a basis for beginning this work, two papers presented at the Pan-American Road Congress this week and printed on pages 351 and 352, contain valuable suggestions. One, by A. N. Johnson of the New York Bureau of Municipal Research, outlines the essentials of proper highway laws and the other, by Nelson P. Lewis, chief engineer of the New York Board of Estimate and Apportionment, discusses the fallacy of long-term bonds for short-lived highway structures. Piecemeal legislation, amendment piled on amendment, special enactment and repeal—all have combined to make the field of highway legislation a maze in which even the experienced seeker for facts soon loses his way. It is time for a general revision of State highway laws and a rearrangement of organization on a simple logical basis which will centralize authority in a non-partisan State department of technically qualified officials, assured of retention in office so long as their work is well done. In fact, if the proper power were vested in the State highway department much of the present confusing legislative enactment could be dispensed with and covered simply by department rules and regulations. The alarming financial situations which have been

created in some States by the issuance of 50-year bonds for road surfaces which cease to exist after 10 years, cannot be condemned too strongly. Mr. Lewis gives some sound advice on the general subject of road financing and dwells particularly on the merits of the short-term and serial bond. The two papers are very closely inter-related and highway engineers, when they return home from the Coast, will do well to see that the members of their State Legislatures are acquainted with the unsatisfactory condition of affairs and its remedy.

How Will Chicago Utilize Its Traffic Census?

TWO legitimate causes for wear and destruction of pavements are traffic and weather. Under severe climatic conditions the latter does the most damage, but ordinarily traffic is the chief cause. Irrespective of the actual condition of a given pavement traffic records are figured as being valuable for future use in estimating first cost and maintenance cost and in selecting types of pavement. Therefore, a traffic count taken in one of the most congested districts of the second largest city in the country cannot fail to attract widespread interest. On page 364 is an article describing the methods pursued and the results obtained in making a traffic census of Chicago's Loop district. The census was taken by the Bureau of Streets to ascertain the effect of all vehicles on street cleaning and as a guide in determining the kind of pavement which should be laid on the streets under observation.

To be of any value in the selection of pavement traffic counts should be carried on over a series of years during the life of the pavement under investigation, records being taken, during the original construction, of the subsoil, drainage, kind of paving, foundation and manner in which paving is laid. In counting traffic note should be taken of the tendency of the vehicles in keeping to the roadway or to track space. In counts subsequent to the first the rate of wear should be recorded if possible and how, when and where deterioration sets in and its possible causes noted. Colonel Waring of New York City, in one of the most comprehensive reports on street cleaning ever published, reported a traffic census taken over several years in the late nineties which enabled him to determine the existing difficulties encountered for each type of pavement under every conceivable kind of traffic. He was then able to reroute his street cleaners. This is one of the prime values of a traffic census applied to street cleaning.

In any close apportionment of cleaners averages are of little value because street conditions are continually changing. Erection of a skyscraper puts a heavy load on the streets traversed by the material wagons, and the piling up of the pavement and earth on the sidewalk while a public utility lays its conduits immediately upsets former arrangements. Undoubtedly the continued tearing up of pavements for underground work in downtown Chicago has far more to do with the deterioration of pavements than any other one factor and just how the department can be helped in the choice of pavements unless it takes into account these other factors is hard to see. The engineering public, particularly that portion interested in street work, will look with interest to see how Chicago's traffic census will be utilized.

Visual Identification of Longleaf Pine —Its Importance

PROGRESS in timber specifications, at least for the Southern yellow pine variety, which, until recently, has been the most important for engineers in the eastern half of the United States, has been very rapid in the last three years. On the parts of the producer and the consumer there has been a determination to find some method of judging the value of timber that should enable, to a great extent, the elimination of dispute, not possible when the chief item of the specification is one as to botanical species. Within the three-year period referred to the acceptance of the ring specification has been widespread, though it has been previously used with wide variations in the number of rings specified. The Forest Products Laboratory has persistently advocated the new ring specification, while its acceptance by lumber associations has given it firm standing among producers.

Now comes a new and very important development in timber identification. The method is not based on strength, and disregards botanical species entirely, as does the ring specification. It determines by easily applied means the botanical species itself. It has been repeatedly stated that, once the log has left the stump, it is impossible by any readily applied means to determine the botanical species. Identification could be made with the misroscope. That was true in the prior state of the art, but has ceased to be true now, for on page 319 of last week's issue was described a visual method of distinguishing longleaf from shortleaf and loblolly pine. It depends on the diameter of the pith and of the second annual growth ring. In longleaf the pith is always 0.10 in. or more in diameter. Some shortleaf and loblolly logs, however, will have piths of 0.10 in. or more, and to insure identification measurement is taken over the second annual ring and the application of this reading and of the pith diameter to a chart determines the identification.

The method appears to be even less open to chance for disagreement than the ring specification. Obviously it is not supplemental to the latter, but stands as a separate, alternative method for purchasing. The ring specification professedly cares not for botanical species so long as the timber is one of the Southern pines. It is predicated solely upon density and strength. The theory back of the new visual test proposed by Mr. Koehler, on the other hand, is based upon confidence in the uniform excellence, as regards strength, of longleaf yellow pine, and purposes, therefore, to make its identification certain.

Obviously the method is a test only. In specifications it would have to be supported by clauses as to straightness of grain, knots, shakes, etc. These additional clauses might well be copied from the recent specifications embodying the ring method, and restricting defects in certain volumes of the stick.

From the trade standpoint the new test is of the very greatest importance. "Longleaf" is a term that carries to the engineer assurance of dependable strength, and there is little doubt that if this test had been developed three years ago it, and not the ring clause, would have become the basis of the newer specifications. It is less revolutionary than the ring clause and would have entered more naturally into the developing pine specifications. Undoubtedly the method of purchase by botanical species will continue, even though the more recent specifications abandon the method. Custom is hard to change, and now that identification of the species is easy, there will be less reason for abandoning the time-honored practice. Progressive producers who want the trade that is willing to pay well for quality will not be slow to recognize the new opportunity, and it is understood that several lumbering interests will shortly announce their readiness to ship under the pith-diameter clause.

The new test is a striking example of the excellent practical help which the Forest Products Laboratory is giving the engineering profession and the lumber industry—help that in the last analysis redounds to the benefit of the country at large.

American Society Stiffens Admission Requirements

A MORE uniform and, in general, a more exacting treatment of applicants for admission to or transfer in the American Society of Civil Engineers is the objective of five resolutions recently passed by the board of direction. The first of these states that no applicant shall be admitted to any grade whose qualifications do not clearly exceed the minimum requirements of the constitution. The second voices the desirability of more than five references whenever possible, and of furnishing the names of persons, whether members of the society or not, who have personal knowledge of the applicant's work in each position enumerated. The third calls for markedly superior qualifications for candidates, who, at the time of application, are not engaged in work demanding engineering education or training. The remaining two emphasize the difference between associate membership and membership, and advocate admission to the latter grade only through transfer from the former, "unless a candidate is eminently qualified for the highest grade."

The resolutions should meet with general approval, and the second is especially to be commended. Too many inequalities in ranking exist at present. Some men have been helped in attaining corporate membership through social acquaintance with older members, and others have been held back through lack of association with members

of the society. The demand for personal knowledge of the professional achievements of the candidate will tend to check the growth of the former class, while the recognition of the value of non-members as references will remove a handicap from the latter class. In fact, the board has heretofore accepted references from non-members in other continents, where members are scarce, but in North America it has not evinced interest in the knowledge or opinions of outsiders. It now remains for all concerned to assume a sacred responsibility for preserving the standards of the society, even against the temptations of friendship and good nature, to the end that the board of direction, whose members are not likely to know all of the many of the applicants, may make no mistakes.

Features of Mitering Lock-Gate at Keokuk

CANAL engineers will turn with interest to the article in this issue on the mitering lock-gate at Keokuk, this article being the first complete and authoritative description of this novel structure so far published. While this journal, during the period of the construction of the development, called attention to some of the unusual features of the gates, opportunity was not afforded for that close study necessary to bring out in all completeness the many departures in lock-gate construction. There is a special satisfaction in presenting the description now, since two years of operation have demonstrated the correctness and value in service of the departures embodied in the design.

To mention all of the features that deserve special consideration of hydraulic engineers would be to repeat in large part the article Mr. Parsons has written. Most notable is the character of the framing on the back of the gate, designed to resist warping stresses and to carry the dead load of the structure itself. The horizontal principle, represented in the curved ribs carrying the water pressure by arch action, is not new, but heretofore gates which have used this principle have had cylindrical surfaces both up and downstream. Such gates, however, are likely to warp, not only from their dead weight but also on account of the application of the moving stress at the top only. Débris caught between the miter posts in the lower part of the gate is also apt to give considerable trouble.

The merits of the Keokuk type of framing are apparent. If any further endorsement is needed it may be found in the fact that this type of framing has, after much investigation, been adopted for a lock on the Ohio River near Louisville, though both horizontally and vertically framed gates were considered. It might be well to note that an alternative design, a horizontally framed gate, was considered at Keokuk, but was eliminated because of the great excess in weight of the alternative and the greater difficulty in fabrication, particularly at the miter posts and quoins. In the alternative designs at Louisville the Keokuk type of gate weighed 500,000 lb. as against 750,000 lb. for the horizontally framed gate. It is only just to remark, however, that a vertically framed gate, figured on for the same lock, weighed about the same as the Keokuk design. It has not, however, the inherent stiffness represented by the latter type.

Space does not permit detailed discussion of other features of the gate and readers will be repaid by a very careful study of the article referred to. The specifications for the steelwork, the permanent anchorage and hinge block, the seal at the miter sill, the very important advantages gained by the dead-centered position of the operating strut at both ends of travel, and the great care taken to secure tightness are all feaures that might be enlarged on at length. Suffice it to say that the departures made in the design have been more than justified by the service which the gate has been giving. The adoption of the most important of the departures, the back framing of the gate, by the Corps of Engineers is sufficient endorsement of the excellence of the Keokuk accomplishments.

A Report Humanized

A REMARKABLE document was published this week. Casting precedent to the winds, Morris L. Cooke, director of the Department of Public Works of Philadelphia, has issued an annual report which is absolutely unique among printed records of municipal work. Nothing less can be said of it than that it is epoch-making—not so much in the matter that it contains as in the mode of its presentation. It leaves the dry trail of inconsequential detail and dull statistics, along which many a weary reader of the usual annual report has plodded, and strikes boldly at the broad problems which the department has faced and which still await solution. And in doing this it substitutes for the stilted, incoherent and confusing treatment which has characterized so many other annual reports, the methods of a well-edited and profusely illustrated magazine. Mr. Cooke has accomplished the unbelievable. He has humanized an engineering report.

To do this has required both skill and courage, but the outcome can safely be predicted. Mr. Cooke's message is told in such an interesting and original style that it will be widely read by the people of Philadelphia. They will understand what the department has done and proposes to do, and, understanding, will give their solid backing to the work in hand. Thus the great power of publicity has been adroitly employed to serve the best interests of public works development, and it is in this respect that the report merits careful study by city engineers elsewhere.

In the first place, no one would suspect that the pamphlet was an engineering report for its title is "Plain Talk," and under this caption on the front cover are printed the subjects discussed, such as "Economies, Waterwaste, Pigeons, Graft, City Plan, etc." The pigeon motif again appears in picture and text on the first page. A bird which has nested in a window of City Hall, in view of passing thousands, is likened to the municipal employees who must go about their work in full view of the city's population. The skeptic asks, "What has a pigeon to do with public works?" The answer is, "Nothing." It is merely a clever introduction to arouse the reader's curiosity at the outset and make him scan the report to find out what it is all about.

In the succeeding pages the work of the several bureaus is discussed in readable style, and the many photographic reproductions add to the human interest of the document. It all makes interesting reading—how the department saved $3,000,000 in the three years to date; how the system of awarding contract was revised and the political czars dethroned; how the employees of the department were made to feel an interest and responsibility in their work by means of a prize competition; how the bureaus of water, sewers, and highways are co-operating to make Philadelphia unrivalled as a city in which it will be a pleasure to live. And so on to the end of the report.

Engineers have not yet begun to realize the possibilities of publicity. Only when they do will they begin to receive that degree of popular support for their work which is their due. On this subject Mr. Cooke's remarks are very much to the point. He says, in part:

"In offering employment to an engineer, other things being equal, I want what might be called a good advertiser. You can secure appropriations for work more easily when it is well advertised. In the matter of writing reports there is the greatest room for improvement. Too frequently in the past they have been stereotyped in form, weighted down with page after page of dry and almost meaningless figures and written in a style forbidding to all except a small professional class of municipal administrators. We have made the effort to retain in the body of our report only such matters as are of more or less general interest and to shape them up so as to command that interest. Tabular and other technical material, interesting only to a restricted class, has been put in appendices. Many data of this kind formerly published in our annual reports, have been placed on file in the bureaus where they can be consulted by the relatively few interested."

The report of the Philadelphia Department of Public Works is an illuminating example of what can be done with a year's record if only the executive in charge can "see the story" in his work and then tell it in words that will command the reader's attention. To the readers of the Engineering Record this subject is not new. The editorials "How Can Annual Reports be Improved" (Feb. 27, page 254) and "More About Annual and Other Reports" (April 24, page 512) made a plea for turning to good use the appalling amount of waste effort that is now put into the ordinary public works document. If engineers in other cities will take the Philadelphia lesson to heart and, what is most necessary, have the courage to turn out of the rut formed by misguided precedent the cause of the civil engineer and his work will receive a decided impetus.

Mitering Lock Gate at Keokuk Presents Novel Features

Type of Framing Gives Unusually Stiff Structure to Carry Dead Loads and Resist Warping Stresses Due to Operation—New Methods of Final Adjustment and Hanging of Gate

By B. H. PARSONS

Member, Hugh L. Cooper & Company, Consulting Engineers, New York, and During Construction, Mechanical Engineer of the Mississippi River Power Company

THE MITERING GATE of the Keokuk lock presents unusual features of design, methods of construction and mode of operation. Two years in regular service, uninterrupted during the navigation season, indicates success, and a brief description is now offered as a contribution to the literature on lock gates.

The feature that has attracted most attention is the type of framing for carrying the dead loads and giving the structure unusual stiffness. In the anchorage and hinge block, the final adjustment of the leaves, the details of the operating mechanism and in other particulars lock designers will recognize departures from customary practice.

This lock and the connecting dam are located at the foot of the Des Moines rapids of the Mississippi, at Keokuk, Iowa. The old Government canal, extending 7 miles upstream, with its three locks and embankment is submerged a sufficient depth for navigation by the pool above the new dam, now called Lake Cooper.

The act of Congress authorizing the hydroelectric power plant in the Mississippi at Keokuk stipulated that the power company should build, at its own expense, for the Government, a new lock and dry dock and appurtenances thereto, including an independent power plant to serve the lock, dry dock and repair shops. Proceeding under this act, the lock, dry dock, lock power house, etc., were designed by the writer and built by the Mississippi River Power Company, under the direction of its chief engineer, Hugh L. Cooper. The whole constitutes a self-contained, independent plant, operating under its own power, and is now the property of the United States Government.

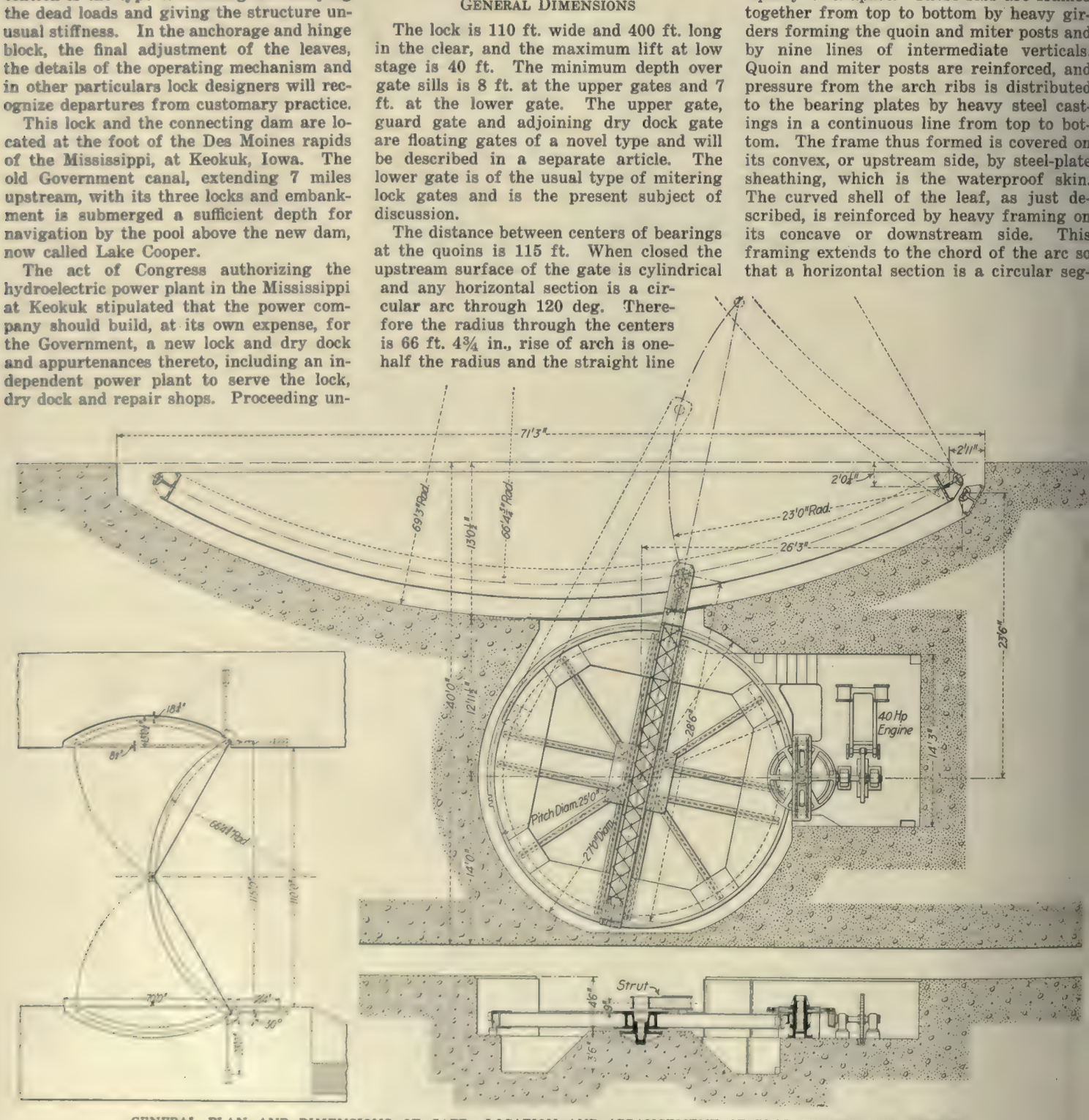
General Dimensions

The lock is 110 ft. wide and 400 ft. long in the clear, and the maximum lift at low stage is 40 ft. The minimum depth over gate sills is 8 ft. at the upper gates and 7 ft. at the lower gate. The upper gate, guard gate and adjoining dry dock gate are floating gates of a novel type and will be described in a separate article. The lower gate is of the usual type of mitering lock gates and is the present subject of discussion.

The distance between centers of bearings at the quoins is 115 ft. When closed the upstream surface of the gate is cylindrical and any horizontal section is a circular arc through 120 deg. Therefore the radius through the centers is 66 ft. 4¾ in., rise of arch is one-half the radius and the straight line distance between centers of bearings on each leaf is also 66 ft. 4¾ in. The height of the gate from center to center of main frames is 48 ft.

General Features

Each leaf is composed of the following parts: Thirteen horizontal arch ribs curved to the arc of a circle and spaced equally 4 ft. apart. These ribs are framed together from top to bottom by heavy girders forming the quoin and miter posts and by nine lines of intermediate verticals. Quoin and miter posts are reinforced, and pressure from the arch ribs is distributed to the bearing plates by heavy steel castings in a continuous line from top to bottom. The frame thus formed is covered on its convex, or upstream side, by steel-plate sheathing, which is the waterproof skin. The curved shell of the leaf, as just described, is reinforced by heavy framing on its concave or downstream side. This framing extends to the chord of the arc so that a horizontal section is a circular seg-



GENERAL PLAN AND DIMENSIONS OF GATE—LOCATION AND ARRANGEMENT OF BULL WHEEL AND ENGINE

ment, and in conjunction therewith the top and bottom ribs are extended downstream to the same plane.

A displacement chamber occupies the central panels at the bottom of the leaf, and is equipped with a manhole and means for removing leakage.

ELEMENTS OF DESIGN

The elements of design are:

1. Waterproof skin on the upstream surface. This arrangement has considerable advantage over that in which the plates are attached to the downstream side, particularly in case of heavy water pressure due to high head; viz., the rivets are not subjected to direct tension by the water pressure; all rivet heads formed during erection are on the pressure side, that is, their shanks are upset in the right direction for effective calking; and butt straps at joints between the plates are located so that they likewise are calked on the pressure side.

2. Water pressure exerted against the gate in radial lines and the resulting stresses carried by arch ribs in direct compression without flexure. This simplifies the whole structure. The ribs are of plate girder section and uniform depth.

3. Stability in vertical planes provided in an unusual and effective manner by the heavy girders of the downstream frame in conjunction with the quoin and miter posts and the intermediate verticals. The intermediate verticals are of the usual form, but the quoin and miter posts differ from some important gates of recent design in that they are of definite girder section and continuous from top to bottom.

4. The use of heavy framing on the downstream side in the form indicated. This frame consists of the quoin and miter posts, the top and bottom horizontal girders and two main diagonal girders, with secondary members making sub-division into four panels. The top and bottom members and the main diagonals are heavy plate girders of considerable depth at the middle and tapering toward each end. The functions of this frame are: To sustain the entire weight of the leaf when hung on its hinges, with no dependence on the skin plates to resist shear; to resist and prevent warping of the leaf under any circumstances, with particular reference to power applied at the top to open the gate when a small head exists between water levels in the lock chamber and the lower pool; and to preserve alignment of the leaf during erection and so avoid troublesome and uncertain expedients to compensate for the deformation inherent in a cylindrical leaf.

To illustrate one phase of the utility of this frame, assume that one leaf is in contact with the miter sill and subjected to a horizontal, downstream force applied at the top of the miter post. This force would cause definite moments in the main diagonal girders, one of which would act as a simple beam supporting the other, which would act as a cantilever. Evidently, therefore, it is reasonable to assume that the principle involved in this design renders the structure statically determinate in respect to all forces which may be applied to a single leaf alone. When both leaves are acting as a three-hinged arch to sustain water pressure, stability in vertical planes may not be definitely determined, but, even in this case, the downstream frame contributes largely to such stability. Further study of the action of forces in mitering lock gates, and the application of this design thereto, will indicate that an effort was here made to evolve a skeleton frame which would eliminate much that has remained uncertain and indeterminate.

BEARINGS AND ANCHORAGE

The foundation for each leaf is a cast-iron base plate embedded in concrete and carefully finished to receive the nickel-steel pintle which is 18 in. in diameter. A large steel casting is built into the heel of the leaf and is fitted with a bronze bushing for the pintle. The anchorage casting is of steel and is provided with a bronze bushing for the main pin. This block is without means for adjustment, is supported by a cast-iron bed plate and is anchored by eye-bars with cast steel bearings and anchors.

Reaction castings at the quoins are of iron, proportioned to transmit pressure to the masonry within the prescribed limits. These castings contain a continuous rectangular recess for the contact plates. The steel castings which are a part of the quoin and miter posts are shaped and finished in like manner to receive the contact plates.

CONTACT PLATES AND SILL

The contact plates are of steel, accurately finished all over and held in place by stud bolts. During erection these stud bolts were opposed by small jack screws in a manner to insure perfect alignment and contact. The space behind the contact plate was then filled with Babbitt metal.

The miter sill is of oak, bedded in concrete and adjusted for position to a mid-range of temperature and deflection of the gate. This adjustment was made after the gate had been entirely completed, adjusted and closed. The miter sill contact is of cast-steel and is rigidly attached to the leaf.

The gate is of steel throughout, except as noted, and the quality of materials entering into its construction is the best obtainable.

LOAD ASSUMPTIONS

Five conditions of loading were considered:

1. Dead load of gate leaf when hung on its hinges in air.

2. Dead load of gate leaf when hung on its hinges in high water; *i. e.*, dead load with maximum uplift from the displacement chamber.

3. Gate closed and subjected to sufficient power applied at the top to open it against a 1.25-ft. head of water at low stage.

4. Gate closed and subjected to static water pressure, with lock chamber filled to the highest level and water excluded from contact with the gate on its downstream side; contact at miter posts, but not at miter sill.

5. Same as Case 4, but with contact at both miter sill and miter posts.

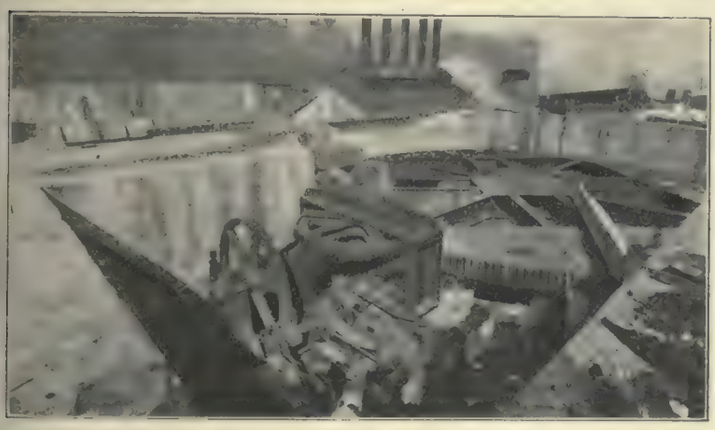
DETAILS OF FINISH

The gate was built by the Chicago Bridge & Iron Works and was erected in place, adjusted and put into operation by the Mississippi River Power Company. The structure exhibits such excellence in workmanship and precision of fit and alignment throughout as to reflect great credit upon the builders. All castings are machine finished at joints and junctions with other parts, and have drilled holes with fitted bolts. The ends of arch ribs are milled to fit.

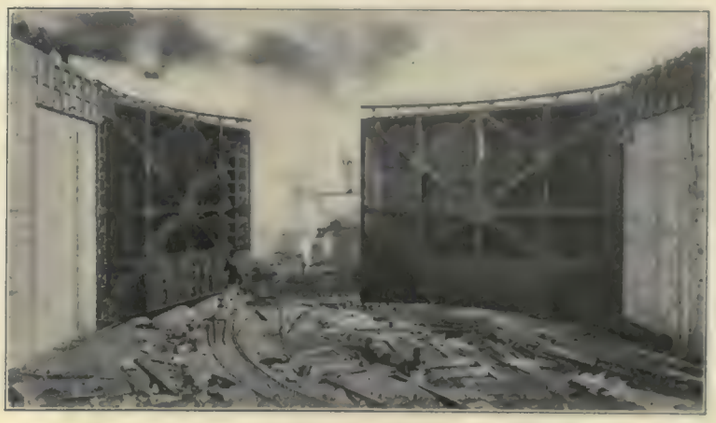
The edges of plates forming the watertight skin are not milled and do not abut. They are sheared to dimensions which leaves clearance between adjoining plates, and all joints between these plates are provided with fitted outside butt straps bevel sheared for calking all over. Except for connection to castings and machinery parts, all rivet holes are punched holes—this upon guarantee by the builders of a higher degree of accuracy by punching than by reaming or drilling. The result was entirely satisfactory.

ERECTION

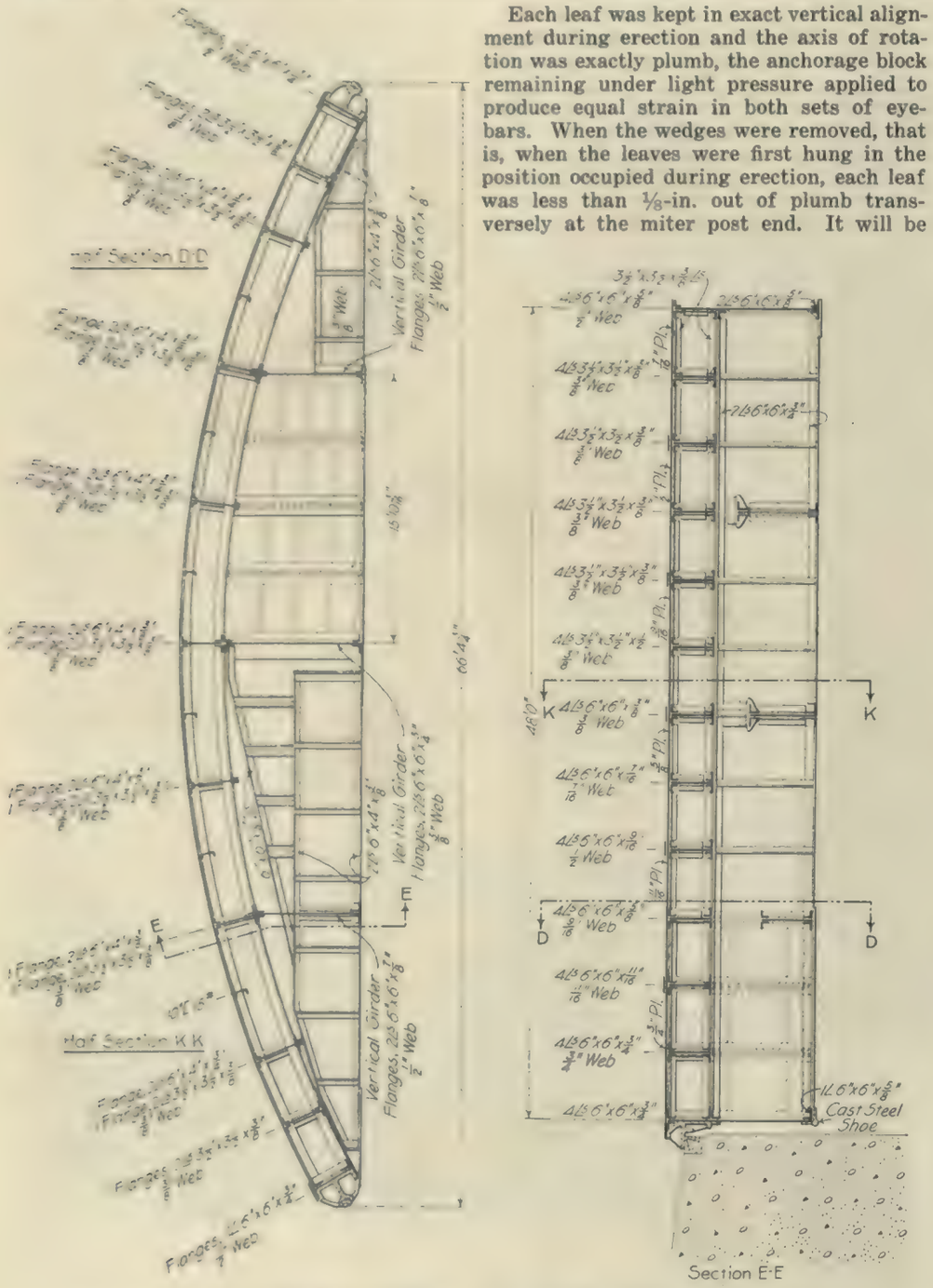
Reaction castings at the quoins were held in alignment during the placing of concrete by specially built steel posts bolted to the base plates and shored at the top. Each leaf was erected upon temporary concrete piers, and screw-actuated wedge blocks were employed to support the structure. The miter post end of each leaf was raised ½-in. above normal to compensate for deflection when



LEFT — MECHANISM AND GEARING BETWEEN ENGINE AND BULL WHEEL IN PIT



RIGHT — ONE LEAF SWUNG, THE OTHER SUPPORTED ON TEMPORARY PIERS



SECTIONS SHOWING MATERIAL AND OUTSIDE VERTICAL GIRDERS

Each leaf was kept in exact vertical alignment during erection and the axis of rotation was exactly plumb, the anchorage block remaining under light pressure applied to produce equal strain in both sets of eyebars. When the wedges were removed, that is, when the leaves were first hung in the position occupied during erection, each leaf was less than ⅛-in. out of plumb transversely at the miter post end. It will be noted that the usual means for adjusting the anchorage was not employed, but gave place to a more simple, perhaps more permanent, method. When a leaf is swung into its recess, the transverse component of the reaction at the hinge pin reverses from tension to a small amount of compression. The anchorage block is a single casting, and was bolted fast to its bed plate after adjustments were completed. It should, therefore, endure such reversal and all load changes, better than if internal strains were transmitted through screws, wedges or other adjusting devices. The gate has remained in perfect adjustment up to this time, and is expected to "stay put." There is practically no leakage through the gate or its contacts, a fact which has prompted much favorable comment.

hung on its hinges. Adjustment of the anchorage after the leaf was hung was accomplished by means of carefully shaped steel plates placed under the curved anchor pedestals shown in one of the drawings, the leaf being jacked up during this process. Trenches left in the lock walls for the eyebars and anchor pedestals were then filled with sand and covered over flush with 4 in. of concrete.

COMPRESSED-AIR OPERATION

All mechanical operations throughout the lock are actuated by compressed air. Air is compressed in the lock power house, located in the portion of dam which connects the east wall to the main power house. Two compressors are installed, and each is belted to a 200-hp. water turbine. There are two receivers, and the hydraulic governors are controlled so as to maintain a constant receiver pressure of 100 lb. per square inch. The whole constitutes a duplicate plant, either of which is of sufficient capacity for the work involved.

Compressed air is conducted to a main header in the lock operator's house, located on the east wall near the guard gate, whence it is piped separately to each engine and machine in the lock. Every such air supply pipe contains a throttle or control valve in the operator's house, and the stems of these valves are extended in such manner that their handles are mounted on a switchboard in a convenient arrangement.

GATE-SWINGING MACHINE

The gate-swinging machine consists of a large horizontal bull wheel, coupled to the gate by a connecting rod in the form of a channel-bar strut, and geared back to a 40-hp., double-cylinder, reversible, link-motion-engine. This apparatus is mounted in a pit at the top of the lock wall. The engine is covered by a house with openings large enough to remove any part, and the bull wheel is covered by removable cement sidewalk construction with bull's-eye lights.

The connecting rod is not of rigid length between pin centers, but may be compressed or extended 1 in. either way from normal, either change being resisted by the compression of a single spring. This is a shock absorber for gear teeth, etc., allows for expansion and contraction of the gate and permits of small obstructions along the miter sill or between the gate leaves without damage, a statement which was proved one day by an 8-in. log caught squarely between the leaves.

The bull wheel revolves through 180 deg. for a complete movement of the gate, and the connecting rod is at dead center at each end of the stroke. This provides slow speed and great power at the beginning and end of the swing, with highest speed and least power during the middle of the movement. This application of power and speed



CONTROL LEVERS AND INDICATORS IN OPERATOR'S HOUSE



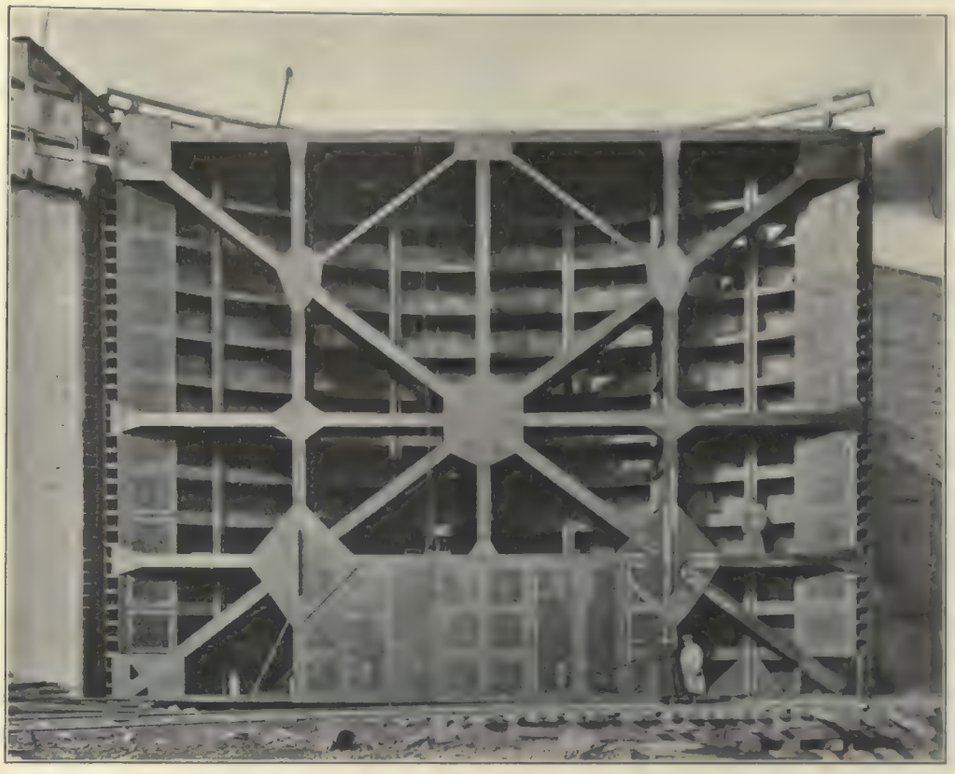
GATE CLOSED AND LOCK PARTLY FILLED WITH WATER

is the outstanding feature of design in this machine, and seems well adapted to the moving of a swinging mass of 300 tons through a fixed distance. It is not possible to slam the gate against the miter sill or the lock wall.

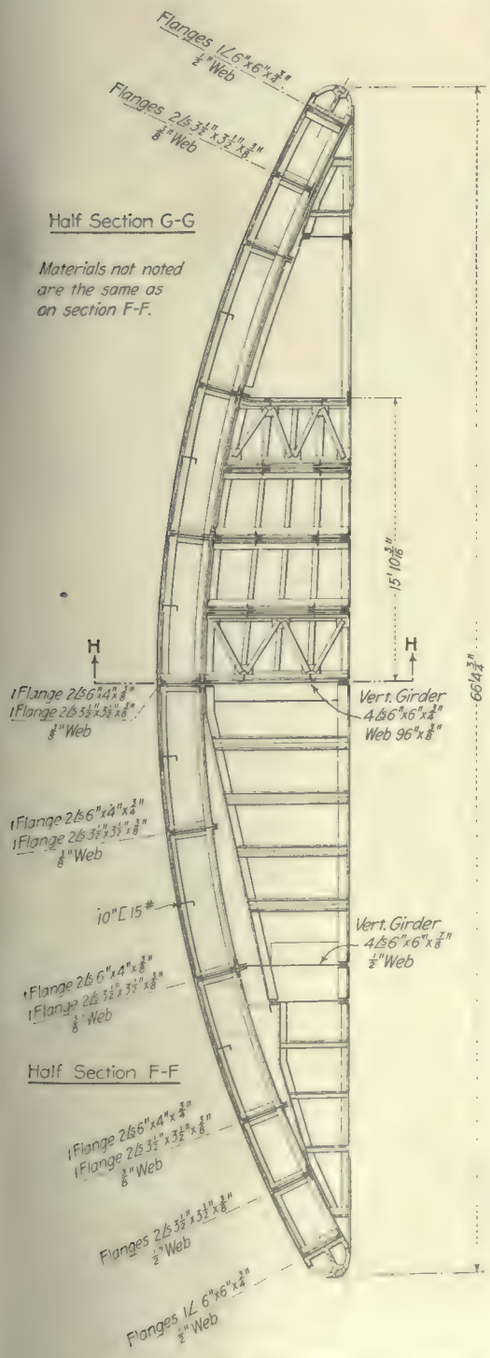
This gate-swinging machine was designed for the Keokuk lock prior to any knowledge of the apparatus to be used in the Panama Canal locks; the machines are identical in principle. One leaf is equipped with a machine which, when the gate is closed, grips a gudgeon on the other leaf and forces the two into exact alignment and contact, as indicated in the detail drawing.

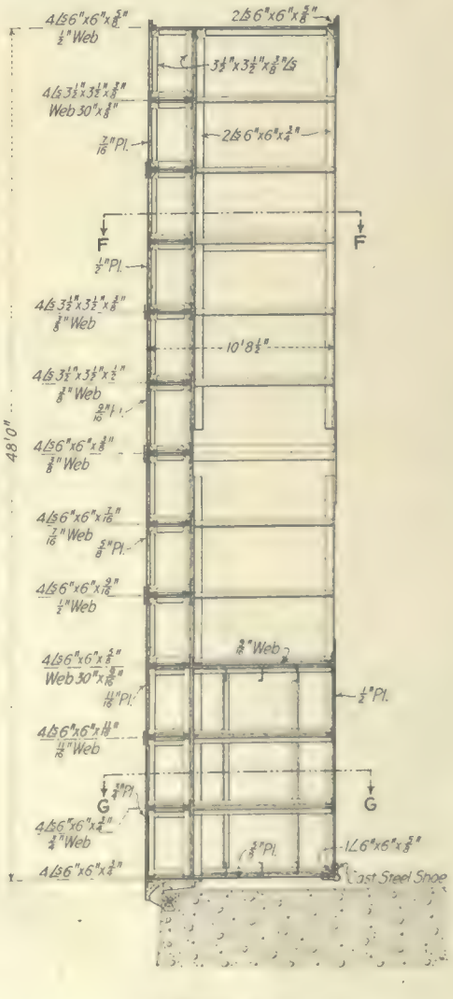
CONTROL

The main throttle valve of the engine, and valves for the reversing cylinder and the miter-forcing machine, are controlled by the operator at the switchboard, some 500 ft. distant, indicating necessity for an automatic rig to prevent over-running the bull wheel. This is accomplished by a four-way limit cock interposed between the main supply pipe and the pipes serving the reversing cylinder. The limit cock is controlled by a circular slot running half way around the bull wheel, with cam motion at each end. Its action is to reverse the engine immediately after the dead center point is reached, irrespective of the position of the valve handle at the switchboard. The machine then runs backward through the length of the cam, about 10 in., when it reverses to forward motion again, and this oscillation continues until the main throttle is closed.



DOWNSTREAM VIEW OF LEAF SHOWS DIAGONAL GIRDERS—BOUYANCY CHAMBER AT BOTTOM





SECTIONS SHOWING MATERIAL AND CENTER VERTICAL GIRDER

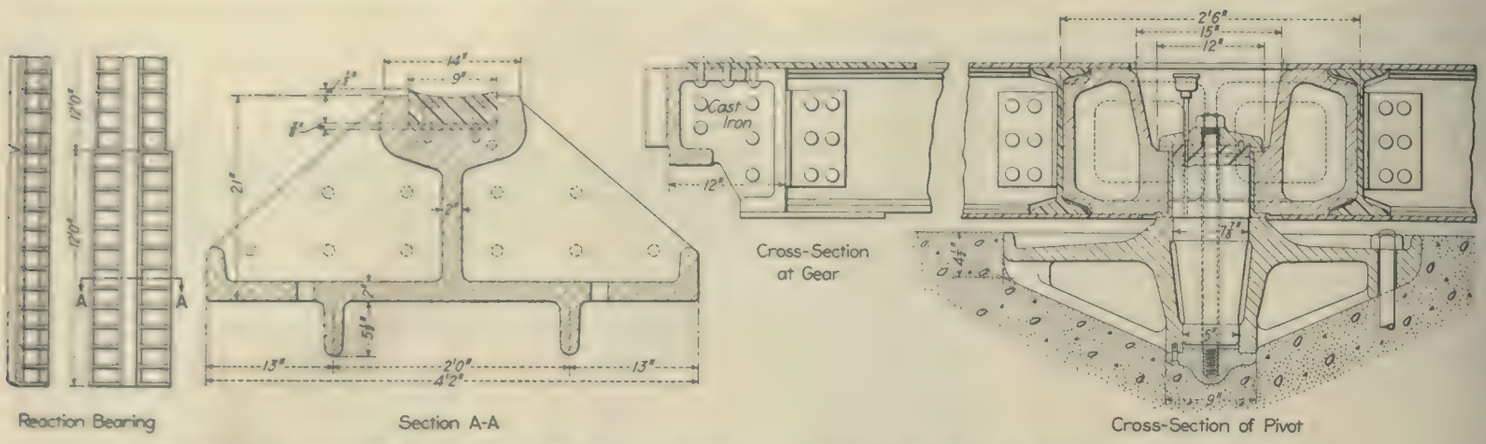
A system of electric indicators insures safe operation at all times. Electric contacts are made at the limits of motion in the miter-forcing machine and the reversing cylinder of the engine, causing distinctive colored lights to appear or disappear on the switchboard as the case may be. Similar contacts are made by the bull wheel throughout its revolution, which always indicate the position of the gate by lights on the switchboard. These lights are white for intermediate positions of the gate, green when approaching the dead center point, green for a few inches beyond dead center, and then red.

The apparatus is in successful operation and seems to demonstrate the practicability of remote control of machinery of this kind actuated by compressed air.

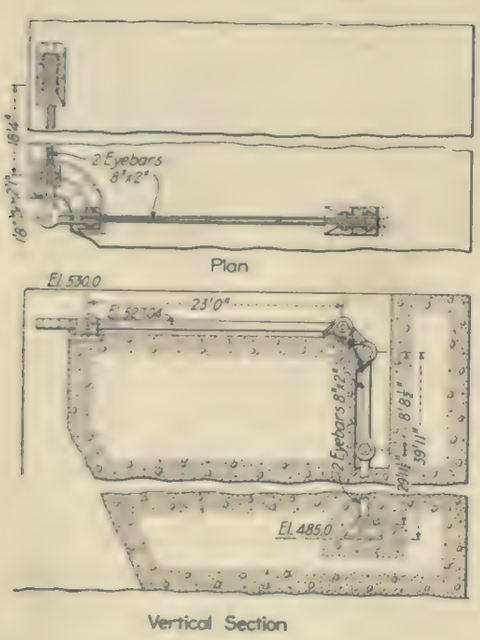
The entire work was conducted under the direction of the Corps of Engineers, U. S. A. Negotiations with the office of Chief of Engineers began in 1906, General Mackenzie being Chief of Engineers at that time.

The importance of this work in the Mississippi River, where large sums of money are spent continually for improvement of navigation, caused the Chief of Engineers' office to give wide publicity in advance to the dimensions of the lock, the depth over miter sills and the general layout. Public hearings were held from time to time, when the proposals of the power company were given to the public for criticism. After these hearings were concluded, and the various reports of the engineer boards were completed, the plans of the work as constructed were approved by the Chief of Engineers and the Secretary of War.

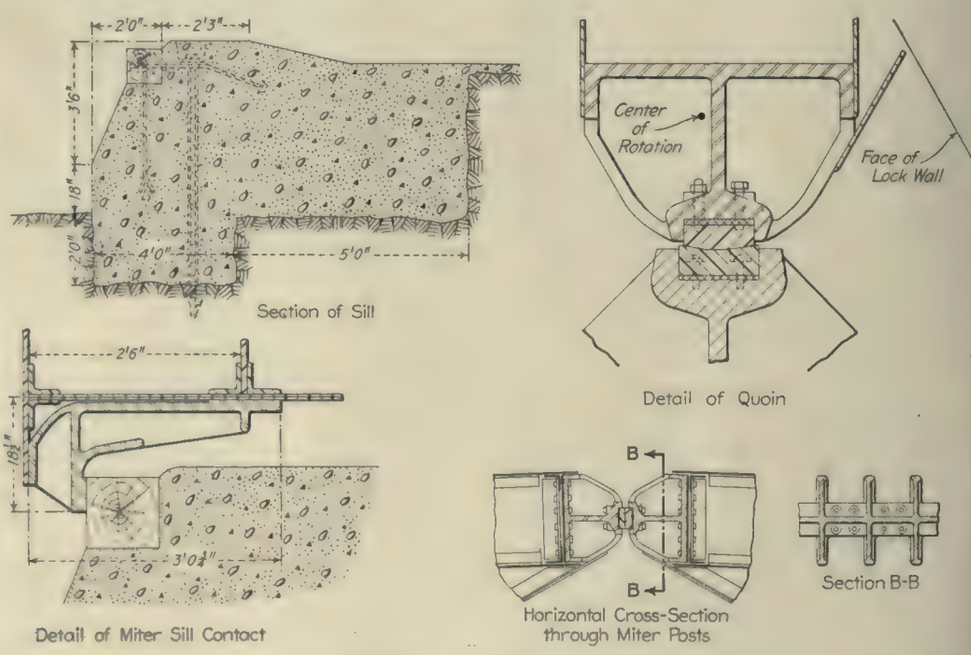
The actual construction was carried out during the time General Bixby was Chief of Engineers, and the district engineer officer in immediate charge was Charles Keller, major (now lieutenant-colonel),



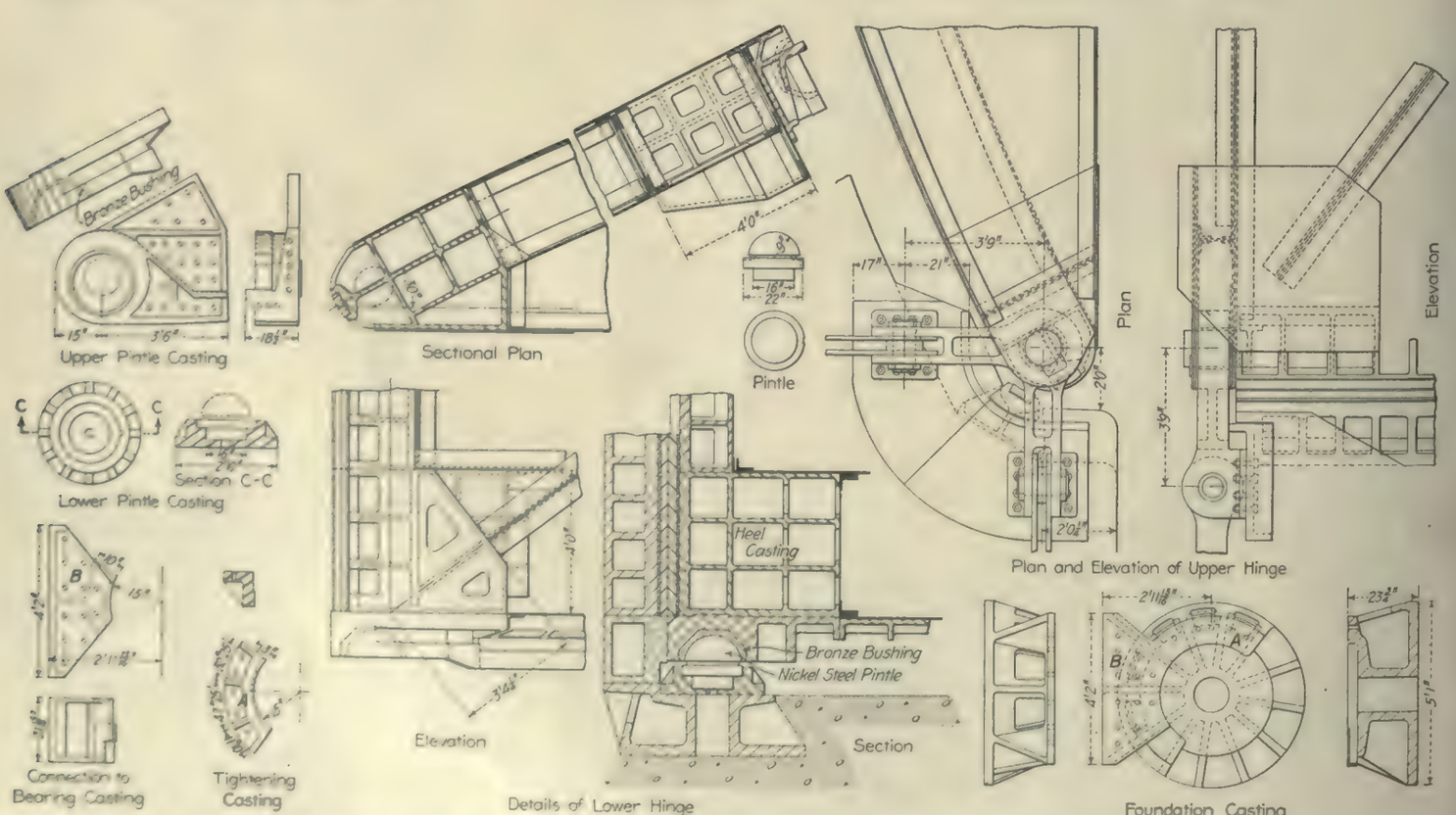
DETAIL AND SECTION OF REACTION BEARING—SECTIONS AT PIVOT AND GEAR SHOWING TURNTABLE DETAILS



EYEBAR ANCHORAGE FOR UPPER HINGE



DETAILS OF QUOIN, MITER POSTS AND MITER SILL CONTACT



DETAILS OF UPPER HINGE, LOWER HINGE, PINTLE AND PINTLE CASTINGS, AND FOUNDATION CASTING

Corps of Engineers. Montgomery Meigs, U. S. civil engineer, was resident engineer for the Government. All plans, details of construction, materials, workmanship and the finished work were exhaustively analyzed and approved and finally accepted by the War Department. The attitude of the army engineer officers throughout the period of eight years on this work was characterized by an admirable and strict fairness which will always be remembered by the engineers of the power company with genuine pleasure.

[*The second article by Mr. Parsons, describing the new type of submersible lock gate, at Keokuk, will appear in an early issue.*—EDITOR.]

FUNDS FOR HIGHWAY MAINTENANCE in California which were received during the period Jan. 1, 1915, to June 30, 1915, from automobile license taxes, amount to $1,722,763, according to the superintendent of the State motor vehicle department.

Tar Paint Proves Better than Lead Paint on Pipes

Reclamation Engineers Try Various Coverings to Withstand Water on the Penstocks and Draft Tubes at Minidoka

WHERE water comes in contact with the paint applied to steel penstocks and draft tubes of the Minidoka power plant, tar paints have been found to be a satisfactory covering, according to an article by Barry Dibble in the *Reclamation Record* for September, from which the following extract, practically in full, and including the table giving costs of cleaning and repainting, has been taken.

The shop paint was of red lead, or iron oxide, and oil. A further coat of red lead and oil was applied on the job, after assembling and riveting the pipes. After two years' service an examination showed that this paint had practically disappeared.

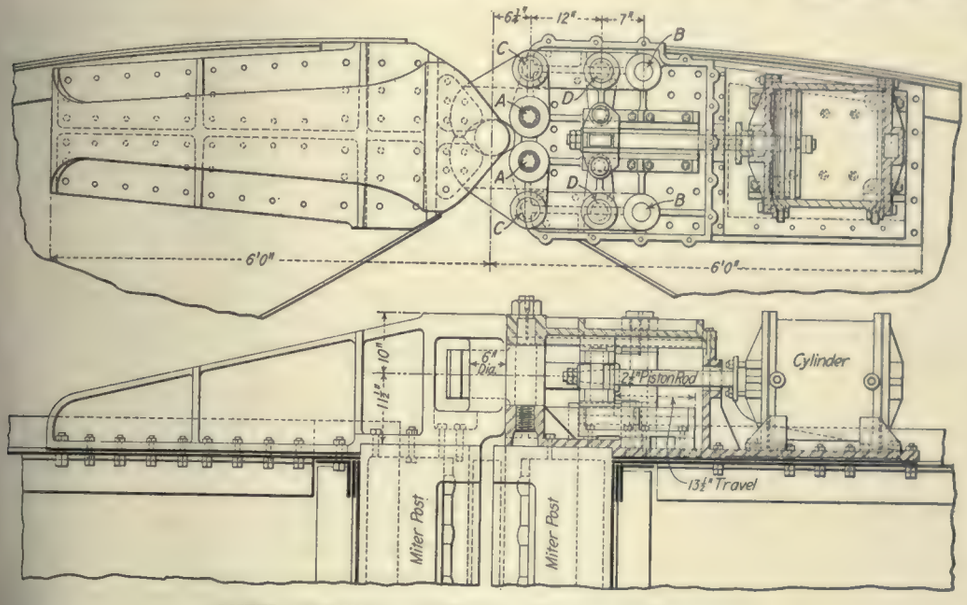
After considerable study and experiment, with unsatisfactory results, the following formula for red-lead paint, obtained from one of the largest paint manufacturers in the country, was adopted, the lampblack being used as a hardener for the surface:

First coat: 30 lb. of red lead per gallon of linseed oil, using one-third boiled and two-thirds raw oil.

Second coat: Same as above, with 4 oz. of lampblack per gallon.

Third coat: Same as above, with 4 lb. of lampblack to the gallon.

Paint was applied according to this formula during the winter of 1912-13. After part of this work was done the chief electrical engineer suggested that we try the material used on the Los Angeles aqueduct, and in accordance with his instructions we ordered water-gas tar for the first coat and coal-gas tar for the second and third coats. This was applied to penstock and draft tube 1.



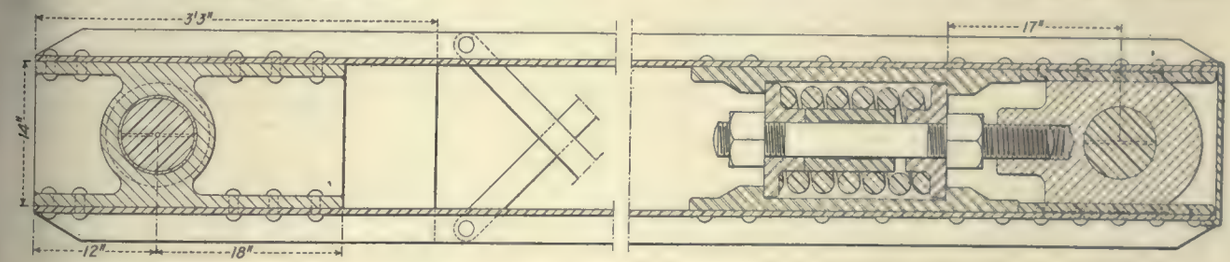
MITER FORCING MACHINE AT TOP OF MITER POSTS

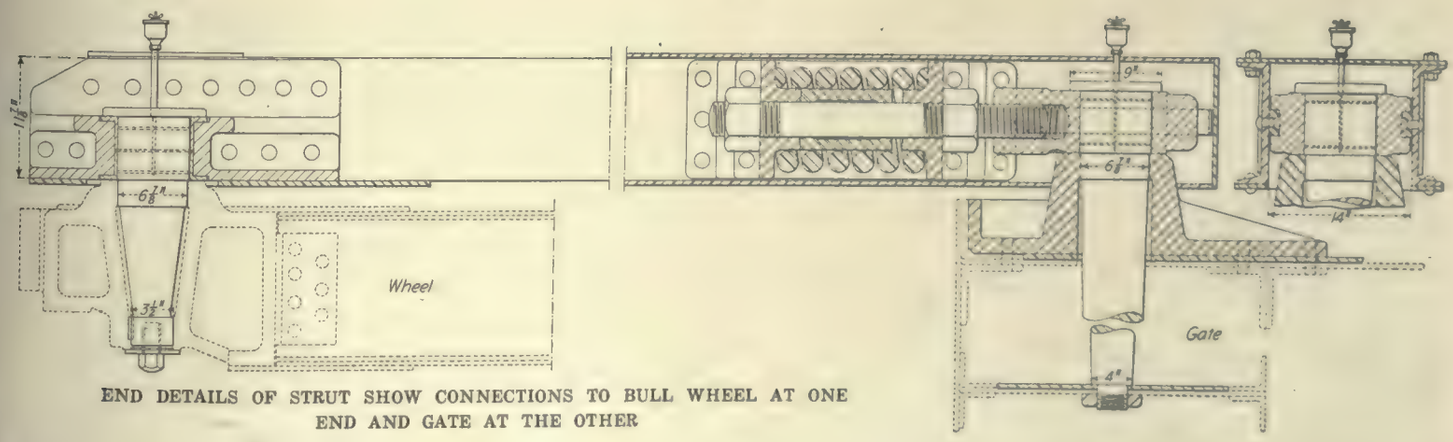
A and B are pivots, C and D are movable pins. The jaws are pivoted around A. Links join C and D, and D and B. When the piston moves backward D is drawn in and C, therefore, rotates backward around the pivot A, thus opening the jaws.

RED LEAD VS. TAR PAINT

At the end of the 1913 season the red-lead paints applied according to the above formula showed decided deterioration where in contact with water, while the tar was in very good shape except for slight rust spots around some of the rivets, where cleaning evidently had not been properly done. At the end of the 1914 season the lead paint had almost entirely disappeared where exposed to water and the tar paint was in good condition on the penstocks, but was apparently getting rather thin on the outside of the draft tube. Where the red lead does not come in contact with the water, as is the case on the upper part of the exterior of the draft tubes, it shows no deterioration and is now in excellent condition.

During the fall of 1914 the parts exposed to water on all the draft tubes were scraped, cleaned and repainted with water-gas and coal-gas tar. The accompanying table shows the cost of this work. There was a considerable variation in the condition on the different tubes, due to the fact that some had two coats of lead and some three, and also due to the fact that in some cases the weather was cold when the paint was applied, and it therefore may not have





END DETAILS OF STRUT SHOW CONNECTIONS TO BULL WHEEL AT ONE END AND GATE AT THE OTHER

COST OF CLEANING AND PAINTING FIVE DRAFT TUBES, MINIDOKA POWER HOUSE

	Draft Tube 1	2	3	4	5	Total
Total surface, sq yd.	170	170	170	170	170	850
Area cleaned and painted, sq yd.	150	150	150	150	150	750
Cost of scaffolding:						
Labor	...	...	...	...	...	$52.32
Material	...	...	...	...	...	22.74
Cost of cleaning:						
Sharpening scrapers	...	...	...	...	...	52.76
Labor	$37.42	$92.98	$58.00	$48.28	$85.10	321.78
Cost of painting, labor:						
First coat (water-gas tar)	7.40	11.99	2.60	6.70	12.93	41.62
Second coat (coal-gas tar)	10.95	16.69	10.16	10.10	12.06	59.96
Third coat (coal-gas tar)	None	None	None	8.50	None	8.50
Total labor, painting only	18.35	28.68	12.76	25.30	24.99	110.08
Material (all coats)	2.40	2.11	1.60	2.40	1.88	10.39
Total cost	...	...	...	...	...	$570.07

Cost per square yard cleaned and painted:	
Scaffolding, labor and material	$0.100
Cleaning, sharpening scrapers, and labor	0.499
Painting—	
Labor	0.147
Material	0.014
Total per square yard	$0.760

set sufficiently before being submerged in the water. The tar paint on draft tube 1 would under ordinary circumstances have gone a much longer time without renewing, but it was thought advisable to go over it in order to determine the condition of the tar coating and the iron underneath.

CLEANING BRUSH ON BREAST DRILL

It will be noted from the accompanying schedule that a very large part of the cost of the work was involved in the cleaning. This cleaning was done by means of steel scrapers and brushes. With the lead paint the iron pitted badly, and it was necessary to clean out the loose scale thoroughly before attempting to repaint the metal.

The rivet heads, particularly, presented a serious difficulty with these scrapers, and we found it very slow to do a good job cleaning around them. After this work on the draft tubes was finished a special brush was made up which could be fitted over the rivet heads and revolved in a breast-drill frame. This worked very satisfactorily, and it materially reduced the cost of cleaning the penstocks.

In scraping draft tube 1 we found an excellent adherence between the metal and the tar paint, which had been on a year and a half at that time. Where it was scraped down to the metal it left a bright surface. On one patch, of about 1 sq. yd., apparently the iron had not been well cleaned before applying the paint, as it was in a place difficult to reach, and here scale had formed. This was the only place, however, where the iron had not been protected from the water. There was a marked difference in the ease with which this tar was cleaned off preparatory to repainting as compared with the work involved on surfaces which had been covered with red-lead paint, and had become pitted. It will be seen from the cost data that tube 1 was cleaned for about one-half the average for the other four tubes. Altogether the results with the tar have been most satisfactory.

There was quite a variation in the consistency of the water-gas tar purchased at different times. As ordinarily obtained it was necessary, in the cool weather during which we painted, to mix a little gasoline with it. Usually the mixture was about 1 qt. of gasoline to from 3 to 5 gal. of tar. This tar was then spread on carefully with a brush in the same manner as ordinary oil paint, it being carefully worked into all pits and around rivets. One gallon of tar covered about 30 sq. yd. with one coat. The cost was about 15 cents per gallon, about one-half of which was freight charge from Chicago to Minidoka.

The tar is rather slow in setting, even if the weather is warm. It hardens when the thermometer drops, but when the weather warms up will become sticky even after a considerable period. As most of the work was done in cool weather, it was possible to apply the second coat within 10 to 14 days. In only one case (draft tube 4) were we able to get a third coat on prior to the time when the weather turned so bad that it was impossible to do outside work. It does not appear to affect the tar to put it into the water before it is thoroughly hardened.

Test Automobiles in Detroit on Artificial Hill

Steel and Wood Structure 40 Feet High in Center of New Speedway Has 12½ and 25 Per Cent Grades on Approaches

ABSENCE of natural hills in the vicinity of Detroit on which to test automobiles led one manufacturer to construct an artificial test hill 542 ft. long, 40 ft. high and 18 ft. wide on the runway, in the center of a ½-mile speedway. One approach has a 25-per cent grade 160 ft. long. The other end is just half as steep and 332 ft. long. At the top is a level stretch 50 ft. long. Both grades are eased off at the lower end to give the cars a more gradual start.

DESIGN OF STRUCTURE

The hill is a composite wood and steel structure designed for a live load of 50 lb. per square foot, and consists of twenty-six all-steel bents, anchored to solid concrete piers, spaced 20 ft. on centers on grades and 16 ft. 8 in. on the level stretch. The bents are composed of 8-in., 32-lb. H-beams properly braced. The horizontal members in the bracing consist of two 5-in. channel irons bowed apart at the center and secured to each other with ¼ x 6-in. batten plates. Other braces are 3 x 2½ x ¼-in. angle irons.

The main crossbeams at the tops of the bents are 12-in., 28½-lb. I-beams riveted to the angle caps of the columns, and are provided with angle clips to receive four 6 x 10-in. pine stringers, to which 3 x 8-in. planking is spiked. Continuous 10 x 25-lb. I-beam struts connect the columns. These struts are connected midway of the span by a four-angle strut. The horizontal braces between the bents and the inside of the bridge are channel irons bowed apart at the center and secured with batten plates. The diagonal members are of angle irons.

WIND BRACING

The wind bracing in the plane of the bridge floor consists of ⅞-in. round rods. At each bent and intermediate between bents occur steel angle brackets, fastened to the main crossbeam and angle struts. A 3 x 8-in. and 3 x 12-in. planking secured to these brackets forms a substantial railing on both sides of the bridge. A 4 x 8-in. pine beam bolted to the floor divides the runway of the bridge in half to avoid accidents from cars running in opposite directions.

The method of laying the planking is practically the same as that used on the speedway, where 3 x 8-in. creosoted planks 16 ft. long are spiked to 4 x 4-in. sleepers. These are butted alternately except on curves, where the joints are even and reinforced. A ⅜-in. space between planks is left to give air space and provide a good hold for the tires.

The hill and speedway were constructed by the engineering department of Dodge Brothers, motor car manufacturers.



ARTIFICIAL HILLS CONSTRUCTED BY AUTOMOBILE MANUFACTURER FOR TESTING CARS ON TWO GRADES

Road Building's Immediate Opportunities Lie in Revised Legislation and Sound Financing

A. N. Johnson and Nelson P. Lewis, Speaking at the Pan-American Road Congress in Oakland, California, This Week, Show Need for New Laws and Short-Term or Serial Bonds

State Road Laws Should Centralize Authority

A. N. Johnson Sets Forth Principles Which Will Bring Order Out of Chaos in Highway Legislation

CENTRAL control over all roads by a State highway department, recruited from the ranks of skilled technical men and not political manipulators thinly disguised as "practical men", must be the basis of highway legislation which is designed to produce good results at reasonable cost. This is the principle enunciated by A. N. Johnson, highway engineer of the Bureau of Municipal Research, of New York City, in a paper presented at the Pan-American Road Congress in Oakland, Cal., Sept. 13-17. In fact, the road laws in almost every State, according to Mr. Johnson, are in such a hopeless snarl as the result of piecemeal legislation, special statutes and amendment heaped on amendment that a general repeal of State laws and a re-enactment on a logical basis is the only way to put an end to the confusion that is now almost universal throughout the country. What is needed is a highway law that has been so carefully considered as to make it unnecessary for the Legislature each year to make vital changes. Mr. Johnson's views regarding the essentials of such a law are given below.

Continuity of Policy Desirable

The law should provide for a proper organization or central authority and give to it sufficient power to promulgate by rules and regulations much that is now detailed legislation. Such authority should be placed with the State highway department whose organization, to be effective, must be such as to secure continuity of policy and employment and retention of trained highway engineers. The State department, as here contemplated, is to have more than the control of merely a restricted system of State roads. It is to have general control of all the road work and the road policy of the State.

Local Administration Ineffective

The many special laws for the expenditure of bond issues indicate clearly the appreciation of the inadequacy of the usual road machinery to carry out effectively road improvement on the scale that is demanded to-day. The question that arises is to what extent have the devices that have been substituted for the regularly organized road administrative methods remedied the defects? Do these special road laws and bond issues provide a satisfactory solution?

During the past ten or fifteen years a noticeable feature of road legislation has been the provisions that have been made for road work to be paid for by local bond issues. The reasons leading up to such legislation, which has involved in the aggregate hundreds of millions of dollars in bond issues, is manifestly to be ascribed to the great public interest and desire for improved roads.

The provisions that are made for an organization to carry out the work are significant. In a majority of cases a special board of commissioners is created and complete organization provided; in others, while the regular officials may have general control, they must employ an engineer or skilled superintendent. In every instance an attempt is made to remedy the defects of the usual road machinery by which no skilled supervision is provided, and which it is realized is necessary when the proposition is to spend a comparatively large sum of money on a few miles of road.

This class of legislation includes the provisions for the establishment of special road districts and organizations to spend particular bond issues. They vary from a road system for a county to the formation of a restricted district for the improvement of but a single road. Usually the work to be done and the amount of money to be spent are submitted for approval to the electors resident within the area from which the funds are to be raised, many laws providing that only voters who are property taxpayers are entitled to vote.

Organization Short-Lived

The organization provided by most of these laws exists only during the period of construction. Thus the skilled control which these special laws secure in a varying degree, at most, extends but a short period.

Beyond providing means for raising revenue and the machinery for expending the same, little or no thought has been given them. No provision is made for continuing maintenance. No fixed income is provided on which to make plans for future work. No definite information is collected on which to base estimates for such an income. Long-term bonds are thoughtlessly voted for short-lived structures. The simplest fundamental economic principles are violated without giving them a thought.

Roads Require Broad Study

Proper road development to-day requires the careful consideration of economic conditions over a comparatively wide area. There must be a careful study made to secure a road system such as will, when completed, meet the traffic needs and for the construction of which a carefully considered plan for the distribution of cost has been worked out. The spasmodic and localized road improvement attempts can fit into such a scheme only by accident. Sometimes the wrong road is chosen; other times it is not properly dimensioned; but in any event little or no thought is given to the part the road will play in a comprehensive road development plan.

More often error is found in the type of construction selected. With so many kinds of construction, each calling for special materials, all of which are actively advertised, the result frequently is the adoption of a type of pavement which represents not what is best for the road but what company employed the most persuasive salesman.

Bad Engineering Practices

It might be thought that as most of these laws usually provide for the employment of an engineer supposed to be skilled in road construction, there could be no serious blunder made as to the type or manner of building the road. Due, however, to the essentially temporary character of the employment afforded and to a lack of understanding in the minds of the people generally as to the necessity for securing high-grade service, there have arisen practices by which apparently some small saving is made but which prove most wasteful.

The shrewd, careful men usually selected to have administrative control of these special road enterprises have had no experience whatever in road construction work and believe they pursue a very commendable course when they auction off the engineering, giving it to the engineer who will take the job for the least money. This short-sighted policy, saving perhaps a few hundred dollars, costs the taxpayers paying for the special work many thousands of dollars through the honest but misguided management of men selected to safeguard their interests.

The selection of the proper type of road is far more of a scientific problem to-day than it was twenty years ago. The changed traffic conditions which make it difficult to select the type of road, make it also impossible, when determining the roads to be improved, to consider but a small area.

Conclusions

It is evident that if a locality is to bond itself for road construction the greatest benefit can accrue to such locality only if it chooses wisely both as to the location and the character of the work to be done. These questions require broad experience, and local effort has not been equal to the task. There must be provided by the State a department capable to advise and direct localities and with authority to prevent unwise expenditures as well as to supervise necessary improvements.

If the proper administrative methods are to be made possible there must be abolished a vast number of small independent units which now exist, with their horde of minor officials selected by ballot. In general there must be reposed in a central State department power to make rules and regulations which now constitute a great bulk of legislative enactment, too often the results of trading and political expediency. The central authority should be charged with the development of policies for the expenditure of all road revenues. Such a department to be effective must be freed from political manipulation, and skilled men must be in control so that a continuing policy may be possible.

Road work is no longer a neighborhood concern and cannot successfully be so administered, but must be controlled by a properly organized, strong central authority.

Life of Highway Improvement Should Limit Term of Bonds

Nelson P. Lewis Shows Economic Fallacy of Long-Term Bonds for Short-Lived Structures in Road Building

LONG-TERM bonds for short-lived structures were denounced by Nelson P. Lewis, chief engineer of the Board of Estimate and Apportionment, New York City, in a paper on "Highway Indebtedness", presented at the Pan-American Road Congress in Oakland, Cal., Sept. 13-17. The justification for debt, Mr. Lewis said, must be based upon benefit which will be permanent or which will at least extend over a period of years, and also upon the ownership of unencumbered property, or sources of income which may be depended upon to provide the interest on the debt and its liquidation at maturity.

There has been a disposition to issue highway bonds for long periods, frequently for fifty years. For such part of the work as is really permanent, such as the widening or straightening of old roads, or the improvement of their grades, this may be proper, but for that part of the work which will be short-lived, such as the wearing surface of the roads, a long loan cannot be justified.

How the Cost Mounts Up

With interest at 4 per cent the total interest payments on 50-yr. bonds will be twice the actual cost of the work. The annual amortization charges for 50 yr. on at 3-per cent basis would be 0.89 per cent, so that for every $1,000 of original cost the State or the city would pay $2,445. The roadway surface will have worn out long before the expiration of the 50-yr. period, yet the public at large will keep on paying. If this apparently easy way of meeting the cost of highway improvement is once begun it is likely to be continued, and even to be applied to meeting the cost of replacing worn-out surfaces. There are many cases where pavements on country roads and city streets will not last more than ten years, and if this policy of financing is continued the public will, after forty years, be paying for five different road surfaces, of which four will have entirely disappeared, and the annual expense during the decade from forty to fifty years after the original improvement was made will be 24.25 per cent of its original cost. These estimates relate only to the wearing surface itself and not to the more permanent portion of the work which will have a life much greater than ten years.

Short-term bonds, when issued for highway improvement, may be generally considered as those whose term will approximately correspond with the life of the improvement, so that the road will not be worn out before it is completely paid for. Some portions of the work will last longer than others, and bonds which will correspond in their terms with the average life of the improvement may properly be considered short-term bonds.

Cost Apportioned

In the case of a highway improvement which is to be entirely paid for by bond issue, if 20 per cent of the cost is represented by such expense as widening, grading and substantial culverts, that portion may be considered permanent and 50 yr. would not be an unreasonable time in which to pay for it; if 20 per cent is for curbing and for gutter paving, which might be expected to last for 20 yr., bonds issued for a corresponding term for this part of the work would be fair and reasonable; if the road surface represented the remaining 60 per cent of the cost and the surface would require replacing in ten years, it would be unwise to borrow the money to pay for that part of the work for a longer period.

The average life of the entire improvement might in such a case be considered 20 yr., and it might therefore be considered proper to issue 20-yr. bonds to pay for it. There is a fallacy, however, in this argument, as the interest and amortization charges will be constant for the entire 20-yr. period, notwithstanding the fact that the part of the work representing 60 per cent of the total cost will have been worn out in half that time, although there will still remain a portion representing 20 per cent of the total cost which will last for at least thirty years after it is entirely paid for. A more conservative plan would therefore be to limit the bonds for an improvement of the kind described to 15 yr.

As the terms of the bonds are shortened the total annual expense grows impressively larger, but it must be remembered that there is less overlapping of the different issues, and after this policy of paying for highway improvements by bond issues has been followed for a period corresponding with the term of the bonds the total amount to be provided to care for the outstanding debt will be considerably less in the case of the short-term bonds.

10-Year Bonds

For instance, if a constant sum of $1,000,000 a year were borrowed for highway improvements and if 50-yr. bonds were issued for the purpose, at the end of 50 years there would be $50,000,000 of these bonds outstanding. During this time the annual interest and amortization charge would gradually increase until it reached $2,445,000, when it would remain constant. If, however, the funds were raised by the issue of 10-yr. bonds there would be $10,000,000 outstanding at the end of ten years, during which time the annual interest and sinking fund charges would increase until at the tenth year they would reach $1,322,000, when they would remain constant. Under the latter policy there would be at the end of fifty years an annual saving to the taxpayers of $1,123,000.

It may be said that these periods are so long that such a discussion is academic, but street and road improvements are going to continue for an indefinite time. Our States and cities hope to remain solvent and must meet their financial obligations, and debts of this kind must be paid in full, so that the actual facts should be squarely faced.

Advantages of Serial Bonds

To distribute the cost of street or road improvements over a term of years, and at the same time to avoid the necessity of accumulating large sinking funds which return a small rate of interest, resort is frequently had to serial bonds. In this case provision must be made for retiring a certain part of the issue each year and for interest on the bonds which remain outstanding. If $1,000,000 of 4-per cent bonds are issued in serial form, $50,000 falling due each year, the provision which must be made to care for the bonds to be retired and the interest on those outstanding will be as follows:

First year	$90,000
Sixth year	80,000
Fifteenth year	62,000
Twentieth year	52,000

One advantage of this plan is that as part of the work is worn out and the value of the improvement becomes less there is a corresponding reduction in the annual burden. It is important, however, that the series shall be so arranged that the amount outstanding at any time shall not exceed the actual value of the original improvement at that time. When serial bonds are issued in such a manner that the last bond will not be retired for a long term of years or a term far in excess of the probable life of a large portion of the work the plan is uneconomic and pernicious. A striking example of the abuse of the serial bond is afforded by the case of two towns now a part of New York City, which, in 1868, secured legislative authority to improve a highway passing through both of the towns and to issue serial bonds. As these bonds were actually issued the last bond of one of the towns will fall due in 1980, and the last bond of the other town will not mature until the year 2147.

It might be feared that serial bonds would not command as good a price as would those running for a longer term, but at a recent offering of a large number of New York City bonds the bids received for serial bonds, then offered for the first time by that city, actually exceeded the price offered for 50-year bonds, both bearing the same rate of interest. It is possible that present financial conditions render a more liquid asset desirable, but the fact that the prices bid for serial bonds were better than those for long-term bonds was a surprise.

Central Control of Finances

Unless State and municipal authorities show a disposition to limit the terms of their obligations more nearly to the life of improvements for which they are to pay, it will probably be necessary to adopt a plan somewhat similar to that followed in Great Britain, where no obligations may be issued by any State, town or county authorities until there shall have been submitted to the Local Government Board a precise statement showing the character of the improvement, its probable life and its estimated cost. This board then determines the amount of the bonds which may be issued and the terms for which they may run, the purpose being to ensure the extinguishment of the debt within a period which is less than the life of the improvement.

Road Bonds Should Provide for Maintenance

J. F. Witt Emphasizes Importance of Having Sufficient Funds Available for Repair Work

LONG-TERM bonds, according to J. F. Witt, of Dallas, Tex., in his discussion of Mr. Lewis' paper, are popular because they require a smaller annual sinking fund. Short-term bonds and serial bonds are, however, often preferred, but the difference in what kind of bond is voted is slight compared to other adjustments that should be made before the money is borrowed. The principal fault is not whether the bonds are 20-yr. serials or 40-yr. straight, but lies more in the lack of provision for a fixed amount for maintenance and repair of the

highways constructed, thus insuring an improvement that will last with the debt. The only way to make the improvement permanent is a definite and adequate method of maintenance.

RESTRICTION NEEDED

Considering a wearing surface in keeping with traffic requirements, the nominal sum available for maintenance and repair, unless special provision has been made, is inadequate, with the result that the wearing surface is worn out long before the invested obligation is discharged.

We may feel that the evolution in traffic in the past 10 yr. will probably be repeated in the next 10 yr., and in that way make it impossible to pre-determine what fixed charge to make for maintenance and repair. In a manner this is true, but in trying to work out a method that would bring about the result suggested we will not have to go far to improve on present conditions. Some restrictions should be passed by every State that would control the issuance of bonds for highway improvement and that would make it as necessary for governing boards to fix a permanent and adequate fund for maintenance and repair, as it is to have an estimate on which to rely for the amount of funds that will be required for construction purposes.

The limitations of borrowed money for highway purposes should be governed by some fixed standard of construction, that standard to be determined by the amount and kind of traffic the highway will have to carry. The necessary number of miles and the layout also enter largely into the question, for, aside from cross-State roads that enter into most highway systems, all intermediate roads should be laid out after a thorough study of traffic zones, so that when the system is completed it will accommodate a larger part of local traffic, and not less than probably 70 per cent of the tonnage of the district that pays the interest and sinking fund made necessary for the construction of the system, thus insuring compensation on the investment. When State-aid is furnished, this plan would probably be modified, but it appears to be about the best method of controlling the expenditure for counties or special districts.

SPECIAL TAXES

In the matter of levying a special tax for the purpose of taking care of indebtedness created for highway improvement in rural districts the prevailing plan of making the levy general over the district benefited appears to be unjust. The method employed in some cities of having the abutting property owners pay for a large part of the pavement cost, appears to be an equitable adjustment that should apply to rural districts as well as to the city—not to as great an extent, for the special benefit derived would not be so great, but charge the abutting land with the greatest percentage and graduate the percentage down for a distance from the highway that would be governed by the layout of the system, until the minimum was reached, which would be the basis for the general levy applied.

All abutting property receives a greater and more direct benefit from the improvement than does property located off the road. It is therefore unjust to make the charge equal. This method of paying for the improvement would also have a tendency to reduce the present manner of distributing to certain localities a preference brought about largely through political influence, by placing all property benefited either directly or indirectly on an equal footing, as all property would then receive a benefit in the ratio of what it paid toward the improvement.

Self-Propelled Compressed-Air Mixing Plant Lines Sandy Ridge Tunnel Under Traffic

Car Run by Gasoline Engine Carries Concrete Materials and Pneumatic Mixer, Which Is Supplied with Air Through Line Laid in Tunnel

A NOVEL mixing plant which carries its own concrete materials with the mixing and placing machinery, and which propels itself at a speed of more than 20 miles an hour, thus dispensing with the services of a work train, is being successfully used by the Carolina, Clinchfield & Ohio Railway, to line a 7800-ft. tunnel without interrupting traffic. The car is loaded from bins under a high storage trestle at one end of the tunnel; it holds 30 cu. yd. of stone and has placed 201 cu. yd. of concrete in a day, at a rate, while operating, of a batch every 45½ sec.

The Carolina, Clinchfield & Ohio Railway has recently completed and placed in operation that part of its line known as the Elkhorn Extension, from Dante, Va., to Elkhorn City, Ky., the terminus of the Big Sandy division of the Chesapeake & Ohio Railway. Where the extension passes under the divide known as "Sandy Ridge", just north of Dante, there is a tunnel 7804 ft. long, called the Sandy Ridge tunnel. This tunnel passes, for about one-half its length, through slate and shale formations which disintegrate upon exposure to air, and for the remaining half, through sandstone formation badly seamed and broken. In view of these conditions, the management decided to begin promptly the lining of the entire tunnel with concrete.

This work required the placing of between 50,000 and 60,000 cu. yd. of concrete, all of which had to be done while traffic was passing through the tunnel. In addition to Sandy Ridge there were a number of other tunnels on the above extension, as well as on other parts of the road, which might require lining in the future under similar conditions of traffic. With this in mind the railway engineers made a special study of various plans for the above work by which it could be done with economy and rapidity, also holding in mind that much of the plant would be used for similar work after the completion of this particular job. The result of these studies was the determination to use the compressed-air method of mixing and placing the concrete, and to provide for this a plant to include a self-propelled concreting car, a loading and storage trestle, a compressed-air plant and pipe line through the tunnel, and concrete forms quickly and easily movable.

CONCRETING CAR DECIDED ON

On account of the great length of the tunnel it was deemed impracticable to furnish the concrete from a mixer located at either portal of the tunnel, as too much time would be consumed in transporting the wet concrete. It was concluded at the outset that the mixing could be done inside the tunnel where the concrete was to be deposited, and that a car carrying the ingredients would be the proper solution. It also appeared most desirable, if not absolutely necessary, to handle the car without filling the tunnel with smoke. These premises led to the idea of a self-propelled concreting car, and finally to the gasoline engine as most nearly fulfilling all conditions for the propelling device. A gas engine emits only a small amount of smoke or gas while moving, and can be shut off entirely when position has been taken. It occupies but small space and can be operated by one man. To obtain capacity, gravity flow of materials, and a convenient and desirable arrangement, the car was made as large as the standard clearance of the road would permit after allowing room for concrete forms. It is 40 ft. long over end sills, 10 ft. 4¼ in. wide over braces, and 17 ft. 9 in. high, from top of rail to top of car. It is built of steel, as the material bins are high above the rail and the weights considerable.

The car has a central chamber, open on the sides, 8½ ft. long, 9 ft. 8 in. wide and



SELF-PROPELLED MIXING CAR CARRIES ITS OWN CONCRETE MATERIALS

10 ft. 3 in. high, in which is located on one side the pneumatic concrete mixer and on the other side the charging skip. Over this chamber is a water tank of 1850 gal. capacity. This tank furnishes water for the concrete and is also connected with the cooling system for the gasoline engine. Facing the central chamber is the stone bin of 30 cu. yd. capacity on one end, and the sand bin of 12 cu. yd. capacity on the other. Each bin has a chute 20 in. wide leading to the charging skip, and each chute is controlled by an under-cut gate. Under the stone bin is space occupied by a 96-cu. ft. air receiver standing vertically, and also a space for the storage of cement in bags, which is protected from water by the bin overhead. Under the sand bin are the gasoline engine and its auxiliary equipment, completely housed from water and dust. The charging skip in its lower position stands with its top rim about 15 in. above the floor, and it travels on inclined guide rails to its upper position over the mixer, being hoisted by a compressed-air cylinder of 9¼-in. diameter. The gate of the skip works automatically by means of a guide rail.

The mixer is for a two-bag batch (4/10 cu. yd.) and has its 8-in. outlet pipe at the bottom running horizontally and curving to the outside of the rear truck and thence vertically to near the top of the car, where it branches by means of a wye into two lines, one a 180-deg. bend to the rear for "shooting" in the foundation and sidewall, and the other going to the roof for shooting into the arch. The wye is a special patented device with a sliding plate controlling the movement of material into either arm. The arrangement of the pipe, traveling with the car and being in position at all times for shooting concrete, is considered an important one in saving time and expense. One of the difficulties of many jobs where the pneumatic mixer has been used is the handling of the big heavy pipe.

Along one side of the car is a folding platform 2 ft. wide level with the main floor. This is used by the men carrying cement, and to get to and from the engine room. During the ordinary work of the car this platform remains down.

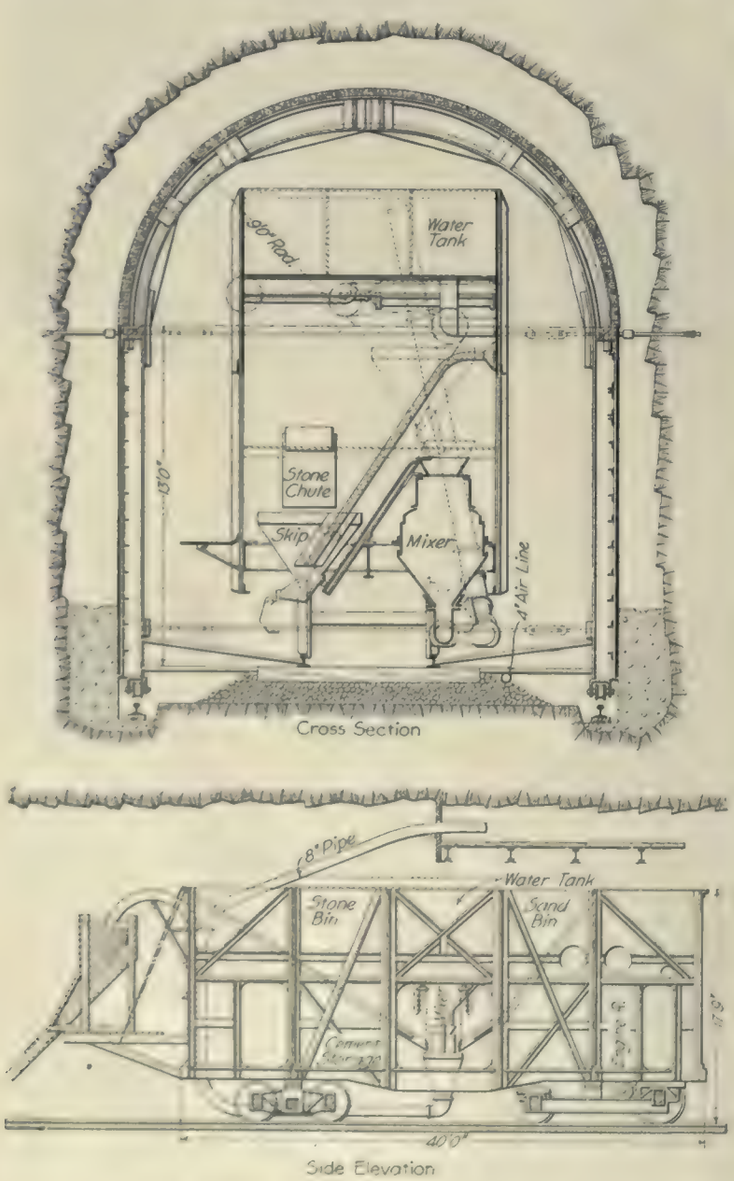
The entire arrangement is compact, and designed with a view of saving manual labor. One man controls the hoisting of the skip, injection of water and mixing and discharge of the batch. One man is placed at each chute and two men carry, open and empty the cement bags.

The gasoline engine is of the six-cylinder four-cycle T-head type, rated 200 hp. at 350 r.p.m. It can be throttled to 125 r.p.m. The motor and its frame constitute one of the trucks of the car. The cylinders stand in a row at right angles to the track and the whole construction is compact but accessible. The engine is started by compressed air being admitted to three cylinders, after which the explosion of the gasoline takes place in the other cylinders and continues the motion. The transmission is by means of a Morse chain on the driven axle, and the control is through a friction clutch of special design. The general principle employed is much the same as in the ordinary automobile.

The car and gasoline engine were built by the McKeen Motor Car Company, of Omaha. It was sent knocked down and was erected at the railway shops at Erwin, Tenn., whence it moved to the work, 105 miles distant, under its own power at a speed ranging at times as high as 25 miles per hour. The mixer was installed and the piping done on the car by the Pneumatic Placing Company, of New York City.

LOADING AND STORAGE TRESTLE

The loading trestle is of special design and is so arranged that the car goes under it and receives stone, sand, cement and water all by gravity and frequently all at the same time. The sand and stone are drawn from overhead bins by means of under-cut gates. Cement is conveyed into the car by a chute. The trestle has a track over its deck on which stone and sand in hopper cars are stored or unloaded into the bins below. There is a continuous row of twenty-seven bins with an aggregate ca-



PNEUMATIC MIXER DRAWS AIR FROM LINE IN TUNNEL



STORAGE TRESTLE CHARGES MIXING CAR BY GRAVITY

pacity of 324 cu. yd. and a total length of 162 ft. Five loaded cars can be stored over these bins, giving an additional storage of 200 cu. yd.

Compressor Plant and Pipe Line

The compressor plant is exceptional for a temporary outfit. To save money on foundations and at the same time increase the space, the floor level of boilers and compressors was fixed 4½ ft. above subgrade and the concrete foundations and rim walls were built up to this height, the cellular space underneath being utilized for water tanks and ash pit. The building is of 1-in. boards covered with tar paper. The arrangement chosen permits coal to be dumped from cars on the trestle to a pile in front of the boilers. There are two boilers, both locomotive type, one new 150 hp. and one old 70 hp. Only two compressors are installed, but an extra foundation for another unit is provided. The compressors are of a high-speed, single-stage type, with a capacity of 375 cu. ft. of free air per minute each. They work under 125 lb. steam pressure and compress air to 115 lb.

From the compressor a 6-in. pipe leads to a 150-cu. ft. air receiver and thence a 4-in. pipe line goes on a steady 0.5-per cent down grade entirely through the tunnel. At the lower end is a pet cock to drain off any water. In order to care for expansion and contraction the pipe line is laid alternately on the east and west sides of the track in lengths of about 1000 ft. and connected by curves of 2-ft. radius. The bottom of the pipe is level with the bottom of the ties, 1 ft. from their ends. About every 100 ft. a long radius tee is placed, and about twenty mine cocks of 24 in. are provided, which can be shifted to the various tees as the progress of the work demands. To any of the mine cocks a 3-in. hose may be connected from the 96-cu. ft. air receiver on the car, and in this way with a hose 60 ft. long the car can be connected to the 4-in. pipe line at any point at which it may stop and receive an ample supply of air.

Steel Forms Used

The forms are of steel, with the exception of the arch ring, which is 3-in. hard pine on steel ribs. They are of the Blaw collapsible type, and of exceptionally stiff design. They are held by anchor bolts to the walls of the tunnel, and are without interior bracing, rods or struts, so that the concreting car as well as trains may pass without interruption. They are collapsed by means of turnbuckles on rods temporarily inserted as shown in the drawing. Five 30-ft. sections are provided, and it is expected that the car will fill at least one section each day and lose no time waiting for the moving of forms or for concrete to take its set. For the foundations and initial bench wall wooden forms are in use. They are made in 12-ft. sections and braced from the track.

The car began regular operation in the tunnel on July 9 and has worked every day since, Sundays excepted. It has steadily increased its output as the men became more used to the work and better organized, as is shown by Table 1. Several runs of 180 cu. yd. per day and one run of 201 cu. yd. have been made. The work so far has been putting in the foundation and initial lift of bench wall 4 ft. 4 in. high, which requires moving the car more often than will be necessary when shooting into the arch form begins. The performance is, however, largely dependent on interference from trains passing through the tunnel.

Table 1—Constantly Increasing Weekly Yardage

Week Ended—	Yardage
July 17	261
July 24	379
July 31	516
Aug. 7	822
Aug. 14	928

One other feature of the plant is the short pipe through which the charge moves. Generally speaking it has been held that at least 50 ft. of pipe was necessary to get a good mixture of concrete. In this case it goes through 41 ft. of pipe and 10 ft. of chute, and the mixture is good. In several installations concrete has been placed through 1200 ft. of pipe and the record for distance to date is believed to be 2805 ft.

One of the difficult problems confronting the designer is to place the charges of ingredients into the mixer fast enough to work it to its capacity. The mixer can shoot a batch every 15 sec. provided sufficient air is furnished, but to give it a charge of material every 15 sec. seems to be an unsolved problem.

Time records of the plant given in Table 2 show the speed at which batches are discharged, giving the actual time the car is coupled to the hose and working inside the tunnel. The variation is due to condition of material, whether wet or dry, which affects the rapidity with which it flows in chutes and skip. It is believed that the operation can be speeded up to an average of 35 or 40 sec. with dry material. The door of the skip automatically opens as the skip reaches the charging position and closes as it is lowered away from it, the door serving as a chute while open. Also, the side slopes are steep and unbroken, so that the skip can free itself quickly.

Table 2—Rate of Discharge of Batches

Date	Batches	Minutes	Average, Sec. Per Batch
Aug. 17	423	381	54.0
Aug. 18	323	302	56.1
Aug. 19	448	340	45.5
Aug. 20	325	250	46.1
Aug. 21	309	280	54.3

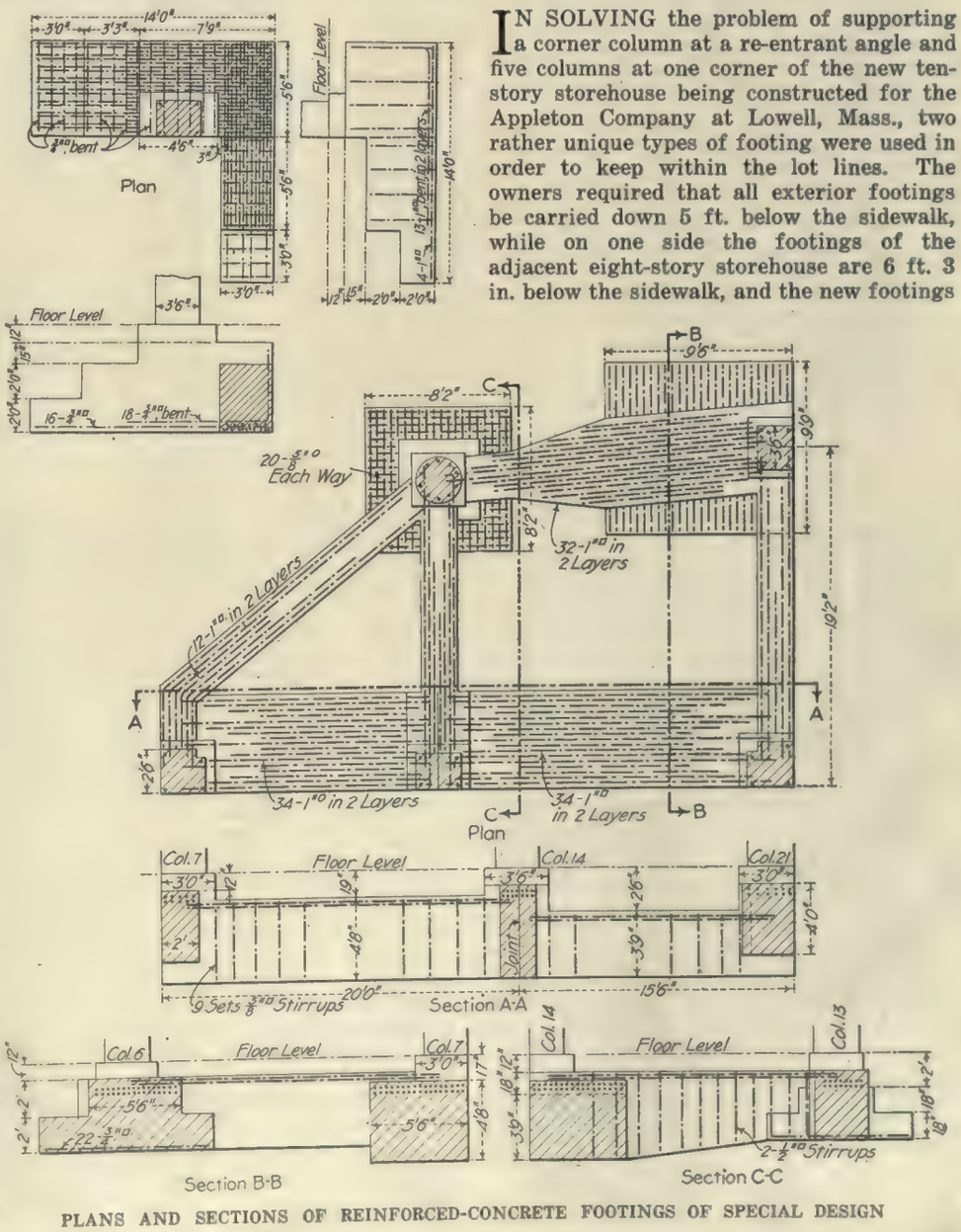
The lighting of the inside of the car is by carbide lights and of the outside work by hand torches and carbide lights.

The plant was designed by O. K. Morgan, office engineer of the Carolina, Clinchfield & Ohio Railway, under the general direction of Ward Crosby, chief engineer.

Reinforced-Concrete Footings of Special Construction

Outside Corner Columns for Ten-Story Storehouse Supported on Low-Bearing Soil Without Extending Beyond the Lot Line

IN SOLVING the problem of supporting a corner column at a re-entrant angle and five columns at one corner of the new ten-story storehouse being constructed for the Appleton Company at Lowell, Mass., two rather unique types of footing were used in order to keep within the lot lines. The owners required that all exterior footings be carried down 5 ft. below the sidewalk, while on one side the footings of the adjacent eight-story storehouse are 6 ft. 3 in. below the sidewalk, and the new footings



PLANS AND SECTIONS OF REINFORCED-CONCRETE FOOTINGS OF SPECIAL DESIGN

had to be carried to the same depth. The solution of this problem (for the most interesting cases) is shown by the plans and sections herewith.

The building is designed for floor loads of 150 lb.; the story heights are 8 ft. except for the first floor, which is 13 ft. 3 in. high. All footings are designed for a soil pressure of 8000 lb. per square foot, and in accordance with the report of test results in the Bulletin of the University of Illinois. The unit stresses used are those recommended by the Joint Committee.

FOOTING AT RE-ENTRANT ANGLE

The unusual angle-shaped footing for the corner column was chosen because of its greater economy. The center of gravity of the footing is under the center of the column. The cantilever stresses at the projecting ends are provided for by the bending up of the tension steel and liberal reinforcement for shear.

The other footing, designed to carry five columns as shown, is also arranged to bring the center of gravity of the total upward and downward forces vertically in line with each other. The long beam shown in elevation at section AA is designed as two simple beams, with the joint at column 14 as indicated. These straps are therefore all designed as simple beams with uniform loading.

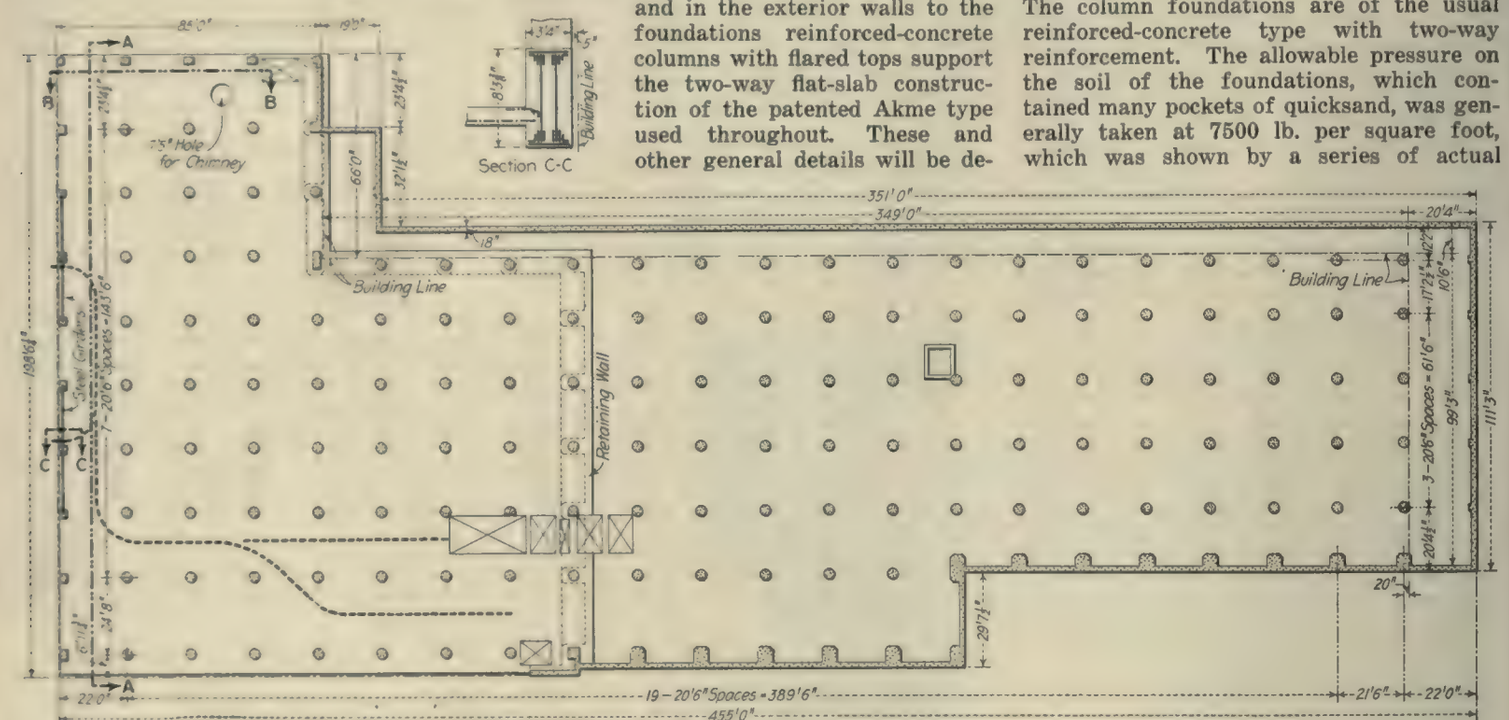
These data have been furnished by E. F. Rockwood, chief engineer of the New England Construction Company, of Boston, contractors for the building.

THE ASHOKAN RESERVOIR basin of New York City's new water supply was cleared and grubbed during 1914 at a total cost of $383,472.90. A total of 10,377 acres was cleared, 1870 acres grubbed and 1022 cu. yd. of material excavated. A strip of 5 ft. above and 15 ft. below the future shore line of the reservoir was grubbed, and two low dikes were built to flood a large part of the reservoir floor in order to reduce the amount of second growth to be cut before the reservoir was finally flooded.

New Steel and Concrete Structure to Furnish Nearly Sixteen Acres of Floor Space

Bingham Warehouse in Cleveland Designed for Heavy Floor Loads—Steel and Reinforced-Concrete Columns Support Flat-Slab Floors

THERE is now under construction in Cleveland a large steel and concrete warehouse for the William Bingham Company, which is to furnish nearly 16 acres of floor space. Unusually heavy columns and floor slabs are required in the 8-story structure to support the specified live loads on typical floors of 500 and 300 lb. per square foot. All the interior columns up to the second floor level and the four exterior columns under steel girders were made with heavy steel cores. Above the second floor in the interior of the building and in the exterior walls to the foundations reinforced-concrete columns with flared tops support the two-way flat-slab construction of the patented Akme type used throughout. These and other general details will be described, including the heavy 41-ft. steel girders supporting 500-ton loads at their midpoints where reinforced-concrete columns carry the upper floors.



GENERAL PLAN OF BINGHAM WAREHOUSE—HEAVY STEEL GIRDERS IN REAR OVER ENTRANCES FOR OVERHEAD TROLLEY

GENERAL DIMENSIONS AND CONSTRUCTION

The typical floor of this warehouse contains about 57,000 sq. ft. and is entirely free from partition walls. As seen on the plan view of the second basement here shown, the front width between building lines is about 99 ft. and the rear width 198½ ft., while the total length is 435 ft. between building lines, or 455 ft. between basement walls, the first and second basements extending 20 ft. under the sidewalk in front. A total of 15.7 acres of floor space is thus provided by the eight upper floors and three basement floors of the building. The height is about 101 ft. above the sidewalk of Ninth Street in front, and 148 ft. above the tracks in the rear, the various story heights being given on the sections shown in the drawings. The third basement floor extends only eight bays from the rear of the building, where a heavily reinforced slab-and-pier retaining wall about 28 ft. high is built. The unusual height of 25 ft. from third basement floor to second basement floor, as shown on section AA in the drawing, was provided to allow the storage of long bars in special racks to be installed on this floor.

The difference in elevation of about 25 ft. between front and rear column footings made it necessary to drive and shore heavy steel piling across the site and build the slab-and-pier wall as a free standing wall with the steel sheet piling left in place.

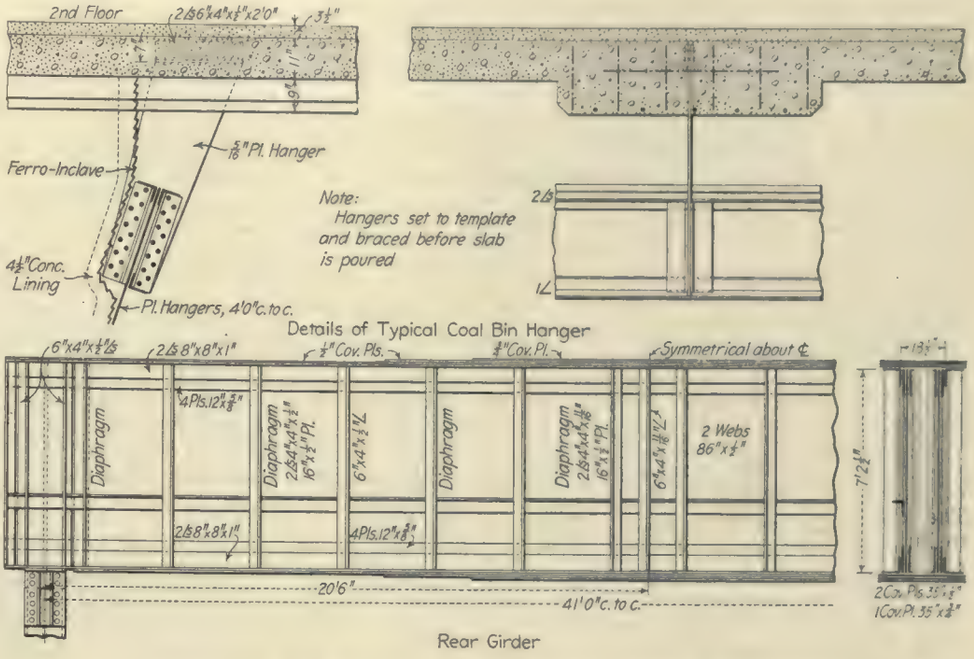
The steel stack with brick lining shown in the section is entirely independent of the building and is supported on a brick pier. The column foundations are of the usual reinforced-concrete type with two-way reinforcement. The allowable pressure on the soil of the foundations, which contained many pockets of quicksand, was generally taken at 7500 lb. per square foot, which was shown by a series of actual tests to be a conservative bearing value for the soil. At the northeast corner, where a stratum containing many quicksand pockets was found, steel piling cofferdams were driven and the footings carried down to a firm foundation. Design loads and unit stresses for the steel and concrete conform to the requirements of the Cleveland building code.

STEEL COLUMNS AND HEAVY GIRDERS

Although most of the columns are of reinforced-concrete, either octagonal with spiral reinforcement, or square with longitudinal rods, the 59-ft. columns in the rear from the foundations to the second floor are designed with steel cores and octagonal concrete fireproofing. The heavy loads on these columns, sometimes exceeding 2000 tons, were assumed to be carried by the steel, the allowable unit stress averaging about 13,200 lb. per square inch, except that 1/16 of the live load was assumed to be taken by the concrete inclosed by the four angles, as allowed by the Cleveland code. The accompanying detail drawing of a typical interior column indicates the manner in which the section is varied by the addition of 16-in. side plates to the main H-section and four angles. The 3 x 3-in.

shelf angles below each floor line are for the purpose of transmitting the heavy floor loads to the steel shaft of the column. A typical heavy cast-iron column base is also shown in detail on this drawing.

In the rear of the building at the second basement floor two heavy steel girders of 41-ft. span were required to support the columns above. In order to allow the installation of a 5-ton overhead trolley in the third basement, as shown in the plan view by heavy dash lines, with two outlets to the track in the rear and large unobstructed openings for material, the omission of two columns in this basement was necessary. The loads carried by the upper sections of these rear columns are more than 1,000,000 lb. each, hence the necessity for providing the heavy 30-ton girders whose sections are shown on the drawing. These two web-girders are riveted to the flanges on the H-columns which support them, are securely tied together with the diaphragms shown, are entirely covered with concrete as indicated by the section AA of the plan drawing, and support heavy square reinforced-concrete columns at their midpoints.

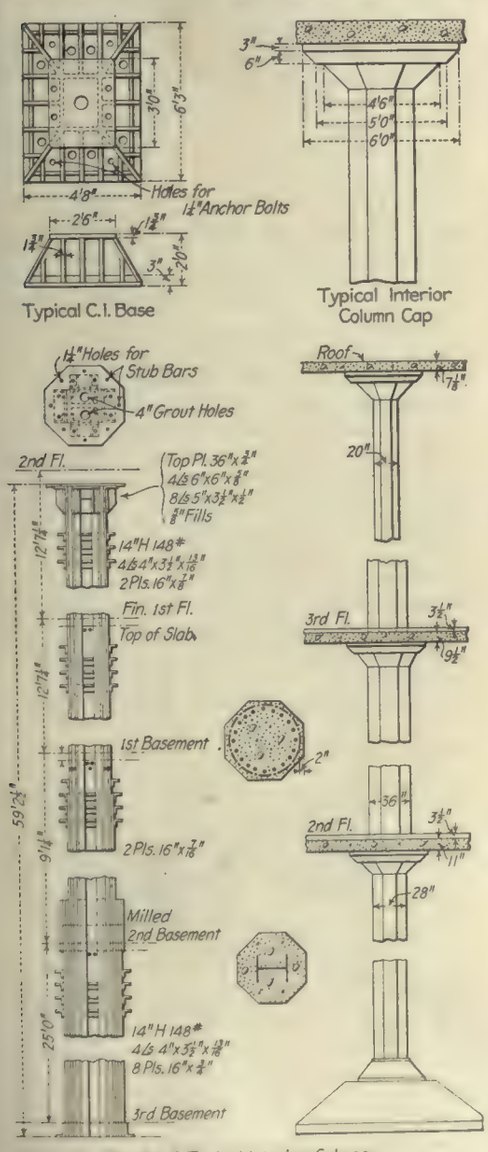


DETAILS OF COAL-BIN HANGER AND HEAVY STEEL REAR GIRDERS

TYPICAL COLUMN AND FLOOR CONSTRUCTION

The reinforced-concrete columns are mainly octagonal in form with spiral reinforcement and are flared out at each floor as shown on the accompanying elevation and section above the second floor, with typical cap dimensions of an interior column indicated. The floor is the patented Akme type, with two-way reinforcement. The typical thickness for these bags which are 20½ ft. square, are 11 in. for the live load of 500 lb. per square foot for first floor and the basement floors and 9½ in. for the 300-lb. live load from the third to the eighth floors inclusive.

The building contains several special features. A spiral package chute is provided, and pneumatic tubes are installed in the elevator shafts. The coal conveyor system from the coal receiving hopper to the 95-ton bins below the second floor is indicated on the section, and makes possible a very efficient handling of the coal for the boilers. Equally efficient is the method adopted for the disposal of ashes by storing in the hopper shown, and then chuting to cars by the chutes indicated on the sections.



COLUMN DETAILS AND CAST-IRON BASES

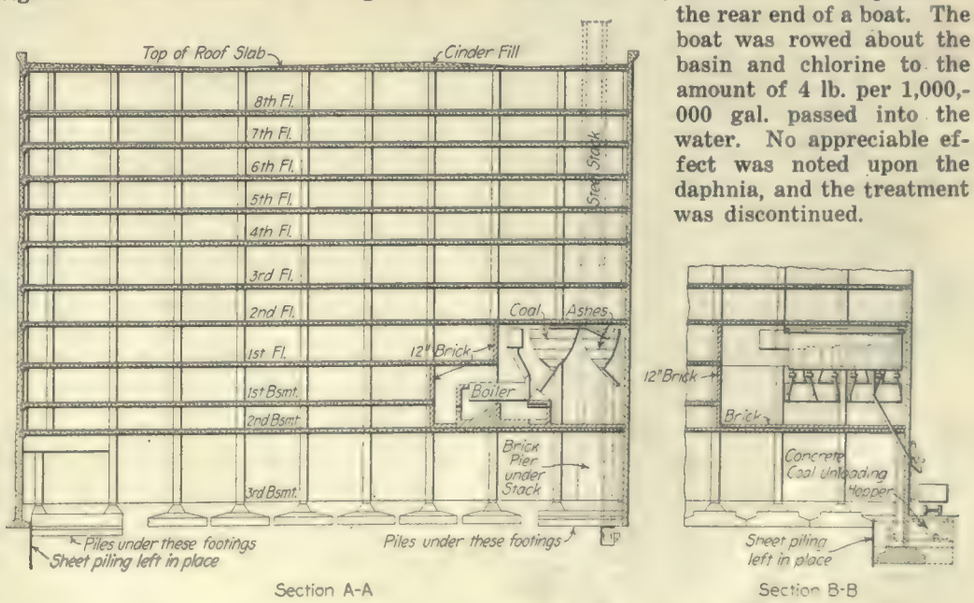
HANGERS FOR BINS

One of the drawings shows the details of the special steel hangers set into the concrete for supporting the coal and ash bins. These supports and bins were designed for coal assumed to weigh 50 lb. per square foot, and ashes 65 lb. per square foot. The usual allowable stresses were used for the steel and the allowable bearing value of steel on concrete was taken at 400 lb. per square inch.

The entire facing of this building is of paving-brick seconds, and all windows are of steel sash and wire glass. About 300 tons of cast iron for the column bases, 1200 tons of structural steel and 2300 tons of reinforcing rods will be required. About 38,000 yd. of concrete will be used, and the total cost will be about $1,000,000.

The architects for the building are Walker & Weeks of Cleveland. The design was made by Christian, Schwanzenberg & Gaede, engineers, representing the Akme system, and approved by T. J. Bryson, engineer for the architects. The general contractor is the Crowell-Lundoff-Little Company of Cleveland, and the structural steel is furnished by the McClintic-Marshall Company of Pittsburgh.

WATER FLEAS IN A ST. LOUIS RESERVOIR were not killed by the liquid chlorine applied to one of the basins. An iron pipe extending to within 1 ft. of the bottom was attached to a cylinder of chlorine placed in the rear end of a boat. The boat was rowed about the basin and chlorine to the amount of 4 lb. per 1,000,000 gal. passed into the water. No appreciable effect was noted upon the daphnia, and the treatment was discontinued.



SECTIONS SHOWING COAL AND ASH HANDLING ARRANGEMENT

Wicket Gates the Logical Development for Hydraulic Turbine Regulation

Careful Study of Efficiency in Commercial Operations, Freedom from Eddies and Corrosion and Other Advantages Sustain American Practice

By LEWIS F. MOODY
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Consulting Engineer, Hydraulic Department, I. P. Morris Company, Philadelphia

TWO ARTICLES which have appeared recently in the Engineering Record—the first entitled "Cylinder Gates Increase Turbine Efficiency," by A. G. Hillberg, in the issue of April 17, page 485, the second entitled "Do Cylinder Gates Increase Turbine Efficiency?" by H. Birchard Taylor, in that of May 29, page 690—have introduced a subject of much interest to all concerned with the development of hydraulic turbines. The discussion by Mr. Hillberg appended to Mr. Taylor's article has seemed to the writer to introduce a number of points which call for further consideration. In fact the whole subject is one of such importance that it does not deserve to remain in the indeterminate state in which this discussion appears to have left it. It is especially important to avoid misconceptions which may arise in the minds of engineers who are not fully in touch with the highly specialized branch of engineering which is concerned with waterwheel design, and such misconception is likely to arise due to the complete disagreement between the conclusions reached by the two authors mentioned.

EVOLUTION OF THE MODERN TURBINE

The modern hydraulic turbine is the product of gradual development during a large number of years, but a large part of the progress has been concentrated into a period extending back not more than about ten years. Fifty years or more ago turbines of all kinds were in use, both the so-called reaction and impulse types being used for ordinary heads, and inward, outward and axial-flow runners being employed. And the methods of regulating the turbines were as much varied as the types of turbines in use. Turbines of both the partial flow and the complete admission types were employed. In the struggle for existence a majority of the types failed to survive and the field became narrowed to a few arrangements.

At the time the first large Niagara plant was planned the field for large units had become narrowed down to the complete-admission "reaction" turbine of either the inward, outward or axial-flow type. The course of development then rapidly eliminated both the outward flow and axial types, leaving the inward-flow turbine as the sole survivor. This form had been advocated many years before by James B. Francis, the American hydraulic engineer, who showed that it had possibilities of higher efficiency than the outward-flow type. It is doubtful, however, whether this form of turbine would have survived rather than the axial-flow or "Jonval" type if there had not been another important consideration affecting the question. This consideration was the method of regulation or control which could be used.

CONTROL OF TURBINE OUTPUT

In order to control the power output of the turbine a few of the methods which have been used at various times are as follows:

In the early impulse turbines, which were of the outward-flow "Girard" type with partial admission, rotating gates were placed between the guides and runner which cut off successively the openings between the guide vanes, these gates operating by a circumferential motion. The evolution of the impulse turbine has witnessed the complete abandonment of these cylindrical gates, the modern impulse wheel being of the tangential type regulated by needle nozzle.

The early reaction turbines of the outward-flow or "Fourneyron" type were usually regulated by cylinder gates moving axially across the discharge space of the runner. The axial-flow or Jonval turbine

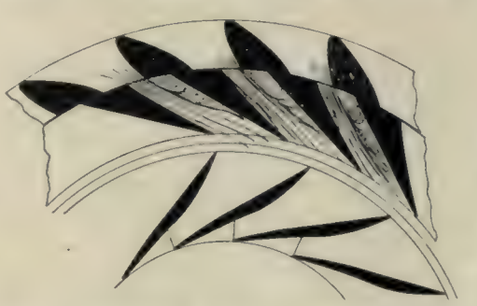


FIG. 1—REGISTER GATES PARTLY ROTATED

was the most difficult of all types to regulate in any efficient manner. The usual methods used were the use of rotating gates or a flexible covering which moved circumferentially and closed off the entrance of the guide passages one by one. This method of regulation caused a turbine which at full gate would have complete admission all the way around the runner to operate at part gate with "partial admission", meaning that water was admitted only part way around the circumference. These methods of regulation, which were available with the Jonval turbine, were entirely unsuited to the requirements of close-speed regulation which were demanded when the modern use of turbines for driving electric generators came into being.

THREE TYPES OF GATES

The inward-flow turbine, or the "Francis" turbine, as it has been named, can be regulated by the following methods:

1. The register gate, which may be described as a division of the guide vanes into two concentric rings, one within the other, either the inner or outer ring being movable circumferentially to fill the openings between the vanes in the other row. (See Fig. 1.)

2. The cylinder gate, which is a cylinder capable of moving across the space between the guides and the runner. In some turbines this gate was made to enter this space from the draft-tube side, but general practice favored its being placed on the crown side of the runner. (Fig. 2.)

3. The pivoted guide vane or wicket-gate arrangement which was formerly known in Germany as the "Fink" method. This method was adopted in some of the early American turbines and has come more and more into use, until to-day it is by far the most approved method.

All three of these methods were greatly superior from a mechanical point of view to those used with the Jonval turbine, and also gave superior efficiency for partially open positions of the gates. These considerations, the writer believes, are responsible in a large measure for the general adoption of the inward-flow reaction turbine at the present time as the surviving type. It is true that the Jonval turbine can be regulated by movable guide vanes similar to the ordinary wicket gates, but this arrangement involves complexities of design and manufacture and is mechanically inferior. The trend toward extremely high speeds in turbines of great unit capacity; that is, toward high "specific speeds," has caused a distortion of the inward-flow turbine until it has approached more and more the axial-flow type, and the modern runner of extremely high-speed departs widely from the simple inward-flow type. If it were not for the advantage of inward flow as affecting regulation the high-speed runner would probably approach the Jonval design more nearly than it would the simple Francis runner.

REGISTER GATES

In comparing the three methods of regulation, the register gate is mechanically simple, but it is so injurious to efficiency when partly closed that it must be discarded except in rare cases. The register gate is also subject to a heavy hydraulic load when partly closed and requires a considerable amount of power to operate it. When the register gate is partly rotated (see Fig. 1) the openings between the successive guide vanes are reduced so that the quantity of water is diminished; but at the same time, since the inner ends of the guide vanes stand at the same angle, this quantity of water is insufficient to fill the space between the vanes, and a large part of the passages becomes filled with eddies. This formation of eddies has two serious objections. The first is the resulting loss of head. and the second the great probability of dangerous erosion being caused, which is a vital defect. The formation of these eddies behind the guide vanes can be avoided by reducing the angle at which the vanes are inclined, thus cutting down the space through which the water is admitted, but at the same time allowing the water to enter the runner in a solid body of revolving water, so that even at small gate openings the water enters the runner with smooth flow and very little turbulence. This leads

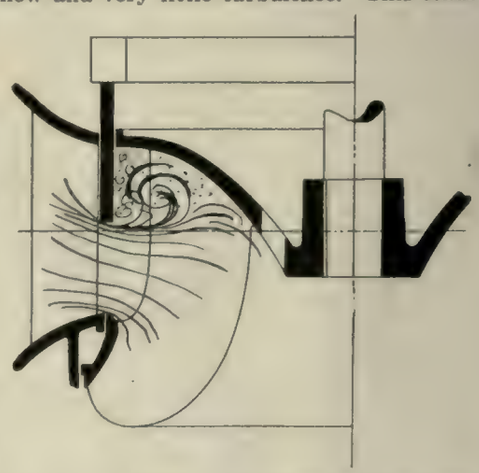


FIG. 2—CYLINDER GATE WITHOUT THE PROJECTING LIP

us logically to the wicket gate, in which the vane angle is changed to suit the quantity of water flowing.

Another unfavorable condition accompanying the use of register gates, and encountered in still greater degree in "partial-admission" turbines, is the variation in the flow through any given runner bucket from instant to instant as the bucket entrance passes from smoothly flowing to turbulent water and back again. The varying conditions thus caused set up surges in the buckets and promote vibration and unstable operation.

Cylinder Gates

The cylinder gate, while requiring less power for its operation than the register gate, is somewhat similar to the latter in that is couples with the reduction of the space through which the water is admitted the introduction of a space behind the gate filled with eddies and turbulent water. Instead of the turbulent condition existing in a series of spaces corresponding to each guide vane, with the cylinder gate the whole volume of water behind the gate is filled with eddies (see Fig. 2) in a manner similar to the space behind a board which is moved in a direction perpendicular to its plane through still water. The existence of this condition is shown not only by the low efficiencies obtained when the gate is partly closed, but also by the rapid erosion or corrosion of the portion of the runner back of the gate. This corrosion has in some cases been experienced even under low head; and when the head is moderately high the deterioration becomes so rapid that this type of gate is strongly condemned on this ground alone.

Attempts have been made to improve the efficiency obtained with cylinder gates by adding projecting lips outside the lower edge, as shown in Fig. 3. This addition has been thought to give a slight improvement; but such a change cannot eliminate the eddy-filled space behind the gate.

Wicket Gates

The action of the wicket gate, while permitting the water to enter the runner in a solid body as mentioned, also involves, to a certain extent, the formation of eddies after the water has entered the runner. This is due to the fact that when the direction of the entering water considered with respect to the rotating runner becomes inclined at a considerable angle to the direction of the runner vanes, spaces are left on one side or the other of the runner vanes which must be filled with eddies. Owing to the fact, however, that the runner vanes converge toward their discharge ends so

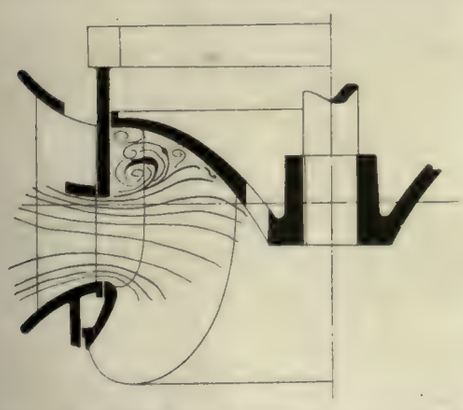


FIG. 3—CYLINDER GATE PROVIDED WITH THE PROJECTING LIP

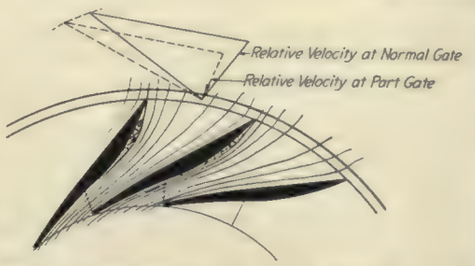


FIG. 4—DIRECTIONS OF FLOW, WICKET GATE

that the narrowest opening is at discharge, the water column is again brought in contact with both adjacent vanes, and at all moderate gate openings the water must fill the runner buckets at discharge. The loss due to this slight tendency to eddy formation remains small over a wide range of gate movement.

The greatest loss in efficiency caused by wicket gates when partly closed is probably due to the fact that the water no longer leaves the runner in a direction normal to the motion of the runner, so that a large discharge loss due to the resulting whirl in the draft tube is produced. The latter loss, however, is produced to an equal extent if either register or cylinder gates are used, since in all these cases the outflow area of the runner buckets retains its full value and is not adjusted to conform to the variation in the guide-bucket area.

Direction of Flow

Mr. Hillberg has noted an interesting theoretical point in comparing wicket and cylinder gates. In his discussion of Mr. Taylor's paper he states that "a stream of water fed to a turbine through wicket gates has different directions at different gate openings. In designing the gates and the runner it is customary to give the direction of flow the most advantageous angle at 0.8 gate. When a cylinder gate is employed the guide vanes direct the flow of the water at a constant angle for all gate openings, which naturally tends to increase the efficiency." This same view has been given in several books on hydraulics.

It is perfectly true that with the cylinder gate the absolute direction of flow of the entering water remains the same at all gate openings, while with wicket gates the absolute direction changes as the gates are rotated. In considering the effect upon the runner of the direction of the water, however, it should be remembered that it is the motion considered relatively to the rotating runner which must be taken into account, and not the absolute motion or motion with respect to the earth. When the turbine gates of either the cylinder or wicket type are partly closed the area through the gates is reduced, while the discharge area of the runner remains the same, as noted above. The effect of this is to permit the water flowing through the guide-vane orifices to reach higher velocities as the gates are closed (in the same way that the velocity through a valve in a pipe is increased when the valve is partly closed.) Referring to Figs. 4 and 5 it will be seen that whether the direction of the absolute velocity is constant or varied the magnitude of the absolute velocity will be changed, so that the relative direction of entrance of the water into the runner is changed in either case. Thus the formation of eddies within the runner is not confined to the wicket gate but also exists with the cylinder gate. In the latter case, however, the eddies due to this cause are added to the large disturbance immediately behind the gate, described above.

Efficiencies at Part Gate

From the above considerations it seems clear that we must look for a much more rapid decrease in efficiency when a cylinder gate is operated than would be caused by wicket gates. That this theoretical conclusion is in agreement with actual experience has been proved many times by turbine tests. The typical efficiency curve obtained from a cylinder-gate turbine shows that as the power is reduced the efficiency falls off almost in direct proportion, the curve being but little above a straight line.

The tests quoted by Mr. Hillberg appeared to upset this generally accepted conclusion, as indicated by the title of the first article. An analysis of the tests on which the article was based, however, shows that on the basis of these tests themselves, the exact reverse of the conclusion noted is unquestionably the fact.

The fallacy of Mr. Hillberg's conclusion arose from the fact that as the cylinder gate is closed a relatively large amount of motion is required to produce a small reduction in power below that at full gate. When the cylinder gate approaches the closed posi-

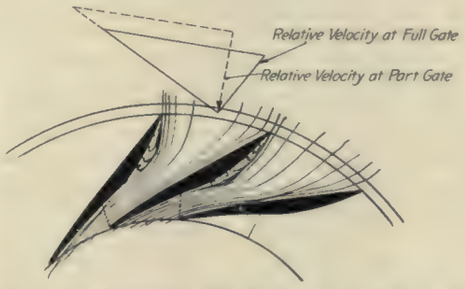


FIG. 5—DIRECTIONS OF FLOW, CYLINDER GATE

tion the rate of reduction in power becomes much more rapid, a curve of horsepower versus gate movement being decidedly convex. With wicket gates the same curve is very nearly straight up to the wide open position of the gate, when it bends over as shown in Fig. 6. While these considerations have some bearing on the action of the turbine governor, they are of no importance in connection with the turbine performance.

Values in Commercial Operation

In considering the value of the turbine in commercial operation, the curve showing the different efficiencies which may be obtained at different rates of output; that is, at different values of the horsepower, should be compared, without reference to the particular gate openings which are required to give these outputs.

It has been customary for some engineers, in specifying the desired turbine performance for new plants, to call for guarantees of efficiency at certain gate openings. This practice is likely to lead to confusion. The performance of a turbine should be judged only with respect to the efficiency which can be obtained at given loads; that is, the performance curve which is significant is a curve plotted between efficiency and delivered horsepower such as that given in Mr. Taylor's article for the same data as the curves mentioned above. An examination of the efficiency-horsepower curves for these data shows that the wheel having the cylinder gate gave its highest efficiency when the gate was fully withdrawn, and

that as soon as the gate was advanced even a small amount across the water passage the efficiency immediately began to drop. Therefore, it is clear that the only condition under which the cylinder gate can give good efficiency is when it is absent.

In the majority of hydraulic power stations it is desired to have the maximum turbine efficiency occur at between 80 and 90 per cent of the full load on the unit, so that for normal operation the unit can be run at or near its point of best efficiency, a margin in power being left above this point to carry the ordinary fluctuations of load experienced. This important characteristic cannot be obtained efficiently with the cylinder gate, because if the wheel is designed to give its best efficiency when the cylinder is not fully withdrawn, this efficiency will be impaired by the partial obstruction from the gate. The comparison of performance of the two turbines, the tests of which form the basis for these articles, would be still more striking if the runner had shown better part-gate efficiencies, and if the guide vanes used in the wicket-gate tests had been of such design as to permit the runner to develop its maximum efficiency. Thus the efficiency at half load is seen to be less than 75 per cent with the wicket gate and less than 70 per cent with the cylinder gate, both of which figures are considerably below the best results which have been obtained in other wheels of the same specific speed.

Comparison of Gate Mechanism

Referring briefly to some of the other points under discussion, the writer believes that a comparison between the mechanism used for operating the wicket gates in the most modern designs of turbines, with the operating mechanism required to handle cylinder gates in large units, will upset the idea which used to be accepted, that the mechanical operation of cylinder gates is superior to that of wicket gates. The writer believes the exact reverse to be true. The mechanism necessary for operating cylinder gates in large units is quite heavy and cumbersome, since the longitudinal motion of the gate must be received through several draw rods which must be connected by a heavy frame and guided so that they will have identical motions, in order to avoid any possible tilting of the gate. This mechanism, while capable of being counterbalanced to carry the weight of the gate, still involves a large amount of inertia which must be overcome when quick action is required of the governor.

Wicket-gate mechanism as now designed is extremely satisfactory from a mechanical standpoint. The small angular motion of the gates is accompanied by slight inertia effects and may be accomplished rapidly. It is true the gates are not balanced in all positions, and it is not desirable that they should be balanced. When properly designed the gates become hydraulically balanced at a small gate opening. When the unit is running at wider gate openings, a breakage of the operating gear would be followed by the automatic closing of the vanes to their balanced position, thus throwing the load off the unit and at the same time avoiding the complete closure of the vanes, an action which involves danger from water hammer.

Cylinder gates in the majority of cases are also not free from hydraulic load. Heavy hydraulic loads are particularly difficult to avoid when projecting lips are used.

In regard to the risk of damage to gates from trash lodging in them, the writer sees little to choose between the two forms. Movable guide vanes of large modern units are of such substantial design that little damage from this cause may be anticipated. It is possible in most cases to design the mechanism so that if an obstruction between two vanes should cause the entire governor power to be concentrated on these two vanes, breakage would still not be caused; and in all cases it is possible to design the links which turn the vane cranks so that these links will fail in tension before any other part of the vanes or mechanism will be damaged, the links being readily replaceable. An obstruction under a cylinder gate may sometimes produce a cocking of the gate which will cause it to jam, although this danger can also probably be avoided by heavy construction. Wicket gates have a decided advantage from the fact that their motion may be used to free them of trash.

Ice Difficulties

In connection with clogging by ice there is no reason why wicket gates should experience any greater difficulties than cylinder gates, and in fact it is possible to clear them of ice by opening them in a way which cannot be done when a cylinder gate is used.

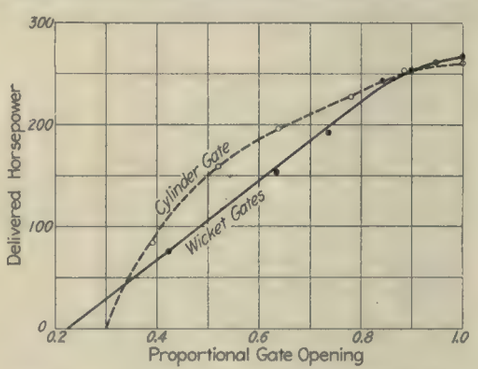


FIG. 6—COMPARATIVE HORSEPOWER AT VARIOUS GATE OPENINGS

It is, of course, possible for any turbine to be completely blocked with ice, but it is difficult to see why wicket-gate turbines should be more liable to clogging than those equipped with cylinder gates.

With reference to the experience at the Holtwood plant mentioned by Mr. Hillberg, I quote from the article of F. A. Allner, general superintendent of the Pennsylvania Water & Power Company, in the Engineering Record of July 24, page 115:

"Jan. 5, 1912.—No clogging up of the guide vanes on main units was observed on this occasion, and the disturbance to service was due to two causes, (1) the clogging up of the intake screens while proper facilities for removing them quickly were not available at that time; (2) the clogging of the runners (not guide vanes) in two small turbine-driven exciters after the removal of the screens. A motor generator exciter was at that time in process of installation but not yet available for service. Since then the alternating-current driven exciter and the installation of an excitation storage battery of ample capacity has removed the danger from this source completely.

"Feb. 14, 1914.—The reduced station capacity on this occasion was again due to the clogging up of the screens. Although slight adhesion of ice occurred at the guide vanes, one is inclined to ascribe this to the fact that the operator permitted his water level in the pit to drop below the intake of the upper runner, the cold air then chilling the machinery parts around the intake excessively. With the wheel-pit gages mounted on the floor and the precautions given in our standard instructions for handling such trouble, there should be, in future, no difficulty whatever in the wheel pits being kept filled.

"Jan. 30, 1915.—This is an occasion when the ice conditions were severe, but due to the methods of handling ice menace as developed from previous experiences, no interference to service resulted, though one main unit (No. 5) had its guide vanes (and probably also its runners) well clogged up, while the turbine-driven exciters suffered, at intervals, slight reductions in capacity. The waterwheel exciters were easily kept sufficiently clear with the assistance of steam. It could not be stated definitely whether any ice formed in the runners or about the guide vanes of these exciter wheels, because it was not necessary to inspect the exciter pits during the ice run. From previous observations, however, one is inclined to ascribe the occasional reduction of the exciter output to the formation of ice in the runner.

"The fact that ice clogged up the guide vanes of main unit 5 is ascribed to the extremely severe conditions during this ice attack, and it is believed that probably any other type of turbine gate mechanism may have met with the same fate. On the other hand, it is believed that the movable-vane type of mechanism assisted materially on this occasion in clearing the water passages, for after a short application of steam had rotted the ice the latter was easily broken up and cleared out by moving the guide vanes.

"The practice of keeping the guide vanes steadily in motion during ice trouble probably helps a great deal to keep the openings clear. In the case of unit 5 on Jan. 30, it is believed that the moving of the vanes was not attended to properly by the operator during the initial stages of the ice run."

Conclusions

It would seem a safe rule that cylinder gates should never be used except for extremely low heads, perhaps not more than 20 ft., on account of the great danger of corrosion; and that they should never be used when the water available for the plant must be conserved.

Whether the turbines installed by the Niagara Falls Power Company to replace their initial installation should be cited as fairly representing modern practice is decidedly open to question. To the knowledge of the writer no results of efficiency tests on these turbines have ever been published, nor is information available regarding the rate of deterioration of the runners. On account of local restrictions which governed the design, and for other reasons, the design of these turbines is hardly like to be copied in other plants.

In conclusion, it is believed that the line of evolution of turbine design in America has been in the direction of progress and improvement, and that the prevailing use of the wicket gate is a logical development and is fully justified by results.

THE UNITED STATES PRODUCED 66.36 per cent of the 400,483,489 barrels of petroleum that entered the markets of the world in 1914, according to statistics compiled under the supervision of J. D. Northrop of the United States Geological Survey.

Practical Suggestions Given for Building Wire Fences and Concrete Posts

Experiences in Inclosing Catskill Aqueduct Right-of-Way Cited by Ralph N. Wheeler, Department Engineer, Board of Water Supply

MANY miles of wire fencing on concrete posts have been erected during the last 3 yr. to define lines of property taken for the Catskill Aqueduct, and to mark rights-of-way and road crossings, all the work being done by contract. In the following paper, presented at the convention of the New England Waterworks Association in New York City last week, Ralph N. Wheeler, department engineer of the Board of Water Supply, explained in detail the methods of doing this work, giving many practical suggestions based upon the fence-building experiences on the aqueduct.

Two Cross-Sections Used

Several cross-sections were used for posts, all reinforced, the posts generally tapering toward the top. For the so-called line post the T-section, reinforced with three No. 5 gage wire rods, was generally used, but on some parts of the work a D-section reinforced by four similar wires was preferred. D-posts being built under an existing contract have four ¼-in. twisted rods. The line posts were generally 7 ft. 3 in. long, and are made to set 2½ to 3 ft. in earth and not less than 1 1/3 ft. in rock. For straining, gate and latch posts, the square cross-section was used, reinforced with four ¼ or ½-in. square twisted rods, depending on the length of the post. No ornamental tops were used, the only attempt at ornamentation being to provide pyramid tops for hinge and latch posts.

Table Method of Casting

All posts were cast in thin sheet-metal forms in horizontal position. The D or T-sections were assembled by the battery or the table methods, the former grouping comprising a small steel car with hinged ends, so designed as to permit the placing and filling of five layers of six molds each, and the latter consisting of a skeleton table on which the molds were placed. Both methods provide for tightly closing the ends of the molds. Preference is expressed for the table method, as the faces of posts are exposed for troweling or rubbing at the proper time; slightly more floor area is, however, required. Objections to the battery method are the drip from the upper layers, which tends to pit the faces below, and the impracticability of troweling or rubbing the faces. Joggling, essential for properly expelling the air, is accomplished by shaking the skeleton table or moving the battery car back and forward along its track.

How to Get Good Results

To secure good posts with either method the following points must be observed: Molds should be coated with only a film of oil. Concrete aggregates should be of two sizes, well graded, the fine up to ¼ in., and the coarse from ¼ to ½ in., for the smaller sections of post, and from ¼ to ¾ in. for the larger posts. The mixture must be very accurately proportioned, analyses being desirable to determine the exact proportions; generally about 1 part of cement of 3 parts, by volume, of aggregates gave the best results. The concrete must be thoroughly mixed and of wet consistency. The ends of molds must be sealed tightly with clay, plaster of Paris or cement, to insure good tops.

The air must be expelled by joggling and running a trowel back and forth through the mixture and along the sides of the mold while placing. The reinforcement must be placed in correct position; this can be accomplished without a spacing device after a workman becomes skilled.

Wires Should Be Rusted

The reinforcing metal, particularly round wires, should be thoroughly rusted or nicked to give a proper bond. Bending the ends of these wires back 180 deg. gave good results. As received from the mill the wires were greasy from the drawing process, and it was found necessary to hasten rusting by the use of a weak acid, afterward neutralized. Posts tested to failure showed that unrusted straight wires would pull through, whereas properly rusted ones, or those with ends bent, would break. It has been suggested that running the wire through a barbing machine such as is used in the manufacture of barbed wire nails would deform it sufficiently to give a good bond. This would add not over one-half cent per pound to the cost.

Posts must be properly cured. They can be removed from the molds in 30 hr., and may then be stood in approximately vertical positions and water sprayed over them from suitably arranged piping, or, preferably, they may be spaced in horizontal positions and covered with sand or sawdust, kept wet. Curing should cover at least two weeks, and better four. The rounding of edges of the exposed face can be accomplished in the form, but better by rubbing with a carborundum brick after erection and before the wire is stretched. If fencing is attached by wrapping wires, rough edges assist in holding the wires.

Handle with Care!

The T-section posts weigh 90 to 100 lb. each, and require very careful handling. They were transported from the casting yard to the work in spring wagons or trucks, generally about 40 posts to the load. Tests showed that the strength of the T-post was greatly increased by substituting three ¼-in. twisted rods for the three No. 5 gage wires, the weight of the reinforcing metal being practically doubled by the change.

Posts were set not less than 30 in. in the ground, and efforts were made to secure a pleasing profile of the tops. It was found very desirable to place stones in the holes around the bottoms of posts and to tamp the refill thoroughly. In swampy ground and where the fence line was curved, posts were generally concreted in, as otherwise the strain of the fencing would throw them out of line. It was found desirable not to set posts in filled ground, as on right-of-way banks, until the filling had stood through at least one winter.

Spacing and Bracing

Straining posts were placed at irregular intervals to suit the topography and alignment, but never exceeding 600 ft.; the average interval was somewhat less than 300 ft. Early experience proved that such posts should be concreted in. Two permanent angle-iron braces were generally used on straining posts, but in case the angle in the line made this impracticable a straining post was set at the angle point and another 16 ft. away, each provided with a single brace. The proper location of straining posts is of great importance if a tight, good-looking fence is desired. Therefore special study of this det ialsi necessary. Early in the work concrete brace bases were cast and set in position to support the lower end of the angle-iron brace. Better results were secured later by digging a hole and filling with concrete in which the lower end of the brace was set. Gate and latch posts were generally set in concrete, this method proving more effective in preserving alignment. All property-line posts were set with the face on the property line; in other words the posts are entirely on city property.

Factory and Field-Woven Fence

Two general types of fencing were used, factory and field-woven, the use of the former being more general. Both types were No. 7 gage throughout, and has seven horizontal strands, all heavily galvanized. The field-woven fencing was of the Knox type, with pickets spaced either 8 or 24 in. This type was used in more conspicuous locations, or over very irregular ground. The factory-woven fencing, made by the American Steel & Wire Company, was delivered in 20-rod rolls, and weighed about 1.1 lb. per foot. The weight of the Knox fencing with 24-in. spacing of pickets is about the same. For erecting factory-woven fence, stretching, wrapping, cutting and crimping tools were required. For erecting the Knox type a pair of light blocks for controlling the strain in each horizontal wire, and a special tool for fastening the pickets to these wires were required.

Many methods of fastening fencing to posts were considered, and the following was finally adopted and successfully used: At end, corner and straining posts the horizontal line wires were carried around the posts and wrapped on themselves, interfering verticals being cut out and the fencing kept under strain while this wrapping was being done. At line posts short wrapping wires, first of No. 12 and later of No. 9 gage, were used. These wires were delivered in bundles, each wire straight and long enough to make two wraps. They were cut into proper lengths, one cut giving the pieces for wrapping the top and bottom horizontal wires, another the second and fifth, etc., thus avoiding any waste.

Attaching Fencing to Posts

Two men generally worked together attaching these wires. The operation was performed as follows: A short bend was first made near one end, giving sufficient material for wrapping four times around the horizontal wire; it was then placed in position snugly against the side of the post and wrapped. The loose end was then carried snugly around the post and wrapped four times around the line wire on the other side. Care must be taken to keep the wrap in the horizontal plane of the line wire and to have it tight and snug against the post. Done in this way the fencing cannot be lifted up, and the batter of the post prevents sagging. This method

of wrapping is preferred because it does away with special attachment pieces or holes in the posts, permits the stringing of wire any distance above the ground or below the top of the post, and is economical. Wrapping tools can be bought for a few cents from fencing manufacturers, or can be made by a handy blacksmith.

Fencing was erected during practically every month of the year. Probably better results were secured from the warm weather work, although this undoubtedly caused more of a strain on the posts due to contraction in the colder months.

BRACES

Galvanized angle iron braces 2 x 2 x ¼ in. by 7 ft., or 2½ x 2½ x ¼ in. by 9 ft. were used. These were bent to fit the side of the post at one end and the concrete anchorage at the other, with holes at each end for attachment. The better way is to bend the upper ends of these braces at a sharp radius with the slotted hole to permit adjustment on sloping ground where bolted to the posts. The bottom ends can be simply bent down and concreted into the brace block. However, even this type of brace cannot be conveniently cut to length in the field, and those contemplating erection of fences should consider braces of 1½ in. galvanized pipe. These can easily be made in the field to special lengths and the use of couplings prevents wasting short pieces. One end should be flattened down for 4 or 5 in., bent to the desired shape, and drilled for the bolt connection. The other end is bent slightly and concreted into the anchorage or flattened and secured to a bolt in the anchorage. It is understood that reinforced-concrete braces, instead of angle-irons, have been used in the outskirts of Brooklyn for the wire fencing along the Sea Beach route of the new subway system put in operation this summer.

GATES

Gates generally 10 ft. long, made of angles and flats, were used freely in the line and right-of-way fences. A somewhat wider gate opening seems desirable. The top support is made adjustable and all hinge supports, top supports, latch plates and bolts are heavily galvanized. This is desirable when the difficulty of securing a good paint for exposed metal work is considered. Gates are locked by inserting the tongue of a small brass padlock through a hole drilled in the latch.

Experience to date has indicated no likelihood of trouble with the posts, although adjustments of gates and their supporting posts have been necessary, particularly on field rights-of-way. Early in the work the posts offered tempting targets to hunters, but it is believed the novelty has worn off. Frequently, too, some country Hercules would try the strength of the posts after erection and before wires were strung, by pulling back and forth, generally with disaster to the post. Once the wire is strung this danger is removed. The importance of securing dense, smooth tops is obvious, as disintegration by frost action is thereby reduced or eliminated.

It appears to Mr. Wheeler undesirable to attach fencing to either the hinge or latch post of a gate, for sooner or later the strain throws the gate out of line and adjustments are necessary. It is better to set extra posts, one of which should be spaced for a manway. Manway openings should not be too wide, particularly in regions where live stock is pastured. It is better to make them so that a man must turn sideways and then contract as much as possible to get through. In other words, the opening should not exceed 14 in. at the top if the posts taper; if not, the opening should not exceed 12 in.

The T-section post, from its peculiar shape, is particularly firm in the ground, but above ground it does not look much like a post. Mr. Wheeler suggests for consideration the use of a post of combination section, made up of a T-section below the ground and a D-section above. In this way a maximum of rigidity will be secured, and at the same time a section above ground which resembles an ordinary post.

The cost of fences erected by contract along the Catskill Aqueduct was approximately as follows:

Line fence with straining post and two braces every 300 ft., and line posts at 16-ft. intervals.	
Factory woven type	16 to 20 cents per foot
Knox or field woven type	19 to 22 cents per foot
Typical right-of-way, approximately 200 ft. long, with the straining and special posts, braces and gates incidental thereto	39 to 42 cents per foot

The type of fencing affected the cost of rights-of-way very little.

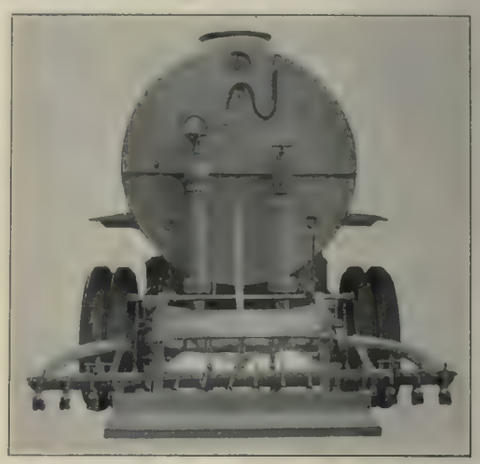
Road Oiler Developed to Meet California Conditions

Machine Designed Locally Has Proved More Satisfactory than Those Previously Obtained from Eastern Manufacturers

THE Los Angeles County Highway Commissioners several years ago decided to have local manufacturers build a road oiler which would be better adapted to southern California conditions than the machines which were bought from Eastern manufacturers. A road oiler was therefore designed and built which has, after various changes and improvements based on practical experiments, been developed into a machine which is said to give highly satisfactory results. The accompanying illustrations show one of the trucks built for the Los Angeles Division of the California State Highway Commission embodying all improvements made to date.

The oiler has a capacity of 1000 gal. and is provided with an insulating coat of manganese and asbestos compound 1 in. thick, and protected by an outer sheet of steel. It is designed for handling oil at from 250 to 350 deg. Fahr., and the oil can be kept in the tank for twelve hours without a decrease in temperature of more than 20 or 30 deg. The chief advantage claimed for the machine is its simplicity. The amount of exterior piping is believed to have been reduced to an absolute minimum, and the pump connections are so arranged that oil is easily handled whether loading or delivering in any one of several ways.

The pump is geared to the main driving shaft of the truck and can maintain a circulation of the oil through the boot while the truck is on the way to its work; thus the nozzles are heated and ready for service



CONTROL MECHANISM, REAR END OF OILER

the moment the truck reaches the road to be oiled. The nozzles, which can be operated either separately or collectively, are designed to give a fan-shaped spray from a single jet. This form of jet is said to be much more satisfactory than the ordinary duplex type. Each nozzle has two nipples, one for a delivery of from ⅛ to ⅜ gal. per square yard and the other for from ½ to 1½ gal. per square yard.

Between the pump and the boot a spring relief valve is so connected that if the pressure in the nozzles rises above 25 lb. per square inch an outlet back into the tank is automatically opened. This prevents the delivery of an excessive quantity of oil to the road surface in case the oil pressure is increased for any reason. The pump can draw oil into the tank through the intake shown on the top or can take on or deliver oil through entirely separate intake and outlet pipes at the front end of the tank.

The work near Los Angeles on which oilers of this type are being used is under the immediate supervision of W. W. Patch, division engineer, acting under the direction of A. B. Fletcher, chief engineer of the California Highway Commission.



SIDE VIEW OF OIL DISTRIBUTOR DEVELOPED FOR CALIFORNIA ROAD WORK



53RD STREET BENTS SET IN ADVANCE BECAUSE OF LONG STRINGER SPANS

Mile and a Half of Track on New York Elevated Line Rebuilt in Fourteen Days

Four "Humps" Erected on Express Track Without Interrupting Traffic on Outside Local Tracks—Difficult Erection Problem at Fifty-third Street

ON AUGUST 1 that part of the center or express track on the Ninth Avenue elevated line, New York City, south of Seventieth Street, was cut out of service, and express trains were run on local tracks south of this point. In the succeeding fourteen days a mile and a half of this track was rebuilt, four "humps" similar to that described on page 138 of the Engineering Record of July 31 being constructed. On Sunday, Aug. 15, a train was run over the rebuilt track, and express service was resumed on the usual schedule the next day. At no time was local service interrupted more than a few minutes.

A great deal of preparation was required for this rapid erection. New cross girders were inserted at many points, and a number of new columns were needed also. The old stringers under the express tracks were blocked up on falsework, so that the rivets connecting those to be removed with the cross girders could be replaced with bolts to allow their rapid dismantling. The new steel was largely delivered in advance and distributed along the street as near as possible where it was to be used. This steel was carefully checked to make sure that every piece would be on hand when it was wanted. The work of strengthening the old cross girders to carry the extra weight was also done in advance.



TRAFFIC STOPPED ONLY A FEW MINUTES TO SET 28-TON GIRDER

SEPARATE ORGANIZATION FOR EACH SECTION

A separate organization built each of the four humps, at Fourteenth, Thirty-fourth, Fifty-third and Sixty-sixth Streets. When the preliminary work was done, the track was torn up at each section to be rebuilt, and a traveler similar to that which built the Second Avenue humps, described on page 86 of the Engineering Record of Jan. 16, was set up on the old stringers. Every other panel of these stringers was removed, and, except at Fifty-third Street, the new bents and stringers were placed by the traveler as it moved ahead, as described in the article referred to.

FIFTY-THIRD STREET SECTION INVOLVED DIFFICULT WORK

The Fifty-third Street hump was the key to the whole scheme. It was not built for a station, as were the others, but to pass the express track over the southbound Sixth Avenue track which turns out of Ninth Avenue at Fifty-third Street. Two new cross girders and four new columns were required at this point, and both the Ninth Avenue and the Fifty-third Street elevated structures had to be supported on falsework to set them. The design of this falsework was complicated by scant headroom and the necessity of locating the towers so as not to interfere with double-track trolley operation under the elevated on both streets.

To carry the raised track at this crossing a pair of 28-ton through girders 100 ft. long were required, and the track had to be raised 3½ feet higher than at the other sections rebuilt. This, and the down grade of the existing structure south of Fifty-third Street, made this hump longer than the others. Then, too, the 60 ft. panels in this section were considerably longer than those at the other points, and the narrow traveler developed to work between the local tracks could not carry a long enough boom to reach out and set the bents ahead of itself. To rebuild this hump in the same time as the more simple sections therefore required more plant and careful planning.

LARGE STIFFLEG DERRICKS REQUIRED

While the preliminary work was being done a heavy steel stiffleg derrick with a 70-ft. boom was set up on towers around the northwest corner of Fifty-third Street and Ninth Avenue as close as possible to the west side of the elevated structure. As soon as the center track was torn up, this derrick erected a traveler equipped with an electric hoist just south of Fifty-third Street on the old center-track stringers. This traveler faced north. It backed south, setting the steel bents and removing every other panel of the old stringers as it went. The upper corners of these stringers were all burned off as soon as the track was torn up, so that they could be lifted out in a few minutes after being unbolted.



"HUMP" ERECTION AT 34TH STREET

TWO TRAVELERS REQUIRED AT FIFTY-THIRD STREET TO FINISH ON TIME

As soon as this traveler was erected, the big derrick set up a light traveler, or "jinny-wink," operated by a steam hoist from the street below. This traveler faced south and was set on the stringers north of Fifty-third Street. It backed north, erecting the steel bents and removing every other pair of old stringers. The hoist was moved with it on the street below. When the north end of the hump was reached, this traveler erected the wedge-

shaped stringers which start the rising grade, up to that panel in which the south end of the new stringers rested directly on top of a cross girder. This pair of stringers was set in place, but not riveted.

Meanwhile, the electric traveler had backed down to the south end of the hump and started north again up the new grade, setting the new stringers and moving forward over them. Before it had reached Fifty-third Street the stiffleg derrick had set the bents and 28-ton girders for the crossing over the Fifty-third Street turnout. One of the illustrations shows the second of these girders being set. These girders form a pony span, with the rail midway between their top and bottom flanges, and the traveler would not pass between them at track level. The big derrick therefore picked this traveler up bodily, slid it along the top of the girder span, and deposited it on the next pair of stringers at the north end as soon as these had been raised. The big derrick was then taken down. Meanwhile the traveler moved down the north slope of the hump, setting the remaining stringers as it went, until it came face to face with the jinny-wink at the north end of the reconstruction. Here the jinny-wink dismantled it and lowered it to the street. The last pair of stringers set by the jinny-wink, which had not been riveted, were slid apart to permit lowering the electric hoist. The small traveler replaced these, and was then itself taken down and lowered to the street.

Platforms Finished After Express Service Is Resumed

At the other three "humps," where station platforms had to be erected, the main traveler set only the first panel of each platform. On this was set a jinny-wink in each case, and the platform erection is now proceeding at the three stations without interference with traffic on the express tracks. The track in each case was laid behind the travelers, the materials being delivered by work train. In this way, by the time the steel was set the new track was practically ready for operation.

All steel was delivered and removed by teams on the street, and, except for the 28-ton girders at Fifty-third Street, hoisted up between the two outside local tracks. The longest delay to traffic on these tracks was 18 min., while one of the big girders at Fifty-third Street was being set.

Except the replacing of the third-rail and electric connections, which was done by the forces of the Interborough Rapid Transit Company, all the construction described was carried out for the Interborough under the general contract for the Manhattan elevated improvements, held by the T. A. Gillespie Company, executive, the Terry & Tench Company, Inc., and the Snare & Triest Company. The whole work is under the direction and supervision of the T. A. Gillespie Company, with Edward J. Govern as vice-president in direct charge. The forces of the Snare & Triest Company, under W. P. Rothrock as engineer, rebuilt the Sixty-sixth Street hump, while the other work was handled by forces of the Terry & Tench Company, Inc., under W. R. Coppage as general superintendent. George H. Pegram, chief engineer, F. W. Gardiner, principal assistant engineer, and S. Johannesson, general assistant engineer, of the Interborough Rapid Transit Company, had charge of the design and supervision of the work.

Chicago Takes a Traffic Census of the Loop

Bureau of Streets Seeks Relationship Between Density of Traffic and Its Waste-Collection and Pavement Problems

IN ORDER to ascertain the effect of traffic density on street cleaning, and for its value in determining the kind of pavement which should be laid on certain streets, Chicago's Bureau of Streets took between July 13 and Aug. 17 a traffic count of all vehicles passing through specified blocks in each direction.

The field force used in making the count consisted of twelve men divided into six groups of two each, five squads being for actual service and one for relief. The men were all section foremen from the various city wards. Previous to beginning the work they were cautioned as to the necessity of accuracy. A team of men was assigned to a block, one on each side of the street, to count the traffic in one direction only. Observations were made in forty-three different blocks, between the hours of 8 a. m. and 12 noon and 1 p. m. and 6 p. m., rain or shine. On Saturdays the men worked from 8 a. m. to 2 p. m. This afforded a means of counting the noon-hour traffic.

The following traffic statistics at different points in the downtown business and commercial districts were compiled for comparative purposes. They show the variations in conditions encountered as well as the congestion at specific points.

Densest Traffic in Chicago

The census taken at the Rush Street bridge revealed the fact that at this point traffic is heavier than at any other point in the city. For the 8 hr. in which the census was taken an average of 1700 vehicles per hour crossed the bridge during the day, or a vehicle every 2.12 seconds. Between 5 and 6 p. m. the traffic reached the peak, 2384 vehicles crossing the bridge during the hour—an average of a vehicle every 1.56 sec. The trend of traffic at this time is northbound, 1872 conveyances passing over the bridge in that direction. The difficulty which a pedestrian encounters in trying to cross the bridge during the rush hour can be imagined with a vehicle of some kind passing every 1.56 sec. Traffic across the bridge was distributed as follows: Horse-drawn vehicles, 19 per cent; auto trucks of all kinds, 6.3 per cent; automobiles, 74.7 per cent.

Busiest Street Intersection

The intersection of State and Madison Streets was found to be the busiest crossing in the loop, an average of 1548 vehicles passing per hour, or one every 2.4 sec. Street cars were found to run 11.8 sec. apart. Traffic was distributed as follows: Horse-drawn vehicles, 43.2 per cent, auto trucks of all kinds, 7.4 per cent; automobiles, 29.7 per cent and street cars, 19.7 per cent. Of this traffic 75.7 per cent was on State Street and 24.3 per cent on Madison Street. Traffic northbound in the block between Madison and Washington Streets was 35 per cent heavier than that southbound, despite the fact that there were 245 more street cars southbound than in any other direction.

Figures taken at eleven different points on streets west of State Street show traffic to average 254 vehicles per hour. At eleven different points on streets east of State Street, the average per hour was 192. Between Lake and Adams Streets on State Street an average of 442 vehicles per hour was counted.

In order to ascertain the length of time spent by vehicles standing backed up to the curb in loading and unloading on South Water Street and streets in the immediate vicinity, eighty vehicles of outside dealers were timed. These were found to stand at the curb an average of 1 hr. and 27 min., while ten other vehicles remained for an average of 4 hr. and 9 min. The vehicles used for hauling fruit and produce to the commission houses averaged from 15 to 30 min. in unloading and departing, while a number owned by parties who do a cartage business, after unloading, remained backed up to the curb for an indefinite time.

Street Cars 14.4 Per Cent of All Traffic

That the new-style heavy double-truck street car is as important a factor in the traffic census as it is in street cleaning may be seen when it is considered that of all the conveyances counted, there were 26,995 street cars or 14.4 per cent of all traffic, and on the streets on which there are tracks the street cars amounted to 21.1 per cent of the traffic. Of the streets on which there are regularly routed street cars, Dearborn Street south of Monroe Street had the lightest amount of street-car traffic. The greatest amount was found on the three-track State Street line, between Lake and Madison Streets, the street cars being nearly 26 per cent of the total traffic. At the intersection of State and Madison Streets there is an average of one car every 11.8 sec. in all four directions.

Of the 100,727 vehicles used for commercial purposes in the cartage of freight and other commodities, 82.2 per cent were horse-drawn and 17.8 per cent were auto trucks of all descriptions. Of the 59,950 carriages, buggies and automobiles used for carrying passengers, 0.9 were carriages, 2.2 per cent were buggies, 19.2 per cent were single-seated automobiles and 77.7 were automobiles with seats for four or more. This gives the percentage of horse-drawn vehicles to automobiles, 3.1 per cent to 96.9 per cent.

The total count showed that all traffic counted in the loop was distributed as follows: Horse-drawn vehicles, 45.1 per cent; motor-driven vehicles other than street cars, 40.5 per cent, and street cars, 14.4 per cent. The average number of vehicles per hour was 258 and the total hours counted 728.

The estimated tonnage used for each class of vehicle is the same as that adopted by the Bureau of Highways, Brooklyn, N. Y., which is as follows:

	Tons
Rubber-tired vehicles	
Large auto trucks, loaded	8
Large auto trucks, empty	4
Small auto trucks, loaded	3
Small auto trucks, empty	1½
Automobiles	1¾
Wagons and carriages	1½
Iron-tired vehicles	
Three-horse trucks, loaded	7½
Three-horse trucks, empty	3½
Two-horse wagons, loaded	4
Two-horse wagons, empty	2
One-horse wagons, loaded	2
One-horse wagons, empty	1

The entire count was under the direct supervision of Charles Smith, ward superintendent; W. J. Galligan, second assistant superintendent of streets, reporting to Walter Leininger, superintendent of streets.

HINTS FOR THE CONTRACTOR

Details Which Save Time and Labor on Construction Work

Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

[*Contributions to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

Dragline Fills In Ahead of Itself for Its Own Track

By LEON C. HEILBRONNER
Eastover Construction Company, Inc., Utica, N. Y.

THE ACCOMPANYING photographs show a drag-line tower mounted on a levee bank, which fills in ahead of itself for its own lower track. The Eastover Construction Company, Inc., is the contractor for excavating a channel through an island in the Chemung River at Corning. The completed channel is to be 85 ft. wide on the



FRONT OF TOWER ROLLS ON CAR TRUCKS

bottom with side slopes of 1½ to 1. The material excavated, which is all gravel, is to be wasted along the base of an existing dike on the north side of the river about 550 ft. from the channel. An 80-ft. dragline tower was erected, operating a 1½-yd. bucket, a 100-hp. boiler and a 12 x 14 hoisting engine being used. The tower was at first operated at the base of the dike on a fill 7 ft. above the river bed. The base of the tower, however, was so long as to prevent the material being brought near enough to the base of the dike to fulfill the specifications. Therefore it was decided to place the rear end on the top of the dike. This brings the front end at the toe of the dike, but 21 ft. above the bed of the river. Three standard-gage freight car trucks were connected and 12 x 12-in. timber columns placed on them and under the base of the tower at the front end. The tower is therefore supported only for about 8 ft. at the rear and 5 ft. at the front.

So that the track for the front end can be kept above ordinary high water at the least expense, a small hopper is placed on the front of the tower just above the base,



SPOUT FILLS TRACK AHEAD OF TOWER

and a 16 ft. dredge pipe with rubber connections hooked on to it. As soon as the tower is moved the bucket dumps into the hopper and the fill for the next section of track is made and graded.

With this outfit 500 cu. yd. per 8-hr. day is excavated, including time taken in moving.

Tunnel Driven Under Inclined Railway with Thin Earth Cover

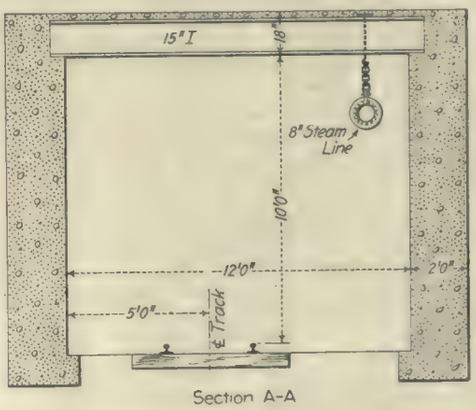
By R. A. RILEY
Riley-Knapp Construction Company, Pottsville, Pa.

A TUNNEL, driven with thin earth cover under an inclined railway which carried heavy traffic, has recently been completed at Frackville, Pa. The inclined railway is known as the Mahanoy Plane. The tunnel was designed for the purpose of hauling coal to the breaker in the operation of the Maderia Hill Coal Company's mine. The plane under which the tunnel is driven is a double-track cable hoist about 4000 ft. long, having an average grade of about 10 per cent. The Philadelphia & Reading Railway uses it to hoist its coal from the Mahanoy Valley to the top of Broad Mountain from where it is taken down the Schuylkill Valley to the Philadelphia market.

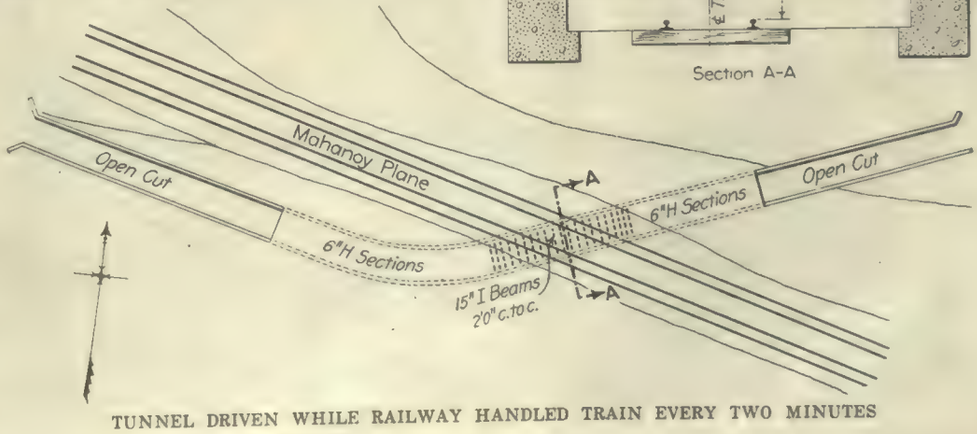
The Maderia Hill Company planned to mine coal on both sides of the plane, and was building a large breaker on the east side. In order to bring coal from the west side to the breaker the company had either to construct an overhead crossing or to drive a tunnel. The plane was operated by an engineer from a tower at its head. The construction of an overhead bridge would obstruct his view, and consequently the idea of the bridge was abandoned.

The tunnel section is rectangular, 16 ft. wide and 13 ft. high in outside dimensions, the roof being made of I-beams encased in concrete. The center line of tunnel crossed the plane on an acute angle, consequently the distance from the roof of the tunnel to the rail of the plane varied from 20 ft. on the east side to 11 ft. on the west side. The material between the roof of the tunnel and the plane consisted of clay and gravel. This material was very difficult to undermine, both because of its nature and because of the continuous pounding of the traffic on the plane, on which four 50-ton coal cars crossed the tunnel every 2 minutes. The cross-section of the tunnel took in about one-third clay and gravel, one-third the Little Buck Mountain vein of coal, and one-third the underlying rock, all pitched on an angle of about 60 deg. The rock occupied one corner of the section all the way through.

All materials were furnished by the mining company. For upright timbers 14-in. yellow pine was used. For collars 6-in. yellow pine was tried, but found too weak, and 16-in. oak was substituted. Directly under the plane where the impact was worst center props were placed under the collars until the I-beams were set. The tunnel was driven from both ends, taking out the full section without any advance heading except what was necessary in driving the fore poles ahead. The timbers were spaced every 3 ft. The mode of procedure, once the timbering was fairly under way, was to



Section A-A



TUNNEL DRIVEN WHILE RAILWAY HANDLED TRAIN EVERY TWO MINUTES

drive fore poles ahead and take out a bench about 3 ft. deep and 6 ft. high, placing the collar and bracing it. Next the excavation was made for the low-side leg, which was unusually in the vein of coal. The rock on the high side was then drilled for the collar or for a short leg if the rock was not high enough for the collar to rest on directly. The rest of the material was then removed by blasting and shoveling. One-yard rolling dump cars pulled by mules were used for removing the muck. The



THIN COVER MADE WORK DIFFICULT

drilling was done with two jack-hammers supplied with air from a company compressor installed near the tunnel portal.

The concrete work followed up the timbering as fast as possible, being started as soon as the headings reached the plane. Concrete was placed in about 20-ft. sections, and kept about 20 ft. behind the heading. This was done in order to make the span supported by timbers as small as possible to reduce the risk of a cave-in. Concrete materials were delivered by the plane, but because of the steep slope and the short space between the ends of the tunnel and the sides of the plane it was not thought advisable to set up a mixer and spout concrete through the roof. Consequently the concrete materials were unloaded from the plane (during dinner hour) and then shoveled through a chute in the roof of the tunnel to a mixing platform inside. Here the concrete was mixed by hand and shoveled directly into the wall forms and the roof. Thus, the concreting did not interfere with driving the tunnel, except for some slight damage done to the forms by blasting.

The work was carried on at the rate of 3 ft. per day, and a night shift was used about half the time. The cost of tunneling, the timber, track and power being supplied by the mining company, was $3.24 per cubic yard of $74.85 per linear yard. The concrete, for which materials were supplied by the mining company, cost $2.11 per cubic yard. It cost $0.0013 per pound to place the steel I-beams with their sheet-iron arches.

Use of Wrecking Crane Saved Money on Small Job

By R. C. HARDMAN
Colorado Springs, Colo.

SEEING the possibilities of a construction situation and making the best use of the facilities at hand, even when they do not happen to be the facilities reasonably provided to do the job, is an excellent way to save money. This is especially true on small construction work, where the cost of performing certain classes of work is made exceedingly high by the lack of the proper equipment, the purchase or rental of which would be out of all proportion to the size of the work.

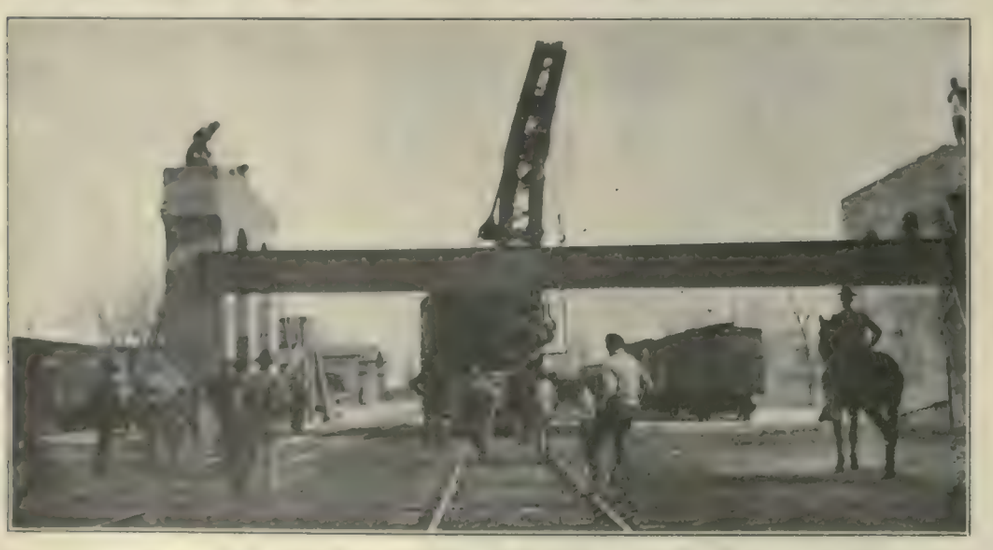
The writer recently had charge of the construction of a reinforced-concrete viaduct in which twelve steel plate-girders were used to carry the floor over railroad tracks. Six of these girders were 62 ft. in length and were placed 23 ft. above the top of rail. The remaining six were 67 ft. in length and 26 ft. above top of rail. The weight per girder varied from 4½ to 5½ tons. Equipment for placing these girders could not be provided on a concrete job, where they formed the only item of heavy steel to be set, and some concern was had as to the best and most economical method of erection. The problem was further complicated by the fact that they were to be placed over the main lines of two important railroads. The cost of assembling the simplest kind of hoisting equipment would have been prohibitive. Finally arrangements were made for the use of a large railroad wrecking crane.

The crane, which had a capacity of 220 tons, was operated by its regular crew, with a switch engine in attendance. Although the crane was self-propelling, the extra engine was provided to keep the outfit safely out of the way of passing trains.

The girders had previously been unloaded from flats by hand, consequently assorting them had not been feasible. Preparatory to erecting the crane had to pick out the girders needed in the proper order. For one span these were handled from a track about 100 ft. distant from the location of the girders, for the second span they were dragged by cable about 300 ft., picked up, carried about 300 ft. down the track and placed into position.

The time consumed in placing the girders was a day and a half, although the actual working time was very much less. The last six girders, by far the most difficult, were placed in 3 hr., or 30 min. each; this time included snaking the girders over to the track, picking up, moving the crane under the span and hoisting the girders and placing them upon their seats.

The cost of the work was about $4.70 per ton, which was a great deal less than the work would have cost if done by other available methods.



USING RAILROAD EQUIPMENT SAVED TIME IN ERECTING CROSSING VIADUCT

Boxing Cableway Anchorage Prevents Tampering with Clips

THE ANCHORAGE of the guys for the twin cableways used in building the Detroit-Superior bridge in Cleveland are boxed, as shown in the photograph, to prevent mischievous persons from tampering



BOX PREVENTS MEDDLING WITH CLIPS

with the cable clamps and endangering the lives of the men on the work. This was found necessary because the anchorages are "outside the fence" where any passerby on the street can get at them.

The viaduct is being built by the Hunkin-Conkey Construction Company, for whom Harry Hilton is engineer and Harold E. Ketchum superintendent.

A FIGURE-EIGHT SCENIC BOULEVARD is being laid out around the summits of Twin Peaks, the highest points in the city of San Francisco.

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

Construction on Philadelphia's New Subway Begun

Ma yor Blankenburg, in Presence of Great Throng, Turns First Spadeful of Earth on Afternoon of September 11

On the afternoon of Sept. 11 the public ceremony which marked the beginning of construction on Philadelphia's new subways was opened by the turning of the first spadeful of earth with a silver shovel, wielded by Mayor Blankenburg. This ceremony, which was witnessed by the mayor's cabinet, members of the City Council and of the department of city transit, and thousands of citizens, took place at the northwest corner of the City Hall Plaza. It was followed with speeches by A. Merritt Taylor, director of the department of city transit, and by Mayor Blankenburg.



A. M. TAYLOR (WITH PICK) AND MAYOR BLANKENBURG (WITH SHOVEL) START CONSTRUCTION OF PHILADELPHIA'S NEW HIGH-SPEED SUBWAY LINES

The first contracts for sections of the new transit lines were awarded on bids opened Aug. 16, for the City Hall section of the Broad Street subway and for constructing foundations for four miles of the Frankford elevated line. Some of the careful and thorough methods employed in locating and designing Philadelphia's new high-speed lines, as well as the progress of the city's fight for adequate transit facilities, have been noted this year in the Engineering Record of May 1, page 567, and of Aug. 21, page 242.

Trip to Kensico Dam Terminates Waterworks Convention

The convention of the New England Waterworks Association held in New York City, Sept. 7-9, an account of which was published in this journal last week, ended with an excursion to Kensico dam at Valhalla, on the afternoon of Sept. 9. The trip was made by special train, in which there was more than ample accommodation for all the excursionists. At Valhalla the party was met by several members of the engineering force at the dam, who led the way about the works. Although the visitors felt the intense heat of the afternoon considerably, it did not lessen their interest in the imposing structure or deter them from going up and down any of the steep inclines that had to be surmounted to get a thorough understanding of its several features. The arrangements went through without a hitch, ample time being provided to inspect the works without having to hurry back to catch the train for the return trip.

Western Society's First Fall Session a Military Meeting

The first meeting of the Western Society of Engineers on Sept. 11, following the summer vacation period, was devoted to a description of the 1915 engineers' camp at Belvoir Tract, Va., by Lieut. H. S. Baker, Corps of Engineers, Illinois National Guard. Capt. L. S. Marsh, Lieutenant Guilford, Sergeant Saner and Private Tomlinson amplified Lieutenant Baker's talk from the different angles of their respective ranks. Military matters are uppermost in the minds of Chicago engineers these days, for 10 per cent of the men who have enlisted for the citizens' camp at Fort Sheridan are engineers. In consequence there was an attendance of 130, despite the hot night.

Ernest McCullough is scheduled to speak on Sept. 20 on "The Engineering Society—Its Past, Present and Future Activities." Some of the subjects for coming meetings are: "Public Health Service," by Earle B. Phelps; "Currents of Lake Michigan and Their Influence on the Climate of Neighboring States," by Col. C. McD. Townsend, president, Mississippi River Commission; "Chicago Terminals," by Dean W. F. M. Goss; "Construction Features of the Winnipeg Aqueduct," by James H. Fuertes; "The Relations of the Railroads and the Public," by L. E. Johnson, president, Norfolk & Western Railway; "The Design of Pontoon Bridges," by H. J. Hansen, and "Ventilation," by Dr. E. V. Hill.

Road Congress Advocates Continuity of Policy

At Pan-American Joint Meeting Speakers Emphasize Need for Stable Organization and Long Tenure of Office for Engineers

(By Telegraph from San Francisco)

The Pan-American Road Congress, which opened its five-day session at Oakland, Cal., Sept. 13, combines for the first time the annual meetings of the American Highway Association and the American Road Builders' Association. The joint committee which was appointed to plan the sessions arranged to include in the congress the Tri-State Good Roads Association and the Pacific Highway Association, and as a result of this four-fold combination the discussion of papers covered unusual scope and breadth of experience.

The opening attendance was small compared to what might have been expected for a meeting of this character nearer the Eastern centers, but the manifest interest of those who had come far, coupled with the enthusiasm of Western delegates, more than compensated for the small number. The opening session was presided over by John H. MacDonald, former State highway commissioner of Connecticut. A notable feature of the early sessions when delegates were getting acquainted was that even veteran members of the associations met an unusual number of strangers. This was doubtless due in part to the joint meeting, but also because it was possible for many Western States to send more delegates than on former occasions.

Long Tenure of Office

Presidential addresses by Fairfax Harrison, for the Highway Association, and George W. Tillson, for the Road Builders' Association, emphasized the need for giving highway officials long tenure of office. There must be continuity of policy to insure success in carrying out the construction of any highway system, and stress was laid upon the great hindrance to the good roads movement arising from political interference in the management of highway commission matters. The elimination of wastefulness in highway construction, regarded as one of the primary purposes of the associations, could only be accomplished, it was shown, by planning and carrying out the work on a strictly engineering basis. Responsibility for directing the work should rest on a single individual or a commission of the smallest number feasible, appointed for long-term service. In this regard a sharp comparison was drawn between the history of highway work in the States of New York and Massachusetts.

In discussing the paper on "History and Future of Highway Improvement," by Logan Waller Page, it developed that laws are being urged in some States which would require counties to provide for the maintenance of roads at the same time that bonds for this construction are issued. Some States do this already, while others expect the sentiment against poorly kept roads to constitute a pressure enforcing proper repairs. In others the State takes over the maintenance of roads after they are properly built. Emphasis was placed on the necessity of recognizing the need for various types of construction on a single highway system, each suited to traffic requirements in a certain district. Citation was made of one highway system on which the same construction was used for the entire mileage, although 20 per cent of the road carried 75 per cent of the traffic.

It was pointed out that the steam age has centered people in cities and that now we are

entering the gasoline age, which is distributing the population into the country again. The fact that in this country farmers own a large and rapidly increasing percentage of the automobiles was cited as evidence that there is to come yet stronger and more intelligent support for good roads propaganda.

Who Shall Supervise Roads?

A paper on rural supervision of road construction, by C. L. Mackenzie, president of the Washington Good Roads Association, provoked much discussion on the question of whether road building should be under the supervision of county, State or Federal authority. Mr. Mackenzie believed that since 90 per cent of all road traffic is local, administration of road matters is most effective under local management. Experience in Washington confirmed this, he thought. C. A. Kenyon, president of the Indiana Good Roads Association, cited experience in that State where roads are built under local management. Indiana is now carrying $35,000,000 worth of 20-year serial bonds, the type of construction being uniformly gravel roads, costing $1,500 per mile. He deplored and strongly disapproved of the Indiana system and suggested that all proposed roads might well be classified as to distribution of nature of traffic and supervision into county, State and Federal roads, each classification to be built by the respective authorities. Without Federal aid, it was pointed out, roads could not be built across the swamp and marsh lands of the South or the desert land of the Southwest. The question was then asked, "If a State highway commission is good for administrating State highways why not a Federal highway commission for directing National road building affairs?"

Well-Known Engineers Named on Naval Advisory Board

Among those selected as members of the Naval Advisory Board, as announced by Secretary Daniels, Sept. 12, civil engineers and those whose activities have brought them in close contact with the civil engineering profession figure prominently. Among those named are: Alfred Craven, chief engineer of the New York Public Service Commission, First District; Andrew M. Hunt, consulting engineer, of San Francisco; William L. Saunders, chairman of the board of directors of the Ingersoll-Rand Company and president of the American Institute of Mining Engineers; Frank J. Sprague, consulting engineer, of New York City, and vice-president of the Sprague Safety Control & Signal Corporation, and Dr. R. S. Woodward, civil engineer, astronomer and geographer, who was for several years connected with the U. S. Coast and Geodetic Survey.

Alfred Craven

Alfred Craven was educated at the U. S. Naval Academy, from which he was graduated in 1867. After serving four years in the naval service, he resigned to engage in engineering work for the California State Geological Survey. In 1873 he entered private practice in California and other western States and continued in it until 1884, when he came to New York and was appointed assistant engineer on the forces of the New York Aqueduct Commission. His connection with the subway system dates from 1900, when he was appointed division engineer of the New York Rapid Transit Railroad Commission. In 1905 he was promoted to the grade of deputy chief engineer, which office he held until the creation of the Public Service Commission in 1907, when he was appointed deputy engineer of subway construction. In 1910 he served as acting chief engineer. He attained the office of chief engineer in 1910.

Andrew M. Hunt

Andrew M. Hunt was graduated from the U. S. Naval Academy in 1879 and served as engineer officer in the navy until 1894, when he resigned his commission to enter consulting practice in San Francisco in partnership with W. F. C. Hasson. This firm, previous to 1897, acted in a consulting capacity on the work of changing the cable roads of the Los Angeles Railway Company to electric and designed and installed the hydroelectric plant of the Victoria Electric Power Company, at Victoria, B. C., and a 800-kw. hydroelectric plant for the Nevada County Power Company. From 1897 to 1898 he was in Alaska where he constructed four steamers for work on the Yukon River. In 1899 he resumed consulting practice in San Francisco in association with E. H. Benjamin and Wynn Meredith. This firm designed and installed various hydroelectric plants, one of which, that of the Vancouver Power Company, Ltd., at Vancouver, B. C., cost approximately $1,000,000 and involved the construction of a water tunnel 13,000 ft. in length.

William L. Saunders

William L. Saunders was graduated from the University of Pennsylvania in 1876 and, from 1878 to 1881, was in charge of hydrographic work and subaqueous rock excavation at Black Tom Island, New York Harbor. Since then he has been identified continuously with the interests that are now included in the Ingersoll-Rand Company. He is the inventor of many rock drilling devices and is the author of "Compressed Air Production," and "Compressed Air Information," and co-author of "Rock Drilling," by Dana and Saunders, and "The Subways and Tunnels of New York."

Frank L. Sprague

Frank L. Sprague received his professional education at the U. S. Naval Academy, from which he was graduated in 1878, and was in the naval service until 1883, when he resigned to become assistant to Thomas A. Edison. In 1886 he began electric railway experiments on the New York City Elevated Railway and, in 1887 and 1888, constructed the Richmond Union Railway. He developed the Multiple Unit System of electric railways in 1897 and has built or equipped more than 150 electric railway systems.

Dr. R. S. Woodward

Dr. R. S. Woodward was graduated from the University of Michigan in 1872 and served as assistant engineer of the U. S. Lake Survey from that year until 1882. For the next two years he was assistant astronomer of the U. S. Transit of Venus Commission and, from 1884 to 1890, was chief geographer of the U. S. Geological Survey. From this work he went to the Coast and Geodetic Survey as assistant and, in 1893, resigned to become professor of mechanics and mathematical physics at Columbia University. In 1895 he was appointed dean of the school of pure science at that university. He held this office until 1904 when he was elected president of the Carnegie Institute at Washington, D. C.

Smoke Prevention Equipment Near Standardization

Growth in Uniformity of Practice Indicated at Association's Convention in Cincinnati Last Week

The general thought brought out by the papers presented at the annual convention of the International Association for the Prevention of Smoke, held at Cincinnati last week, was to the effect that equipment for suppression of smoke in stationary and locomotive practice was rapidly becoming standardized, but that considerable research is still necessary in the special application of furnaces to commercial processes, such as metallurgical work in connection with powdered coal, producer gas, etc. It was decided at this convention to change the name of the association to the Smoke Prevention Association and to admit to active membership anyone interested in smoke abatement.

William A. Hoffman of St. Louis was elected president for the ensuing year; C. W. Heath of Cincinnati, vice-president, and F. A. Chambers of Chicago, secretary-treasurer. St. Louis was selected as the place of next meeting, which was set for September, 1916.

The first afternoon of the three-day meeting was devoted to the general questions involved in smoke abatement work, with special reference to organization and the relation of the department to the public. "Civic Phases of the Smoke Problem," by John O'Connor, Jr., of the Mellon Institute of Industrial Research, covered these points. Other papers at this session were, "Starting the Work of a Smoke Department," by Martin A. Rooney of Nashville, Tenn., and "Value of Publicity," by J. W. Henderson of Pittsburgh.

(*Continued on page 370, first column.*)

New York Public Service Chief Engineer and Compressed Air Authority Chosen as Members of Naval Advisory Board



ALFRED CRAVEN



WILLIAM L. SAUNDERS

Baltimore Filtration Plant Placed in Service This Week

Rapid Sand Plant at Lake Montebello Opened with Formal Ceremonies September 13— Works Comprise 32 Filter Units, Each Having a Normal Capacity of 4,000,000 Gallons Daily

Baltimore's rapid filtration plant at Lake Montebello was formally dedicated and placed in operation on the morning of Sept. 13. The program for the ceremony, which was presided over by Robert L. Clemmitt, president of the Water Board, included the following addresses: "Baltimore's New Improvements," by Mayor James H. Preston; "Historical Sketch of Baltimore's Waterworks," by Richard Bernard, member of the Water Board; "Relation of Water Supply to Public Health," by Granville R. Jones, professor of sanitary engineering at Johns-Hopkins University; "Tuning-up the Filtration Plant," by James W. Armstrong, engineer of filtration; and "How the $5,000,000 Loan Was Spent," by Ezra B. Whitman, consulting engineer.

The Montebello filters comprise thirty-two rapid sand units, each having a normal capacity of 4,000,000 gal. daily. They are designed to operate at a rate of 125,000,000 gal. per acre daily. The chemicals used in the treatment of the water are common lime, hypochlorite, and sulphate of iron. There are two filtered water reservoirs, covered by ground arch concrete vaulting, each holding 7,500,000 gal. They cover a ground area of 250 x 500 ft.

Montebello is a place of more than ordinary natural beauty, and, as the plant is conspicuous from numerous viewpoints, it has been the aim of the designers to make the buildings harmonize with the natural surroundings.

All buildings are of similar design and construction. The structural portions are built of reinforced concrete, and the exteriors are covered with a local red brick of a pleasing soft color. The trimmings and belt courses are of a buff colored glazed terra cotta. The roofs are pitched 30 deg. and have overhanging eaves without gutters. They are covered with dark green, glazed Spanish tiles, supported on a cinder concrete roof carried by steel trusses.



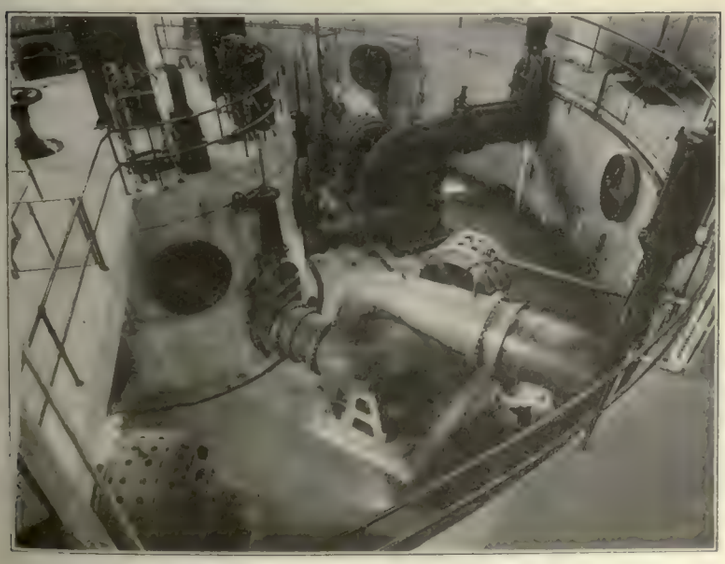
THE BUILDINGS OF THE NEW FILTER PLANT ARE OF RED BRICK AND THE ROOFS ARE COVERED WITH DARK GREEN TILE



TREATMENT OF TYPICAL ENTRANCE



ONE OF THE TWO OPERATING GALLERIES



CIRCULAR PUMPING STATION 23 FEET BELOW GROUND



WHERE THE CHEMICAL SOLUTIONS ARE PREPARED

One entire forenoon was given over to the discussion of railroad smoke. The papers presented were "Smokeless Operation Without Special Apparatus," by H. H. Maxfield; "Eliminating Smoke from Round-Houses," by M. D. Franey of Elkhart, Ind.; "How Smokeless Operation of Locomotives Was Obtained in Washington, D. C.," and "What the Railroads Have Done to Abate Smoke in Cincinnati," by G. H. Funk of Cincinnati.

"Special Furnace Applications to Manufacturing Processes" was the subject of a paper by Joseph Harrington of Chicago. It was followed by a paper on "Inforcing a Smoke Ordinance," by S. H. Viall of Chicago. An illustrated talk on "The Effect of Furnace Design on Fuel Economy in Smoke Abatement" was also given by O. Monnett of Chicago.

The marine situation was covered by Roy L. Peck of Chicago with a paper entitled "Smoke Abatement on Lake and River Steamboats." Another difficult problem was discussed by A. W. Clement of Des Moines, Iowa, with a paper on "Smokeless Combustion as Applied to the Burning of Clay Products."

Health Association Discusses Sewage Treatment

At Rochester Convention Many Subjects in Sanitary Engineering Field Were Dealt With in Papers and Reports

That the Imhoff tank for sewage treatment has followed the German army into Belgium and France since the occupation of those countries by the Teutonic forces, was the information imparted by Dr. Rudolph Hering to the forty-third annual meeting of the American Public Health Convention, held at Mechanics' Institute, Rochester, N. Y., Sept. 6 to 10. The meeting was a joint affair, in which the New York State Sanitary Officers' Association participated. Governor Whitman was tendered a reception and ball at the New York State Armory at which the visiting members and guests were present to the number of 5000. On the evening of Sept. 6 U. S. Surgeon-General W. C. Gorgas spoke of his work in Havana and Panama, and on Sept. 7 an open meeting listened to an address by Secretary of Commerce William C. Redfield.

Discuss Sewage Treatment

The section on sanitary engineering, of which George W. Fuller is chairman, held a joint session Sept. 7 with the section of public health officials, which consisted of a symposium on sewage treatment, largely with reference to isolated installations and small communities. Among the papers presented were: "Institutional Sewage Treatment Plants," by Charles Mebus of Philadelphia; "Sewage Digestion Tanks for Small Towns and Cities," by G. Everet Hill, New York City; "The Sewage Problem in Small Towns," by Paul Hansen, University of Illinois, Urbana, Ill., and "Sewage Disposal Problems of a Coast Summer Resort," by W. E. Brown, York, Me. General considerations were advanced in the handling of sewage from institutions and small communities, the expressed opinion being that the character and completeness of process should depend upon the money available and the kind of supervision and operation obtainable.

Health officers from Virginia, Indiana, Illinois, Saskatchewan and other parts of the continent described the various conditions which confront them. Prof. William T. Sedgwick, in discussing Robert Spurr Weston's paper on self-purification of streams, referred to the fact that some years ago he had stated that it was quiet water which purified itself rather than running water. Dr. Rudolph Hering stated that engineers wanted from the biologists more information as to the relative persistence of bacteria of different kinds. He also stated that the Germans have constructed many Imhoff tanks for sewage treatment in Belgium and portions of France.

The second session of the section on sanitary engineering, Sept. 8, was devoted to descriptions of various features of the convention city. Edwin A. Fisher, city consulting engineer, referred in general terms to the public works of Rochester, and briefly described the policy of the city with reference to its construction and maintenance. John F. Skinner, principal assistant engineer, described the waterworks and sewerage systems. Frederick T. Elwood, city engineer, dealt with the general construction of street pavements, bridges and street lighting. Herbert W. Pierce, commissioner of public works, took as his subject the maintenance and care of streets, including the collection and disposal of ashes, garbage and refuse. Calvin C. Laney, superintendent of parks, described parks and playgrounds.

Rochester has two sewage treatment plants under construction. One, on the shore of Lake Ontario, is the largest installation of Imhoff tanks yet constructed. It is designed for an ultimate population of 400,000. The smaller one consists of grit chambers, Imhoff tank, sprinkling filters and final settling basins, and was described in the Engineering Record of May 29.

Mr. Fisher, in his remarks, paid a glowing tribute to the late Emil Kuichling, who was a native of Rochester and had been closely identified with its waterworks, sewage disposal and street cleaning methods for many years.

The third session of the section, Sept. 9, took up the following program:

"Mosquito Growth in Catch Basins," by Dr. John W. M. Bunker; "Self-Purification of Sewage Polluted Streams," by Robert Spurr Weston; *"The Sanitary Control of the Rochester Water Supply," by Charles Wright Dodge; *"Studies on the Effect of Chlorine Disinfection Upon the Self-Purification of Streams," by Arthur Lederer and Frank Bachmann; "Purification of Sewage by Aeration and Growth," by H. W. Clark; "Cause of Rapid Increase of Efficiency and Rate of Deep Compared with Shallow Trickling Filters," by H. W. Clark, and "Some Remarks on Activated Sludge," by William T. Carpenter, Brooklyn.

The city of Rochester has no catch-basins. Many speakers, in the discussion of the first paper, held that they should be abolished and the sewers frequently flushed, the flushing to remove odors and deposits and the grit to be removed at the disposal plant as an economic proposition.

Committee Reports

The fourth session, Sept. 10, consisted of reports of committees as follows: Sanitary control of waterways, by Harrison P. Eddy; refuse collection and disposal, by Samuel A. Greeley; recent progress in refuse collection, particularly as relates to the use of motors, by Samuel A. Greeley; †street cleaning, by Samuel Whinery; sewerage works and analytical methods, by W. L. Stevenson.

Mr. Greeley's reports showed a mass of material collected on the use of motor trucks in various places, and indicated that improved methods are being tried in all sections of the country. Mr. Eddy stated that streams might properly be divided into two classes, those furnishing water supply, ice and raw food, and those not so used. He also held that the condition of the stream, after pollution had occurred, should be the criterion rather than the character of the discharge which polluted it.

Although Mr. Eddy's remarks were not presented as a formal report, but rather as a statement of means of approaching the problem, they elicited considerable discussion and generally favorable comment.

The report of W. L. Stevenson, assistant engineer, sewage disposal division, Philadelphia, was a very carefully prepared paper. Mr. Stevenson also presented a tentative method of determining the "drainability of sludge" from Emscher tanks.

*Read by title.
†No report.
‡Read by Secretary.

150 Engineers En Route for World Congress

Progress of the Party Which Left New York Last Week by Special Train for San Francisco

(By Mail to The Engineering Record)

With the presidents of all the National engineering societies (except the civil), aboard, and with a party intent on holiday making, the "Engineers' Special," carrying delegates to the International Engineering Congress at San Francisco, is, at this writing (Saturday afternoon, Sept. 11), bowling over the Kansas prairies. One hundred were in the party when the train left New York. Reinforcements have come along the way until the party now numbers 150, cared for in eight Pullmans, a compartment-observation car, two dining cars and a buffet-smoker. The high temperature and humidity have not sapped the energy of the card players; one car accommodates a bridge party, another a five-hundred party. A group who know not the allurements of the spotted pasteboards holds forth in "progressive conversation" in the observation parlor.

Representation of Societies

The representation by societies is as follows: American Society of Mechanical Engineers, 25; American Society of Civil Engineers, 23; American Institute of Electrical Engineers, 19; American Institute of Mining Engineering, 15; foreign delegates, 7. The remaining members of the party are guests and ladies.

R. B. T. Tinsley, manager of the Venezuela plant of the Barber Asphalt Paving Company, arrived in the United States from Venezuela just in time to take the special train from New York to the International Engineering Congress. Before going to Venezuela he was superintendent of construction of the Miraflores lock and dam.

Charles Warren Hunt, secretary of the American Society of Civil Engineers, was evidently intent on forgetting his responsibilities during the trip, probably expecting a full quota of work during the meeting of the society and the subsequent sessions of the International Congress. He wore in his coat lapel the badge of the Italian Society of Engineers, of which he is a member, but nowhere was the badge of the American Society of Civil Engineers in evidence on his person. Pressed for an explanation he said that the wearing of the Italian button made him a distinguished visiting engineer and so relieved him of responsibility.

Among the prominent men on the train were the following: H. J. E. Wenckelbach, of The Hague, and Robert Snellen, of Amsterdam, representing the Holland Engineering Society; Jean de Pulligny, of Paris, representing the French Government; José R. Villalon, commissioner of the Department of Public Works and a member of President Menocal's cabinet, Havana, representing the Cuban Government; Prof. A. E. Rohn, of Zurich, and Dr. Franz Nissler, of Freiburg, representing Switzerland; Roger Tappan, of Sjundea Station, Sjundby, Finland; Walter Chamley, of Sao Paulo, Brazil; John A. Brashear, president, American Society of Mechanical Engineers; J. J. Carty, president, American Institute of Electrical Engineers; W. L. Saunders, president, American Institute of Mining Engineers; Mansfield Merriman, president, American Society for Testing Materials, and Lawrence Addicks, president American Electrochemical Society.

Capacity of San Pedro Oil Reservoir Will Be 500,000 Barrels

The oil storage reservoir of the General Petroleum Company near San Pedro, Cal., on which construction has been started, as was noted in this journal Aug. 21, will have a capacity of 500,000 bbls., instead of 500,000,000 bbls., as was stated.

Engineering Record

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Engineering Record

A Weekly Journal Devoted to Civil Engineering and Contracting

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Coatesville's Dam Assured

IN the face of opposition which was commented on editorially in the Engineering Record of Aug. 28, page 247, the State Water Supply Commission of Pennsylvania has refused to rescind its permit for the construction of the water supply dam at Coatesville. It would have been a severe blow to the engineering profession if the State authorities had allowed themselves to be stampeded by the cry that dams in general constitute menaces which, in Coatesville's case, would eventually result in a repetition of the loss of life and damage to property during the Erie flood. Coatesville needs a new water supply system, and the attempt to block the Rock Run plans, if successful, would probably have resulted in more deaths from typhoid than from the actual breaking of any structure across the creek.

Bonds for Road Oiling

THE principle that bonds should not be issued for longer terms than the life of the improvement has become generally accepted. It would seem, however, that as soon as a group of men is assembled as a Legislature, the supposed knowledge of the individual is often not reflected in his legislative acts, if he may be judged by the statutes so copiously and freely piled upon the public. Without insinuating that the Illinois Legislature surpasses other States in its output of silly and useless statutory writings, one amendment to the road laws of Illinois recently enacted makes such a capital illustration that it should serve as a horrible example. Who, if asked for how long a term bonds should be issued for oiling earth roads, would even suppose a bond issue would be thought of in such a connection? Yet the last Illinois Legislature amends the road laws permitting townships to issue 15-yr. bonds for "hard roads" by including within the scope of improvements that may be constructed "earth roads to be oil treated!" Whether any township will issue bonds for such a purpose is exceedingly doubtful. But this is not the point; the fact remains that the road laws of Illinois, as now written, do permit townships to vote 15-yr. bonds for an improvement that may last not longer than six months.

Why Not the Contractor?

A DISCUSSION arose as to joint leakage and methods of testing water mains at the convention of the New England Waterworks Association held in New York City, Sept. 7 to 9. Engineers expressed their opinions and told of their experiences, and waterworks superintendents contributed their part. But one voice that could have added much valuable information was missing. The contractor was not heard from. In that particular discussion he could probably have spoken with as much authority as any other class present. To the engineer and waterworks superintendent the test is but a small part of a large work, and, if his department is a large one, he is acquainted with the action of the individual joint mainly through the reports of his subordinates. To the contractor the test is the most important part of the work and the individual joint is a matter of grave anxiety and deep interest. A leak to him means added expense, great or little depending upon conditions, but never so small as to be neglected. The primary object of the waterworks associations and similar bodies is to spread knowledge and hasten progress by an exchange of the results of studies, opinions and experiences. The contractor would have been especially welcome because no one appreciates the value of his knowledge more than does the man who has had charge of the works he has constructed.

As the Coast Does It

ELABORATE and cordial entertainment has always been a characteristic of the annual meeting of the American Society of Civil Engineers, but it may well be questioned whether the social annals of the society show anything to equal the delightful surroundings and the completeness of the session at San Francisco last week. The actual happenings are recorded in the news section of this issue. That account, by itself, would do a gross injustice to the San Francisco association of the society, for it tells nothing of the long and hard labor necessary to carry through the Del Monte excursion successfully. San Francisco is favored, of course, by having the California scenery at hand, but it took courage to convey the visitors a distance of 125 mi., providing conveyance by special trains and automobiles and arranging for out-of-door luncheons on a marvelous beach and in the heart of a giant forest. The setting was ready, it is true, but hearts less cordial would never have used the setting. One feature will serve to show how thorough were the preparations for the excursion. One of the trips took the party by automobile from Santa Cruz, 66 mi. across the Santa Cruz Range and through the giant redwood forest to San José. Previously a member of the San Francisco association had motored over the route and taken speedometer distances to points of interest. These points were then described in geographical order in a guide book prepared for the occasion, and markers were placed at the roadside to correspond with the distance points in the guide book. Moreover, two maps of the region traversed were prepared, photos engraved and inserted in the book. Little more need be said than that the San Francisco association has made for itself a reputation of which it may well be proud.

Engineering Economics

IT is notable that many of the papers presented at the International Engineering Congress this week treat their subjects from the viewpoint, not merely of technical detail, but of broad administrative policy. Briefly characterized, they might be said to emphasize the business side of engineering. This is true of the papers by Mr. Newell on irrigation, Mr. Stevens on railroads, and Mr. Lewis on city planning. Mr. Newell asks "Does irrigation pay?" and then proceeds to answer his question with statistics from reclamation projects in the United States and elsewhere. Some engineers might regard the question as one for the financier or economist and not for the designer and builder of works; but a broad conception of the duties of the engineer inevitably leads to the conclusion that it is part of his business to be sure of his foundations in this regard. Mr. Newell sums the matter up well when he says that if these works as planned and completed by the engineer are then found to be not financially successful, or not economically sound, he necessarily loses in the opinion of his fellow men. The business of the engineer is popularly supposed to be that of creating by the use of a dollar those results upon which the less able man would spend two dollars or more. If, however, the result of the dollar's expenditure is not capable of returning a fair interest and profit, then the engineer's reputation must suffer with that of others concerned. Obviously, therefore, he should devote thought to the economic as well as to the technical features of the works he plans.

Present-Day Railroad Building

RAILROAD building, the subject of John F. Stevens' paper at the International Engineering Congress in San Francisco this week, is a somewhat hackneyed topic, and the casual reader, looking over the abstract of this paper on page 381 and seeing subheads pertaining to "reconnaissance" and "pusher grades," may conclude at once that Mr. Stevens has said nothing new. And, in fact, he has not presented anything startling in its newness. Certain truths, however, and the adaptation of them to twentieth-century conditions, are so vital to successful railroad building, and are so often overlooked by promoters and locating engineers alike, that they are well worth

reiterating. This Mr. Stevens has done in a clear and logical manner, leaving to others the details and dealing with only the broad business principles—the balancing of safe probable income against probable outgo, the determination of whether the line should be built at all, and, if so, where, of what character and at what cost. The engineer, in his zeal for balancing cut and fill precisely, for holding to certain maximum grades and curvature, and for keeping the cost of land to a minimum, must never lose sight of the larger questions of whether the road, as he locates it, will pay, and whether it will pay as well as some other location and will permit adequate expansion to meet future needs.

Economy with Cantilever Beams

THE possibilities of large saving in weight of steel-frame buildings, which can be effected by the use of cantilever beam construction, are shown by an actual example in the article on the Mannheimer Building in St. Paul, on page 392 of this issue. In spite of the fact that it contains an uneconomical truss of 119-ft. span, on which comment was made in the issue of Aug. 7, the steel for this building is designed with unusual economy. This journal wishes to correct any false impression which it may have created regarding this design. Special architectural requirements for the spacing of window openings enforced the use of the steep diagonals and short panels which caused the loss of economy mentioned in the case of the 119-ft. truss. Although comparisons based upon cubical contents are not conclusive, the striking values given in the article, showing a saving of over 35 per cent for this building, compared with the averages for similar buildings, seem convincing, especially when it is noted that the columns are designed to carry a future additional story.

The special design of cantilever girder-beams supporting intermediate suspended beams between columns has resulted in marked saving over the usual construction. As stated in the article, the length of the suspended beams was fixed with the idea of producing equal positive and negative bending moments in the cantilever girder-beams. Calling x the variable length of the suspended span, a formula for this variable can easily be developed. It will be found that the positive bending moment at the center of the cantilever beam and at the center of the suspended beam, for assumed full uniform loading of w lb. per linear foot, is $wx^2/8$ in each case, assuming no restraint at columns or at the end connections of the beams. By equating this value to the negative bending moment at the column, $w(l^2-x^2)/8$, (if l equals the panel length, assumed constant throughout) and solving for the value of x, the length of the suspended span is found to be 0.708 l. For a panel length of 27 ft. 3 in., x is 19.3 ft., which checks closely with the value of 19 ft. 5 in. used by the designer in this building.

The foregoing analysis is based upon the assumption of full uniform load on all panels. If the live load w_l per linear foot be applied only on the cantilever beam panel, the positive bending moment at the center is of course increased. By equating its total value, $w_d x^2/8 + w_l l^2/8$, to the negative bending moment, $(w_d + w_l)(l^2 - x^2)/8$, the value of x will be found to be $l/\sqrt{2+r}$ if r is the ratio w_l/w_d. If the live load is equal to the dead load, for example, the value of x becomes $0.577l$. The positive bending moment, $wx^2/8$ for the suspended beam is of course decreased for this case, and these beams can be made lighter.

The principle applied by Mr. Payzant in the design of the beams in this building is certainly sound and undoubtedly results in economy, particularly for long panels. Although the theoretical formulas just given are suggestive, it should be noted that continuity of action, although certainly present both at the columns and at the end connections, is not allowed for in the analysis. The principle advantages of the design, in addition to its economy, are clear spaces for pipes to run down beside the webs of the columns and the ease in erection of the girder-beams outside of the columns. By the use of the diaphragms between the pairs of beams any eccentric stress on the columns, due to single panel loading, is greatly reduced, if not practically eliminated.

Sewage Effluents on Watersheds

ONCE again the question of the possible pollution of New York's water supply by the discharge of sewage from a State hospital on the Croton watershed presents itself for solution. Commissioner Biggs of the State Health Department has approved plans whereby the sterilized effluent from a sewage treatment plant, comprising Imhoff tanks and sprinkling filters, will be allowed "temporarily" to enter Mohansic Lake, which is tributary to Croton Lake and distant therefrom about 6 mi. This permit has raised such a storm of protest from New York City's representatives that it seems probable that the plans will be revised so that the effluent will be diverted from the Croton watershed and carried through a long sewer into the Hudson River.

In its general features the case is precisely similar to the one presented three years ago when the location of a tuberculosis hospital in Westchester County was under discussion. The Engineering Record sees no reason for changing the opinions expressed on this subject in its editorial columns Nov. 30, 1912, page 595. While the danger of contaminating Croton water with the treated sewage is, admittedly, remote it is best to follow a very conservative policy in matters affecting the health of several million people. The trouble is that skilled operation of sanitary works is not generally insisted upon in this country. If the day arrives when every sewage treatment plant is placed under the constant supervision of a sanitary engineer or a chemist it will be possible to place more dependence upon the effluent. That time has not yet arrived, and where a municipal water supply is not filtered, as is the case with Croton water, a sewage effluent which is allowed to reach a reservoir is a constant menace to public health.

Conservancy Legislation

AFTER being bitterly fought through all the courts of the State, the Ohio Conservancy Law is at last firmly established; and the Indiana Legislature, at its last session, passed a group of bills permitting the organization of various kinds of districts for conservancy and flood prevention work. The Engineering Record has already commented upon the organization, under the Ohio law, of the important districts under the lead of the cities of Dayton and Columbus. Recently the Upper Scioto Drainage and Conservancy District has been organized in Hardin County, Ohio, and petitions have been filed for the formation of a district in the basin of the Ottawa River. Campaigns are well under way for the carrying out of flood-prevention work under the new Indiana law at Fort Wayne and Kokomo, and steps are under consideration at other points.

Credit is due to the Buckeye State for having evolved out of the disasters of the spring of 1913 so effective a method of expressing its enterprise; and Indiana places itself well in the van of the States by following so closely the example of Ohio. But all of these projects are most significant as straws which show the way the wind is blowing. These activities are but typical of the growing interest in flood prevention throughout the country. There is little doubt that more and more legislation of this character will be passed during the next few years.

Such legislation, if successful, must take advantage of the experience under these pioneer laws and must be based upon a knowledge of their weaknesses as well as their strong points. It is interesting to note, therefore, that the defects in the Ohio law are already beginning to be apparent. The Upper Scioto district, with headquarters at Kenton, is located in the same basin as the district which centers in the city of Columbus. The upper district is flat and includes within its limits a great onion marsh which is perhaps the most important economic feature of the district. Its great problem is a drainage problem—to get the water away from its fertile lands as promptly as possible. The lower district includes the capital of the State and one of its wealthiest communities. Its problem is to protect a great concentration of property value from the effect of floods, and the project which is being developed as most effective and economical involves the storing of flood waters in the upper reaches. It is already apparent that conflict of plans is probable. For such cases the Ohio Conservancy Law provides only a contest before the courts by the proponents of the conflicting plans. The result is more apt to be a compromise, less well adapted to the needs of either district, rather than

a comprehensive correlation of plans so as to secure the most economical result and the greatest possible benefit for the entire basin.

It is important that future legislation of this character shall not ignore the fact that a stream is a unit from its source to its mouth; that States, counties and other political sub-divisions are artificial rather than natural units; and that the problem of flood control, broad as it is, is but one phase of the still larger and more important problem of water conservation and stream regulation. The prevention of such conflicts as appear likely to result from conditions in Ohio, as well as efficiency, economy and the greatest good of all the people, should require that plans for conservancy projects should be subject to the review of State and National conservancy commissions, endowed with ample resources and authority, and charged with the harmonizing of local interests and the co-ordination of the needs of water supply, water power, flood control, navigation, drainage and irrigation.

What the Pan-American Road Congress Accomplished

A JOINT convention of the two National highway organizations has so long been urged and its benefits so often explained that any such combined meeting would be predestined to success if for no other reason than by sheer force of the moral support that would be unconsciously extended by all. A joint convention was the only logical outcome, since both associations desired to meet on the Pacific Coast, and the total number of delegates from both organizations who could be expected to travel so far from the eastern centers of road-building activity was needed to constitute a representative gathering.

The first question as to what the Pan-American Road Congress accomplished is naturally in regard to any permanent plan for joint annual sessions. While no definite action on this subject was taken it may be assumed that the committee appointed to "consult with similar committees of other organizations called for the purpose of bringing into closer relations the efforts for road improvement in the eastern and western portions of the United States, and to consider suitable recommendations for such changes in the constitution and by-laws of the association as will best secure these desired resolutions" will consider the question of a joint session next year. If a permanent arrangement for a joint annual meeting results, this alone will have made the journey to the Coast worth while.

Although some excellent papers were presented, the sessions were not as well attended as would have been expected at a convention in the eastern or middle-western centers and, in fact, not a few of those who went to California primarily to attend the meetings were kept away from some of the sessions by other attractions found in the Exposition City. This neglect, however, cannot be charged entirely to the delegates, for several features of the convention plan militated against maximum attendance.

The fact that Oakland, where the meeting was held, is the terminus of the Lincoln Highway was not a sufficient reason for holding the sessions in that city at a point more than an hour's travel from the Exposition grounds in San Francisco. A meeting hall within a 20-min. ride of the Exposition would have made it possible to open sessions more nearly on time and would undoubtedly have increased attendance and greatly lessened the inconvenience and formality of conducting proceedings from a stage. The bad acoustics in a hall with 1200 empty seats was also in sharp contrast to the comfortable rooms seating 200 or 300 that were used in San Francisco by other conventions.

One point in the discussion that aroused interest far more intense than any other was a phase of "preparedness" entirely within the field of the road builder. On this score officials responsible for the Congress are to be heartily congratulated on the stand taken and the spirit shown in the debate that continued 2 hr. beyond closing time to get at the bottom of the question. The opposition cry of the pacificists was heard when the word military was introduced in the resolution (given in full elsewhere), and under the claim for a right to equal distribution of Federal attention to all parts of the country, eloquent argument against the resolution was offered. Fortunately the desire for peace and safety and the real facts of the case were deeply impressed on the minds of those who fathered the resolution and the opposition only brought out the significance of underlying principles in a way that startled the convention and won almost unanimous support for the measure. Broad-minded men having National interests at heart, big men who are above the suspicion of scheming for petty private interests, are sorely needed in such crises.

Smoke Prevention Difficulties

SMOKE in Chicago is gradually becoming less of a nuisance as more and more of the older plants go out of commission and the owners and officials come to a better understanding in the enforcement of the smoke ordinance. Following the adoption of the "thirty-day rule" in January, 1914, the number of violations reported per hour of watching per observer immediately dropped off more than one-half. Under this rule two violations observed upon a stationary plant or marine craft during thirty consecutive days constitute sufficient cause for suit. When a violation is observed a letter of warning is sent the owner. This stringent policy was adopted after the Smoke Department had labored incessantly for several years with plant owners in an effort to clean up their stacks. It was found that the "constant smokers" remaining needed to be controlled with a stronger hand. That the policy is sound is indicated by a chart shown at the recent convention of the International Association for the Prevention of Smoke at Cincinnati by S. H. Viall. In 1910 the average smoke density of stationary plants was 6.5 per cent. In the next four years it dropped by the following steps, 4.7, 4.6, 3.8 and to 3.4 per cent for 1914.

Locomotives showed a much greater fluctuation. In 1910 the smoke they emitted had a density of 22.3 per cent; in the next four years, 7.4, 10.7, 6.1 and 7.4 per cent respectively. The suit policy against railroads is similar to that applied to stationary plants, and has been developed from data compiled from a number of years' experience which indicate the relative opportunity the Smoke Department has of seeing locomotive stacks, due to the number of engines operated in the city by the railroad, to the location of the railroads, and to the opportunity of observing locomotive stacks as compared with the opportunity of observing the average stationary stack. Taking these factors into consideration a schedule was worked out which allows the different railroads a varying number of violations per month. If a railroad is observed violating in excess of the number allotted to that road, suit is started upon the evidence of all violations reported for that month.

That this record is not accomplished without great effort, patience and a certain amount of co-operation on the part of the public was brought out very distinctly by Mr. Viall. One of the difficulties of the smoke inspector's position—and of any other inspection service requiring a duplication of the same effort—is the danger of getting into a routine rut. Firemen will quickly learn if they are caught violating only during certain hours. Speaking of the rut of routine, Mr. Viall believes that the smoke inspector is to be pardoned when he feels that all parties offering excuses or reasons for violations of the smoke ordinance are traveling in the same rut. There is but little variety in the explanations received. At times the inspector is tempted to get out a set of printed forms so as to save his friends the trouble of dictating and himself of reading the same stories over and over again.

As to the co-operation on the part of the public many citizens think all that is necessary is to make a complaint to the smoke inspector's office. This helps to a certain extent, but not as much as if the citizen also complains directly to the owner. Many plant owners tell the smoke inspector that no one in the neighborhood is complaining, that the smoke inspector himself is the only one who is finding fault, and that he, the smoke inspector, is doing so merely to be officious and make trouble.

It requires effort on the part of the public, as well as patience of the officials, to follow matters through the courts and for that reason any other amicable method seems in the end to be extremely desirable. One of these tried in Chicago with success is to promote a rivalry between owners and their employees so that each will try to have a better average smoke density record than his neighbor. The department notifies the owners from time to time of their position in the honor list.

New Plant Marks Further Step in Development of Deerfield River, Massachusetts

Construction Costing Nearly $1,500,000 Completes Another Link in the Development of This River—Part I, Design

THERE APPEARED in this journal Feb. 1, 1913, page 116, Feb. 8, 1913, page 153, and Feb. 15, 1913, page 181, a series of articles on the general scheme for the complete development of the Deerfield River in Massachusetts and a description of the first steps toward carrying out that scheme. At that time there were under construction the three hydroelectric stations near Shelburne Falls, the Somerset storage reservoir, and the power house only of the Hoosac Tunnel, or No. 5, station. Up to January, 1915, the last-named station had been used as a frequency-changer station. The present article deals with the design and construction of the structures necessary for converting this electrical substation into a hydroelectric plant utilizing a head of 240 ft. The work deserves special attention because of the remarkably short period of time in which it was completed. It was started the last of April, 1914, and on Jan. 20, 1915, power was delivered to the line. The cost was nearly $1,500,000.

General Features

The completed plant conforms to the original general scheme, but differs in detail to the extent that instead of a new dam being erected about three-quarters of a mile below Monroe Bridge, as at one time contemplated, rights were acquired to take water from the Monroe Bridge dam. While this arrangement added about 33 ft. to the normal operating head and did away with the construction of a new dam, it did not simplify the construction, as it added a complicated intake structure, an 1100-ft. tunnel, 2200 ft. of 12-ft. reinforced-concrete conduit and about 600 ft. of canal.

The work involved in completing the hydraulic part of the plant consisted of an intake at the dam, three sections of 12-ft. reinforced-concrete conduit with a total length of 5000 ft., three sections of open canal with a total length of 9800 ft., four concrete transition structures, one special spillway and brook-intake structure, a concrete surge tank, three 7-ft. steel penstocks with a total of 1600 ft. and three 7500-hp. turbines.



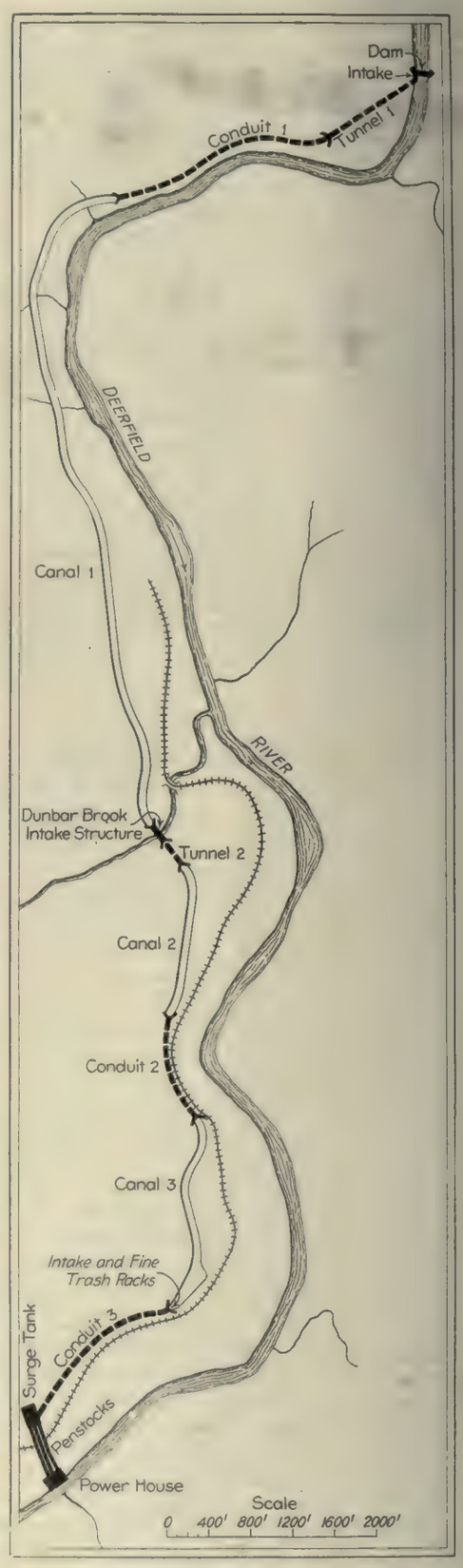
SURGE TANK AND POWER HOUSE

General studies only had been made of the design previous to the beginning of the work, so that the designing and detailing was done just ahead of the construction. In the work of designing, simplicity for the sake of ease in construction, consistent with maximum operating efficiency of the completed plant, was constantly kept in mind. The question of pondage was of much importance for the operation of the plant, and a general rule followed in determining between conduit and canal for any given location was to build canal if practicable, even to the point where it might cost considerably more than conduit.

Intake and Conduits

The intake is a concrete structure, entirely on ledge, at the west end of the old dam at Monroe Bridge and occupies the site of a former pulp mill building, which had to be demolished to make way for it. By careful study the structure was designed to increase the spillway length of the dam proper from 111 to 141 ft., by passing the water to the intake through a double rectangular passage underneath the concrete spillway. The water from the spillway passes over the roof of the intake entrance and thence off the side of the structure to the channel below. The intake water passes through the double passageway to an open well about 50 ft. downstream from the crest of the dam. On the river side of this well are two submerged sluice-gates 7 ft. 9 in. x 8 ft. and over these gates a spillway at an elevation 3 ft. above the elevation of the dam crest. On the downstream side of the well, and at right angles to the submerged sluice-gates, is located the main intake, with an opening of 12 ft. 6 in. x 13 ft., controlled by a gate made up of a structural-steel frame filled with concrete. Downstream from this main gate is located a Stickney siphon spillway with a throat of 20 sq. ft. The three gates in this structure are operated by a motor located in a gatehouse over a part of the structure.

From the intake structure the water enters a tunnel 1100 ft. long, about 400 ft. of which is through rock and 700 ft. through earth. The tunnel through rock, equivalent to a 16-ft. circular section, is unlined except for the seals near the ends of the rock section. The section through the earth is horseshoe shape and equivalent in area to a 12-ft. 2-in. circular section. At the lower portal the tunnel is made continuous with the first of the three 12-ft. circular reinforced-concrete conduits. All three sections of these conduits are placed on a bench cut in the sidehill. Conduit 1 is 2200 ft. long. At its outlet to canal 1 there is a transition section, in the design of which an attempt was made to conserve the velocity head of the water flowing in the conduit by means of such a structure as would give a well proportioned velocity-distance curve. This same type of structure was also used at two other points.



GENERAL LAYOUT OF WORK

Canal 1 extends 6600 ft. and, in general, follows the contour of the sidehill, the material being removed from the canal prism and placed in an embankment forming the lower side of the canal.

Dunbar Brook Structure

At the lower end of canal 1 a brook with 12 sq. mi. drainage area intersects the line of canal. This brook with its steep descent has the reputation of being a torrent at times. Briefly the problem here was to deal with the brook in a manner to allow the utilizing of the water from it under all ordinary conditions and still furnish means



CANAL FLOWS INTO LOWER PASSAGES OF DUNBAR BROOK STRUCTURE

of passing the floods without endangering the safety of the canal. At the same time it was considered a desirable place to locate a canal spillway. The valley bottom is of earth and boulders, with the exception of one side at the foot of a steep nose of ledge rock. The width of the valley is about 120 ft. at canal grade. To have placed a straight spillway across the brook, forming the lower side of the canal would not answer, first, because sufficient length could not be obtained at a reasonable cost, and, second, even if length were obtainable the brook always would have been a menace to the safety of the canal. The aim, therefore, was to separate the canal and brook, thus eliminating all danger to the canal from the brook, and still being able to utilize the flow from, and the pondage of the brook.

An attempt at a description of the structure is as follows: Approach the structure from canal 1 and bear in mind the right-hand side is the uphill side. First, consider the use of the structure to the canal. Water enters two rectangular passages which extend about two-thirds of the way across and then are combined into a single passage. These two passages are inter-connected horizontally. The left hand side of the structure is carried to the desired spillway elevation. The wall between the two passages is also carried solid above the roof to the spillway elevation. The roof of the left-hand passage has openings which allow water to pass to or from the upper trough in addition to the free access from the canal end. When water becomes high it can spill to the left into the old brook bed or to the right onto the top of the roof of the right-hand passage and from here flow forward out over the roof of the structure to the brook below, and also by two culverts, which lead from the roof of the right-hand passage down and under the structure to the rock below. This part of the structure furnishes the desired canal spillway.

Relation of Structure to Brook

Now, consider the relation of the structure to the brook. The right-hand side of the structure is carried to the desired spillway elevation for the brook. This wall extends along the upper side of the structure to a point about 30 ft. beyond the end of the canal spillway described above. It then crosses the roof of the main waterway to the lower side and extends along the lower side to the portal of a tunnel under the ledge nose. This wall furnishes the desired spillway for the brook, and water spilling from the brook passes along the roof of the right hand main waterway passage, through the two culverts underneath the passages, directly over the roof of the one main passage and also, at the forward part of the structure, directly into the old brook bed.

A 4 x 5-ft. double-pressure wooden gate in the right-hand side of the main waterway controls the flow of the water to or from the brook. A 5 x 5-ft. cast-iron gate in the right-hand side of the structure, with a culvert underneath the main waterway, can be used to drain the upper side of the structure and handle the flow of the brook at ordinary stages without interfering with the passage of water to the plant. A 4 x 4-ft. cast-iron gate is located on the downstream side of the main waterway near the tunnel end, and may be used to drain canal 1, the structure, and tunnel 2. One surface sluice-gate, 10 ft. wide, is located at the forward end of the canal spillway and controls the water in the left-hand trough over the main waterway. A duplicate gate is located in the brook spillway crest 25 ft. toward the tunnel from the canal spillways. These two surface sluices may be used for disposing of floating débris.

A concrete platform supports the five gate hoists, and a wooden platform supported by concrete piers extends to either end from this.

The over-all length of the structure, including the canal embankment wing walls, is 225 ft. Yet there is about 150 ft. of brook spillway length and about 200 ft. of canal spillway length, or a total of 350 ft. of spillway length in the structure. It is believed that with water standing at the maximum desirable elevation in the canal it would be impossible to get a rise exceeding 1 ft. under the most severe conditions.

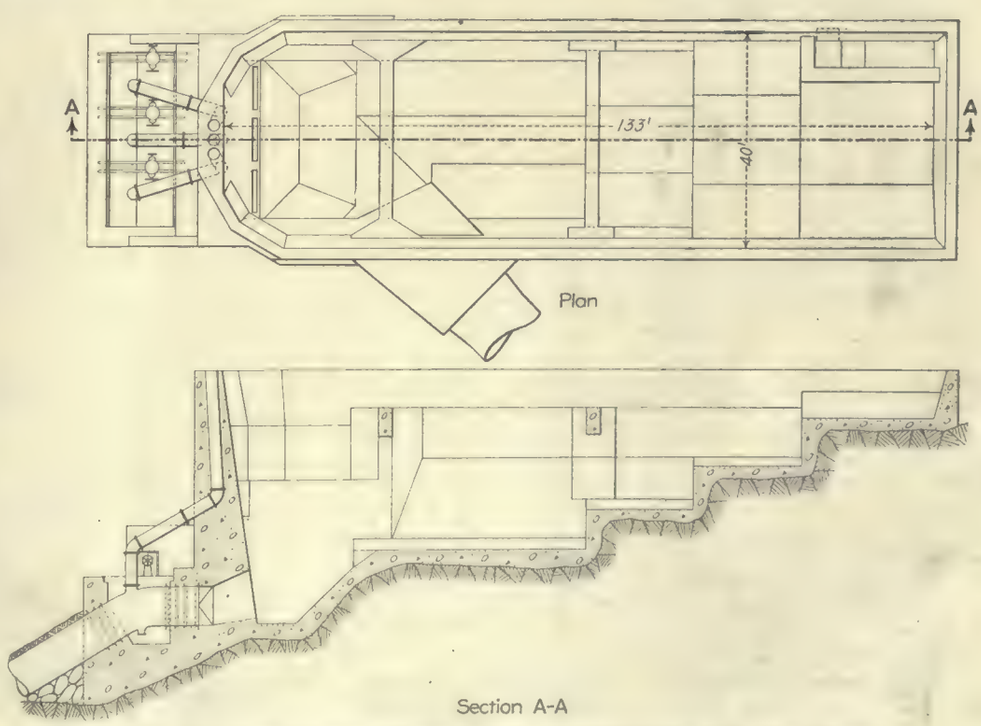
Dunbar Brook to Surge Tank

Water passes directly into tunnel 2 from the Dunbar Brook structure. This tunnel is 320 ft. long through the ledge nose. It has a nominal diameter of 16 ft. and is unlined. Then comes canal 2, which is 1500 ft. in length. One thousand feet of conduit follows canal 2 and then canal 3, which is 2000 ft. long.

At the lower end of canal 3 the intake is provided with fine trash racks. These are the only racks the water passes through. From this intake the water flows through 1800 ft. of conduit to the surge tank.

Surge Tank

The surge tank is a heavily reinforced-concrete structure with side walls backfilled, rectangular in plan, about 44 ft. x 160 ft. in outside dimensions, and extends from elevation 870, on the front or down-



SURGE TANK STEPS WERE FITTED TO THE NATURAL RISE OF THE SLOPE

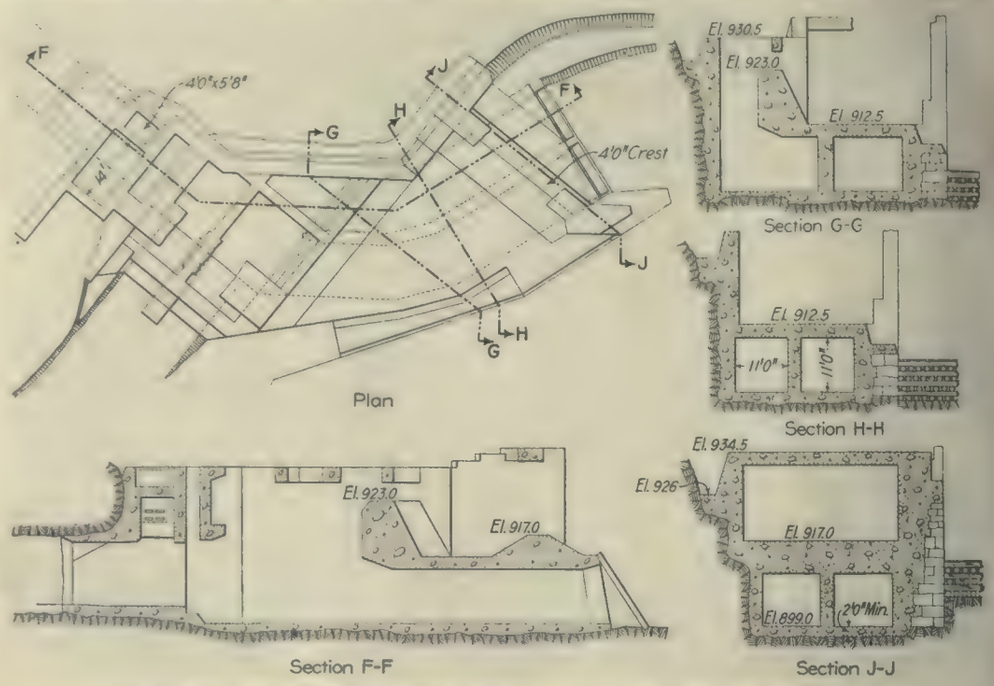
hill end, to elevation 930. The conduit enters it at an angle, well to the front, with invert elevation of 894. In section, looking at it from the side, its floor rises in steps. These steps fitted approximately the natural rise of the original slope. In front of the front wall of the tank proper is a gatehouse which shelters the motors and other operating mechanism of three 7-ft. butterfly valves. The valves are located in a recess in the substructure of the forward part of the tank and control the three 7-ft. penstocks. In the same recess are located three cast-iron elbows joined to the valves, which make the turn from the horizontally placed valves to the sloping steel penstocks. From the top of these elbows 24-in. steel air-vent pipes extend up through the gatehouse to the front wall of the tank proper, then, embedded in the center of the wall, they extend to the top of the tank.

PENSTOCKS AND WHEELS

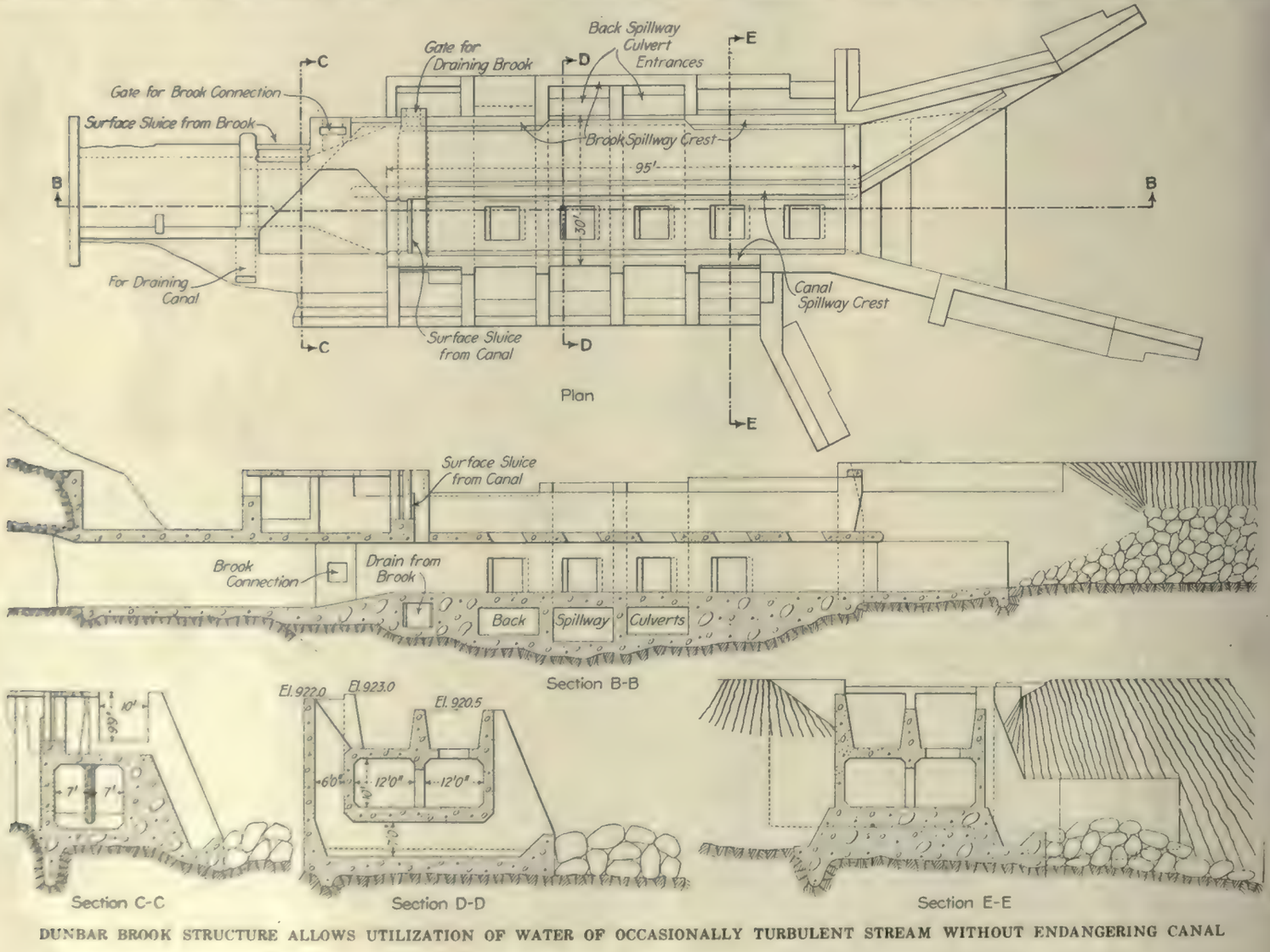
The penstocks were designed to take the excess pressures due to probable load fluctuations, without the aid of relief valves. However, as it was impossible to predict how severe the future load conditions of the plant might be, provision was made whereby relief valves might easily be installed in the future if found necessary.

The penstocks, heavily anchored at the ends, are laid in earth trenches, and with the exception of one concrete anchorage half way down the hill they are held in place simply by well placed backfill. The pipes are 7 ft. in diameter and about 550 ft. long each. At the power house they pass from the rear of the station by means of bays, provided in the substructure, to the side toward the river where the turbines are located. They were furnished and erected by the William B. Pollock Company, of Youngstown, Ohio. A second set of butterfly valves, hydraulically operated, is located in the basement of the station, about 36 ft. back from the center line of turbines.

The waterwheel equipment, including the butterfly valves, was furnished and erected by the Allis-Chalmers Manufacturing Company. The wheels are of the horizontal, single-runner Francis type, with spiral casings and have a capacity of 7500 hp. each. Each unit drives a double generator, operating at 300 r.p.m. and composed of a 60-cycle and a 25-cycle machine. These double generators have been operated for the previous two years as fre-



INTAKE DESIGNED TO INCREASE SPILLWAY LENGTH OF DAM THIRTY FEET



DUNBAR BROOK STRUCTURE ALLOWS UTILIZATION OF WATER OF OCCASIONALLY TURBULENT STREAM WITHOUT ENDANGERING CANAL

quency changers between the company's 25-cycle and 60-cycle lines.

The draft tubes are of steel and are incased in concrete below the basement floor.

Because of the importance of allowing new embankments to become settled and because of the very severe winter conditions under which the last part of the work was completed the plant has thus far been operated without flashboards, at levels 5 to 10 ft. below the maximum contemplated.

George W. Bunnell, president of the Power Construction Company, was the active administrative head, and personally directed the execution of the construction work, with F. W. Barnes as principal assistant. A. A. Conger, hydraulic engineer, was responsible for the design and proper execution of the work. C. F. Cook was resident engineer in charge of field engineering, and A. C. Eaton, assistant hydraulic engineer.

The plant was built as an addition to the New England Power Company's system of plants, operated by the Connecticut River Transmission Company, the managing and financial representatives being Chace & Harriman, Inc., and Baker, Ayling & Company, of Boston.

Overhaul Bubbly Creek Filters After Seven Years

Sand Found Clean, Gravel Dirty in Spots—Air Pipes Three-Quarters Full of Sand and Many Broken at Header Connections

AFTER seven years of service the filters at the Bubbly Creek plant of the Union Stock Yard & Transit Company, Chicago, were overhauled for the first time and the condition of the underdrains and sand was noted carefully by C. A. Jennings, superintendent. The eight filters have a combined filtering area of 2507 sq. ft. Both air and water are used to wash the 2½ ft. of sand, which has an effective size of 0.40 mm. and a uniformity coefficient of 1.70. The sand rests on 9 in. of graded gravel ranging in size from ⅝ to ⅛ in.

Underdrain System

The underdrain system was described in the Engineering Record of Dec. 12, 1908, page 661, as follows: "Off the main header thirty-two 2-in. galvanized iron laterals extend at right angles. These laterals are each 4 ft. 8 in. long and are tapped into the main header at intervals of 10 in., center to center, and at a point slightly above the center of this pipe, but precisely on the concrete floor of the filter in which the main header is embedded.

"At intervals of 6 in. brass tees are screwed into the top of these 2-in. laterals. The arms of these tees are 4 in. long and each arm contains eighteen slots about 1 in. in length and 1/64 in. in width. The total open area of these strainers in each filter is about 0.35 sq. ft.

"For agitating the sand layer during washing, compressed air is used. The air line enters each filter as a 4-in. cast-iron pipe branching at the entrance into two 3-in. lines of cast-iron pipe. These two lines extend along the long dimension of each filter tank about 4 ft. from the outside of the tank in each case. In both sides of these pipes ⅜-in. brass laterals are screwed horizontally. These laterals are set 4 in. apart, center to center, about 10 in. above the strainers, described in the last paragraph, and contain slots on both sides at intervals of 3¾ in. These slots are each about ½ in. long and 0.01 in. in width."

Sand in the Air Pipes

All of the 3-in. header air pipes were found to contain sand, most of them being three-quarters full. As the outlet for the air from these pipes into the ⅜-in. laterals was at the bottom of the 3-in. pipes, little air could get out of the headers. Many ⅜-in. pipes were found broken away from the tees in the 3-in. pipes at the threads. Mr. Jennings is of the opinion that much of the sand found entrance at these points.

About 75 per cent of the air-pipe slots were stopped up completely with sand, which was removed by washing with water and a wire brush and by blowing out with compressed air under 30 lb. pressure.

No sand stuck in the strainer pipe slots and there was no sand inside these pipes. Some of them had a coating of slimy mud, which was removed by the same means used on the air pipes. Quite a few of the strainer pipes were found broken off from the tees at the threads, the weakest point in the thin brass tubing. These breaks permitted a larger volume of water to be applied to some parts of the bed, a condition resulting in poor washing.

Sand Clean

The sand was found to be fairly clean in spite of the condition of the air pipes. However, the overhauling was started as soon as the broken pipes were discovered. The gravel was found dirty in spots.

No cost data were kept after the work had progressed for two days, when the superintendent noted the "speed" that was not made. On the first filter it took five men 5½ days to take out the sand, air pipes and strainers, and then replace them. The same operation for the second and third filters required five days and for the five remaining filters, ten days.

Models, Properly Designed, Show Correctly Performance of Dams and Turbines

Theory Does Not Indicate That Full-Size Structures and Wheels Should Develop Markedly Higher Efficiencies than Small-Scale Replicas

By B. F. GROAT
Hydraulic Engineer, Pittsburgh

I HAVE always supposed that a pool at the foot of a dam was the most effective method of absorbing the kinetic energy due to the fall. If a jet of water be directed into a relatively large body of water the result must be the complete absorption of all the kinetic energy of the jet. This energy must appear in the form of heat and a rise in level of the pool unless the section of the pool is so much larger than that of the jet that any rise in level is impossible owing to the off-flow in all directions. That is, the entire kinetic energy is converted into heat except the very small residue necessary to conduct the water away. The very interesting question of design for a pool, or water cushion, will probably be best answered by tests upon actual dams and upon models. I have made some study of the theory of models with the conclusion that hydraulic models, if not too small to introduce relatively large effects due to viscosity, surface tension and molecular interactions between water and solids, must give very decisive results.

In particular if a study of the resistance of surfaces similar to those of the dam and model, including the channel below, be made and the surface of the model be so constructed that the skin frictions of the dam and model are proportional to the squares of the corresponding velocities over homologous surfaces, then the dam and model must perform almost exactly alike.

The reasons for these conclusions are more apparent after an examination of the theory of hydraulic models which I give as it appears to present itself to me, basing it upon the usual theory of models and propositions of similitude.

Similarity of Hydraulic Models

In designing an overfall dam it may be desirable to experiment with a model. The question then arises how far we may safely go in drawing conclusions as to the action of the water in the case of the real structure from experiments on the model.

It is a simple matter to make the model geometrically similar to the full-size structure. This must be done by making the linear dimensions of the model in a given ratio to their homologous dimensions in the full-size structure. Thus, if r be any given dimension of the structure and r_1 the homologous dimension of the model, $r = lr_1$, where l is a fixed ratio between all homologous linear dimensions, or $1/l$ is the scale of the model.

The question now arises what mechanical conditions must be imposed in order that the water flowing over the model may act in exactly the same way as it does over the real dam, but on the same reduced geometrical scale. In other words, two homologous particles will describe exactly similar curves, the scale of one being l times that of the other. When this condition is imposed it will be said that the real dam and its model are mechanically or dynamically, as well as geometrically, similar.

It is a well-known fact that if each of the forces of a system of forces acting upon a particle be increased in the same ratio and the mass of the particle be also increased in that ratio, the motion of the particle will be exactly the same as before, both as regards velocity and scale of motion; for example, two pendulums of exactly the same size and shape but of different materials when oscillated in vacuo over the same amplitude.

Two machines, therefore, made on the same geometrical scale but of different materials will be geometrically identical, but they will differ mechanically, since any two homologous forces in two similar systems of forces necessary to produce equal motions will not be equal, but will bear a constant ratio to each other. Thus the two mechanically similar systems of forces are so related that any force in one bears a given

ratio to its homologue in the other system.

Corresponding, therefore, to the ratio of dimensions, if F and F_1 are respectively any force acting upon a particle of water in the case of the real dam and its homologue, in the case of the model, we have $F = fF_1$, where f is the constant ratio between homologous forces.

Gravity, however, imposes the limitation that forces acting upon homologous particles must be proportional to the masses of the particles, that is, to the cubes of linear dimensions where water is employed in the experiments on the model. In case some other liquid be employed in the experiments on the model, this ratio would be modified in the ratio of the densities of the two liquids.

Confining ourselves to the case of water as a liquid for the experiments, it must follow as a consequence of the limitation due to gravity that homologous accelerations in model and dam must be equal since, by reason of the limitation, homologous inertias are also in the ratio of the cubes of linear dimensions. Therefore, we have

$$V^2/r = V_1^2/r_1$$

or, velocities are proportional to the square roots of linear dimensions, since homologous accelerations are determined by forces which are proportional to the masses upon which they act.

Thus far nothing has been said about skin friction, viscosity, surface tension, adhesion and cohesion. Forces which result from these do not ordinarily follow the rule for forces resulting from gravity. An exception results, however, in the case of skin friction where the surface of the model can be made of such a character that the homologous skin frictions of the dam and model are proportional to the corresponding homologous areas and squares of velocity; that is, such that, for skin friction,

$$F/F_1 = (AV^2/A_1V_1^2)x$$

From the condition of equal accelerations imposed by gravity and from the ratio of scales of dam and model, we have

$$V^2/V_1^2 = r/r_1$$

and

$$A/A_1 = r^2/r_1^2$$

Therefore

$$F/F_1 = AV^2/A_1V_1^2 = r^3/r_1^3$$

or, homologous skin frictions are proportional to the cubes of linear dimensions, the same as gravitational forces, provided the surface of the model can be so constructed that skin friction relatively to homologous parts of dam and model is proportional to area and square of velocity.

In the case of ship models the skin friction and residuary resistance are usually treated separately, the residuary resistance being proportional to the cubes of linear dimensions. But if the surface of the model could be made smooth enough the total resistance should follow the law of proportionality to the cubes of linear dimensions. The reason why the law usually fails for the total resistance in ship models is that the coefficient of skin friction decreases with the length, so that to correct this it would be necessary to make the surfaces of the model smoother than the surfaces of the ship.

There is one difference between the action of a model dam and a model ship which should be noticed. In the case of the ship the relative velocity of the water along the ship begins at a maximum and decreases along the sides, while the reverse is true in the case of the dam. It is very likely, therefore, that a model dam can be more easily constructed in the sense of mechanical similarity of skin frictions than a model ship, for the difference in length of dam and model would have less effect than in the case of ship and model.

MODEL TURBINES

The foregoing theory applies directly to model turbines, and the tests on these, perhaps, afford the best proof of the correctness of the theory. Where there have been differences between the performance of turbines and their models there have also been material differences between the full-size turbine and its model, as regards the water passages, guide cases and draft tubes, if not in the runners themselves. In other words, the model, in such cases, was not a real small-scale replica.

The same rule as to skin friction applies to turbines and other hydraulic models as to model dams. The surfaces of the model should be so constructed that skin friction will be proportional to areas and squares of velocities. If this rule be adhered to models of turbines, and hydraulic models in general, should give very correct indications of the performance of the full-size machine.

The theory does not indicate that the efficiencies of large-size machines should be materially different from those of their models, unless the models are so small that viscosity, surface tension and other molecular actions come into undue prominence in the model.

The foregoing theory is applicable to hydraulic models of all descriptions, where gravity limits the ratio of forces to the ratio of cubes of linear dimensions.

The Engineer a Practical Idealist

Extracts from Presidential Address of Charles D. Marx Delivered at Forty-seventh Annual Convention of American Society of Civil Engineers in San Francisco Sept. 16

ANSWERING the charge that engineering and idealism are of necessity incompatible, Charles D. Marx, in his presidential address delivered before the forty-seventh annual convention of the American Society of Civil Engineers in San Francisco, Sept. 16, by citing such cases as those of the municipal and sanitary engineer who makes possible the physical development of cities, the bridge builder, the railroad pioneer, and the irrigation engineer, proved convincingly that the technical man is not only an idealist but a happy combination of the idealist and the utilitarian—in other words, a practical idealist, a man who first dreams and then makes his dreams come true. The aqueduct builder, for example, sees more than the number of lineal feet of conduit laid each day. His imagination looks forward to the prosperity in the city miles away which will follow the completion of a system for delivering an abundant water supply. Professor Marx said, in part:

Let us turn in detail to various branches of our profession, and see if the practice of them is likely to be destructive of idealism. The Mosaic code of laws shows that the health of the Jewish population was a matter of such supreme interest that special legislation on that subject seemed warranted. The Greeks, and particularly the Romans, recognized fully the moral value of personal cleanliness, but it has been left to our country to show clearly and on the basis of scientific study the interdependence between sanitation and disease, sewerage and crime. Munsterberg has said, "Hygiene can prevent more crime than any law." Speaking before the Massachusetts Conference of Health Officials, Dr. Charles W. Eliot, president emeritus of Harvard, addressed them, in part, as follows: "The progress of knowledge of preventive medicine made during the past fifty years, and in applications of that knowledge in social practice, has been the most cheerful phenomenon in the recent history of civilization. The new applications of physical forces—heat, light and electricity, which mankind has learned to use in its conflict with nature—have proved to be highly beneficent in the field of preventive medicine. Civilized communities have been enabled to make their water supplies, food supplies and drainage systems safe, and to contend with unexampled success against formidable pestilences, the common communicable diseases, and the bodily ills which attend urban life and the factory system."

SANITARY ENGINEERING ACHIEVEMENT

In this work of preventive medicine the sanitary engineer has borne his full share. As we read these inspiring words of Dr. Eliot our thoughts turn at once to that monumental work in sanitation carried out on the Panama Canal under the direction of General Gorgas, and with the hearty cooperation of the engineering staff. Under disheartening difficulties, and with sacrifice of personal comfort, yes, at the risk of their lives, the men labored who made the Isthmus a place fit for the white man to live, and thereby made the construction of the canal, which means so much to mankind, possible. Honor, deserved honor, has come to him who directed this splendid piece of sanitary engineering, but I desire to put on record here the appreciation of this society for the men who stood by. Is it reasonable to suppose that the engineers who did this work, who made these sacrifices, were not the highest type of men—practical idealists?

We are called iconoclast engineers, utilitarians, non-respecters of tradition, antiquity and picturesqueness. Iconoclasts? Yes; reformers usually are. Utilitarians? That, too, is an accusation that we cannot deny, but is an act less noble for being useful? Non-respecters of tradition and antiquity? Again we plead guilty, if tradition stands for error, and antiquity for decay. Destroyers of the picturesque? A general denial cannot be entered against this charge either, and in some cases, I am free to confess, too little justification can be shown for the disregard of the picturesque. This is a point I shall touch upon more fully later, but with special application to the cases cited above and similar ones, what is picturesqueness but the diseased condition of structures and their surroundings? What is this vaunted love of the picturesque, in many cases, but a selfish and thoughtless appreciation of surface appearances? Selfish and thoughtless, I say, because the few are willing to sacrifice the weal and woe, the health and happiness of the many, in order that they may feast their

eyes on narrow winding streets, on quaint gables, far-reaching eaves, small, curiously leaded panes of glass. They are taken in by the surface appearance of things. But little heed give they to the squalor and dirt, the misery and sickness existing in these picturesque quarters. Who, then, is the idealist? The man probing into the sore which has so little surface indication, finding its deep-rooted seat, and skillfully using the knife, or the man who, misled by these same facts, applies a surface dressing and allows the sore to eat into the body? To the thinking man the answer is simple. Perhaps you will grant now that at least one branch of engineering, sanitary engineering, and idealism are not only not incompatible, but that they are almost inseparable. And what I have shown somewhat fully for this branch of the profession can be shown as well for the many other branches.

Irrigation Opens New Territory

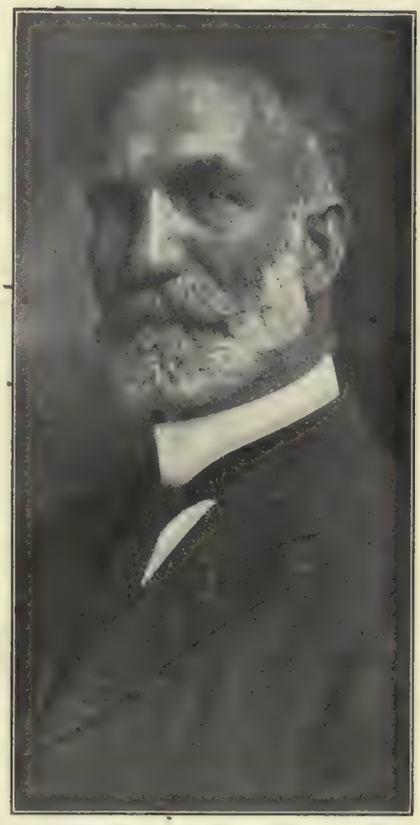
Take irrigation engineering, for instance, the possibilities of which are only beginning to be realized in this country. Is it likely that the men carrying out these works see in them but the piling of one stone upon another, the digging of so many feet of trench, the laying of so many feet of pipe? These black cast or wrought iron cylinders stand for more than this to the true engineer. He realizes that with every water or drain pipe *well laid* he is bringing prosperity and happiness, health and vigor where before existed poverty and misery, sickness and languor. Perhaps the most wonderful instance on record in modern times of the far-reaching effects of irrigation engineering is found in Egypt. In an article on the regeneration of Egypt by the former librarian at Stanford, Mr. Woodruff (now professor of law at Cornell), he unhesitatingly and justly, I think, attributes a large share of the credit for this "new birth" to the work of the English engineers. Mr. Woodruff says, "The history of the English in the administration of Egypt for the past nine years is the record of the return to health, strength and prosperity of a country that has been bled and starved almost beyond resuscitation. And yet there has been little romance in this restoration. It is chiefly a story of common sense, honesty and straightforward hard work."

But we need not turn to foreign countries to find work of the irrigation engineer worthy of commendation. Our own Reclamation Service has made a record of which we may well feel proud. Here, too, the men, with a devotion to the cause of mankind, with loyalty and steadfastness, have given a service the value of which is not yet fully recognized. They are the men of whom Chief Engineer Davis said: "Their chief tie to the service is not the matter of salary, but interest in their work and loyalty to it and the belief that they are appreciated." Again I ask, is such work destructive of idealism, are such men lacking in ideals?

Railroads Unite Mankind

In railroad engineering, think you that the men who through virgin forests and sandy deserts, through miasmatic swamps and rocky canyon, across rivers and over mountains, carried the steel bands that now tie mankind so closely together—think you that these men were engaged in an occupation likely to kill their ideals? When the final balance is struck, I warrant that the debit will not be on the side of this grand army of peace of the present, as compared with the armies of war of the past and present, for deeds of ideal heroism, self-sacrifice and devotion to duty. It seems like carrying coals to Newcastle to speak in an audience like this of what the railroads have done for all countries—for our own country especially, and more particularly for the Pacific slope. It was not so long ago when I read of the beginning of construction of the Trans-Siberian Railway which now unites the Atlantic and the Pacific on the other continent. The Cape to Cairo Railway, too, has passed through the stages of its preliminary surveys and partial construction. What centuries of fighting could not accomplish these two roads will in time accomplish. The light of civilization will be spread on the Dark Continent, and its strong rays will burst the fetters and open the prison doors of suffering men and women in Russia. Who then is destructive of idealism?. The man whose works are a means, if but a humble one, of bringing his fellow beings into a direct contact with the wonders of creation, or he who, enveloped in the mantle of exclusiveness, bemoans this defiling contact?

President of American Society Denies Imcompatibility of Engineering and Idealism



PROF. CHARLES D. MARX

Romance of Bridge Building

What bridge engineer has not been touched by the romance of his profession? What engineer has not been thrilled by Kipling's story of the "Bridge Builders," where that master hand has voiced in prose which is almost poetry the thoughts that came to the engineer as he viewed his work? "It was a long, long reverie, and it covered storm, sudden freshets, death in every manner and shape, violent and awful rage against red tape half frenzying a mind that knows it should be busy on other things; drought, sanitation, finance; birth, wedding, burial, and riot in the village of twenty warring castes; argument, expostulation, persuasion, and the blank despair that a man goes to bed upon, thankful that his rifle is all in pieces in the gun case. Behind everything rose the black frame of the Kashi bridge—plate by plate, girder by girder, span by span—and each piece of it recalled Hitchcock, the all-round man, who had stood by his chief without failing him from the very first to this last."

If I desire to show that in still another branch of engineering—the one of river and harbor improvement—there is nothing destructive of idealism, I need not go far for an illustrious example. What James B. Eads has done for the people living in the Mississippi Valley in opening up the mouth of the Father of Waters stamps him as one of the benefactors of mankind. For years he labored and fought; removed mountains of obstacles, overcame prejudice, malice and ignorance. Mr. Corthell, the staunch friend and principal assistant of Captain Eads on this momentous work, quotes him as saying. "I therefore undertake the work with a faith based upon the ever-constant ordinances of God Himself; and so certainly as He will spare my life and faculties for two years more, I will give to the Mississippi, through His Grace and by the application of His laws, a deep, open, safe, and permanent outlet to the seas."

Art and the Engineer

I think enough has been brought before you now to show clearly that engineering is not destructive of idealism. That much refuted there still remains the charge that engineering is destructive of, or at least in part responsible for, the decay of art. I propose to show that this statement also is false. Artist and romanticist appear as accusers. Again they point backward and say: "'See what the past has created; what have we that can be placed by its side?" Their eyes are blinded to the changed condition of things. They lack the sympathetic understanding of the complex problems of the life of to-day, and the materialized solution of these problems does not appeal to their idea of the beautiful. For the intelligent enjoyment and, more particularly, for the criticism of any creation, there is needed at least a fair knowledge of the underlying principles of construction, be that a work of symphony, a poem or a bridge. It is true that a symphony or poem appeals much more readily to a large audience than does a bridge or a complicated piece of machinery; yet both the latter may be as much works of art as the former, a higher degree of development of the intellect being needed, however, to see and feel their beauty. Every engineering structure is the materialized idea of its function. The ideas underlying engineering works are often ideal ones, and the works themselves therefore can be idealized. When this is done the engineering structure becomes a work of art.

In all ages that which most truthfully and characteristically embodied in itself the representation of the life and the ideas of those times was deemed a work of art. He is the artist who expresses most faithfully what we think and feel. If such representation has not been had in our century, it is not for lack of new ideas and materials furnished by science pure and

applied, but for the lack of adequate assimilating power on the part of the would-be apostles of the beautiful.

THE ARTISTIC IN THE STRUCTURES OF THE PANAMA CANAL

It is encouraging to note that our own government in connection with the structures of the Panama Canal sent the sculptor, Daniel C. French, and the landscape architect, Frederick Law Olmsted, to report on the artistic character of the Isthmian structures and to make suggestions for such improvements as to them seemed desirable.

"The canal itself and all the structures connected with it impress one with a sense of their having been built with a view strictly to their utility. There is an entire absence of ornament and no evidence that the aesthetic has been considered except in a few cases as a secondary consideration. Because of this very fact there is little to find fault with from the artist's point of view. The canal, like the pyramids or some imposing object in natural scenery is impressive from its scale and simplicity and directness. One feels that anything done *merely* for the purpose of beautifying it would not only fail to accomplish the purpose, but would be an impertinence." Thus spoke the true artists.

IS IT PROFITABLE TO BEAUTIFY ENGINEERING WORKS?

Is it profitable to beautify engineering structures? Here we stand before a momentous question. If the answer be given by the engineer, or by one who holds that the status of a people is determined not merely by the accumulated wealth of the nation, the quantity of goods produced, and of articles manufactured, then it will be in the positive, ten times over. But if the man of low ideals and mercenary motives gives answer, it is likely to be an emphatic "No." This answer has been given too often in our own country, and the blame for the deep scars in the face of nature, the ugly dams and rugged cuts, must not be laid on the shoulders of the engineer. Where broad-minded liberality and far-seeing policy govern the construction of engineering works, as is the case in countries older than our own, these works stand as worthy art products of the spirit of the times symbolical of the best and highest in the life of to-day.

Science and its applied form, engineering, therefore, have not been destructive of idealism, for in the words of another: "When the period of history we now call modern will be rounded to completeness, all the highest and most sacred human ideals will not be lost or dimmed, but will become nearer and more real," and science has not been destructive of art or beauty. As Emerson says, "Beauty will not come at the call of a legislature, nor will it repeat in England or America its history in Greece. It will come, as always, unannounced, and spring up between the feet of earnest men. It is in vain that we look for genius to reiterate its marvels in the old arts; it is its instinct to find beauty and holiness in new and necessary facts, in the field and roadside, in the shop and mill. Proceeding from a religious heart, it will raise to a divine use the railroad, the insurance office, the joint-stock company, our law, our primary assemblies, our commerce, the galvanic battery, the electric jar, the prism, and the chemist's retort, in which we seek now only an economic use. Is not the selfish and even cruel aspect which belongs to our great mechanical works—to mills, or railways, and machinery—the effect of the mercenary impulse which these works obey? When its errands are noble and adequate, a steamboat bridging the Atlantic between Old and New England and arriving at its ports with the punctuality of a planet, is a step of man into harmony with nature. The boat at St. Petersburg, which plies along the Lena by magnetism, needs little to make it sublime. When science is learned in love, and its powers are wielded by love, they will appear the supplements and continuations of the material creation."

Arkansas Approach to Memphis Bridge Rapidly Erected

CONSTRUCTION is rapidly proceeding on the new $3,000,000 Harahan bridge at Memphis, Tenn., being built by the Arkansas & Memphis Railway Bridge & Terminal Company for use by the Rock Island lines, the Missouri-Pacific Iron Mountain system and the St. Louis Southwestern Railway. The Arkansas approach, one view of which is shown in the accompanying photograph, is now practically completed, and forms an excellent example of rapid erection of a combination railroad and highway heavy steel viaduct of standard construction.

This western approach on the Arkansas side is 2360 ft. long and will contain about 5500 tons of steel. The double-track railroad is carried on the usual type of plate girders supported on cross-girders at the steel bents. The two roadways for vehicular traffic are carried on brackets projecting from the sides of the columns at different elevations, providing the graded approach.

This bridge was designed by Modjeski & Angier, consulting engineers, Chicago, who supervise the entire construction. The special traveler was designed by the engineers of the Virginia Bridge & Iron Company of Roanoke, Va., the contractors on the western approach, and has resulted in a large saving in time and cost of erection. The contractors on the substructure are the Union Bridge & Construction Company, of Kansas City.



ARKANSAS APPROACH TO NEW HARAHAN BRIDGE AT MEMPHIS, ERECTED BY A SPECIAL TWO-BOOM TRAVELER

American Engineers Tell International Congress of Country's Contribution to World's Progress

Extracts from Eight Civil Engineering Papers Presented at San Francisco This Week by John F. Stevens, Nelson P. Lewis, F. H. Newell, Logan Waller Page, J. A. L. Waddell, J. E. Greiner, George F. Swain and Emory R. Johnson Indicate Scope and Variety of Subjects Discussed

Business Principles Should Govern Railroad Building

By JOHN F. STEVENS
New York City

THE STUDY of the conditions leading up to the contemplation of all new railroad lines involves the same general problems—whether or not the line should be built at all, and if so, where, of what character and at what cost. Balancing the safe probable income against the probable outgo becomes all important, and the study of this consideration presents a separate, distinct problem in each individual case.

In order to secure capital for the building of a new independent line, the probable results to be expected must show at least ability to earn operating expenses, taxes, fixed charges, and a sum over and above of at least twice these amounts, to be applicable to sinking fund and dividends. The consideration of the probable safe financial results, is one to which is rarely given the amount of study which the conditions demand. The path of railway planning and building in the past, in the United States, is strewn with the wrecks of the hopes and fortunes of promoters and capitalists who have been lured to disaster by unwarranted assumptions of traffic certainties, which, in most cases, a cold, careful, logical analysis made by competent, conscientious, experienced traffic men would have been clearly shown to be impossibilities. None but such men should be entrusted with the securing and preparing of such data, and no factor, great or small, which might affect this result, should be overlooked. What may be termed a house to house canvass covering all of the entire territory which the new line can reasonably be expected to serve should be made. Markets, connections with other lines, divisions of rates, probable competition, are most important factors to be carefully studied. The character of the country which the new line will traverse, and its probabilities as to future growth, based not only on its apparent resources, but on the results which experience shows have been obtained in similar sections and under similar conditions, should be thoroughly investigated.

Physical Problems

Once, however, all the necessary data have been collected, carefully sifted and summarized, and the decision has been reached that the building of the line is a necessity, that it can be fully justified, and that the proper financial support can be found, then there enter into the proposition certain problems, which, while they are largely physical, are yet of great importance; and the manner in which they are handled, in connection with the purely economic questions, may make or mar the enterprise. These problems cover the actual planning and constructing of the physical road itself, in giving it a constitution and members suited to its needs, in short, to make it the kind of tool best adapted to the work it is to do, and it is these problems that it is peculiarly the province of the engineer to solve. The nature and amount of the expected traffic, as well as the country to be traversed, are the controlling factors, the proper appreciation of which must determine the physical characteristics of the proposed line.

Broad Engineer Needed for the Problem

The economics involved in the building of a new line should be intrusted only to a man who not only is a good technical engineer, in the broadest sense of the word, but also has a practical knowledge of the intricacies of handling transportation, the best and most economical methods of maintaining railway properties, and in a general way at least, the effect which the working out of the details of his problem will have on the attracting of traffic to the line or repelling it. He should be furnished, not only with the general factors which made up the decision that the line should be built, but also with the details. This is especially true where the road will naturally enjoy a good local business. With such a line there is hardly a mile of its entire length where its character and cost of construction may not be affected by its prospective local business.

The probable proportion as between passenger and freight earnings, as well as the character of each class and their relative importance, are factors to which careful attention must be given. Ordinarily, in terms of both earnings and expenses, the freight will largely predominate, but too much prominence should not be given to that feature, as the comfort of passengers must be provided for, and while a road with easy grades and comparatively heavy curves may economically handle heavy freight, human beings will complain if hurled at high speeds over such a road. The mixture of passenger and freight traffic is a handicap which prevents the engineer from working out a perfect machine, but he must adjust his plans to meet the conditions, and not sacrifice the interests of either class entirely to the other. Unless, however, the road is to be built to compete for highly remunerative passenger traffic, the one fact alone that usually from 65 to 80 per cent of the earnings come from freight should emphasize the importance of securing the lightest grade the country will reasonably admit of, even at the expense of the introduction of somewhat heavier curvature than high-speed passenger service will demand.

Careful Reconnaissance Essential

A careful reconnaissance of all the territory to be covered by the new line—a study which will give the engineer a correct mental picture of it in all its physical features, geographical and topographical—is a very important, economical necessity. More mistakes in the essentials of location have been made, and more miles of poorly located line have resulted from the assumption of arbitrary rates of grades and curvature, and attempts to fit such standards to an unknown topography, than from any other cause. True economics demand that the engineer shall, when all data as to traffic and details of country are known to him, evolve a line of such character that will come nearest to meeting all conditions, instead of trying to force a preconceived line of certain character on the country to handle its traffic.

The engineer must remember that in the operation of the road, its financial status is, in the last analysis, like that of the individual—dependent entirely upon its income and its outgo; and these terms mean, in the case of the former (as far as freight is concerned) ton-miles (income) and train-miles (outgo), and his problem is to build a road that can handle the greatest number of ton-miles with the least number of train-miles. It does not necessarily follow that the lightest possible grade he can force through the country is necessarily the most economical one. An unnaturally light grade may involve such length of line and such enormous cost of construction (necessitating not only abnormal fixed charges, but cost of maintenance, all of which will be reflected in heavy train-mile expenses) that it will be found that a heavier grade, by reason of its shorter line, less expensive construction and better alignment, will prove, with proper adaption of power, the more economical.

Again, it is not so much what the road can earn as what it can save. Light or heavy grades are comparative terms, and it is the grade over which the business can be the most cheaply and efficiently conducted that should be adopted, regardless of its percentage. The introduction during the last few years, of a certain class of locomotive, whereby enormous tractive power is obtained without materially increasing strains on track or bridges, has introduced a different factor into, and to a great extent, has simplified the problem of gradients, especially on heavy mountain lines.

Pusher Grades Often Desirable

Another economy to which the attention it merits is seldom given is the pusher grade. The prevalence of opinion among railway operating men is against such grades, but no special reason can be given. The question comes squarely back to cardinal principles—fixed charges and train-miles. In many cases, where long stretches of non-revenue producing mileage would be forced to maintain a continuous light grade line, with abnormal expense in construction and maintenance involved, a thorough study of the value of pusher grades would surprise some engineers who have been prone to give them no consideration.

The matter of maximum rate of grade being decided, its distribution becomes a problem of importance. Economical movement of trains demands that they shall be

moved, not only with as large a tonnage as time will permit, but that they shall be moved solidly for the greatest distance practicable to avoid both loss of time and cost of intermediate switching. Thus, if the proposed line is to be more than the economical length of one engine run, then the grades of each separate operating run must be worked out as an individual problem. And wherever any difference in rates of maximum grades may exist between different runs, it should be eliminated by adaptations of different classes of power, so that a continuous unbroken movement of a uniform tonnage train can be made over the entire road. When we reflect that the average daily movement of a freight car is less than one-fourth of the daily mileage that the railways are paying train and engine crews for, it becomes very apparent that the fewer inducements that are given for holding up and switching a train, the better will be the operating results.

Unbalanced Traffic

The economic adjustment of grades, in cases where the traffic is unbalanced, presents a complicated problem. Many times this question is simplified by the nature of the country, as in case of roads built to handle the products of mines, which are often situated in high altitudes. No set rules can be made to govern each case, but here is where the operating experience of the engineer, combined with his knowledge of construction and operation costs will, as a rule, produce the best results.

The effects of curve resistance, not only in the absorption of power, but in the increased cost of maintenance of track and rolling stock, are too well appreciated to need discussion here. The compensation for curvature, if properly applied, will largely eliminate the first handicap, although, as it is sometimes applied, without due consideration as to location or curve, speed and length of train, it is not of the full value that it should be. Practically each curve presents a problem which should be worked out on its own individual merits.

To what extent permanent work should enter into the construction of the line is a consideration that must be governed largely by circumstances. There are times and occasions when the building of masonry structures, steel bridges, expensive stations, etc., cannot be considered. The comparatively cheap cost of timber in some localities, and the absence of definite knowledge as to required capacity of waterways, fully justify its use in many instances. In the construction of almost every new line there are instances where the expenditure of large sums can be deferred for long periods, or until the road has, by constantly increasing earnings, fully justified such expenditures.

Terminals All-Important

But the economic consideration which, it would seem from results, usually receives little attention, but which, without doubt, deserves very much, is the providing for proper terminals of a capacity not only sufficient for the present, but also susceptible of enlargements for future requirements. It is a safe assertion that no one cause, from a physical standpoint, contributes more to the high cost of operation or is a greater handicap in giving good service than the poor terminals of most of our railroads. If it becomes necessary to economize do it out on the line, but not at stations; and especially not at terminals proper, particularly in the area of real estate secured. And these terminals should be located as near the center of commercial and manufacturing activity as possible, especially if traffic competition exists, or is liable to exist, as is generally the case.

The field of railway promotion and building is still open, and the writer believes it will widen and become again attractive when the financial situation becomes normal, and when the general public understands and admits the community of interest which exists between it and the railways. The field is a legitimate one, but it must be cultivated on strict business principles, a few of which the writer has endeavored to point out.

City Planning—What It Is—Four Main Features

By NELSON P. LEWIS
Chief Engineer, Board of Estimate and Apportionment, New York City

THE CONVENIENCE and attractiveness of a city will depend upon four features of its plan:

1. The transportation system, or the means provided for getting in and out of the city, and for quick movement of passengers and freight from one part of the town to another.

2. The street system in and through which the daily business is done and by which the people gain access to their homes and pass from these homes to their work, recreation and amusement.

3. The park and recreation facilities upon which the comfort and health of the community are to a large degree dependent.

4. The location of public buildings, which may render the conduct of public business convenient or difficult and may give a favorable or unfavorable impression to visitors.

Transportation

The modern city owes, in most cases its genesis, and in all cases its growth and prosperity to its facilities for internal communication and for easy access to its sources of supply and to markets for the disposal of its manufactured products. The fullest consideration should, therefore, be given to the general problem of transportation in the original planning of a city, and ample facilities to enter and leave a city are as important as those for inter-communication between the different parts of the same city. In a paper presented to the city-planning conference in Chicago in 1913 [abstracted in the Engineering Record of July 19, 1913, page 65] Milo R. Maltbie points out that the city which has the best transportation facilities by land and water is the one which will increase most rapidly and that "the city which has the cheapest, most rapid and most convenient facilities for communication between its various parts is the city, other things being equal, which has the most productive and healthful citizenship. The transportation problem is a separate subject, however, and will be referred to in this paper only in its relation to fundamental city planning.

Correlation of Terminals

Seaport cities have been slow to appreciate the need of the proper correlation, if not the unification, of rail and water terminals. Railroad terminals are often planned as if there were no other means of transportation. Shipping terminals are likewise designed as though railroad connections were of little or no importance. Only recently has the problem of port organization attracted the attention which it deserves. Too much emphasis cannot be laid upon the need of keeping in mind from the beginning the proper connection of railway lines with each other and with the terminals for water-borne traffic.

Railway and waterfront terminals, though neglected in the original planning of a city, can be provided or enlarged notwithstanding the fact that the general city plan did not contemplate their need, even though the cost of doing so will be very great; but the handicap placed upon the intra-urban transit system through an inadequate and badly arranged street system can never be fully overcome. It is impossible, also, to anticipate just how a city will grow or what transit lines will be required first.

Wide Streets for Transit Lines

In great cities elevated and underground railways may be required on certain streets; these, however, will be few and will be confined to the most heavily traveled routes on which the surface lines will have preceded them. A street which will accommodate a double-track surface railway and leave room for vehicles between the cars and the curb will also accommodate a two-track underground railway with station platforms, while the difficulty and cost of constructing rapid-transit lines in city streets are so intensified in narrow streets that the provision of adequate street widths for transit purposes is fully justified.

By far the greatest mileage of railway lines in any city will be the surface tracks in the streets, operated by the overhead trolley system. The inflexibility of the surface railway in comparison with motor-buses and other free-wheel vehicles necessitates a greater roadway width for their accommodation, and unless there is room for other vehicles to pass between the cars and the curb, congestion will result. The author believes that any street which is likely to be called upon to accommodate surface railway tracks should be given a width of not less than 70 ft., while in the case of main traffic arteries where elevated or underground railways may also be required, such width should in no case be less than 80 ft.

Street System

There have been a few cases where important cities have been planned as a unit; where the administrative center, the commercial, industrial and residential districts, the lines of transportation and their terminals, have been laid out after careful study to meet conditions which could be confidently expected or to a large degree controlled. Washington is one of the most notable instances of such city planning. The city planner usually finds, however, that the beginning has already been made, a beginning which may prove a serious handicap or may, though less frequently, be an admirable nucleus for the larger plan. Most old cities have simply grown with very little planning. Comprehensive plans, where such have been prepared, are of comparatively recent date and have had to adapt themselves as well as might be to the older portions of the towns as they were, and make designs for sections not yet de-

veloped conform with the haphazard growth which had already taken place. Plans of such cities, therefore, commonly consist of a number of separate designs more or less unrelated to each other, abutting upon the confused and uneconomic system of streets in the old town, which in most cases has persisted as the actual center.

Streets in Undeveloped Sections

In every city, however, there are large areas not yet developed and not even planned, where opportunities are presented to design a street system, the different parts of which will be properly located with respect to each other and to such modification of the system of the existing town as may ultimately be carried into effect. Too often these undeveloped sections are planned as if they were so many different urban areas unrelated to each other or to the original city, and too often the obvious blunders of the older sections are repeated in the new additions.

In nearly all cases where a street plan is to be devised, whether it be for a large area which can be treated almost as an entire city in itself, or for a smaller tract contiguous to the built-up portion of an important city, the first essential is an accurate plan of the existing roads showing their widths and the buildings fronting upon them. The old highways which serve to connect villages or centers of population have a good excuse for existence and serve a useful purpose; they lead where people want to go and are likely to be fairly direct. Their alignment may be somewhat faulty, their grades excessive in some places, and their widths inadequate in view of the fact that they will naturally become the main lines of traffic for the urban district which will include them. With such straightening and widening as may be deemed necessary and such changes in line as will reduce excessive grades, these old roads will be the logical basis of the street plan which is to be prepared. When they have been platted, it will be obvious that additional roads will be needed, some to establish cross connections, others to give greater directness to the roads traversing the entire territory, others as bypasses around groups of buildings so located as to render the widening of some portions of the old roads unduly expensive, and still others to furnish lines of main drainage along the valleys through which the lateral sewers and subsidiary trunks must ultimately find their outlets.

Primary Streets

While no one can predict with any certainty the precise manner in which any city will grow, the purpose of the preliminary design is to establish lines of least resistance which future development is quite likely to follow. The streets laid down in this plan will probably become the main arteries of traffic. They will divide the territory into a series or irregular figures having three, four or more sides, which sides may be a quarter or a half a mile or more in length. These areas must be subdivided by secondary roads in the location of which regard should be paid wherever possible to property subdivision, to the possibility of some of them developing into main traffic roads, and to the avoidance of awkward junctions with the main roads already laid down, which would result in confusion of traffic. It is difficult to say how wide the primary and secondary roads should be made. The Royal Commission on London Traffic in its report, made some years ago after an exhaustive study, suggested the following widths: Main avenues 140 ft., first-class arterial streets 100 ft., second-class arterial streets 80 ft., third-class streets 60 ft., fourth-class streets 40 to 60 ft. This scale of widths may be somewhat over-generous and might involve unnecessarily great cost.

Lastly will come the minor streets which will serve almost entirely for access to dwellings. Their alignment and grades are of little importance. The chief concern is that they should be so laid out as to furnish ample light and air and discourage, if not prevent, a too intensive development with rear buildings in case the city ordnances do not prohibit this menace to health and decent living. To plan far in advance the precise location of these minor streets is not necessary, if it be not unwise. There is no reason why a street which is to be devoted to private residences should be long and straight. Among the most attractive features of a city are small residential areas treated in a distinctive way, each with a character of its own, which the visitor stumbles upon with agreeable surprise. If these minor subdivisions are planned at different times or by different persons, this variety in treatment is more likely to be realized. The important thing is that the skeleton should be created first.

While directness is desirable in the main and even the secondary streets, it does not follow that such streets should be perfectly straight; in fact, straight streets are seldom interesting. Neither need circumferential or curved streets be laid out with perfect symmetry. In studying a plan the slightest departure from symmetry is noticeable, but on the ground it cannot be detected. One can ride or walk along a boulevard following a sweeping curve and be unconscious of the fact that its radius is frequently changing.

Parks and Recreation Facilities

The city park, located, acquired and developed as a public playground, is a modern idea and is a result of the steadily increasing size of our cities. The park system, however, is usually of haphazard growth and its place as a part of the city plan is not yet fully appreciated. It is obvious that the needs of a city for open spaces cannot be anticipated to the same degree as can its requirements for transportation and a street system. Estimates have been made of the percentage of a city area which should be devoted to parks and of the proper number of people to each acre of park lands, but the needs of an urban community cannot be determined in this manner. The compactly built city where the individual dwellings have no open spaces about them, where the streets are narrow and where the average number of occupants to each dwelling is large requires a greater park space per capita and a larger space in proportion to the area of the city. On the other hand, where dwellings are detached and each has its garden, where the streets are broad and lined with trees, the need of parks is much less. The industrial town or district has a far greater need of such reservation than does the residential town or district, while it usually has less.

It is frequently argued that it is folly to select and acquire park reservations until the actual need of them is imperative, that they can then be placed where that need is greatest, that the additional expense of their acquisition at the enhanced value, and on account of the destruction of buildings, will be less than the carrying charges and loss of taxes, and that, unimproved parks being of little value, their development at great cost is likely to be undertaken prematurely if purchased before they are actually needed. There may be some instances where this has proved to be the case but they are exceptions rather than the rule.

Three Classes of Parks

The argument that a park should not be acquired unless it is to be improved at once is an unsound one. Public pleasure grounds may be divided into three classes —the wild park where the natural conditions remain undisturbed as far as possible, the developed park where by skilful treatment and planting such natural features as meadows, woods and lakes are combined, and the formal park which is more in the nature of a garden. A city park if of sufficient size may pass successively through these stages. There is no greater boon to the city dweller than the opportunity to frequent a place where nature has been interfered with to the least possible degree. A few walks or roads through the woods are all that is necessary in the way of improvement. As such parks become more frequented and as their natural beauties are more likely to be destroyed, a greater degree of development with more strict policing may be required and gradually the wild park becomes a developed park, while portions of it may in time be treated as a formal garden.

The land which will in time make the best parks will often have been passed over by the real-estate developer as unsuited to his purpose—precipitous hillsides where the cost of development would be prohibitive, creek bottoms or meadows which may be subject to periodical flooding, wooded tracts somewhat off the lines of transit, even marshes which are unfit for development until thoroughly drained —any or all of these present great opportunities for effective and economical development into parks. Their actual value is small, the return from them in taxes is insignificant, and to carry them until their development is needed will not be a serious burden.

The planning of a park system should receive as careful study as the planning of a transportation or street system, and it is just as much a part of a comprehensive city plan. While it is obviously impossible to formulate as definite a plan for parks as for streets, there must be some relation between them, not necessarily an economic relation, not even a ratio between the total area of parks and that of the city, not a maximum and minimum of size nor any standard as to their shape. It may be said that in planning a city the park reservations should be governed by the street system. While this is true, the streets should also bear some relation to the park system.

Parks Should Be Connected

In planning a system of parks provision should be made for connecting them. Experience seems to show that streets more than 100 ft. in width rarely develop into business thoroughfares. Consequently, if

those which are to serve as park connections or parkways are given a width of from 120 to 150 ft., business will be likely to avoid them, while such width will be sufficient to provide certain park features when the time comes for their development.

The judicious selection of the park areas will require skill and judgment, and the advice of a competent landscape engineer or architect should be secured. To defer this until the time comes for actual development is unwise. Expert knowledge as to the possibilities of the different park sites is worth far more than skill in adapting an unsuitable site to the desired purpose.

PUBLIC BUILDINGS

The designation "public buildings" is commonly used as applying only to those in which the business of the Nation, State or city may be conducted. In their relation to city planning there are many others which can properly be called "public buildings," not only libraries and museums, but also schools, penal and charitable institutions, markets, hospitals, police and fire houses, baths and structures connected with water supply and drainage. They may also include churches and buildings used for amusement and entertainment under private as well as public management, and railway stations and terminals, lighting and heating plants, financial institutions, etc.

The effective grouping of public buildings to create civic centers has received much attention of late and appears to have become somewhat of a passion in American cities. Numberless towns, great and small, and even villages, are now studying this problem. The aim of city planners and architects is usually to locate public buildings, whether isolated or in groups, so that each building shall be a single unit, even though it may bear a certain relation to others. Each building is given a site of its own with due regard for those of its neighbors.

[In the next issue the Engineering Record will abstract the remainder of Mr. Lewis' valuable paper, which goes into more detail regarding the working out and financing of the city plan, and closes with an appeal to the engineer to take a broader part in the work.—EDITOR.]

Does Irrigation Pay?

By F. H. NEWELL
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THE ENGINEER who plans and builds irrigation works sometimes forgets that on the back of the farmer the entire superstructure of the development rests. Landowner, investor, promoter, State and nation, all look to the farmer to justify the effort made in irrigation development. With a wider view of his opportunities and responsibilities, the engineer is beginning to appreciate the fact that he has a duty in seeing to it that the works are planned and built with primary consideration of the farmer's need and personality. We have given more thought to the legal status of the irrigated land than to the ability of this land to produce crops.

FARMING AS A BUSINESS

The Department of Agriculture, through its Office of Farm Management, has begun to bring together results of careful studies, analyzing the condition of the farm from a business standpoint and bringing out clearly the fact that the average farmer obtains for his investment and labor about 5 per cent on the capital involved and an earning about equal to the wages of a day laborer. If he employs farm labor, the cost, under prevailing conditions of high prices and inefficiency, may eat up a great part of these scanty earnings. These considerations of cost and returns from the irrigation farm are fundamental in any discussion of the economic advisability of irrigation, and it may be said that the study of irrigation farming as a business should be a part of the irrigation engineer's duty as well as that of the promoter and investor.

The economic importance to the nation of the development of irrigation is best illustrated by the fact that the crops produced under irrigation in 1909 aggregated in value over $180,000,000, or an average of $25 per acre irrigated. The total amount of money then invested in the various irrigation enterprises was over $300,000,000. These irrigation systems were by no means complete, and the lands were not all fully developed. If we should throw out of consideration the farms on which irrigation had just been begun, or which were not brought up to fair condition of cultivation, the average crop production would be much larger. For example, in the State of Washington where the lands were more carefully handled, and largely in fruit, the average was nearly $50 per acre.

THE INVESTOR

The success of the promoter and of the investor whom he interests in the work is not merely a personal affair; it is one in which the State and nation may take a proper interest, as leading to a larger development and use of the otherwise untouched resources of the commonwealth. It is a matter of public importance that the investor be shown that there exist fair and safe opportunities for profitable use of his money, in storing the floods and in diverting the otherwise waste waters to lands, which, without this added moisture, are unproductive.

In the case of irrigation bonds, for example, it may be necessary, in order to make these more attractive to the investor, that some of the States safeguard these to a larger extent than in the past, not only by throwing added protection of law about the bonds, but also by going still further and adopting methods which may be comparable to those of the pure food laws, or so-called blue-sky enactments.

In many instances the lands have been sold to newcomers, who, with more enthusiasm than capital, have paid out their last dollar in making a first payment and who have agreed to make deferred payments at an interest rate which perhaps originally was 8 per cent, but has been gradually raised to 10 or 12 per cent, or even more. This results in a burden which cannot possibly be carried by the ordinary tiller of the soil, particularly under pioneer conditions. It is these heavy interest charges on land purchases which are causing the greatest distress in the irrigated region. Moreover, the irrigators are usually land poor, in the sense that each man is attempting to handle more land than he can fully utilize with the labor and capital available, and is paying the heavy interest charges for this excess land, these eating up all possible profits.

Investigations made show that throughout the arid region the prices for undeveloped land which is susceptible of irrigation have ranged, as above stated, often, from $50 to $100 per acre, the purchases being usually made on installments, with about a fifth or a tenth down and the balance in from 5 to 10 yr., and at interest rates rarely as low as 6 per cent and more often at 8 per cent and upwards.

The taxes on these lands are necessarily large, because the country is in a pioneer condition. Everything must be done; roads must be built, schoolhouses erected and provision made for county and other officials. Everything is new and untried, and there is general lavishness in these matters, such as accompanies an influx of population. In the case of homestead land for which patent has not been issued, taxes usually cannot be levied on these lands, but the improvements may be assessed. The valuation is usually low, being a half, or even much less, of the sale price, but the tax rates may run as high as 2 per cent, or more, on this valuation.

The large expense, however, on the raw land, after the purchase price, is that of leveling and subduing the soil. In some favored areas where the surface has not been cut by winds and rains and where there is little vegetation the cost may be as low as $10 or $15 an acre. In other cases, such as on the rich alluvial soils near Yuma, Ariz., the removal of the heavy growth of cottonwood and willows and the bringing of the surface to proper level may cost $50 an acre, or even more. This cost, however, is largely that of the labor of the owner himself and usually requires little cash outlay. The cost of improvements, equipment, stock, feed, seed and trees for a 40-acre farm may range from $2,975 to $4,520.

FARM RETURNS

A study made by the Office of Farm Management of the Department of Agriculture as to what the farm contributes directly to the farmer's living shows that of 483 families in ten representative agricultural districts, the average annual value of the food, fuel, and use of the dwelling in families of between four and five persons is between $400 and $500 per family, averaging a little over $90 per person. In the estimates of the returns from the farm, it is assumed that the owner is entitled to 6 per cent interest on the true value of the investment which he has made. Returns from southern Utah relate to sixty-nine farms, which are fairly representative of conditions throughout the arid regions where the pioneer stage has been passed. The average size of these sixty-nine farms was under 50 acres, and the crop area about 30 acres. The average capital invested was $9,000, or, in round numbers, $175 per acre, including all improvements. The receipts were slightly under $1,500, and out of these were paid a little over $600 for expenses, leaving a net farm income of nearly $900, of which the labor income was figured at a little over $400, leaving, in round numbers, $500 for the earning of the investment and of the farm itself.

Taking out of the sixty-nine farms a group of thirty, which are devoted mainly to fruit and the raising of sugar beets, we have an average size of 60 acres, of which a little over 40 acres are cropped. The capital invested is a little under $12,000 and the receipts approximately $2,000, with an expense of $950, leaving a farm income of about $1,000, of which the labor income is something over $600.

With the energy and thrift which are necessary for success in almost any line of endeavor, the farmer on irrigated land has the possibility of increasing his profits to a large degree, and with greater assurance of continued success than in many other enterprises. He is sure of a home and food for the family, and, with the comparatively dense settlement of an intensively cultivated region, he can enjoy many conveniences, such as graded schools—and often electric light and power. He also has the opportunity to secure constant and increasing profits, dependent almost wholly upon his initiative and strength.

The question of increasing the profits is one which, as in almost any other business, is dependent, first, upon the capital available, and, second, upon the skill with which this is used. There are certain limits, however, which define the size of the individual business. In the case of ordinary farming in the East, it has been found, for example, that about 200 acres, representing an investment of, say, $20,000, is the most advantageous; the extent of land and amount of capital being most nearly adapted to the strength and ability of the good farmer. Beyond this limit, it is necessary to employ hired labor, and often at a loss.

Economic Factors All-Important in Rural Highways

By LOGAN WALLER PAGE
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THE highway engineer should be able to determine what to build and where to build it, as well as how the building is to be done, and he should bear in mind that as much waste is likely to result from improving the wrong roads or employing wrong types of improvement as from using faulty materials or methods in making the improvements. It seems well to consider briefly, therefore, the extent to which determinations of each character may be rationalized.

The only reasonable basis for determining which of perhaps a great number of public roads in a community should be improved, or the order in which improvements should take place, is public convenience. In order to make each improvement add the maximum amount to the convenience of the public, however, it is necessary that the engineer who plans the improvements shall have a comprehensive understanding of the economic and social relationship which exists between different parts of the community under consideration and also the effect which different roads, if improved, would have in making this relationship more advantageous.

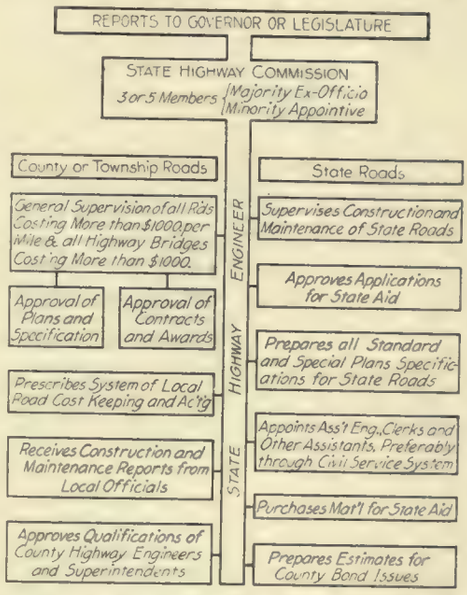
Plan Model System

In order to gain a comprehensive understanding of this kind it is usually necessary for the engineer to prepare a plan showing the various highways in proper relation to each other, and showing also how population and industries are distributed. The amount and character of traffic using each important road, or which would use an improved road having the same location, may be estimated by means of traffic counts or otherwise, and should be shown on the plan.

With such a plan before him, it is practicable for an engineer to lay out an intelligent system of improved highways which would accommodate the entire community, and to assign relative weights to each unit of the system according to its importance. This system would serve as a model toward the development of which all road improvement work should be directed, but which might be readily modified to meet the exigencies arising as the system developed.

Economic Considerations

The proper type of improvement for any particular road ordinarily depends for the most part on purely economic considerations. The principal factors which affect the economic efficiency of an improved road and upon which economic comparisons should be based are: First, cost of construction; second, cost of maintenance; third, amount and character of traffic, and fourth, the average unit cost of hauling before and after the improvement is made. If these factors be all intelligently considered for each of the types of any ordinary road, it is apparent that the most economical type in theory may be readily selected.



SCOPE OF MODEL STATE HIGHWAY DEPARTMENT AND DUTIES OF ENGINEER

The first factor, cost of construction, can usually be satisfactorily estimated for any particular road, when the conditions which affect the availability of materials, the character of labor, the prevailing gradients, etc., are understood.

The second factor, cost of maintenance, is dependent on the character of material used, the volume and character of traffic, and the climatic and topographic conditions which affect the road under consideration. This array of variables, especially when it is considered that traffic conditions are constantly changing, makes the cost of maintenance appear at first glance almost indeterminate. For most types of road improvement, however, the effect of these variables can be estimated within reasonably close limits from the data already available, and the Office of Public Roads is now working in co-operation with State highway departments and other interested persons in an effort to make these data more nearly complete. It is hoped that within a short time the information which is being collected can be so reduced and correlated that the cost of maintaining any particular type of improved road, under any given set of ordinary conditions, can be estimated with a very satisfactory degree of accuracy.

The third factor, amount and character of traffic, has its principal importance, from an economic view point, in the effect which it has on the cost of maintenance.

The fourth factor, average unit cost of hauling before and after the improvement, varies very slightly for different types of improved roads, provided that they are all equally well maintained. The real economic justification for improving any road hinges on this matter of reduction in the cost of hauling, however, and it, therefore, deserves the most careful consideration. If the unit cost of hauling before and after the improvement, and the total volume of traffic using the road are known, the total annual saving resulting from the improvement can evidently be estimated; and, if the improvement is to be justified economically, this total annual saving must be sufficient, after all costs for maintenance and repairs are deducted, to pay a reasonable interest on the original investment. To determine what type of improvement will return the largest net rate of interest on the original investment is the sole purpose of making an economic investigation.

State Control Desirable

If a model system of highways has been previously worked out, and the importance of each unit in the system has been properly weighted, it is apparent that the investigation for determining the proper type of improvement to employ on each road will be greatly simplified. It is also apparent that the more comprehensive this system can be made within reasonable limits, the less will be the duplication of work required and the greater will be the possibility of securing satisfactory results through efficient organization. The State is therefore much better circumstanced for planning and supervising road improvement work than are any of its political subdivisions. This is evidently true, even though the officials controlling road work in the subdivisions are as honest and intelligent as those in the State organization.

The chart shown herewith is intended to illustrate the scope of a model State organization and is based on several existing ones which are at present accomplishing very satisfactory results. It is evident that with an organization of this kind the experience gained and data collected in each section of a State can be turned to the greatest possible advantage in every other section.

Organizations Are Improving

There are now forty-two States out of the total of forty-eight which have established highway departments of one kind or another, and the organizations under which these departments operate are being constantly revised and improved. This shows that the public is awakened to the advantages to be gained by having all highway work done under a scientific and comprehensive organization. There is also unquestionably a growing public demand for quantitative assurance that every dollar levied for the purpose of highway improvement is being spent to the best possible advantage, and in order for the engineer to meet this demand he must be in a position to analyze the factors which affect the economic efficiency of improved roads and reduce his findings to a more or less rational quantitative basis. The general method of procedure necessary to accomplish this has already been outlined.

Alloy Steels Economical for Long-Span Bridges

By J. A. L. WADDELL
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THE FIRST actual use of nickel steel in bridge work resulted from experiments by Gustav Lindenthal, of New York, in 1903, when nickel-steel eyebars were employed in building the Queensboro bridge. The International Nickel Company financed an extensive investigation by the author into the economics of nickel steel for bridges, begun in 1903 and continued for three years. The results appeared in the *Transactions* of the American Society of Civil Engineers in 1909.

This investigation proved that nickel steel is in every way a suitable metal for the manufacture of bridge superstructures, being just as reliable as carbon steel and from 50 to 70 per cent stronger. The correctness of this statement is proved by the fact that it has been used in the Manhattan suspension bridge at New York, the St. Louis municipal bridge and the new Quebec bridge.

Results of Experiments

The author found by his experiments that it is perfectly feasible to produce commercially an eminently satisfactory nickel steel for bridge work having a minimum elastic limit of 60,000 lb. per square inch, a minimum ultimate tensile strength exceeding 100,000 lb. per square inch and an elongation in 8 in. of 15 per cent. The actual cost per pound for this metal, delivered at the bridge site, as compared with ordinary carbon bridge steel, he figured, should not be more than 1.5 cents.

Unfortunately, however, the steel makers and bridge manufacturers have for years refused to guarantee for nickel steel an elastic limit of more than 50,000 lb. per square inch, and they have asked an excess pound price of from 1.5 to 2.0 cents. The excess price per pound for the St. Louis bridge was 1.65 cents. If there were anyone available to unload rejections upon, as there is in the case of carbon bridge steel, the steel makers would quite willingly quote more reasonable figures for nickel steel; but the constant dread of being left with a large lot of unsalable alloy steel on hand militates against their so doing. It is only by having engineers create a large demand for the alloy, thus initiating competition in its production, that a reasonable unit price for it can be established.

Mayari Steel Tests for Memphis Bridge

The Pennsylvania Steel Company has obtained control of an iron mine containing a small percentage of nickel, and is, consequently, able to place upon the market a low-grade nickel steel at a reasonable excess cost above that of carbon steel. This steel has been denominated by its makers "Mayari steel." It is a natural alloy of nickel-chromium steel, containing from 1 to 1.5 per cent of nickel and from 0.2 to 0.75 per cent of chromium, with sulphur below 0.04 per cent, phosphorus below 0.03 per cent and manganese as desired. The carbon range is from 0.03 to 1.5 per cent, depending on the use of the steel. The ore comes from a deposit of some 25,000 acres at Mayari in the province of Oriente on the island of Cuba. It is estimated that there are 500,000,000 tons of this ore in sight.

Mayari steel is made only by the Pennsylvania Steel Company and the Maryland Steel Company. Like other nickel steels, it offers greater resistance to corrosion than the ordinary carbon steel. The following extracts are from a letter to the author written by J. V. W. Reynolds, vice-president of the Pennsylvania Steel Company.

Table 1—Results of Tests of Plates of Extreme Thicknesses

Thickness, in.	Tensile Strength, lb.	Elastic Limit, lb.	Elong. in 8 in. Per Cent	Reduction of Area, Per Cent	Chemical Elements: C Per Cent	Mn Per Cent	Ni Per Cent	Cr Per Cent
1⅛	99,600	64,660	17.5	41.9	.29	.77	1.36	.31
1⅛	94,300	62,270	18.0	33.6	.28	.75	1.41	.37
1⅛	98,820	63,080	17.0	34.7	.28	.72	1.49	.49
⅞	90,040	55,270	21.0	45.5	.28	.67	1.57	.31
1⅛	91,550	62,210	18.5	46.8	.30	.66	1.41	.40
⅜	94,060	56,030	18.5	47.1	.27	.61	1.42	.33
1⅜	90,300	57,540	19.0	53.6	.29	.71	1.53	.39

"Our principal experience on Mayari steel in bridge work has been in connection with the manufacture and fabrication of the large bridge which is to span the Mississippi River at Memphis. On this bridge alternate quotations on carbon and alloy steel designs were submitted. We quoted on the basis of using a steel made from the Mayari ore. By a selection of this ore steel can be produced with a uniform nickel content which may be varied at will between quite wide limits. It has been found, however, that a content of approximately 1.40 per cent is sufficiently high for bridge steel for most purposes. The steel is normally produced with only the usual additions in the open-hearth plant, although usually a small amount of chromium is added.

[The accompanying tables give the results of typical tests of large-sized angles and of plates. It will be noted that the results are well above the specified values of 85,000 minimum for tensile strength, 50,000 for elastic limit, 1,600,000 divided by tensile strength for elongation in 8 in. and 30 per cent for reduction of area.]

"The phosphorus in all these heats will average less than 0.02 per cent and sulphur averages about 0.03 per cent, the specified limit for each being 0.04 per cent, with an allowance of 25 per cent for check analysis of the finished material. In the specifications changes in the elongation and reduction of area are allowed for steel running over 1 in. thick.

"Below (Table 3) are given the specifications for full-size eyebars and the results of a test on a sample 14 x 123/32-in. bar.

"It has been our experience that this alloy steel works quite as well in the shop as any other steel with which we are familiar, making due allowance, of course, for the increased toughness. We find that it is easier to work than a 3¼ per cent nickel steel.

Table 2—Results of Tests of Large Size Angles, from 8 x 6 x 1 In., to 8 x 8 x 1⅛ In.

Tensile Strength, Lb.	Elastic Limit, Lb.	Elong. in 8 In., Per Cent	Reduction of Area, per Cent	Chemical Elements: C Per Cent	Mn Per Cent	Ni Per Cent	Cr Per Cent
95,580	64,700	16.8	45.5	.36	.62	1.27	.36
91,400	60,130	19.5	44.4	.32	.68	1.45	.44
95,400	62,300	18.0	46.7	.34	.75	1.51	.38
94,400	54,300	17.0	50.4	.35	.71	1.48	.43
93,240	55,300	21.5	51.3	.34	.75	1.37	.43
96,740	60,540	16.3	43.3	.32	.75	1.49	.40
98,420	61,060	17.0	48.9	.37	.78	1.31	.42
91,700	56,960	19.0	56.3	.31	.68	1.45	.44
94,180	58,130	20.5	51.5	.30	.77	1.48	.47

"It is difficult to give an exact extra which we would charge for rolled sections of Mayari steel over the market price of similar sections of carbon steel. We do not expect, however, that it will be necessary at any time to charge an extra of more than one cent per pound. The excess price for manufactured bridges depends upon so many circumstances that it is almost impossible to give any figure. It will vary greatly as the relative proportions of carbon and Mayari steels in the finished bridge are varied.

"With regard to quantity, we expect shortly to be in a position to produce 18,000 to 20,000 tons per month of Mayari steel shapes, if necessary; thus, even for the present, it is safe to say that we can meet any reasonable demand."

Electric Steel Production

The following extracts are from a letter by W. R. Walker, assistant to the president of the United States Steel Corporation:

"Although the electric steel process is a comparatively new one, being only ten years old, nevertheless there are in operation about 130 electric furnaces in this country and Europe which are making high-grade steels commercially. This steel has proved to be of such excellent quality that it is rapidly displacing crucible steel. It is also being used in seamless tubes, wire, sheets, ship angles, rails, thin armor plate and especially tools.

Table 3—Specifications for Full-Size Eyebars

	Required, Lb. Minimum	Obtained, Lb.
Tensile strength ...	80,000	88,200
Elastic limit	47,000	51,700
Elongation in 20 ft.	10 per cent	12.7 per cent
Reduction of area..	..	42.0 per cent

"In 1909 the steel corporation began the operation of a 13-ton electric furnace at the South Chicago plant of the Illinois Steel Company, and in 1910 began the operation of a similar furnace at the Worcester works of the American Steel & Wire Company. We have made about 10,000 tons of rails, which are now in track. Up to this time none of our electric steel rails have broken in service—even those located in the far Northwest during the very severe winter of 1912.

"Although the electric furnace at Worcester has not been in operation for some time, due to commercial reasons, the furnace at South Chicago has operated almost continuously ever since its installation, and is now employed in making alloy steels, such as nickel-chrome, chrome-vanadium, high-silicon steel, etc. From these facts I think we can safely conclude that electric steel is no longer an experiment and that its quality is equal to the best made by any other process."

Aluminum and Vanadium Steel Possibilities

In March, 1914, the author published in the *Proceedings* of the American Society of Civil Engineers a paper on the possibilities of the use of high-alloy steels. Figures and diagrams were given showing that in simple long-span structures there is an immense saving in weight of metals by using alloy steel instead of carbon steel, also that the rate of saving diminishes gradually as the elastic limit of the metal increases. The saving of material for cantilever bridges, while not so striking, is still most apparent.

Concerning rivets for bridges built of high-alloy steel, it is a foregone conclusion that the ratio of the strength of the alloy-steel rivets to that of carbon-steel rivets cannot be as great as the corresponding ratio of strength of plate-and-shape alloy steel to that of plate-and-shape carbon steel. On this account in high alloy steel bridges it will be necessary to use proportionately either more rivets, or greater diameters, or both.

There appears to be a great possibility in the use of aluminum as an alloy for bridge steel; but, so far as the author can determine, very few experiments in aluminum steels have yet been made, hence the possibility is more or less hypothetical.

The possibility of obtaining a good high-alloy steel for bridges by the use of vanadium appears to be almost a certainty; but the highest elastic limit and ultimate strength which can be obtained on a commercial basis by the use of that element cannot be determined without making some elaborate and exhaustive experiments.

[The foregoing abstract omits the details of the author's discussion of nickel steel and vanadium steel, and of comparative costs and diagrams, because of space limitations. Much of that matter has already been printed in the papers and discussions of the American Society of Civil Engineers.—EDITOR.]

Overloads Allowed in Operating Railroad Bridges

By J. E. GREINER
Consulting Engineer, Baltimore

THE PREVAILING practice among the majority of railroad companies is to design their bridges for Cooper's E60 standard loading with the American Railway Engineering Association's standard specifications as a basis. Structures designed in accordance with these standards will carry an overload of 50 per cent in regular service at unrestricted speed, and a much greater overload occasionally, or even regularly, at restricted speed, without impairing their safety. This 50 per cent overload means that these bridges are sufficiently strong to carry Cooper's E90 loading, and the modern actual service types of locomotives equivalent in their effects are given in the accompanying table.

These are the increases in rolling loads anticipated by those railroad companies which build what are known as E60 bridges; and an examination of the weights of locomotives in the table, with wheel bases as they exist to-day, will undoubtedly suggest a strong feeling of the physically impossible, unless all present standards of roadbed, gage of track and side and overhead clearances are abandoned and the railroads are practically reconstructed. Those railroads, therefore, which are making provision for the physically impossible in the way of rolling loads are surely building strong enough to take care of whatever is possible in this respect, and they should have no fear that their bridges will not carry all the loads which can ever pass over them.

When we consider that even if such excessively heavy types of locomotives are constructed and placed in operation, without changing standard gage or clearances and without reconstructing our railways, their operation would most assuredly be confined to high grade divisions, and they would not be regularly operated on low grade divisions. If such is the case, then those conservative roads which are designing their bridges for Cooper's E50 class of loading, which bridges are capable of carrying E75 without any restrictions whatever (and even E90 under restricted speed), are anticipating all possible future increases in rolling loads, and at a saving of from 12 to 15 per cent of the cost of E60 bridges.

As there are practically no roads which at the present time build lighter bridges than E50, it appears that all American railways, at the present time, are profiting by past experience with short-lived railroad bridges and are fully anticipating all possible increases in rolling loads which can be operated over their tracks until their entire lines are reconstructed; and if the next quarter of a century will again record the full life of an American railway bridge it will not be because the increase in the weight of rolling stock has not been anticipated, as has been the case in the past.

FULL REGULAR SERVICE TRAFFIC CAPACITY FOR E60 BRIDGES BASED ON AN OVERLOAD OF 50 PER CENT

Locomotive	Weight	Wheel Base	Axle Load	Percentage of Increase†
Cooper's E90	405,000	23.00	90,000	50
*Atlantic	336,000	31.79	98,800	57
Prairie	427,600	34.25	99,100	75
Consolidation	411,000	26.50	90,700	58
12-wheel	413,500	27.08	87,600	58
Decapod	449,400	29.83	79,500	68
Pacific	450,000	35.20	98,000	67
Mikado	473,000	35.00	93,500	55
12-wheel articulated	523,800	30.66	87,100	56
10 coupled	515,800	43.50	86,000	43
20-wheel articulated	754,800	59.80	85,000	58
16-wheel articulated	662,500	40.17	75,400	34
24-wheel articulated	834,000	65.92	74,400	35
12-wheel electric	552,000	38.50	94,600	84
16-wheel electric	619,200	44.22	77,400	94

*The Atlantic type applies to spans under 15 ft.; for greater spans the weight of this class of engine would run over 90 per cent in excess of the heaviest type now in service.

†Percentages of increase represent the approximate increase in weight of locomotives and driving axle loads in excess of the maximum weights now in actual service.

PRESENT TENDENCIES

In regard to present tendencies, it may be stated that the introduction of new grades of structural steel and the improvements in machinery and in methods of construction are influences to be considered in future developments. There is a tendency toward the use of alloys with high ultimate strength in the long span bridges, and when these new materials inspire general confidence in their uniformity and reliability for lighter work and their production commercially becomes less expensive they may gradually replace the present standard structural steel, just as the latter has superseded wrought iron. This, in turn, may require some different types of metal bridges to be designed, so as to take advantage of the greater strength of the metal without sacrificing stiffness in the structure as a whole; or perhaps the present quality of stiffness in metal structures will give place to more elasticity.

In conclusion, it may be stated that the recent improvements in American railway bridge practice embrace the substitution of solid-ballasted decks for open decks on short-span, beam-girder bridges and for trestles; of plate girders for short-span, riveted trusses; of riveted trusses for short-span, pin-connected trusses; of stiff bracing and counters for adjustable members; and of concrete and reinforced-concrete masonry for cut stone work.

American Engineering Education Makes Rapid Advances

By GEORGE F. SWAIN
Professor of Civil Engineering, Harvard University

THIS PAPER is not a complete discussion of engineering education or of any phase of it. It only discusses the general tendency and development of engineering education in this country, and touches a few salient points.

The laboratory method of instruction, now so fully developed everywhere, was first put into operation, in any systematic way, in the United States. Even up to the time of our Civil War, or later, chemistry was studied in our colleges entirely as a lecture-room subject. Some experiments were made by the professor in the presence of the students, but the latter received no training in experimental work, except in graduate courses.

The Massachusetts Institute of Technology recognized from the beginning the importance of the laboratory method, even for undergraduates, not only in subjects like physics and chemistry, but in engineering; and, at a time when the German technical schools were offering little or no laboratory training, American schools had constructed efficient laboratories, which were used not only for research, but in which every student was required to acquire some practice in the manipulation of the apparatus and materials which formed the subject of his studies. Since that time engineering schools the world over have recognized the value of laboratories, spacious buildings have been constructed both here and abroad, equipped with the most modern apparatus and machinery for use by the students in connection with the various engineering courses.

UNFORTUNATE TENDENCIES—LECTURE SYSTEM AND OVERCROWDED CURRICULA

While the development of technical curricula and of mechanical equipment has thus been extremely rapid in this country during the last thirty years, it is a question whether methods of teaching have correspondingly improved, or whether indeed they have improved at all. A generation or two ago it was recognized that education consisted in drill, discipline and self-culture. Of late years, however, there appears to have been a tendency to consider it to consist of listening to lectures. The lecture system, the characteristic feature even now of foreign schools, has apparently steadily grown in this country, until the prevailing impression is that all that a college professor does is to lecture. The writer considers this tendency—if he is correct in conceiving that it is a tendency—to be an unfortunate one, and that much would be gained in some of our colleges and technical schools, or in some of the courses therein, in going back to the old ideas of discipline, recitation and work by the student, in place of the too prevailing practice of work mainly by the professor.

Another unfortunate tendency has accompanied the great development of engineering science and the establishment of a greater number of courses and subjects of study, and that is the endeavor to crowd a constantly increasing amount of work into the same space of time. It seems to have been too often forgotten that a four years' course, like a measure of volume, can only hold a fixed amount. In order to get into

our engineering curricula, therefore, an increasing number of subjects, one or both of two alternatives become necessary, namely, either to crowd out some of the subjects previously taught, or to crowd in others at the expense of the time formerly devoted to those already existing. In other words, something had to be crowded out or the pressure had to be increased. The result has been, in the case of students who could only afford to take the standard college course of four years, a narrowing and one-sided training, or a superficial knowledge.

ARE PRESENT RESULTS EQUAL TO THOSE OF TWO GENERATIONS AGO?

Notwithstanding, therefore, the great development of our technical schools in physical resources, it may well be doubted whether the results obtained are as good as they were two generations ago, or whether we are now turning out men who are really any better qualified to develop into capable engineers than we did two generations ago. This appears to be particularly true in view of the fact that the phenomenon just discussed is not only observable in our technical schools and colleges, but in our primary and secondary educational institutions. Thoroughness, the development of initiative and the habit of reflection, seem to have been largely replaced by a smattering of many things.

The above tendencies have been accelerated and accentuated by the extension to the young and immature of the ideals of personal freedom and individual equality, so generally held up to admiration as the peculiar characteristics of a democratic form of government. The tendency certainly has been to substitute academic freedom for academic restraint and discipline. Perhaps the result has been good, on the whole, but the writer is one of those who disbelieves this.

EDUCATION A PREPARATION FOR LIFE

Education is a preparation for a vocation, perhaps, but, more than that, it is a preparation for life; and life requires not only the development of initiative, but the ability to submit to discipline, to realize responsibility to obey orders and to accomplish unpleasant tasks cheerfully and well. Education in this country to-day does not seem to be well calculated for these latter purposes; it rather trains young men to be intellectually arrogant, intolerant of others, unwilling to learn from those who have experience behind them, and to be a fit preparation for the great American game of bluff rather than for a modest, efficient and successful life.

Of course, these things, like almost all things that form the matter of subjects like education, economics, history, politics, government, etc., are incapable of exact determination. The statement can never be verified nor conclusively demonstrated that present-day education is better or worse than that of the past, because the question is not whether the graduates of our schools to-day, or any large proportion of them, achieve success, but whether the same man exposed to the same conditions would succeed better with our present education or with that of former years. Subjects of the class that we are now considering differ from those in physics and mathematical science, not only in that the conclusions reached are, in general, unverifiable, but in the fact that effects are due to a plurality of causes rather than to a single cause. These peculiarities render dogmatic statements on any of these subjects in bad taste and open to serious question.

VALUABLE SUBJECTS CROWDED OUT

Noticeable, however, is the fact that in the crowding out process, which has been referred to, some subjects have been displaced which were formerly considered among the most valuable subjects for educational discipline. Among these may be mentioned formal logic which (though included in the first course at the Rensselaer Polytechnic Institute) is now studied by an insignificant proportion of students in our colleges. Physiology, descriptive geometry, and some other subjects of great importance, have been either crowded out or greatly reduced in time.

The tendency seems to have been to replace these subjects by courses consisting too largely in the giving of mere information. Scientific facts have accumulated with such wonderful rapidity that training of the mind has been largely subordinated to the acquisition of scores of these facts, unmindful of the unquestioned truth that the ability to think correctly is a faculty which can be turned upon any subject with which the human mind may be engaged, and is, therefore the most valuable acquisition which a student can hope to make. Many will probably agree with the writer that too much is made of knowledge and too little of training.

SUBORDINATION OF THE EXCEPTIONAL TO THE AVERAGE STUDENT

Another significant fact connected with the recent development of our technical schools and colleges is the greatly increased number of students. This has led to another evil, namely, the subordination of the exceptional man to the average man. It is probably safe to say that to-day the exceptional man in our schools is held back, to a considerable extent, and made to conform to the average of the class, just as is the case in greater degree in the trades unions. There is a leveling down instead of a leveling up.

Some of our colleges have met this difficulty by offering advanced subjects in almost every field, resulting in very small classes, where men who are specially interested pursue their chosen specialties, as far as they like. This fact does not quite meet the difficulty, but rather, substitutes, in some cases at least, another one, namely, excessive specialization and corresponding narrowness. Would it not be desirable if in every subject, even those which ought to be taken by every student, the exceptional man were offered an opportunity to press ahead as fact as he could? In other words, as President Hyde of Bowdoin College has expressed it, should not our colleges run special trains for those who are capable of traveling in them?

ATTEMPTS TO REMEDY DIFFICULTIES

The difficulties which have been outlined are apparent to our educators, and an attempt is being made to remedy some of them by increasing the length of the engineering courses from four to five or six years, and by the suggestion that breadth of training may be obtained by taking a college course of three or four years and superposing upon this an engineering training, as is done in some schools of law and medicine. This fact for several reasons, does not fully meet the case.

In the first place, very few students can afford to follow the latter suggestion, and indeed a four years' course is all that the great majority of engineering students can take the time to pursue, considering the fact that when a young man has graduated from an engineering school he is by no means an engineer, but must begin at the bottom of his professional ladder in the school of experience. Perhaps this is not any more true in engineering that it is in medicine, and yet the writer believes that it is.

In the second place, engineering differs fundamentally from the law, theology, or medicine, in regard to the preparation necessary for the technical work. It matters nothing to the student of law what subjects he has studied in college. He may have studied mathematics, or the classics, or economics, or language. Provided he has a reasonably trained mind he can enter the law school and begin the study of law equally well, no matter what his collegiate training may have been. The same is true with regard to medicine and theology, though perhaps not quite to the same extent.

ENGINEERING AND APPLIED SCIENCES—PROPOSED SOLUTION FOR DIFFICULTIES

Engineering, however, resting as it does upon mathematics, the natural sciences, and mechanics, requires a definite sequence of study from the beginning of the college course. In other words; the aim should be toward applied science from the beginning, and not from the end of the college course. Does it not follow, therefore, that the best course of study for the engineer is one which is directed from the beginning toward applied science, and which includes both technical and general subjects in every year, the proportion of technical studies gradually increasing toward the end, and the proportion of general studies correspondingly decreasing?

Does it not follow also from the foregoing discussion that the difficulties which have been outlined may best be met by cutting off from the top of our present too elaborate and too widely expanded curricula, and in offering the bachelor's degree for a more general course in engineering science and the humanities, in which fundamental principles rather than practical applications are emphasized; and in attracting, if possible, men with the intellectual capacity, the money, and the time, by post-graduate courses of one or two years, leading to higher degrees, in which the various technical subjects are pursued to the limits of the various fields as they are known to-day?

The writer believes that this is the proper direction in which our engineering schools should develop, and that it will lead, if combined with improvement in some respects in present methods of teaching, to better results than have been attained within the past few years.

It may be added that it is not necessary that every engineering school should offer post-graduate courses. The great majority should confine themselves, the writer believes, to the fundamental or elementary four years' course, leaving to the comparatively few institutions who have the means, the equipment, and the men, the task of offering post-graduate instruction.

It seems to be admitted, however, that so far as concerns curricula and the opportunities for obtaining the highest engineering instruction in the various fields, there is absolutely no need to-day, except perhaps in chemistry and possibly physics, for an engi-

neering student to go outside of the United States of America. Conditions have so changed within the past twenty-five or thirty years that while, as already stated, it was formerly necessary to go to Europe to obtain the highest instruction, it is now not only unnecessary, but it is extremely probable that better opportunities are now offered in some institutions in this country than are to be found anywhere in the world.

What Panama Canal Means to Commerce and Trade

By EMORY R. JOHNSON, Ph. D., Sc. D.
Professor of Transportation and Commerce, University of Pennsylvania; Special Commissioner on Panama Canal Traffic and Tolls, 1911-13

IN REQUESTING this paper, the chairman of the International Engineering Congress stated that:

"While the other papers to be included in this volume [upon the Panama Canal] relate wholly to technical engineering subjects, we feel that the volume as a whole would be quite incomplete without a presentation of the general subject of the economic and commercial significance of the canal, written from a broad standpoint and intended to round out for the technical reader the real significance of the canal as a development in ways and means for expediting the world's commerce."

The people of the eastern and southern parts of the United States are interested in the Panama Canal, (1) because it affords a shorter highway to the west coast of the United States, (2) because it reduces the distance to the west coast of South America and (3) because it opens a shorter route to Australasia and the Orient. The people of the western section are benefited because it gives them readier access to the markets of Europe and the eastern part of the United States, while the manufacturers and traders of Europe are benefited by securing a shorter and more direct route to the west coast of the three Americas.

Time Savings

A freight vessel operated at an average speed of 10 knots can run between New York and San Francisco by the Panama Canal in 32 days less than are required via the Straits of Magellan. It can run from Liverpool to Callao in 16 days less by way of Panama than via the Straits of Magellan. From Liverpool to Valparaiso it will save 5 or 6 days via Panama.

Before the opening of the Panama Canal the relatively large commerce between the eastern part of the United States and Australia and New Zealand was shipped via the Cape of Good Hope, the distance from New York to Australia via Suez being about the same as by way of the Cape of Good Hope. Ten-knot freight steamers can save about 16 days by using the Panama Canal for trips from New York to Sydney. From New Orleans to Sydney, the saving in time for such vessels is 22 days. A vessel sailing from Sydney for Liverpool will select the Suez route if the master of the vessel needs to discharge and take on a cargo at intermediate ports. If the vessel sails from Sydney with a full cargo for Liverpool it will probably be more economical to take the Panama route, by way of which fuel costs will be less than via Suez.

Hongkong and Manila are almost equally distant from New York via the Suez and Panama routes. It is probable, however, that most of the commerce between the eastern part of the United States and the Philippines will be handled via Panama because the trade with the Philippines will naturally be carried on by vessels engaged also in the trade with China and Japan, Manila being a terminal port for a voyage from New York to the East. Singapore is decidedly nearer New York via the Suez Canal than by way of Panama, and it is not probable that much traffic from Singapore to New York will be handled via Panama.

The trade between Europe and China, the Philippines and Japan—with the possible exception of some of the Japanese trade—will be handled by way of Suez and not through the Panama Canal. Although the entire Orient is nearer Liverpool and other European ports via Suez than via Panama, it may be economical for some of the traffic between Japan and Europe to be handled via Panama, because of lower fuel expenses, and because of the opportunity to engage in American commerce.

The Canal's Traffic to Date

The canal was opened for traffic Aug. 15, 1914, before it was fully completed. Since it was opened for traffic, slides in the Gaillard (Culebra) cut have, on a few occasions, interrupted the use of the canal for periods of one to five days, and these interruptions to traffic have doubtless somewhat delayed the establishment of regular services through the canal, and have possibly made the increase in the traffic of the waterway somewhat slower than the gain otherwise would have been. The conflict in Europe started shortly before the canal was opened, and all advance estimates as to the use that would have been made of the canal have been thrown out of line. It is probable that the war has cut in half the tonnage of the Panama Canal traffic.

The traffic through the canal, both eastbound and westbound, comprises a large number of commodities. This is especially true of the trade between the two seaboards of the United States. Among the manufactures shipped from the eastern seaboard to the west coast of the United States in large quantities in April were iron and manufactures of iron and steel, chemicals, machinery and textiles. The eastbound shipments through the canal also include many kinds of commodities, although the number of articles shipped eastbound is less than the number of those moving in the opposite direction. Sugar from the Hawaiian Islands to New York is a large single item of eastbound traffic. Lumber in relatively large tonnage is shipped through the canal to the east coast of the United States, to Canada and across the Atlantic to England. Flour from the west coast is shipped mainly to Europe.

Effect on European Market Already Shown

The lines that have formerly been operated between New York and Australia by way of the Cape of Good Hope have been changed to the Panama route. The establishment of direct steamship services between the eastern seaboard of the United States and trans-Pacific countries has already tended to lessen the importance of Europe as a market for the Australian and Oriental goods imported into the United States. The shifting of markets due to the establishment of new transportation routes is a slow process and the influence of the canal upon the relocation of the world's primary trade centers will be gradual, but, in the long run, of great importance to the United States.

The use made of the canal by American manufacturers and traders will depend upon the extent to which the steamship lines are able to compete with the rail lines for traffic originating or terminating at interior points. It is too early to reason with any degree of finality concerning the ability of the coastwise carriers to secure traffic between the Mississippi Valley and the Rocky Mountain States. There is no doubt, however, that the rail and water lines will actively compete for large west-coast shipments to and from all points between the Atlantic seaboard and places as far west as St. Paul and St. Louis.

Probable Effect on Inland Points

Producers located at inland points will, without doubt, have to pay higher rates on goods shipped in either direction between the eastern and western sections of the United States, and producers located at or near the Atlantic and Gulf seaboards will enjoy lower rates than can be secured by producers at interior points, not only on traffic between the two seaboards of the United States, but on shipments to and from western South America, Australasia and the Orient. On account of these changes in rates at and near the seaboard, manufacturers having plants both at inland cities and at places on or near the seaboard will, probably, when it is practicable to do so, turn over to their seaboard plants orders for foreign shipment and orders requiring the shipping of goods between the two seaboards of the United States.

The advantage in freight rates which seaboard plants will have because of the canal may also be expected to result in the erection of some plants at or near the seaboard that would, if there were no canal, be constructed at inland points. The United States as a whole is so large, however, its industries are so varied and so widely distributed through the country, and the interstate commerce by rail is so many times greater than the entire traffic through the canal will ever be that the commerce by way of the canal between the two seaboards of the United States and between either of those seaboards and foreign countries can be only one of the many forces affecting the location of industries.

The first and the most direct effect of the canal is its influence upon ocean freight rates, but inasmuch as transportation rates are but one of the items in the cost of production, the indirect and most important benefit of the canal is the aid it renders in the development of industries. The general industrial effect produced by the canal through its reduction in the expense of transportation is to afford a wider market within and without the country for the products of the mills and factories of American producers. For the trade of the United States with western South America, Australia and the Orient the canal has made it possible for American industries to compete much more readily with European industries, and, as time passes, the favorable effect of these improved conditions of competition should become increasingly evident.

What should be the policy of the United States in the management of the canal?

In the long run, this will probably test the ability of the Government as fully as did the construction of the waterway. Tolls have been fixed to be paid by all vessels using the canal. The tonnage of the waterway will, it is believed, within ten years, be sufficient to enable the Government to make the canal commercially self-supporting, providing the present rate of tolls is maintained and is exacted of all vessels, American as well as foreign. Doubtless, pressure will be brought from time to time upon Congress and the President to lower the rate of tolls. The Government should resist this pressure until the revenues derived from the canal cover the annual operation and maintenance expenses and the interest on what it cost to build the waterway.

The revenues needed to make the canal commercially self-supporting will amount to about $20,250,000 per annum. This large total is made up of the following items:

Operation, maintenance, zone sanitation and government	$ 5,000,000
Annuity payable to the republic of Panama	250,000
Interest at 3 per cent upon the cost of the canal	12,000,000
Amortization of the investment, ¾ per cent per annum	3,000,000
Total	$20,250,000

By the end of the first decade of the canal's operation the tonnage of vessels using the waterway will amount to 17,000,000 net tons per annum, unless the European War should so cripple the international trade of the world as seriously to restrict for a considerable time the volume and rate of increase of the world's commerce. If the rate of tolls that has been established is maintained for ten years and if subsequent reductions in the rate of tolls are conservatively made, it will be possible for the American people to secure from the Panama Canal revenues that will recover out-of-pocket expenses and return to the United States treasury the sum that has been invested in the waterway. This can be done without restricting the usefulness of the canal, and if this policy is followed out it will be possible for the United States, with less burden to the taxpayers of the country, to construct other needed public works.

[The foregoing is a much-curtailed abstract of Professor Johnson's paper, which contains numerous tables showing the exact saving in distance and time effected by the canal, and other tables of traffic movement. It also gives an extended discussion of the transcontinental railroad rate situation, and the probable effect of the canal thereon.—Editor.]

Pipe Joint Fails by Pulling Out at Elbow

Accident at Wilmington, Del., Floods Pumping Station—Repairs Involve Bracing at Curve

FAILURE of a joint in a 42-in. cast-iron forcing main at a point about 50 ft. from the Brandywine pumping station of the waterworks system at Wilmington, Del., was the cause of considerable damage recently. According to information received from Edgar M. Hoopes, Jr., chief engineer of the Water Department, the first evidence of trouble appeared on the afternoon of Aug. 9, when water was discovered on the pumping station lawn. The following morning the line was uncovered at the top and found to be leaking at the bell end of a 45-deg. bend. An effort was made to calk the leak under pressure, but while this work was in progress the entire joint failed, the calkers and several laborers having very narrow escapes from drowning. The check valves on the end of the line at a 35,000,000-gal. reservoir held, but the contents of the main (about 1,000,000 gal.) flooded the pumping station to a depth of about 5 ft. and completely uncovered several sections of the pipe near the broken joint.

The joint failed by pulling out at the elbow, a short piece of plain end pipe having been used between the elbow and sleeve. The main at this point was under a pressure of 115 lb. per square inch, and all joints for three lengths on either side of the elbow were pulled out at the bells from 1 to 3 in. No bracing of any kind had been placed at the elbow originally.

A repair was completed in 60 hr. of continuous work. An oxy-acetylene torch was employed for the purpose of melting out the joints to permit realignment of the main. During this period no water could be pumped to the sedimentation reservoir, and a filtered water famine was narrowly averted. The nature of the failure clearly illustrates the necessity of carefully bracing all bends to overcome the outward thrust which results from their curvature when under pressure. The bracing on the outside of the elbow shown in one of the illustrations, was incased in concrete before the trench was filled in.



REPAIRED BEND WAS BRACED AND INCASED IN CONCRETE TO PREVENT MOVEMENT



AFTER THE JOINT PULLED THE LEAD WAS BURNED OUT WITH OXY-ACETYLENE TORCHES

Canada's Railway Mileage

CANADA'S operating railway mileage totaled 30,795 on June 30, 1914, according to the annual report, recently issued, of the Dominion comptroller of railway statistics. This represents an increase of 1492 miles during the fiscal year 1914. The greatest yearly gain from 1908 to 1914, inclusive, was in 1913, when 2575 miles were added, but in none of the other years was the 1914 increase equalled. The Province showing the greatest gain was Saskatchewan, which added 438 miles and is now second, with 5089 miles. Ontario has 9255 miles. Saskatchewan passed Manitoba in 1912 and both passed Quebec in 1913.

The foregoing figures cover only the lines under operation. In addition 11,472 miles were surveyed in the whole Dominion in 1914, 5521 were under contract and 3417 were completed but not in operation. The bulk of this mileage was in the western Provinces. Alberta had 805 miles under contract and 1189 completed but not in operation, while the corresponding figures for British Columbia were 1235 and 698; for Saskatchewan, 340 and 555 and for Manitoba, 108 and 134. Ontario rivaled any single Western Province, with 1841 miles under contract and 836 completed but not in operation.

A Test Result Omitted on the diagram, page 237 of the Engineering Record of Aug. 21, may give the impression that the curve does not properly average the plotted results. One other test was included on the original diagram. It should be plotted at 21-ft. penetration just above 2 tons.

Tells Pan-American Congress How Pennsylvania Resurfaces Old Roads

William D. Uhler, Chief Engineer of State Highway Department, Advocates Use of Large Stone and Thorough Rolling

EMPHASIZING, among other details, the importance of avoiding stone of too small a size, and advocating thorough rolling, cleaning of the surface, and uniform application of bituminous material, William D. Uhler, chief engineer of the Pennsylvania Highway Department, described at the Pan-American Road Congress in Oakland, Cal., last week, the methods employed by his State in resurfacing old roads.

The essential points to be considered in the selection of a proper type of surface for an old stone road, Mr. Uhler said, are the character and amount of traffic, the grades, and, as a rule, that most important factor, the funds available for the work. When the traffic has been determined and the character of surfacing selected a thorough study should be made of the existing foundation and drainage facilities. Test holes should be made at sufficient intervals in the road to determine the depth of the existing foundation, and usually it is found that a considerable portion must be restored before a surface can be applied. Too much stress cannot be laid on the desirability of having proper lines and grades before resurfacing, in order to avoid increasing or perpetuating the difficulties of future improvement of these roads. The question of providing proper underdrainage must be considered and drains installed where necessary.

Water-Bound Macadam

The methods used in the preparation of the base for both water-bound and bituminous macadam are the same. If any holes or depressions are found in the base, the road should be dug out and replaced with good-sized, clean stone, keyed with a smaller size, and rolled with a 10-ton roller until thoroughly compacted. The roadway should then be cleaned thoroughly and the existing surface broken or loosened with picks, harrows, or, if necessary, rollers equipped with spikes, so that the new material will bind properly with the old surface.

After the base course has been finished, there should be laid a layer of properly graded, approved stone, passing a 2½-in. mesh screen and being retained on a 1-in. mesh screen, this stone being known as 1½-in. stone. The stone should be spread upon the base course with shovels from piles along the side of the road or from a dumping board, but in no case should the stone be dumped upon the first course surface. This layer should be rolled with a roller weighing not less than 10 tons until it is compacted to a firm and even surface. The total thickness of the surface course should not be less than 3 or 4 in. after rolling. When a surface course of a depth of 3 in. is specified it should be laid in one layer, and a 4-in. course should be laid in two layers of 2 in. each. Should difficulty be experienced while rolling in getting the stone to compact thoroughly, sprinkling with water or spreading lightly with screenings will prove beneficial.

After the surface course of stone has been thoroughly rolled, screenings, varying in size from dust to ¾ in. should be spread, with shovels, from piles along the side of the road, or from dumping boards, but, again, in no case should the screenings be dumped directly upon the surface of the stone. These screenings should then be thoroughly rolled with a 10-ton steam roller, additional dry screenings applied, and the rolling continued without the use of water until the interstices of the stones are filled. The road should then be sprinkled with water, rolled, additional screenings spread and the sprinkling and rolling continued until the surface is well-bonded and set. The rolling in all cases should begin at the sides and work toward the center of the roadway, thoroughly covering the area with the rear wheels of the roller and should be continued until the surface is hard and smooth and shows no perceptible tracks from vehicles passing over it.

To protect a water-bound macadam road from the ravages of automobile traffic, it should be given a bituminous surface treatment of either approved tar or asphalt. Prior to applying this bituminous material the surface of the road should be cleaned thoroughly by sweeping with machine and hand brooms. After all the caked dust has been scraped off and the stone exposed uniformly over the surface, the bituminous material should be applied.

Bituminous Macadam

In resurfacing with bituminous macadam the base course should be prepared as for water-bound macadam, after which broken stone passing a 2½-in. screen and retained on a 1-in. screen should be spread on the base course. with shovels, from piles along the side of the road, or from a dumping board, to a depth of 3 in. after rolling. After the broken stone has been laid and placed true to line and grade and cross-section, it should be rolled, with a roller weighing not less than 10 tons, until the stone has been thoroughly compacted and ceases to creep in front of the roller. When the rolling has been finished there should be spread evenly over the surface a quantity of approved bituminous binder, not less than 1½ nor more than 1¾ gal. to each square yard of surface area. The binder should be heated to the proper temperature for the material used.

After the bituminous binder has been applied there should be spread a layer of ¾-in. dry, crushed, approved stone, free from dust, and in such quantity as will just cover the surface and fill the surface voids. Rolling should then be continued until the surface is thoroughly bonded; the surface then should be swept clean of all loose stone and an application of bituminous binder of approximately ½ gal. to the square yard of surface area applied evenly. This binder, in turn, should be covered immediately with a thin layer of dry stone chips, free from dust, and rolled lightly. The quantity of chips should be just sufficient to absorb the excess of bituminous material remaining on the surface and to prevent the existence on the surface of an excess of binder.

Bituminous Concrete and Sheet Asphalt Resurfacing

Bituminous concrete and sheet asphalt pavements should be laid on a concrete base, instead of on the old existing macadam foundation which, heretofore, has been the generally accepted practice for country roads. In view of the increased amount and change in character of traffic, even though slightly more expensive, it is advisable to provide for either a 4-in. or a 5-in. concrete base on top of the broken stone or telford base, due to the tendency of macadam to shift or to consolidate further under traffic and possible sub-grade trouble, all of which tend to bring about a wavy or uneven condition of the surface. In conjunction with the concrete base a concrete header curb should be constructed extending 6 in. beyond the fixed edges of the bituminous pavement and to the finished grade. After the concrete base has developed a hard set, and from one to two days prior to the placing of the bituminous wearing surface, the base should be cleaned thoroughly of loose and foreign material, by sweeping, and then covered with an asphaltic cut-back mixture consisting of equal parts, by volume, of asphaltic cement, 55 to 65 penetration, and commercial naphtha, 52 to 55 gravity, the mixture being applied by a pressure distributor at the rate of ⅛ gal. to the square yard. The object of this paint coat is to secure a better bond between the concrete base and the bituminous top. The bituminous top, 2 in. in thickness, is laid under the same requirement as to preparation, laying, rolling and inspection as for a standard sheet asphalt pavement.

The following penetrations are recommended for the asphaltic cement:

Penetrations Recommended for Asphaltic Cement

	Heavy Team or Motor Traffic, Penetration	Medium or Light Traffic, Penetration
Trinidad asphalt	45-50	50-55
Bermudez, Mexican and California	50-55	55-60

Experience has demonstrated that the turning of traffic on and off a bituminous surface will result in grinding or cracking the edges and also, unless a perfect bond has been secured with the base—and this cannot be relied upon—heavy wheel loads, at a distance of 1 to 2 ft. from the edge, will produce a spreading of the bituminous surface. To prevent this, provision should be made, no matter what the formation may be, for a 6-in. concrete header curb on either side of the road if it is not paved to the full width.

In resurfacing with a sheet asphalt top, the concrete foundation should be laid true to line and grade, and the binder and wearing surface laid to a uniform depth and raked to true cross-section and grade, after which it must be rolled thoroughly.

Rolling Important

Unquestionably, the most important single point in the laying of sheet asphalt wearing surfaces is the rolling. More pavements are failing to-day through displacement from original form than from all other causes combined, and aside from other reasons to which this result may be attributed —and there are undoubtedly many—it is certain that unless a pavement is free from waves at the time of its completion it never will be, as the tendency of the pavement is to push under traffic, thus increasing the wavy condition. It is important, therefore, that all pavements should be thoroughly compressed, carefully rolled and cross rolled.

In the preparation of bituminous mixtures all materials should be subjected to rigid plant and laboratory inspection.

In the resurfacing of water-bound macadam it is frequently the case that the engineer in charge of the work allows too small a stone to be used, which, it is true, will require decidedly less rolling, but will not stand the motor traffic of to-day.

Another fault quite often found is the spreading of screenings before the 1½-in. stone is thoroughly locked, and very frequently using too large quantities of screenings, thereby causing a heavy crust to form on the road surface.

The success of the bituminous treatment of water-bound macadam roads depends entirely upon the cleanliness of the road before the application of the material.

Many failures are due to the lack of proper care in this most important detail. In cleaning the surface of the road the sweeping should be windrowed along the edges of the wearing surface, in order to prevent the running off of the bituminous material, which later should be swept back on the road. Special attention should also be given to applying the chips, just sufficient chips being used to prevent the traffic from picking up the bituminous material.

In bituminous macadam or penetration work no bituminous binder should be applied unless the stone surface is thoroughly dry, and the temperature of the air is 65 deg. or higher, and special attention paid to the heating and applying of the binder. One of the important features in connection with obtaining the best results in bituminous-concrete construction is the use in the wearing surface of good, durable stone, free from dirt and decomposed material, as decomposed stone in the mixture will naturally develop weak spots in the pavement and ultimately result in failure. The penetration of the asphaltic cement used in the mixture should be governed by the character of the traffic requirements.

As before stated, the success of all bituminous-concrete and bituminous pavements is very largely dependent upon the rolling, and the best results can be obtained only by using a light roller for the initial compression and a heavier roller for the final compression, with an equal amount of transverse and longitudinal rolling.

THE COST OF ENGINEERING AND SUPERINTENDENCE in St. Louis for $1,404,316.49 worth of new construction in the water department was 3 per cent, according to the latest annual report.

Economy in Cost and Erection of Steel Building Results from Cantilever Beam Design

Mannheimer Building in St. Paul Averages Favorably in Total Weight Although Heavy Truss and Girders Were Required

SUPPLEMENTING the description in the Engineering Record of Aug. 7, page 159, of the heavy riveted truss used in the Mannheimer Building, in St. Paul, it can be stated that, in spite of the unfavorable handicap imposed by the unusual conditions requiring the use of this truss and two long girders, this building was designed with remarkable economy in total steel required. Special cantilever beam construction was adopted for the long girder-beams between columns, which resulted in a large saving in beam weights by the decrease in bending due both to the cantilever action and short suspended beams and to the decrease in the span length of the transverse intermediate beams. In addition, a saving of 8 ft. in height of building was thus effected. Important further advantages of the construction are the open vertical spaces beside the webs of the columns for pipes, sprinkler system, pneumatic tubes, etc., and the economy in erection resulting from the ease with which the beams could be slid sidewise to their seats upon the outside of the columns.

TYPICAL FLOOR LAYOUT

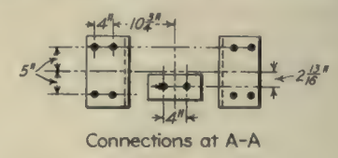
The accompanying part plan of the sixth floor of this seven-story building indicates the method adopted to reduce the steel weight. As the building is about 150 x 300 ft. in plan, a saving in the weight of floorbeams soon amounts to a large total. The scheme adopted for the long girder-beams between the columns spaced 27 ft. 3 in. apart is the use of beams offset to run past the columns in pairs and cantilever into the intermediate spans. The length of the suspended beams and the amount of overhang were fixed by trial to give equal positive and negative bending moments in the cantilever beams, and equal to the positive bending moment in the suspended beams. For the given spans of 27 ft. 3 in. the overhang for this condition was made 3 ft. 11 in.

By thus using separated pairs of beams between the columns it is seen that the floorbeams, which support a tile-arch floor construction, are shortened in span length by the distance 2 ft. 1½ in. between the girder-beams. This resulted in an average decrease of between 6 and 10 lb. in weight per foot of the floorbeams. Standard end connections were used and diaphragms consisting of a web plate and angles connect the pairs of beams.

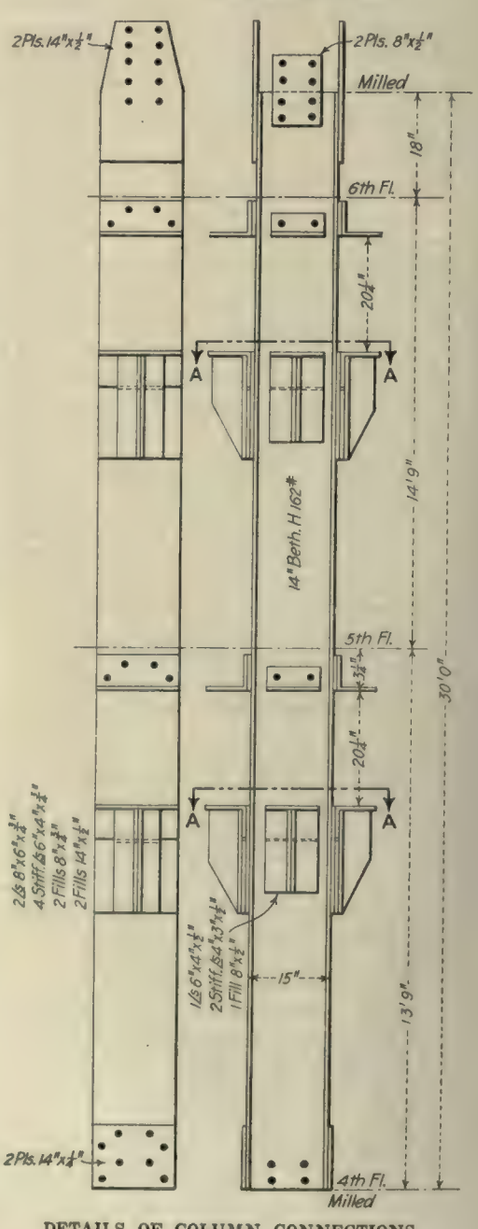
COLUMN AND BEAM DETAILS

The typical connections and column seats are shown in one of the drawings. It is worthy of note that the connections are symmetrical and the loading is practically so when the action of the connecting diaphragms between the pairs of beams is considered.

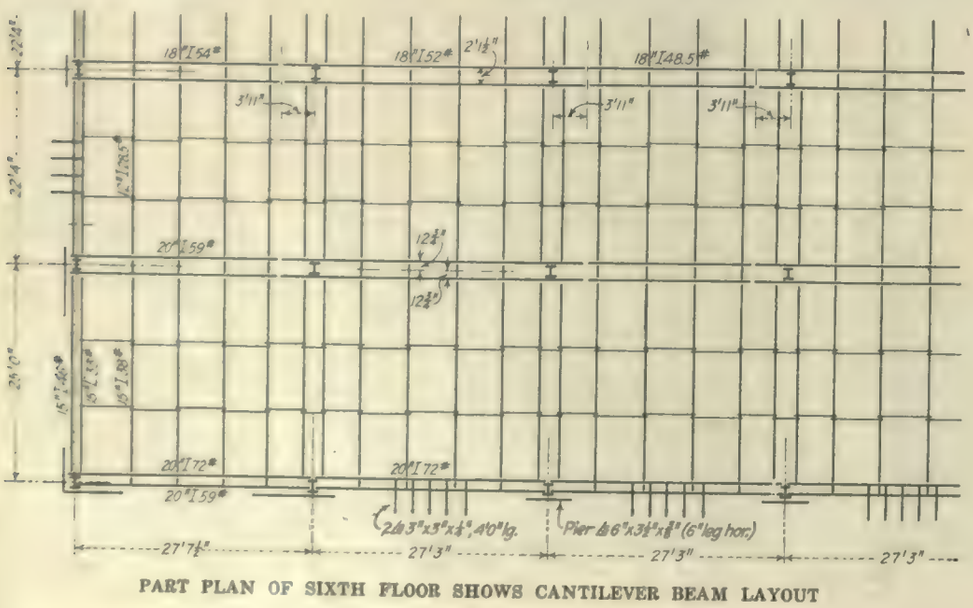
It is further evident that the connection between suspended beams and cantilever beams, shown on the detail, is quite stiff.



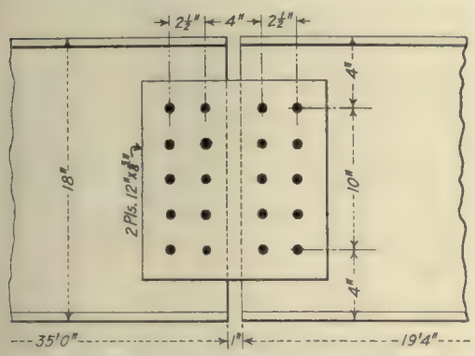
Connections at A-A



DETAILS OF COLUMN CONNECTIONS



PART PLAN OF SIXTH FLOOR SHOWS CANTILEVER BEAM LAYOUT



CONNECTION BETWEEN CANTILEVER AND SUSPENDED BEAMS

The assumption of simple beam action is therefore not exact, but of course errs on the side of safety as in the case of all beams having rigid end connections.

Relative Economy

The use of pairs of I-beams between the columns instead of single girders resulted in a decrease of about 8 ft. in the total height of the building, due to the decreased depth and the fact that fixed beam clearances were specified. Cantilevering the floorbeams over the girder-beams was also considered, but was not adopted because it would have resulted in the loss of the economy due to the decreased height just mentioned.

The total weight of steel in the building, including the column bases of cast iron, is nearly 4300 tons. This gives an average of 1 2/3 lb. per cubic foot for the 5,000,000 cu. ft. above sidewalk level. Figures furnished by the architect show that twelve similar New York and Chicago buildings averaged 2 2/3 lb. per cubic foot, and none ran below 2 lb. The difference of 1 lb. per cubic foot amounts to 2500 tons for this building. The relative economy of the cantilever type of floor is therefore quite evident, although part of the low weight may be due to the lighter Bethlehem sections, which were used throughout for columns and beams. To offset, this, however, the columns were designed for the loading due to a possible future addition of one story in height.

The building was built for the Mannheimer Realty Company, of St. Paul; A. H. Stem of that city was the architect, O. S. Payzant, of New York City, was the designing engineer, and the steel was fabricated by the Minneapolis Steel & Machinery Company, of Minneapolis.

Build Standard-Gage Railroad to Haul Road Materials

Low Cost per Ton-Mile Obtained at New Lexington, Ohio, by Bringing Freight Cars Directly to the Job

ALL MATERIALS, consisting of 1000 carloads of screened gravel, sand, cement and brick for 6.1 miles of 16-ft. brick road, with a concrete foundation, now under construction at New Lexington, Ohio, are being hauled directly to the job in railroad cars without rehandling. A 65-ton geared steam locomotive is used to pull the cars over a spur built entirely upon new right-of-way. The track, which is standard gage, is constructed with 60-lb. relay rails. Sixty per cent of the ties are railroad unspiked discards and are used only to furnish bearing. The remainder are standard ties which hold the gage.

Some trouble was anticipated, due to the possibility of the track settling on new fills. As a result the ties on the fills were spaced closer and 3 or 4-in. saplings were placed under the ties parallel with the rails. However, the fills are few and all are short. The track is laid just outside the limits and parallel with the curb of the new road. A number of 4, 5 and 6 per cent grades are encountered.

Operation of Material Train

For the concrete work a train consisting of one car of screened gravel, one car of sand and one of cement is kept moving alongside the Koehring paving mixer. The original intention was to use a tank car for hauling water for the concrete work, but owing to the heavy grades it was decided to pipe the water and thereby relieve the work of the locomotive.

The gravel car is spotted directly opposite the mixer. A batch hopper is hung on the side of the car and is loaded while the mixer skip is discharging into the machine. When the skip is lowered to the ground a gate in the batch hopper is opened and gravel is shot into the skip. The sand car is pushed ahead of the gravel car, and sand is unloaded through a chute into wheelbarrows. The cement is unloaded from the cement car and distributed along the line of the work. One man is kept busy dumping cement into the skip.

The cars of brick are unloaded by carriers and laid directly from the car. The accompanying photograph clearly portrays the concrete train at work on the job. High speeds are not needed and considerably fewer trips were necessary than with other common methods of transportation.

The foregoing table indicates a haulage cost of 12 cents per ton-mile. The contractors are Swank & McIntyre of Dayton.

Total and Ton-Mile Hauling Costs

First cost		
New hardwood ties, 4000 at 32 cents	$1,280	
Old ties from railroad, 12,000 at 10 cents	1,200	
Relay rail, 60-lb., 550 tons at $17..	9,350	
Labor laying and removing track, 32,000 ft. at 15 cents	4,800	
Locomotive	4,500	
		$21,130
Operation, 8 months at $250		2,000
		$23,130
Salvage		
Scrap rail, 550 tons at $13	$7,150	
Locomotive	1,500	
		8,650
Net cost		$14,480

1000 cars, or 40,000 tons hauled an average of 3 miles equals 120,000 ton-miles. Cost per ton-mile, 12 cents.



THIS METHOD OF HAUL COST THE CONTRACTOR 12 CENTS PER TON-MILE

Rochester Effects Saving by Using Odd-Diameter Pipe

Although There Were Doubts as to Character of Interior Surface Due to Wrapping Cores, Lengths Were of Excellent Quality

THIRTY-SEVEN-INCH PIPE, instead of the standard 36 in., was used last year by the city of Rochester, N. Y., in laying 7.69 miles of a new 25-mile conduit from Hemlock Lake, the city's source of water supply, to the city. As a result there was a large saving in tonnage and a considerable increase in carrying capacity. The outside diameter of a standard 36-in. pipe was adhered to, thus allowing the use of standard curves and other specials. The pipe selected as a basis was the standard "Class D" section of the American Waterworks Association, which has an outside diameter of 39.16 in., or a wall thickness of 1.58 in. Using this outside diameter, and a wall thickness of 1.04 in., the inside diameter was 37.08 in., or roughly 37 in.

When bids were called for the manufacturers demurred, contending that the wrapping of the standard 36-in. cores to secure the larger diameter might result in pipe with rough inside surfaces. The city engineer's office reports, however, that the pipes delivered were among the smoothest ever received. The standard flasks, of course could be used without alteration.

It is proposed to complete the line as soon as funds are allotted for the work. It is expected that tenders will be invited on both steel and cast-iron. For the latter still other diameters than the 37.08 in. will be called for, the increase in head in the lower reaches demanding greater wall thickness. The sizes to be used and the quantities of each to complete the line to Rush Reservoir, 9.68 miles, are as shown in the table on page 394.

The argument against the use of special

Sizes and Quantities of Pipe to Be Used, with Resultant Saving

Rochester class	Approximate Length, Ft.	Wall Thickness, In.	Inside Diameter, In.	Max. Allowable Head, Ft.	Wt. Per Ft., Lb. Standard	Special	Saving	Total Saving, Tons
A.	11,130	1.04	37.68	137	625	425	200	1130.0
B.	14,600	1.20	38.76	225	625	487	138	1007.4
C.	24,000	1.42	38.32	329	625	570	55	660.0
D.	.....	1.58	36.00	...	625	*..	...	.....
Total saving								2797.4

Class D fittings used throughout.
*Standard.

sizes does not apply in this case, since the quantity required is sufficient to justify the necessary changes by the manufacturer while the large tonnage could not be taken from stock, but had to be cast on order.

The pipe for the first section was furnished by the United States Cast Iron Pipe & Foundry Company of Philadelphia, and inspected at the foundry by William R. Conard. The pipe dimensions were fixed by the city engineer's office at Rochester. Alternate proposals were received on 37-in. lock bar and welded pipe and 39-in. riveted steel pipe ¼ in. thick. The cost of hauling and laying and the relative permanency of the different materials were elements entering into the final selection.

Chicago Should No Longer Depend on Sewage Dilution

Experts Deem Filtration Necessary—River and Channels Denominated Open Sewers Violating First Law of Public Health Work

THAT the present means of protecting the water and getting rid of the sewage in Chicago are not, and cannot be, made satisfactory and that decided changes are needed both as to policy and procedure is the final opinion expressed by a board of three international sanitary engineers on Chicago's sanitary problem in their final report to the Real Estate Board. The board consisted of George A. Soper, New York, Arthur J. Martin, London, and John D. Watson, Birmingham, and spent 13 months in studying the extensive literature on the subject, following a fortnight of attention to the problem on the ground. A preliminary report submitted on May 1, 1914, was abstracted in the Engineering Record, page 578, May 23, 1914. The following conclusions are taken from the final 212-page cloth-bound report just issued by the Chicago Real Estate Board. Most of the statements contained in the preliminary report are confirmed in the final draft.

However perfect the dilution scheme may once have appeared from a theoretical standpoint, in practice it has proved to be inadequate both as a means of obtaining pure water and as a means of getting rid of the sewage. It has never produced completely satisfactory conditions at Chicago and it never can do so. It has produced insanitary conditions for many miles down the drainage channel and the Desplaines and Illinois Rivers.

Water Supply Not Safe

The idea of excluding all the sewage from the lake calls for the placing of a larger territory under central sanitary control than is practicable. The region whose drainage pollutes the lake lies in four States. There is occasional contamination to be feared from vessels in spite of any precautions which can be taken. In short, the sources of pollution which now exist are too numerous, too various and under too many governmental jurisdictions to be centralized.

The vital statistics can be quoted either to show that the water supply is, or is not, dangerous to health. In comparison with some cities, the typhoid rate is high, with others low. The water supply is, and long has been, occasionally polluted, according to detailed official analyses which have been examined by the board of experts. The United States Public Health Service classes Chicago with cities whose water supplies are subject to intermittent pollution with great dilution of the polluting material. In the opinion of Dr. Young, former head of the Chicago Health Department, waterborne typhoid cannot be considered as having been entirely eliminated. It is the opinion of the board of experts that the water supply is not safe.

River and Channels Open Sewers

Chicago's policy of using its river, and constructing canals, some of them running through the business and residence sections of the city, as open sewers, is not in accordance with good sanitary practice and should be given up. Limits of pollution should be established for these waterways based on what is proper under the conditions, and the necessary works should be built.

For cities to utilize the self-purifying capacity of water for the ultimate disposal of their sewage is quite justified under proper circumstances, but to cast the entire burden of Chicago's filth upon the Chicago River and its artificial outlet is to impose conditions upon these waterways which are alike insanitary, unfair and unnecessary. It violates the first law of public health work, which is that dangerous and offensive wastes shall be promptly removed from their points of origin and kept under control until they are rendered harmless and inert.

Aside from Chicago's right to appropriate the largest river in the State for the purposes of sewage disposal, a proceeding the justice of which is here questioned, the result in the city of Chicago is not satisfactory. The scheme as it exists to-day, after 15 yr. have been devoted to its perfection, leaves very much to be desired. There is not an arm or branch of the Chicago River which looks clean when viewed in the light of what has been accomplished in cities where sanitary problems have been adequately dealt with.

Sewage Works Proposed

A policy of prevention rather than cure is recommended in attempting to keep the Chicago River clean. Instead of discharging sewage into the river in unlimited quantities and without restriction as to composition, limits should be placed upon the quantity and amount of domestic sewage and trade wastes which it may receive. Restriction should be placed not only upon industrial drainage, but upon domestic sewage as well. Only that part of the drainage which the water can absorb can carry away without producing offensive conditions anywhere should be emptied into the waterways. The remainder should be collected and disposed of in such ways as the experience of Chicago and other cities shows to be desirable and the opportunities of the situation permit. Intercepting sewers, screens and settling basins will have to be employed extensively and it is probable that more efficient methods of purification will be required to a considerable extent. It is recommended that trade wastes should be dealt with at private expense when, by reason of their volume, nature or strength, they add unduly to the cost of treating the sewage.

Water Filtration

No plan or method of dealing with the sewage will afford the complete protection of the water supply which is desirable, and the city must face the fact that the water supply should be purified. Filtration works can, and should, be constructed at once for a part of the water supply and extended later to cover the entire supply as necessity and opportunity present.

The adoption of a policy of cleaner waterways and a cleaner water supply does not run counter to the plan, which the city has followed, of diverting all the sewage from the lake and keeping the lake water as pure as possible for drainage purposes. The filtration works are necessary to supplement the sewage works and are required for the reason that the sanitary and ship canal alone is not capable of accomplishing the results required. It will always be desirable to keep as much sewage as practicable out of the lake and to dispose of the sewage with as little offense as is consistent with a due regard to economy.

It may be expected that the standards by which the success of the sewage disposal works and water purification plants is to be tested in the future will be considerably in advance of those of to-day. In the recommendations here made that the water and sewage be treated, due allowance is made for the development of the works as an ultimate to secure a higher efficiency than is at first needed.

Progression Plan

The works here recommended can and should be built in accordance with a progressive plan. It is not intended that the whole, or any very large part of the structures which may be needed 50 yr. from now shall be put into the ground at once. But the outlook should be sufficiently broad and the plan sufficiently comprehensive so that whatever building is done shall be toward a result which is clearly foreseen.

The next step which should be taken toward a sanitary disposal of Chicago's sewage is the preparation of a definite general plan and policy of sewage disposal which will show what works are required, where they should be located, when they should be built, and what they should cost. To do this work properly will require an intimate knowledge of the ground.

The Production of Petroleum in the United States in 1914 aggregated 290,312,535 bbl., states a bulletin issued by the U. S. Geological Survey. Of this 265,762,535 bbl. were either marketed or utilized directly in field development, and 24,550,000 bbl. were placed in producers' storage. The amount marketed or utilized in 1913 was 248,446,230. As the average price per barrel in 1914 was only 80.6 cents, however, as compared with 95.4 cents in 1913, the value of the marketed production was only $214,125,215 in 1914, as against $237,121,388.

HINTS FOR THE CONTRACTOR

Details Which Save Time and Labor on Construction Work

Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

[*Contributions to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

Large Quick-Dumping Concrete Car Used at 46th Street Pier

THE CONCRETE car shown in the accompanying photograph discharges a batch into the hopper at the top of the cofferdam, from which the concrete is spouted to place, makes a trip to the mixing plant 100 ft. away and returns with a fresh batch before the first one has run out of the hopper. It is handled by a dinky, and carries a crew of two men, one to open the lever gate, and one on top to load the car. The car holds 2 cu. yd. and is lined with sheet steel.

This car is in use for spouting such parts of the pier footings within the cofferdam as can be reached by chute from the top of the cofferdam. Much of the first concrete, now being placed, is handled by locomotive cranes in dump buckets, and a great deal of concrete will be chuted later on in the construction. It was not feasible to put up a tower at this stage, as it was not practicable to locate the concrete plant on the center-line of the pier. The piles for the new pier are largely driven, which has necessitated setting up the concrete plant on the cofferdam over the new north slip, so that its derrick can reach the material barges.

This contract is being carried out by the Holbrook, Cabot & Rollins Corporation under the direction of Thomas B. Bryson, with Daniel Hughes as superintendent.



CAR, HOPPER AND MIXING PLANT AT NEW YORK PIER



CAR DISCHARGES IN FEW SECONDS

2000-Ton 14-Story Building Underpinned without Settling

TWO THOUSAND tons of brick, steel, and wood underpinned without accident, damage, or settling more than 1/16 in. is the feat accomplished recently in shoring the front end of the Adams Express Company Building, Chicago. This work was done in connection with the enlarging of the basement and bank floors of the building. About 2500 24-in. jacks, capable of lifting 5 tons each, were used.

The front piers of the building were cut out and replaced by 20-in. needle-beams. A side of a pier was cut out at a time and small pump-locks and screws placed until the entire pier rested directly on the jacks and drums. Then the jacks were removed one row at a time and the needle-beams inserted. In order to take the load off the piers the contractor shored under the ends of the beams with five rows of drums and screws. The piers were then removed and the structural steel set in place.

Level readings were taken on the piers three times a day to keep track of any tendency to settlement. In order to maintain the building at the original level, men were kept constantly turning the screws. The blocking settled 8 in. but the piers have never been below their original level.



LARGE NUMBER OF SCREW JACKS USED

Crowe Brothers, of Chicago, were the shoring engineers.

Large Drill Boats Used at Halifax Ocean Terminals

TWO DRILL boats used in submarine excavation for the Ocean Terminals at Halifax, N. S., drill their holes through 6-in. casing pipes, which are pulled by clamping them to the boat and raising the scow on its spuds. The charges of dynamite are made up in cartridges and lowered to the bottom of the holes with the wires attached to small floats, which support them at the top of the water while the casings are being withdrawn. When these casings are clamped to the scow at the level of the deck, the spuds are shoved down, raising the boat and the casings with it until the latter are free and can be withdrawn. The boat is then removed some distance, the lead wires carried on the floats are connected up, and the blast is fired with a battery. Dynamite is carried on a special scow, which is shown in front of one of the drill boats in the accompanying photograph. This drill boat carries a battery of seven drills, while the other is equipped with a battery of ten.



DRILL BOAT AND DYNAMITE SCOW AT HALIFAX TERMINAL

Work on the Halifax Ocean Terminals is being carried on by Foley Brothers, Welch, Stewart & Farquier, with L. G. Fuller as general superintendent.

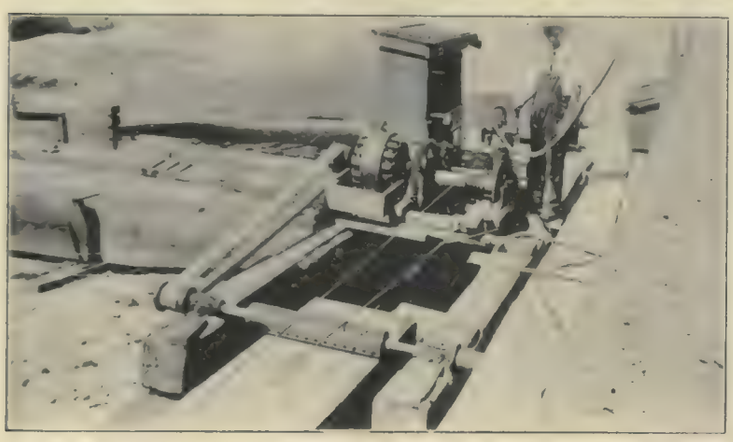
Home-made Planer Used to Size Large Timbers on the Job

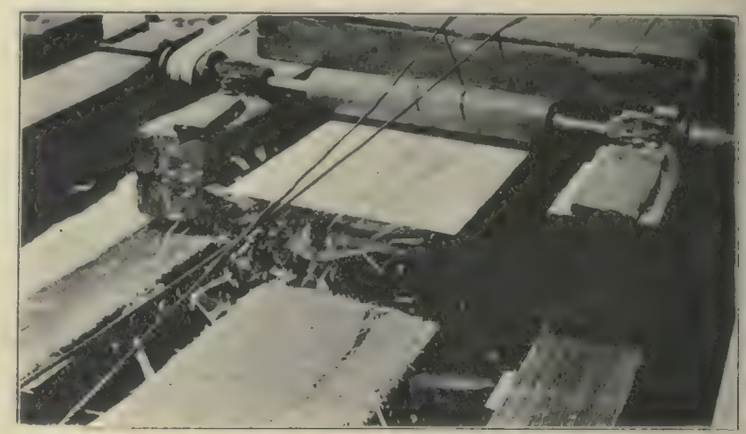
By R. W. CADY
Assistant Engineer, Cayuga & Seneca Canal

THE HOME-MADE planer shown in the accompanying photograph was used to size accurately on the job the large timbers employed in constructing wooden lock gates for barge canal locks on the Cayuga and Seneca Canal. These timbers varied in size from 24 x 34 in. x 27 ft. to 12 x 24 in. x 27 ft. Each leaf of these gates is built by placing timbers on top of each other, the largest at the bottom grading up to the narrow ones on top. In order to have these sticks fit closely together and build up plumb, it was necessary that the top and bottom of each should be perfectly flat and parallel. At the mill in the West where the timber was bought it was impossible to dress timbers larger than 30 in. wide. Even the smaller timbers that had been surfaced at the mill were so much "in wind" by the time they reached the site that they had to be redressed before they could be used.

This tool is mounted on a movable platform about 16 ft. long under each side of which is a 12 x 12-in. timber. Each timber is fitted with hardwood blocks to reduce the sliding friction. These blocks slide in a track on two 12 x 24-in. x 46 ft. timbers, which are set on edge about 4 ft. apart. The tops of these timbers were set perfectly level in the same plane and made very smooth. An air hoist mounted on the platform hauls it back and forth on the long timbers by cables running to deadmen at each end. A 38-in. cutter head driven by a 10-hp. motor is mounted on one end of this platform so that its axis is perpendicular to the axis of the timber track and parallel to the plane in which the top of this track is the maximum cut that can be made in one operation. As some of the timbers are an inch or more out, it requires four or five cuts to surface them. The capacity of the machine is seven or eight sticks a day. It requires two men to operate it and the service of a crane to handle the timbers.

The results were so good that when the timbers were erected in the gates, which are 41 ft. high, there were no cracks that would leak and the gates measured the same at all points. The machine was devised and built by the Drilling & Contracting Company of Albany, N. Y.





HOME-MADE PLANER THAT SURFACES BIG TIMBERS ACCURATELY ON THE JOB, AND ITS CUTTER HEAD IN ACTION

Platform Raised with Tackle Used to Erect Subway Roof Forms

INSTEAD of building a car to the full height of the subway section to handle steel forms for the jack arches of the roof, the contractor for the 138th Street-Southern Boulevard section of the east branch of the Bronx subway in New York City is using a light platform hung from the steelwork with four sets of falls. This platform is pulled up under the roof, the forms are taken down and landed on it, and the whole is lowered by the falls and landed on a small car running on the construction track below. The car is rolled forward, the falls are hooked to the steel or to slings previously hung, and the platform is raised in position to set the forms in the next section.

The small cars can be used for many other purposes, and are run on the regular track without being in the way as a full height carriage would be, unless an outside track were provided for it. The entire arrangement is light and easily handled.

Work on this section is in charge of H. R. Shailer, superintendent for the Richard Carvel Company, Inc. R. S. S. Guerber is section engineer for the Public Service Commission.

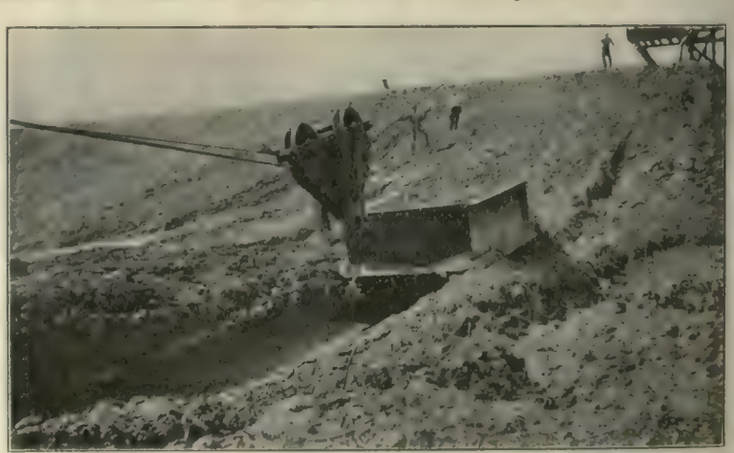
Light Cableway Outfit Handles Heavy Dragline Bucket

IN ORDER to avoid deep borrow pits, which result in excessive seepage, in connection with levee work on the Mississippi River below Memphis, a drainage contractor designed and constructed the cableway dragline apparatus shown in the accompanying photograph. A light-weight tower which could be moved quickly and easily over the wet, soft ground was obtained by dragging the heavily loaded 6-yd. bucket along the ground, thus taking the strain off the towers.

The tail tower is anchored by means of a movable counterweight which consists of a large wooden box filled with sand. When the tower is to be moved the weight, which hangs from a boom, is swung forward to its new location. It is then detached and the tower run ahead on its track the required distance. The maximum distance between towers is 500 ft. About 1000 cu. yd. of earth are handled in a 10-hr. day. According to R. H. & A. G. McWilliams, the contractors, of Chicago and Memphis, by taking the strain off the towers they have greatly increased the life of the cableway and minimized cable repairs.



PORTABLE DRAGLINE TOWER MOVES ITS OWN DEADMAN



LIGHT CABLEWAY DOES NOT RAISE BUCKET FROM GROUND

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

Collapse of Street Decking Follows Subway Blast

As Timbering Falls Crowded Seventh Avenue Street Car Plunges to Bottom of 28-Foot Cut for New York's New Rapid Transit System—7 Killed

A blast of the usual size, fired at 7.56 a. m., Sept. 22 in the east half of the main cut for the new Seventh Avenue subway just south of Twenty-fifth Street in New York City, was followed by the collapse of the street decking for the full width of the roadway south to a point below Twenty-fourth Street, where the street load had been transferred to the last permanent steel erected. This section of the subway is being built with unusual steel support for the timber street decking, which has been criticised by construction men for its unnecessary weight and strength. The method of support gives a clear, full-height working face, and, because the section is in rock cut, requires a minimum of horizontal bracing below the level of the steel beams. It was described on page 57 of the Engineering Record of July 10, 1915.

Condition at Time of Shot

At the time of the shot the needle-beams on the east side of the street, where the shot was fired, were carrying the decking for a span of some 30 ft. Those on the west side of the street, where the excavation was not quite so far advanced, were probably not carrying the entire load, as the cross-beams had been posted down to the floor of the shallow heading cut preparatory to advancing the needle-beams. The hangers securing the cross-beams to the needle-beams were, however, still in place. After the collapse these beams and the section of decking they supported remained intact, while the south end of the east pair, and the decking over them, fell to the floor of the cut.

Condition After Collapse

The decking over the shallow heading above Twenty-fifth Street did not collapse; neither did the sidewalks, except for half their width at a few points. These sidewalks had, for the most part, not been decked, and were sup-

(*Continued on page* 400, *first column*)

World's Engineering Works Reviewed by International Congress at San Francisco

General Goethals Tells of Panama Canal at Opening Session—Materials of Engineering Discussed—Record Tunneling at Rogers Pass Excites Interest—Activated Sludge the Chief Topic at Sanitary Session

(*By Telegram from San Francisco*)

Interest in the administration and technical features of the Panama Canal and in the development of the Diesel engine were the chief features of the sessions of the International Engineering Congress held prior to the recess on Wednesday afternoon, Sept. 22. The session devoted to these subjects drew the largest attendance. Discussion in all of the sessions, however, was disappointing, due to the limited advance distribution of papers. Furthermore, the authors, in most cases, were absent, a fact tending to suppress the questions which might ordinarily be put. The papers, however, possessed unusual value and, collected in volume form, will make most valuable contributions to the literature of engineering. No attempt will be made here to summarize the papers.

Those papers that are of importance to the readers of the Engineering Record will be printed in part or in abstract in early issues. Extracts from eight of the papers appear elsewhere in this issue.

Goethals Speaks of Canal

The first session Monday morning was an impressive gathering, fully befitting the magnitude of the work, the Panama Canal, which occasioned the Congress. On the platform with the honorary president of the Congress, Major-General George W. Goethals, were the vice-presidents, the foreign delegates and the presidents and secretaries of the national engineering societies. The keynote speech emphasizing the purpose and the occasion of the Congress was made by Dr. William F. Durand, chairman of the committee of management. General Goethals spoke next; he sketched the historic settling of the Canal, the efforts made and the plans projected since Spanish times for connecting the two oceans. He emphasized too that the Canal, calling into play almost every branch of engineering, might well be the inspiration for the gathering of specialists of every class, while the world-wide influence of the Canal on commerce justified its selection as the prime motive for an inter-

New Committee Will Harmonize Good Roads Movement

Body Appointed at Pan-American Road Congress to Secure Co-operation Among All Highway Organizations—Military Road Approved

(*By Telegram from San Francisco*)

One effect of the joint meeting of highway associations at the Pan-American Road Congress, in Oakland, Cal., last week may be a single national meeting in the future, instead of separate meetings of the leading organizations, as in the past. This, at least, is the inference drawn from the American Highway Association's action in appointing a committee to confer with representatives of other organizations to "harmonize" the good roads movement. The resolution is given in full below. The Congress went on record in favor of a Pacific Coast highway as a measure of military preparedness. The following report of the sessions is a continuation of the one published in the News of the Week section last week:

(*Continued on page* 402, *first column*)



A BLOCK OF DECKING COLLAPSED, KILLING SEVEN IN NEW YORK SUBWAY CONSTRUCTION ACCIDENT

national gathering. General Goethals took advantage of his survey of the Canal's history to pay graceful tribute to the achievements of his predecessors and the loyal support and invaluable assistance of his confreres in the work. To John F. Stevens and John F. Wallace he paid special tribute, outlining in some detail the particularly important accomplishments of their administration.

Tribute from Foreign Delegates

Following his address General Goethals greeted the officially accredited delegates from foreign countries, each responding with a few words of felicitations. One could not but be impressed by the sincerity of the delegates, their admiration of the success of American engineering genius and their appreciation of the honor conferred in inviting their countries to be represented at the gathering. It is not too much to say that the presence of these delegates and their addresses gave the gathering a singular flavor that emphasized strongly the momentous character of the Congress. The enthusiasm of the French delegate, Jean De Pulligny, and the polished and gracious response of the Swiss delegate, Prof. A. E. Rohn, were especially noteworthy. Besides these two delegates the representatives of Canada, Cuba, China, Guatemala, Japan, Netherlands, Nicaragua, Spain and Sweden presented their felicitations.

The program called for the presentation to Dr. James Douglass of the John Fritz Medal, a feature that had to be omitted owing to the absence of Dr. Douglass who was detained in the East by illness.

The real business of the convention began Monday afternoon with a well attended session on the Panama Canal. The papers were general rather than engineering, taking up organization, administration, purchase of supplies, geology and the commercial and trade aspects of the Canal. One engineering paper on the climatology and hydrology of the Canal was presented at this session. All of the papers dealt with matters treated in this journal to a greater or less extent, depending on the particular subject, during the past seven years. There was only one discussion by C. E. Grunsky. He advocated that the Panama Canal, like river and harbor improvements, should not be expected to pay back into the treasury of the United States its cost, or, in other words, that amortization charges should not be included in the operating expenses. He believed it permissible, however, to provide in the tolls for interest at a low rate upon the cost.

Technical details regarding the Canal were treated in ten papers presented in two succeeding sessions, both well attended. While there was no discussion, numerous questions were put to General Goethals, General Sibert and Mr. Williamson, the principal Panama Canal engineers present.

Engineering Materials Discussed

Tuesday morning the Congress split into sections with six to eight sessions in progress simultaneously. At the first session, on materials of engineering, timber was taken up. The principal papers were valuable contributions by H. S. Betts and W. B. Greeley of the Forest Service on structural timber in the United States and by Howard F. Weiss and Clyde H. Teesdale of the same service on preservative treatment of timber. The discussion was meager. E. J. Mehren of New York described the unsatisfactory condition of the timber market in the eastern part of the United States which had forced the abandonment of specification by botanical species and the adoption of the density or ring clauses. Prof. Charles B. Wing of Leland Stanford University pointed out that a similar condition did not occur on the Pacific Coast, the differences in the structural timbers being so great as to be readily distinguished by the eye. Other papers described the timber resources of Canada, India and Russia.

The second session on materials, devoted to concrete, brought out no discussion. At the third session there were excellent papers on the outlook for iron by Prof. James F. Kemp of New York and on alloy steels in bridge work by Dr. J. A. L. Waddell of Kansas City. Professor Kemp reviewed at length the iron resources of the world and particularly of the United States, concluding that supplies for the next 200 or 300 years are in sight, even under large increase in use.

Railway Location

The second session on railways, following the presentation of the paper on locating a new line, by William Hood, chief engineer of the Southern Pacific, brought out a discussion on the extent to which practice for locating steam lines could be modified for a line to be operated electrically. It was advanced that the shorter wheelbase of the electric locomotive allowed the use of sharper curves while its great overload capacity for shorter periods permitted steeper short grades than does the steam locomotive. Mr. Hood, however, was of the opinion that it is not advisable to locate a line on the theory that steam equipment will never be used on it. Such an assumption is not likely to be borne out. Consequently he did not favor modification of steam-line locating practice for sections to be electrified.

Tunneling at Rogers Pass

Following the presentation, by Charles S. Churchill of the Norfolk & Western Railway, of his paper on "Tunnels," J. G. Sullivan, chief engineer of the Canadian Pacific, emphasized the reasons for using the pioneer drift in driving the 5-mile Rogers Pass tunnel. With this scheme it has been possible to keep men at work drilling, mucking and loading except where shooting is actually in progress. As a result the contractors have broken the American record in tunnel driving. Whereas the original offers of contractors for driving the tunnel called for completion in seven years, the bore will actually be finished in three and one-half years, half of this time being taken in the approaches. He emphasized that the scheme was applicable only in hard rock.

Commenting also on Mr. Churchill's paper Mr. Hood remarked that he could build a tunnel 17 ft. wide almost as cheaply as a 14 or 15-ft. tunnel. The added width resulting in convenience and safety to track men who need not run to places of refuge is well worth the slightly greater cost.

Sewage Treatment

In the discussion on sewage treatment George W. Fuller, of New York, commented on the activated sludge plan as sound in theory and very promising, in that clarified liquid and non-putrescible sludge is produced. On the other hand questions of power and attendance might make it uneconomical. He emphasized the need for experienced management of sewage treatment plants as absolutely essential to satisfactory operation. In sewer construction the engineer should make provision, he thought, for proper inspection of house connections to insure tight pipe joints. He cited the case of a large sewer construction job in which 2 per cent of the total cost was allotted to rigid inspection of joints in the mains, but later on, when the house connections were made, there was no adequate joint inspection and the resultant storm-water leakage into the laterals flooded the sewage treatment plant.

Mr. Fuller said he had abandoned mortar joints and has substituted bituminous compounds to secure tighter sewers. Captain K. Hallen, of Sweden, cited the favorable experience in that country with Imhoff tanks about 30 ft. deep, built with enlarged top cross-sections to lessen scum troubles. Mechanical agitation was highly desirable, he thought. Charles Gilman Hyde estimated that there were about forty sewage farms in California, but that, as a rule, they were not highly successful. He suggested that further study of this question, particularly in the dry Southwestern States, would be well worth while. Edward Bartow expressed an opinion that fine screens remove very little of the putrescible matter unless the sewage is fresh.

In the discussion on water supply papers the question of how to increase metered water consumption was raised. A California town has a contract with a water company for a fixed minimum quantity greater than the present consumption and is endeavoring to encourage consumers to use more water. John R. Freeman suggested that sliding meter rates in use in other localities have produced good results and seem fair to company and consumer.

West's Scenic Splendors Enliven Trip to International Congress

The "Engineers' Special," carrying delegates from New York and other Eastern cities to the International Engineering Congress, reached San Francisco on time at 9 p. m., Sept. 15. The long journey across the continent was interrupted at Colorado Springs, where a day's stop had been arranged for a trip to Pike's Peak on Sunday morning, Sept. 12. The engineers went by automobile to Crystal Park over a remarkably tortuous and steep highway cut into the sides of the mountains. In the afternoon various parties were organized, the largest group, which numbered about seventy, electing to go up Pike's Peak. About twelve took the regular train on the cog railway at 1.30 p. m., the other two left in special cars at 2.30 p. m. The first of the latter was brought to grief within 15 min. after starting by the breaking of one of the pistons of the engine, necessitating the abandonment of the trip.

At the Grand Canyon more than one-third of the party, including some ladies, showed their mettle by taking the trip down the Bright Angel trail, a very fatiguing descent of a mile to the river. Wednesday morning a mirage in the Mojave Desert caused much excitement, while the crossing of the Los Angeles aqueduct and the Tehachapi Loop naturally received much attention from the engineers.

Praise has been loud for the efficiency and courtesy of the special railroad representatives accompanying the party, G. S. Harner of the New York Central, and T. W. Conway of the Santa Fé.

Representatives of local committees of the various national societies boarding the train at Fresno and other points near San Francisco were enthusiastic over prospects for successful meetings.

Port Authorities Meet

The American Association of Port Authorities held its fourth annual meeting at Los Angeles, Sept. 13-15. J. P. Gilmer, Los Angeles Board of Harbor Commissioners, acted as chairman of the convention. The following papers were presented and discussed: "Recent Port and Railway Development in Philadelphia," by John Meigs, director Department of Wharves and Docks; "Port Terminal Development," by Paul P. Whitham, Seattle; "Public Control of Our Waterfront and the Obstacles to Be Overcome," by E. F. McSweeney, Boston; "Free Ports," by Calvin Tompkins, New York City; "Assessing Scientific Port Charges and Basis of Method of Such Charges," by Ernest M. Loeb, president Board of Harbor Commissioners, New Orleans; "The Best Method for Developing Port Traffic," by J. P. Gilmer, Board of Harbor Commissioners, Los Angeles.

The report of the resolutions committee, approved by the association, called for the appointment of committees to investigate ten subjects involving problems of interest to port authorities. These committees will report results of their studies at the next meeting.

J. J. Dwyer, chairman, Board of San Francisco Harbor Commissioners, was elected president of the American Association of Port Authorities for the ensuing year, and Montreal was selected as the meeting place for the 1916 convention.

President Marx Discusses Ideals and Art in Engineering

Charles D. Marx, president of the American Society of Civil Engineers, opened the forty-seventh annual convention of the society at San Francisco, Sept. 16, with an address in which he discussed in detail idealism and art in relation to engineering. His thesis was that the engineer is a practical idealist, that in the construction of sanitary work, irrigation projects, railroads, bridges and other engineering structures he makes it possible to bring to the masses such comforts and advantages without which the attainment of a high moral and intellectual civilization is impossible. By citations from men such as Emerson and Kipling he threw into relief the idealistic side of engineering work.

In discussing art in relation to engineering he emphasized the intrinsic, artistic character of a structure well fitted to perform the function for which it was designed, even though devoid of ornament as that term is usually employed.

Extracts from his address will be found on page 378 in this issue.

Business Matters

The business part of the program was unusually brief. Many suggestions were received as to the time and place of the next convention. Among the places Pittsburgh led with 118 votes, Boston was second with 51 and Chicago third with 48. September, by a very large majority, was recommended as the time for the convention. The entire matter, however, was referred to the board of direction for action.

The meeting also referred to the board of direction a resolution of the Seattle Association of Members of the society, suggesting that the parent body urge the establishment of a greater number of weather bureau stations in order that more complete observations may be made of precipitation, evaporation and snow storage.

Social Events

Thursday evening was devoted to a reception, dinner and dance at the Old Faithful Inn in the Exposition Grounds and at three o'clock Friday afternoon a special train conveyed the members and their guests to Del Monte on the shore of Monterey Bay, from which point several trips were made to points of scenic interest.

Goethals Day at the Exposition

Major-General George W. Goethals was honored at the Panama-Pacific International Exposition on practically the same scale as were former Presidents Taft and Roosevelt. Sept. 7 was designated as Goethals Day and appropriate ceremonies were arranged, the most popular of which was the address by the "canal builder" himself, delivered in the Court of the Universe to as many as could stand within reach of his voice.

In his speech Major General Goethals epitomized his views on the future management of the canal zone by saying: "I am going to advocate to Congress that the United States open up the canal zone to American merchants and manufacturers, but restrict to American citizens the use of the canal zone for business purposes." He reviewed the history of the canal project, beginning with activities prior to the nineteenth century, touched on the policies at Washington during various administrations and recounted some of the difficulties in governing the people of Panama. He made the point that it was not lack of sanitation, but lack of money that forced the abandonment of the French project.

The United States has not enough dock room at the canal terminals, he pointed out, even though commerce through the canal is at low ebb now on account of the war. Additional docks, however, are to be built. In commenting on the fortifications, he said: "The military force on the zone is sufficient to take care of any raid which might be made by a foreign power and beyond that we have not gone."

After planting a tree from the Isthmus in the permanent Exposition gardens, Major General Goethals was presented with a casket of jewels from the tower of jewels by C. C. Moore, president of the exposition.

French Engineer Leaves Trenches to Attend Engineering Congress

Jean de Pulligny, who gained a wide acquaintance in the United States while head of the French mission of engineers studying American engineering practice, was granted a two-months' leave of absence from the French army in order to represent his government at the International Engineering Congress, in San Francisco, this week. M. de Pulligny has been a familiar figure at American highway conventions for several years, being called on often to compare American with French road building and maintenance practice.

At the beginning of the war M. de Pulligny rejoined his battalion, in which he had held the rank of major previous to his resignation several years ago, and was promptly assigned, with his former rank, to take charge of a road-building detail at the front. His command consisted of 700 men, with 235 horses and 20 motor trucks. Of the trucks some (steam-propelled) had a carrying capacity of 10 tons. On account of the heavy traffic in munitions and food supplies—carried largely by heavy motor trucks and trailers—the building and maintenance of the roads to the front and along the trenches is most important, and M. de Pulligny's command was occupied entirely with this work.

He left the front Aug. 26 and came directly to the United States, stopping for a day only in Paris, which he had not seen for a year. When asked to discuss the war, M. de Pulligny stated that his mission was one of international courtesy and that he desired to refrain from talking on a matter that was the subject of much controversy in the United States.

F. H. Newell Appointed Member of Illinois Board of Examiners

F. H. Newell, head of the civil engineering department of the University of Illinois and, previous to that, consulting engineer of the U. S. Reclamation Service, has been appointed a member of the Illinois Board of Examiners of Structural Engineers. Mr. Newell was in the Government service for over twenty-six years, having entered it in 1888. His appointment as head of the department of civil engineering at the University of Illinois was noted on page 599 of the May 8 issue of this journal.

Thinks San Francisco Will Soon Need Rapid-Transit System

Discussion on transit problems at the first municipal session of the International Engineering Congress developed comment from M. M. O'Shaughnessy, city engineer of San Francisco, that in a very short time a system of elevated tracks would be necessary in that city. Preliminary studies that have already been made show that the double-track elevated line may be expected to cost $800,000 per mile, as against $3,500,000 per mile for a subway system. He estimated the construction of surface lines to cost about $215,000 per double-track mile. He pointed out that under present traffic conditions a trip to the western residence district during rush hours requires 20 min. longer than would be required with an effective rapid-transit system, and that this time saving multiplied by the total number of passengers carried represented an annual saving warranting a considerable investment in a rapid-transit system.

Irrigation Congress Convenes for Thirty-second Time

The Twenty-second International Irrigation Congress held its opening session in Stockton Sept. 13, and followed this with successive sessions in Sacramento, Stockton and San Francisco, visiting some of the more important irrigation systems of the San Joaquin Valley during the latter part of the week and holding the concluding session at the Exposition Sept. 20. The resolutions adopted included recommendations that Government funds be used for the completion of unfinished reclamation projects outside of those begun by the U. S. Reclamation Service, and that the financial system of the service be revised so that administrative costs shall not be charged against the settler. The principles of the Newlands-Broussard river regulation bill, which urges Federal legislation for adjudication of water rights on interstate streams on the basis of private appropriation and beneficial use, were commended.

The following officers were elected unanimously: Richard F. Burgess, El Paso, president; J. S. Dennis, Calgary, first vice-president; George Albert Smith, Salt Lake City, second vice-president; L. A. Nares, Fresno, third vice-president; Burt Grunwald, Denver, fourth vice-president; L. Clapp of Hatch, N. M., fifth vice-president; Arthur Hookes, Spokane, secretary.

Consumer Protected by Ruling on Fire Hydrant Water in Indiana

The State Board of Accounts of Indiana has ruled that cities owning waterworks systems in that State must estimate the cost of all water used from fire hydrants and charge themselves a proper rental for it. The ruling follows the Indiana utility commission law, which provides against discrimination by any utility corporation against any customer.

Water Leakage Survey Recommended for Minneapolis

Stating that Minneapolis loses 200,000,000 gal. of water per year, the value of which is $30,000, F. W. Cappelen, city engineer of that city, has recommended that an engineer be engaged to carry on a leakage survey of the water distributing system, so that leaks in the mains may be found and repaired.

Baltimore & Ohio to Build Large Coal Pier at Baltimore

A coal pier to cost $1,500,000 and have a yearly capacity of 10,000,000 tons is to be built by the Baltimore & Ohio Railroad at the company's Curtis Bay terminal at Baltimore, authority having been voted recently by the board of directors. The pier will be 700 ft. long by 115 ft. wide, of steel construction throughout. There will be two car dumpers inshore, built in units and equipped with rapid-moving belts leading to movable towers on the pier, which can load into vessels on either side; or the entire loading capacity can be directed to one vessel. The car dumpers will be capable of handling cars 53 ft. long and unloading forty 100-ton cars per hour. The belts for conveying the coal will be run at speeds of from 250 to 500 ft. per minute, thus giving a capacity of from 3000 to 6000 tons per hour.

The necessity for the pier has arisen from the large increase in coal traffic from Curtis Bay, the tonnage this year to July 31 having exceeded that for all of 1914. Work on the improvement will therefore be started as soon as the contracts can be let, and it is estimated that eighteen months will be required for its completion.

The pier was designed by Francis Lee Stuart, chief engineer of the railroad.

Collapse of Street Decking Follows Subway Blast

(*Continued from page 397, first column*)

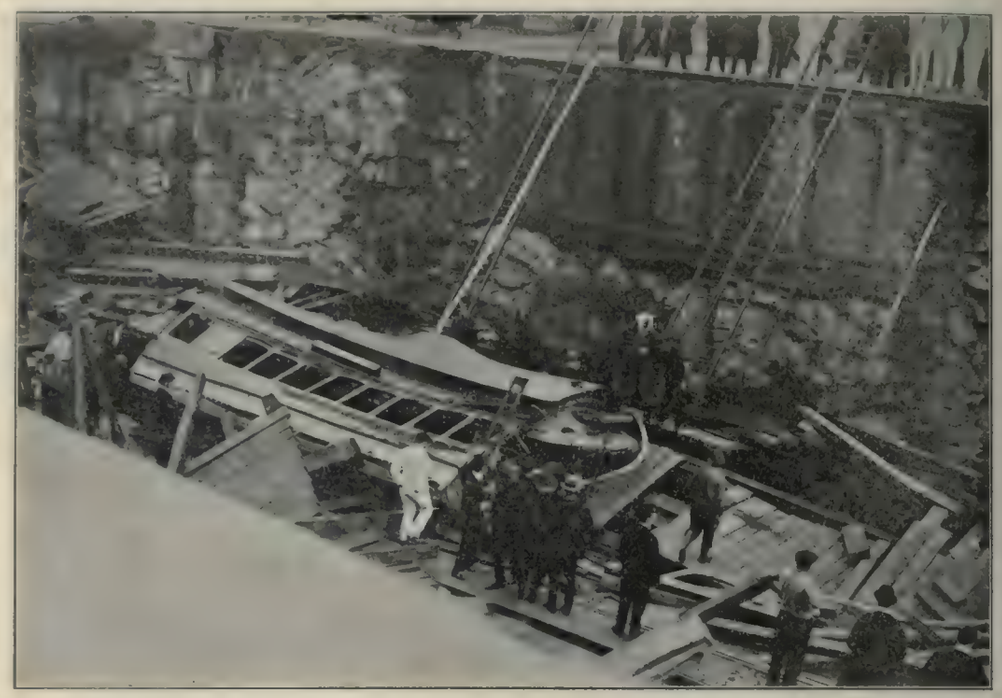
ported by the original brick vault walls, which extend practically to the bottom of the 28-ft. cut. The remainder of the street space between the working face and the last permanent steel set was a great open pit, littered with steel beams and the wreckage of the wood deck, across the top of which lay the two street-car tracks, and in which were the wrecks of a street car, a large motor truck and several delivery wagons. The latter, according to witnesses, had been standing along the curb over the collapsed section at the time of the accident. The street car, which had been northbound, lay north of the middle of the block below Twenty-fifth Street. Its trucks were still upright on the rails, the brakes were set tight and the power shut off, and there were no marks of any kind on the strip of asphalt, still intact between the rails, to indicate that the car had jumped the track at any time previous to its fall.

Stories of Eye-Witnesses

The blast was fired by a regular firing crew, which goes to work before the regular day shift comes on at 8 a. m. The day shift had not entered the cut, which accounts for the small total of seven deaths; four of the men killed were subway laborers. The man who fired the shot is reported to have said that he saw nothing, as he was bending over the battery, and when he looked up at the time of the collapse, the cloud of dust cut off his view. Four flagmen and four additional men, it is stated, were at their stations at each end of the collapsed section and on Twenty-fourth Street to keep traffic off this part of the decking until after the shot had been fired. The two flagmen at the north end and the guards on the cross street apparently fulfilled their tasks. One of the two flagmen at the south end is reported to have told the engineers of the Public Service Commission that the motorman of the car which was wrecked failed to heed his signal to stop, and that he boarded the front step of the car, which was going at fair speed, in an effort to halt it. This man was carried to the bottom of the cut with the car, but escaped without serious injury. The heavy motor truck which fell in was at the extreme south end of the section, at least 250 ft. from the blast, and appears to have been partly on decking which was supported by the permanent steelwork.

Probable Cause of Collapse

It is possible, though no definite evidence had been brought out at the time of going to press to support the view, that the collapse was due to the knocking out of one or more of the posts or towers under the south end of the east pair of needle-beams by rock hurled from the blast. This cause alone, it is thought, would not result in serious collapse of the decking. In this connection, it must be remembered that the car was on the east track, which was largely supported by the east needle-beams. The fact that the power was off the car and the brakes set does not prove the theory advanced by some that the car had been brought to a halt, that the decking collapsed from north to south progressively, and that the car rolled down the tilting track into the hole. In this event, the car would probably have left the rails and scored the asphalt between them. It would be most natural for the motorman to shut off the power and apply the brakes as soon as the collapse began, and it seems highly probable that this is what actually occurred. It seems plausible, then, to consider that some of the posts under the rear ends of the east needle-beams, and perhaps also under the bay of cross-beams behind them, were first knocked out. The weight of the trolley tracks, yokes and concrete-encased cable ducts, probably helped by the vibration and impact of the oncoming car, may then have thrown down the bents of posts, both below and above the cross-beams, progressively from north to south. The collapse, although progressive, must have occupied a very brief space of time, as the car did not have time to turn over or leave the rails between the instant the collapse began and the time the car reached the bottom of the cut. In the photograph the car appears to have turned over because the superstructure collapsed sideways and fell across the car floor, which remained nearly horizontal.



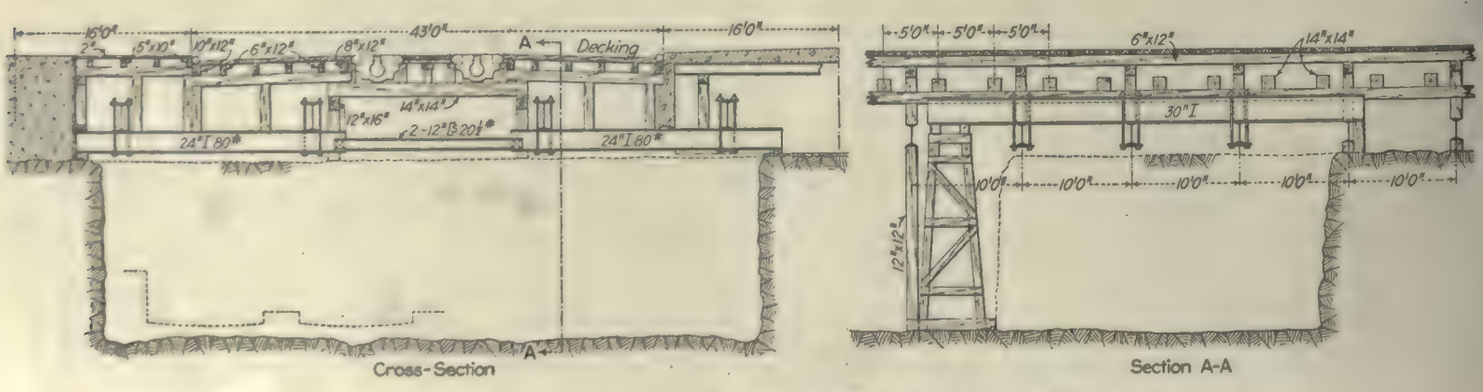
STREET CAR PLUNGED INTO SUBWAY CUT WHEN DECKING SUPPORTS GAVE WAY

Officials Hurry to Disaster

Valves on the numerous gas and water lines broken by the collapse were closed, by forces of the contractor with extraordinary dispatch. There was no large sewer in the affected section, and only a little water accumulated in the cut. This was pumped out by fire engines which arrived on the scene in response to an alarm turned in by someone under the impression that a gas explosion had occurred. Firemen and police promptly took charge of the work of removing the dead and injured from the wreckage. Within a short while Mayor Mitchel, Chairman McCall and Commissioner Hayward of the Public Service Commission, Robert Ridgway, chief engineer of subway construction, D. T. Turner, deputy engineer of subway constructing, John F. Meyers, engineer of the division which includes this section and the chief engineer for the contractor, the U. S. Realty & Improvement Company, were on the scene. Mr. Ridgway remained all day, directing the work of restoring service on the broken public utility lines and of clearing the wreckage.

Wrecking Operations Begun Promptly

George H. Clark sent the traveling locomotive crane used on the Times Square subway section by the Holbrook, Cabot & Rollins Corporation, down Seventh Avenue to the north end of the break. The contractors for the section on which the collapse occurred set up a jinny-wink on the west side of the break at Twenty-fourth Street. Within a short time both were busily engaged in removing the wreckage. At the same time, the contractor for the section secured two of the cableways commonly used in sewer construction, and by night had them set up and partly rigged, spanning the break on opposite sides of the street from north to south. It will probably be a week or more before traffic can be restored across the gap and construction resumed.



GENERAL SCHEME OF STREET SUPPORT IN SUBWAY SECTION WHERE ACCIDENT OCCURRED

Men Who Made International Congress a Success

Some Facts Regarding the Officials Whose Labors Have Resulted in the Meeting Held This Week in San Francisco

The International Engineering Congress, toward which the engineering fraternity has looked forward so long, has cost more in the way of personal effort than is generally realized. All the credit for the work, which was begun almost four years ago, cannot be given to any one man or to any group of individuals, for able assistance has come from many quarters and in one way or another a great number of engineers have contributed toward the success of the meeting. However, the responsibility for shaping the policy through two and a half years of the later preparation and the great burden of handling the rush of work in making final plans for the Congress has fallen directly upon one group of men who have worked long and energetically without any financial remuneration—the committee of management.

Chairman Durand

Prof. W. F. Durand, who, from the inception of the plan, served as director of Congress affairs in the position of chairman of the committee of management, graduated from the U. S. Naval Academy in 1880 and served seven years in the Navy Engineer Corps. In 1883 he was assigned to special duty as assistant professor of mechanical engineering at Lafayette College where he remained until 1885. He was at Worcester Polytechnic Institute in 1887, and professor of mechanics and superintendent of the mechanical department at Michigan State Agricultural and Mechanical College from 1887 to 1891. In 1888 he received the degree of Ph.D. from Lafayette. He went to Cornell University in 1891 as professor of marine engineering and principal graduate school of naval architecture and marine engineering. Since 1904 he has been at Stanford University, California, where he holds the position of professor of mechanical engineering.

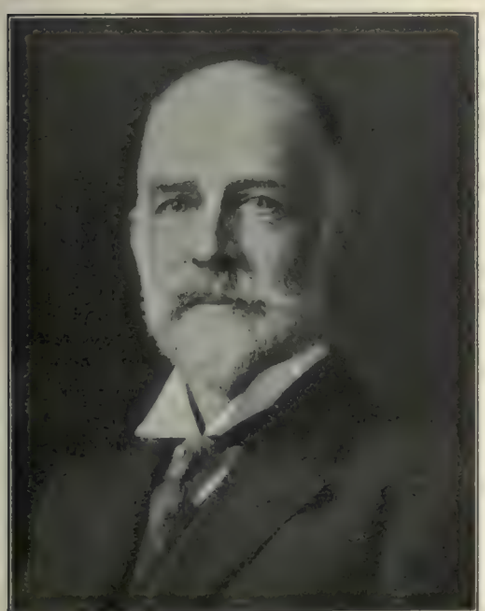
Secretary-Treasurer Cattell

The office of secretary-treasurer of the committee of management has involved a work of importance second only to that of the office of chairman. The usual problems of a technical secretary were multiplied more than five-fold in the secretarial work that covered the combined interests of five national engineering associations. In this capacity W. A. Cattell, consulting civil engineer, has earned distinction in giving painstaking supervision to the detail work. Mr. Cattell graduated from Lafayette College in 1884. In recent years his work has included many phases of engineering, ranging from a report on a proposed 164-mile Alaskan railroad to the valuation of public utility properties in Southern California.

Other Officers

Major-General George W. Goethals needs no introduction to readers of the Engineering Record. Those who know him personally will readily imagine how reluctantly he came into the limelight as honorary president of the congress. Once enlisted in the work, however, he took an active interest in it, supervised the preparation of most of the text in the volume on the Panama Canal and himself wrote one

Prime Movers in Organizing and Directing World Congress of Engineers



PROF. WILLIAM F. DURAND, CHAIRMAN, COMMITTEE OF MANAGEMENT



MAJOR-GENERAL GEORGE W. GOETHALS, HONORARY PRESIDENT OF CONGRESS



W. A. CATTELL, SECRETARY-TREASURER, COMMITTEE OF MANAGEMENT



MUNICIPAL AUDITORIUM IN SAN FRANCISCO WHERE MEETINGS OF CONGRESS WERE HELD

of the more important papers. Major-General Goethals went to San Francisco two weeks prior to the opening of the Congress in order to take part in Goethals' Day ceremonies at the Exposition. Exposition officials secured his consent to this only after a year and a half of persuasive effort.

A. M. Hunt, as chairman of the committee on papers, has rendered most valuable service in the arrangement and classification of topics and the selection of authors. E. J. Dupuy, although not an engineer, has done creditable work as executive secretary, giving particular attention to the handling of foreign correspondence and translations. Edwin Duryea, Jr., has devoted much time to working out a satisfactory plan of presentation. Thomas Morrin has had charge of local affairs and George M. Brill, called upon in the rush preceding the convention to take charge of Congress headquarters, greatly expedited the successful carrying out of eleventh-hour plans.

New Committee Will Harmonize Good Roads Movement

(*Continued from page 397, second column*)

Location was agreed upon as the most important phase of highway construction, because of its being the only feature not subject to wear and deterioration or obsolescence. Location, it was held, must include grade and curvature and the engineer must be prepared to resist pressure for cutting down cost of location surveys, especially as the strongest opposition to a road construction plan often develops at the outset, when funds for the work of surveys are required. It was noted that the cost of location surveys on the Columbia River highway ranged from $200 to $400 per mile.

Highway Bridge Problems

Highway bridge problems were discussed in detail and there was general agreement that present methods must change. The opinion was that it is unwise and uneconomical to allow steel companies to select bridge types and prepare designs. It was estimated that $100,000,000, or one-half the total amount expended in the United States each year on road work, is used for repair and renewal of highway bridges. This was regarded as unreasonable; one-half of this sum could be saved, it was claimed, if proper supervision of design were provided. A highway bridge department, dependent on the Legislature for support, was suggested as a suitable protection. Citations indicated that there is a tendency to keep down the first cost of highway bridges to an uneconomical limit.

In the past twelve years Kansas highway bridges have suffered damage, chiefly due to floods, totaling $3,000,000, according to W. S. Gearhart, Kansas State engineer, who described Kansas bridges built low enough to allow flood waters and the drift they carry to flow over the submerged structures without damage.

Highway Finances

The question as to whether highway funds could best be raised by bond issue or by taxes was the subject of discussion for an entire session. The State of Washington is building roads successfully without bond issues, the State tax for this purpose totaling 2.5 mills on the dollar. Road building without bond issues was to be advocated where feasible, it was agreed, especially for temporary roads, but it was shown that under the bond issue plan there was greater probability that those who use the roads will be those who pay for them. Public service corporations are required to have approval of public utility commissions before they can issue new securities and some similar protection for the public was urged when bond issues for highways are proposed. The law should, at least, require and provide for adequate surveys and engineering supervision before authorizing the bonds finally. The point was made that no financial policy is successful which does not provide protected roads of low cost for light traffic in remote districts as readily as costly pavements for main thoroughfares between cities.

An inquiry about experience with reinforced-concrete pavements brought several citations tending to show that thin pavements with light reinforcing would be found strong and durable. One such pavement was built in two courses with reinforcing imbedded between. The cost for steel was 1 cent per square foot, the reinforcing being placed in 4-in. mesh that weighed 40 lb. per 100 sq. ft.

Medals for Associations

On the evening of Sept. 14 a banquet was held in honor of distinguished guests of the Congress. Attendance was even larger than had been expected, and the spirit of the gathering was pronounced unusually good. On the morning of Sept. 15 the session was held in Oakland, as usual, but the afternoon session convened in Festival Hall on the Exposition grounds. A commemorative medal was presented by Exposition officials to each of the four associations included in the Pan-American Road Congress. After a brief business session the meeting was adjourned until the morning of Sept 16 to allow the remainder of the afternoon for a personally conducted visit to certain exhibits of interest to road builders.

Military Highway Proposed

A warm debate that continued for 2 hr. past closing time Sept. 16 brought out various views of the advisability of calling the attention of Congress to the need for a highway on the Pacific Coast to be used for military and commercial purposes. Samuel Hill, president of the Pacific Highway Association, explained that such a road is a vital need at this time, for it would simply be an insurance of American safety. Opposition came from a few delegates from the central States who wanted no preference shown by Congress to any particular section in assisting highway projects. Charles F. Stern, California highway commissioner, pointed out that this was a national, not a local, question; like other questions of preparedness, the only time to attend to it was before a crisis came. The following resolution was then passed by an almost unanimous vote:

"Resolved, that the Pan-American Road Congress recommends to the Congress of the United States the advisability of investigating the necessity of building a hard-surfaced highway along the Pacific Ocean side from Mexico to British Columbia and other national highways to be used as military and commercial highways."

"Safety First" on Roads

The afternoon session of Sept. 16 was marked by an interesting discussion of "safety first" as applied to the highway. The matter was brought up by C. A. Kenyon of Indiana, who expressed regret that a place had not been assigned on the program to this topic. He proposed that there be established in each State highway department a safety-first bureau, to be in charge of an engineer vested with police powers and delegated to draw up such regulations and standards of a reasonable character as would contribute to safety on the highway. Mr. Kenyon suggested, among other matters, that the safety-first engineer concern himself with the following subjects: 1. The gathering of statistics regarding accidents, on which regulations and standards would be predicated. 2. The erection of fences on bad side-hills and at dangerous turns. 3. The placing of suitable signs at highway and railroad crossings and at sharp curves. 4. Examination of applicants for drivers' licenses, to determine their competence. 5. Clearing out of brush that obstructs the view at intersections. 6. Determination of penalties, for statutory enactment if necessary for violation of traffic regulations.

These views were heartily seconded by those entering into the discussion, the sentiment being especially strong for the revocation of the licenses of those convicted of the violation of traffic rules.

Massachusetts Practice

The closing session, Sept. 17, was presided over by Col. W. D. Sohier, chairman of the Massachusetts Highway Commission. In answering the many questions about Massachusetts experience, Colonel Sohier pointed out that it usually costs about 25 cents per ton-mile to deliver road materials, although under the plan used in France, involving a traction engine and two trailers, the cost is 5 to 7 cents. If the annual maintenance and upkeep of a pavement exceeds 12½ cents per square yard, it is economical, he thought, to pay the interest and sinking fund on an investment in a more expensive pavement. Colonel Sohier explained his reference to contraction joints by saying that when a concrete pavement takes its final set it always contracts twice as much as it ever expands again. Nearly all the Massachusetts highways are thrown at least 2 in. by frost and the resulting cracks are filled with tar and sand.

Harmony in Good Roads Movement

The following resolution was adopted by unanimous vote:

"Whereas the American Highway Association earnestly favors harmony and correlation of the organized good roads movement throughout the United States, it is ordered that a special committee of seven members be appointed by the chairman and empowered to confer with similar committees from other organizations and to consider and present to the association at a subsequent meeting or, prior to such meeting, at a meeting of the board of directors, suitable recommendations for such changes in the constitution and by-laws and the working plan of the association as will best secure those desired results, as well as to bring into closer relation the efforts for road improvement in the Eastern and Western portions of the United States, and that the chairman of the meeting be chairman of the committee."

The chairman appointed the following members of the committee: S. E. Bradt, Illinois, chairman; W. R. Roy, Washington; A. B. Fletcher, California; W. D. Sohier, Massachusetts; T. H. MacDonald, Iowa; W. E. Atkinson, Louisiana; G. P. Coleman, Virginia, and F. F. Rogers, Michigan.

The American Highway Association elected the following officers for the ensuing year: Fairfax Harrison, Washington, president; L. W. Page, Washington, vice-president; John Burke, Washington, treasurer; James R. MacDonald, Connecticut, E. J. Mehren, New York; George L. Cooley, Minnesota, Joseph Hyde Pratt, North Carolina, Henry G. Shirley, Maryland, W. T. Beatty, Illinois, and C. R. Kenyon, Indiana, directors.

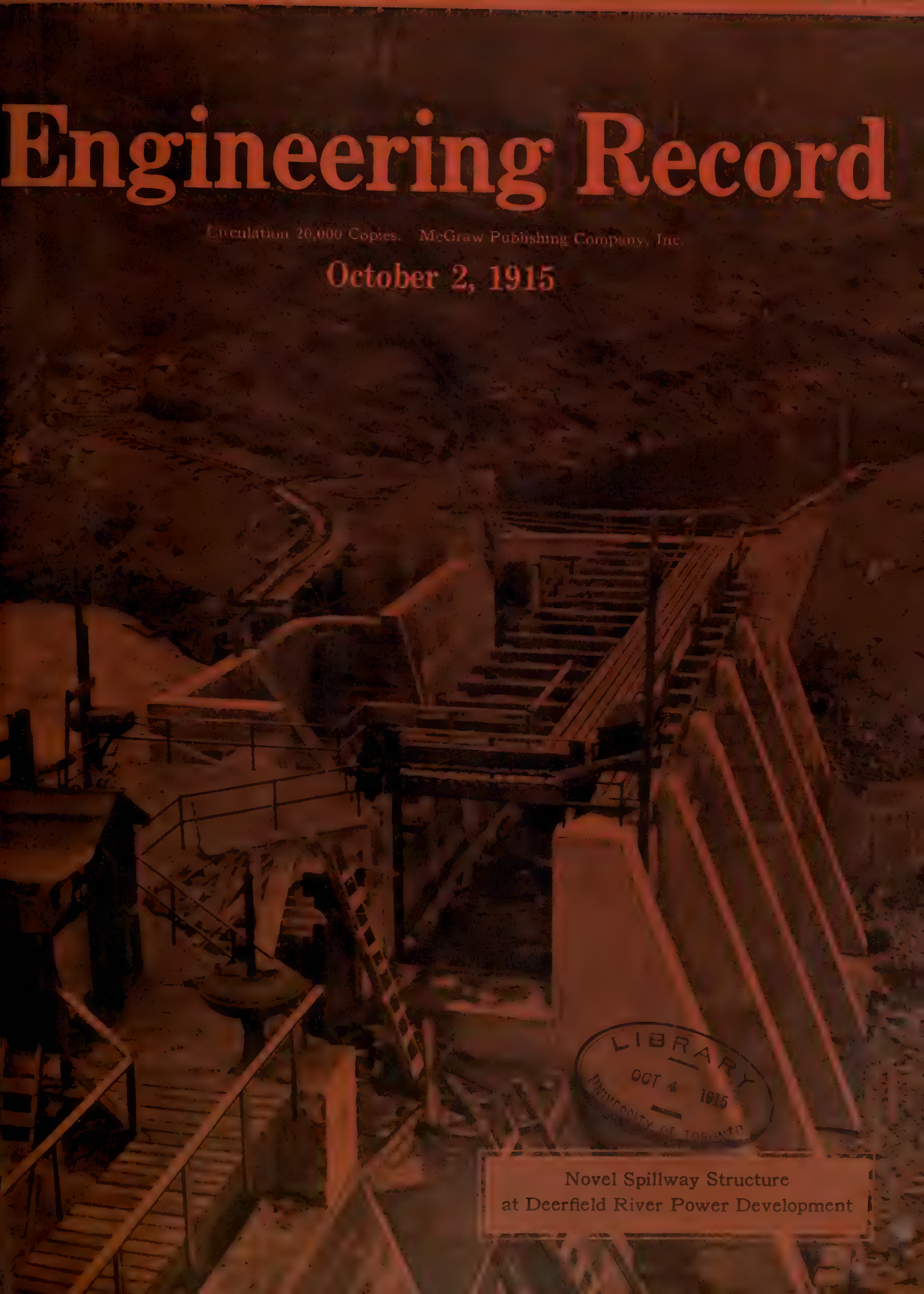
Batavia Sewage Pumping Station Wrecked by Explosion

The superstructure of the Batavia, N. Y., sewage pumping station was completely wrecked and the sewage pumps put out of commission by an explosion that occurred between the main floor and second floor of the plant Sept. 18. The accident is attributed to a workman's lighting a match to relight a gas jet that was usually kept burning in a vent pipe leading from beneath the second floor to the outside atmosphere. Mayor Burkhart telegraphed Chester & Fleming, consulting engineers, of Pittsburgh, of the happening and Messrs. Chester and Schlumpf of that firm took charge of the situation Sept. 19. Temporary pumps will be installed to handle the sewage until permanent improvements can be effected. The information on which this report is based was received by telegraph from Chester & Fleming.

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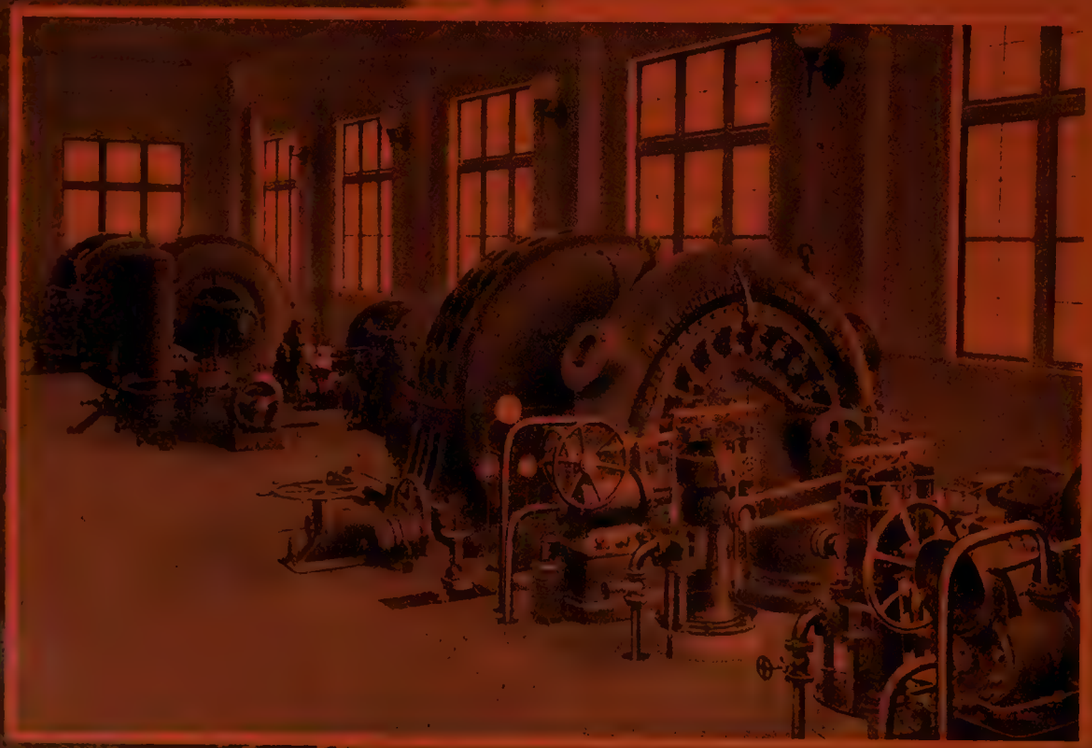
Novel Spillway Structure
at Deerfield River Power Development

WRITE

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FOR LATEST

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No. 1636

Engineering Record

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Deserved Recognition

ENGINEERS are accustomed, after bearing the burdens of great undertakings, to take a back seat and let others get the credit. In connection with the Panama-Pacific Exposition, however, custom has been brushed aside and due recognition given to the fact that from its material side the Exposition is the engineer's work, carried to completion under his full administrative control. Even the architect reported to the engineer. His was the entire responsibility for the expenditure of the $17,000,000 put into buildings, roads, water supply, sewerage and the other essential works. The engineer management has been a success and it was graceful, indeed, on the part of the Exposition directors to show their appreciation publicly on Engineers' Day during the International Engineering Congress by presenting the heads of departments with commemorative plaques. It was a gratifying feature of a notable week.

San Francisco Knows How

IT is not possible to repeat the expression of appreciation regarding San Francisco's hospitality and energy, which were on the lips of every speaker at the closing session of the International Engineering Congress, without appearing, to those not present, to be extravagant. With the events of the week fresh in mind, the speakers attempted no restraint. They paid a deserved tribute to the wisdom and organizing ability of the committee of management; to the excellence and perfection of the Congress arrangements; to the thoroughly enjoyable social features; to that hearty hospitality which let no visitor want for anything as soon as his desires became known. Nor did the speakers pay less sincere tribute to the other evidences of San Franciscan ability and energy—the wonders of the Exposition and the Phoenix City which has risen from the ashes of nine years ago. Truly was there reason for deep feelings.

To Professor Durand, Mr. Cattell and those who labored with them, not only the visitors, but the profession at large, owe a large debt of gratitude, for, aside from the amenities of the Congress, there has been added to the world's store of engineering knowledge a large fund of accessible material. The various branches of the profession, too, have been brought closer together. Due recognition, too, should be given to the engineering organizations, the public service and industrial companies which co-operated with the management of the Congress. In the arrangement of the excursions and social affairs particularly their help, in men and in finances, was necessary to the complete success of the meeting. They gave of both without stint. Taken as a whole the Congress was a striking example of the team work and fearlessness that characterize San Francisco. To use an expression popular on the Coast, "San Francisco knows how."

Unity of Engineering

IS the time for closer co-operation among the National engineering societies at hand? One would certainly think so, judging by the significant remarks made at the International Engineering Congress. President Marx of the American Society of Civil Engineers at the banquet expressed the hope that a modus operandi would be found, while President Carty of the American Institute of Electrical Engineers made the first public announcement of the discussions which have been in progress when he said that he hoped for some tangible results. It will be remembered that the views of Secretary Hunt of the American Society of Civil Engineers, favoring closer co-operation, were reported in this journal several months ago. Certainly the time is ripe for action, for some method by which closer co-operation can be secured. There is co-operation now on the John Fritz Medal Board of Award and in the management of the engineering foundation, while there have recently been joint committees on several important subjects. The International Congress itself was a joint affair. The preliminary steps have, therefore, been taken. They demonstrate what joint action can accomplish, what influence can be wielded and what benefits derived when the resources of all the engineering societies are massed. General Sibert called attention to the unity of engineering and was greeted by enthusiastic applause. The discussions in progress are aimed at insuring, in practice, that unity which was so strikingly emphasized by the general.

City Planning and the Engineer

SEEMINGLY every phase of the big subject of city planning is covered in the valuable paper of Nelson P. Lewis presented at the International Engineering Congress last week, extracts from which appear in this and last week's issues of the Engineering Record. Special attention, however, is called to his last three paragraphs, setting forth why city planning is work for the engineer as well as for the architect, artist and social worker. The engineer is awaking to the fact that his field is something bigger and broader than surveying and the calculation of stresses. The business and administrative sides of engineering are coming to the front, as such addresses as that of Professor Newell on the civic responsibility of the engineer (see page 420) testify. The engineer's training and judgment are as much needed in determining what shall be built, and why, as in deciding just how to build it. And there is no more fruitful field for this broad-gage engineering, this matching of technical possibilities with civic needs and financial limitations, than city planning.

Deferred Maintenance

RAIL FAILURES are commonly attributed to flaws in the steel, defects which in the present state of the art are not to be avoided. Accidents caused by them are therefore to a large degree immune from criticism. In a rail-failure wreck recently reported on by H. W. Belnap, chief of the division of safety, Interstate Commerce Commission, the immediate cause is given, not as a flaw in the metal, but as defective track which resulted in undue stresses in the rail. Investigation showed that because of insufficient spiking and bracing an outside rail on a curve was forced outward, and that furthermore the far end moved the more rapidly and set up tension in the gage side of the rail, causing its rupture. This points to a dangerous condition in present-day railroad affairs. Opinions have come to this journal from several reliable sources that more than one road, in these times of meager dividends, is getting along with less than a safe minimum of maintenance. In this particular case further investigation would be needed to determine whether the poor track was due to the delinquency of one foreman or to the untoward economy of the road's management. The fact that a track walker went out over the track only once a week suggests a very small force trying to look after a very large section. And when one reads of an unspiked joint, and of 20 ft. of rail with only three holding spikes on the inside, this on a Middle West trunk line handling three passenger trains daily each way, one must conclude that somebody above the foreman took long chances. The road has only within a few years emerged from a receivership, and the times are not conducive to the rapid upbuilding of such a line. Neither, however, can it afford to neglect safety. If the condition is a common one on other roads the public and the regulators cannot wholly escape responsibility. Their persistent refusal to allow rates to keep pace with rising wages and prices for material has forced some companies to a point where the money for adequate maintenance is simply not to be had. Meanwhile Mr. Belnap has rendered a public service by his reminder that rail failures are not necessarily acts of God.

Graduate Engineering Courses the Solution for Overcrowded Curricula

ADDRESSING the International Engineering Congress on the subject of American engineering education, Prof. George F. Swain of Harvard University proposes a solution for the well-recognized overcrowding of 4-yr. courses. The administrators of engineering courses in this country would do well to ponder carefully his outline of many of the more serious difficulties and weaknesses which have affected the progress of engineering education, and which still exist in many institutions. The loss of training opportunities through use of the lecture system, the weakness due to "a smattering of many things," the substitution of mere-information courses for preparation-for-life courses, the subordination of the exceptional man to the average man, and the lack of thoroughness, initiative and reflective thought—all are given the emphasis which their importance requires.

This part of Professor Swain's address and his proposed remedy will be found in full on page 387 of this issue. He condemns the lengthening of the usual 4-yr. courses to 5 and 6 yr., or the requirement of college degrees for entrance to engineering courses, as adopted in some institutions, and proposes the lightening of the usual 4-yr. course at the top by the removal of highly specialized technical courses to the graduate school, to be given to those with the time, the money and the inclination or aptitude to profit most by them. This, of course, is exactly what Professor Swain has been doing at Harvard University for several years, and the results should speak for themselves.

With his contention for a standard 4-yr. course devoted to broad but thorough training in the fundamental principles of technical science, combined with short graduate courses highly specialized for the few, this journal is in complete accord. The short course leading to the bachelor degree should include such subjects as logic, philosophy, public speaking and English. The combined practical and theoretical courses offered at Cincinnati and Pittsburgh point the way to possibilities in the educational field, strenuous though they be for the student. If properly co-ordinated, with "humanity" courses included, they offer unlimited promise for uplifting the technical detail of engineering life by intimate contact with high conceptions of the significance of all human activity. Furthermore, practical instruction in the engineer's duty to the community in his civic relations is too often absent from our engineering courses, though so essential to the success of any educational process.

Whether Professor Swain's concluding statement that it is no longer necessary to go to European universities for higher technical training in engineering, and that American schools now offer better opportunities than are to be found anywhere in the world, be true depends largely on the degree to which our graduate schools actually accomplish their avowed object. Such a claim is directly affected by the present war in Europe, which will probably result in modifications in the content and spirit of the courses offered in foreign universities which cannot even be predicted.

Road Maintenance Cost Data

WITH the introduction of high-priced construction on country roads, together with the building of large systems of roads, there has come about an increased necessity and appreciation of maintenance cost data. To be of service, a clear understanding of the purpose the data ought to serve should be had and the charges to the maintenance accounts should be made in such a manner as will bring out the information desired.

Maintenance data, or data on the up-keep of country roads, are required by the officials in charge, first, that intelligent estimates of the funds that will be needed for the ensuing year may be made; second, that scientific comparisons may be made of various types of roads to ascertain which is most economical. It is evident that the data required for the former purpose will not necessarily give available information for the latter. To make a general estimate for the up-keep of a system of roads for the year does not necessitate any detailed analysis of the various factors, such as repairs to bridges, culverts, drains, gutters, shoulders, and the pavement proper.

Without attempting a comprehensive discussion as to how maintenance cost data should be secured and presented, there are two points which are of special importance and are frequently overlooked. First, there is often charged to maintenance what is really an addition to the capital investment in the road. This may be illustrated in the instance of a new culvert or a new guard rail other than was provided in the original construction. It is clear such expense is not, properly speaking, maintenance, but is in fact an addition to the capital investment.

It is equally an added investment in the road when a more expensive type of surface is employed to restore a worn out pavement of another type, although it is more difficult to state precisely just how much of the cost of the improvement in the latter case should be charged to the up-keep of the old surface, and how much is to be charged to capital investment. This amount would depend, in a given instance, on the extent to which the old surface had been worn. The longer it had been allowed to go without repairs, the greater would be the amount that would be necessary to restore it to its original condition; the greater, therefore, would be the charge against maintenance of the old type of surface, and the less would there be to charge to capital investment in the road due to the construction of a new type. But the maintenance costs reported on the State system of highways of New York arbitrarily, according to statutory provision, charge every expenditure following original construction to maintenance.

The second point, and one that adds greatly to the confusion in comparing reports on the maintenance costs of different types of road surface, is the inclusion of items for the up-keep of the shoulders, gutters, drainage system, and other portions of what may be termed the right of way, with that of the pavement surface proper. The cost of up-keep of right of way is practically independent of the type of the pavement. If, therefore, comparisons are to be made between types of pavement, only those data should be used which concern the surface of the pavement. All other maintenance work upon the road should be kept separate.

Until reports on maintenance costs are made so as to show separately the cost of up-keep of the pavement proper there is little value in such data to determine definitely as to the most economical type of road surface under given conditions, which is at present of the utmost importance.

Impressions of the Congress

THE Congress was a success. That is the principal impression to be recorded regarding the International Engineering Congress which closed in San Francisco last Saturday. That success lay, from the technical point of view, primarily in the opportunity afforded for discussing engineering topics. During the first three days oral discussion was meager. Beginning Thursday morning, however, the Congress seemed to take on new life and many meetings adjourned while the very first paper of the session was still under consideration. Particularly vigorous, interesting and valuable were the discussions on irrigation and hydroelectric development, subjects on which Western engineers are especially competent to speak. Eastern engineers attending these sessions must have gained a new conception of the meaning of water to these communities and of the possibilities and the problems the future holds forth for its more efficient use. Fortunately there was always a good sprinkling of Eastern members. It would have been well had the number been greater for, through Federal control, irrigation and hydroelectric development in the West will be stimulated or checked in accordance with Federal laws whose molding is effected by Nation-wide opinion.

The second impression of the Congress is one that holds a lesson for the future. Oral discussion would have been stimulated by a wider advance distribution of the papers. Failure to distribute copies broadly was the only adverse criticism of the Congress. That criticism, too, was always accompanied by comment on the wonders wrought by the management, and on the difficulty of making a judicious distribution where so large a membership was involved. It might have been feasible, however, to send a copy of the program to each member three weeks in advance of the meeting requesting him to indicate those papers which he desired to examine with the purpose of entering into the discussion.

The third impression relates to the opportunity afforded the individual for be-

coming acquainted with conditions in various parts of the country and of the world. Not the least of the returns for attendance lay in the visits with foreign delegates and with engineers from every part of our own country. There must have resulted therefrom a broadening in technical knowledge and of one's general horizon. Both foreign and local members seemed to appreciate the opportunity. Necessarily, too, the many new acquaintanceships formed with those who attended will not count as an insignificant feature of the meeting.

With the pleasures and benefits of the Congress fully in mind one cannot but echo the sentiment of one of the foreign delegates at the closing meeting—that international gatherings of engineers should be of more frequent occurrence. Certainly if international meetings cannot be held at shorter periods than in the past there is no reason why the National engineering societies cannot hold joint sessions annually or biennially.

Safety in Subway Construction

THAT the two recent serious accidents on the construction of New York City's new subways, in which sections of street decking collapsed, require investigation, fixing of responsibility and the fullest publicity is appreciated by no one more than by the engineers of the Public Service Commission. Because of the reckless disregard by motormen, truck drivers, chauffeurs and even pedestrians of the simplest warning signals in the vicinity of construction work, people who use New York City's streets have been in danger of just such accidents for many months. The reason for this recklessness seems to be a desire on the part of traffic to run by red flags in the hope of passing through the danger zone before the blast is fired. An editor of this journal was a passenger recently on a Seventh Avenue car which ran directly over a blast as it went off.

All the evidence now available seems to indicate that the official investigations will bring out the fact that the Seventh Avenue car which plunged into the subway cut Sept. 22 ran a block beyond the flagman, who first tried to stop it below Twenty-fourth Street, before it was finally brought to a halt. Had this car stopped when flagged the lives of its passengers would have been safe and it is also likely that the collapse of the street support would have been far less extensive.

The blasting foreman is said to have admitted that he ordered the shot fired with the car very close to the south end of the needlebeam. He had the choice of allowing the car to proceed, which would have encouraged others to disregard his flags, or of taking, as the history of subway construction shows, a chance of less than one in a thousand of endangering its safety. The motorman should have been compelled to back up, but construction flagmen have no authority to enforce orders of this kind or to bring to time those who disobey them. The police have such authority, but the police have troubles of their own, and, apparently, have not sufficiently explicit instructions on the subject to cause them to give these flagmen the support that must be given if the public is really to be safeguarded.

The Engineering Record believes the investigations will show that the type of street support employed by the U. S. Realty & Improvement Company is of ample strength when loaded in the manner intended. To be absolutely foolproof and safe even under accident conditions, however, it needs more X-bracing in vertical planes parallel to and at right angles to the street. Such bracing would probably have saved the collapse on Seventh Avenue, though it could hardly have minimized that on Broadway. It must be remembered that such bracing would have made both the street support and the construction work itself much more difficult and expensive, and, if required, would have caused a reversion to the all-timber street support generally used, a good example of which is described on page 439 of the Engineering Record of April 3, 1915. This type of support is not so strong under direct loading and does not make construction as economical as does the type used on the two damaged sections. It is, however, stiffer under accident conditions and somewhat less liable to total collapse.

If the public expects its engineers to guard it from all accidents, even when a large contributing cause is found in recklessness over which these engineers are given but slight control, its new subways must cost heavily in the shape of extra outlay for construction methods that are needlessly foolproof. The engineers and contractors are shouldering their share of the blame for both accidents. Let the public help by insisting on the observance of the rules provided for its own safety in construction zones where blasting is necessary.

The West's Water Powers

THE West has spoken on the disposition of its water powers, and its views, as set forth in the Western States water power conference at Portland, Ore., Sept. 20-23, will be considered radical except in the West. As reported in the news section of this issue the conference declared in favor of the relinquishment by the Federal government of all control over water powers on public lands. The control, the West believes, should be in the hands of the State government. Theoretically the position of the conference is correct. Under the doctrine of beneficial use, which governs the taking of all water in the Western States, ownership of the land does not give control of the water. The public lands, however, are made inviolate because the States do not possess the right of eminent domain over them.

Practically, however, the country at large will refuse to surrender the rights which public land ownership gives over Western water powers. In making its broader demands the conference was wasting its breath. Its time would have been better spent in the details under which private capital would be willing to develop power with Federal control. Condemnation of the Ferris bill was to have been expected and was fully deserved. Western water powers would not be developed under its provisions, for it not only gives too much arbitrary power to administrative officers of the Government, but is economically unsound in forbidding payment of appreciation and of development expense if the Government should take over the plant.

Between the extreme doctrines of entire surrender of control to the States and the Ferris bill, however, there is a middle course which, on the one hand, would safeguard the fundamental rights of the people and, on the other, encourage the development of the powers now going to waste. Such a measure would put the regulation of the power companies under the State public utility commissions and, as to relations between the company and the Federal government, set forth the terms definitely, not leaving matters to "the discretion of the Secretary of the Interior." The clauses covering these relations would then be simple. An irrevocable permit for a definite period must be provided, with recapture thereafter only on fair terms, allowing appreciation and development expenses. Holding powers for speculative purpose must be made impossible.

Compensation to the Government, theoretically, should be no more than a land rental, for that is all that the Government contributes to the enterprise. Where the power is developed for public sale such a rental compensation is entirely satisfactory, for the public utility commission, through rate regulation, will insure return to the public of its share in these valuable powers. On the other hand when powers are granted for the exclusive use of an industry, as they should be and must be, if the waste of power is to stop, land rental would not assure a fair return to the people and compensation depending on the horsepower developed is necessary. Manifestly the rate per horsepower would vary with conditions, but the figure set in the agreement should be unalterable for the irrevocable life of the franchise. For that reason, therefore, Congress should permit the compensation to be based either on land rental or on power developed. As to minutiæ—assignments of lease, liens, mortgages, combinations of power companies, etc.—they should be left to State regulation and to existing Federal statutes.

A sane power bill is badly needed. The waste of powers on the Pacific Coast is nothing short of criminal. It will continue so long as our Eastern representatives and senators feel that the Western States and their public utility commissions are monopoly-ridden. The West is, however, thoroughly capable of handling its affairs and securing for its people the full measure of benefit from the publicly-controlled powers. It is to the interest of the country at large that the West be freed from its present water-power shackles. Action is imperative. The next Congress will do well to proceed along the lines indicated and not along those in the Ferris bill.

Costs and Special Features of the New Water Supply of Victoria, British Columbia

Inaccessible Mountain Country Imposed Severe Difficulties, Particularly in Conduit Design and Construction—Concrete Pipe Used for Flow Line and Steel Pipe for Pressure Line

By BOYD EHLE, M. Am. Soc. C. E.
Of the Sanderson & Porter Engineering Staff—Resident Engineer, Sooke Lake Water Supply System

THE EARLY PART of this year saw the completion of a new water supply system for the city of Victoria, B. C., the culmination of years of investigation and agitation for an increased supply. The general plan of the project and some details as to the construction of some of the features were described in the issues of the Engineering Record, Feb. 21, 1914, page 225, and Aug. 15, 1914, page 176. It remains now to give some attention to the costs and some of the details of special structures, and this will be done in a series of three articles. The first, presented herewith, will take up costs and special features of design on various structures. The other articles will discuss the construction of the concrete flow line and of the steel pressure line, projects of much difficulty owing to the virgin and mountainous character of the country.

As set forth in the previous articles, the new supply is taken from Sooke Lake and is brought by means of a 37-mile pipe line to the city. The scheme involved the raising of the level of Sooke Lake 12 ft., the construction of a 42-in. concrete pipe on a slope of 1 in 1000 to an artificial lake known as the Humpback Reservoir, and then a 36-in. riveted steel line to the Smith's Hill reservoir, at the city. The supply provided has a capacity of 21,000,000 Imp. gal. per day.

There were nine tenders received for the construction of the system, with the usual wide variation in cost. On account of local sentiment, the work was let to a resident bidder, whose tender was $304,408 less than that of the next bidder, and $601,800 less than that of the average bid. The chief item of interest—the conduit from Sooke Lake to Humpback Reservoir—was offered at a price per linear foot of concrete pipe about as low as wood-stave pipe, and because of its permanent construction, it was decided to built the conduit from Sooke Lake to Humpback Reservoir as a concrete flow line.

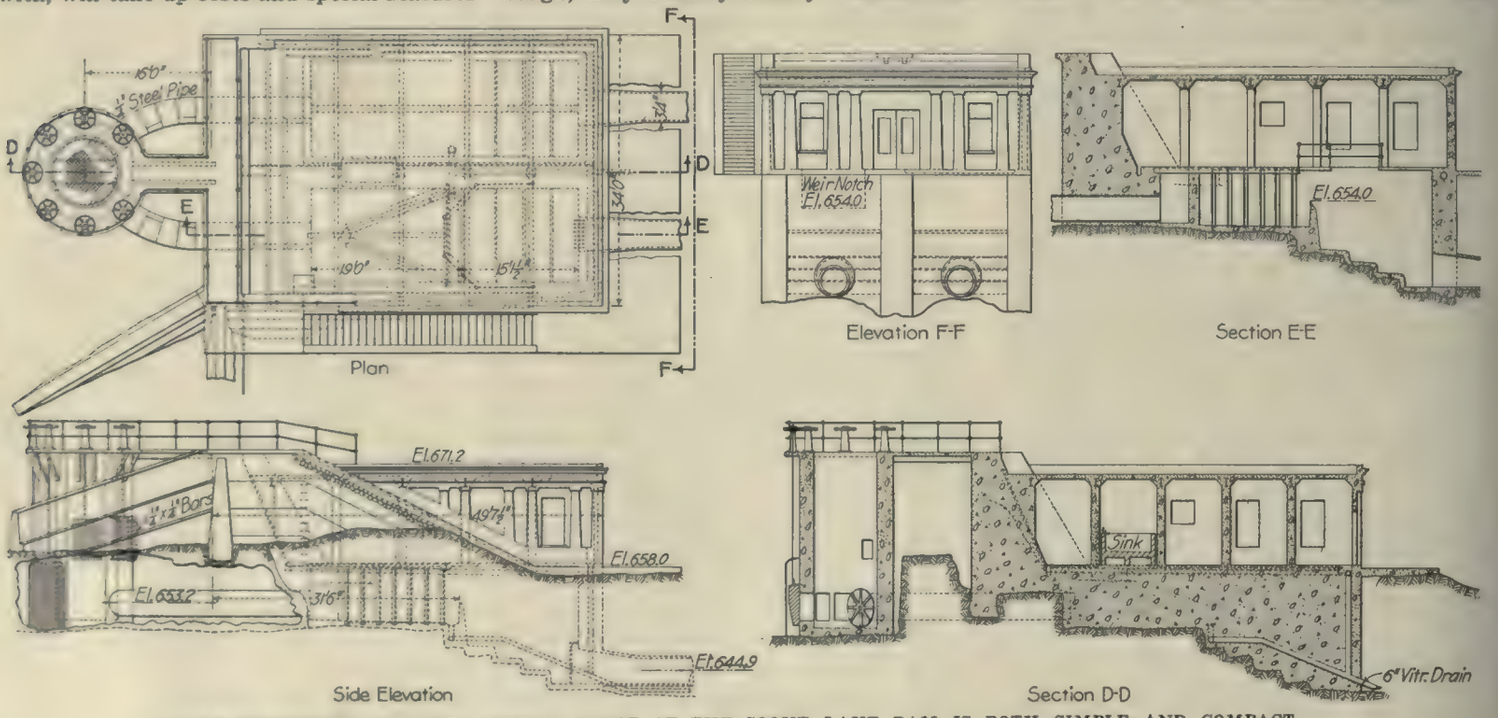
Sooke Lake Reservoir

Sooke Lake, which acts as a gathering reservoir, lies 18 miles to the northwest of Victoria, at an elevation of 655 ft. above datum. It is about 4 miles long and ½ mile wide at its maximum, surrounded by rough, hilly country thickly forested with Douglas fir. Two narrows divide the lake into three parts, of which the upper and larger is 150 ft. deep in places. The watershed is approximately 30.1 square miles and this reservoir receives water from Fergusson Creek on the east side and a large spring and Whiskey Creek on the west side. The flow from these sources in the dry months of summer barely makes up for the evaporation from the lake surface. Sooke Lake watershed is adjacent to the Leech River watershed of 27 square miles, which will be used to supply water to the lake in the ultimate development, when a tunnel about 7 miles long will be driven from Wolf Creek direct to Humpback Reservoir.

The flow records, gaged on the weir of the concrete dam in 1914, show a total runoff of 64,353 acre-feet for a total annual rainfall of 57.53 in., giving a 70 per cent runoff. Table 1 gives the hydrographic data for Sooke Lake, while Table 2 gives the storage capacity at various elevations about normal lake surface.

Sooke Lake Dam and Control Works

The chief item of construction at Sooke Lake is the dam and control works. This dam is an ogee concrete masonry weir 175.5 ft. long, with a section of reservoir wall at the west side of the river, on the lower side of which a concrete screen house is built.



THE REINFORCED-CONCRETE SCREEN HOUSE AT THE SOOKE LAKE DAM IS BOTH SIMPLE AND COMPACT

TABLE 2—STORAGE CAPACITY OF SOOKE LAKE AT VARIOUS LEVELS

Elev. in Ft.	Rise in Ft.	Storage, Acre-Ft.
667	12	12,840
670	a15	16,415
700	b45	64,000

a, with 3-ft. flashboards on dam; *b*, ultimate development.

TABLE 1—HYDROGRAPHIC DATA, SOOKE LAKE

Months	Inches Rainfall Per Month 1911	1912	1913	1914	In. Vaporation 1911	1912	Av. c.f.s. 1914	Acre Ft. 1914
January	....	7.47	9.66	16.79	....	0.00	336.5	20,650
February	....	7.48	3.89	3.85	....	0.00	100.0	5,540
March	....	1.89	5.16	4.19	....	0.27	120.0	7,370
April	....	0.68	2.00	2.04	....	1.07	7.5	446
May	....	1.59	1.60	1.28	....	2.85	13.5	600
June	....	2.05	2.98	1.77	....	3.31	9.5	57
July	....	0 62	1.59	0.05	....	3.03	0.0	00
August	....	4.62	0.81	0.40	....	1.45	0.0	00
September	0.24	1.91	0.90	3.26	1.05	1.10	0.0	00
October	1.70	5.74	4.85	10.07	0.60	0.53	72.6	4,460
November	10.37	12.99	16.55	11.70	0.08	0.02	331.5	19,740
December	7.72	12.77	3.57	1.95	....	0.00	89.5	5,490
Total	....	59.81	53.56	57.35	....	13.53	....	64,353

The remainder of the dam is an earth embankment with a concrete core wall. The total length of the dam is about 425 ft. over all. Above the dam and back of the screen house is the circular concrete intake tower, shown in one of the drawings, with seven sluice gates, to draw water from different levels. Three of the gates are 42 x 30 in. and four 24 x 30 in., caged against drift by iron slats on the upper side.

INTAKE TOWER

The intake tower was built of 1:3:6 concrete. The well, 8 ft. in diameter is covered with a paneled, checkered ¼-in. iron plate setting on an iron curb. The top slab of the tower is corbeled out to place the stands vertically over the gates.

From the well of the intake tower to the screen house are two 40-in, riveted steel inlet pipes. One of these outlets for future need is closed by a cover plate. The water from these pipes passes through two sets of screens—one 40-mesh and one 80-mesh per linear inch. These screens slide in channel-iron guides and are operated from the screen-house floor. The water passes over an 8-ft. sharp edged measuring weir, El. 654, and cascades down to the inlet of the concrete flow-line conduit with its axis at El. 645.0. A gage rod and a vertical floating vernier rod are used to measure the height of flow over the weir.

On the screen-house floor, adjacent to the screens, is a concrete sink, to which pressure water is piped from an elevated tank on the hillside at the west end of the dam. A never-failing spring supplies water to this tank. The caretaker washes the screens, laying them on this sink with the dirty side down and the jet of water quickly cleanses them.

CLEARING

Around the shores of Sooke Lake it was necessary to cut and burn 296 acres of brush and timber in order to provide for raising the lake surface 15 ft.

This work was done after the usual logging methods in successive stages as follows: (a) Swamping and burning the brush; (b) falling trees and close cutting stumps; (c) bucking the timber; (d) rolling, piling and burning.

A steam donkey engine on skids was usually used to haul and pile the timber and stumps, using a tree for a mast to pile around its base. Dynamite was used, when necessary, to split up large timber and trees for hauling to piles. For pulling the sunken logs, the donkey engine was moved on a raft around the margin of the lake.



WATER ENTERS HUMPBACK RESERVOIR OVER CASCADE AT END OF DAM

DAM FOUNDATION

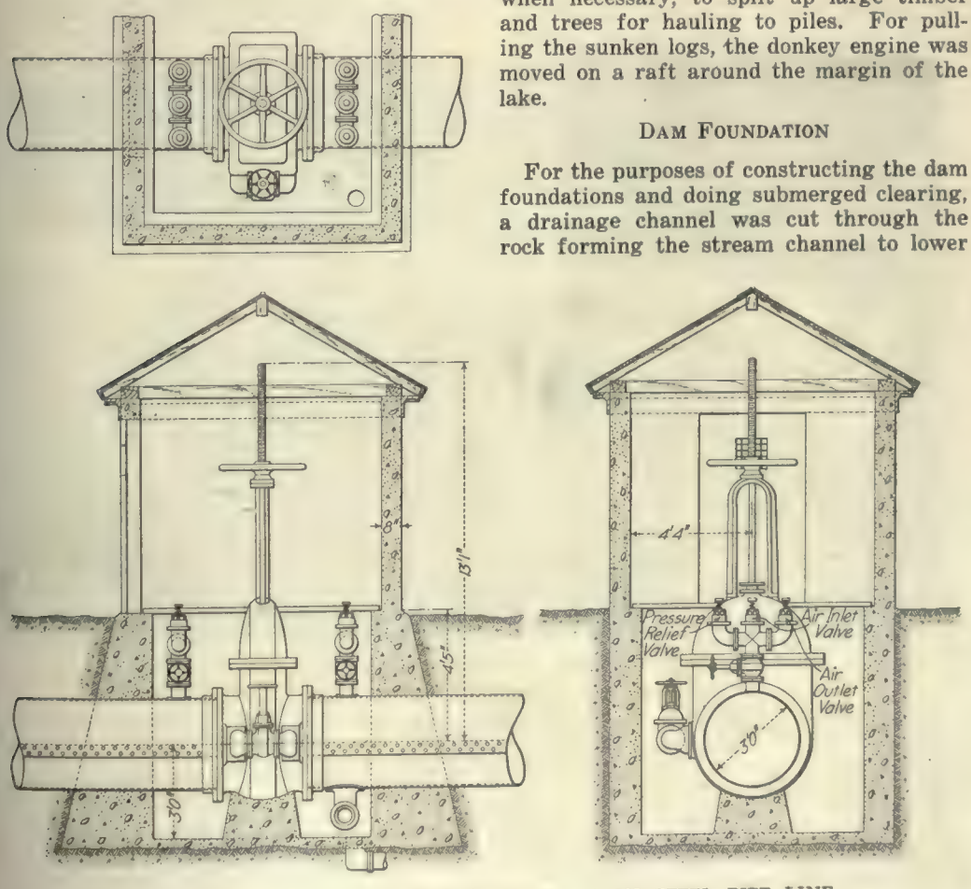
For the purposes of constructing the dam foundations and doing submerged clearing, a drainage channel was cut through the rock forming the stream channel to lower the low water lake surface 3 ft. The rock at the dam site is of a schistose character, loose and considerably weathered at the surface. The use of powder increased the difficulty of obtaining tight conditions for the dam, and it was necessary to pick out a large amount of the rock in order to get a firm foundation. Wheelbarrows on plank runways were used for disposing of the spoil along the river banks where it did not restrict the waterway.

On account of the isolated location of the dam site, transportation charges on the plant and cement were high for hauling from the railroad. There was a gravel deposit at the upper end of the lake and a quantity of dirty sand that was hopelessly bad for mortar. By cross-cutting one of the smaller valleys, Fergusson Creek, with prospect holes, a small deposit of sand was obtained.

WASHING SAND AND GRAVEL

It was necessary to instal washing plants at the site of the gravel and of the sand deposits, and some difficulties occurred in getting a passably clear product on account of the clay coating on the sand and gravel. A rotary-screen washer, driven by a gasoline engine, was used at the gravel deposit, with a perforated pipe, discharging inside on the gravel. At the sand deposit a gravity washer was installed, using water from a flume to Fergusson Creek, discharging under pressure through holes in the bottom of a box, by which the dirt was washed up and overboard. The product at each washer discharged by gravity on the deck of scows. There were two of these scows built on the lake. These were towed by a small tug having a 12-hp. gasoline engine.

The sand and gravel was unloaded into buckets of an inclined cableway running over a storage pile. The cement was teamed in from the railroad and stored in warehouses at the dam site. The aggregate was wheeled to a ½-cu. yd. Ransome mixer, with loading attachment. The mixer discharged into buggies which dis-



STANDARD GATEHOUSE FOR 36-INCH VALVE ON STEEL PIPE LINE

tributed the concrete from a trestle through chutes into the dam forms. For the high levels of the dam a builder's hoist was used for lifting the buggies to the top of the trestle. The form work, which was very simple, was braced back by struts to the ground. The dam was built with about 20 per cent of plums.

Embankment

The earth embankment at the end of the concrete dam was built up in 6-in. layers with scrapers, after the natural ground was thoroughly cleaned and plowed for binding. A light concrete core wall was built to prevent seepage. The 6-in. layers of the embankment were slightly dished toward this wall and compacted by wetting and ramming. The upstream slope was paved with hand-placed rubble from the foundation excavation.

At the west end of the dam, overlooking it and the lake, was built a tasty, two-story log cottage for the caretaker.

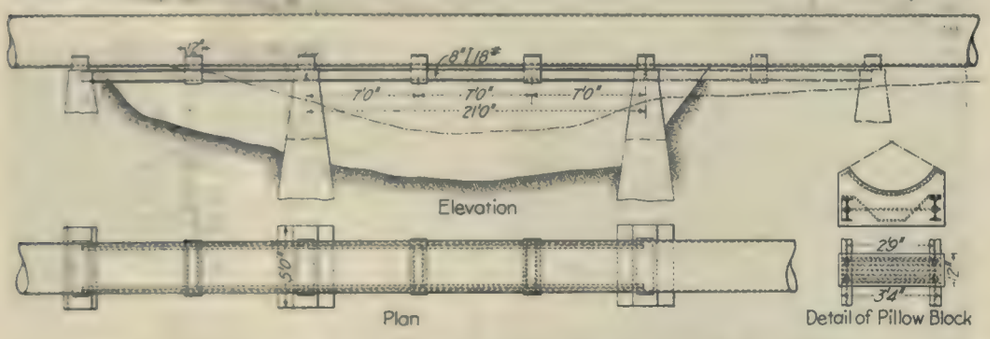
The contractor, before abandoning the work, April 12, 1912, had done about one-half of the clearing around the lake and had nearly completed the excavation for the dam foundations. The remainder of the work was done by day labor under the engineer's direction.

The costs of the work at Sooke Lake are shown in Tables 3 and 3a.

Concrete Flow Line

When the use of wood-stave pressure conduit was found inadvisable, it was decided to build the reinforced-concrete pipe as a flow line, laid on an 8-ft. roadbed, excavated along the grade contour. The concrete line is 27.3 miles long, and, as before noted, is composed of 42-in. reinforced-concrete pipe of the lock-joint type. For the flow line, the wall is 3 in. thick, and for the siphons, of which there are six, with a maximum head of 90 ft., the walls are 4½ in. Drawings herewith show the type of concrete trestles, overflows and stand pipes used. Minor drainage crossings are cared for by 24-in. and 12-in. pipes.

A survey party staked the field location by adjusting circular curves to fit the grade contour after the manner of irrigation canal location, using a minimum radius of 76.7 ft. and 3 deg. maximum chord angle. Table 4 shows the location curves that were used.



THIS SIMPLE I-BEAM CROSSING OF DEADMAN'S RIVER IS TYPICAL

Table 3—Average Unit Costs of Work at Sooke Lake Dam

Clearing (296 acres)

	Per Acre
Swamping and burning	$65.60
Falling and close-cutting of stumps	29.60
Bucking, splitting, piling	75.60
Rolling, piling and burning, grubbing and pulling of rotten stumps	143.50
Miscellaneous	11.35
	$325.65

(Plant charge, maintenance and incidentals included.)

Earth Excavation, Sooke Dam (2054 cu. yd.)

	Per cu. yd.
Labor	$0.736
Material and plant charge	0.043
Camp charge	0.121
	$0.900

Rock Excavation, Sooke Dam (2907 cu. yd.)

	Per cu. yd.
Labor	$2.71
Plant and material	0.281
Camp	0.449
	$3.440

Sooke Dam

Foundation concrete (1:3:6) to rock line, 1176. cu. yd.	Per cu. yd.
Cement	$4.74
Sand	1.46
Gravel	2.27
Forms	1.07
Mixing and placing	1.90
Plant and tools	2.20
Supplies	0.74
Camp	1.31
	$15.69

Concrete (1:3:6) above rock line, in screen house, core walls, etc., 862 cu. yd.	Per cu. yd.
Cement	$4.64
Sand	1.32
Gravel	2.22
Forms	1.34
Mixing and Placing	1.94
Plant	0.49
Supplies	1.27
Cleaning up	0.57
Miscellaneous	0.29
Camp	1.74
	$15.82

Table 3a—Wage Scale on Sooke Lake Work

Eight-hour day; time and one-half for overtime	
Foreman	$4.00—$5.00
Common labor	2.75
Head fallers in clearing	4.00
Second fallers in clearing	3.50
Buckers in clearing	3.50
Carpenters	4.25
Blacksmiths	4.00
Cooks (per month according to camp size)	$75.00—90.00
Flunkies (per month according to camp size)	$40.00—45.00
Bull cook	2.75
Hoisting engineer	4.00
Teams	$6.00—7.00

Table 4—Location Curves for Concrete Pipe Line

Degree.	Radius, ft.	Deflection angle.	T angle offset, ft.
75° 00′	76.737	9° 22½′	4.07
62° 30′	91.959	7° 49′	3.40
50° 00′	114.816	6° 15′	2.72
37° 30′	152.956	4° 41′	2.04
25° 00′	229.294	3° 07½′	1.36
18° 45′	305.70	2° 20½′	1.02
16° 40′	343.878	2° 05′	0.91
15° 00′	382.087	1° 52½′	0.82
12° 30′	458.421	1° 34′	0.68
10° 00′	573.131	1° 15′	0.55
8° 20′	687.76	1° 02½′	0.45
6° 15′	916.89	0° 47′	0.34
5° 00′	1146.26	0° 37½′	0.27
4° 10′	1374.76	0° 31′	0.23

Chord of 25-ft. length staked.

Tests

The use of a 3-in. shell for pipe 42 in. in inside diameter at first seemed critical but the results proved that this was ample. The pipe was not backfilled, except for about 2000 ft. in a deep sliding cut, where 4½-in. shell pipe was used. A test of the 3-in. shell pipe, 4 ft. long, gave a crushing load of 1½ to 2 tons and a bursting pressure of 20 to 25 lb. per square inch, equal to a pressure head of 53 to 57 ft. The siphon was laid under hydraulic heads up to 90 ft. and a test of the conduit under working conditions shows practically no leakage.

The question of taking care of expansion effects on the pipe line caused some anxiety and the contractor at first installed some copper diaphragm expansion joints with no appreciable effect and they were discontinued. The engineers' idea was to let the cracks develop where they might and then take care of them if necessary, as it was impossible to predict their location. However, the cracks at the pipe joints laid in extreme variations of temperature caused no trouble, as the ballast, in connection with the reinforcement, prevented any considerable movement of the pipe. In a general way, it appeared that a hair-line crack



CONCRETE TRESTLES WERE ALSO USED FOR SOME OF THE CROSSINGS

TABLE 5—INTERNAL PRESSURE TESTS OF 42-IN. CONCRETE PIPE—TESTED TO DESTRUCTION

Kind of pipe.	No. tested.	Age in days.	Broke at lb. per sq. in.
3-in. shell, no reinforcing.....	1	60	25
3-in. shell, standard gravity pipe	1	35	22
3-in. shell, standard gravity pipe	1	35	26
3-in. shell, standard gravity pipe	1	35	28
3-in. shell, standard gravity pipe	1	55	29
3-in. shell, standard gravity pipe	1	105	15
3-in. shell, double mesh gravity pipe	1	60	30
4½-in. shell, siphon pipe, 20-ft. head	1	60	45
4½-in. shell, siphon pipe, 40-ft. head	1	60	45
4½-in. shell, siphon pipe, 40-ft. head	1	60	60

All concrete 1:2:4 mix. Reinforcing for standard gravity pipe is No. 9 wire 4-in. centers; reinforcing for 20-ft. head siphon pipe is ¼-in. square twisted rod, 3½-in. centers; reinforcing for 40-ft. head siphon pipe is ⅜-in. square twisted rod, 3½-in. centers.

developed at about every fourth joint. These caused no trouble.

In order to give access to the pipe, manholes, covered by a screen and cap, were placed at both ends of the siphons and at each 2000 ft. of line. These limit the possible pressure head on the flow-line pipe to 2 ft. A 10-ft. overflow weir, 800 ft. below the Sooke Dam, with 1½-ft. freeboard, will control any excess water unwittingly turned into the conduit. All siphons have 6-in. steel nozzles and gate valves for emptying the conduit.

Caretakers will be on duty at each end of the conduit and will look after about 4 miles of line. Two patrol houses are built for the intermediate patrolmen who will each look after about 10 miles of line. A phone line was built along the conduit between the caretakers' houses and the reservoirs, with connections to the waterworks office in Victoria, the patrolmen's houses and various patrol boxes for effectively operating and maintaining the conduit.

Table 5 gives results of internal pressure tests on the pipe, and shows that the reinforcement in the 3-in. wall flow line was not necessary except for handling. Table 6 gives the coefficient n in Kutter's formula for various depths of flow. The difference of depth of flow in the pipe and the coefficient show the loss of water which was larger than normal before the pipe was finally tightened up.

HUMPBACK RESERVOIR

The water from the conduit discharges into a concrete chamber under a perforated concrete baffle board cover to still the flow over the measuring weir. The water passes over an 8-ft. sharp-edged measuring weir down the cascade steps 20 ft. to the surface of Humpback Reservoir, at elevation 480 ft. The water can be discharged below the surface of the reservoir through a pipe with a submerged outlet to prevent churning to a milky appearance at short periods in the year when some minute vegetable growth is present. A third outlet pipe by-passes the reservoir and connects to the pressure conduits to the city service reservoir.

The reservoir site—about 40 acres—was cleared of all trees, brush and vegetable growth. The bottom peaty soil, after grubbing of the vegetable matter, was covered with a 6 to 8-in. layer of clean sand and gravel.

TABLE 6—COEFFICIENT n OF KUTTER'S FORMULA IN 42-IN. CONCRETE FLOW LINE FROM WEIR MEASUREMENTS

At Sooke Lake.		At Humpback Res.	
Depth of flow. in.	n	Depth of flow, in.	n
8⅝	0.01152	8	0.0121
14½	0.01185	13¾	0.01157
20	0.01175	19½	0.01142
26	0.01165	25	0.01125
Full	0.01058	36	0.0117



CONCRETE PIPE FOR FLOW LINE WAS USED UNDER MAXIMUM HEAD OF 90 FEET

The storage capacity of the reservoir is as follows:

Elevation, ft.	Capacity, Imp. gal.
480	125,901,000
475	85,350,000
470	53,947,000
465	30,500,000
460	12,913,000

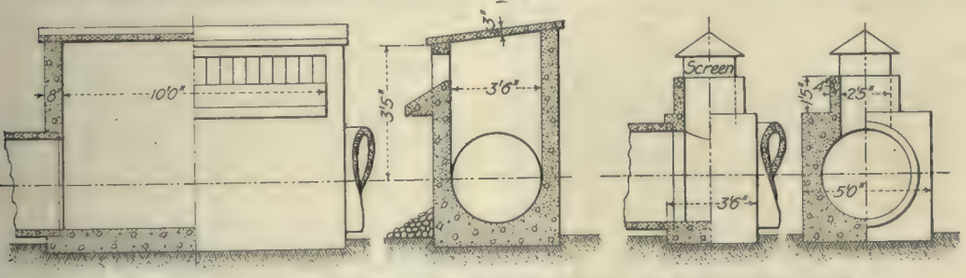
455 top of pipe taken as zero.

The impounding dam is a reservoir section, built of concrete on trap rock foundation. Its length is about 675 ft. and maximum section about 60 ft. high. Details of the dam and of the construction cost will be found in the Engineering Record of Aug. 15, 1914, page 176.

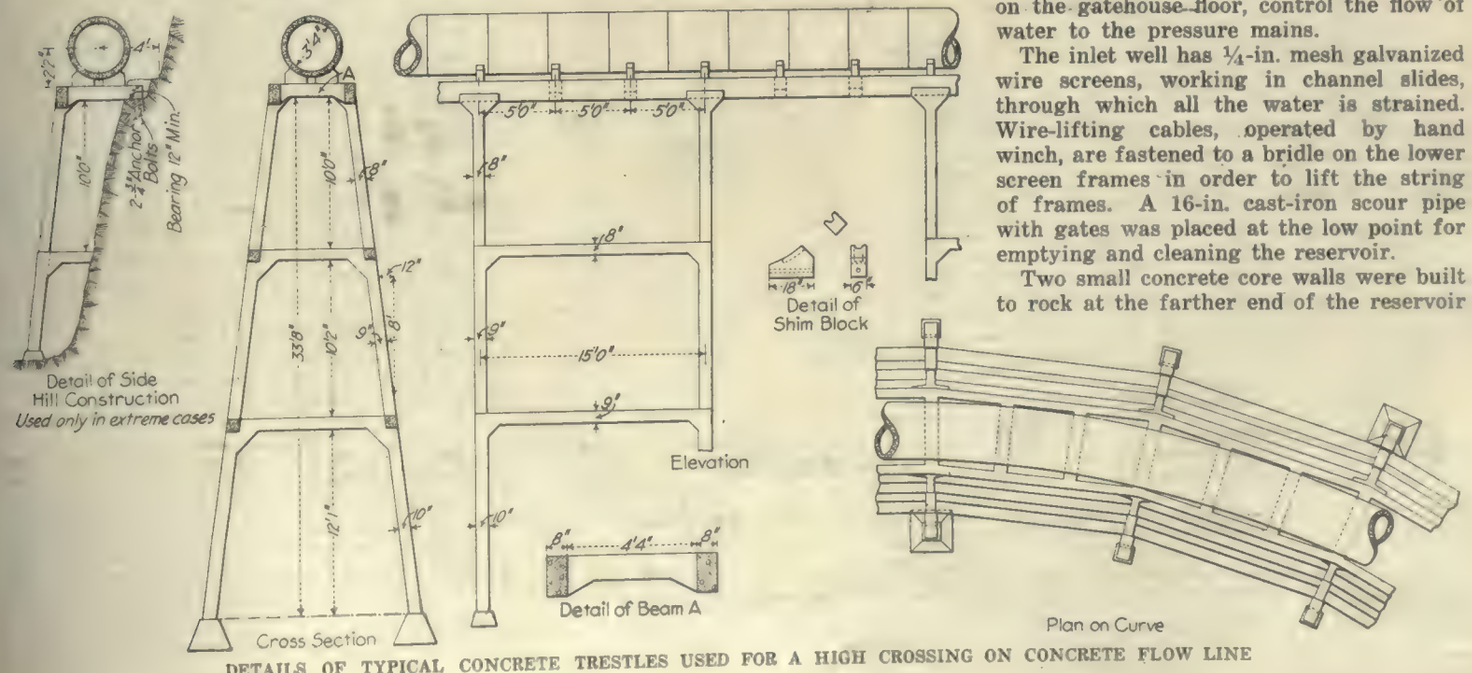
A concrete well and gate house was built near the middle of the dam with two outlet connections for the 36-in. pressure mains. Two low and two high-level inlet sluice gates, operated by stems to standards on the gatehouse floor, control the flow of water to the pressure mains.

The inlet well has ¼-in. mesh galvanized wire screens, working in channel slides, through which all the water is strained. Wire-lifting cables, operated by hand winch, are fastened to a bridle on the lower screen frames in order to lift the string of frames. A 16-in. cast-iron scour pipe with gates was placed at the low point for emptying and cleaning the reservoir.

Two small concrete core walls were built to rock at the farther end of the reservoir



OVERFLOWS AND STANDPIPES WERE PROVIDED ON THE CONCRETE LINE



DETAILS OF TYPICAL CONCRETE TRESTLES USED FOR A HIGH CROSSING ON CONCRETE FLOW LINE

to act as cut-off walls in gravelly soil that might leak.

PRESSURE LINE

Water from Humpback Reservoir is delivered to Victoria through a 36-in. riveted steel pipe line, 56,677 ft. long, of which 20,137 ft. are of 5/16-in. and the remainder are ⅜-in. plates. Details of two drainage crossings, one a simple I-beam bridge, and the other a suspension bridge, are given herewith, as is also a drawing of one of the gatehouses.

In the same manner as in the concrete flow line certain definite location curves were adopted, being based upon the length of sheets used and economy in cutting them.

The minimum radius adopted was 31.5 ft. and the maximum chord angle, 3 deg. For straight sections a single length of pipe consisted of four 68-in. sheets, giving about a 22-ft. length. Each course is composed of one plate, bent to a complete circle, with double-riveted lap joints longitudinally and single-riveted lap joints circumferentially. In the ⅜-in. plates ¾-in. rivets are used; in the 5/16-in. plates, ⅝-in. rivets. An accompanying drawing shows the layout of plates for curves of different radii, while the actual figures are given in Table 7. For the curve of minimum radius the plate was cut so that three pieces of pipe could be secured from one 68-in. sheet. All other layouts are made of straight or beveled plate of the 68-in. stock.

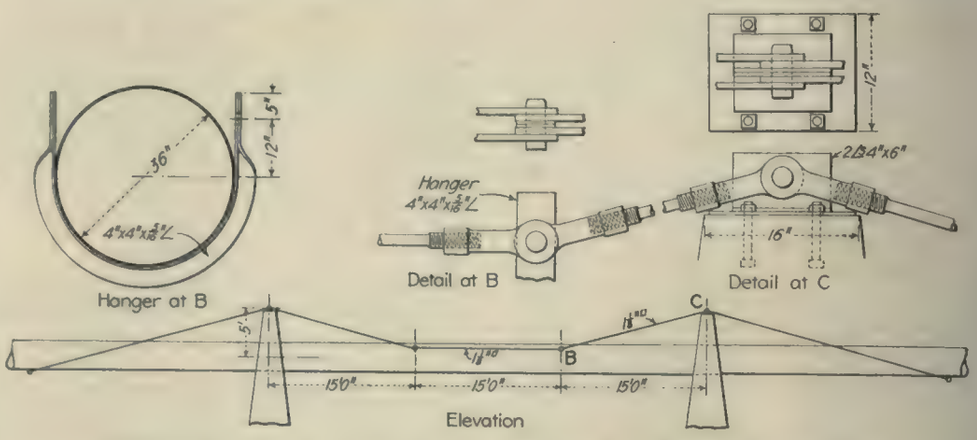
TABLE 7.—LOCATION CURVES FOR 36-IN. RIVETED STEEL PIPE

No.	Chord length ft.	Radius, ft.	Degree of curve	Chords
1	1.65	31.50	181° 49′	1/3 course
2	5.49	103.13	55° 33′	1 course
3	10.88	207.79	27° 34′	2 course
4	16.36	312.45	18° 20′	3 course
5	21.84	417.11	13° 44′	4 length
6	43.76	835.75	6° 52′	2 length
7	65.68	1254.43	4° 34′	3 length
8	87.60	1673.03	3° 25′	4 length
9	109.52	2091.67	2° 44′	5 length
10	131.44	2510.31	2° 17′	6 length

The pipe was tested for leakage between the sectionalizing gate valves outside of the city, but oftener along the streets, by using bumped heads, riveted in the ends of the pipe. The pressure was pumped up by an air pump to 200 lb. at the lowest elevation of the section tested and the leaks calked up until the loss of water was not greater than at the rate of 1 Imp. gal. per foot of pipe for 24 hr. The maximum pressure was held for at least 20 min. No considerable difficulty was experienced in meeting these requirements. The raw field work was carefully painted with bitumastic-enamel solution after the field riveting, and later, retouched at all points where the coating was injured by the recalking.

The drainage structures, gatehouses, Venturi meter house and manholes at all outlets were built by day labor.

All summits were provided with air outlet valves and air inlet valves near the steep grades to protect the pipe against collapse. Six-inch blowoff outlets, with gate valves, were placed at the bottom of all depressions for emptying the conduit. Air, inlet, outlet and pressure relief valves were placed on both sides of the sectionalizing gate valves. Brick manholes were used in the streets and rubble manholes in the country, with the city standard castings and covers. Two of the sectionalizing gates, lying on their sides, were placed in concrete vaults under the streets and three placed vertically in concrete gatehouses. All the water passing through the city is measured by a Venturi meter in a concrete vault adjoining the gatehouse, about 150 ft. below Humpback Dam. The recording and registering apparatus is placed in a room in the gatehouse.



SUSPENSION SUPPORT USED AT MILL STREAM CROSSING OF STEEL LINE

In later articles details will be given as to the methods of constructing the concrete flow line and the steel pressure line. The articles will also contain costs of these features of the work.

After the failure of the original contractor the work was done by force account. C. H. Rust, M. Am. Soc. C. E., as city engineer and water commissioner of Victoria, had full charge of the work. Wynn Meredith, M. Am. Soc. C. E., a member of the firm of Sanderson & Porter, of New York and San Francisco, was consulting engineer, and the writer, resident engineer in charge.

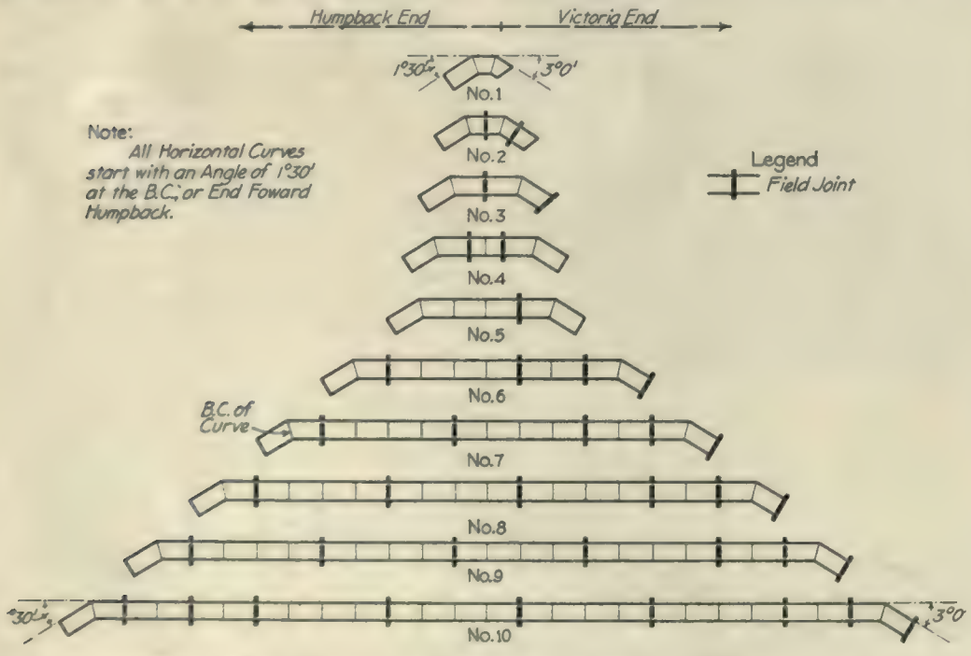


PLATE LAYOUTS FOR CURVES OF DIFFERENT RADII

Table 7 gives data as to chord lengths and radii.

Stone Production in 1914 Less Than in 1913 or 1912

THE production of stone in the United States in 1914 reached a grand total value of $77,412,292, according to the U. S. geological survey. This was slightly less than the production of 1912, and 7 per cent less than the production in 1913. Classified by the kind of stone quarried, the largest item was limestone, at $33,894,155, followed by granite, at $20,028,919. Next came marble, trap and sandstone in the order named, the production of each of which was valued at less than $10,000,000. Classified by the uses to which the stone was put, a large lead was held by crushed stone with a value of $30,161,766. Building stone and riprap fourth and fifth with $18,000,000, monumental stone third with a value of more than $7,000,000, and paving stone and riprap forth and fifth with values of less than $4,000,000. Pennsylvania, the leading stone-producing State, quarried in 1914 10 per cent of the output of the country. Vermont was second with 8 per cent. The other States which during the year produced stone valued at more than $2,000,000 are, in the order of output, New York, Ohio, California, Indiana, Massachusetts, Illinois, Wisconsin, Missouri, Georgia and Virginia. Virginia showed the greatest gain over 1913, advancing from twenty-fifth to twelfth place, displacing Tennessee, which fell below the $2,000,000 mark in 1914.

IRRIGATION OF SUGAR-CANE LANDS as a means of partly offsetting the reductions in benefit due to free sugar is becoming of great importance in Porto Rico. The Fajardo Sugar Company has works under construction to irrigate 2000 acres of its lands at Fajardo, P. R., and contemplates extending them in the near future to irrigate 2000 acres more.

Grandstand at Sheepshead Bay Speedway, New York, Seats More than 30,000

Proposed Extension to Present Steel-Frame Structure Will Give Total Capacity of 45,000—Cantilever Trusses and Timber Floor

PROVISION for more than 30,000 people has been made in the seating capacity of the grandstand at the new Sheepshead Bay Automobile Speedway, New York City, where to-day the Astor Cup race will take place on a track which already holds a world's 10-mile record, made Sept. 18. This steel grandstand, while not containing many unusual features, provides safe and numerous exits, is well braced and conservatively designed for loads and stresses prescribed in the New York building code, and is made of sufficient strength to allow future replacement of the timber flooring with concrete. Care was used in the design to insure that the lines of sight from all seats to any part of the track would be unobstructed.

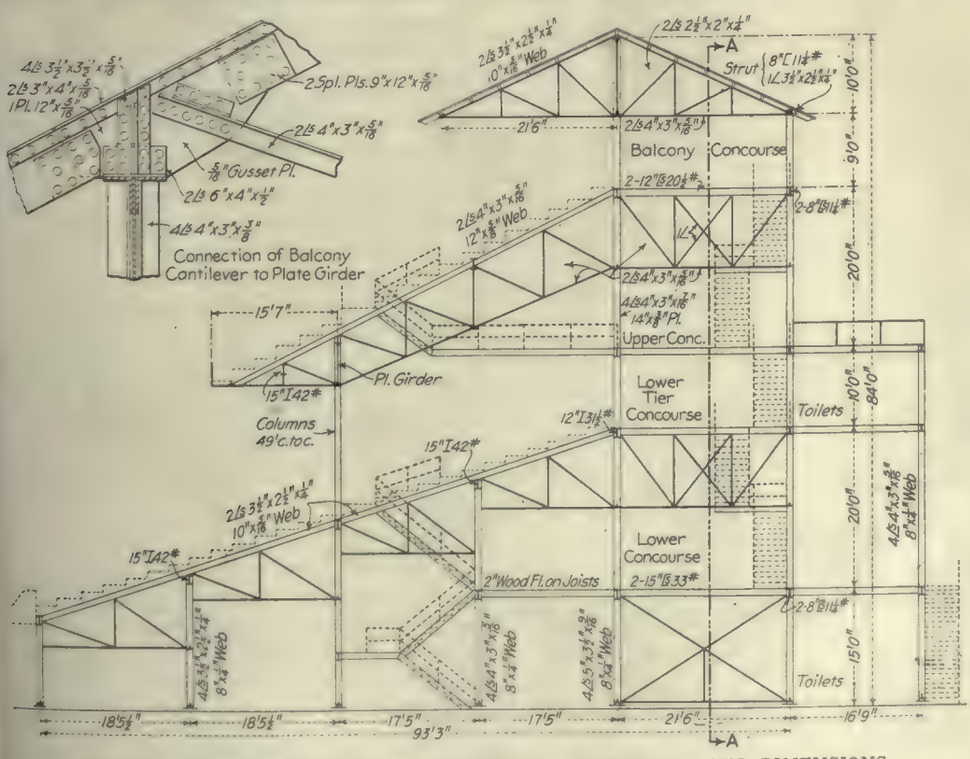


LEFT — RAMPWAY LEADS TO LOWER CONCOURSE — BANKED TRACK ON RIGHT



RIGHT — SECOND TIER TRUSSES, BEAMS AND BRACING FOR RUNWAY

While roof protection is not furnished for the inner parts of the lower tiers of seats, owing to added cost and interference with the view of proposed aeroplane races, the upper roof truss is so designed as to permit a future extension to cover a much greater proportion of the upper-tier seats. The wide concourses under cover would furnish protection in case of sudden storm. The 2-mile track, which is of unique construction and is the only one of its type in this country, was described in the Engineering Record of June 12, page 739. The present article will illustrate the main features of the grandstand. The bleachers, on the opposite side of the track, are of the usual timber-bent construction, and only noteworthy because of their unusual size and capacity. They are 1036 ft. long and 80 ft. wide and at present can accommodate 14,000 spectators. Concrete piers have been built for an ultimate length of 1800 ft., which will accommodate 26,000 persons.



TYPICAL CROSS-SECTION SHOWS STRUCTURAL FRAMEWORK AND DIMENSIONS

Section A-A will be found on the following page.

General Features of Design

The completed grandstand, shown by the accompanying section and elevation, is 1225 ft. long, but the intention is to extend this to at least 1800 ft. if conditions require it. The total width of about 121 ft. for the typical section consists of 28 ft. for the front boxes, of the wooden construction shown on the detail drawing, and about 93 ft. for the structural steel frame proper. The lower concourse is extended backward 16 ft. 9 in. as shown, and provision is made for upper and lower toilet rooms every eighth bay, where the steel frame is extended upward to support the upper toilet rooms, which have concrete floors between steel beams.

The wide concourse and numerous stairways make the exit and entrance facilities unusually ample. One stair has been provided for each five hundred seats. Steel channel stringers with wooden treads and risers on angle brackets, and two-line gas-pipe handrails are used for the stairs as shown. The flooring throughout is of yellow-pine timber; a detail is shown for the upper tier, and the lower tier consists of a single layer of 2-in. planking. The slopes adopted insure good views of the track from all seats, and the general dimensions and heights provide clear lines of sight from the rear seats.

Structural Details

The steel framing is the usual braced column and cantilever truss type of grandstand construction. The columns are spliced at the points of countraflexure under wind stress, and the design is carefully tested for wind bending in the columns. Longitudinal plate girders below the front of the upper tier span three bays and carry the intermediate cantilever trusses at each bay. The detail at the support of this truss on the longitudinal girders is shown in the drawing, and can also be seen in one of the photographs.

The upper roof cantilever is so designed that it can be extended forward in the future to provide greater roof area. The steel sections used are indicated on the cross-section. Rod diagonals are furnished in the plane of the roof and of the upper tier to take erection and wind stresses. I-beam stringers as noted are used to support sloping I-beams spaced 5 ft. 5 1/3 in. apart, on which timber strips are bolted for attaching the timber flooring.



APPEARANCE OF REAR OF GRANDSTAND ON SEPTEMBER 18



VIEW FROM LEVEL OF SEAT ON LAST ROW OF LOWER TIER

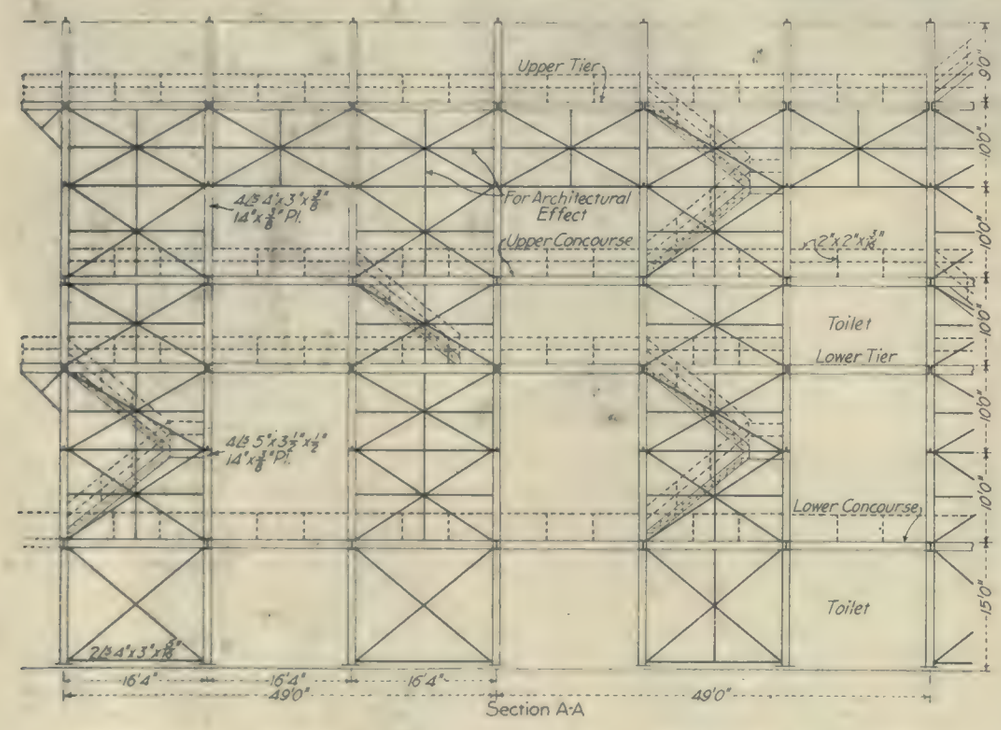
Right-hand photograph shows banked track in right distance, end of timber stand for judges in left foreground.

The present capacity of the grandstand is 31,300, consisting of 4500 in the lower tier boxes, 16,000 in the lower tier seats, and 10,800 in the upper tiers. The probable capacity when the length is extended to 1800 ft. will be about 45,000. The ramp shown in the photograph provides entrance to the lower concourse.

A pleasing appearance of the rear of the grandstand will be offered by arched openings in all bays formed by stucco-on-metal walls up to the level of the lower concourse. The bays containing toilets will be inclosed by similar walls, with doors and windows and an arched opening at the level of the lower concourse. The photographs show the general appearance on Sept. 18, when a world's record was made. The longitudinal bracing and some steel details are indicated. The stiff bracing at the hangers for the platforms leading to the upper tiers should be noted.

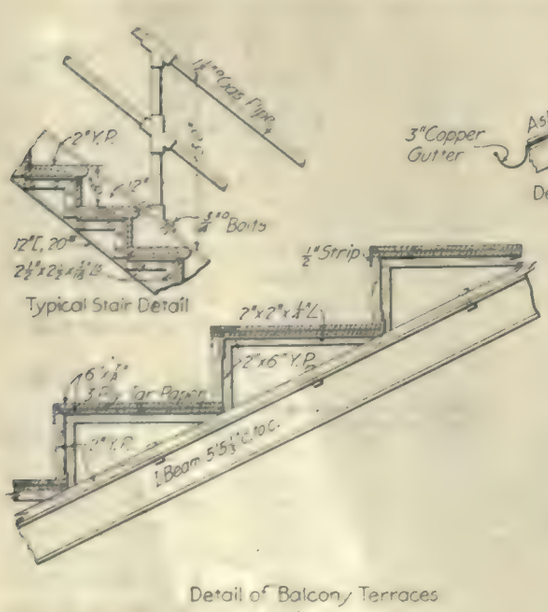
The steel frame of the grandstand was erected in thirty working days by the steel contractor, using a stiffleg derrick with a 26-ft. mast and 90-ft. boom, running on rails of 30-ft. gage—considered a good record for the total of 2750 tons of steel. This steel was furnished by the Lackawanna Bridge Company, of Buffalo, and the 3,500,000 ft. of timber in the grandstand and bleachers was furnished by the Florida & Gulf Standard Lumber Company. The chairs were furnished by the American Seating Company.

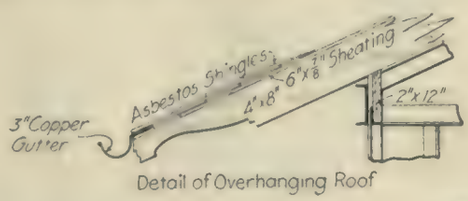
The design and methods of construction have been worked out by Blaine H. Miller, chief engineer, who designed the Indianapolis speedway, and H. B. Thorn and C. F. Gardiner, assistant engineeers, for the Sheepshead Bay Speedway Corporation, of which Everard P. Thompson is manager and vice-president. The general contractors are the Coast & Lakes Contracting Corporation, of New York, with E. F. Gray as resident superintendent.

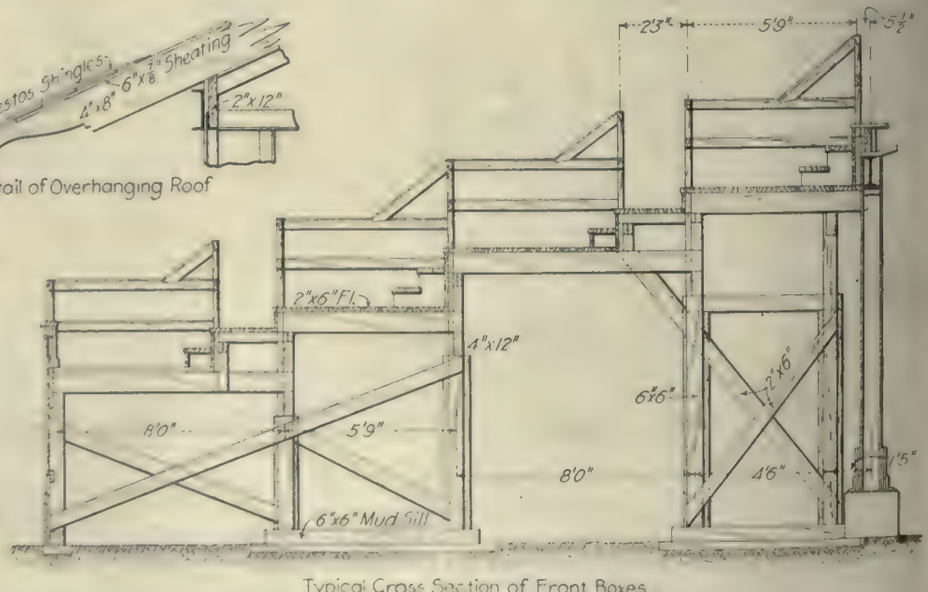


LONGITUDINAL ELEVATION SHOWS TYPICAL BRACING AND COLUMN SECTIONS

ABOUT TWENTY THOUSAND men are now employed by the contractors engaged in building New York City's new rapid-transit lines. The work is rapidly reaching the point where the greatest amount of construction will be going on at one time on the entire project.







DETAILS OF STAIRS, OVERHANGING ROOF, BALCONY TERRACES AND FRONT BOXES, SHOWING MATERIAL USED

Design of Scroll Cases and Intakes for Single-Runner Turbines Analyzed

Part I—Efficiencies of Waterwheels Depend Upon Water Passages as Well as Upon Wheels Themselves—Steady Flow and Absence of Eddies Essential

By A. G. HILLBERG
Hydraulic Engineer, New York City

THE EFFICIENCY of a turbine depends not only upon the design of the runner, but also upon the shapes of the intake, scroll case and draft tube. The high over-all hydraulic efficiency of plant, obtained in tests of single-runner units at the Appalachian plants, at Keokuk and at Holtwood, which are only 2 or 3 per cent less than the efficiency of the turbine itself, could not have been obtained had not the design of the passages of water been studied as carefully as that of the turbine. In the plants referred to above, these passages have been molded in the concrete.

For reaction wheels, operating under medium and high heads, the spiral casing has long been recognized as being the best available type. These casings have generally been made of cast iron and given a tapering shape, as water is diverted into the runner at the same rate throughout the length of the casing. This taper has been so designed as to keep the pressure around the distributor constant. The part between the casing and the runner is designed as a bell mouth for accelerating the flow, so that the water enters the turbine at a higher velocity than that in the casing proper.

Evolution of the Scroll Case

Experience has led designers to establish rules as to the best velocity of flow in these spiral casings or scroll cases. In general the velocity varies from 0.15 to 0.20 of the spouting velocity, $\sqrt{2gh}$, where h is the effective head of the plant. The lower value is used for high heads, and vice versa. In the speed ring this velocity is accelerated to from 0.6 $\sqrt{2gh}$ to 0.8 $\sqrt{2gh}$, at which velocity the water enters the turbine.

Years ago, as turbine units grew larger, the amount of material required in scroll cases of cast iron became unduly high and designers began to use steel plates. As difficulties were met with in making such casings of circular cross-section, they were made square, and channels, Z-bars or angles were used to stiffen the plates. Lately, however, the advances in methods of shop manufacture have permitted the building of circular and tapering scroll casings of steel plates.

When about five years ago the vertical, high-speed single runner was adopted as the standard for low-head plants, the volumes of water to be fed to the turbine became so large that even plate-steel casings were out of the question. Previously smaller single-runner wheels had been placed in open wheel pits, generally square in plan. As in practically all ordinary cases these wheel pits were made too small, and as, furthermore, the flow was uncontrolled, eddies formed, preventing the water from flowing into the runner at the same rate at all points of the periphery. The result was that the rotor of the unit was subjected to unbalanced forces, so that the lower steady bearings wore out at unduly rapid rates. Efforts were made to relieve these bearings by introducing baffle plates in the wheel pits, and gradually the shape of the whole pit became that of a scroll case.

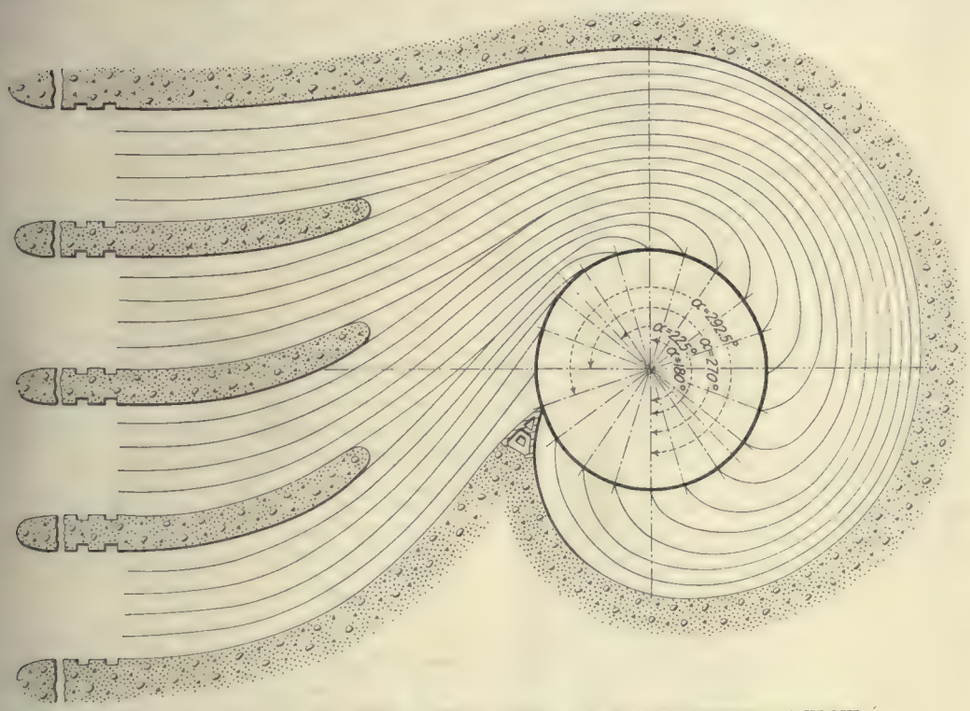


FIG. 1—SCROLL CASE DIVIDED INTO TWENTY IMAGINARY STRIPS OF FLOW

Passages for Water

In a low-head, single-runner installation the passage for the water can be divided into five main parts: Intake, scroll case, speed ring, turbine and draft tube. This article will deal with the intake and scroll case only. The term intake will signify the passage from the front of the head-gate piers up to the point where the scroll case begins.

In designing an intake the designer must avoid abrupt changes in the flow, as eddies formed at these points, will upset the flow throughout the intake and the scroll case. It is, therefore, best to divide the flow into imaginary vertical strips and regulate the velocity of each strip so that no eddies can form.

Suppose that the intake is so large that four gate openings are required, and that the speed ring of the turbine has twenty vanes. The flow, then, may be conveniently divided into either twenty or forty strips. It is, however, usually divided into as many strips as there are vanes. Therefore, assume twenty strips in this case. As there are four gate openings, there will be five of these strips per opening. Fig. 1 shows a scroll case in which the flow has been divided in this manner. Beginning at the scroll case proper and working backward, it will be readily seen that these vertical strips or flow lines are of different lengths. The passages in the concrete, obviously, must be so designed that the water in each flow line moves at the same velocity as that in the adjacent line at points where such lines meet or run alongside each other. Otherwise eddies will form.

As the lengths of these flow lines vary it is necessary to separate the groups belonging to each headgate opening. This is readily done by the introduction of piers, which also serve to break up the span of the roof of the intake. Theoretically such piers should be carried out to a knife edge on their downstream side, but it is impossible to do this in concrete, and as, if it were done, the flowing water would soon eat away the edge, it is necessary either to provide a knife edge of steel plate or cast iron, or to end the pier with a suitably rounded edge. Examples of such designs are shown in Fig. 2.

Velocities

The velocity of the water through the racks and the headgate openings should be kept as low as possible so as to make the loss in head due to the entry small. Under no circumstances should this velocity exceed 5 ft. per second, in which case the loss in head due to entry would be less than 0.2 ft. For wheels operating under heads lower than 30 ft. this loss due to entry would be excessive, and a lower velocity should be used. The losses due to entry should never exceed 0.5 per cent of the total head.

Assuming that this loss is permitted to be 0.5 per cent we have that, as

$$v = \sqrt{2gh_v} \text{ and } h_v = v^2/2g = 0.01h$$
$$h_e = 0.5(v^2/2g) = 0.005h$$

or
$$v = 0.8\sqrt{h}$$

A plant operating under a head of 25 ft., therefore, should have a velocity of 4 ft. through the headgate openings, and the loss due to entry would be 0.125 ft.

In many instances, however, the roof of the intake opening lies so high that when the water level in the forebay is low a velocity of $0.8\sqrt{h}$ per second, with the corresponding depression of the water level in front of the gate opening, might draw air into the turbine. In such cases the velocity must be kept below the critical velocity.

Velocity Acceleration Saves Space

The velocity through the headgate openings can be maintained throughout the intake and the scroll case, but as a sufficient amount of concrete must be provided between the different units in the plant to

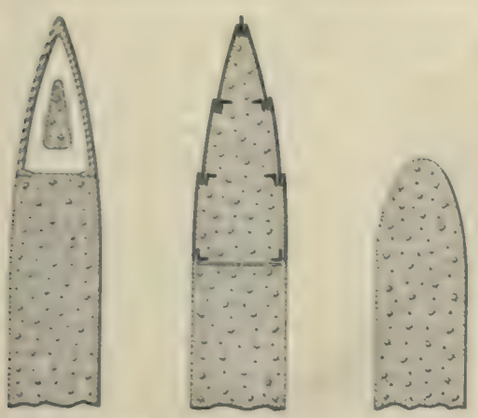


FIG. 2—THREE EXAMPLES OF GOOD PIER ENDS

carry the weight of the substructure, the horizontal unbalanced part of the hydrostatic pressure and the water pressure on the partition walls when adjacent units are shut down, it is often necessary to accelerate the velocity of the flow in order to economize on space. When the flow is accelerated the passage is made smaller and more space is available for concrete. As the velocity through the headgate openings is known, it is necessary to determine the velocity in the scroll case and the distance between the headgates and the scroll case proper in order to determine the rate of acceleration. This increase in velocity should be a constant amount per linear foot.

The rate of acceleration should also be maintained in the scroll case. When points of equal velocity have been determined on the flow lines, these points should be combined by curves, and if any irregularities are discovered they should be adjusted. The boundary lines of the two extreme flow lines will determine the limits of the concrete.

SCROLL CASE

When the flow lines are carried around the scroll case they naturally decrease in number each time a speed-ring vane is passed, as shown in Fig. 1. The maximum velocity in this part must be kept low enough so as not to cause erosion of the concrete. Either this maximum permissible velocity can be assumed at the end of the scroll case, and the velocity accelerated at a uniform rate from the headgate opening to the end of the scroll, or the velocity at the beginning of the scroll can be determined by the formula

$$v = c\sqrt{2gh_o}$$

where $c = 0.15$ to 0.18; g, 32.16, and h_o, the net operating head. As only the maximum, minimum and average heads on the plant are known, the net operating head must be guessed at. For this purpose the writer has derived the following empirical formula, which for average heads between 7 and 65 ft. gives very close results:

$$h_o = h_a - (\sqrt{h_a})\ 3$$

where h_o is the net operating head and h_a the average head.

As soon as the operating head is known, the most suitable velocity of flow at the beginning of the scroll can be calculated. Many engineers prefer to keep this velocity constant throughout the scroll, but, if the water be accelerated at a uniform rate in the intake, it is better to keep this rate of acceleration in the scroll also.

The next step in the calculation is to determine where the scroll case actually begins. Theoretically the best place is on the transverse axis of the unit, in which case the angle α in Fig. 1 is 180 deg. The whole discharge Q then passes through the vertical plane through this line, and, at the opposite side, where $\alpha = 0$, an area sufficient to pass $Q/2$ must be provided. This, however, sometimes makes the breadth required by the unit unduly large. To economize on space, and, consequently, concrete as well, it is advisable to place the end of the scroll at another point. Calling the discharge in the scroll case to the left of the unit D_1, and that to the right D_2, Table 1 shows the discharges to be provided for.

TABLE 1—DISCHARGES TO BE PROVIDED FOR AT DIFFERENT POINTS IN THE SCROLL CASE

α	180°	225°	270°	315°	360°
D_1	Q	$7Q/8$	$3Q/4$	$5Q/8$	$Q/2$
D_2	$Q/2$	$3Q/8$	$Q/4$	$Q/8$	0
Total	$3Q/2$	$5Q/4$	Q	$3Q/4$	$Q/2$

Not much difference in efficiency exists between the cases where $\alpha = 180$, 225 and 270 deg. Where α is larger than 292.5 deg. the curvature of the side of the intake will be so sharp that it is almost impossible to prevent the formation of an eddy. The effect is that less water will enter the runner at that point, thus subjecting the runner to an unbalanced thrust.

The general rule applies to all cases that the intake masonry should be an easy curve and as nearly as possible a smooth continuation of the speed-ring vane.

In cases where the available space necessitates making α larger than 292.5 deg. it is sometimes advisable to shape the concrete so as to feed the water in a radial direction against the speed ring for a certain distance. In doing this the forming of an eddy at the corner will be prevented, but the runner will, nevertheless, be subjected to an unbalanced thrust. The thrust in this case would be opposite in direction to that had an eddy been permitted to form. In feeding the water directly against the turbine for a small part of the circumference of the speed ring one advantage will be gained in that no decrease in the efficiency of the turbine will take place, which is the case if eddies are formed.

The speed-ring vane at the end of the scroll case must be specially designed so that the concrete can be anchored to it. It should also be carried out far enough to protect the tapering end of the concrete and prevent the excess pressure at the end (due to the higher velocity) from breaking through the concrete. In most cases a thickness of from 18 to 24 in. will suffice. Fig. 3 shows two scroll noses of good design.

To save metal only one side of the concrete needs to be protected, but in that case care must be taken to make the joint as long as possible to prevent seepage.

As the reduction in area of the scroll will decrease the hydraulic radius of the stream, that is, make $R = a/p$ smaller, it is obvious

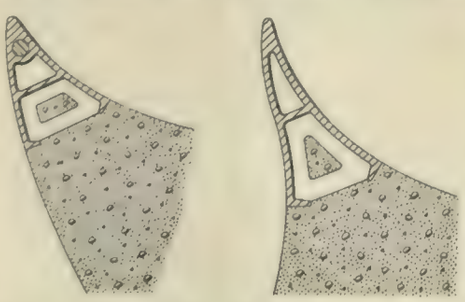


FIG. 3—TWO SCROLL NOSES OF GOOD DESIGN

that some adjustment must be made in the sizes of these areas. As the influence of the skin friction on the stream is in direct proportion to the square of the velocity, which in turn is in direct proportion to the square root of R, this correction in area must be in direct proportion to R. But R is in direct proportion to a, which indicates that by making a larger, the influence of the skin friction can be kept constant.

CURVATURE OF SCROLL

There is, however, another factor to be taken care of. The path of the stream is not linear, but spiral. The radius of the curvature at any point can be determined by the formula

$$R = \frac{\left[1 + \left(\frac{dy}{dx}\right)^2\right]^{3/2}}{\frac{d^2y}{dx^2}}$$

where R is the radius. Introducing x_1 and y_1, the co-ordinates of the point on the curvature, the value of R for the point in question is obtained.

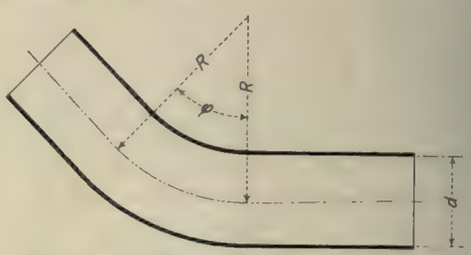


FIG. 4—DIAGRAM FOR DETERMINING n

The co-ordinates α and β of the center of curvature are

$$\alpha = x_1 - \frac{\frac{dy}{dx}\left[1 - \left(\frac{dy}{dx}\right)^2\right]}{\frac{d^2y}{dx^2}}$$

and

$$\beta = y_1 + \frac{1 + \left(\frac{dy}{dx}\right)^2}{\frac{d^2y}{dx^2}}$$

These formulas apply in cases where the equation of the shape in plan of the scroll has the form

$$y = f(x)$$

If this is not the case, that is, if the equation is expressed in polar co-ordinates, or

$$\rho = f(\theta)$$

this radius and the corresponding co-ordinates of the center of curvature must also be expressed in polar co-ordinates, or

$$R = \frac{\left[\rho^2 + \left(\frac{d\rho}{d\theta}\right)^2\right]^{3/2}}{\rho^2 + 2\left(\frac{d\rho}{d\theta}\right)^2 - \rho\frac{d^2\rho}{d\theta^2}}$$

For applying these formulas the shape in plan of the scroll must be known. The various areas are located in radial directions and, consequently, the equation of the shape can sometimes be more conveniently expressed in polar than in orthogonal co-ordinates. It is not necessary, however, that the shape of the curve be a true spiral, and it seldom is. Several of the higher-plane curves lend themselves well for this purpose, and as, later on, when the different areas are known, the shape of the scroll in plan might have to be modified, it does not matter much what curve is used in the original calculations. Curves that can be

used for the first calculation are the involute of a circle, the spiral of Archimedes and the logarithmic spiral.

RADIUS R

Theoretically the radius R decreases throughout the curvature and is not equal for two succeeding points. Considering, however, that the circle of curvature at any point has three points in common with the curve, that it would be well-nigh impossible to build forms for the concrete as accurately as the curvature could be calculated, and that, furthermore, the change in radius per linear foot of curvature is small, it is customary to use the same radius for several sections. Assuming that the subtended angle for a certain part of the curvature having the radius R is φ (see Fig. 4), the head lost due to the curvature in this part would be

$$h_f = n(\varphi/90)\ (v^2/2g)$$

where

$$n = 0.131 + 0.163(d/R)^{3.5}$$

In this formula d is the width of the scroll case outside the vanes of the speed ring. Values of n calculated from this formula for various values of the ratio (d/R) are given in Table 2:

TABLE 2—VALUES OF n CORRESPONDING TO VALUES OF d/R

d/R	n	d/R	n
0.2	0.131	1.2	0.440
0.3	0.133	1.25	0.487
0.4	0.138	1.3	0.539
0.5	0.145	1.4	0.661
0.6	0.158	1.6	0.977
0.8	0.206	2.0	1.98
1.0	0.294		

As a certain amount of water is diverted into the turbine throughout the length of the scroll and the velocity of flow is kept constant, except for the slight increase due to acceleration, no friction losses take place, because of the contraction of the section, other than those due to the decrease in R.

PRACTICAL METHOD

As seen above the friction losses in a scroll case can be determined with accuracy. The method outlined, however, involves lengthy computations, and as all losses are in proportion to certain areas, turbine designers generally use empirical rules whereby the influence of the friction can be allowed for. The method consists simply of enlarging the sections a certain predetermined amount. As the influence of the friction grows larger in proportion as the areas get smaller, the areas must be increased in accordance with a sliding scale. If the succeeding sections to be calculated of a scroll case are numbered 1, 2, 3, 4 . . . n it is customary to enlarge them 0, 1, 2, 3 . . . $n-1$ per cent. Experience has shown that smaller scroll cases designed in this manner have a high hydraulic efficiency.

Good judgment, however, should be exercised in selecting a suitable sliding scale, as large sizes of the casing and low velocities of flow may in certain cases require the adoption of a smaller scale than that given. When the shape of the scroll and the velocity are known approximately, the formulas given above can be used in a rough sort of way to give the designer an idea of what the proper scale to use would be. As the designer cannot predict the quality of workmanship of the concrete in the finished scroll case, it is always advisable to use a slightly larger increase in the scale than the theoretical computation indicates.

(To be concluded)

City Planning—How It Should Be Prosecuted—Why It Is the Engineer's Work

Nelson P. Lewis Discusses Further Details of This Work and Urges Engineers to Take a Broader Part than Executing the Ideas of Others

PART of the paper on city planning presented by Nelson P. Lewis, chief engineer of the Board of Estimate and Apportionment, New York City, at the recent International Engineering Congress was presented in the Engineering Record of last week, page 382. In that part Mr. Lewis defined and discussed four main elements of the city plan—the transportation system, the street system, the parks and recreation facilities, and the public buildings. The remainder of his paper goes further into the means of preparing the city plan, treats of its financing, and ends with an appeal to the engineer to take a broader part in the development of the city than merely making the surveys and carrying out the ideas of others. These additional notes are taken from the paper.

ADAPTATION TO TOPOGRAPHY

That the various elements of a city plan should be adapted to the topography of the site seems so obvious as to need no special emphasis, yet there are numerous instances where this has been done only to a limited extent. The topography should, in fact, be the first thing to be considered in determining general features of the comprehensive plan. Upon it will especially depend the system of main drainage, provision for which must be kept in mind from the beginning, and the transportation system which, while it will naturally be designed to carry people where they want to go, should be able to follow the lines of least resistance, excessive grades and sharp curves involving not only heavy operating expenses but a certain amount of danger.

The first step is to secure a good topographic survey of the territory to be platted. Sometimes this initial survey is made in far more detail than is necessary, the idea being that a complete street plan is to be made at once. The time and expense of doing this could be used to better advantage in a study of the larger aspects of the problem or in working out only the skeleton plan. The survey required for the first study should show existing roads with the location of buildings fronting on them, the actual drainage, including both the valleys and the ridges dividing the drainage areas, the existing railroads and routes suitable for additional lines, the waterfront, if there be one, and the localities best adapted to the accommodation of water-borne commerce and the places which, from their picturesque features, are most suitable for park reservations. Further details are not required for the first study of the plan; they will come later.

A contour map or a model will be of great help in laying out the first skeleton plan. When this has been determined and the time comes to fill in the details, further surveys will be necessary, but they can be taken up one section at a time as each of the areas lying between the arterial streets can and should be studied separately. In this connection, proper drainage should be the first consideration, while the location of property lines will be of great assistance in so planning the minor streets as to avoid damages, caused by leaving unusable remnants, wherever it is possible to do so, and still secure a rational and convenient plan.

EXCESSIVE GRADING TO BE AVOIDED

The first step in the physical creation of a street system is the grading, and as this comes at a time when the value of the abutting property is small, the cost should be kept down to the lowest figure consistent with a reasonable plan. The preference for rectangular blocks which will produce the greatest possible number of right-angled lots is so general that excessive grading and needlessly steep grades are frequently the price paid to secure them. This policy often defeats its own purpose, as the grading up or down of the abutting lots is likely to involve a cost greater than the value of the few lots gained by a rectangular system over those which would result from one conforming more closely with the natural surface, while the latter would be far more attractive. A long sweeping curve may be a pleasing feature of a street plan on level ground; diagonal streets to afford direct access from one part of the tract to another are always desirable; but a series of sharp curves and frequent abrupt changes of direction are as inappropriate for a level site as are straight lines regardless of natural contours for a rugged site.

The sites for public and semi-public buildings should receive consideration in the first topographic survey. Such buildings should not only be placed where they can be seen from the streets approaching them, but wherever possible, they should be placed at grade summits.

There may be some precipitous hillsides or deep ravines in the area to be platted and, while these are of little value for other purposes, they will make admirable parks. They should be located in the topographic survey and the main roads should be so fixed as to afford easy access to them when they become public pleasure grounds.

The general plan should be adapted to the topography. Attempts to create on a level plain a city having the picturesque features of a hillside town will result in failure, while to lay out on a rugged site a plan suited to a level or gently sloping tract will not only involve needless expense, but will sacrifice opportunities for charming effects and produce a result which is palpably commonplace.

STREET DETAILS

While the general plan for the streets and roads of a city and its environs may have been well thought out, and while the streets may be of generous width and of good alignment and may have been skillfully located with respect to the topography, their traffic capacity may be less than it might be, owing to improper proportions of roadways and sidewalks. The roadway pavements may be unsuited to the character of the traffic or to the grades. Injudicious tree planting or the entire absence of planting may make them bare and unattractive. There are many details of street arrangement and design worthy of the most careful study, and even when these details have been carefully worked out for one street, or

for streets of different classes and widths, a standard cannot safely be adopted for every street of the same class and width. The undesirability of long straight streets at fixed intervals, each of the same width, has already been pointed out. Equally objectionable is the identical arrangement of the minor details on each of these streets.

Trees

The importance of trees in a city street cannot be over-estimated. Their position should therefore be one of the street details to receive careful study. The practice of placing them immediately back of the curb is quite general, and where buildings are placed on the street line it may be necessary to do so in order to give them space for growth. If they are placed between the sidewalk and the building line, however, the street acquires an added dignity and appears to be wider than where the trees are placed along the curb.

The orderly arrangement of the great variety of structures beneath the surface of city streets should receive careful consideration in city planning, but the lack of attention to this detail has been conspicuous. The provision of subways or galleries for the accommodation of all underground structures has frequently been urged as the only effective remedy for the conditions which so commonly exist and which involve the continual mutilation of the street surface in order to reach the various pipes, mains and conduits. Yet it will be difficult to find two cities where the street pavements are in better general condition than in Liverpool or Berlin, the former conspicuous for its excellent stone-block, and the latter for its good asphalt pavements; yet neither of these cities has built pipe subways. The reason for the admirable condition of their streets is probably due to efficient administration and also to definite regulations covering the precise location of pipes and other structures of different classes beneath the roadways and sidewalks, avoiding thereby the exploration beneath the surface for the purpose of finding what is wanted when repairs are necessary.

Height and Other Limitations

Limitations as to the height of buildings, the proportion of the lot which may be built upon, and the general arrangement of buildings, are commonly referred to in the United States as restrictions. In European countries it is quite generally taken for granted that the city will make such regulations as are calculated to insure to the citizens at large the full enjoyment of all the advantages which a well-organized city should supply, and prevent such acts of the individual or such use of private property as will in any way militate against such enjoyment. Among these advantages, besides the free and safe use of the public streets, may be included freedom of obstruction of light and air by a neighboring owner; prohibition of the appropriation of public property to private use; guarantee of the preservation of the character of a district when once established by protecting it against invasion by industries, uses and occupations inconsistent with that character; conservation of the value of private property by a consistent scheme of development and improvement; prohibition of the erection of structures, either permanent or temporary, which will offend the eye, or of anything destructive of amenity.

The right of the city to control and prevent the private occupation of its public streets is so obvious that it can scarcely be questioned, but the modern idea that the obligation of the city to its citizens is much more comprehensive and extends to the use which may be made of the property outside the street lines and which is actually owned by individuals, is not so generally accepted on the part of the owners of real estate, although regulations affecting the use of private property are now becoming quite general. The most common regulations of this kind are those affecting the arrangement and height of buildings. The most obviously necessary are those governing the proportion of lots which may be built upon and the arrangement of the buildings and open spaces, as these are essential to good sanitation and decent living. Those designed to limit the height of buildings are not always accepted as reasonable.

Sizes of Blocks

The sizes of blocks and lots have become so standardized, especially in the United States, that they are likely to control the street layout. This has tended to prevent the most successful treatment of the smaller subdivisions which go to make up a great city. The building plot of 100 ft. in depth has become a habit and seems to persist without regard to its adaptability to either general or special conditions. But the poor man should have the opportunity to pay for as little land as will provide the home he wishes with an insurance of sufficient light and air about it to make that home decent and healthful. A cottage 25 or 30 ft. in depth does not need a lot 100 ft. deep to accommodate it. Why, then, should not the builder of such a cottage be able to secure a lot of suitable size on which to place it?

Financing a City Plan

The development of a proper city plan is a slow process requiring years of painstaking work, but to carry it out physically will require much more time. The work must be done progressively as needed and it is of the utmost importance that such work should be sanely financed. There are several ways in which the cost of improvements included in the plan can be met; by direct assessment upon the property which will be benefited by each particular improvement, by making the expense a general city charge or by a combination of the two methods.

Conditions in different cities, in the several parts of the same city, and at different stages of its growth and development, vary so greatly that the same methods of financing will not be applicable to all cases. In the small town—and no town is so small that it does not need a plan—the creation of a public square about which or in which the chief buildings including, perhaps, the churches are to be grouped is of general interest and benefit to the entire community. All public activities and even recreation and amusement will center there, and it will be conceded that the town itself should properly pay the expense. If the main street of the town needs widening, straightening or extending, the benefit will again apply to the entire community. But the town grows and becomes a city; other main streets must be provided; other centers of activity or recreation are needed. These new projects will still result in some general benefit but in a large measure of special benefit. Hence the fair share to be assumed by the town will be less in proportion to the amount of special benefit resulting to the particular locality.

It remains for the town to determine whether it is to pay all or part of the cost of any improvement, and, if its credit is such that it can borrow the necessary funds, whether it will issue its bonds for a long term of years or whether it will carry out the improvement on a cash basis by tax levies or short-term bonds.

A large city is really a group of small towns grown together. While there are certain great projects commonly deemed of general interest, there are few which do not involve some special benefit to a particular locality.

The Neglected Responsibility of the Municipal Engineer

The keenest interest in city planning has heretofore been shown by architects, landscape architects, artists, students of civic affairs, social workers, etc., while engineers appear to have been content to carry out the physical work along lines already laid down or, when called upon to make plans for future development, to adopt the conventional features followed by their predecessors. Engineers engaged in this particular class of municipal work have so long been accustomed to doing things when they are told, as they are told and because they are told by those whose function they have thought it to be to determine general plans and policies, that they are to a large degree responsible for the idea so generally prevalent that the chief work of the engineer is to carry out the ideas and policies of others. The exercise of vision and imagination on their part has too often been deemed a dangerous incursion into a field foreign to their proper activities; and yet the engineer is the first man on the ground in laying the foundations upon which our cities are to be built. He has been too prone to regard this preliminary work as a mere matter of surveying, and he has been more intent upon the accuracy of his measurement of lines and angles and of his computation of areas than upon the larger problem of providing for the orderly and sightly development of the city.

The City Plan Is Never Finished

The making of a comprehensive plan for the future development of a city or for correcting the obvious defects of an existing plan is no work for an expert who may be called in for a few weeks or months and who, it is fancied, may have an inspiration which will solve all the difficulties which are apparent. Acres of plans have been made in this way; they have been exhibited, admired, filed away and forgotten. The creation of a proper plan is more likely to be the result of years of patient work, and the men who did it will be forgotten before it is finally carried out. It is no one-man job and it is never actually finished. However carefully and skillfully the first plan may have been made, unforeseen changes will take place, new methods of transportation will be developed, new inventions will powerfully affect the social life of the community, and the plan, where still susceptible of change must be modified to meet the changed conditions.

Comprehensive city planning can best be done by the regularly employed technical staff of the city, but the organization created for this purpose should be carefully

selected. It should contain men who are familiar with the past history and traditions of the community and are in sympathy with them, but who can appreciate changing conditions and adapt the old to the new without destroying it. The work should be directed by men who do not think the exercise of imagination an engineering crime; men who are enthusiasts without being doctrinaires; men who are content to do their work well without hope of popular applause and who are willing to await the verdict as to their work which will be rendered by coming generations. They will not, however, be obliged to wait indefinitely for recognition if they manifest an intelligent interest in this subject and an appreciation of its importance. The work of planning as well as that of building a city is so obviously that of the engineer that he has but to reach out and take it. Other expert advice will be needed, that of the architect and the landscape architect; such advice should always be welcome and in some respects their judgment should be controlling. If the engineer does not assume this task and show his capacity for it, he will have no one but himself to blame if others take it away from him.

Railroad Net Revenues Gained Slightly in Last Fiscal Year

NET OPERATING revenue and income on the railroads of the United States showed a slight gain for the fiscal year ended June 30, 1915, as compared with the previous year, according to a bulletin issued by the Bureau of Railway Economics. This was despite a decrease in gross operating revenues. The figures given in the accompanying table show that the improvement was all in the Eastern district, where an abnormally high operating ratio had prevailed in 1914, and where in 1915, in consequence, it was possible to effect a reduction in operating expenses of 10.0 per cent with a decrease in gross revenues of only 4.9 per cent.

REVENUES AND EXPENSES PER MILE OF LINE OF STEAM RAILROADS OF UNITED STATES FOR FISCAL YEARS ENDED JUNE 30, 1915, AND JUNE 30, 1914

	United States			Eastern District			Southern District			Western District		
	1915	1914	Inc., Per Cent	1915	1914	Inc., Per Cent	1915	1914	Inc., Per Cent	1915	1914	Inc., Per Cent
Total operating revenues.	$12,641	$13,483	d6.3	$21,790	$22,916	d4.9	$10,019	$11,181	d10.4	$9,282	$9,836	d5.6
Total operating expenses	8,894	9,801	d9.3	15,767	17,516	d10.0	7,323	8,141	d10.0	6,239	6,744	d7.5
Net operating revenue..	3,747	3,682	1.8	6,023	5,400	11.5	2,696	3,040	d11.3	3,043	3,092	d1.6
Operating income	3,158	3,078	2.6	5,079	4,441	14.4	2,253	2,588	d12.9	2,570	2,603	d1.3
Operating ratio, per cent	70.4	72.7		72.4	76.4		73.1	72.8		67.2	68.6	

d Decrease.

For the month of June, 1915, comparing with June, 1914, gross operating revenues in the whole country fell only from $1,097 to $1,090, while operating expenses were reduced from $789 to $730. This effected a gain in net operating revenue of 16.9 per cent and a gain in operating income of 21.2 per cent. The operating ratio was reduced from 71.9 to 67.0.

The improvement in the Eastern district was even more striking, where an increase of 3.3 per cent in gross operating revenue was met with a reduction of expenses of 7.4 per cent, resulting in a reduction of the operating ratio from 73.7 to 66.0, and an increase of operating income of 39.2 per cent. In the other districts small losses in gross revenues were met with larger reductions in expenses, resulting in material increases in net income.

Deep Tunnel Completed in Unsound Rock Solidified by Extraordinary Grouting

After Rush of Water and Débris Flooded One End of Astoria Tunnel, New York City, Fissures Were Plugged from Behind Bulkhead in Other End

THE MOST SERIOUS trouble experienced in the construction of the Astoria gas tunnel under the East River in New York City was caused by a flow of 10,000 gal. per minute breaking through the Astoria end of the last 122 ft. of bench remaining to be excavated after the top heading had been holed through. This break flooded the Astoria end of the tunnel on Oct. 5, 1913, and the work of removing the bench was not resumed until Feb. 5, 1914. In the meantime high-pressure grouting from behind a bulkhead at the Bronx end of this stretch of bench, both into the fissure below the tunnel from which the flow came, and into the heading above the bench, as far as the bulkhead on the Astoria side of the break, was resorted to. The entire work of constructing the tunnel is described by J. Vipond Davies, of Jacobs & Davies, New York City, who supervised it, in a paper published on page 1405 of the August *Proceedings* of the American Society of Civil Engineers. The paper will be presented before the society Oct. 6. These notes describing the overcoming of the trouble above mentioned are taken from the paper.

This tunnel, 4262 ft. long, was driven, between stations 35 and 39, station 0 being at the Astoria shaft, through a decomposed dolomite, which formed a disturbed contact zone between Fordham gneiss on the north and Inwood limestone on the south. The tunnel extends at a depth of more than 225 ft. from the Astoria plant of the Astoria Heat, Light & Power Company, opposite Little Hell Gate, to the 132nd Street distributing station of the company in the Bronx. It carries two 72-in. gas mains with provision for two more to be added at a later date. At the point referred to a channel more than 80 ft. deep exists, and a water pressure of 95 lb. per square inch was found.

The tunnel crosses the contact line at an acute angle. By driving headings outside the tunnel lines and more nearly parallel to the contact, thus keeping in relatively sound rock, it was possible to drill cross holes into and above the strata to be pierced by the tunnel itself, and to consolidate these strata by grouting at high pressure. In this way the headings were holed through.

LARGE FLOW ENCOUNTERED

After the meeting of the headings on July 17, 1913, efforts were concentrated on the removal of the remaining bench, which at that time amounted to 474 ft. This length of excavation was attacked from both ends. For the first 237 ft. on the Astoria side and for a considerable distance on the Bronx side no serious difficulty was encountered, the rock on the Astoria side being good, sound dolomite and that on the Bronx side partly but not badly disintegrated. Work proceeded until test holes disclosed the presence of excessive water at the Astoria end. The total flow from these holes at high pressure was about 1500 gal. per minute. The holes were piped for grouting, and incased in an inclined concrete buttress, 20 ft. long and extending from the haunch of the arch to the rock bench. After this buttress had set for one week, the valves of the drains were closed preparatory to grouting, when the water broke through the top of the bench at the toe of the buttress. It was then decided to place a full-section emergency bulkhead at each end of this remaining 122-ft. section of bench. On the completion of these bulkheads the inclined buttress was removed and a much heavier one, 34 ft. long, was constructed. At the same time the western side of the bench top, at the Bronx end, was covered with a 23-ft. inclined buttress extending from the recently constructed Bronx emergency bulkhead to a heading emergency bulkhead on top of the bench which had been placed during the driving of the Astoria heading. A similar inclined buttress was placed against the west side of the arch, thus covering the entire 122 ft. of exposed bench on the west side by a series of concrete bulkheads and buttresses.

After allowing these structures to set, grouting through them began, 139 bags of cement being injected successfully into the two shorter buttresses. The grouting of the heavy 34-ft. buttress was not successful, as the structure cracked badly from the pressure developed by closing the drain valves. It was then decided to remove this buttress entirely and replace it with one in the form of an inverted arch to react against the permanent roof arch already in place. Removal of this buttress was done by blasting with extremely light charges, and was completed about 8 a. m. Sunday, Oct. 5, 1913.

TUNNEL FLOODED

Shortly after 8 a. m. a large flow of water, carrying greensand, burst forth under high pressure from the top of the rock bench about 15 ft. from the Astoria emergency bulkhead. After flowing 30 min. the flow abruptly ceased, only to burst forth again a few minutes later with a volume of approximately 10,000 gal. per minute, which eventually overcame the capacity of the pump at the Astoria end. The bulkhead doors were promptly closed. On the Bronx side the force of the water was broken by the intervening heading bulkhead, and the workmen were able to close the drains. On the Astoria side, owing to the rush of water and sand, they were able to close only two of the three drains in the bulkhead. It was found later that a small piece of 1-in. board, floating in the water, had become wedged between the door and the door frame of the bulkhead on the Astoria side. Through the small opening thus caused and through the drain pipe which the men had not been able to close,

the water poured into the tunnel, carrying with it a large volume of dolomitic sand and débris. The water in the Astoria shaft rose steadily until, at 3.15 p. m., it had completely submerged the pumps. At this time the pumping plant in the Astoria shaft consisted of twelve pumps with an actual discharge of probably 5500 gal. per minute.

Immediately following the flooding of the Astoria end, the Bronx emergency bulkhead was strengthened by a reinforced central buttress. On the completion of this buttress an additional emergency bulkhead was built 105 ft. nearer the Bronx shaft. The actual need of this bulkhead never arose, as the first one withstood the full hydrostatic pressure.

GROUTING FROM BRONX END

Observations of the rise of water in the Astoria shaft were carefully made, and also the tidal readings during the continuance of the shaft inundation. The water rose and fell with the tide, but the entire tidal rise was not obtained, the rise in the shaft being only about one-half that in the river. From the continuance of these conditions and also from the flow obtained through small pipes in the Bronx bulkhead, it was apparent that the flow had not choked itself as had been hoped. It was decided to grout from the Bronx end into the water-filled chamber between the Astoria and Bronx bulkheads, with the object of filling this with cement to permit the unwatering of the tunnel from the Astoria end. At the same time diamond-drill borings were driven from the Bronx bulkhead, the purpose of which was to intercept the fissure at a point beyond its opening into the tunnel, and through this to inject cement, in an effort to seal the source of flow beyond the tunnel. The first drill hole was intended to tap the fissure at a point 5 ft. below and 5 ft. beyond the point of flow into the tunnel. This hole measured 120 ft. from the bulkhead face to the point. The accuracy of both the location and pointing of this hole was conclusively proved by the injection of 870 bags of cement and by the conditions disclosed when driving through this section in February, 1914. The grout in this instance was evidently well directed into the fissure, but naturally could go no further than the débris in the fissure would permit.

Grouting through a diamond-drill tube into the heading space began at 3 p. m. Nov. 10, and continued without interruption until 4 p. m. Nov. 12, during which time 8850 bags of cement were injected at a pressure of 400 lb. per square inch. The grouting was discontinued on the appearance of cement in the seepage around the Bronx bulkhead door.

From the action of the water in the Astoria shaft, it was quite evident that this grouting had been effective in sealing to a large degree the direct passage between the tunnel and the river, but had not entirely sealed the leak through the Astoria bulkhead, as the draining of water through numerous small pipes in the Bronx bulkhead lowered the water in the Astoria shaft 17 ft. The reduction of head thus caused on the water in the tunnel resulted in an unbalanced pressure on the freshly injected grout in the fissure, so that when an absolute pressure of the 11 lb. existed on the fresh grout, the grout gave way, causing water from the fissures to flow into the tunnel again and the water in the shaft to rise. Consequently on Nov. 14 and 15 2699 additional bags of cement were injected into the heading space, when the pressure gage on a pipe extending through the bulkhead began to jump in excess of the hydrostatic pressure and grout began to appear through the bulkhead pipes. Again on Nov. 17 an additional 164 bags were injected through this tube, making a total of 11,342 bags of cement.

Meanwhile the diamond-drill borings had been continued, and although water and greensand were encountered, only a small quantity of cement could be injected. It was evident on removing this piece of bench that the fissure in question was pierced only by the first drill hole. On opening various pipes in the Bronx bulkhead it was found that they gave water without pressure, and therefore it was considered safe to begin the unwatering of the tunnel from the Astoria end.

UNWATERING WITH AIR LIFT

Existing in the Astoria shaft prior to the flooding were an 18-in. ventilator pipe and three 8-in. discharge lines. These four pipes were converted into a pneumatic water-lift system by placing a 3-in. air pipe inside the 18-in. ventilating pipe, extending to a depth of 240 ft. below mean sea level, and by placing a 2-in. air pipe inside each of the 8-in. lines to the same depth. The discharge ends of these air lines, for some 24 in. in length, were perforated with small holes drilled at an angle of 45 deg., so that the air discharge would point upward. These air lifts all discharged at the shaft surface. This emergency equipment was the only means used to lower the water 176 ft. from the top of the shaft, and proved both rapid and effective. The 18-in. and two of the 8-in. air lifts, which were operated continuously from 8 a. m. to 9 p. m. Nov. 24, discharged an average of 1349 gal. per minute.

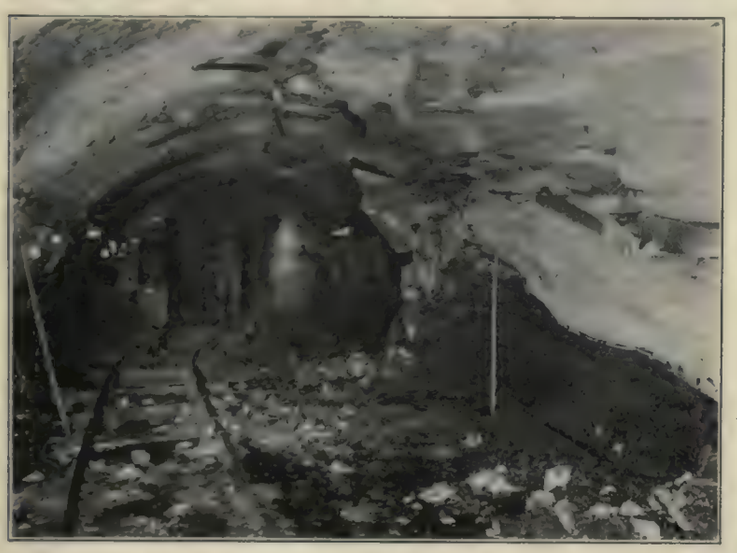
An emergency pumping plant had been secured and prepared for operation, consisting of two pumps with a combined capacity of 1800 gal. per minute on a steel pontoon floating in the shaft, and three 600-gal. pumps placed in the elevator wells after the water had been lowered by the air lift. These pumps were lowered from time to time as the water dropped until, at 10.40 a. m. Nov. 30, the original shaft pumps were started and the water quickly drained from the tunnel.

CONDITION OF UNWATERED TUNNEL

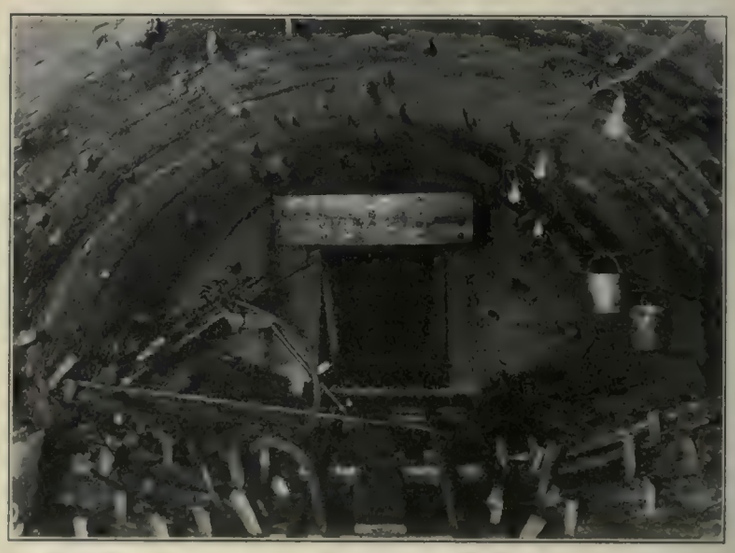
On the evening of Nov. 30, with the water 4½ ft. below the crown of the arch at the portal, two boats containing the tunnel engineers entered the tunnel and made a tour of inspection to the Astoria bulkhead. Comparatively little damage had been done by the flooding, although a considerable quantity of grout and sand had entered the tunnel through the door, which was not securely closed, and through the 8-in. drain which had been left open. A bank of grout 12 ft. thick at the bulkhead, sloping to 12 in. thick 500 ft. south of the bulkhead, was found. The surface of this bank was in a plastic condition for a depth of 6 in. None of the material was set up hard, the subsequent removal being performed with pick and shovel. From the 8-in. drain clear water at the rate of 900 gal. per minute was flowing, and from a 3-in. cable conduit bulkhead there was a stream of 100 gal. per minute, neither being under pressure.

The construction of an emergency bulkhead about 60 ft. from the closed bulkhead was immediately begun. Simultaneously with the construction of this bulkhead the cleaning of the tunnel proceeded.

The method of procedure adopted for completely sealing the water flow of Oct.



LEFT—HIGHLY STRATIFIED GROUT BEING REMOVED FROM HEADING SPACE BETWEEN BULKHEADS



RIGHT—INVERTED ARCH BUTTRESS—NOTE LARGE NUMBER OF HOLES FOR GROUTING BENCH

5 consisted in driving a series of long test holes in an effort to pierce the fissure well outside the tunnel lines. The first hole drilled encountered water at full pressure at the computed depth of about 22 ft. The shorter holes were drilled with percussion drills and the long ones with diamond drills through the side walls of the tunnel close to the bulkhead.

The observation of results obtained in grouting was accomplished by the attachment of pressure gages on both the Bronx and Astoria bulkheads, and by allowing the pipes in the Bronx end to remain closed. Grouting began Dec. 18, and was followed immediately by the appearance of grout in the Bronx pipes, thus indicating that the point of injection communicated with the water hole of Oct. 5 and that the latter was still unsealed. On Dec. 19, after the injection of 3360 bags of cement, the hole finally refused.

It was quite apparent that the recent grouting had been effective, but during the time necessary to allow this to set a thorough investigation of the underlying rock was made by drilling ten long diamond-drill holes. The result was that although the rock structure outside the tunnel lines was found to be extremely disintegrated no water was encountered. On Jan. 5, 1914, the work of removing the grout fill between the bulkheads was begun. A small drift was driven through the Astoria bulkhead, after which the door was raised and the removal of the grout fill resumed. This work proceeded with very light blasting toward the Bronx bulkhead door, which was raised Jan. 15, and preparations were made for resuming the bench excavation after a delay of 102 days caused by flooding the tunnel.

Unusual Stratification of Grout

In removing the grout fill it was found to be in an unusual condition of stratification. Some layers were extremely hard and others were equally soft. Some sections were highly stratified and others quite massive. Some layers and masses of what might be described as solidified "laitance" were found, which were as soft as chalk and had a curious chemical composition quite different from that of the original Portland cement. Layers of sand also extended through the mass, and in the vicinity of the water hole a 4-ft. blanket of coal, sand, shells, bits of wood, etc., was disclosed. No indications of water were apparent other than the usual normal seepage through the concrete lining.

Although the sum total of cement injected from both ends from the time of the flood to the completion of the grouting was only 595 cu. yd., about 1150 cu. yd. of solid grout was removed, in addition to 400 cu. yd. of débris, to say nothing of the quantity of cement grout which remained in and sealed the fissures themselves. The possible explanation of this is that in some manner the injected cement had mixed freely with very fine-grained decomposed dolomite, probably in suspension in the water, and that cement in the form of grout does not act as normal Portland cement does in maintaining a constant volume.

For removing the remaining stretch of bench a method of attack was devised which consisted of the construction of an inverted concrete arch over the remaining length of bench between bulkheads; an even more thorough exploration of the underlying rock with test holes as long as could be drilled; the injection of cement through these holes in an effort to solidify the rock mass, the inverted arch acting as a resistance to this grouting; the careful excavation of the exposed rock by very light blasting of small sections only, and the immediate concreting of the tunnel lining on completing a short length of full-section excavation.

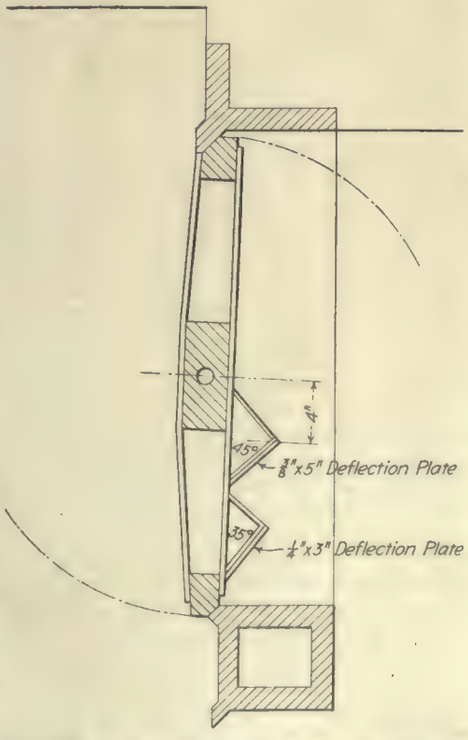
The inverted arch was 24 in. thick and 8½ ft. below the concrete tunnel arch on the center line. As this working space did not permit of drilling to the tunnel invert extrados, the exploration was accomplished by first testing to a depth of 5 or 6 ft. below the inverted arch. Drilling pits were then excavated and lined with concrete as an inverted arch well bonded into the tunnel arch and the inverted arch slab. The drilling was then continued from these pits, thus reaching well outside the necessary lines of excavation.

In removing this 122 ft. of bench, all the rock encountered was extremely wet, and although two flows of fair volume occurred, no unusual difficulties were experienced. On uncovering the water hole of Oct. 5 it was found to be a greensand seam, 24 in. wide and of unknown depth, filled with sand, coal, shells, etc., through which a 9-in. layer of hard grout extended. No water was flowing, nor was there any further trouble from this fissure.

Tests of Butterfly Valves Result in Modified Design

Report by Charles Keller Describes Experiments Made at U. S. Government Locks in Alabama —Deflection Plates to Be Added

AS A RESULT of experiments made on butterfly valves in the locks of the Black Warrior River in Alabama, the United States Government engineers have decided to modify the design of future valves and to add new deflection plates to all existing valves. Charles Keller, in the September-October *Professional Memoirs* of the Corps of Engineers, United States Army, describes these experiments and illustrates the results and the modifications mentioned.



SECTION THROUGH UPPER BANK VALVES AS ALTERED IN JUNE, 1912

Except two locks, which have cylindrical valves, all culverts on this Alabama waterway improvement are controlled by butterfly valves, either in pairs or in sets of three, operated by hand. Difficulty in operating three valves keyed to a single hand wheel led to the investigations. Two causes for this difficulty are apparent: Firstly, when two or more valves are operated simultaneously, water deflected from the first or upstream valve, when partly opened, comes into contact with and tends to close the second valve. The stream deflected from the latter offers a similar resistance to the opening of the valve next downstream. Secondly, the valve divides the stream moving into the valve opening, and the portion of the current downstream of the valve is deflected by the valve body. The eddy motion thus caused may produce a reverse pressure on the in-moving or downstream side of the back plate of the valve near the culvert floor, thus also tending to close the valve.

The retarding influence of one valve upon another has been overcome at some of the locks of 10 and 14-ft. lifts by installing steel partitions between the valve openings. At one lock with a 21-ft. lift reinforced-concrete partitions were provided during the construction.

In August, 1911, under the auspices of G. K. Little and H. C. Mower, assistant engineers, a series of tests were made to ascertain the effect of various arrangements of deflection plates applied to butterfly valves. As certain of these tests gave similar results, further tests were made in June, 1912, to permit a choice to be made between two arrangements of deflection surfaces. The head under which the latter tests were made averaged 6 ft.

Modifications Proposed

As a result of all of the tests it was decided to add to all butterfly valves then in service, in addition to the 3-in. deflection plates originally provided, a second plate 5 in. wide secured to the back of each valve, with a horizontal angle of 45 deg. between them, and with the outer edge 4 in. upstream from the center line of the back plate, as shown in the accompanying figure. The valves of lock 16 (21-ft. lift), which had not yet been built, were designed to embody the same arrangement for deflection surfaces. This additional deflection plate, combined with the partitions between valves previously described, has made it possible for one operator to open to normal position the three valves of any set simultaneously and under full heads up to 21 ft.

The preceding account is derived from the records of the United States engineer office at Mobile. The experiments described are those referred to by H. C. Mower in *Professional Memoirs No.* 33, in which a general description of this improvement will be found.

INTEREST IN HIGHWAY IMPROVEMENTS in Louisiana is best shown, says W. E. Atkinson, State highway engineer, by the large number of public meetings to which the Highway Department has been requested to send a representative to discuss some phase of road improvement. Eagerness for individual information is also pointed out by the great number of inquiries.

Awakening the Engineer to Service Through Civic Responsibility

F. H. Newell Discusses Lines of Effort for Improving the Condition of the Profession—Thousands of Unaffiliated Engineers

ADDRESSING the American Association of Engineers on Sept. 14, F. H. Newell, head of civil engineering department, University of Illinois, made a strong appeal for greater co-operation of engineers in efforts to improve legitimately the condition of the profession through the assumption of greater responsibilities and the performance of greater service to the community. The material welfare of engineers can be promoted through several lines of activity, which are outlined in detail. Following are notes of the principal points made and suggestive facts cited:

The Engineer Must Render Service

The quality which distinguishes the engineer as a professional man from his brother, the mechanic, is education. To be an engineer in the true sense one must have that education which enables him to understand the true perspective of things, to know the big from the little, to obtain facts and judge correctly from them. The education of the engineer, whether obtained through books or through things, has been largely at the expense of others—either society, the State or his more immediate employers. It is the recognition of duty to others which gives rise to the ethics of the engineering profession. The conception of engineering ethics is fundamental to the profession, and finds its highest expression in service—and service consists of those acts which tend to lessen trouble or increase the health, prosperity and convenience of others.

Engineers in performing service are by this very fact entitled to full recognition. Service implies a suitable reward, and while the effort may be altruistic, it does not involve unnecessary self-denial. A proper remuneration, one assuring a good living, is due the engineer. He who performs service rightfully does it with full expectation of reward, directly or indirectly, in the satisfaction of duty well done.

Conservation and Engineering Service

One of the more recent manifestations of this altruistic spirit has been in the so-called conservation movement — initiated largely by engineers—essentially an appeal to patriotism, characterized by love of mankind and having a deep religious significance. Other manifestations are in the rapidly increasing number of movements for civic betterment, for better farming, better schools and better homes made possible by the study of domestic economy. Among all the various occupations there is none which is more capable of leading in service to mankind and in realizing higher ideals than engineering.

The engineer should be a man of vision, a missionary of light and progress. His life is devoted to careful, impartial measurement and weighing of facts. He can not afford to be deceived or to mislead others on these facts; having ascertained them in their true proportion, it is then his business to idealize, to plan and to use his ingenuity in devising methods for adding to the comfort and convenience of mankind, such for example, as through better conditions of transportation, of communication, of heating, lighting, water supply and of the things which tend to produce better health and longer life in the community.

Engineer Ahead of Public

In this work, the engineer is far ahead of the public. The latter in many ways has not yet caught up with the growth of knowledge and does not appreciate the possibilities which are awaiting realization under the magic touch of the skilled engineer. Many a community is declining because it does not utilize the available water supply or have constructed the needed sewage system.

The public is not wholly to blame. The engineer is to a certain extent culpable. He has not fully felt the need of diffusion of information, except among his professional brothers. He has not taken the public into his confidence and explained in simple terms, in ways that would attract the public, the results already achieved, nor has he given these a setting or application such that the ordinary citizen and taxpayer can comprehend how this work affects him or how his condition may be improved.

Of 100,000 Engineers, 40,000 Are Members of Organizations

Without attempting to discriminate very nicely between the different classes of men who may be considered as engineers, it is safe to assume that there are in North America more than 100,000 men whom we would class as "engineers," outside of the purely mechanical occupations. Of these, more than 40,000 are members of approximately 100 organizations. The greater part of this number is included in four great National societies, the membership of which in round numbers is as follows:

American Society of Civil Engineers	7,700
American Society of Mechanical Engineers	6,100
American Institute of Mining Engineers	5,000
American Institute of Electrical Engineers	7,750
	26,550

The above total of 26,550 includes many duplications, particularly of names of the more prominent engineers. It is safe to assume, however, that there are at least 20,000 engineers, embracing most of the men who have become leaders in the profession, included in the membership above noted.

The organizations next in point of size are the Engineers' Society of Western Pennsylvania, with headquarters at Pittsburgh (1150 members), and the Western Society of Engineers, with office in Chicago (1200 members). Next comes the Associated Engineering Societies of St. Louis with 800. The hundred or more local engineering societies organized at the principal centers of population have a membership each of from 100 or less up to 500 or more, averaging about 200, so that their total membership averages about 20,000.

Yearly Influx and Overcrowding

To this large body of engineers there is being added each year about 5000 recruits, mainly from the engineering colleges, more or less well trained in the fundamentals of engineering. There was a time within recent years when there was demand for every one of these young men in active engineering work. At present, however, it is necessary that many of them go into other lines. It is not to be supposed that their education is by any means wasted, as the training of a good engineering college is probably the most valuable to be had in preparing young men for their life work in lines of trade and commerce.

One of the problems that are now confronting us is the fact that each year this large group of graduates, as well as the thousands of young men employed in engineering offices, is coming into a profession apparently overcrowded. This overcrowding, however, is more apparent than real. Relief is to be obtained not by limiting the influx of men, but rather by widening the field of service.

Unlimited Fields and Opportunities

The field is practically unlimited, the bounds extending with every improvement in the conditions favorable to human health, comfort and industry. If every taxpayer and voter in the country, every town, city, county and State officer was fully aware of the conditions which surround him, and the extent to which the engineer could remedy or improve these conditions, there would be an immediate demand for all engineers who could be found.

Take, for example, the matter of road building. The public has been slowly educated toward the need of good roads, but not so fully to the fact that to build these good roads a certain amount of skill and experience is needed. We have the spectacle, surprising in a country which prides itself on its good sense, of millions of dollars being spent on new roads and in improving old roads, often without any preliminary survey or study of correct location or preparation of plans and estimates, or of adequate supervision of the work, even if well planned.

Waste Should Be Avoided

The amount of money which is being wasted to-day in the amateur efforts of elected officers, who will be replaced next year by men no better qualified, would furnish employment to a great part of the engineers in the country. The point to be observed, however, is not that we are arguing for the employment of these men, but that the claim is based upon the far more substantial grounds of benefit to the public and to the man who pays the bill.

The opportunities are boundless—they stand on every hand ready for us when we awake. Listen! opportunity speaks:

"They do me wrong who say I come
no more
When once I knock and fail to find
you in,
For every day I stand outside your
door,
And bid you wake, and rise and
fight and win!"

Art of Salesmanship Needed

The engineer, to succeed, must acquire the art of salesmanship. He may not recognize or label the quality and may even deny its existence. He points to the code of ethics rigidly observed against advertising or self-exploitation, and yet while conscientiously observing all proper rules of

ethics, he may possess to a high degree the real art of presenting his wares in such a way as to convince the world that the general welfare is promoted by purchasing from him.

He has for sale, not boots and shoes, or legal opinions, but what is more difficult of delivery, ingenious but true ideals, imagination, trained by years of study and practice. He has acquired the power of making these "dreams come true." In proportion that the public or his employer recognizes these qualities, to that degree is he able to sell his wares.

There is perhaps nothing more instructive to the young engineer than to try to ascertain the methods of salesmanship which have led to the recognition of certain well known and respected engineers. Some have succeeded through or in spite of extreme modesty and a reticence which has been hard to break through; but in each case there has been not only true value of the goods to be delivered, but some quality of mind or action which has impressed upon others the fact that the goods are of superior value.

SUGGESTED LINES FOR ACTION

In the present awakening innumerable schemes have been suggested for action, but most of these fall under one or another of two principal lines: First, co-ordination and co-operation of existing engineering societies and organizations; second,, formation of one or more new associations devoted almost exclusively to the material welfare of the engineers. These movements are the natural outgrowth of the discussion and unrest which have prevailed. They are not antagonistic and may be mutually helpful. Not all men think alike and the path which will be attractive to one group is not to another.

Summing up the needs and opportunities, it appears that a great part of the main body of engineers is not fully employed to the best advantages to society and to themselves, with corresponding loss to all. Nearly two-thirds of those who may properly call themselves engineers, or perhaps 60,000 men, are not members of any well-recognized organization, and are not utilizing their potential strength to help themselves or each other. There is need of enlightenment, of raising ideals and of united effort toward better things. The existing engineering organizations, which include perhaps 40,000 men, are devoted almost exclusively to technical questions as distinct from those things which concern the engineer as an individual and a citizen.

Few of the older societies attempt to bring in the rank and file of the profession, or attempt to cover the field of the new American Association of Engineers, in its efforts to help and reach the masses of the profession. The program already laid out by this association is founded on the solid basis of proposing primarily to raise the standard of ethics of the engineering profession and to protect the economical and social affairs of engineers.

THE RESULTS OF GOOD ROAD DAYS in Pennsylvania, according to information received from W. R. D. Hall, statistician of the State Highway Department were as follows: Miles worked, 6008; men who gave their services, 82,393; teams employed, 14,858; drags used, 1859; and road machines in service, 83.

Time at Hand When the Engineering Society Should Awake to Its Deficiencies

Ernest McCullough States Before Western Society of Engineers That the Young Man Is Overlooked in Existing Technical Organizations

THAT THE TIME has come when the engineering society should pause and consider whether it is doing a necessary work was the contention of Ernest McCullough, consulting engineer, in a paper presented Sept. 21 before the Western Society of Engineers. While he conceded that the earlier societies performed a valued service in that they brought together men having similar interests where papers were read and discussed by the older men, he charged the technical societies with not having developed with the work of the engineer, and with still lingering in the past and considering themselves as institutions organized solely for educational purposes. "This is the way they are conducted," said Mr. McCullough, "but the majority of the members know that many societies exist rather as an evidence of the standing of the members than for their declared purpose. The modern technical journal is doing far more real educational work than any society, no matter how large or how important it may be. The pages of the weekly and monthly papers bring to us news from the front fresh and in a way which the more formal papers of a society cannot."

Mr. McCullough's remarks were in part as follows:

MUTUAL ADMIRATION SOCIETIES

"The young man feels he has not been paid the proper attention. There is a well-founded idea that engineering societies have for many years past been mutual admiration societies of successful men and used for the furthering of insidious advertising by men qualified to take full advantage of the position their membership brings them. The papers are generally obtained only by hard work on the part of the publication committee in each society. Many are hardly worth printing and would be rejected on merit by the average technical journal. The discussions are too frequently inadequate and real criticism is seldom developed when the author of the paper is of commanding eminence. Some men even use the society to which they belong for exploiting patented processes and materials. The young man learns something, but not much, from the papers, and feels diffident about discussing them, as he fears his opinion would not be well received. 'Get a reputation first,' is the attitude of too many authors when they write a closure to a discussion.

THE YOUNG MAN WANTS FELLOWSHIP

"The young man wants fellowship, companionship and definite recognition. He is glad to attend a meeting where he knows refreshments will be served, not because of the refreshments, but because something to eat and drink signifies a lack of formality and perhaps an opportunity to mingle freely with older men who have made their mark. He wants to make acquaintance with men having like interests with himself. He wants to feel that the society is more than an editorial body or compilation of engineering facts; that it is composed of flesh-and-blood men who want to help him because of their knowledge of the trials and tribulations he is undergoing. The older members have been over the ground and should help him. He would rather know how to obtain a position and how to hold it than hear how other men have done engineering work, for he reads the technical journals and gets a surfeit of such material.

WHY YOUNG MEN ORGANIZE SOCIETIES

"From time to time young men organize societies which are intended to help them meet their particular troubles. These societies generally start out with the idea that every educated man should be kept at work, and the employment question is uppermost. They are generally organized as a protest against commercial agencies which obtain positions for technical men and charge large fees for putting the 'jobless man in touch with the manless job.' It is known that in many large offices the chief draftsman is a stockholder in such agencies and many discharged draftsmen think they are but pawns of fate in the hands of men who profit by their frequent changes in position.

"This year two such societies have been organized in Chicago. One is known as the Associated Technical Men, the other as the American Association of Engineers. Judging from my own mail I have no doubt all members of the Western Society have been regularly receiving printed matter from these societies. The aims and objects of the Associated Technical Men being too long to present in this paper, only the objects of the American Association of Engineers will be presented, for the two societies seem to be working toward the same end.

AIMS OF A NEW ORGANIZATION

"The objects of the American Association of Engineers are to raise the standard of ethics of the engineering profession and to promote the economic and social welfare of engineers by affording means for the interchange of information; by maintaining a service clearing house; by affording patent and legal advice; by supervision of legislation; by proper publicity. Wherein do the objects of the association and of our own conflict? If there is no conflict, why is there such an association when there are several hundred technical societies already in operation in the United States?

"The answer is that the older societies are not attending to business. The work above outlined should be attended to by the veterans. 'Old men for counsel, young men for action,' should be the motto of the older societies. If this were the motto and lived up to properly the young men should obtain all the objects sought and the societies would grow faster than they are now growing. The members should receive the worth of their money; the older men in the feeling of satisfaction of following every worthy action, the young men in the experience of material benefit. In their turn the young members become old members and will pass the good work down to succeeding generations. Discussing the methods outlined by the American Associa-

tion of Engineers the older societies can honestly say only the first has been attempted by engineers.

ENGINEER A WANDERER FROM JOB TO JOB

"That the second has not been properly attempted is a reproach. The engineer is a wanderer from job to job. When capital is active he is hard to find. When dull times come and capital rests, the streets are full of technically trained men out of work. They wander from office to office, many of them starving and too proud to admit it, many never getting a substantial footing. Their work is concerned with new enterprises, and with the day laborer they share the ups and downs of fortune, helpless and frightened when they face the facts. One of the most bitter things is the inability to explain their plight to their parents and families, for the popular idea of the engineer is that he is highly paid and always busy. There is a place for all and it is the duty of the older engineers to take care of these their brothers.

"Every day that the Western Society and the other large societies delay in organizing a service whereby members out of employment can be placed in positions is an inexcusable reproach. The organization is here; it requires only the spirit.

"The third method, namely, the affording of patent and legal advice, needs to be approached with care. The society should have an attorney who can help members who have trouble in collecting pay; that is, members who fall into the hands of unscrupulous employers. There are many such.

LEGISLATION THAT MEANS PROTECTION

"The fourth method is concerned with legislation for technical men. Not only must the modern engineering society see that legislation is secured to protect and elevate the enginering profession, but it must also carefully look after proposed legislation to the end that no laws will get on the statute books which work harm to the people of the State. That is, as citizens we must protect fellow citizens whose lack of knowledge of technical affairs leaves them at the mercy of special interests.

"The fifth method is proper publicity. The societies heretofore have concerned themselves with the publicity work of individuals. What is now a crying need is publicity work of a proper sort by the societies for the benefit of the membership, and, incidentally, of the technically educated men not members of any societies. Through proper publicity work all technical men not members will want to become members, Incidentally, the work of technical men will be so placed before the public that there will be an increase of good material in the ranks. Proper publicity should have the effect of sifting out desirable men from those not so desirable.

"Permit me to quote from a circular issued by the American Association of Engineers under date of Aug. 1:

" 'This association will be devoted to the best interests of the AVERAGE engineer of good standing, NOT to elevate the ALREADY ELEVATED, but to bring up the standing of the Rank and File to that attained in other professions. We solicit the support of the Big Engineer and Employers of Engineers and aim to command their respect through the above methods, and in the course of a little time (within your lifetime) secure the same standing for the Commercial Engineering Profession as that enjoyed by the Legal, Medical and Military Professions—Material Compensation, Consideration and Self-Respect.

" 'Why is the average graduate in Civil, Mechanical Electrical, Chemical or one of the dozen other engineering branches after five or ten years of labor in his chosen field still treated with the consideration given to day laborers and no recognition given to his part in the big commercial achievement resulting directly through his efforts?

" 'It is because there is no organized effort to show these results, and they are being usurped by others. These men (you and I) are so concentrated on the technical points of our daily labor that we overlook the big fundamental law that "he who does not speak for himself will be cursed by small praise." We must have a *Speaking Trumpet* for the Commoner. We need at least 5000 of the 100,000 men who are doing engineering work before we can expect to gain recognition.

MATTER THAT IS NOT NICE READING

"Such printed matter distributed broadcast by young, energetic, well-educated men is a slap in the faces of the older men who attained standing in the days when competition was not so strong in technical work, and who fail to realize that the engineering graduate of to-day is up against it harder than were the men of the generation immediately preceding. This sort of printed matter is not nice reading, but it does represent the sentiments of thousands of young fellows who are earnest and are not yet anarchists or I. W. W. propagandists. It should waken all the older engineering societies so that improvements in conditions will come from the older men who have not forgotten the days of their own struggles. Let us help the men who want help before they have a grievance, for the nursing of a grievance, real or imaginary, is harmful to the souls of men.

"It is the duty of engineering societies to break away from precedent and get back to first principles. They must become again the places where the interests of the young men are the concern of the older men. They should not permit themselves to be classed as organizations for the elevation of the already elevated, but they should be *in loco parentis* to the rapidly increasing family of technical men. The work should not be done in a patronizing way, but should be regarded as something that should be done. It is not an opportunity which is faced by the Western Society. It is a duty.

" 'I hold every man a debtor to his profession, from which as men, of course, we seek to receive countenance and profit; so ought they of duty to endeavor themselves by way of amends to be a help and ornament thereof,' said Bacon. So as long as reproach can be brought that the societies do little more than print papers and discussions dealing with physical facts and neglect to consider men, the members are not ornaments to their profession. We must clear engineering of the charge that it is a most interesting profession but a mighty poor business."

Gravel Roads Treated with Calcium Chloride as Dust Cure

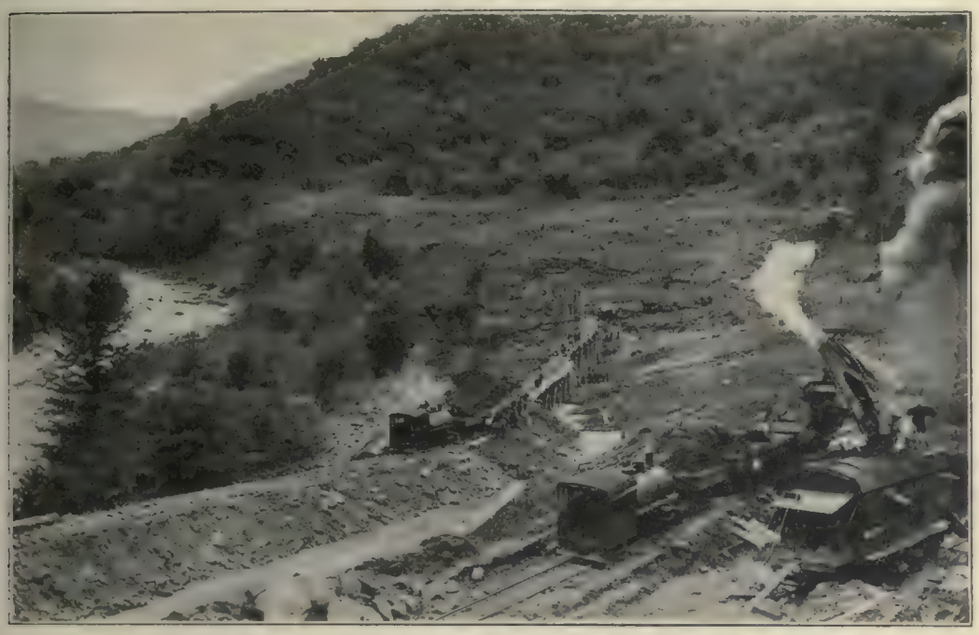
CALCIUM chloride as a dust preventative has recently been given demonstration on 25 miles of gravel roads in Grand Rapids and vicinity by the highway commissioners of Kent County, Michigan. The chemical was placed on the road by a distributing machine, a grain seeder, which dropped about 1½ lb. to the square yard. It was found to be preferable to apply the calcium chloride in the afternoon to avoid heavy traffic and secure quicker and deeper penetration due to the cool, moist air of the evening. In order to prevent the chloride from being carried off and scattered by traffic it was not applied until the roads had been sprinkled with water or after a rain. When this rule was followed it remained where it was placed and traffic packed it into the ground, instead of picking it up on the wheels. Where there was more than ¼ in. of dust on the road it was swept or cleaned off. The chemical used by Kent County comes in 350-lb. drums from the Semet-Solvay Company, Syracuse.



FILLING CALCIUM CHLORIDE DISTRIBUTING MACHINE



ONE APPLICATION DOES AWAY WITH MUCH SPRINKLING



MATERIAL FOR CANAL EMBANKMENT EMPTIED FROM CARS ON TRESTLE

New Plant Marks Further Step in Development of Deerfield River, Massachusetts

Construction Costing Nearly $1,500,000 Completes Another Link in the Development of This River—Part II, Construction

TO THE construction department of the Power Construction Company fell the difficult task of carrying out the work, and this the department was asked to do in the short period of eight months. By conservative estimate this $1,500,000 job would ordinarily have taken two years to complete, yet the work was completed and the plant in operation within twenty days of the scheduled eight months. Moreover, the work was greatly handicapped by a heavy fall of snow and zero weather from the last half of November.

The work was located in as rough a territory as can be found in New England. It extended from Monroe Bridge village for about three miles downstream toward the town of Hoosac Tunnel, which in turn was three miles from the lower end of the work. At Monroe Bridge are located a paper mill and about a dozen dwellings. At Hoosac Tunnel are about the same number of dwellings. The first problem, therefore, was to build a camp and furnish a railroad connection for getting in equipment and materials. A camp site was chosen midway of the work and a large gang of carpenters set at work erecting buildings, the material being drawn in by teams.

It was at first planned to connect the only suitable site for railroad yards, shops and camp with the Hoosac Tunnel & Wilmington Railroad on the opposite side of the Deerfield Valley. The railroad was here some 50 ft., and the camp some 60 ft. above the river. This crossing was a matter involving a long-span bridge and trestles, requiring no small time and expense. Permission to connect with the railroad at this point was at first refused, and, not daring to delay, the company immediately started construction on a standard-gage supply road of its own from a siding it had previously constructed on the main line of the Boston & Maine Railroad at Hoosac Tunnel.

SUPPLY RAILROAD

The valley is very narrow, with very steep rugged slopes on either side, and this, together with the fact that a railroad on one side of the river and a highway on the other already occupied the more desirable locations, made the construction rather difficult. There was much sidehill rock cut and trestle work. Even by using the maximum possible grades, the track was 60 ft. in elevation below the site of the conduit bench at the lower end of the work. As the first use of the road was to get in two steam shovels, a switchback was used to place the shovels on the conduit bench. The work on the railroad started April 27, and shovel 3 arrived at the surge tank June 9. Shovel 4 was moved in July 5. Meantime two steam shovels, dinkies, dump cars and other equipment were moved to the upper end of the work over the 110-ft. span steel highway bridge at Monroe Bridge, and the first shovel work was done on May 19.

To get supplies to the camp site and to the upper shovels in the shortest possible time a temporary standard-gage track followed shovel 3 along the conduit bench and up the line of the proposed canal. Thus the switchback line was used for getting in supplies until Aug. 9, when a lower level railroad was put into service. Then the temporary line along the conduit bench was used for the concrete mixing plant for building the conduit.

Although the supply railroad was only about 5 miles long from the camp to the Boston & Maine Railroad tracks as finally located, a total length of about 7 miles was built because of the necessary temporary locations along the job.

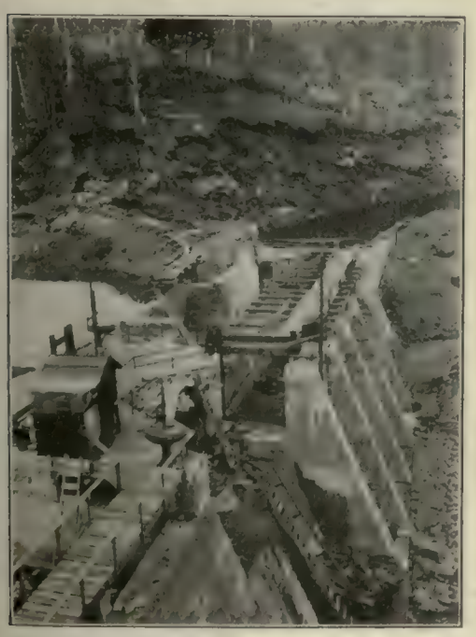
For facilitating the construction work this railroad proved to be of very material value and was considered to have justified its cost. The time of moving supplies to the job from the yard of the through Boston & Maine line was governed by the company rather than by a third road. The standard-gage track two-thirds the length of the work placed practically all the material at its destination with the minimum of handling, with a spur from the railroad across the valley to the camp only narrow-gage tracks would have been built from this point. The standard-gage equipment which could be used on much of the work was a material advantage. In addition to these advantages, the saving in freight charges amounted to a large sum.

POWER LINE ALONG LENGTH OF JOB

One of the first moves when work started was to run a 2300-volt line the length of the job from plant 5. This furnished much of the power without the necessity of getting in large quantities of supplies for generating it.

The maximum force employed was about 1200. It is thought the attractive living conditions in the camp was a help in maintaining a plentiful supply of good labor throughout the job.

Up to Nov. 20 an exceptionally dry fall greatly aided the work and allowed the sidehill conduit work to be rushed to completion without a setback, whereas had heavy fall rains occurred at certain times the



DUNBAR BROOK STRUCTURE



PENSTOCKS ANCHORED IN CONCRETE

consequences might have been serious. From Nov. 20 to the completion of the work severe winter conditions existed, and the company was playing against heavy odds.

Considerable labor and material was saved by receiving the conduit hoop reinforcement in exact required length, bending to shape in a power bender and electrically butt-welding the ends. So far as known this is the first time this method of welding reinforcement in the field instead of lapping it has been used. It is interesting to note that by this method about



INTAKE AT MONROE BRIDGE

2½ ft. of steel was saved on each hoop, of which there were 10,000.

QUANTITIES INVOLVED

As an indication of the amount of work involved, the following quantities of the more important items are given: 750,000 cu. yd. of excavation, which included an excessive percentage of boulders requiring drilling and blasting; 24,000 cu. yd. of ledge rock excavation and 6000 cu. yd. of tunnel rock excavation, 620,000 cu. yd. of canal embankment and backfill, 23,700 cu. yd. of concrete, 1,260,000 lb. of reinforcing steel and the installation of three 7-ft. penstocks, 550 ft. long and three turbines.

All of the work except the placing and connecting up of the penstocks and turbines was done by the Power Construction Company under the direction of George W. Bunnel, president, assisted by those named last week in Part I.

Reclamation Service Opens Library on Its Projects

A LIBRARY of more than 500 volumes of histories, specifications, engineering investigations and cost data of the various reclamation projects under construction and being operated by the U. S. Reclamation Service has been assembled in the engineering section of the Washington (D. C.) office of the service. Many of the volumes are in manuscript and quite a few are illustrated with photographs. The library is unique in that in it may be found descriptions of the plans leading up to works, the actual construction, the cost of works and the settlement of project lands and operation. As far as possible the volumes are arranged alphabetically by State, and then by project.

Literature

For the Civil Engineer and Contractor

New Publications

AMERICAN ROAD BUILDERS' ASSOCIATION, proceedings of the Eleventh Annual Convention. Paper, 391 pages. Published by the association, 150 Nassau Street, New York City.

OFFICIAL HANDBOOK OF THE PANAMA CANAL, 1915. Paper, 58 pages and map. Washington, Government Printing Office.

Gives much valuable information as to the operation of the canal, together with a brief review of the principal construction features.

RESULTS OF EXPERIMENTS ON SEWER PIPE AND DRAIN TILE. By E. H. Beckstrand, professor of mechanical engineering, University of Utah. Bulletin 7, Utah Engineering Experiment Station. Paper; 6 x 9 in.; 52 pages; illustrated. Salt Lake City, State School of Mines, University of Utah.

DEPARTMENT OF CITY TRANSIT, PHILADELPHIA. Annual report for year ending Dec. 31, 1914. Cloth, 322 pages; 91 maps; tables. Issued by the City of Philadelphia.

Two appendices are of particular interest, one giving condensed plans and profiles of the proposed subway and elevated lines, and the other describing the extensive traffic investigation made by the department prior to laying out the new lines.

GUIDEBOOK OF THE WESTERN UNITED STATES—PART D. The Shasta Route and Coast Line. By J. S. Diller and others. Bulletin 614, U. S. Geological Survey. Paper, 6 x 9 in.; 142 pages; illustrated. Washington, Superintendent of Documents.

This is Part D of the excellent popular guidebook issued by the U. S. Government and reviewed in the Engineering Record of July 17, page 85. It describes the Shasta and Western Coast line route (of the Southern Pacific Railroad) from Seattle to Los Angeles.

VALUE OF THE HIGH-PRESSURE STEAM TEST OF PORTLAND CEMENTS. By B. J. Wig, engineer physicist, and H. A. Davis, assistant engineer physicist, Bureau of Standards. Technologic Paper No. 47. Paper; 7 x 10 in.; 34 pages, illustrated. Washington, D. C., Government Printing Office.

Discusses the problem of an accelerated test for unsoundness of Portland cement and the various steam or autoclave tests proposed. The conclusions were printed in the Engineering Record of May 22, page 655.

STRUCTURAL STEEL HANDBOOK. Cloth, 7 x 9 in.; 319 pages; illustrated. London, R. A. Skelton & Company's Handbook No. 16, $2.50 net. (75 cents to professional men under special conditions.)

Tables and notes containing much valuable information concerning English rolled sections. The general arrangement and the use of a thumb index greatly facilitates rapid and easy reference. In addition to the catalog of sections, new and useful notes, formulas, tables, diagrams, etc., are included, which are asserted to be authoritative and accurate.

CONFERENCE OF BUILDING INSPECTORS AND BUILDING COMMISSIONS OF THE UNITED STATES AND CANADA.—Reported by J. G. Needham, official stenographer. Paper, 8 x 10½ in.; 115 pages; 7 plates. Brooklyn, N. Y., J. G. Needham, 1973 East Fourteenth Street. $4 per single copy, $3 each for five or more, $2.50 each for ten or more.

Record of the first Building Inspectors' Conference held in New York City May 14, as reported by the official stenographer and edited by those who took part in the discussion. Floor loads, hollow tile for walls, automatic sprinklers, inclosure of stairways and methods for the building official are discussed.

EFFECTIVE BUSINESS LETTERS. By Edward Hall Gardner, assistant professor of English, University of Wisconsin. Cloth, 5½ x 7½ in.; 376 pages. New York, The Ronald Press Company. $2.

Engineers in executive positions will be particularly interested in this book, which contains in systematic form the principles involved in the best modern business letters. The following specific types of letters, which are discussed in detail, should prove of special value: Sales letters, adjustment letters, letters asking information, letters applying for positions and letters of recommendation.

TECHNOLOGIC PAPERS OF THE BUREAU OF STANDARDS. S. W. Stratton, Director. Paper; 7 x 10 in. Washington, D. C., Government Printing Office.

No. 44—INVESTIGATION OF THE DURABILITY OF CEMENT DRAIN TILE IN ALKALI SOILS. By R. J. Wig, engineer physicist, and G. M. Williams, assistant engineer physicist, in co-operation with others. Contains results of first year's tests. 56 pages, illustrated.

No. 48—AN AIR ANALYZER FOR DETERMINING THE FINENESS OF CEMENT. By J. C. Pearson, assistant physicist, and W. H. Sligh, aid. 74 pages, illustrated.

WATER POWERS OF CANADA. Paper, 6½ x 9½ in. Ottawa, Canada, Dominion Water Power Branch, Department of the Interior.

THE MARITIME PROVINCES. By K. H. Smith, resident engineer. 34 pages, illustrated.

THE PROVINCE OF QUEBEC. By F. T. Kaelin, assistant engineer. 35 pages, illustrated.

THE PRAIRIE PROVINCES. By Percival M. Mitchell, consulting engineer, 78 pages, illustrated.

THE PROVINCES OF ONTARIO. By H. G. Acres, hydraulic engineer, 41 pages, illustrated.

THE PROVINCES OF BRITISH COLUMBIA. By G. R. G. Conway, consulting engineer. 167 pages, illustrated.

The above set of five pamphlets has been prepared under the direction of J. B. Challies, superintendent of the Dominion Water Power Branch of the Department of the Interior, Canada, for distribution at the Panama-Pacific Exposition in connection with the Canadian water-power exhibit there installed. They are fully illustrated by excellent maps and photographs and describe the general hydroelectric and power situation in the various Provinces of Canada at the present time.

Books Reviewed

A City Manager

Author, H. A. Toulmin, Jr. Cloth, 5 x 8 in., 310 pages. New York, D. Appleton & Company. $1.50 net.

This book, beginning with an historical review of the city government in the United States, and a brief statement of conditions abroad, endeavors to show the position of the city-manager and commission form of municipal government in its proper place in the progress being made by municipal administration. The book, quite naturally, says little about results. It is too early yet to say the final word as to the success of the plan. Mr. Toulmin, a resident of Dayton, has made it—correctly so, this journal believes—a review of such meager results, from a year or two of operation, as are now available. Certainly all indications are that the plan will prove successful.

The book will prove of value to those who wish to know the details of organization under the city-manager plan. Each department is taken up in detail, and variations in the different cities which have adopted the scheme are pointed out. Arguments are given at length for and against the plan, the author drawing from many sources. An appendix contains a report on city government by commission made by the National Municipal League.

Practical Track Work

Author, Kenneth L. Van Auken. Cloth, 5½ x 8 in.; 216 pages; illustrated. Chicago, Railway Educational Press, Inc. $1.50.

This book does not pretend to be an engineering work, nor does it cover the general phases of maintenance of way. It is a nontechnical presentation of the problems of the track foreman and supervisor in the laying of tracks and switches, written largely from the author's own experience as track laborer and foreman. At the same time the author expresses the belief that the book will be useful to the young engineer in charge of track work, and the reviewer fully agrees with this opinion.

The author starts at the logical beginning—labor and organization—and the chapter on that subject embraces wages, housing, instruction, agencies and other phases of the problem. Then follows a chapter on material and tools, in which the author lays great stress on the importance of having good tools in good condition, and of handling material in such a way that economy in one operation is not offset by added expense in

another. The next four chapters deal with tracklaying, and two more chapters follow on switches. A final chapter treats of surfacing new track. In these latter chapters alternative methods of doing the same thing are presented and compared, and the organization of forces for the different operations is discussed in detail. Considerable space is also devoted to various machinery for this sort of work.

An appendix contains an outline of a method of laying out curves with a 50-ft. tape, a 36-page glossary of terms, and twenty-two tables—not the familiar trigonometric and logarithmic tables, but simple tables of middle ordinates, switch data, superelevation on curves, and quantities of ties, bolts, spikes and the like in given amounts of track.

The book is written in simple English, with good clear type and plain illustrations, and is a useful addition to the none too abundant supply of American literature on track.

Manual of Surveying for Field and Office

Author, Raymond E. Davis, instructor in civil engineering, University of Illinois. Leather, 7 x 4 in., 395 pages, 54 illustrations. New York, McGraw-Hill Book Company, Inc. $2.50.

Reviewed by F. N. Menefee

Assistant Professor of Engineering Mechanics, University of Michigan, Ann Arbor, Mich.

Due to the nature and age of the subject very little actually new matter can be expected in a manual of surveying intended for students just entering a course. But without detracting from the service rendered the profession by books used in the past, improvement can almost always be looked for, in the matter of convenience, arrangement and general presentation. In looking over Mr. Davis' "Manual of Surveying for Field and Office," one is struck with the idea that he has kept a practical point of view in mind and has succeeded in working out a systematic method of presentation which will prove attractive and useful.

In each problem the object and procedure are clearly stated under separate heads and brought into the foreground with heavy type. These heads are followed by equally clear "Hints and Precautions" and "Practical Applications." The hints and precautions should keep the inexperienced from the usual run of mistakes and the practical applications will arouse the interest of that class of students who are prone to read parts of their texts superficially unless they know of the good use to which they may put the given problem.

The topics included are very complete; the figures easily understood and the cuts well chosen. Samples of notes are plentiful and large enough to be easily studied. The field work is closely co-ordinated with that of the office. The matter of clearly defining such terms as declination, azimuth, traverse, etc., has been overlooked and may invite criticism.

There are three pages well devoted to the relation between angles and distances and the precision necessary in reading angles corresponding to a required precision in distances. The text is followed by the usual tables. The index is complete and titled after the fashion of dictionaries, suggesting at a glance the contents of the pages.

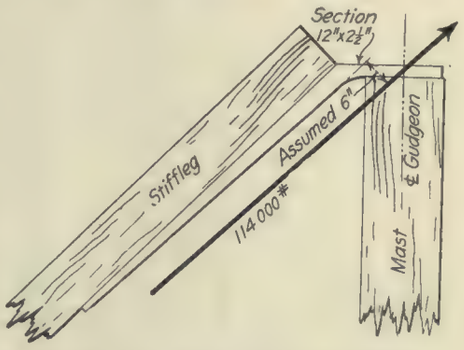
Letters to the Editor

Comment on matters of interest to engineers and contractors will be welcomed

Strength of Gooseneck That Failed on Chicago Derrick

SIR: In your issue of Sept. 4, page 306, there is a description of the failure of a gooseneck in a derrick which was lifting a load of 21½ tons. It seems to me that an explanation of this accident is to be found in the common way in which goosenecks are designed, with reference to calculating the bending moment at the bend. Assuming a 50-ft. mast, a stiffleg at 45 deg., and the 118-ft. boom at 45 deg. in the plane of the stiffleg, the tension on the stiffleg when the boom was supporting 21½ tons appears to be about 114,000 lb.

This stress, however, acts on the gooseneck with a lever arm of at least 6 in., as



GOOSENECK UNDER BENDING STRESS

shown in the accompanying sketch. This produces in the bend of the gooseneck a bending moment of 684,000 in.-lb. In the 12 x 2½-in. gooseneck this moment would produce an extreme fiber stress of 54,700 lb. per square inch. If the gooseneck were a tight fit on the gudgeon pin the latter might help it out by taking a part of the moment, but this would be a precarious thing to depend upon. Attention is called to it only as a possible explanation of why the gooseneck did not fail sooner. Excellent quality in the steel would not save for very long a piece of equipment subject to stresses like this.

The fact that the same derrick had lifted a load of 37 tons previously might be explained by supposing that the boom was at a higher angle, thus diminishing the stress in the stiffleg, or by supposing that the boom was not in the plane of either stiffleg, so that the stress was divided. Some things about the strength of equipment used for handling loads need closer analytic scrutiny than they are receiving.

EDWARD GODFREY.

Pittsburgh.

Dr. Imhoff Leaves German Trenches to Design Sewer Systems

SIR: We received on Sept. 3 a letter from Dr. Karl Imhoff, and knowing that many of your readers will be glad to hear from him I send you the following item:

Since last October his regiment has been in the trenches in western France. They were so well entrenched that there had been but little effective fighting and hardly any losses. Imhoff has devoted himself for eight months almost exclusively to military studies and training, and is in the best of health and sends kindest greetings to his American friends.

During this summer Germany has given her soldier officers on the western front liberal vacations. Dr. Imhoff was going off on leave of absence for six weeks. During this time he expected to complete his designs for the sewerage system of the Wupper district, including Elberfeld and Barmen, which he left unfinished when the war broke out. He is now about to return to his regiment.

From other sources I learn that the German Government has been building a large number of Imhoff tanks as a part of its general work of sanitation in the cities of Belgium and northern France occupied by the German army.

RUDOLPH HERING,
Consulting Engineer.

New York City.

Experiments to Determine Stresses in Parts of Rope Falls

SIR: I read with much interest the article on page 78 of the Engineering Record of July 17, by A. S. Beale, describing the lowering of a 79-ton derrick car from an elevated structure by its own power.

In analyzing the stress in the rigging used, Mr. Beale considers the load distribution among the various parts of the tackle due to the friction of sheaves and binding of the cable. He says, "The amount of increased stress in the standing part over that in the lead line was a matter of estimate, since up to the present nothing on the subject has been published." Not long ago we had occasion to calculate stresses in a somewhat similar tackle and found a formula taken from Weisbach's "Mechanics of Hoisting Machinery" that gives the efficiency of both fixed and moving pulleys. The efficiency of a fixed pulley is

$$\frac{1}{K} = \frac{1}{1 + C\,\frac{d^2}{r} + 2s\,\frac{P}{r}\,\sin L}$$

in which d = diameter of rope; r, effective radius from center of sheave to center of rope; P, radius of sheave pin; $2L$, arc of contact of rope on sheave; s, coefficient of friction (0.08); C, empirical constant.

The efficiency of a pulley moving up with a load is $(1+K)/2K$, and the efficiency of a pulley lowering the load is $2/(1+K)$.

For the value C in our problem we used $C = 1.8$, which is a value determined from experiments by the American Bridge Company, using ¾-in. wire rope. These experiments are described in the "Transactions" of the American Society of Civil Engineers of 1903, volume 71, page 161, and also in the Engineering Record of 1903, volume 48, page 307. The American Civil Engineer's Pocket Book also has a similar formula, and extracts from the American Bridge Company's experiments, on page 1225.

These experiments showed results that agree closely with the values calculated by

the Weisbach formula. They determined a number of values for the constant C, depending on the size and material of the cable or rope used. However, only one value of C for wire rope, that for the ¾-in. size, was determined. It would seem that further experiments to determine the relation between the size of rope and the value of C would be of much value to the profession.

C. S. ADAMS.

Douglas, Ariz.

Sloping Versus Curved Crowns for Highways

SIR: Mr. Farley's letter on "Sloping Versus Curved Crowns for Highways" in your issue of Aug. 7, page 174, I have read with interest. I agree with him in favor of the sloping crown.

A month ago I took an auto trip to Lake Erie over the Ohio roads from here to Warren, Ohio, and from there to Geneva. Some of the "dirt" roads in this section have such excessive curved crowns that it was all I could do to keep my car from going into the ditch when turning off the middle of the road to let another car pass. And the road was not wet. Of course, some will say that this would happen on a sloping as well as on a curved road, but I claim it would not near as much. There is also the advantage, as stated by Mr. Farley, in the sloped road in being able to use the road grader or drag, finishing at one operation.

I am very much opposed to a high crown, the disadvantages being as above stated. The crown should be just enough to let the water run off—about ¼ in. fall per foot on a paved surface and ½ in. on a dirt surface.

In connection with this, it might be well to say that many of our dirt roads could be kept in good condition by using a log drag just after a rain. Instead of doing this, some simple-minded supervisor on a road which I passed over this summer had thrown the dirt and grass from the ditches into the ruts. Surely, the fools are not all dead yet!

The above is about on a par with the State Highway Department of our State a few years ago (in 1912, for example), who built "waterbound macadam" on our Alleghany Mountain highways. I must say to the credit of the present administration, however, that I do not believe they are doing that now. The above highway, of course, at the first heavy rain, washed out; "and the end of it was worse than the beginning."

A. E. DUCKHAM,
Consulting Engineer.

Pittsburgh.

Curved Overhang Suggested for Galveston Sea-Wall

SIR: I have read the editorial and two articles on the Galveston storm in the Engineering Record of Aug. 28.

Your remark, on page 247, that "there is an opportunity for profitable study in what might be termed a secondary line of defense along the waterfront, some provision for holding back water blown inland from the sea-wall" is correctly suggested, but would it not be in order to prevent the heaviest of the water blown in from falling on the city side of the wall? I know of sea-walls that materially reduce this trouble, and it can be minimized, though not altogether averted under such extraordinary conditions as those at Galveston, by carrying the wall (see profile, page 274) about 4 ft. higher, vertically, on the back, but on the front (sea side) commence a curve at the existing top and curve outward in a uniform circular arc, until, at the 4-ft. superelevation, it has a 1½-ft. overhang from the existing face. This would make the width of the parapet on top $5 + 1\frac{1}{2} = 6\frac{1}{2}$ ft. This parapet should be made in one solid monolith, securely anchored to the top of the existing wall, for the overturning force will be tremendous. This will throw the wave mass *outward*, and while some of it will be blown inside the back of the wall, it will be mostly spray. The curve now in front is exactly adapted to cause the damage that occurred.

The most important work now needed to be done is to raise the channel, or port, side of the city about 10 ft. to get it above, not the tidal wave, but the bay wave, when the wind, as it generally does, whips into the north and drives the waters piled up in the bay (which has an area of 271 sq. mi.) against the "waterfront," not "sea front," while the great gulf swell is still coming in against this wave from the bay. This work was proposed, I understand, at the time the sea-wall was built, but evidently the great cost of raising the whole waterfront of the city staggered the financial source, and it was left to good luck to save the city from inundation from that side.

As to the sea-wall it is a splendid engineering and constructive work. I do not criticize it. It has proved itself adequate to withstand the shock of a hurricane which struck it fair and square. My suggestion looks to mitigation of the disaster along the boulevard back of it, and to do on the waterfront, by a wall or ramp, what was originally intended.

E. L. CORTHELL,
Consulting Engineer.

North Egremont, Mass.

New Concrete Elevator at Galveston Withstood Hurricane

SIR: We are sending you a photograph that may possibly be of interest—a large concrete grain elevator completed at Galveston, Tex., in June of this year, and erected by the Southern Pacific to replace a wooden elevator that was burned late in 1914. The builders were James Stewart & Company. Although it was feared that tall buildings would be demolished during the recent Galveston hurricane, we learn that this building came through the storm in fine shape with no injury except that the window glass was smashed by flying débris.



THIS NEW ELEVATOR AT GALVESTON WITHSTOOD THE RECENT STORM

The basement was flooded with sea water, but this seems to have done no harm. Naturally we are pleased that this happens to be an Alpha cement structure.

S. ROLAND HALL,
Advertising Manager, Alpha Portland Cement Company.

Easton, Pa.

TIMBER LANDS IN THE CHUGACH NATIONAL FOREST IN ALASKA, amounting to 5,802,000 acres, or about half the total area of the tract, have been returned to the public domain by a proclamation recently signed by President Wilson. The timber effected is located in three large tracts: one along the entire southerly slope of the Chugach Mountains, the second lying northeast of Seward, between Resurrection Bay and Kings Bay, and the third, northwest of the Kenai Mountains in the region around Tustamena and Skilak Lakes. These areas, which are to be crossed by the Government railroad, do not include the better grade of timber. The Alaskan Engineering Commission has been authorized to cut 85,000,000 ft. b.m. of timber for use in constructing the Government railroad.

HINTS FOR THE CONTRACTOR

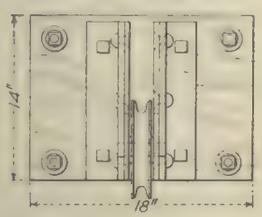
Details Which Save Time and Labor on Construction Work

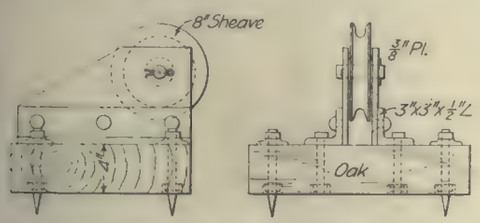
Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

[*Contributions to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

Device Helps Auto Truck Remove Chutes Through Street Decking

A SHEAVE mounted on a 4-in. plank in the corners of which are four spikes to keep it from sliding has been rigged to save labor in removing vertical chutes hung from the street decking on the 138th Street-Southern Boulevard section of the east branch of the new Bronx subway in New York City. These





SPIKES PREVENT SLIDING

chutes, which are made of 5-ft., telescoping, circular sections, were formerly pulled up with much heaving and strong language by a full crew of laborers hauling on a rope attached to the bottom section of spout. The chutes nest about one foot, which makes them stiff enough to come up as a column, the sections being detached at the top as they come above the decking. A foreman got the idea of hitching the rope onto one of the auto trucks instead of pulling the chutes out by hand, and tried it with success. H. R. Shailer, general superintendent of the Richard Carvel Company, Inc., the contractors, witnessing the destruction of good manila rope caused by this practice of using the rough edge of the hole in the decking as a sheave, had this simple device built.

In operation the block carrying the sheave is set on the decking at the hole through which the chutes are to be raised. A ¾-in. manila rope is dropped down the hole, tied around the bottom of the chutes, laid over the sheave and the upper end tied to an auto truck. As the truck takes a strain the spikes in the device bite into the wood decking and prevent its slipping. As the truck moves the chutes rise up out of the hole, guided by two men, who keep them from fouling and detach the sections as they come up. The device is said to work very well, and much time has been saved by this method in moving these drop chutes from place to place.

Oiled Roads Quickly Sanded by Whirling Disk on Motor Truck

BY attaching to the rear of a motor truck a hopper which feeds onto a circular plate rotated by bevel gears and a chain and sprocket drive from the rear axle of the machine, the cost of spreading sand on freshly oiled roads has been reduced at Victoria, B. C. The accompanying photographs, received from Charles H. Rust, city engineer, show how the device is operated. Shovelers stationed in the body of the truck keep the hopper filled with sand and the rate of flow may be controlled at the bottom opening by a sliding plate.

The wrought-iron whirling plate is 30 in. in diameter and is divided into four sectors by angle-iron plates forming vertical, radial ridges which, as the plate revolves, act in the same way as the vanes of a centrifugal pump and cast the sand outward upon the road surface in the form of an evenly distributed shower. The sprinkler will spread sand over a 10-ft. width of roadway. When the truck travels at the rate of 3 miles per hour the disk rotates at a speed of 285 r.p.m.

Buggy Bodies Mounted on Truck Fill the Bill as Concrete Car

By F. C. JEWETT

Superintendent, Quinlan & Robertson, Ltd., Campbellford, Ont.

A SIDE-DUMPING concrete car of requisite capacity which would pass clearance limits that were too narrow for an ordinary concrete car of the same capacity is shown in the accompanying photograph. This home-made car was used in concreting a 100-ft. gap left in a retaining wall along the Trent River at Campbellford, Ont. Part of the contract on this section of the Trent canal consisted of building a concrete wall on each side of the Trent River, which is here used as the canal. Near the south end of the town the river is crossed by a bridge belonging to the Grand Trunk Railway. The approach on the east side of this bridge is an earth fill about 35 ft. high, the top of which is approximately 10 ft. higher than the top of the wall.

The walls were first completed, leaving out a short section of the east wall about 100 ft. long through this embankment. Last February three rows of piles were driven on each side of the location of the wall in the embankment by a track pile-





SAND SPRINKLER, RUN BY THE MOTOR OF THE TRUCK, SPREADS AN EVEN LAYER OF SAND AT LOW COST ON REPAIR WORK



CLOSE-QUARTERS DUMP CAR MADE ON THE JOB FROM BUGGIES AND TRUCK

driver. These were capped and decked to carry the railway of track while the section of the wall was being finished. The excavation for the wall between these bents was then made, using heavy cross-braces. On account of the cold winter weather the sides of this cut gave no trouble, but stood up straight.

To concrete this section of wall a Smith hand mixer was set up on the backfill behind the end of the completed wall north of the railway embankment, where gravel could be easily delivered by teams. The mixer was blocked up about 3 ft. so as to dump into the distributing car. This car was made by bolting two concrete buggies, from which the wheels had been removed, side by side on a long, light four-wheel truck of 24-in. gage that had formerly been used in the machine shop. A track was built from the mixer along the section of wall level with the top of the forms. This was located so that the buggies dumped directly into the form, which was only 3 ft. wide at the top.

One man could handle the car, dump the concrete and make the round trip with little delay to the mixing, although on the longer runs an additional man was put on to speed things up. On each trip the car took four or five batches in the two buggies. In this way an average of 32 cu. yd. was placed per 10-hr. day. With this car no concrete was slopped outside the forms, as would have been the case with wheelbarrows or buggies, and the carpenters were able to work under the track whenever necessary without inconvenience. A standard concrete car of the same capacity would not have had sufficient clearance to operate under the railroad track.

The contractors for this section are Quinlan & Robertson, Ltd., for whom the writer had charge of the work.

Special Equipment to Cast and Handle Large Concrete Blocks

THE SEVEN-TON "strong back," as the special grapple shown in one of the accompanying views is called on the job, is being used to handle 60-ton cellular concrete blocks in the casting and storage yards of Foley Bros., Welch, Stewart & Farquier, who are building the new Ocean Terminals at Halifax, N. S. The other illustration shows one of the blocks being poured and another being finished. These blocks are cast in a large yard with concrete made in the central mixing plant shown in the photographs. Collapsible steel forms are used. When hardened, the blocks are loaded on cars by the 150-ton Industrial crane and either stored or sent to the water front. Here they are to be laid up in a wall more than a mile long, comprising a quay wall, a 1250-ft. pier and two steamship basins. The blocks will be laid on a level bed-rock-and-concrete foundation prepared by a large diving bell. They are to be laid up to the coping of the wall, and then the open cells will be filled with reinforced concrete, bonding the blocks into a continuous wall. L. G. Fuller is superintendent of the work for the contractors.

Dynamite Placed in Canvas Ring Cuts Cylinder Pier Off Smooth

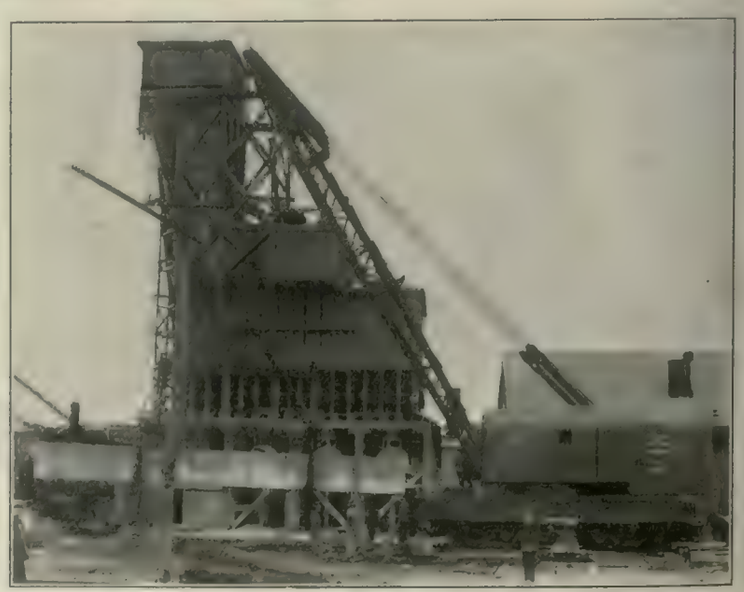
SOME 3-ft. concrete cylinder piers with ½-in. sheet steel shells were recently cut off smooth below water by placing a charge of dynamite around each in a canvas collar, sunk to the level of the mud bottom.

A condition of the job, according to the *Du Pont Magazine*, was that the break at the mud line, 8 ft. under water, should be a smooth one. The first attempt was made by placing three charges of dynamite in twenty-four holes drilled into the pier at the mud line in three groups of eight holes each. This charge cut off the pier, but left a jagged top.

Mr. Bolger, who was in charge of the blasting, then made a canvas pocket of 2-in. diameter, a little more than 10 ft. long. This was loaded full with sticks of dynamite, tied around the next pier as a collar, and slid down to the mud line. When the shot was fired the pier cracked off level with the mud, leaving a surface almost as smooth as a saw cut.

METALLIC TIN is now mined in Alaska. According to the U. S. Geological Survey 526 tons, valued at $380,000, were produced there in 1914. The ore is reduced in Wales, at Singapore, and, very recently, at Seattle.





LEFT, CASTING BLOCKS IN YARD—RIGHT, GIANT CRANE WITH 58-TON BLOCK IN FRONT OF MAIN MIXING PLANT

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

Rock Slide Causes Second Collapse of Subway Decking

One Life Lost in Accident at Broadway and 38th Street, New York City—Steel Set in Collapsed Seventh Avenue Section

A slide of schist from the west wall of the subway cut on Broadway just above Thirty-eighth Street, New York City, at about 7.30 p. m. on Sept. 25, carried away the posts supporting the decking on that side of the street for about 50 ft. in the rear of the needlebeams at the heading, causing that half of the roadway to fall into the cut, and the two street-car tracks and the other half of the roadway to sag. An empty taxicab, standing directly over the slide, and three pedestrians, one of whom, a woman, was killed, fell into the hole. A workman below was also injured. A street car which was on the edge of the sagged section of the tracks was backed to safety by its motorman.

Decking Stands Up Well

Contrary to what occurred in the total collapse on Seventh Avenue on Sept. 22, the Broadway decking behaved exactly as might have been predicted. That part from beneath which the posts were swept fell in, and the rest stood up very well, with a little sagging in the immediate vicinity of the gap. This section is under construction by the U. S. Realty & Improvement Company, on whose work the Seventh Avenue accident happened. The same type of street support as gave way on Seventh Avenue was used in the Broadway cut. The behavior of the Broadway construction is thought to indicate that there is nothing radically wrong with the system of supporting the street used on the two sections. The rock slide acted across the cut, whereas rock hurled from a blast in the heading would act in line with the cut; but the slide at Thirty-eighth Street took out enough posts to demonstrate that the strength of this type of street support under accident conditions is by no means inconsiderable.

Concealed Cracks Cause Slide

The rock at Thirty-eighth Street and for some distance south is a partly-weathered micaceous schist, the treacherous character of which has been well known since the Pennsylvania tunnels were driven through it under Thirty-third Street some time ago. On this account great care has been taken to underpin all buildings along this part of Broadway to subgrade of the new subway. The strike of this formation at Thirty-eighth Street is approximately parallel to Broadway, while the dip is more than 60 deg. to the west. Fearing cleavage planes along the dip, the engineers had carefully watched the east side of this section for signs of a slide. A crack here would have shown in the cut; but the almost vertical cracks which the slide on the other side shows to have existed under the west sidewalk above Thirty-eight Street were not apparent, either under the sidewalk or in the short crosscut at Thirty-eighth Street, when examinations of this side of the excavation were made on Sept. 23 and 24 by engineers of the Public Service Commission and the contractor. Cross-sections of the cut show that the west face, prior to the collapse, was practically vertical.

Noted Engineers Called In

Henry H. Quimby, chief engineer of the Philadelphia Department of City Transit, came to New York on Sept. 23 to look at the collapse on Seventh Avenue. The New York Public Service Commission instructed Alfred

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Animated Discussion on Wide Range of Subjects Marks Concluding Sessions of International Engineering Congress

Irrigation Held to Be a Human Problem—State Supervision Suggested—Experts Discuss Flood Prevention, Dams and Waterways—Trend of Development Indicated by Opinions on Bridge Building—Technical Education Should Be Broad—Municipal Engineers Condemn Pavement Cuts

So far as the civil engineering membership of the Congress was concerned hydroelectric development, railway electrification and irrigation were the outstanding features of the latter half of the International Engineering Congress in San Francisco which ended last week. These subjects naturally engaged the attention of a great many engineers on the Pacific Coast. The discussions were lively, varied and valuable.

Irrigation

Irrigation was discussed at four sessions, the first being devoted to a general consideration of its economic advisability. Throughout the discussions there was insistence upon the human and economic, rather than the engineering, aspect of the subject. A number of the speakers expressed the belief that in this country we would shortly be forced to assist settlers by building houses for them and selling them equipment on time. In support of this policy there were cited the experiences of Australia, Italy, Spain, and of the Canadian Pacific Railway.

It was pointed out by several speakers that men, inexperienced in irrigation farming, were allowed to go on projects, with the inevitable result. Unfortunately, too, these men have been lead into the belief that irrigation farming offered large and certain profits. The proper procedure is to develop a large project unit by unit, not taking up a new section until the previous ones are settled and in service. G. N. Houston of Calgary pointed out that in sections where irrigation is not an absolute necessity, but is resorted to merely for the purpose of increasing crops, the settler with insufficient capital will not go to the expense of preparing his land for water but will continue to use dry farming methods.

State Supervision

At one of the later sessions Prof. Charles D. Marx of Palo Alto and Major P. M. Norboe of Sacramento related the efforts made in California to secure State supervision of private irrigation enterprises in much the same manner as the railroad commission supervises the finances and operation of public utilities. Under the present State law plans for projects are submitted to the State authorities but no machinery or funds are available to insure the execution of the works in accordance with the approved plans. The object, of course, is to give standing to the securities of irrigation companies but that object cannot be attained under present legislation. Efforts are to be made to secure the passage of an adequate act in the near future.

Underground waters as irrigation supplies came in for considerable discussion, prompted by the paper of G. E. P. Smith of Tucson on that subject. Charles H. Lee of Los Angeles strongly advocated legal control of ground water in somewhat the same fashion as surface supplies are controlled by the State. Other speakers, including J. C. Nagle of Austin, Tex., and Major Norboe indorsed Mr. Lee's position.

Duty of Water

The discussion of the duty of water brought out clearly that averages for water application to various crops are entirely untrustworthy, the requirements for any given crop varying

Assail Ferris Bill at Water Power Conference

Heated Debate Centers on State Versus Federal Control of Western Resources

As a result of the Western States Water Power Conference held in Portland, Ore., last week resolutions were adopted by the delegates on Thursday, Sept. 23, strongly urging the contention of State rights as opposed to governmental control and contending that the Western States are fully capable of dealing with water-power legislation themselves. Many of the States object strongly to the Ferris bill.

The resolution specifically called for a declaration from Congress recognizing and acknowledging that the interest of the United States in the public lands should be subject to the jurisdiction and eminent domain of the States in which the lands are located. It was contended by the delegates that the State ownership of the water was far more valuable than the federal government's ownership of the land, and that the States could handle the situation from that viewpoint.

The conference was the direct result of a resolution passed by the Oregon Legislature in the spring of this year calling for a conference of delegates from Western public-land States. In consequence, fourteen Western States appointed delegates, and of these fourteen States all but South Dakota and New Mexico were represented at the convention.

The first two days of the conference were spent largely in listening to addresses by well-known officials and utility operators. The position of the government was outlined by Messrs. Tallman, Graves and Merrill, and Senator Chamberlain of Oregon stoutly upheld the merits of the Ferris bill. Messrs. Dawson, Piles, Roemer and Ralston spoke in favor of a logical conservation that would permit development of the country's resources on an economical basis.

Water-Power Franchises

In discussing the terms of federal water-power franchises John H. Roemer recommended the indeterminate permit with an initial fixed period of fifty years. He suggested that an independent tribunal, such as the Interstate Commerce Commission, be intrusted with the administrative features of such legislation.

"Unless Congress will recognize the fact that men of affairs will not engage in any undertaking where they must suffer restrictions and bear burdens to which others engaged in the same business are not subject," Mr. Roemer declared, "it would be better to allow the existing laws to remain, with perhaps an amendment negativing the power of any public official

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greatly in different localities, depending upon slope and location of the land, rate of evaporation and plant transpiration, etc. For example, alfalfa in some sections of Arizona requires only 1 acre-foot while in others 6 acre-feet are needed. In this connection, too, attention was called to the effect of temperature of water upon production, snow water supplies tending to give lower yields than warmer sources under the same soil and climatic conditions. Most of the speakers who joined in the discussion emphasized the need for careful studies of duty under different conditions and then the practical application of the data determined.

Flood Prevention

In the session on flood prevention there was much highly technical discussion on the regimen of rivers in alluvial and glacial valleys and also upon the cycle which a river system goes through in order to regain stable conditions when a by-pass has been formed. In explaining the solution of the Sacramento Valley problem C. E. Grunsky said that it consisted essentially in making the stream carry all the flow possible by the highest practicable levee and then letting the surplus go into the natural basins in the valley through the by-passes. Abraham Gideon of Manila told about a flood of 40,000 sec.-ft. in the Pasig River, which has a normal flow of 6000 sec.-ft. One of the tributaries alone during that flood carried 65,000 sec.-ft. from a drainage area of only 100 sq. miles, while the total watershed is 300 sq. miles. On examination it was found that the surplus waters had backed from this tributary into a large lake which thus served as a retention reservoir. Had this not been available the water in the city of Manila would have been 15 to 18 ft. deep. Moreover, due to the lake, the high water lasted for several days.

Dams

In discussing the paper on dams, prepared by Arthur P. Davis and D. C. Henny, John S. Eastwood of San Francisco stated that the multiple-arch dam does not come into its own until fairly good heights are reached. He was of the opinion, too, that the earth dam can compete with the multiple-arch dam only when hydraulic sluicing is possible. In his judgment there would be no trouble in carrying a multiple-arch dam to a height of 200 ft. and at a lower cost than for any other type. Gardner S. Williams of Ann Arbor, Mich., on the other hand, referring to the multiple type of arch dam built under his direction in Michigan and Wisconsin, felt that their province was mainly for the lower structures.

Waterways

In the session on waterways Col. C. McD. Townsend, discussing Col. C. S. Riché's paper on inside route waterways, stated that the intracoastal waterway is illogical as a transportation route for through freight. The cheapest transportation in the world is by ocean steamships. A Mississippi River packet, for example, burns thirty-eight times as much coal per ton-mile as a large lake freighter with a speed of 12 miles per hour. Insurance rates, too, are higher on inland waters. On the Mississippi they exceed 10 per cent; consequently, few vessels are insured. In a thinly settled region, Colonel Townsend believed, where railroads must charge 1 cent per ton-mile a canal may compete as a freight carrier, but in a thickly settled region where the railroad charges are three to four mills per ton-mile a small canal cannot compete successfully.

In discussing the commerce on the River Rhine, Colonel Townsend pointed out that in 1883 the Rhine commerce amounted to 3,800,000 tons while that of the Mississippi passing St. Louis was 2,000,000 tons. In 1913 the commerce of the Mississippi past St. Louis had not increased, but that of the Rhine had reached 28,000,000 tons. The figures for the Mississippi, of course, do not include the commerce coming down the Ohio, which enters the Mississippi at Cairo.

Railway Bridges

Railway bridges came in for discussion following the paper by J. E. Greiner of Baltimore on that subject. Prof. Charles Derleth, Jr., of Berkeley, expressed the view that more and more, where cost will permit, masonry bridges will be used where short spans are possible. In trusses the tendency is in the direction of solid floor systems. He believed it a wrong tendency to propose completely continuous spans for long-span work unless the piers are on rock so that there will be no settlement. In regard to computations, he was of the opinion that more and more they should be left to experts who do practically nothing else, always, of course, in consultation with the engineers responsible for the project.

Prof. Charles B. Wing of Palo Alto emphasized that the bulk of the bridge building is in the short spans, and that to effect large economics careful study should be given types adapted for use in the smaller structures. He believed that for the western part of the United States there is still much warrant for the use of timber deck type trestles. The type used on the Southern Pacific has an asphalt deck-covering that protects the structure from water.

Commenting further on the Southern Pacific's type of trestle, William Hood, chief engineer, explained that his company used untreated timber, except for the guard rails which are exposed to rain and to the more destructive agent, the fierce Western sun.

Fire Protection

In discussing John R. Freeman's paper on fire protection, T. W. Ransom, mechanical engineer in the city engineer's office, San Francisco, thought that there was danger in going too far with high-pressure fire systems. They are applicable, he stated, only in the larger cities. High-pressure streams require large, trained departments, while 75 lb. is high enough for the smaller cities.

Public Utilities

On the subject of utilities there was sharp disagreement with the anti-municipal ownership views of Dr A. C. Humphreys of New York. M. M. O'Shaughnessy city engineer of San Francisco; T. W. Ransom, of Mr. O'Shaughnessy's staff, and A. H. Dimock, city engineer of Seattle, contended that with proper personnel and the utilities removed from politics municipal plants can be operated economically and with advantage to the people. Mr. Dimock cited the drop in power rates in Seattle from 20 to 6 cents a kilowatt-hour as a result of the city's entry into the power field. M. H. Brinkley, of the California Railroad Commission, also dissenting from Dr. Humphrey's views, declared that cities should be allowed to work out their own problems, adopting municipal ownership if the majority believed it of advantage to the city. He believed that public ownership was the ultimate solution of the utility problem.

Technical Education

Discussion of the papers of Prof. George F. Swain, of Harvard, and President Ira N. Hollis of Worcester Polytechnic Institute on technical education was mainly to the effect that we have carried specialization too far, that we seek rather to give a mass of facts than to develop the thinking power of the students.

Railway Electrification

In discussing papers on electrification of railways the question of whether the railroad shall purchase or generate power and problems of speed changes and regenerative control were among the subjects of debate. George N. Eaton, of the Westinghouse Electric & Manufacturing Company, reviewed the thus far fruitless search for some satisfactory speed changing scheme for electric locomotives; he

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Rock Slide Causes Second Collapse of Subway Decking

(*Continued from page* 429, *first column*)

Craven, its chief engineer, to call in Mr. Quimby, Edmund S. Davis, chief engineer of the Boston Transit Commission, and D. B. Thayer, past-president of the American Institute of Mining Engineers, to advise on methods for preventing a recurrence of the accidents. Mr. Quimby and Mr. Davis, with Robert Ridgway, engineer of subway construction for the Public Service Commission, visited the scene of the accident at Thirty-eighth Street and Broadway on the morning of Sept. 28.

Steel Set in Open on Seventh Avenue

While the civil authorities and engineers were carrying on a large number of investigations into the accidents and into the work of other subway contractors, the forces of the U. S. Realty & Improvement Company set to work, cleared the wreckage of the Seventh Avenue collapse, placed the concrete bench footings for the permanent columns and set practically all of the 250-ft. section of steel from below Twenty-fourth Street to Twenty-fifth Street in the short space of six days. Trestles to carry the car tracks are being erected on this steelwork, and the street can soon be decked and restored to traffic. This method was adopted as allowing the street to be replaced in a condition safe beyond question, and as being practically as rapid as the erection of any temporary structure. The cableways set up on the day of the accident to clear away the wreckage have been used to advantage in erecting the permanent steel.

Engineers Approve Shoring in New York Subway Construction

Mayor John Purroy Mitchel of New York City has appointed a committee headed by Nelson P. Lewis, chief engineer of the Board of Estimate and Apportionment, to investigate the methods of street support being used in building the new subways in that city. The other engineers who served on the committee are E. P. Goodrich, consulting engineer of the Borough of Manhattan, J. W. F. Bennett, consulting engineer of the Borough of the Bronx, George W. Tillson, consulting engineer of the Borough of Brooklyn, Eugene Stern, chief engineer of the Bureau of Highways, Borough of Manhattan, Merritt H. Smith, chief engineer of the Department of Water Supply, Gas and Electricity, Edwin J. Fort, chief engineer of sewers, Borough of Brooklyn, John R. Healy, chief inspector of the Bureau of Combustibles, Benjamin F. Welton, chief of the Efficiency Bureau, Commissioner of Accounts, Francis W. Ferry, of the engineering force of the Department of Bridges, R. W. Creuzbaur, consulting engineer of New York City, and Amos Schaeffer, consulting engineer of the Borough of the Bronx.

The report of this body, which was not given out until it had been presented to the Public Service Commission on Sept. 28, found fault with the methods being used on five counts, involving only a few localities, all on Broadway between Twenty-sixth and Thirty-first Streets. The recommendations included the substitution of bolts for spikes at a few points in the timbering of the street support, the placing of extra shores against a one-story building, and the placing of additional X-bracing at several points. This report gave a clean bill of health to the great majority of the subway sections now under construction.

After orders had been issued by the civil authorities closing several miles of streets, including two blocks of Broadway where construction had not yet been started, and tying up traffic for the whole day on Sept. 27, a common-sense understanding was reached between the Mayor's office and the Public Service Commission whereby traffic was restored to normal after the recommendations of Mr. Lewis' committee had been complied with.

Two Failures of Decking Over New York Subway Cuts in One Week

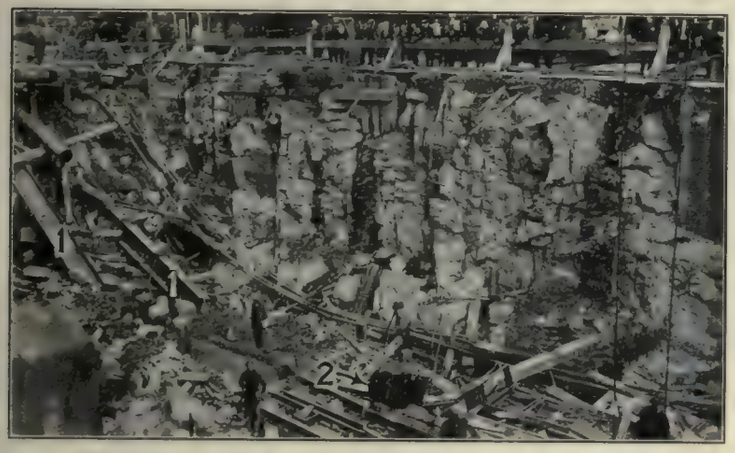


CABLEWAYS, DERRICKS AND CRANE AT WORK CLEARING SEVENTH AVENUE WRECK BEFORE DARK





WEST NEEDLEBEAMS, POSTED, STOOD UP



CAR (2) VERY CLOSE TO SOUTH END OF NEEDLEBEAMS (1)



WRECKAGE ON SEVENTH AVENUE ALMOST CLEARED BY NEXT DAY



ROCK SLIDE THAT CAUSED THE COLLAPSE ON BROADWAY SECTION



TRACKS ON BROADWAY SAGGED BUT DID NOT FALL INTO CUT



DERRICK SET UP AT BROADWAY AND THIRTY-EIGHTH STREET

Assail Ferris Bill at Water Power Conference

(*Continued from page 429, second column*)

to cancel certificates except upon the ground of non-user or misuser by the holder, and provide for a court review of the act of cancellation by such official.

"The Ferris bill seems to be designed to limit the compensation as nearly as possible to the depreciated value of the physical property, or, as characterized by Justice Lurton in the Omaha water case, the 'bare bones of the plant.' This in most cases would be far from rendering the owner just compensation, and its advocacy is having a baneful influence upon the public utility industries of the country. Those who are endeavoring to have this doctrine prevail as a matter of law in the belief that they are rendering a great public service will, if successful, sooner or later awake to a realization of the fact that men of ability, experience and character who have developed the public-service industries of the country, have made new discoveries and inventions in the arts involved, devised new methods of operation, and, through combination of properties and management, have reduced the cost of service to the benefit of the public, will be either driven out of or voluntarily abandon the field of such industrial activities, allowing it to pass into the hands of a mediocre class, to the great detriment of the public.



LEFT—BATAVIA SEWAGE PUMPING STATION DAMAGED BY EXPLOSION

"Unless the highest order of technical skill and acumen and organizing financial and executive ability can be attracted to and retained in the industry, little advancement can be expected. The present stage of the utility arts is due to the men who have devoted their lives and means to their promotion, not as a philanthropy, but in the hope of reaping financial rewards commensurate with the energy and ability exerted."

On the floor of the conference Senator Thomas J. Walsh of Montana was the recognized spokesman of the administration, and he strongly assailed the position of the power companies and the opponents of the Ferris bill. Senator Reed Smoot of Utah attacked the Ferris bill, contending that it was an infringement of State rights and that it would be legislation on matters that could be far better handled by the States concerned. There seemed to be a general disposition on the part of the delegates to object to any governmental taxation of water-powers that would result in these being turned into revenue-producing enterprises at the expense of the Western States.

S. Z. Mitchell, president of the Electric Bond & Share Company, spoke at considerable length against the proposed legislation, contending that it was impracticable and that it would be impossible to finance water-power development under its provisions. Frank H. Short of Fresno, Cal., spoke strongly against the Ferris bill.

The last day of the conference was marked by heated debate between Senators Walsh and Smoot and Clyde C. Dawson, a delegate from Denver. Senator Clarence D. Clark also assailed the Ferris bill in the closing hours of the conference.

As a result of the conference the following resolutions were passed by a vote of twenty-eight to seven:

"Whereas the new States admitted into the Union are of necessity upon an equal footing in all respects whatever with the original States; and

"Whereas each State has full jurisdiction over all lands within its borders, including the beds of streams and other waters; and

"Whereas the ownership by the federal government of the technical title to vacant public land within a State does not confer upon the federal government any greater or other governmental powers than it possesses within the original States; and

"Whereas the long-established and sound policy of the United States with respect to the disposition of its unappropriated public lands is opposed to the making of a direct revenue therefrom, beyond the expense incident to the surveying, classification and disposing of such lands, but, on the contrary, said policy is intended to encourage and promote the settlement and development thereof, and any act of Congress or any administrative interpretation thereof which is not in harmony with this policy does an injustice to the new States by placing them on an unequal footing with the original States, and by discouraging and preventing the settlement of such new States and the development of their resources; and

"Whereas the vacant land belonging to the federal government constitutes two-thirds of the area of the States represented in this conference and amounts to more than twice the area of the thirteen original States; and

"Whereas the vacant lands belonging to the federal government are under the law exempt from taxation, while the burden of maintaining local government over their entire area rests upon the States; and

"Whereas the maintenance inviolate of the constitutional equality of the States of the Union is essential to that balance of power on which the perfection and endurance of our political fabric depend, and to the harmonious operation of the scheme upon which the Republic was organized; now, therefore, be it

"Resolved, That we are unalterably opposed to any legislation which is in conflict with the fundamental principles above declared.

"Resolved, That the States have the constitutional right and power to control and regulate the appropriation and use of the waters within their boundaries for all beneficial purposes except navigation, and also the right and power to control and regulate the rates and service of their public utilities.

"Resolved, That we are opposed to any policy that looks toward imposing the system of leasing generally upon the public domain, for the reason that such system is contrary to the spirit of our free institutions and would retard the development of the resources of the States in which there is still any public land.

"Resolved, That in view of what we believe to be administrative misconstruction of existing legislation, we are in favor of a declaratory act by Congress recognizing and acknowledging that the proprietary interest of the United States in the vacant land within the States is subject to the jurisdiction and eminent domain of those States for all uses which are declared by the laws of those States to be public uses and which are essential to the development, well-being and prosperity of those States.

"Resolved, That the purposes of encouraging the development and utilization of the natural resources of the country by private enterprise which actuated Congress in the enactment of the right-of-way acts of July 26, 1866, and March 3, 1891, and in the enactment of the acts of March 3, 1877, and June 4, 1897, making all non-navigable waters on public lands, including forest reservations, free for appropriation for beneficial uses, should actuate Congress to-day in the enactment of any further legislation upon those subjects.

"Resolved, That any legislation by Congress the purpose or effect of which is to substitute arbitrary or discretionary authority of executive officials for the fixed rules of law governing the administration, sale or other disposition of public lands and reservation and rights-of-way over the same will be unwise and inconsistent with the spirit of our Constitution.

"Resolved, That we are opposed to ownership or control either direct or indirect by the United States Government of intrastate public utilities."

Still in Doubt as to Cause of Batavia Pumping Station Explosion

Beyond the theory that the explosion at the Batavia sewage pumping station, which was noted in these columns last week, might have been caused by gas escaping from a jet that had gone out beneath the second floor, no conclusion has been reached as to the cause of the disaster. Chester & Fleming, consulting engineers of Pittsburgh, who have been retained to take charge of the works, have made recommendations as to temporary expedients to take care of the sewage. It is planned to pump it from a manhole adjacent to the building until the pump at the sewer well can be placed in operation again. Later a new pumping plant building will be erected.



RIGHT—ENTIRE WEST SECTION CONSIDERED UNSAFE AFTER EXPLOSION

Missouri, Kansas & Texas Goes Into Receivership

A receiver was named Sept. 27 for the Missouri, Kansas & Texas Railway and the Missouri, Kansas & Texas Railway of Texas, the two roads constituting what is commonly known as the "Katy" system. The receivership was due to inability to meet 5-per cent notes for $950,000, the holders of which refused a year's extension at 6 per cent. The system embraces about 3000 miles, and is the third large Middle West line to go into receivership this year.

Concluding Sessions of International Engineering Congress

(*Continued from page* 430, *second column*)

spoke of the impracticability of various gear systems that have been tried. The mercury vapor rectifier experiments on the New Haven had been completed and the equipment was again in the laboratory. This, he said, might prove to be an important development, but it is yet too early, he thought, to predict the outcome, as was also the case with the split-phase scheme tried on the Norfolk & Western. Electric locomotives deteriorate even more rapidly than steam locomotives when not regularly attended, Mr. Eaton said, and allowance for inspection and overhauls should not be slighted in preliminary estimates.

The degree of adhesion to the rail on the same electric locomotive varied, he had found, over 100 per cent under different conditions, and it was unsafe to depend much on the greater adhesion of electric locomotives. Steam engineers learned to handle electric locomotives without difficulty, he found, and were usually eager to change. As to the source of power, Mr. Eaton pointed out the undesirable nature of electrified railroad load when the power systems carried no other, and therefore recommended the purchase of power under contract.

In reply to this A. H. Babcock, consulting electrical engineer, of the Southern Pacific Railroad, said that the load factor for operating trains on mountain divisions would be such that power companies could not handle it, nor could the train schedules be adjusted to make it more favorable, because of the fixed time for moving crops and the congestion on the line in emergencies. On the subject of regeneration, Mr. Babcock said that the value of power thus obtained was negligible as compared to the effective means of braking thus afforded. The advantages are in the elimination of troubles resulting from overheated brake shoes and other brake derangements that often lead to derailments. The great percentage of such troubles that occur with ordinary brake systems near the foot of grades emphasize the desirability of regenerative control.

Condemns Pavement Cuts

In commenting on brick pavements, A. H. Dimock, city engineer of Seattle, said that experience in that city indicated that repressing does nothing but injure brick; wire-cut brick provided with lugs and one beveled edge are preferred. He expressed a wish that some new compound for use as filler for brick pavement could be developed. There is need, he said, for a filler that will not require as much time for setting as does Portland cement, but which will support the edges of the brick better than bituminous compounds.

The evils of frequently tearing up pavements to lay conduits were reviewed by M. M. O'Shaughnessy, city engineer of San Francisco, who pointed out the great necessity for laws under which public service corporations could be made to conform to reasonable rules. It was pointed out that in a half mile on Broadway, New York, a public utility company in six months made seventy-five holes in a pavement for locating leaks and later could not be compelled to overhaul the worn out gas system prior to placing a new pavement. The gas company had found it more economical to remedy trouble after it occurred. Mr. O'Shaughnessy stated that in California a contractor cannot legally be compelled to maintain a contract job in repair after the work has been finished and accepted. The suggested remedy of using sub-sidewalk space for conduits usually laid in streets could not be applied in some cities, it was pointed out, because sub-sidewalk space has been appropriated by property owners. When space is so used, property owners should be obliged to pay the city rental, and it was suggested that it would be very desirable to reserve such space for conduit use where feasible.

Henry Welles Durham, formerly chief engineer, Bureau of Highways, Borough of Manhattan, New York, recommended the adoption of definite limits for subsurface as well as surface construction. He pointed out that Western cities could profit by the experience of New York, which did not adopt such a policy early enough, and the practice in Europe which has long been strict in this regard. In discussing the width of streets, it was pointed out that the distance between curbs should be just sufficient to allow a definite number of streams of traffic. For example, the widening of the roadway of any street would be economical only if an additional line of traffic could thereby be accommodated. In Seattle, the standard roadway in downtown streets is 54 ft., which allows six lines of traffic at 9 ft. each. If this width is increased, it is desirable to make the roadway 72 ft. wide, accommodating eight lines of traffic. Eighteen feet is the standard Seattle allowance for a double-track car line with the standard spacing of 10 ft. on centers. The San Francisco municipal track spacing is 11 ft.

Lapwelded Pipe Has Advantages

In the mechanical engineering session devoted to waterwheels, it was suggested that the fields of civil, mechanical and electrical engineers overlap in hydroelectric power plant design and construction to such an extent that a committee representative of these branches of engineering could formulate rules of much value. W. A. Doble, in comparing the merits of lapwelded and riveted pipes, pointed out that the lapwelded pipe, by its smoother interior, reduces friction enough to permit the use of a smaller diameter pipe; the wear is also lessened, so that a thinner pipe will give the same factor of safety. The lapwelded pipe can be laid in the trench more quickly, and, due to the method of construction, which permits of brush treatment and the application of protective coating while the metal is still hot, the rust and scale objections are eliminated.

Impulse and Reaction Wheels

In the discussion on impulse wheels it developed that local conditions govern the question of single or multiple-jet design. The latter permits of lighter castings, but the single jet simplifies control. Sustained efficiency of the waterwheel for a period of years, it was pointed out, should be considered as carefully as first cost. In choosing between impulse and reaction wheels, the clarity of the water should be carefully considered. The efficiency of a turbine runner, Mr. Doble said, depends first upon its design and second upon the quality of water. In general, the greatest tendency to cut appears in runners of lower specific speed.

Water Power Policies

Strong criticism of Government policy in water power matters was made at two sessions. In the paper by William Hood, engineer of the Southern Pacific Railroad, it was claimed that National laws are such as to prevent Western railroad companies from considering development of water power to electrify their lines. In the paper by John D. Galloway it was stated that a well-defined policy both State and National of hampering all initiative in hydraulic development is the only obstacle to greater use of hydroelectric power. However, G. H. Marx, professor of mechanical engineering, Stanford University, took exception to this view, and expressed an opinion that legislative effort has been solely to protect the public against monopolistic exploitation.

Exposition Engineers Receive Bronze Plaques

"Engineers' Day" was celebrated in the court of abundance at the Panama-Pacific International Exposition on Sept. 24, when C. C. Moore, president of the exposition, presented nine specially designed plaques to the engineers under whose direction the exposition was constructed. The following received plaques: H. D. H. Connick, director of works; A. H. Markwart, assistant director of works; C. L. Bayley, chief mechanical and electrical engineer; E. E. Carpenter, chief civil engineer; Shirley Baker, construction engineer; H. D. Dewell, chief structural engineer; William Waters, superintendent of construction; W. M. Johnson, engineer of fire protection, and L. F. Lourey, assistant chief mechanical and electrical engineer. Each of the nine plaques is 5 x 7 in. in size, of Florentine model, with a laurel wreath surrounding the engraved inscription: "Presented in recognition of services as one of the engineers of the Panama-Pacific International Exposition by its board of directors on 'Exposition Engineers' Day, Sept. 24, 1915."

Municipal Improvements Society Issues Convention Program

The American Society of Municipal Improvements has issued its program for the annual convention to be held at the New Hotel Miami, Dayton, Ohio, Oct. 12-15. The convention will be opened at 9 a. m., Oct. 12, with addresses by George W. Shroyer, mayor of Dayton, Henry M. Waite, city manager of Dayton and Fred W. Rike, president of Greater Dayton Association. The response will be by Morris R. Sherrerd, chief engineer of the Board of Public Works of Newark, N. J. The papers presented will deal, with waterworks, street cleaning, garbage collection and disposal, paving, flood prevention, wood-block treatment, sewerage and sanitation, stream pollution, street lighting, sidewalks and curbs, the Dayton plan of government, obligations of the State to the city in matters of public works, traffic, park development and maintenance and fire prevention. Among the speakers will be: William A. Howell, president of the society; John T. Fetherston, commissioner of street cleaning, New York City; E. R. Conant, chief engineer, Savannah, Ga.; J. E. Barlow, director of public service, Dayton; Dr. D. Frank Garland, director of public welfare, Dayton; Charles H. Rust, city engineer, Victoria, B. C.; C. F. Davis, chairman, Bureau of Water, Philadelphia; A. F. Macallum, city engineer, Hamilton, Ont.; Robert A. Meeker, State engineer of the Department of Public Roads, New Jersey; E. A. Deeds, chairman of the board of directors of the Miami Conservancy District; R. M. Cooksey, principal assistant engineer, Paving Commission, Baltimore; C. D. Pollock, consulting engineer, New York City; W. H. Taylor, Jr., city engineer, Norfolk, Va.; A. M. Reynolds, chief engineer, Essex County Park Commission, Newark, N. J.; J. W. Howard, consulting engineer, New York City; Hermann Von Schrenk, consulting engineer, St. Louis; E. R. Dutton, assistant engineer, Minneapolis; A. D. Duck, city engineer, Greenville, Tex.; William C. Perkins, chief engineer, inspection department, Dunn Wire-Cut-Lug Brick Company; T. Chalkey Hatton, sewer commissioner, Milwaukee; Prof. Earl B. Phelps, U. S. Public Health Service; Louis L. Tribus, consulting engineer, New York City; Alexander Potter, consulting engineer, New York City, W. W. Crosby, consulting engineer, Baltimore, and Henry M. Waite, city manager, Dayton.

The International Engineering Congress Delegates Visit Exposition

The afternoon of Sept. 22 was left open when the program for the International Engineering Congress was made out in order that the visiting engineers might spend this time at the exposition. On that afternoon the delegates assembled in Machinery Palace and were greeted by exposition officials, who presented a bronze medal commemorative of the occasion to the congress. Prof. W. F. Durand, dean of the department of engineering at Stanford University, representing the congress, accepted the medal.

Personal Notes

H. Blitman, formerly inspector on construction work in the East River tunnels, New York City, has been appointed instructor in the department of engineering at the University of Minnesota.

Howard E. Hyde, formerly designing and principal assistant engineer of the Havana Sewerage and Drainage Contract and, more recently, with Fay, Spofford and Thorndike, consulting engineers of Boston, engaged upon the project for the sewerage and drainage of the city of Fall River, Mass., has joined the staff of Frank E. Winsor, chief engineer of the proposed new water supply for the city of Providence. Mr. Hyde was graduated from Cornell University in 1900 and a few months later went to Havana, Cuba, as engineer in the department of sewers. He left this work in 1902 to become engineer in charge of the construction of the superstructure of the Lower Miami River Bridge of the Toledo Terminal Railroad Company, at Toledo, Ohio, where he continued until 1903, when he went to the Philippine Islands as assistant engineer in the office of the city engineer. In 1906 he attained the grade of acting city engineer of Manila in full charge of the department of engineering and public works, including the department of streets and bridges. In 1907 he returned to Cuba where, as engineer in charge of studies for the protection of the city of Sagua la Grande from flooding by the Sagua River he prepared plans and estimates for controlling works 6 miles long. On the completion of this work he made studies of the Havana water system, including preparations and plans for an additional 42-in. conduit from the Palatino reservoir to the city, estimated cost of which was $240,000. He became principal assistant engineer on the Havana sewerage work in 1908. His return from Cuba was noted in these columns March 13.

C. E. Henderson, formerly assistant city engineer of Port Arthur, Ontario, has been appointed city engineer of St. Augustine, Fla.

Franklin Henshaw has been appointed street commissioner of the village of Scarsdale, New York. The village is planning to expend a considerable amount of money this fall on the improvement and repair of the streets, and expects by next year to be able to develop a comprehensive system for the care of its 26 miles of improved highways and the development of new roads.

John M. Heffelfinger has been appointed assistant resident engineer on the construction of the improved sewage treatment plant at Columbus, Ohio.

L. G. Krull has been appointed county engineer of Wright County, Iowa, succeeding R. E. Rotzler, resigned. Mr. Krull's headquarters are at Clarion.

R. C. De Frees, formerly assistant engineer on the forces of the Interurban Railway, Des Moines, Iowa, has been appointed computer for the Interstate Commerce Commission, Division of Valuation, Karpen Building, Chicago.

A. L. Dierstein, formerly instructor in civil engineering at Purdue University, has been appointed instructor in structural engineering at Pennsylvania State College.

A. H. Anderson, who was graduated from Massachusetts Institute of Technology in May of the present year, has been appointed junior assistant on the engineering forces of the New York State Public Service Commission, First District.

W. D. Pearce, formerly assistant engineer for the Northern Pacific Railway at Duluth, has been promoted to the position of supervisor of bridges and buildings on the Yellowstone Division for the same company, with headquarters at Glendive, Mont.

H. S. Williams, assistant county engineer, of Cass County, Iowa, has been appointed county engineer succeeding J. E. Lowther, resigned.

Robert H. Kuss, formerly sales engineer for the Edge Moor Iron Company, has opened a consulting engineer's office at 112 West Adams Street, Chicago. He was engineer with the Chicago smoke department for four years and for two years previous he tested fuels for the U. S. Geological Survey, Technologic Branch. He was graduated from the University of Illinois in 1903 and remained there until 1905 as instructor in mechanical engineering. Mr. Kuss has just completed a series of locomotive coal tests for the Grand Trunk Railway System, Western Division, involving the examination of thirteen Middle West coals under running conditions. His lines are steam generation and utilization including smoke prevention and heat transmission problems.

F. K. Bennet, formerly supervisor for the Minneapolis & St. Louis Railroad at Monmouth, Ill., has been appointed valuation engineer of the same road with headquarters at Minneapolis.

Julius E. Willoughby, formerly assistant chief engineer of the Atlantic Coast Line Railroad, has been appointed chief engineer succeeding Edward B. Pleasants, whose death was noted in this journal, Sept. 4. Mr. Willoughby was graduated from the University of Alabama in 1892 and served as traveling land agent for the Louisville & Nashville Railroad from that date until 1900, when he was appointed principal assistant engineer of construction on new lines in the State of Alabama. In 1901 he was appointed engineer of construction on the Alabama & Florida division of the same road. He left this service in 1902 to become division engineer on the Knoxville, La Follette & Jellico Railroad and, a few months later, was appointed chief engineer, in which capacity he had charge of the construction of 105 miles of road, including eight tunnels from 300 to 3600 ft. long and the terminals at Knoxville, Tenn. In 1905 he returned to the Louisville & Nashville as engineer of construction, where he remained until 1912, when he was appointed chief engineer of the Carribbean Construction Company, which was building a railway system in Haiti. He became assistant chief engineer of the Atlantic Coast Line Railroad in 1913.

James N. Gladding, formerly city engineer of Albuquerque, N. M., has been appointed city engineer of El Paso, Tex. He was graduated from Massachusetts Institute of Technology in 1906 After spending a few months as draftsman for the American Cableway Company, of Fall River, Mass., he was appointed city engineer of Albuquerque, which office he held continuously up to the present appointment.

Frank C. Campbell has been appointed assistant chemist at the plant of the Great Western Portland Cement Company of Kansas, at Mildred, Kan.

Robert E. Hill, formerly assistant computer in the valuation department of the Chicago & Eastern Illinois Railroad, has established a residence at San Juan, P. R., where he will engage in a land surveying business.

Charles E. Preston, general contractor, specializing in the building of public schools, of White Plains, N. Y., has recently completed a high school at Flemington, N. J., for which he had the contract and is starting work on a school building at Scarsdale, N. Y.

Henry A. Burr, formerly connected with the Stone & Webster Engineering Corporation and, previous to that, with the bridge and construction department of the Pennsylvania Steel Company, has accepted a position in the maintenance-of-way department of the Nashville, Chattanooga & St. Johns Railway at Nashville, Tenn.

W. H. Heiby, construction engineer on the forces of the Department of Public Works of the State of Ohio, has been assigned to take charge of shore improvements at Indian Lake in Logan County.

Chester G. Gillespie, formerly assistant to the city engineer of Sacramento, Cal., has assumed office as director of the Bureau of Sanitary Engineering of the California State Board of Health, which was created by the State Legislature at its last session to investigate water and sewage problems. Mr. Gillespie was educated at the University of California, being graduated from there in 1907. Following graduation he assisted on filtration investigations and miscellaneous sanitary engineering matters under W. W. De Berard, now Western editor of the Engineering Record, and Prof. Charles Gilman Hyde. In 1912 he served as assistant engineer under Professor Hyde, C. E. Grunsky, Charles D. Marx and John R. Freeman on the San Francisco water supply investigation and, later in the year, was appointed assistant engineer for the California State Board of Health on the Sacramento sewage investigations. Subsequently he was on the staff of George W. Fuller, consulting engineer, of New York City, and Langdon Pearse, of Chicago, engaged principally as resident engineer on the construction of the Evanston, Ill., filtration plant. He was appointed assistant to Frank C. Miller, city engineer of Sacramento, in the early part of the present year.

J. E. Moreland, formerly resident engineer for the Dickson County Highway Commission, has been appointed resident engineer on highway work in Humphreys County, Tennessee, for G. B. Howard & Company, engineers, of Nashville.

G. L. Reinert has been appointed assistant in engineering on the faculty of Pennsylvania State College, Gettysburgh, Pa.

W. H. Badeau, formerly connected with the Acme Cement Corporation of Olsen, N. Y., is now engaged with N. R. Porterfield, 17 Battery Place, New York City, on the construction of a 300-ft. Ambursen dam in connection with the waterworks system of Watervliet, N. Y.

I. A. Baum, city engineer of Texarkana, Ark., and J. W. Haynes have entered into a partnership to practise as consulting engineers, with offices in the State National Bank Building, Texarkana. Mr. Baum, previous to becoming city engineer, was for a number of years in the engineering department of the Chicago, Rock Island & Pacific Railway. Mr. Haynes is a recent graduate of the University of Mississippi.

Civil Service Examinations

United States.—The Civil Service Commission announces that there will be held at the usual places on Wednesday, Oct. 20, examinations for the positions of junior civil, junior structural, junior mechanical, junior signal and junior electrical engineers, grades 1 and 2, salaries from $1,200 to $1,680 and from $720 to $1,080 a year for grades 1 and 2 respectively, and for the position of junior architect, salary $1,200 to $1,680, in connection with the Interstate Commerce Commission. Applicants must be between 21 years and 36 years of age and must have specific training in their respective fields, experience being in work in connection with railroads. The required length of this training and experience is four years for grade 1 and two years for grade 2 engineers and four years for the position of junior architect. These positions are open especially to young men who have recently started in engineering or architectural work. Further information, for which it would be advisable to apply immediately, may be secured from the Civil Service Commission, Washington, D. C., or the civil service boards at the principal cities, from whom form 2039, stating the title of examination, should be requested.

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Choosing a Career

THIS is the time of the year when freshmen in technical colleges are trying to decide what branch of engineering will be best for them to follow. They are handicapped by lack of knowledge as to the qualifications for and the opportunities in each of the several fields and they find it difficult to make an intelligent decision as to their future. Undergraduates, as a rule, place far too much importance on the making of such decisions so early in their careers. The matter can well be dismissed for a year or two and thought given to the fundamental requirement for success in engineering work. This was well expressed by President Maclaurin in a recent address to the incoming class at the Massachusetts Institute of Technology. "Do not worry too much about the choice of a subject," he said. "Success can be attained equally well in any line of work, for out of every course can be derived the two essentials of future advancement—the right method of attacking a problem and the right spirit in which to undertake work." The young technical student who takes this sound advice to heart need not be uneasy as to the wisdom of casting his lot with the civil, mechanical, electrical or mining engineers.

Hell Gate Arch Closed

THE closing of the Hell Gate arch of the New York Connecting Railroad on Sept. 30 and Oct. 1 marked the end of the most difficult part of the erection work on the longest arch span ever built. The precision and ease with which the closing members were set and the saddles under the erection ties lowered till the two parts of the arch came to an accurate bearing were so great that to those fortunate enough to witness these operations any sense of the unprecedented character of the achievement was almost lost. The engineers and erectors deserve the heartiest congratulations on building the heavy arch and swinging it with as little fuss and complication as if it had been an ordinary span. In erection work of this magnitude telephones are a practical necessity. It is difficult to see how the Hell Gate span or the Quebec bridge could be built without them. The increasing attention being paid to the workmen's safety and convenience in building large bridges has been commented on before. It will be seen from the photographs published on another page of this issue that the men who guided the closing sections into place had safe, solid platforms and runways from which to work. This fact undoubtedly contributed largely to the remarkable record made in setting these bottom-chord sections in 25 min. each. The Hell Gate arch will connect two of the country's great railway systems, the Pennsylvania and the New Haven, thus linking the New England territory with the trunk lines serving the West and South. With the completion of the New York Connecting Railroad and the Seventh Avenue subway, the Pennsylvania's comprehensive plan of terminal improvement, adopted thirteen years ago, will be concluded.

New Lock Gate Design

TWO YEARS' OPERATION has demonstrated convincingly the advantages of the new type of submersible gates used at the Keokuk lock. The article by B. H. Parsons, which appears on page 446 of this issue, not only explains the many unusual features, but makes it clear that the special conditions found at the site must govern the selection of such gates and should be considered in all installations of gates of this type. The height from gate sills to the clean-swept bedrock was unusually large—31 ft.—and made possible the vertical movement of the gate without interference from silt. Control by compressed air and buoyancy chambers was adopted because of the compressed air plant available near the gates. The duplication of the gates and provision for interchange with the dry-dock gate or the guard gate make practically continuous operation certain, even if accidents should temporarily put one gate out of commission. It is evident that the designers exercised the greatest care and forethought in devising the details of the Keokuk work, and the successful record in operation should give them considerable satisfaction in having developed a new and satisfactory form of gate.

Records of Congress Proceedings

THE value of the bound volumes in which the International Engineering Congress will publish a record of its proceedings has risen markedly in the estimation of engineers since the Congress itself has become history. Not a few of those who attended the sessions commented on this point even before the busy week was well begun, but now that there is a clear perspective of the entire program it is apparent that an importance greater than was at first realized attaches to the permanent records. In many sessions there were present authorities whose views it was greatly desired to hear at first hand under conditions where open discussion was possible. To allow time for expressions of opinion from the convention floor it often seemed wise to reserve for the bound volumes the written discussion which had been submitted. To this material will be added the revised and amplified discussion that took place at the convention as well as that which was contributed after the sessions were over. In order to crowd into one week about 200 papers it was necessary to arrange a certain number of simultaneous sessions and naturally some interests overlapped. Although the committee of management made every effort to have an ample supply of printed copies of the papers on hand at each session it was not always possible to do this—some papers came in late and others were in such demand that the supply was exhausted so that, all things considered, a complete set of papers bound with all of the revised and co-ordinated discussion will be a most valuable addition to the library of every engineer. The demand will be greatest among those who attended the Congress and sensed its spirit.

Erie's Opportunity

IF the city of Erie, Pa., puts into effect the flood-prevention plans outlined on page 440, a repetition of last August's disaster, in which Mill Creek overflowed its banks and surged through the streets, sweeping buildings and bridges before it, will be impossible. Erie knows what a flood means, and now is the time to begin construction on the project of channel improvement and stream control recommended by Farley Gannett. The plans, in brief, propose sections of closed conduit and open, concrete-lined channel in place of the present stream bed, which is restricted by encroaching structures of all sorts; substitution of easy curves for all sharp bends, and construction of a dry detention reservoir some distance above the city to impound extraordinary flood flows. Neglecting entirely the humanitarian aspects of the problem it is good business for Erie to build the proposed works, for another flood would cost much more than the preventive measures recommended. Erie, to-day, is in much the same position as was Galveston after the hurricane which almost annihilated the city in 1900. But Galveston had learned its lesson and wisely built a sea-wall, which, as the results of the recent tropical storm prove, was a potent factor in reducing the damage to a minimum. Galveston, with its sea-wall, and Erie, with its flood-prevention works, will be in much the same position as men with paid-up life insurance policies. They need have no anxiety about the future. With an election coming along next month the City Council should lose no time in taking the steps necessary to submit to the people of Erie a proposal for a bond issue for flood prevention works. Another point well worth considering is that, with financial conditions as they now exist, it will be a long time before the proposed works can be built as cheaply as at present.

New Railroad Link Ordered

FOR THE FIRST time in the history of the State of California the Railroad Commission has ordered the construction of a railroad. The Santa Fé system is directed to build a line with a minimum length of 12 miles and an estimated cost of $657,000, to be completed within fifteen months. Many years ago several clubs and chambers of commerce in San Diego and Riverside counties gave a predecessor company a bonus of land and money worth several million dollars to build a railway from San Diego through Riverside into San Bernardino County. The line was built in 1884 and operated until 1891, when 12 miles, from Temecula to Fallbrook, about midway of the line, were washed out and never rebuilt. This has left two disconnected spurs, and through business has to find some other route.

The recent proceedings were to determine whether or not the railway had fulfilled the obligation attached to the bonus, and the commission decided that it had not. While the railway must replace the missing link, the commission recommends that it be done by a 33-mile line reaching territory not touched before. This journal does not know the details of the case and has no criticism for the commission, which had the facts before it. The matter does, however, suggest nice questions of obligation under circumstances that might have existed.

The fact that the washed-out section was not immediately rebuilt suggests that the line had not proved profitable in the seven years of operation. If not, whence would have come the money to rebuild the 12-mile link? Even though the original bonus was far in excess of the cost of the 12 miles it had, presumably, all gone into the construction of the whole line, and what had not been washed out was still in existence and in operation. Obviously the commercial organizations would never have made their donation except for a permanent railroad, but did they or did they not assume risk of destruction of the property? And should the owners of a losing proposition be compelled to raise, or try to raise, more money to lose?

Again, what should be the responsibility of a successor company, if it acquired the property many years later, mainly for the purpose of utilizing certain parts of it in connection with other lines—taking the whole property in order to get these parts? If the remaining tangible evidence of the bonus was confined in the main to right-of-way, grading and track of unprofitable spurs, should the purchaser be obliged to draw from its other resources to fulfill this old obligation?

Turning back from the hypothetical to the actual case, the future career of the property will be worth following. Will the public authority that compels the reconstruction guarantee a fair return on the cost? Or, if the investment proves unprofitable, will the regulators, in the course of time, justify this fact by the easy explanation that the road ought never to have been built? It is to be hoped that the Santa Fé will be able so to keep its accounts as to show just how the line is faring.

Why the Lumber Industry Is Sick

DECREASED consumption and unregulated production are blamed as the two primary reasons for the present unprofitable and wasteful condition of the lumber industry in all sections of the country. These bald facts are set forth by the National Lumber Manufacturers' Association, which has compiled exhaustive figures of stumpage values, itemized costs of production and realization for lumber at the mills. The decrease in consumption is partly explained by the general depression in business during the past year; the popular belief in the diminishing supply and the advancing price of lumber, which has encouraged the exploitation of many other building materials to take its place; the attacks upon lumber in the name of fire elimination; the lack of advertising of lumber and its uses; the cessation of lumber exports and the removal of duty on foreign lumber.

These depressing conditions, according to the association, are gradually being corrected. General business conditions are on the upturn, and vigorous campaigns of education, advertising and promotion are being conducted to impress the public with the abundance of standing timber and the cheapness of lumber. Literature concerning its proper uses and intrinsic merits is being prepared by trained engineers and extensive laboratory tests are being made. The causes underlying the disastrous overproduction of lumber during the last year, however, are much more fundamental and much less susceptible of betterment under the existing organization of the industry and the present interpretation of federal statutes. The pressure of liquidating stumpage, the incomplete and often misleading methods of figuring costs of production, the necessity of continuous operation of plants forming the industrial support of dependent communities, the present lack of legal means for comprehensive and effective regulation of supply to meet the existing demand, the lack of a general knowledge of the actual condition of the industry by the individual members, and the inherited optimism of past years have all contributed to this overproduction of lumber.

The manufacturers of lumber have presented this situation openly and frankly to the Federal Trade Commission with the hope of receiving constructive aid in overcoming the adverse conditions brought to light, and the national association has sought to give this frank presentment of the industry the widest publicity by publishing full reports of the hearing in Chicago. There has been some criticism of this course by critics of the optimist class, who claim that such publicity has hurt lumber credit, but it is believed that the frank and honest statements made by representatives of the industry have won for it the respect of the financial world, have tended to eliminate speculative ventures, have prevented a great loss to individual operators, actual and prospective, by the information thus presented, and that at least an appreciable check on wasteful overproduction now exists. An introspective analysis of the causes of a situation is a large part of the solution, for there will now doubtless come plenty of support to the association in its constructive, educational campaign.

Qualifications of Secretaries

RECENTLY this journal was in receipt, from a member of a local society, of a severe criticism regarding the election of a new secretary. The man chosen was known as a capable constructing engineer, but had not given evidence of special administrative or promotional ability. It was the contention of the correspondent that the secretary of a technical society is, or should be, essentially a promoter and an administrator, and that without demonstrated ability in these lines a candidate should be considered unfit. It was his belief that engineers with these qualifications could be found within the membership of the society, and that the organization was sure to suffer by the election of a calm, dignified gentleman, unimpeachable as to character and engineering achievements, but without the enthusiasm and experience for the promotion work falling to the working head of a technical society.

This journal is in hearty accord with these views. The building of a technical society, and its elevation to a place of prominence and influence in its community are essentially problems of salesmanship, of promotion, of grasping chances to impress the organization upon engineers and the public, of seeing and developing new opportunities for service to its members and its community. It is true that there is other work to be done in a technical society—the planning of committee work, the arrangement of programs and the very necessary financing. But the secretary cannot be expected to do all the work, nor, in practice, does he do it. With the proper enthusiasm and organizing ability he can delegate to others much of his work, and particularly that part, of a technical order, which most of the members of the society are qualified to do. Many local societies might well elect for secretary not a designing, a constructing or a consulting engineer, but one who has apparently abandoned his profession and gone into salesmanship—a sales engineer. Many will fear that a man of this type would develop policies not consistent with the dignity of an engineering organization. There is that possibility, but it can be avoided by careful selection.

Surely no organization would elect as its secretary someone with whom it was not well acquainted. There may be radical men of the salesman type in the society, who must for the organization's own good be passed over, but there will be others of a more conservative mold who nevertheless have the very important selling and promotional points-of-view so necessary for developing the full possibilities of an organization.

Sensational Achievement in Wireless Telephony

THE transmission of speech by wireless over the 4600 miles that separate the great station at Arlington from Honolulu will be likely to rank as one of the big achievements of the twentieth century. It bears the same relation to telephony as did the first wireless messages across the Atlantic to the early experiments of Marconi. It was certainly remarkable enough to have speech transmitted from Arlington to San Francisco, but that the listener quietly sent to Hawaii should have picked up the same impulses at his distant station falls little short of wizardry.

Wave telephony, in fact, impresses the untechnical mind as being about as near black magic as is permissible in this unimaginative age. In very fact it is extraordinary in theory even as in practice. There is something weirdly impressive in the idea of transmitting through space a large amount of electro-magnetic energy at a frequency so high as to produce no sound in the receiver, and yet capable, by its far less rapid variations in intensity, of transmitting articulate speech. It gives even the jaded imagination of the engineer something of a shock to hear a wireless telephone transmitting station tune up for business, the loud singing growing shriller and fainter until at last it fades away into a mouse's squeak and then, quite unheard, continues pouring out a stream of energy into space by the variations of which speech is transmitted.

Oscillations of 30,000 or 40,000 per second can produce no audible effect and the frequency has to be carried even much higher than this before the individual wave lengths become of the order of magnitude usual in long distance wireless telephony; 50,000 oscillations per second means a wave length of 6000 meters, twice what is commonly employed in telegraphy. Thanks to the ingenuity of various inventors there are ample means, and have been for some time past, of getting a large amount of energy at such frequencies radiated from the antennae.

The success of the recent experiments shows clearly that the single really difficult problem of wireless transmission of speech —that is, the control of a sufficient amount of energy by the transmitting device—has been successfully solved, but by what means this has been done has not yet been made public. For several years past it has been possible to get a sufficient output of energy at the proper frequency and the receiving apparatus is relatively a simple matter. To produce, however, a telephone transmitter capable of impressing the necessary modifications of current intensity on a big scale has proved to be a very troublesome matter and the group of engineers who have just won out deserve profound congratulation for their feat.

Obviously wave telephony over great distances will meet the same difficulties as ordinary wireless in the effects of atmospheric conditions, yet it gives a most beautiful solution of many problems of transmission of intelligence. It makes it possible to hold communications with ships over the whole width of the Atlantic and with isolated islands. Inasmuch as speech can be passed on from a wire line to a wireless stretch and then again to the subscriber, one can imagine, for example, calling up a correspondent in Bermuda or the Azores as comfortably as across the street. Of course, messages sent out can, in the present state of things, be heard by anybody who can tune in on the required frequency, which is inconvenient for some purposes. On the other hand, the receiving station can, with considerable success, limit its listening to messages coming from the direction of a particular station. It is quite impossible to forecast the limitations that may serve to hem in the sphere of wireless telephony, but it is most emphatically here as an accomplished fact, and is certain to find very many useful applications. How many time alone can tell.

When Haiti Awakes

IF a stable government should be established in Haiti, as now seems likely, that island will offer one of the most profitable fields for engineering promotion and development known in recent years and, as a corollary, a good field for engineers and contractors. To-day Haiti is practically an undeveloped country—a wilderness. A century and a quarter ago it was one of the most highly developed and richest countries in the West Indies, but the wars of the negro liberation reduced it to a great charnel house, and it has gone backward ever since. Yet it has cities of large population, has natural resources equal to, if not greater, than those of Cuba, which is now almost completely prosperous. In recent years a considerable mileage of Haitian railways have been constructed, an electric lighting system has been put in operation in Port au Prince, a first class wharf has been constructed there and a few spasmodic attempts have been made to pave the streets. Beyond this practically nothing has been done, although the country is credited with a population of over a million.

Many millions of dollars could be spent on sewers, waterworks, paving, street railways and other municipal works in Port au Prince alone, and yet not bring it up to the standard of improvement to which its hundred-thousand population entitles it. Aux Cayes, Jeremie, Jacmel, St. Marc, Gonaives and Cap Haiten are all seaports of importance. All of them are in crying need of wharves and other improvements. There are lands for sugar growing, but hardly any mills, vast tracts for coffee and fruit growing, but few facilities for getting the products to market, and great forests of valuable woods, equally hampered by lack of means to utilize them. Given a period of rest from incessant revolution, Haiti can pay the bill for its improvements.

The coffee alone, if properly cultivated, could support the entire country. Sugar-growing possibilities are vast and the forests are rich in such woods as mahogany and lignum vitae. Added to these resources are mineral deposits, which, though not so certain in quantity, are sufficiently in evidence at least to justify investigation. The population is, at heart, industrious and mentally alert. Lack of incentive has held it back for many years and has seemingly smothered these qualities entirely, but they could be easily quickened into life. Haiti is ripe for development in which the civil engineer should play no small part.

Chicago Building-Code Violations Getting Publicity

THE FIRE-STOP clause in the Chicago building code is in a fair way to be enforced, for a special educative effort is being made to bring to the attention of the public the reasons for the stops at floor levels and show how little the point is heeded by the building inspectors. Former building commissioners have pleaded lack of inspection force whenever vigorous appeals have been made to see that all the provisions of the code are carried out. As yet no adequate reason has been given in Chicago for disregarding in so many cases a really troublesome detail in building construction. The *American Lumberman* of Sept. 4 reports an elaborate investigation of apartment buildings and finds the responsibility is largely with the mason contractor. The architect, if a bona fide one is employed, usually covers the point in a general way, requiring the contractors that work on the building to observe all rules and regulations of the city. Occasionally it has been found that a specification will repeat in substance the specification in the code. The latter reads as follows: "In buildings of every class where wood furring is used on brick walls, the brick between joists shall be projected from the bottom of the joist to the top of the joist for the full thickness of the furring, and in no case shall such projection be less than 2 in." The idea is to seal off each vertical space between furring strips at every floor level so that any fire which starts in a lower floor will not be provided with a continuous flue from basement to attic. If proper stops are built the fire will often languish from lack of oxygen, and be confined to the locality of its origin.

The National Board of Fire Underwriters is initiating an active campaign in an endeavor to educate the general public in good fire-resisting construction. A series of illustrated pamphlets dealing with details of such construction for various classes of buildings is being prepared. While many of the activities of the association in the past have been directed toward the displacement of wood in the endeavor to effect a fireproof structure, it is highly important that fire-resisting methods of construction be promoted vigorously. Many buildings, with exterior walls only of material other than lumber, come within the fire limits. Since records show such high percentages of fires starting within, building departments can serve the public in no better way than in a strict carrying out of such fire-preventive measures as are contained in their code.

World's Longest Arch, Across Hell Gate, New York City, Is Closed and Swung as Planned

Closing Bottom-Chord Sections Set September 30 in Record Time—Lowering Jacks Under Erection Backstays Next Day Brings Arch to Bearing—Floor System to Be Placed as Backstays Are Dismantled

AT TEN O'CLOCK on the morning of Sept. 30 the south bottom-chord section forming the first connection between the east and west halves of the 977½-ft. Hell Gate arch of the New York Connecting Railroad in New York City, the world's longest arch span, was fitted into place with 3½ in. to spare on its west end. The member was raised and set in 25 min. by the two traveling erection towers which had built each side of the arch. This time was 10 min. less than the best time made in erecting any previous section of the bottom chords. Shortly after noon the closing member for the north truss was successfully set in the same length of time, although the hot sun had expanded the bridge till there was less than 2 in. clearance in which to manipulate the 90-ton chord section.



LAST CHORD SECTION, ASSEMBLED WITH GUSSET PLATES, WEIGHED 90 TONS

The two diagonals from the top of the east side of the panel to the bottom of the west side were next set with half the diagonals from the bottom of the east side. The closing panel is a true center panel, and the temporary hinged bearing that will support the arch till the full dead load is being carried is in the bottom chord at the west end of this panel.

TELEPHONES SYNCHRONIZE WORK

On Oct. 1 the jacks on the main posts of the backstays, which rest on the two main piers, were lowered varying distances from 15 to 20 in. to bring the center hinge to a bearing. This operation was successfully accomplished and the eyebar ties over the backstay posts were released in about 1¼ hr. through the use of a multi-party telephone line with stations at the center, at each backstay jack, at each counterweight and at the office. Men stationed at all these points were thus kept continually informed of all relative movements, each station being directly connected with all the others, and all "listening in" to the orders and reports from each of the points. Previous calculations of the required movements at each jack had been made to insure even lowering at the top hinges so that no appreciable shear would be transmitted through the center chords. Scales adjusted to allow for the unsymmetrical lengths and weights of the two cantilever halves were placed beside the jacks, and the lowering operations thus were made absolutely uniform and exact.

The erection of the backstay material on the Ward's Island end began about Feb. 1, and about June 1 the shoes were set and the erection of the arch proper progressed continuously without any effort at record-making for the four months until closure on Oct. 1. No lives were lost in this operation; safety and accuracy were considered of primary importance throughout. The total weight in the arch as now erected is about 13,000 tons, and there are about 23,000 tons in both backstays and anchorages. When completed with hangers and floor system in place there will be nearly 20,000 tons of steel in the arch span.

ADJUSTMENT BOLTS FOR TOP CHORDS

The east ends of the top-chord sections in the center panel were at once riveted up, but the west ends will be left free to move until the arch has reached its final position under full dead load. These ends slide on shelf angles on the east end of the last top-chord members of the west half of the arch. In order finally to match up this panel point it was thought best to leave one pair of members blank and drill them by the other pair after the arch was under full dead load.

As temperature changes on any ordinary day would throw this work out of alignment before holes could be drilled to insert enough drift pins to withstand the temperature stresses, some means had to be provided for holding the top-chord sections rigid at this panel point. This is accomplished by a 7-in. diameter bolt inside of each top-chord section parallel to its center line. The end of one of these bolts is shown in an accompanying photograph. The nuts on these huge bolts engage diaphragms in the top-chord sections of the panel west of the center. These bolts are strong enough to take all temperature stresses and hold the ends of the top-chord sections rigid till they can be drilled and riveted.

DRIFT PINS HOLD BOTTOM CHORDS

As the dead load stress is carried by contact joints in the bottom chord, it was



SECTION BEING RAISED INTO POSITION WITH 3½ INCHES CLEARANCE



SETTING THE FIRST CLOSING MEMBER IN THE WORLD'S LONGEST ARCH SPAN



GIANT BOLTS TAKE TEMPERATURE STRESSES WHEN TOP CHORDS ARE CLOSED



ELEVATOR FOR MEN AND LIGHT LOADS



CHORD SECTION SET IN 25 MIN.—A RECORD FOR THE JOB



FALLS REACHING DOWN FOR LAST BOTTOM CHORD MEMBER



LAST BOTTOM CHORD SECTION NEARS ITS FINAL POSITION

not desirable to rivet the bottom chords at the panel points until the arch was swung. Bolts could not be used under such heavy loads. They cannot be made a driving fit nor be tightened enough to prevent slipping. Consequently, all the holes would have been out by the difference in the diameter of the hole and of the bolt before the time came to rivet them.

The solution was found in the use of steel drift pins, with which every panel point in the bottom chord now bristles. Enough of them are used to carry all the dead load stress, and only enough bolts are used to clamp the plates of the adjoining chord members together and prevent their spreading under stress. Riveting on the bottom chord will be begun now, but will not be carried far until the steel for the floor system is in place. Some of the 1¼-in. rivets used are 11 in. long.

ELECTRIC EQUIPMENT

There is an electrically driven compressor plant on each side of the river. Air is piped to the riveters through an air main at the level of the top chord for each side of the arch. The travelers are operated entirely by electric hoists. Current is carried across to Ward's Island in a submarine cable laid especially for the job.

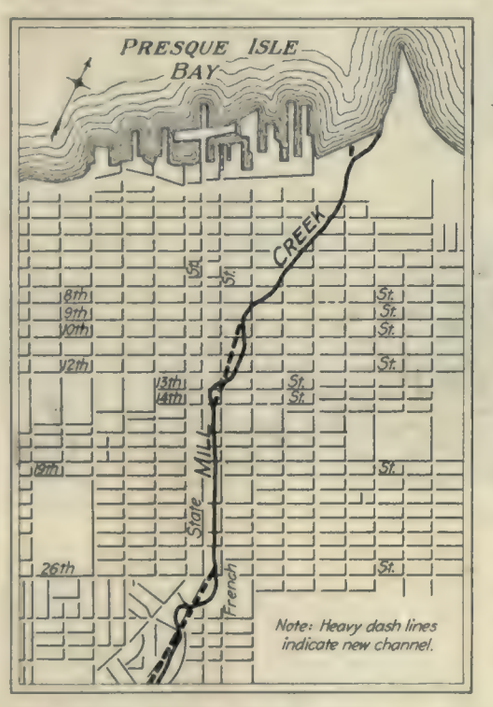
To carry men and light loads quickly to the top of the bridge while the main travelers are working out over the river, two elevators, one of which is shown in an accompanying photograph, are used. They are handled on two parts of wire rope by the backstay travelers, and are tagged by a small block at one side of the car which runs on a wire-rope guide. These guides, stretched from the top laterals to dead men in the ground, are purposely out of plumb. This causes the cars to hang on the under sides of the guides, and prevents twisting.

The Hell Gate bridge was designed and is being erected under the direction of Gustav Lindenthal, chief engineer, and O. H. Ammann, assistant chief engineer of the New York Connecting Railroad. H. W. Hudson, construction engineer, has immediate supervision of the erection. The contractor for the fabrication and erection of the arch is the American Bridge Company, for which C. G. Emil Larsson, assistant chief engineer, is in general charge of the work, and J. B. Gemberling, erection manager, is in charge of erection. J. Loewenstein, H. H. Starr and W. J. Parsons, engineers for the American Bridge Company, are connected with the work, and Daniel Burns is general foreman in direct charge of erection.

Erie Can Remove Flood Menace by Spending $798,000 on Mill Creek Improvement

Farley Gannett, in Report to City Engineer, Recommends Channel Rectification, Closed and Open Sections of Conduit and Dry Reservoir for Stream Control

TO prevent a repetition of the disastrous flood which swept through Erie, Pa., last August, a project involving the expenditure of $798,000 for the rectification of the alignment of Mill Creek, the substitution of a closed concrete conduit and an open, concrete-lined channel for the present stream bed and the construction of a dry detention reservoir to impound extraordinary flood flows and control the stream flow, has been proposed by Farley Gannett, consulting engineer, of Harrisburg, in a report submitted Sept. 25 to Benjamin E. Briggs, city engineer of Erie. Of the several possible methods of stream treatment considered Mr. Gannett recommends that the following one be adopted on the grounds of effectiveness and economy:



NEW PLANS REMOVE SHARP BENDS IN MILL CREEK CHANNEL

PROPOSED PLAN

The closed, reinforced concrete conduit proposed extends from the lake front at the Pennsylvania Railroad crossing to the Nickel Plate railroad crossing, approximately 8100 ft., eliminating all sharp bends and relocating about 2400 ft. of the channel to obtain a shorter and straighter course. It will be 18 ft. wide by 14 ft. high, and will have a capacity of 6000 sec.-ft. From the Nickel Plate crossing to the city line the creek will be carried in an open, concrete-lined channel, 4800 ft. long, 25 ft. wide on top and 12 ft. deep, with the same carrying capacity as the closed conduit. A dry reservoir at the forks in the creek, 1¼ miles above the city line, having a capacity of 52,000,000 cu. ft. is recommended. This reservoir would ordinarily be empty, as it would be drained by a culvert large enough to pass all but exceptional floods. The plans would effectively prevent floods in Mill Creek, Mr. Gannett states, and the cost would be far less than the damage done by the flood of Aug. 3, which was described in detail, with records of rainfall and runoff, in the Engineering Record of Aug. 14, page 186.

DESCRIPTION OF MILL CREEK

Mill Creek is a small, swift stream flowing into Presque Isle Bay, Lake Erie, through the eastern part of the city of Erie, draining at its mouth 12.9 sq. miles. Of this area, 2.0 sq. miles lie within the city limits and are largely built over. The watershed lies in the sandy, gravelly soil typical of this once glaciated region, and is underlaid by a gray slate formation, which is productive of a high rate of runoff, particularly when the gravel subsurface soil is saturated.

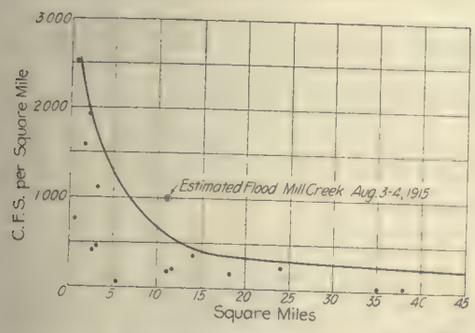
The uplands are in a high state of agricultural productivity, while the lower valleys are deep and bordered with steep hills. The countryside is composed of rolling hills, with small patches of timber. The only village on the watershed is Belle Valley, composed of a small group of houses. Just before entering the city limits the stream emerges from a narrow valley, through which it passes for about 2 miles. The sides of this part of the valley rise sharply about 100 ft. above the water.

The sources of Mill Creek are at an elevation of 1100 to 1300 ft. above sea level, or 500 to 730 ft. above Lake Erie. Above the city for two miles the fall of the creek is





THIS IS THE SORT OF DAMAGE WHICH THE ERIE FLOOD PREVENTION PLANS, IF ADOPTED, WILL RENDER IMPOSSIBLE

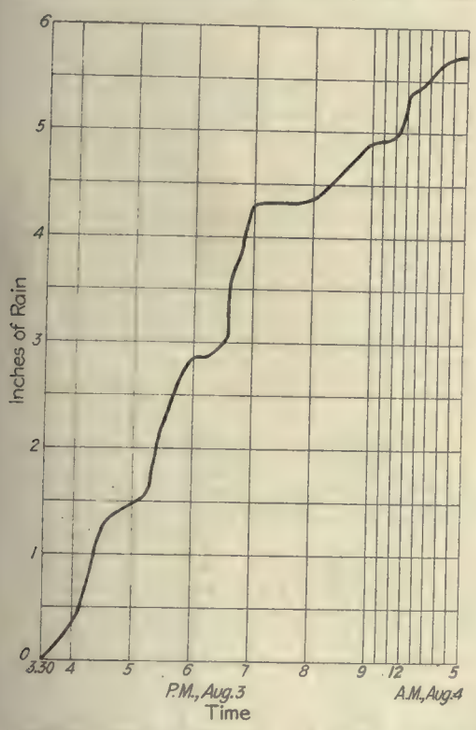


MAXIMUM RECORDED RATES OF RUNOFF FOR PENNSYLVANIA STREAMS

1.04 ft. per 100 ft. At the southern boundary of the city the creek is at an elevation of 170 ft. above the lake. The fall per 100 ft. through the city is 1.20 ft., being 20 per cent steeper than in the section above.

AUGUST FLOOD

The total rain for the storm at Erie was 5.77 in., between 3.30 p. m., Aug. 3, and 5 a. m., Aug. 4. The rain in the hills above the city was about 40 per cent greater than



ACCUMULATED RAINFALL AT ERIE DURING THE STORM OF AUG. 3-4, 1915

at Erie, and such in fact must have been the case to have caused the extraordinary rate of flow that occurred. The evidence is that the rain was largely confined, on the upper watershed, to the period from 5 to 8.30 p. m. The comparatively short time within which it fell is the reason for the great flood which resulted.

At Twenty-sixth Street the rate of flow per square mile from the 11 sq. miles above that point was about 1000 cu. ft. per second per square mile. This figure has often been exceeded from smaller areas but seldom from so large a watershed, according to Mr. Gannett. The extraordinary volume of this flow of 11,000 sec.-ft. may be best appreciated when one realizes that it is about nine times the extreme dry weather flow of the Ohio River below Pittsburgh, which drains 23,000 sq. miles, against 11.1 sq. miles drained by Mill Creek above Twenty-sixth Street, in Erie.

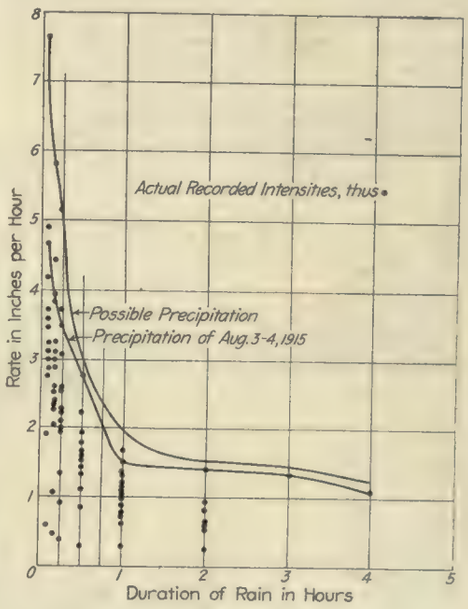
One of the most destructive features of the flood was the vast amount of débris, consisting of trees, brush, lumber, parts of houses and barns, and all manner of furniture and personal property, including carriages, wagons and automobiles, which was washed into the channel and clogged the bridge and culvert openings over the creek. In the city limits not one of the twenty-one street crossings and three railroad culverts carried the flood. When they were overtopped, either the bridge or the culvert, or the approach fill was destroyed. In most cases the culverts stood and the fills failed by overtopping.

CHANNEL ENCROACHMENTS

The course of the stream through the city is extremely tortuous; there are two bends of approximately 90 deg. and numerous other sharp turns. Portions are walled in on one or both sides with concrete or stone walls. Buildings abut on and encroach upon the channel. The creek bed has long been used for dumping all manner of débris. Houses, mills, stores and factories have been built on the waterway, reducing its channel area far below safe proportions. All of these things contributed to reducing the channel area and to lessening its capabilities of discharging a large volume.

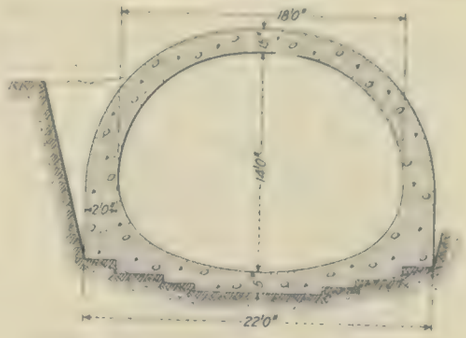
IMPROVEMENTS RECOMMENDED

Wherever possible the present alignment would be followed in Mr. Gannett's plan, but, as it is most essential that all bends be eliminated and that the route be made as short as possible, certain changes in alignment are desirable, as shown by the dash line on the accompanying map. The greatest divergence of the revised alignment from



PRECIPITATION INTENSITIES AT ERIE SINCE THE YEAR 1900

the present channel would be from Tenth to Twelfth Street, where they are approximately 200 ft. apart. The new line traverses a section in which few buildings stand and in which all were either removed or badly damaged by the flood of Aug. 3. From Fourteenth Street to Twenty-sixth Street the old channel is closely followed. At Twenty-sixth Street the new line swings on an easy curve to the west of the present creek, crossing it at Hill Road and Moorhead Street, eliminating two sharp bends and 1000 ft. of length, terminating to the west of the old line near the city limits. The improved channel would terminate in an in-



PROPOSED CLOSED CONDUIT SECTION

take, with wing-walls and dikes designed to throw the water into the concrete channel. Between the intake and the reservoir it is proposed to remove dead trees, logs and débris and to improve the existing channel in some places.

DRY DETENTION RESERVOIR

Where the side hills converge 1¼ miles above the city line, a dry detention reservoir is proposed. This reservoir, formed by a massive concrete barrier, 60 ft. high, with an opening in its base 7.5 ft. in diameter, would have a capacity of 52,000,000 cu. ft. or 390,000,000 gal. This structure would be 350 ft. long on top and approximately 40 ft thick at the base. The reservoir would be 1 mile long, but the land inundated would be of small value, as most of the 55 acres is stony lowland or steep valley side.

The reservoir would seldom have any water in it, as only at long intervals would a flood come down the creek larger than would be carried by the culvert which would drain it. But at the rare intervals when such a flood did come the reservoir area would be there to absorb it, letting out just so much water as could be safely carried down through the city. The conduit is so designed as to be capable of carrying the water let through the reservoir plus the maximum runoff from the area north of the reservoir which would enter the creek. The reservoir would catch débris from the 8.5 sq. miles above it and so prevent its getting into the channel. A drift, or débris catcher or deflector, could also be constructed at the upper end of the concrete channel.

The economic advantage of the reservoir scheme lies in the fact that, through its construction, the channel through the city can be made much smaller at a large saving in cost. Some day the channel between the city line and the reservoir will have to be improved and this work would also be cheaper if there were a reservoir.

REASONS FOR CHANNEL SECTIONS

The open, sloping-sided channel above the Nickel Plate railroad crossing is recommended for several reasons. The land is not so valuable as below. The sloping-sided channel is cheaper than the closed conduit and there is little immediate need of covering this portion of it. If the city



PROPOSED OPEN CHANNEL SECTION

purchases the abutting property along the creek, from the Nickel Plate railroad to Glenwood Park, for park purposes, it would never need to be covered.

Below the Nickel Plate railroad crossing the land is valuable and the construction of a covered conduit through this section would result in the reclaiming of 12 acres of land for residential, commercial and industrial use. It is believed that this would represent a value of several hundred thousand dollars. About 150 acres in this part of the city, below Twenty-sixth Street, was depreciated and damaged by the flood of Aug. 3. With the creek inclosed and no longer a potential danger, and with this land utilized by buildings, it is computed that the increased taxes would more than pay the interest and sinking fund charges for this work. After completion of the conduit, property owners will rapidly refill the area over it to street grades and utilize it. At least, such has been the experience in other places.

At Twenty-sixth Street a high concrete arch bridge is proposed, spanning the entire valley with one or two arches.

The estimate includes reconnecting all broken sewers with the interceptor in the lower portion of the city, and siphoning under the conduit at all sewer crossings. It also includes refilling all street crossings and repaving streets at creek and conduit crossings and replacing curbs and sidewalks. It also includes cleaning up the remaining débris and leaving the entire area in a suitable condition.

Manholes at street crossings would give access to the conduit for inspection and cleaning, although the high velocity, 20 miles per hour during extreme floods, would keep it clean. The grade has been determined so that the top of the conduit and top of the walls of the open section will be below street grades.

The work can be done well within the cost of $798,000, Mr. Gannett states, if contracts can be let this fall or early next winter, but as prices for labor and materials are rising, delay beyond that time will probably increase the cost materially.

HOLDING-DOWN BOLTS of Monel metal in the Evanston (Ill.) rapid filter underdrains are giving satisfaction, none having broken since they were installed six months ago. Many of the first set of ¼-in. bronze bolts and the second set of ⅜-in. bronze bolts gave a great deal of trouble from breaking.

Design of Scroll Cases and Intakes for Single-Runner Turbines Analyzed

Part II—Location of Case, Allowances to Be Made in Calculations and Desirable Shape of Cross-Sections, Floor and Roof Discussed

By A. G. HILLBERG
Hydraulic Engineer, New York City

THE VERTICAL sections of a scroll case should as far as possible be symmetrical about the horizontal center line of the distributor. Consequently, this center line must be known before the scroll case can be given its shape. In determining the location of the horizontal center line of a distributor, which is a plane in which are located the horizontal center line of the wheel gates as well as the rated diameter of the turbine runner, the velocity of flow in the upper part of the draft tube must be known. This velocity can be determined by the formula $v = c\sqrt{2gh}$, where c is a constant depending upon the design of the runner. For larger low-head units c varies from 0.3 to 0.4. The turbine builder must be requested to give either this constant or the velocity of flow directly. Should the designer of the power-house substructure require a value of c to enable him to locate approximately the center line of the unit, before the design of the turbine has been determined definitely, it is better to assume too high than too low a value.

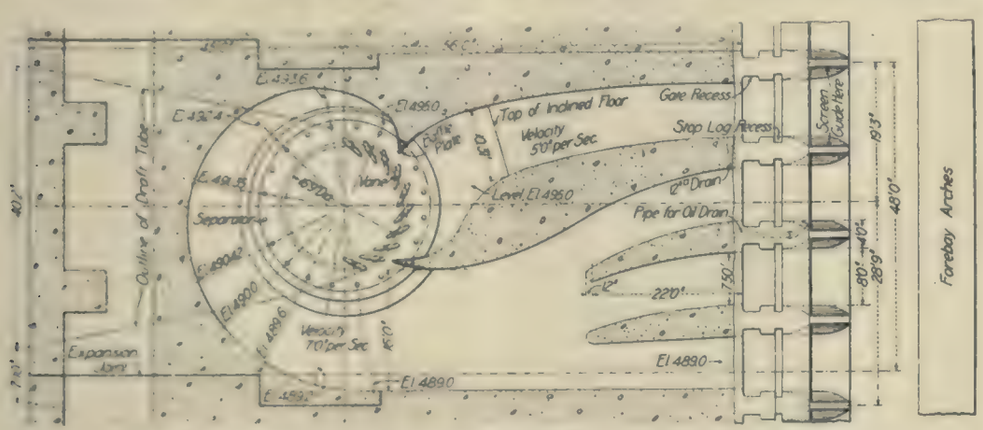


FIG. 5—WELL-DESIGNED SCROLL CASE—ONE-FOURTH OF DISCHARGE FED DIRECTLY TO WHEEL IN ORDER TO DECREASE OVER-ALL WIDTH OF UNIT—IN THIS CASE $\alpha = 315$ DEG.

Criticism—Fillets are too small, which permits dead water, thus decreasing effective area of section.

In locating the horizontal center line of the distributor above the lowest tail-water level the determining factor is the atmospheric pressure, which at the sea level and 62 deg. Fahr. equals a column of water 33.9 ft. in height. The height of this column decreases with the increase in altitude. The total draft head, however, that is, the static head plus the velocity head, must be made less than the theoretic barometric column for the elevation under consideration, because a margin should be allowed:

1. For governing purposes, as a sudden closing of the turbine gates tends to increase the vacuum immediately below the runner, and a margin must be available in order to prevent the total draft head from exceeding the height of the barometric column.

2. For the vapor tension of the water—or, in other words, the absolute pressure of the water in the draft tube just below the runner should not be less than the pressure at which water will vaporize under the existing temperatures. For ordinary temperatures this pressure is less than 1 ft. of water, and hence a very slight margin need be allowed on this account.

In the usual installation air leakage into the draft tube is a negligible factor and need not be considered as affecting the draft head.

Because of the losses in the draft tube due to friction and curvature and the outflow loss from the draft tube, all of which tend to decrease the total actual draft head, it is possible to increase the distance of the turbine above tail water.

It is customary to measure the static head to the top of the runner band, or the bottom of the distributor, which is the same thing. The velocity inside the band of the runner at this point is calculated, so that a maximum value of the total draft head is obtained. It may be argued that the vacuum does not extend into the runner as high as to the bottom of the distributor,

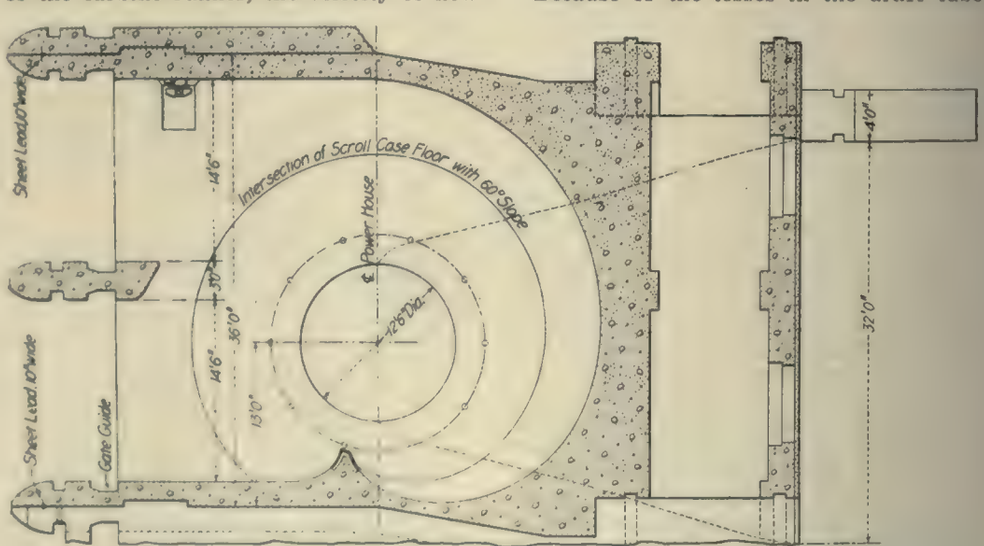


FIG. 6—POORLY DESIGNED SCROLL CASE—INTAKE TOO SHORT—PIER NOSE TOO BLUNT—$\alpha = 340$ DEG.—POSSIBILITY OF AN EDDY BECAUSE OF SHARPNESS OF CURVE CONNECTING MASONRY WITH SCROLL NOSE

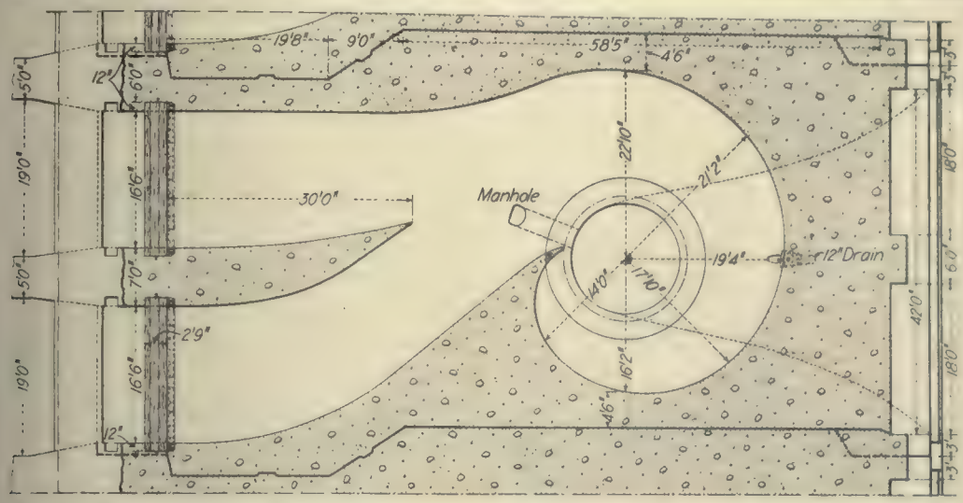


FIG. 7—EXCELLENTLY DESIGNED SCROLL CASE AND INTAKE—$\alpha = 260$ DEG.—NOTE SMOOTHNESS OF CURVATURE AND THINNESS OF PIER NOSE

which is true of that part of the runner adjacent to the band. At the center, however, it does extend that far, and in some wheels even a little farther, because the water at the center of the runner has already been discharged from the runner passages at that elevation. Consequently, if the vacuum is too high, there is danger of erosion at the center, if not elsewhere.

Applying Bernouilli's theorem to this case, the equation

$$D = E + (v^2/2g) - L$$

can be established, where D = total draft head at the runner; E, difference in elevation between top runner band and lowest tail-water level; v, velocity of flow through band of runner at full load; g, 32.16; and L, all losses due to friction and curvature in draft tube and outflow loss at end of draft tube.

It can be readily seen from this formula that for a given value of D the greater the losses are in the draft tube, the greater is the value of E. Thus, in determining the value of E for a given plant, a margin must be allowed between the total draft head at the runner D, and the height of the barometric column, in order to allow for governing and vapor tension, as mentioned above.

If, therefore, E is solved for in the formula and D is given the value $33.9 - M$, where M is the margin allowed for governing and vapor tension, the formula becomes

$$E = 33.9 - (M - L) - (v^2/2g)$$

In this equation all quantities are known except E and $(M - L)$. It is usual to assume the value of $(M - L)$ to be from 3 to 6 ft., depending upon the physical conditions of the plant in question. Should the draft tube be excessively long, therefore, and the expected load variations severe, it is advisable to assume the higher value of 6 ft. In the case, however, of a plant with a normal-length draft tube, where the load conditions ordinarily would be steady, the minimum value of 3 ft. could be used.

Conservative engineers have, in the design of very large draft tubes, where the conditions were favorable and v was 18 ft. per second, used 8.9 ft. as the value of $(M - L)$, thus making E 20 ft. It must be borne in mind, however, that such a procedure is not always advantageous, as one of the advantages of single-runner units is that the runner can be placed high enough to make it accessible for inspection at average stages of the tail water, without requiring cofferdamming the draft-tube opening, and pumping out the water.

The horizontal center lines of the cross-sectional areas of the scroll case should be located in the same plane as the center line of the runner. It is, however, not always possible to do this, for reasons that will be given later.

SHAPE OF SECTIONS

Theoretically the best shape of the cross-sections of a scroll case is circular, as the hydraulic radius is then a maximum and the difference between the maximum and minimum velocities of the flow in the section a minimum. Economic reasons, however, prevent the use of such a shape, as the width of the unit, and, consequently, the amount of concrete needed in the substructure would be unduly large. In order to reduce the over-all width of the scroll case as much as possible the cross-sectional areas are usually flattened in such a way that their longest dimension is vertical.

To facilitate the form work it is customary to make the far side of the scroll case, that is, its periphery, vertical. The floor and the roof may be horizontal, but as sharp corners will create "dead" water, thus reducing the sections, large fillets must be provided. These fillets are sometimes so large that they meet in the center, thus making the roof and the floor arcs of circles in the transverse sectional elevation.

The upper and lower foundation rings of the speed ring usually have curves conforming with the arcs of circles. In that way an efficient bell mouth is created. To increase the effect of this bell mouth the scroll case is connected by sloping sides to this speed ring. These sides have a slope

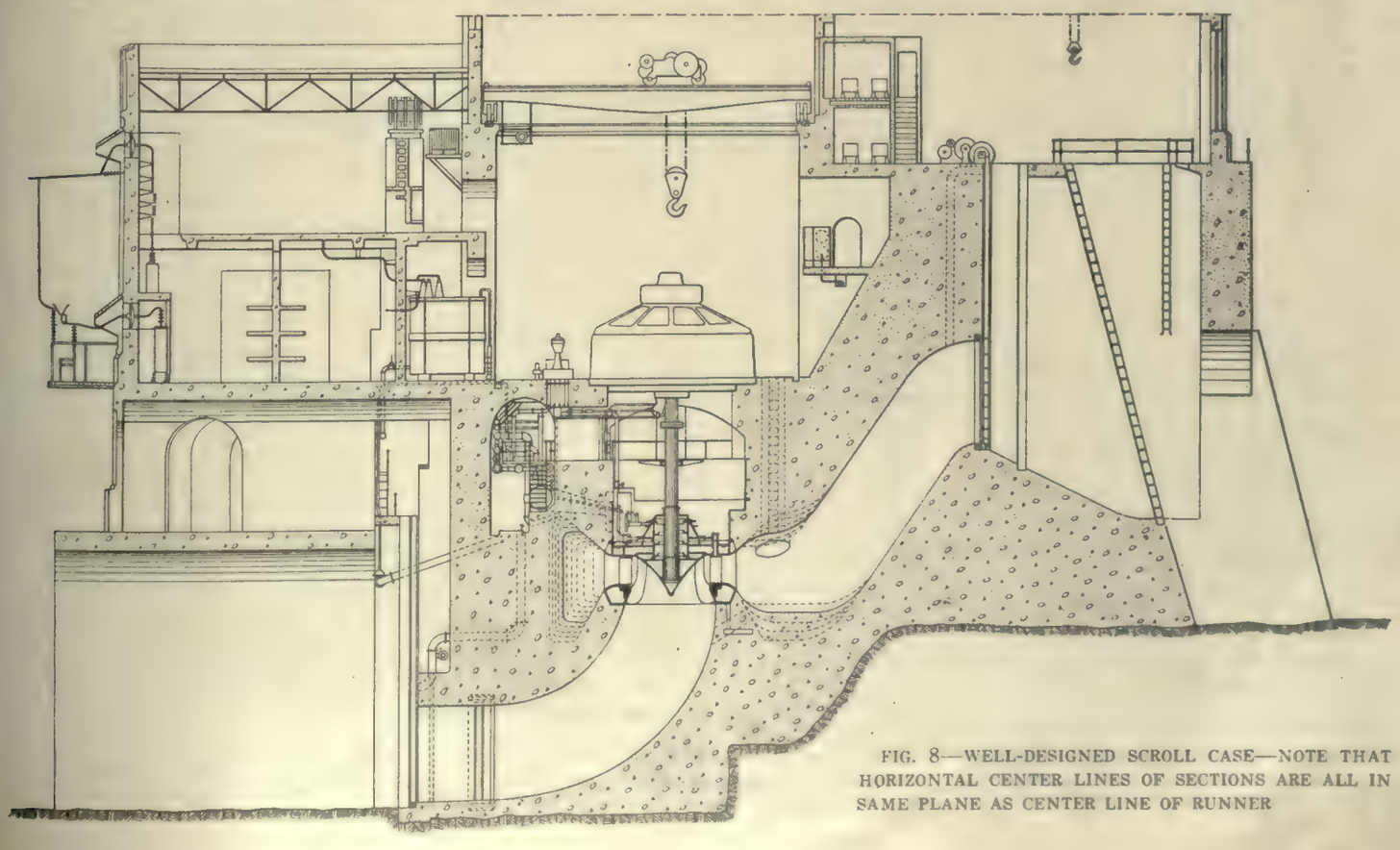


FIG. 8—WELL-DESIGNED SCROLL CASE—NOTE THAT HORIZONTAL CENTER LINES OF SECTIONS ARE ALL IN SAME PLANE AS CENTER LINE OF RUNNER

of from 45 to 60 deg. with the horizontal. The effective area of the scroll case sections, however, are to be figured up to the outer edge of the speed-ring vanes. Typical scroll-case sections are shown in the accompanying drawings, Figs. 5 to 8.

As previously stated, the most advantageous location of the scroll case is when its horizontal center line conforms with the horizontal center line of the runner. Generally such a location will place the scroll case rather high, thus requiring more concrete in the substructure than with the center line at a lower elevation. This may lead the reader to believe that the lower the center line of the scroll case, the more economical will be the substructure, but there is a limiting feature which cannot be disregarded without serious effect. The draft tube curves in a downstream direction, and the designer must provide enough masonry between it and the scroll case to prevent the water from breaking through or even percolating through the masonry at the thinnest point. The critical section is generally that located on the transverse center line of the unit, or, more exactly, that located in a vertical plane laid through the axis of the draft tube.

Floor and Roof

The floor and roof of a scroll case can be parallel to each other until such a point has been reached that it is necessary to slope them toward each other in order to reduce the cross-sectional areas of the scroll; they can be given a uniform slope from the beginning to the end of the scroll, or the roof can be kept horizontal while the floor is given an upward slope. For very large and deep scroll cases placed so that the horizontal center line is considerably lower than the horizontal center line of the runner, this latter arrangement is advantageous, as it brings the center line of the scroll higher and higher. As soon as a point is reached where both lines are in the same plane, the roof should also be given a slope, so that this condition is maintained for the rest of the way.

As long as the cross-sectional areas are comparatively large, and, consequently, the amount of water abundant, it does not make much difference whether or not the horizontal center lines of scroll case and runner coincide, but the smaller the area gets and the smaller the amount of the available water becomes, the more important it is to have this condition satisfied. Furthermore the hydraulic radius should also be kept as large as possible, and in order to accomplish that it is necessary to design the smaller areas with a rapid decrease in height.

The author wishes to express his thanks to Chester W. Larner, hydraulic engineer of the Wellman-Seaver-Morgan Company; H. B. Taylor, hydraulic engineer of the I. P. Morris Company, and F. H. Rogers, assistant hydraulic engineer of the same company, who have been kind enough to examine the manuscript of this article and to submit valuable suggestions.

HYDRANTS MANUFACTURED in the municipal shops of the city of Chicago numbered 1832 in 1914, an increase of 457 over the previous year's output. Repairs were made on 1054 hydrants during the year. The 1448 valves manufactured ranged in size from 4 to 16 in. The work performed in these shops aggregated $421,525.80.

Colorado Makes 50 Per Cent Saving with Convict Labor

J. E. Maloney, State Highway Engineer, in Discussion, Describes How Criminal Labor Is Organized for Road Work

CONVICT LABOR used on 140 miles of State road work in Colorado during the years 1913-14 has resulted in a saving in cost to the State of approximately 50 per cent, according to J. E. Maloney, secretary engineer of the Colorado Highway Commission, in his discussion of the paper on "Convict Labor," presented by G. P. Coleman, State highway commissioner of Virginia, on Sept. 16, before the Pan-American Road Congress. Forty miles of the work was through a rough mountainous country and about 100 miles through the more level plains section.

According to Mr. Maloney convict labor is especially adapted to rough, sidehill work, where but few teams are required, and where a large number of men can be used to advantage after the grade line is established and the work opened up.

Convict Camp Organization

The camp is placed in charge of a superintendent, who is assisted by one or more foremen. These men are all the salaried officials connected with the camp. Anywhere from 25 to 75 prisoners are detailed to a camp. The selection of the men who are placed in charge of the camp is in the hands of the penitentiary officials. The salary of the superintendent runs from $100 to $125 per month, and for the assistants the salary runs from $60 to $75 per month. In addition to salary, board is furnished.

In all the camps in the State the equipment is paid for from the county and State road fund. This equipment consists of wall tents of extra heavy canvas, with flies, and in the winter the walls of the tents are boarded and papered and heating stoves provided. The men sleep in separate bunks, from four to eight in a tent. Then there are the superintendent's quarters, the assistants' quarters, the cook and dining tent, the commissary tent, and the necessary tents and shelter for the stock. The men are well provided with clothes from the penitentiary, but are not in stripes, being clothed about the same as an average workman would be clothed around any contractor's camp. The sanitary conditions are looked after carefully, especially the cleanliness of the camps and the men. Sanitary precautions are taken and a close inspection of the health of the men is made.

The stock necessary for the hauling of supplies to the camp or for work upon the roads is also paid for by the county and State road fund. A camp outfit for 35 men costs about $2,500, not including the cost of the stock.

Choice of Camp Officials Important

In organizing a convict road camp, according to Mr. Maloney, it is important that the men selected as superintendents and foremen or overseers should be properly qualified for their place, as these are most important positions, and the success of the work depends entirely upon their management of the men and the work. Along these lines Mr. Maloney's remarks were in part as follows:

"A comparative idea may be had by the actual cost of labor per day per man actually at work on the road. This runs from 77 cents to $1.50 per day, and, having this figure, compare the relative efficiency of the labor as between the prisoner and the ordinary road laborer. It is believed this work of the prisoners will show an average saving of about 25 per cent for the conditions under which they have been worked in this State. In some cases a much larger saving than this is shown, and in other cases the saving is smaller.

"In addition to carefully selecting the men in charge of the work, it would be wise to have the State Highway Commission authorized to take entire charge of the direction of the work, especially as to the locality to be improved, and also in regard to the character of the work, in order that the improvements may be along some connected system of roads, rather than at disconnected points all over the State, and also in order that the work may be uniform and along standard lines."

Typical Costs from Two Camps

In one camp run from October, 1912, to July 1, 1913, the total cost was $6,284.74, equipment not included. The total number of days worked was 248. The average cost of food per man per day was 31.5 cents; the average cost per man per day was 61.5 cents; this includes all salaries, repairs, stock feed, etc., and the average cost per man per day actually worked on the roads was 77 cents. The average number of men in camp for this time was 40, about eight of these being used about the camp. The average number of head of stock, 8; average cost per mile of road built, $2,513.89. The men in this camp completed 2½ miles of 16-ft. road, all mountain sidehill work.

In another camp for the season of 1914, or from Aug. 1, 1913, to Sept. 1, 1914, the total number of days worked was 296½. The average number of men, 33; the average number of head of stock, 6; the average cost per man per day for food, 37.6 cents, and the average total cost per man per day was 89.15 cents; the average cost per miles was $3,163.60, and a length of 3.67 miles was finished during the season at a total cost of $11,613.96. The average cost per man per day actually worked on the road was $1.50. This included a drilling outfit, which cost $2,000. The work consisted of mountain sidehill and extremely heavy rock cut for about 1¼ miles; the remainder was earth and loose rock, moderately heavy timber clearing. The roadway averaged 16 ft. in width.

The Engineering Record for June 12, 1915, page 751, contains an article on "Virginia Convict Labor for State Road Work."

CONSTRUCTION BY NIGHT on the breakwater at Victoria, B. C., has been necessitated by the fact that but few low tides accur this season during daylight hours. About 150 ft. of concrete superstructure was added during the month of August, which was considered good progress. The following statistics were given out by Dominion Government Engineers' office at Victoria: The total amount of core, or fine rock, deposited up to Sept. 1, in breakwater and piers is 249,925 tons; of rubble, or coarse rock, 712,884 tons. From the time the contract was started not less than 66,373 tons of granite blocks have been deposited and 2978 cu. yd. of concrete facing, 18 in. thick, has been completed, while a total of 12,366 cu. yd. of concrete superstructure has been laid.

New Type of Chart Shows Operation of Terminal

Engineers Devise Simple Diagram for Recording and Analyzing Rush-Hour Train Movements at Dearborn Station, Chicago

DIAGRAMS showing the track occupancy and throat movements during the evening rush period at Dearborn Station, Chicago, which is used by eight railroads, have been prepared by the engineers of the Chicago & Western Indiana Railroad. At the bottom of the accompanying diagram the track layout leading into the station is shown. Above this are drawn on cross-section paper heavy horizontal lines numbered and named to correspond to the positions of the various terminal tracks. On the horizontal lines time is plotted, 1 in. being equal to 5 min. The vertical lines are used to indicate the number of cars per train, 1 in. being equal to 10 cars. In the accompanying reduced-scale cut only the 1-in. cross-section lines are shown.

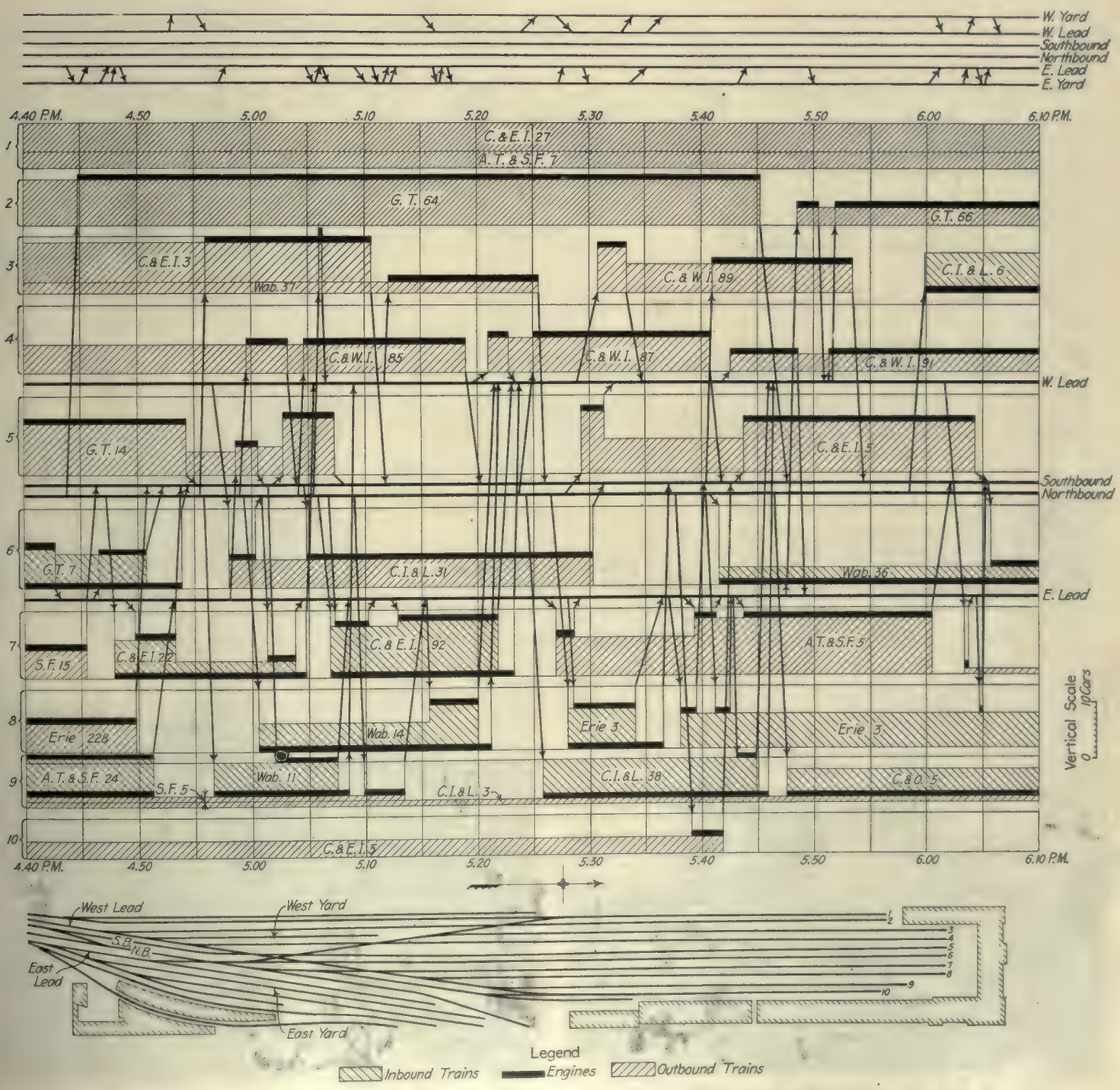
The timetable in effect when the diagram illustrated was made is shown in the accompanying table, although it appears in the upper right-hand corner of the original diagram. In the period of 1½ hr. there were 129 train or engine movements, averaging one every 42 sec.

Arrows are used to show the direction of engine movements. For example, at 5.28 p. m. a light engine comes from the northbound main to track 5 with outbound Chicago & Eastern Illinois train 5 of twelve cars. At 5.32 the engines go to the west lead with five of twelve cars. At 5.43 a road engine comes with three baggage cars and at 6.04 the train pulls out over the southbound main. At 5.30, it may be noticed, every track except No. 3 is occupied, and an outbound train is backing in on it. Track 1 could be emptied if needed, however, as it is only storing evening trains.

EVENING RUSH-HOUR TIMETABLE AT DEARBORN STATION, CHICAGO.

Arrive			Leave		
Railroad	Train No.	Time	Railroad	Train No.	Time
G. T.	7	3.30	A. T. & S. F.	15	4.45
A. T. & S. F.	24	4.30	Erie	228	4.48
C. & E. I.	22	4.50	G. T.	14	5.00
Wab.	11	4.55	C. & E. I.	3	5.10
Wab.	14	4.59	C. & W. I.	85	5.18
C. & E. I.	92	5.05	Wab.	37	5.25
C. I. & L.	38	5.25	C. I. & L.	31	5.30
Erie	3	5.30	C. & W. I.	87	5.40
C. & O.	5	5.47	G. T.	64	5.45
Wab.	36	6.00	C. & W. I.	89	5.53
C. I. & L.	6	6.02	A. T. & S. F.	5	6.00
C. & W. I.	602	6.05	C. & E. I.	5	6.04
			Wab.	39	6.20
			C. & W. I.	91	6.22
			G. T.	66	6.25
			C. & E. I.	27	7.30
			A. T. & S. F.	7	10.20

By the aid of this chart the operating officials can see at a glance what tracks are occupied at all times, and can also follow all train movements across the throat of the terminal blocking other tracks. The method of analysis is believed to have ad-



DOVETAILING OF TRAIN AND ENGINE MOVEMENTS IN DEARBORN TERMINAL, CHICAGO, DURING EVENING RUSH HOUR

vantages over any of those investigated by the committee on yards and terminals of the American Railway Engineering Association.

The diagrams and study were made under the direction of E. H. Lee, vice-president and chief engineer, and R. W. Stevens, general superintendent of the Chicago & Western Indiana Railroad.

SANDY SEWER TRENCHES for a 11½-mile system in Rockford, Ill., all required sheeting, but the work was completed in 4 months. Standard sewer pipe ranging in size from 9 to 33 in. was laid. About 17,000 ft. of 9-in. and 12,000 ft. of 10-in. pipe comprised the largest quantities of any one size. Work was started April 31 and by July 31 the job was completed except for a few manholes. Eleven gangs were maintained by the contractors, the J. B. Sheets Company, of Pittsburgh.

New Type of Submersible Lock Gate at Keokuk Operated by Compressed Air

Unusual Depth to Bedrock Led to Adoption of Floating Gate Controlled by Buoyancy Chambers—Gate and Railroad Bridge Combined

By B. H. PARSONS

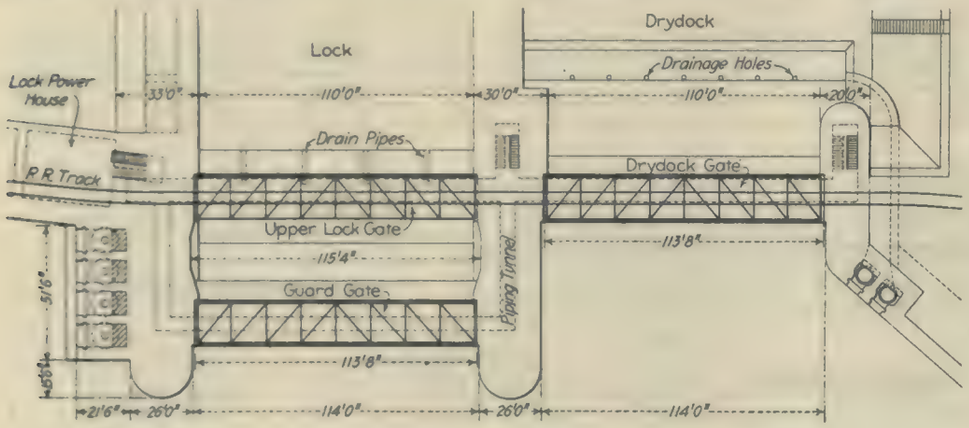
Member, Hugh L. Cooper & Company, Consulting Engineers, and During Construction, Mechanical Engineer of the Mississippi River Power Company

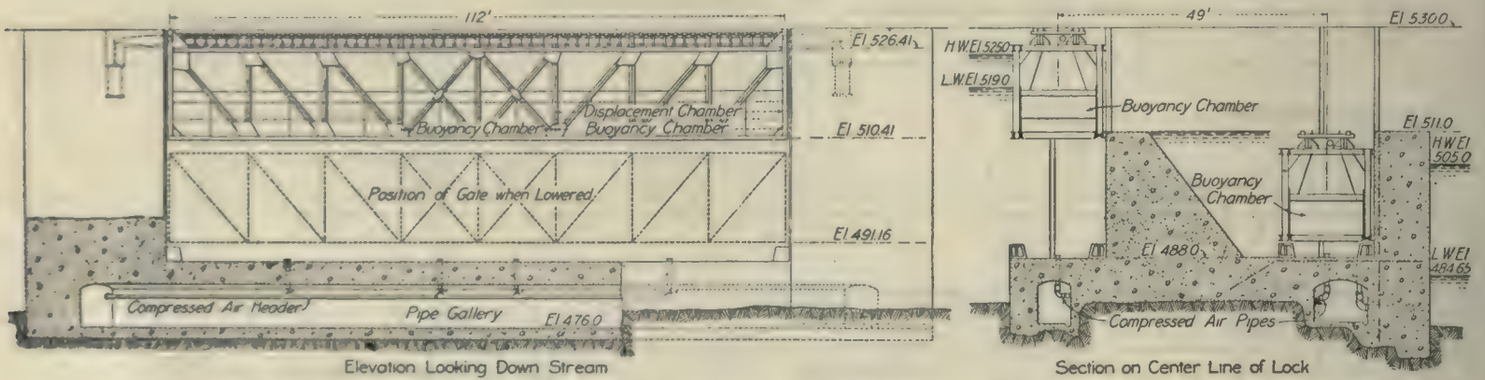
A SUBMERSIBLE lock gate, extending straight across the lock, floating partly out of water when closed and submerged to the level of its sill when open, its movement vertical and controlled by varying the displacement of buoyancy chambers by compressed air—this is a new type and marks a departure in lock-gate design. The writer is not aware of the existence of any similar gate prior to the design and installation at Keokuk.

However simple its form and manipulation, a novelty in such a structure as a lock gate, long established and familiar to all, seems to be cause for interest and speculation. This gate, without machinery, which disappeared beneath the surface, or emerged, frequently covered with fish, excited the curiosity of river folk along the Mississippi and attracted attention generally. New things are invented from time to time, but novelty in engineering structures usually indicates merely the correct adaptation of design to unusual circumstances or conditions of nature.

The lock has been in commission for two years and its operation has not been interrupted during navigation seasons. The gates have, therefore, been thoroughly tested by regular and continuous service. The result is satisfactory in every respect. No lack of compressed air has occurred, nor any shortage in pressure or volume. The power plant operates automatically and requires but little attention. The gates remain, without change or alteration, the same as when first turned over to the Government. After this demonstration of success, the gate is submitted to engineers as a proper solution for the Keokuk lock.

A previous article which appeared in this





GENERAL PLAN, ELEVATION AND SECTION OF GATES—RAILROAD CARRIED BY UPPER LOCK GATE AND DRYDOCK GATE

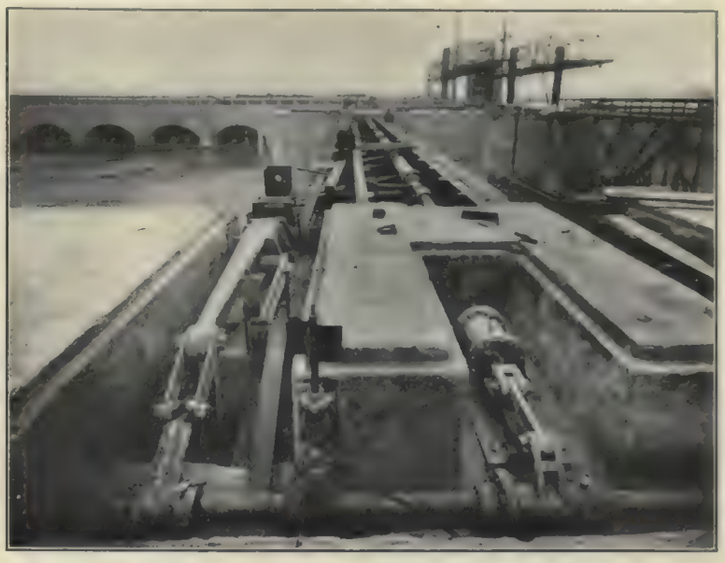




TWO VIEWS OF UPPER LOCK GATE AND GUARD GATE—NOTE SMALL LEAKAGE IN RIGHT-HAND PICTURE



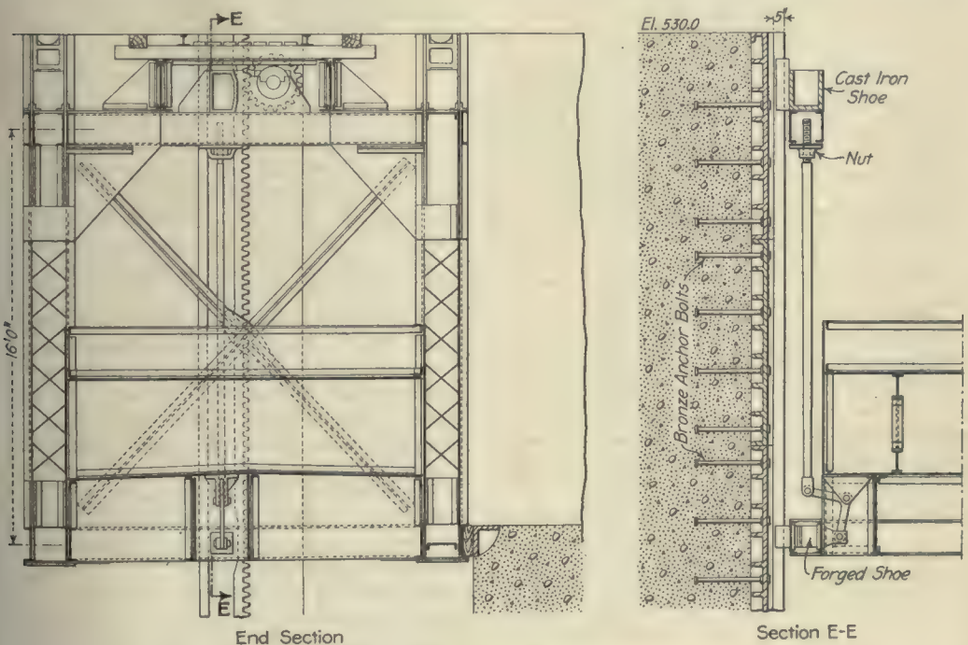
UPSTREAM GENERAL VIEW OF ENTRANCE TO LOCK



LATCH OPERATED BY AIR CYLINDER—SEMAPHORE SIGNAL

journal (see the Engineering Record of Sept. 18, page 344), in regard to the mitering gate, mentions among other general features of the lock that its width is 110 ft. and that compressed air is its motive power. Some additional data will assist to a better understanding of the present subject.

The bedrock under the river is Keokuk limestone, and was found to be clean swept and exposed throughout the location of the works. Its surface in the vicinity of the upper gates is nearly uniform at El. 480, Memphis datum plane. The water level of the lower pool fluctuates from El. 484.65 to El. 505.00. The established surface level of the upper pool is El. 525.00, and this may be drawn down during extended periods of low water to El. 519.00. The sills of the upper gate, guard gate and adjoining drydock gate are at El. 511.00, and the top of the lock walls is at El. 530.00.

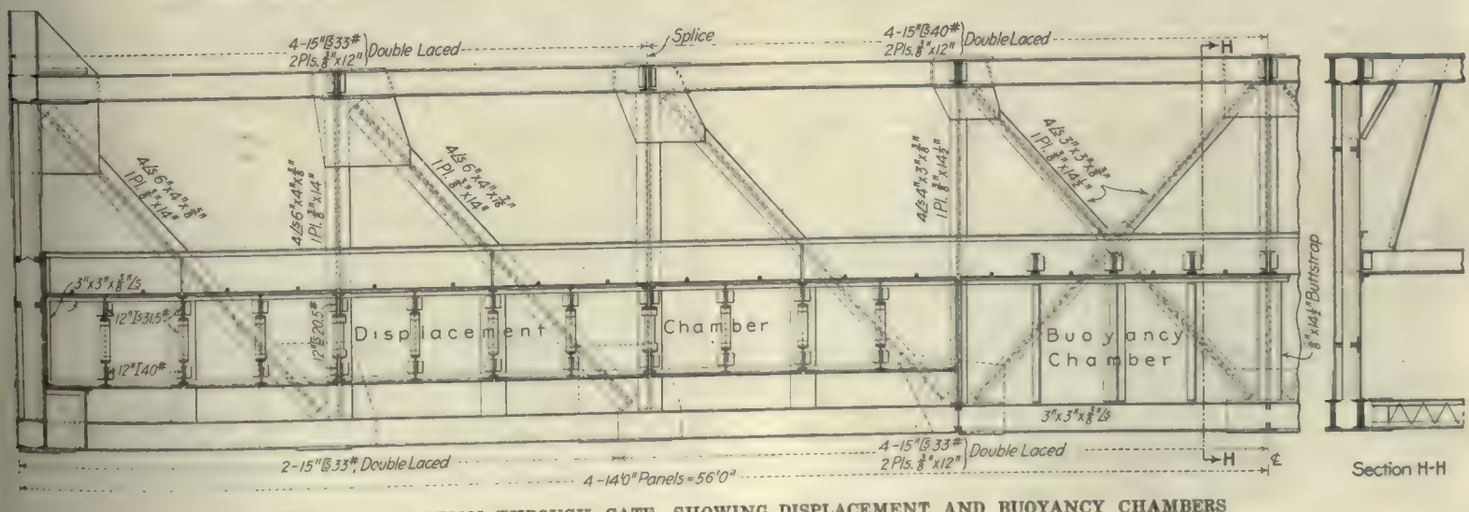


END SECTION SHOWS RACK AND PINION FOR BALANCING GATE

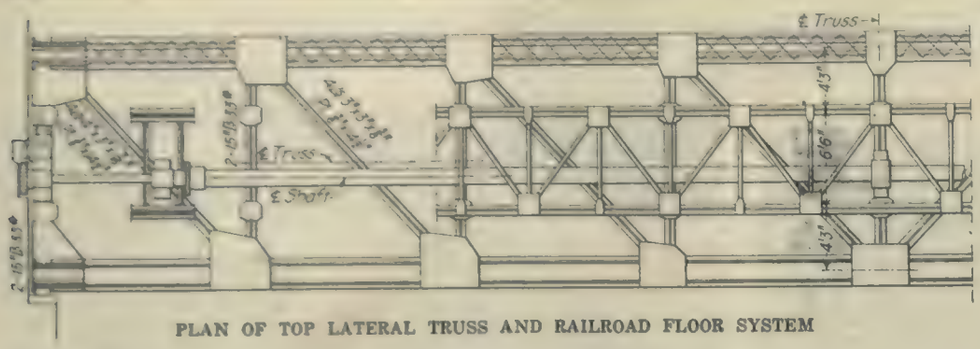
ARGUMENT

It will be noted that the height of the gate sills above bedrock is 31 ft., and that this space is sufficient to allow a gate to descend vertically to the level of its sill without danger of encountering a deposit of silt. There is in fact more than 10 ft. clearance from bedrock to the bottom of the gate when it is in open position. A gate of this kind would not be practicable if it were necessary to excavate a pit in the river bed for its accommodation. The great depth from gate sill to bedrock is a feature of the natural conditions which led to the adoption of this type of gate.

The most convenient railroad to the works is along the Iowa shore, and connecting tracks are laid on the drydock grounds. It was necessary to provide for a railroad track to extend across the drydock and the lock, and thence into the downstream end of the main power house. This track is to serve both the Mississippi River Power Company and the U. S. Government works. Such railroad facility is necessary to the Government works, because the lock power house, the intake and discharge of the culvert system and other machinery and apparatus are on the river side of the lock. The new gate is a bridge as well as a lock gate. If mitering gates had been used,



SECTIONAL ELEVATION THROUGH GATE, SHOWING DISPLACEMENT AND BUOYANCY CHAMBERS



PLAN OF TOP LATERAL TRUSS AND RAILROAD FLOOR SYSTEM

then bascule or other type of lift bridges would have been needed for the railroad track. This circumstance also led to the adoption of the new gate.

Compressed air as the motive power for the lock and drydock had been determined in advance, and the fact that machinery was to be installed for this purpose was additional reason for adopting this gate.

An advantageous feature of these gates is their interchangeability; any one may replace either of the others, and all may be floated out of their recesses by their own buoyancy. Furthermore this type of gate naturally resulted in the building of galleries in masonry under each gate to accommodate the air-supply pipes, etc. These galleries are of value for inspection and communication across the lock. They are inter-connected and have stairways leading to the lock power house and to the top of the lock and drydock walls, and they provide convenient space for the permanent pumping plant for use when it is desired to pump out the lock chamber and culvert system for inspection or other cause.

Attention may also be directed to the economy resulting from the use of this type in place of mitering gates, which is manifested particularly in the decreased length of the lock walls, which are about 55 ft. high.

Finally, it was expected that the new gate, in a single structure, lacking elaborate machinery, and operating by such a safe and dependable power as the displacement of water, would prove to be of the utmost utility, and economical in operation and upkeep.

General Plan of Construction

The accompanying drawings indicate the form and dimensions of the gate, the sizes and arrangement of parts and details of construction. Photographs illustrate the work during its progress.

The upper gate and the drydock gate are opposite to each other, and the guard gate is 49 ft. farther upstream. All three are exactly alike and interchangeable. Each may be raised and floated out of its recess to the drydock for repairs or painting, or to replace either of the other gates, without removing any part, except air connections, and without assistance other than tow lines and barges lashed alongside to prevent its turning turtle.

Each gate consists of two vertical trusses 112 ft. long, center to center of bearings, and 16 ft. deep. The trusses are spaced 15 ft. apart and connected together in the plane of the top chords by a horizontal truss, and in the plane of the bottom chords by lateral bracing—all in the form of a deck railroad bridge, with the usual track stringers and floor system. The downstream truss is, in fact, a plate girder, and its web is heavily reinforced to sustain hydrostatic pressure, thus forming the waterproof skin of the gate. The resulting pressure along the top chord of this girder is sustained and carried to the lock walls by the horizontal truss at the top of the gate. The bottom chord and end frames of the downstream girder are fitted with oak contact blocks, which take bearing upon, and transmit pressure to, the gate sill and the recesses in the lock walls. The gates are eight-panel structures of steel throughout, except as noted.

Displacement Chambers

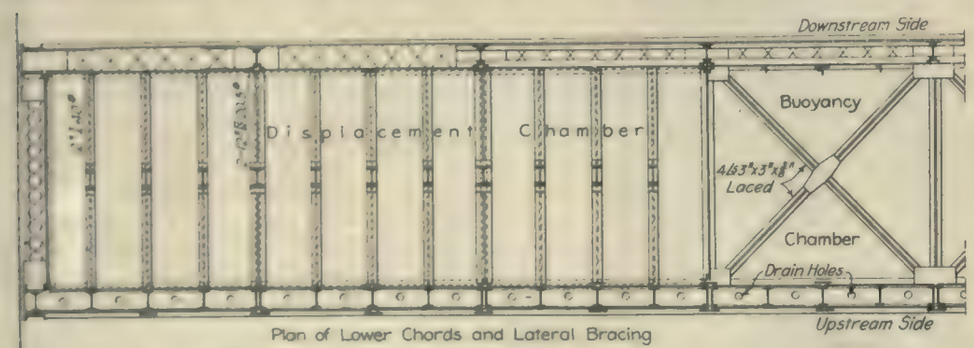
The entire lower part, from a plane 13.21 ft. below the top of the rails and 7 ft. above the lower surface of the bottom chords, is occupied by displacement tanks, arranged as follows: Three panels at each end contain a rectangular box, averaging 4 ft. deep, entirely inclosed and watertight all over. The bottoms of these tanks slope 3 in. toward a small sump at each end of the gate for drainage, and the sumps are connected by heavy pipe of large diameter to equalize any leakage. These tanks contain about 20 tons of ballast, which are needed to balance the gate in all directions, and are provided with manholes, which are accessible when the gate is closed. The combined displacement of these two tanks is 4600 cu. ft.

The remaining 3 ft. of depth below the fixed displacement tanks just described, and the entire depth of 7 ft. in the two central panels of the gate, forms an open-bottomed buoyancy chamber, the displacement of which may be varied at will by admitting air, or allowing it to escape through exhaust pipes provided for the purpose. The maximum displacement of the open-bottomed tank is 5990 cu. ft.

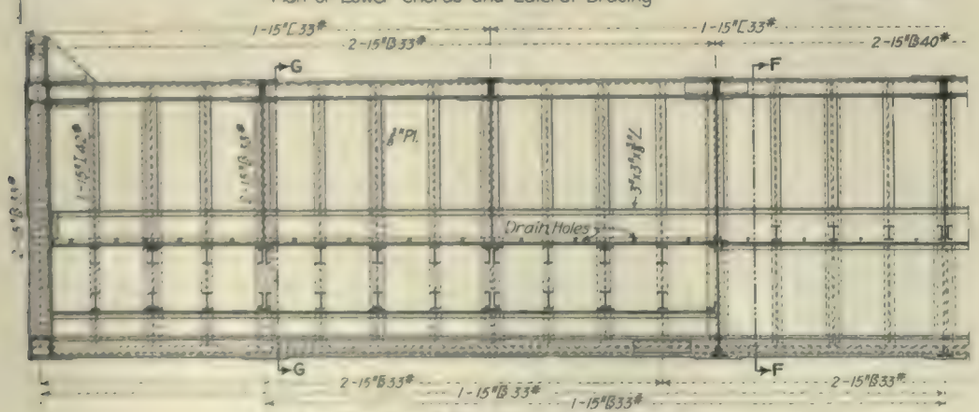
Guides—Sill—Seat

The vertical movement from open to closed position is 19.25 ft., and the gate is confined to position and transverse alignment by guide runners sliding in vertical cast-iron guides bedded in the lock walls at each end. The guides also form toothed racks which engage a spur wheel at each end of the gate, and, as the spur wheels are keyed fast to a heavy shaft which extends from end to end, the simultaneous movement of every part of the gate, and its longitudinal alignment, are assured. The racks, gears and shaft are proportioned to transmit one-eighth of the assumed dead load from either end to the other.

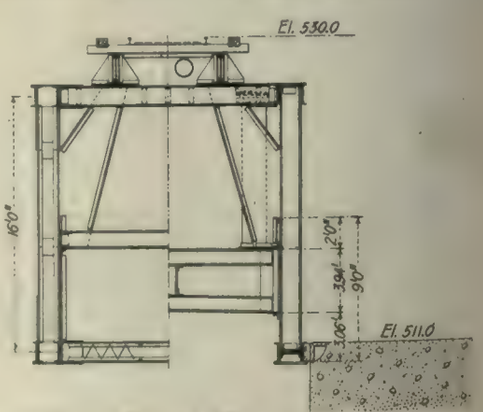
Recesses are formed in the lock walls to receive the ends of the gate, and the downstream faces are continued and connected across the lock below El. 511.00 by the vertical back of a straight transverse wall which forms the gate sill. The downstream face of each recess, and the upstream edge of the transverse wall, which are in one plane normal to the axis of the lock, form the gate seat for closed position, and for



Plan of Lower Chords and Lateral Bracing

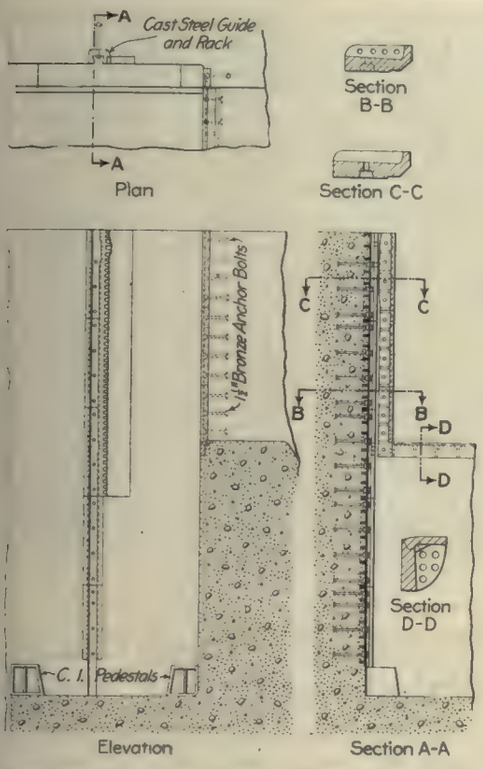


Sectional Elevation of Plate Girder Looking Upstream

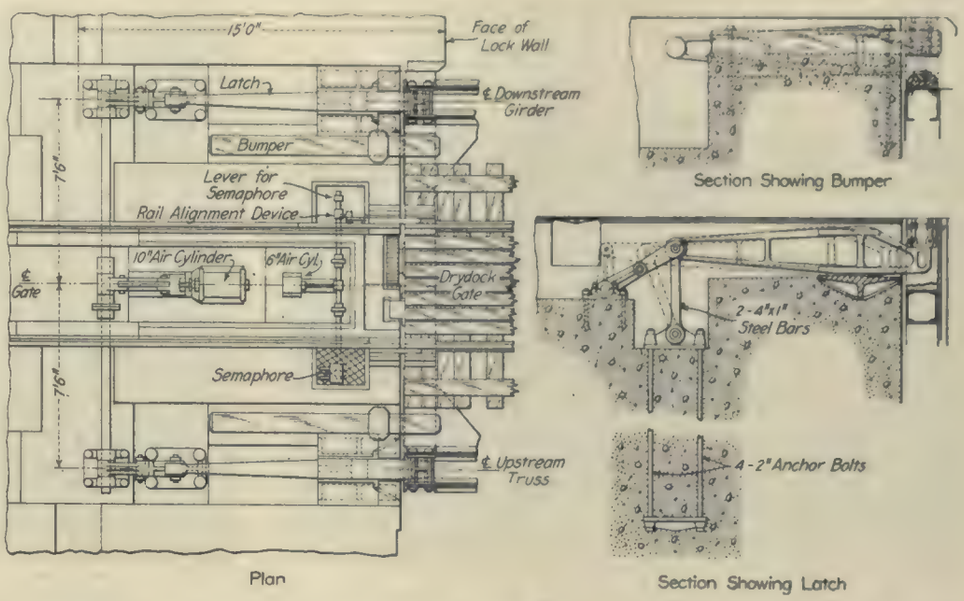


Half Section F-F Half Section G-G

LOWER CHORDS AND BRACING IN PLAN VIEW—SECTIONAL ELEVATION THROUGH GATE LOOKING UPSTREAM



DETAILS OF CAST STEEL GUIDE AND RACK



BUMPER, LATCHES OPERATED BY AIR CYLINDERS AND RAIL ALIGNMENT DEVICE

this purpose are fitted with machine-surfaced reaction castings. The anchor bolts for these castings, and for all other similar parts attached to masonry under water, are of bronze.

WATER SEAL—SUPPORT LATCHES

When the gate is in high position, it becomes a barrier between the upper pool and the lock chamber, for, if water be then drawn from the lock chamber, as in the ordinary course of operation, a head will immediately build up against the gate, and the pressure due to this head forces the gate into contact with its seat. The water seal is thus due to hydrostatic pressure against the gate. The cast-iron guides in which the gate slides vertically are so formed that the gate is withheld from contact with its seat at all times except when in the closed position.

The gate rests on cast-iron pedestals when open, and is locked and supported when closed by heavy cast-steel cantilever beams securely anchored to the lock walls. These beams, or latches, as they are known, are connected in pairs at each end of the gate, and are caused to slide in or out by self-locking toggle connections to a rocker shaft, actuated by an air cylinder. The movement is accompanied by the turning of a semaphore which is in plain view on top of the lock wall at each end of the gate. Bridge joints for the track rails are operated in a similar manner and their movement is likewise indicated by semaphores. The upward movement of the gate is limited by oak bumpers with rubber cushions, which project from the face of the wall. All of this apparatus is located in a pit on top of the walls, and is covered over flush by cast-iron checkered plates.

LOADING USED IN DESIGN

The downstream girder is proportioned to sustain the hydrostatic pressure due to water at El. 525.00 on the upstream side, with no water pressure acting against the downstream side. The top truss is proportioned to sustain a uniformly distributed load of 2100 lb. per linear foot, which represents the portion of hydrostatic pressure accumulating along the top chord of the downstream girder.

The vertical trusses, acting as a bridge, are proportioned to sustain, first, a dead load of 400,000 lb. uniformly distributed and applied at all panel points, with bridge supported by the latches, or by the displacement tanks; second, a live load consisting of a continuous train of Cooper's E40 locomotives, bridge supported by the latches. The stresses produced by the dead and live loads are such as would result if the structure were supported in air.

The gates were built by the Chicago Bridge & Iron Works, and were erected in place and put into operation by the Mississippi River Power Company. The workmanship is of high order throughout and reflects much credit upon the builders, particularly in respect to the large amount of difficult watertight work involved. Most of the rivets in the web plates of the downstream girder are subjected to direct tension in their shanks by the water pressure. The holes for these rivets were treated by a countersink in a manner to remove the sharp edge under the rivet heads. There is practically no leakage through the gates or their contacts.

AIR SUPPLY AND DISCHARGE

A pipe gallery or tunnel is located under each of these gates, and a large compressed-air main extends from the lock operator's house through each gallery to serve each gate separately. The air-supply mains are fitted with four discharge branches extend-



GATE ERECTED IN LOWERED POSITION BY TWO-BOOM DERRICK



ANOTHER VIEW OF GATE SHOWS SMALL LEAKAGE

DATA RELATIVE TO GATE MOVEMENT—VARIATIONS OF DISPLACEMENT AND AIR PRESSURE

Position of gate	Elevation of upper pool	Elevation of top of rails	Weight of gate in air, tons	Displacement of gate, tons	Displacement required in open bottom tank		Air pressure, lb. per sq. in.
					Tons	Cu. ft.	
Open	525.00	510.75	231	185.50	45.50	1456	13.59
Top of rails awash	525.00	525.00	231	185.50	45.50	1456	7.40
Top of upper chords awash	525.00	527.96	231	165.75	65.25	2088	6.36
Closed	525.00	530.00	231	159.50	71.50	2288	5.54
Top of tanks awash	525.00	538.21	231	155.25	75.75	2424	2.00

ing up through the roof of the tunnel and terminating in open ends immediately below, and along the center line of, the open-bottom displacement chamber. When compressed air is admitted to the main supply pipe under the gate, it rises freely in open water from each of the four branches, enters the buoyancy chamber and displaces a certain volume of water. Flotation is thus established, and the volume of displacement may be increased up to the full capacity of the tank by this air-supply system.

The open-bottom tank is provided with a pipe of large diameter for the purpose of discharging air. This pipe is fitted to the roof of the tank and is led to one end of the gate and thence up a vertical post of sufficient height to overhang the lock wall when the gate is open. The discharge pipe is then continued vertically upward by a flexible metallic hose to, and around, a large wheel, which is mounted in a housing at sufficient height above the lock wall to accommodate the vertical movement of the gate. The wheel is so constructed, with hollow shaft and stuffing boxes, that the discharge main is continued unbroken past the switchboard. This wheel is counterweighted on one side of its rim and connected to the gate by wire rope on the opposite side, whence its revolution follows the movement of the gate positively without strain on the metallic hose.

OPERATION AND CONTROL

The air supply and discharge systems are controlled at the switchboard, and the volume of displacement may be varied at will, with the result that the gate is raised or lowered as may be desired. The variations in displacement and air pressure, and other data for various positions of the gate are indicated in the accompanying table.

The floor system, containing considerable wood, and the large hollow shaft displace some 632 cu. ft., about 20 tons, within a vertical space of 3 ft. at the top of the gate. When the gate emerges from the surface, this displacement is suddenly released, with the result that the upward movement is arrested, actually stopped, and additional air must be admitted to close the gate. Likewise in descending, this displacement is suddenly thrown upon the gate by the time the rails are awash, and again the movement is effectively stopped.

The displacement of the open bottom tank is elastic, being caused by the air contained, and its volume therefore varies directly with the water pressure under the tank; that is, with the depth of immersion. This displacement is compressed into smaller volume as the gate descends, and would result in acceleration if additional air were not admitted in sufficient quantity, finally, to retard the motion. These conditions are reversed in ascending, when, after the gate has started, air must be discharged to prevent acceleration. In either case the interruption of motion at the surface caused by the large volume of displacement at the top of the gate, is a safeguard of much value over against carelessness or mistakes in the control of the air supply and discharge. Its action is that of an effective brake applied automatically.

Compressed air may be admitted to the fixed volume displacement tanks by a pipe with flexible metallic hose, rigged in the same manner and by the same means as the air discharge. By this means, with pipes leading from the drainage sumps and fitted with suitable check valves, any accumulation of leakage may be expelled. Gages on the switchboard indicate the air pressure in the closed tanks and also in the open-bottom tank.

A system of electric indicators insures safe operation at all times. Electric contacts are made at the limits of motion in the latches and the rail joints, separately for each end of the gate, causing distinctive colored lights to appear or disappear on the switchboard. Similar contacts are made by the large air-discharge wheel throughout its revolution, that is, throughout the vertical movement of the gate, and these contacts always show the position of the gate by suitable lights on the switchboard.

The lock was designed by the writer and was built for the U. S. Government by the Mississippi River Power Company, under the direction of its chief engineer, Hugh L. Cooper. The entire work was conducted under the general supervision of the Corps of Engineers, U. S. Army.

Large Saving in Steel Effected by New System of Flat-Slab Reinforcement

Youth's Companion Building, Boston, a Six-Story Reinforced-Concrete Structure, Contains First Completed Example of New Type of Floor

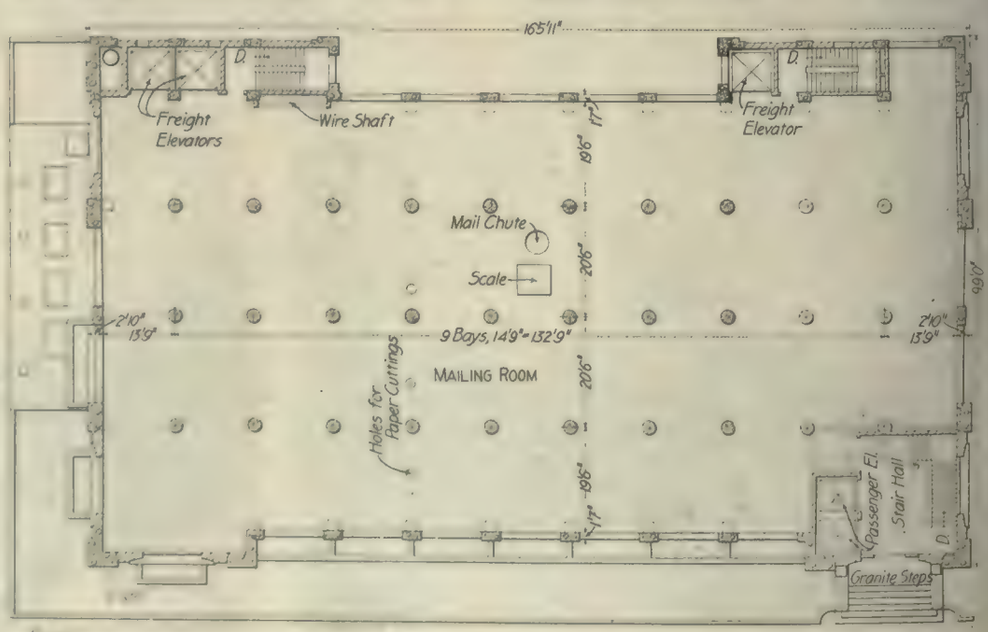
THE RECENTLY completed Youth's Companion Building on Commonwealth Avenue, Allston, Mass., about 3 miles from the State House in Boston, is a six-story reinforced-concrete structure which contains a new type of flat-slab reinforcement which is asserted to effect a saving of from 20 to 40 per cent in the steel required for slab reinforcing as compared with ordinary types. A general description of this building and the details of the reinforcement will be given in this article, and an article on the results of tests of the new slab, including a theoretical discussion, will appear in an early issue.

The building, which will be occupied exclusively by the printing, editorial and business departments of the publishing company, has 165 ft. frontage and is about 100 ft. deep. The columns are spaced as shown on the accompanying plan, the typical floor slabs being 14 ft. 9 in. x 20 ft. 6 in. The story heights vary from 11 ft. 9 in. in the basement to 14 ft. for the first and fifth floors, the other floors having the following heights: Second floor, 13 ft.; third floor, 12 ft.; fourth floor, 13 ft., and sixth floor, 12 ft. 8 in. to the ceiling. A sub-basement extends over about one-third of the building. The exterior finish is concrete with spandrel walls and large steel-sash windows, with a brick and concrete tower at each end, and brick parapets.

FOOTINGS AND COLUMNS

The foundations are on fine compact sand and all columns have independent footings. The interior column footings are square, 8½ x 8½ ft., and 3 ft. deep, reinforced with two layers of steel, each consisting of seventeen round ¾-in. rods. The wall column footings are 8 x 6 ft. and 2 ft. deep, reinforced with twenty-seven round ⅝-in. rods in the shorter direction and eighteen round ⅝-in. rods in the longer direction.

The interior columns are round, 26 in. in diameter in the basement and 22 in. for



GENERAL PLAN AT FIRST FLOOR OF YOUTH'S COMPANION BUILDING



ASSEMBLING OF STEEL REINFORCEMENT BY UNITS



WALL UNIT IN RELATION TO COLUMN REINFORCEMENT

the remainder of their length. Ornamental column heads at each floor are 6 ft. in diameter. In order to carry the heavy loads in the lower stories the columns in the basement, first and second stories were made of a richer mix, 1:1:2 proportions, with spiral reinforcement. Above these stories longitudinal reinforcement and 1:2:4 mix were used, with ⅜-in. ties 1 ft. apart.

Floor Thicknesses and Loads

Three standard thicknesses of floor slab were used: a 9-in. slab for the second floor, which carries the heavy printing presses, designed for a live load of 300 lb. per square foot; an 8-in. slab for the basement over the sub-basement, and for the first, third and fourth floors, which will be used for storage rooms and the remainder of the printing plant, designed for 200 lb. per square foot live load; and a 7-in. slab for the fifth and sixth floors and the roof, designed for a live load of 100 lb. per square foot, with special design under heavy vaults. These upper floors are used by the business department.

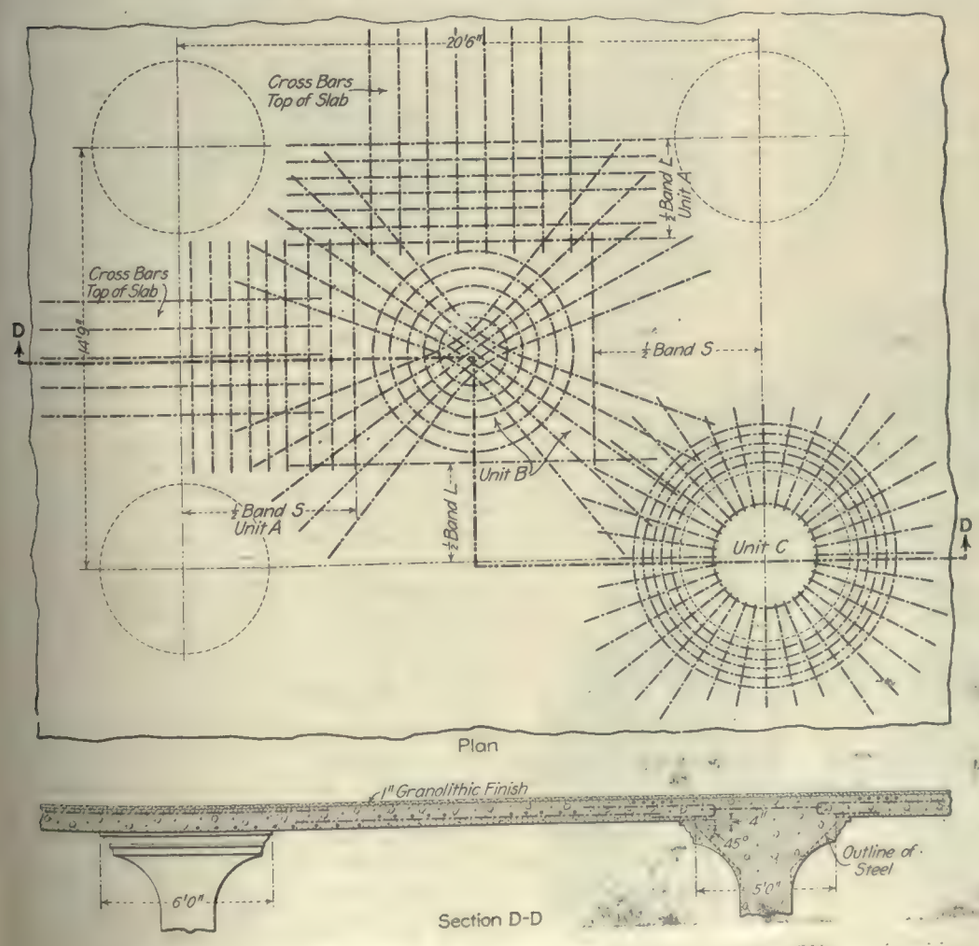
All floors have a 1-in. granolithic finish, cast after the structural slab had set.

Floor-Slab Reinforcement

The floor reinforcement for each type of slab is patented and is known as the Smulski or S-M-I system. It consists of three separate units as indicated on the drawing; unit *A*, a series of short rods at the bottom of the slab, which form the cross bands; unit *B*, the bottom steel at the center of the panel, and unit *C*, the top steel over the column head. The arrangement of steel in this floor design is patented.

Unit *A* for interior panels consists of ⅜-in. round rods 8 ft. long for the short sides of the panel and 13 ft. long for the long sides, bound together at the specified spacing by two and by three ⅜-in. tie rods respectively. The number and spacing of the rods in these units is varied according to the loading. For the exterior panels ⅝-in. and ½-in. round rods are used. Unit *B* consists of five concentric rings, spaced 7 in. apart, and two sets of five rods each placed in a diagonal direction, and slightly curved as shown. The ends of the rings, which are deformed rods, are looped forty diameters to form the splice. Unit *C* consists of six concentric rings and from thirty-six to forty radial rods, bent in a U shape with unequal length of prongs, the upper prong being the longer and serving as tension reinforcement, the shorter, lower prong serving as compression reinforcement.

All the radial rods over the column heads (unit *C*) are looped around a center ring 3 ft. 8 in. in diameter, which consists of either a 1-in. or a ⅞-in. round rod. The remaining five rings are placed on top of the radials and wired to them as illustrated in the photographs. These rings are lapped and two prongs bent down to reach the bottom of the form to keep the unit at its exact height and position. The single heavy ring serves two purposes: It carries the stress at the column head, and serves to stiffen the unit as a whole during construction and erection. The radials vary in length and size according to their position; those in the diagonal direction take the largest stress and hence are large rods spaced close together, extending farther out from the column head than those parallel to the long side of the panel, which are of the same size, but spaced farther apart; the shortest radials are parallel to the short side of the panel.



SKETCH PLAN AND SECTION, SHOWING UNITS IN TYPICAL PANEL

Wall and Corner Units *C*

The wall units and corner units *C* are, in general, one-half or one-quarter of the whole column unit *C*, and are composed of half or quarter rings and the proper number of radials. The center ring is hooked into the columns and the radial bars are

looped about it; the other rings are hooked or anchored into the spandrel beams. These spandrel beams are 15 x 20 in. and are reinforced to carry the wall loading and to prevent temperature cracks. Roof beams are designed as part of the cornice of the building and each tower has an arched beam at the roof level.

Secondary reinforcement of ⅜-in. round rods 8 ft. long over the long cross bands and 10 ft. long over the short cross bands of the *A* units is placed at the top of the slab to resist negative bending moment over these bands at right angles to them.

FABRICATING THE UNITS

Units *A* and *C* were fabricated in the yard on templates and stored there until ready for use. Wooden plugs or nails were used to locate the exact position of the rods, and assembly was rapidly accomplished. One photograph shows a *C* unit being assembled, and another show how it appears when in place. These units were assembled by first placing the center ring and looping the radial rods around it, locating them according to marks on the template frame.

The *B* units at the center of the panels were easily wired together on the forms. The center of the panel was marked and the diagonal rods were placed on the forms at their required spacing, after which the concentric rings were placed over them and wired in place.

In placing a floor panel of reinforcement the bottom units *A* and *B* were placed first and the upper units *C* over the columns last.

ADVANTAGES CLAIMED—THEORETICAL AND PRACTICAL

Theoretically, it is claimed, this system of slab reinforcement insures the placing of steel in the most effective directions to resist stresses. At the column head the stresses act both radially and circumferentially. The radial rods take the radial stress and the rings, in addition to resisting circumferential stress by hooping action reduce the radial stress and tend to prevent cracks around the head. Another claim is that compression reinforcement at the column head required by the very large compressive stresses is very effectively provided for by the lower prongs of the radial bars placed in the direction of these compressive stresses.

In unit *B* the diagonal bars converge toward the center, thus concentrating the maximum amount of steel at the center of the slab where the stresses are largest. By spreading their ends they reinforce the parts of the slab not covered by the rings and transfer the load directly to the column head.

The center ring of the *C* units over the column head is large enough in diameter to avoid interference with column reinforcement and to allow pouring of the concrete into the column shaft. It is pointed out that this center ring is also of special advantage when a large number of rods is required and where structural steel columns are used. Furthermore, the spacing of the rods in this unit allows room for flow of concrete around all the steel and avoids the massive screen of reinforcement over the column head found in the usual two-way and four-way systems.



ASSEMBLING UNIT *C* ON TEMPLATE

FORMS AND CONSTRUCTION

Ordinary wood forms were used for the footings, the basement walls and the wall columns. The floor forms were built of 18-gage metal nailed to 2 x 3-in. joists spaced 4 in. apart and supported by wooden bents about 7 ft. 6 in. on centers. Metal forms were used for the columns and ornamental column heads.

Gravel concrete was used throughout for the structural frame and floors. The construction plant was located about 10 ft. below the roadway level in the rear of the large lot. Concrete materials were wheeled in 5-ft. hand carts to the 175-ft. main mixing tower located at the rear and at the center of the building. Two supplementary towers, one at each end, were connected to the main tower by wire cables. The concrete was distributed by a three-joint metal chute rigged from these cables.

The architects and engineers in charge of the construction are Densmore & LeClear, of Boston. The reinforcing of the floor slabs was designed by Edward Smulski, of the S-M-I Flat Slab System Company, in connection with the office of Sanford E. Thompson, consulting engineer, of Boston. The contractors are the W. F. Kearns Company, of Cambridgeport, Mass.



TOWERS AND CHUTES USED IN POURING REINFORCED-CONCRETE FRAMEWORK

Water Slopes of Earth Dams Protected in Novel Way

Arthur P. Davis and D. C. Henny Describe Interesting Experiment on Large Embankments of Deer Flat Reservoir

DIVIDING dams into two general classes, masonry and earth, Arthur P. Davis, chief engineer, U. S. Reclamation Service, and D. C. Henny, consulting engineer, Portland, Ore., in their paper on "Dams," presented before the recent International Engineering Congress, review briefly the leading developments in both types of construction. In their discussion of earthen dams, the following paragraphs are especially suggestive:

The protection of the water slope of earth dams is always an important and expensive problem, especially under the circumstances which often obtain in the West, where rock is not at hand, and the costly rail and wagon haul make cement for concrete paving expensive.

An interesting experiment is now in progress on the two large embankments that form the Deer Flat reservoir of the U. S. Reclamation Service, which have a gravel facing. Wind action produced peaching and wearing down of materials. No rock was within reach for riprap. The embankments were widened at the top to a total of 60 to 70 ft. by dumping gravel on the 3:1 water slope from cars, which was then allowed to lie at its natural angle of repose, to be worked down the bank by the waves. Wave action is expected to work the gravel down the slope gradually, the fine silt and sand settling in the bottom of the reservoir where it is much needed to check seepage under the dam, the coarsest material remaining on the slope. The degradation of the bank has been much slower than was expected, and the extra top width has nowhere been reduced as much as 25 per cent, and in some places hardly at all, in spite of the fact that the largest cobbles do not exceed 5 in. in length and the reservoir has a very large wind exposure.

Indications along the natural gravel slopes of the Wachusetts reservoir are that permanent slopes in such circumstances will assume an inclination of 1 to 4 or 5, in which case further gravel may have to be deposited on the Deer Flat embankments in the future, or other protection provided.

Cushionless Brick Pavements, Built as Monoliths by New Method, Win Widespread Favor

Many Road Engineers Are Revising Former Practice by Omitting Sand Cushion and Using a Thin Bed of Mortar to Support Blocks Laid and Rolled Before Concrete Base Has Hardened

IT seems probable, although it is still too early to say the final word, that a general revision of practice in the construction of brick pavements will be the outcome of the work at Paris, Ill., last summer, where the usual sand cushion was replaced by a thin layer of dry mortar and the blocks laid and rolled before the concrete base had hardened. This work was described in the Engineering Record of July 10, page 54, and editorial comment on the new monolithic form of construction appeared in the issues of July 3, page 3; July 17, page 64, and Sept. 11, page 311. Evidence of further confidence in what may be termed this "cushionless" type of construction is contained in the following articles. One, a paper presented at the Northwestern Road Congress this week by Rodney L. Bell, division engineer, tells of the work done by the Illinois State Highway Department. D. Moomaw cites the experiences of Cuyahoga County, Ohio; and F. A. Churchill sums up the arguments against the sand cushion and tells how the monolithic construction eliminates rumbling and wear. Information is given also on work of this type done in other localities.

Illinois Finds New Mortar Bed an Improvement

Paper by Rodney L. Bell, Division Engineer, Illinois Highway Department, Presented at Northwestern Road Congress in Grand Rapids, Mich., This Week

SINCE the first monolithic brick road was laid April 1 and 2, 1915, at Paris, Ill., according to Mr. Bell, our common enemy, the so-called sand cushion, has found some very strong and able defenders.

Mr. Bell was of the opinion that every one conceded that the only reason for the layer of sand between the concrete base and the brick wearing surface was to take up the irregularities in the concrete base and the paving block, but it seems there are those who believe that it acts as a cushion. With the old type of construction, when sand or asphalt filler was used and each brick might act at least partially independent of the other, this might have been true, but if the sand acts as a cushion it must give or move, and this is fatal to cement grout filled brick road.

Baltimore constructed a street some four or five years ago and in place of using the ordinary sand cushion, a dry mortar cushion, 1 part cement to 5 parts sand was used. This cushion was spread on the concrete base, struck off to a thickness of 1 in., as in ordinary construction. The brick were then laid and rolled, after which water was applied on the top of the brick in sufficient quantity to set the cushion.

St. Louis is putting in some of the same kind of work this year, except that a 1½-in. dry mortar cushion is used; the cushion is made up of 1 part cement to 4 parts sand. In 1914 there was laid in Cleveland, Ohio, a strip of pavement which was along the same line as the work done in Paris, Ill. The 6-in. concrete base was laid and 5-in. brick were immediately placed on the green concrete, rolled by a light roller and grouted. This pavement was put in by a cold storage company but the name of the company or the exact location is not a matter of record. In the Pennsylvania Terminal in New York there is an example of this work which was laid on a dry mortar cushion. The brick were only 2½ in. thick and were fire clay brick. Mr. Bell has been told, but has been unable to verify it, that paving of the same kind has been laid in Springfield, Mo., along the street car tracks. It is very probable that other work has been done along these same lines of which there is no record.

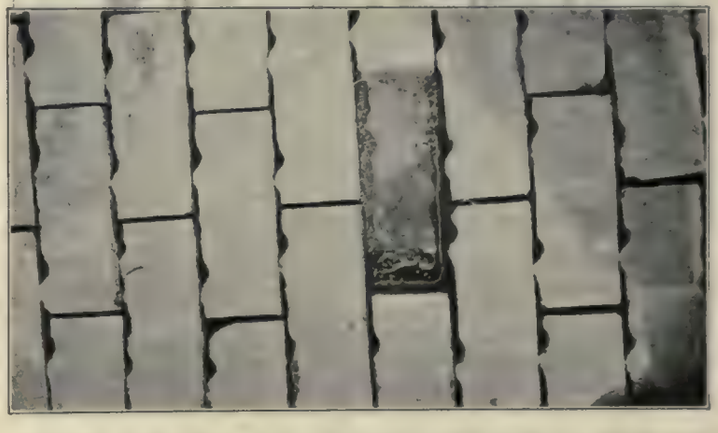
Where grout filler is used the sand cushion is not so much a convenience as it is a constant source of annoyance and worry, if the work is to be properly constructed. One specification provides that sand must not be rolled up between the brick more than ½ in. This means that any brick pavement that receives a rain before the brick has been rolled may have to be relaid. It makes inspection exceedingly difficult in that it is hard to tell just where to draw the line.

The Illinois Highway Department does not use cross expansion joints and believes, according to Mr. Bell, that they are not only useless but destructive to brick roads. The cross expansion joints allow the pavement to move and this movement should be avoided. A pavement without cross expansion joints does not move in expansion if it is properly confined; it only tends to move. The force is always there, however, to move it when the restraints are removed. A good illustration of this was seen at Paris this summer. A brick road with no cross expansion joints, 4500 ft. long and 17 ft. wide was laid on a 1-in. sand cushion, terminated at one end against an 80-ft. steel bridge. Due to the construction of a new dam it became necessary to remove this bridge and put in a new one 8 ft. higher than the old structure. This necessitated the removing of 400 or 500 ft. of the road. Just as soon as the brick were removed the pavement began to creep and has moved 3 or 4 in. since the restraint was removed.

Mr. Bell, last summer, visited a pavement that had blown up at Chrisman, Ill. This pavement was constructed in 1914, the brick being laid on a 2-in. sand cushion and rolled with an 8-ton roller. An examination of the brick that had blown up showed that in a majority of the cases the sand had been rolled up between the brick at least one-half the depth of the brick, or about 2 in. To any one familiar with what brick will do under such conditions it is no wonder at all that this pavement refused to stay in place.



GROUT FILLER EXTENDS TO BOTTOM OF THE BRICK, THUS BONDING THE WORK INTO A SOLID MONOLITH



ONE BRICK REMOVED TO SHOW WATER FILM WHICH ROLLING HAS BROUGHT TO TOP OF CONCRETE BASE

In order to get away from the constant worry of how the sand cushion was acting the new type of pavement was developed. W. T. Blackburn made the first sample of this work and the details of the construction have been worked out by A. J. Parrish, a contractor of Paris, Ill. [The work is described in detail by Mr. Blackburn in the Engineering Record of July 10, page 54.]

Monolithic Work at Paris

When the weather stopped the State-aid work in Edgar County in 1914 the department had enough donated money left to build 400 ft. of 10-ft. brick road. When this construction was brought to Mr. Bell's attention he immediately secured the consent of the State engineer to build this 400 ft., using the monolithic type of construction. The work was started April 1, 1915, and 200 ft. were laid; the remaining 200 ft. were laid April 2. Since that time there has been constructed in and near Paris 13,150 sq. yd. of this type of brick road and there is under contract at the present time 11,780 sq. yd. of State-aid work which will be constructed this year. Before starting work this spring doubt existed as to how the new method would work out in practice. It not only worked out satisfactorily but it is an easier means of construction in every way than the old method.



LEFT — TEMPLATE BY WHICH DRY MORTAR MIX IS SPREAD ON GREEN CONCRETE BASE JUST IN ADVANCE OF BRICK-LAYING



RIGHT—WHERE ONE DAY'S WORK HAS ENDED AND ANOTHER BEGUN ON MONOLITHIC CONSTRUCTION

In the preparation of the subgrade on the Illinois construction the rough work is generally done with a traction engine and a grader, the engine thoroughly compacting the subgrade. The subgrade is dressed up by hand, after which a 5-ton, self-propelling roller is kept constantly at work while the material is being hauled. Steel forms 8 in. in depth and 12 ft. long are then set true to line and grade. The concrete base is 4 in. thick and the brick are 4 in. in depth, making, when completed, an 8-in. monolithic pavement. Steel forms, while not absolutely essential, are a great convenience in this type of construction, according to Mr. Bell.

Special Template for Base

The concrete for the base was a 1:6 mixture of cement and washed gravel. The gravel tested very close to 50 per cent. through a ¼-in. square mesh. The base for the State-aid work now under contract will be 1 part cement, 3½ parts fine aggregate and 6 parts coarse aggregate. Enough water is used so that the concrete is of a quaky consistency, but will not flow. It was found that an excess of water caused no trouble in keeping the brick up to a true surface.

In order to get approximately the right thickness of concrete before cutting it with the template a small wooden guide is used. The steel template used is necessary in order to secure accurate results on this type of work. This template is made up of a 6-in. I-beam in front and a 6-in. channel behind. They are placed 2 ft. apart and supported by four rollers, one at each end of each member. The rear edge of the template is set exactly 4 in. below the top of the forms and the front edge is set 4 3/16 in. below the top of the form. The hopper-like space between the two edges is kept filled with a dry mix consisting of 1 part cement to 5 parts sand. The template is drawn forward by means of a cable and a friction clutch on the mixer. As the template is drawn forward the front edge cuts the concrete 3/16 in. below grade and a thin film of dry mortar is spread over the concrete, filling all the little depressions in the surface. Theoretically, the dry mortar coat should be exactly 3/16 in. in thickness. In reality it does not have any noticeable thickness but is sufficient to give a perfectly smooth surface for the brick.

Laying the Brick

Practically the only place where more care need be taken with this type of construction than where a sand cushion is used is in the laying of the brick. It is essential to have the brick rolled within 20 to 30 min. after the concrete base is laid and to do this culling must be reduced to a minimum. The carriers are required to deliver the brick to the setter so that he can easily lay them in the road with the good face up and the lugs all one way. In this way most of the culling is done by the carriers and but very few brick need be turned after they are placed in the road. It is necessary for the setter to use a little more care than where a sand cushion is used, he is the only man in the gang who does not work at top speed. It is advisable to have two planks, 1 x 12 in. and of a length equal to the width of the pavement, for the carriers to use when coming on the pavement. This saves tracking dirt on the brick and also prevents uneven places in the pavement, due to the fact that the carriers will all come on the pavement at about the same place.

As soon as the brick are laid the necessary culling and batting is done, the pavement swept and rolled. A two-section roller, 30 in. long and 24 in. in diameter and weighing about 750 lb. is used. This roller is easily handled by one man and leaves a much better surface than it is possible to secure with the old type of construction. The brick are not embedded more than ¼ in. in the base.

Grouting Joints

A 1:1 mix of cement and sand is used for the grout filler. This is mixed dry in a small batch mixer and then conveyed to the grout boxes on the pavement by means of wheelbarrows. The maximum size of batch allowed in the boxes is 2 cu. ft. of the mixture. Water is added slowly and the mortar built up gradually, after which it is thinned to a consistency that will flow readily into the joints. The grout is stirred constantly while being removed from the boxes with scoop shovels. The joints are filled completely at the first application, but after settling the top of the grout is about ½ in. below the top of the brick. Before the first application has taken its initial set the joints are filled a second time. The second application of the grout is mixed to a consistency of thick cream. In making this second application enough surplus is left on the road so that the surface can be gone over again without bringing the boxes back. The surface is finished with a squeegee, the joints being entirely filled.

In order to secure the best surface the squeegees are pulled over the road at an angle of 45 deg. with the joints. This prevents the squeegee from dragging mortar out of joints and leaving them lower than the surface of the brick. The pavement is covered the following day with ½ in. of sand or earth which is kept wet at least 5 days. The side forms are removed the second day. The pavement is allowed to set 10 days before the side roads are graded and three weeks before being opened to traffic.

Advantages of New Type

The advantages of the monolithic type of construction are the following: A better surface can be obtained; the work is easier on both contractor and inspector; there is no guess work at any point of the construction; under similar conditions it represents a saving of from 10 to 12 cents per square yard over the old method; it eliminates the breaking down of the filler at a construction crack, as each brick has a rigid support; it opens the field for experiment with thinner brick; the filler is sure to reach the bottom of the paving block; there is no need of a flush curbing; rumbling in brick pavement is eliminated.

Ohio Uses Cement-Sand Support for Brick Pavement

Method Provides Firm Support for Surface Which Does Not Shift Under Jar of Passing Traffic

By D. MOOMAW
Road Engineer, Cuyahoga County, Ohio

CUYAHOGA County, Ohio, has completed or under construction 51,160 sq. yd. of brick pavement and 11,900 sq. yd. of granite pavement in which the cement-sand cushion is used. This cushion, which replaces the old sand cushion, consists of a dry mixture of cement and sand in the proportions of one bag cement to 3 cu. ft. of sand, thoroughly mixed and spread upon the concrete foundation. The cushion is then shaped and rolled in the same manner as has been employed for sand cushion. The brick are laid, culled and rolled in the usual manner before adding water to the mixture. The depth of the cushion is specified as 1 in. after rolling. After rolling, the cushion is sprinkled with a spray until the cushion is wet through. Grouting of the pavement may follow the sprinkling or may be delayed until the cushion has hardened.

PURPOSE OF CUSHION

The purpose of a cushion between the foundation is to permit the forming of a smooth and regular pavement surface. When sand is used as a cushion, the sand remains in the completed pavement, a serious weakness and a source of much trouble. It is to eliminate this trouble that the cement-sand cushion is now employed.

It has been clearly demonstrated that the shifting and yielding of the sand cushion is the cause of failure of the surface bond over large areas, and that freezing and thawing of water in the sand cushion is a fruitful source of longitudinal cracks. To perform the function of the sand cushion and at the same time correct its evils, the cushion must be yielding during construction, and dense, firm and unyielding after the pavement is completed. These properties cannot be more easily obtained than by the use of sand and cement. The ingredients of this cushion should be of such quality as would render them suitable for use when a good grade of concrete is desired.

CEMENT-SAND PROPORTIONS

In some places where this type of cushion has been tried the cement and sand have been used in the proportions of 1:4 and 1:5. A careful analysis of the object to be gained will show such mixtures to be too lean. The primary object of this cushion is to secure a bottom support to the brick sufficiently rigid to insure the integrity of the grout filler, and second, more completely to exclude water from the vital parts of the structure. As we decrease the cement below the proportions necessary to fill the voids in the sand, we increase the porosity and decrease the strength of the mortar, thereby decreasing the efficiency of that part upon which depends the life of the pavement. A 1:3 mix is about the upper limit of proportions upon which we can fairly well depend upon the filling of the voids of sands not especially compounded. A dry mix is necessary because of the unavoidable lapse of time between the preparation of the cushion until the rolling and culling have been completed, during which period it is necessary to have the cushion free from hardening.

The thickness of cushion required is the minimum depth that can be depended upon to overcome the irregularities of the concrete foundation and variation in depth of the paving block. A 1-in. depth is found to be ample upon a concrete base that is finished with reasonable care and with an allowable variation of ¼ in. in depth of block. With less than 1 in. considerable difficulty is experienced in bringing the brick to a smooth even surface. The cushion should be rolled with a hand roller before the brick are dropped. As the mixture is easily compacted, it is not necessary to roll as much as will be required for dry sand. Rolling prevents the splashing of the dry mixture when the brick are dropped, and prevents the cushion rising in the joints when the brick are rolled.

ROLLING BRICK

Specifications for rolling the brick call for rolling only enough to obtain a smooth even surface. This may be accomplished with a hand roller, but it is now recommended on work in this county that a 5-ton steam roller be used, because by so doing the cushion is given additional compression which will add to the density and strength of the cushion. When the hand roller is used, somewhat better results can be obtained by sprinkling the pavement immediately before rolling. In that case the cushion should not be thoroughly saturated until the rolling has been completed.

Water should be applied in a spray, or at least not in a direct jet or by dashing it on with pails. The force of the water should not be such as would displace the cushion or wash the cement out of the sand. Wetting the cement-sand cushion should be very carefully attended to, as too light an application will leave a portion under the middle of each brick dry, and too free a use of water will so soften the cushion that the brick will settle of their own weight and cause roughness of the pavement. Several applications of water with frequent examination will give the best results.

When the sand is slightly damp the cushion should be prepared but a short distance ahead of the droppers and the culling and rolling carried on as expeditiously as possible, so that setting of the cement need not be disturbed after it has started, and that the cushion may suffer no ill effects from partial hydration of the cement. With the use of the cement-sand cushion the method of grouting should be modified to correspond to the new conditions. The cushion being rigid and nearly impervious, it is recommended that the application of thin grout be omitted entirely and that the joints be filled as completely as possible with the one application, finishing with a second application if necessary.

The advantages of this type of construction over the old are:

1. We secure a fixed unyielding support under the rigidly bonded wearing surface, a support that does not shift under the jar of passing loads.

2. We reduce the capacity of the pavement for absorbing moisture.

3. The cushion becomes a part of the rigid structure, gives a partial bond between the wearing surface and the foundation, and thereby increases the strength of the structure.

4. It presents a new distribution of the vertical forces, and hence a new distribution of the stresses in the pavement, bringing the strength of the foundation into play in such a way as to reduce the stresses in the grout-bonded surface to a point where we can depend upon there being a fair factor of safety.

The pavements of this type constructed in Cuyahoga County, have not been in use long enough to ascertain whether or not there will result a noticeable reduction in the noise produced by traffic or if the use of the cement-sand cushion will offer advantages or disadvantages under thermal and humidity changes.

Alternate bids received on sand and cement-sand cushion for brick pavement show a difference of from 5 to 35 cents per square yard, the higher figure no doubt being that of a skeptical contractor, and the lower being decidedly under cost. An intelligent figure is between 15 and 20 cents per square yard, depending upon the location of the job.

Rigid Bed Eliminates Noise and Subsurface Pockets

Cement-Sand or Mortar Layer Eliminates Objectionable Rumbling and Possibility of Settling of Blocks Undermined

By F. A. CHURCHILL
Dunn Wire-Cut-Lug Brick Company, Conneaut, Ohio

SAND beds for brick pavements seem destined to be relegated to that discard whence no abandoned engineering device returns. It is yet too early to venture a positive prediction concerning the ultimate fate of sand beds, but recent developments seem to warrant the belief that cement-sand beds and mortar beds will eventually supersede sand beds in the favor of highway engineers.

Theoretically, the function of a resilient cushion under the brick pavement is twofold: It is supposed to distribute the shock of traffic impact, which, it is alleged, is transmitted through the brick surfacing to the foundation; and it is contended that a sand cushion prevents crushing of the brick under the weight of traffic. Many engineers have questioned the soundness of this theory, but as the sand bed has been regarded, until recently, as indispensable for leveling the surface of foundations, the question of resiliency has been held in abeyance.

The cement-sand bed, now excluding all other beds in the city of Baltimore and coming into general favor, and the mortar bed imposed upon a green concrete foundation, as exemplified on State highway work in Edgar County, Ill., have proved equal to the sand bed in compensating the inequalities of foundations, and they are self-evidently superior to the sand bed in obtaining true monolithic construction. The practical value of resiliency is, therefore, the last defense of the sand bed. If the argument for resiliency falls, the sand bed must go. If we grant the need of a shock-absorber between the pavement proper and the foundation, the concession is the end of the discussion.

IS A CUSHION NECESSARY?

Is a cushion necessary? A mathematical formula may validate the claim, but every engineer knows that actual facts cannot always be expressed by a mathematical formula, nor do the facts of experience and the conclusions of mathematical calculations

always agree. If the theory of resiliency is submitted to the test of pure reason, certain factors appear. First, a grouted brick pavement, being bonded into a single slab, is itself a distributor of shock. Second, a brick pavement describes a segment of a circle; the crowning of the pavement for surface drainage purposes introduces the arch principle, thereby not only minimizing the direct transmission of shock to the foundation, but also strengthening the pavement's resistance to the impact of traffic. A concrete example of the upstanding strength of a grouted brick pavement was furnished in Cuyahoga County, Ohio, not long ago. A flood washed from under a grouted brick highway the subsoil and the foundation for a linear distance of 50 ft. and to a depth of over 6 ft., but the 4-in. brick pavement sustained the weight of a touring car by virtue of the strength given it by the bond and the arched construction.

SHOCK TRANSMISSION

It is not consistent with reason or with facts attested by experience and observation, to assume that a well-grouted, crowned brick pavement can transmit to the foundation any appreciable shock—a shock sufficient to shatter the concrete. Nor is it credible that such a pavement with a solid beam would more easily crush under the weight of traffic than it would with a double beam divided by a sand cushion. Mere weight does not crush a grouted brick pavement laid on a concrete foundation, either with or without a sand cushion. Sharp-edged iron tires, if bearing a very heavy load, may cut into the surface of brick not adequately vitrified, but there is no recorded instance of a grouted brick pavement supported by a concrete foundation crushing down under traffic. If paving brick manufacturers could not make a paving brick that would bear the crushing force of street highway traffic, the paving brick industry would collapse.

A cement-sand bed on a set-up 6 in. concrete foundation, or a mortar bed on a green 6-in. concrete foundation, gives a monolithic pavement approximately 11 in. deep, including a 4-in. vitrified brick wearing surface. Reason rejects the assumption that such a pavement is likely to break down under traffic because of a lack of resiliency. The life of a brick pavement continues as long as the bond holds. Rigidity to a depth of 11 in. seems more likely to safeguard the grout filler than does a resilient cushion of sand under the pavement crust. If there is a resilient motion in the sand cushion, a like action of the brick is inevitable. Even a slight springing motion imparted to a brick slab bonded by hardened concrete has at least a strong tendency to break the joint.

Neither vitrified brick nor cement-grout possesses the properties of flexibility or elasticity in such degree that when bonded with the other it can withstand the fracturing effects of a continuous springing motion. If the degree of resiliency is not sufficient to affect the bond injuriously, it is not easy to understand how the resilient function of a sand cushion can offset the damage done a pavement by the shifting of the sand cushion, and the settling of the sand in spots on account of the absorption of excess moisture content. It is well known that sand beds frequently do settle in small areas, leaving the pavement unsupported at such points. The consequence is an unpleasant rumbling and the positive assurance that if the bond breaks the pavement will seek the depressed sand bed by settling.

LITTLE NOISE WITH MORTAR BED

Recent experiments have demonstrated that the noise made by iron-tired vehicles in passing over brick pavements is due to the sand bed. Hollow rumbling has been believed for a long time to be caused by the sinking of the sand bed away from the surfacing material, but now it is known that an ordinarily noisy brick pavement is noisy because of lack of a solid bearing for the brick.

The demonstration has been made at Paris, Ill., by W. T. Blackburn, consulting engineer of the Dunn Wire-Cut Lug Brick Company of Conneaut, Ohio, and A. J. Parrish, contractor. The construction of brick pavements, with a thin mortar bed upon a green concrete foundation, the brick being immediately laid, rolled and grouted, has solved the problem of how to eliminate noise. Iron-tired vehicles passing over these pavements make hardly any noise.

One such pavement, 30 ft. wide, joins a second one, brick constructed, with a concrete foundation and a 1½-in. sand bed. The same make of brick is used in both pavements, and the same contractor and engineer were in charge of both pavements. Recent experiments were made by several prominent engineers and city officials from various cities, and, as one of the visitors said, "One can tell almost the course of brick when one leaves the almost silent mortar-bed pavement and strikes the noisier sand-bed pavements."

The elimination of noise by the construction of a solid beam from surface to subbase, is an additional reason for predicting the passing of the sand-bed from the ken of highway engineering.

Furthermore, one of the troubles incidental to the construction of brick pavements with sand beds is the tendency of the brick to spawl and break at the point of abutting against another type of pavement. This trouble entirely disappears when the rigid type of construction is used. If the brick, the mortar, or cement-sand bed and the concrete foundation are united in a single rigid beam the end course of brick in a pavement is supported as firmly as any other portion of the pavement, and the tendency to break away from another type of pavement is overcome.

Careful tests of the mortar-bed pavements have apparently established these facts beyond question, and these facts constitute another argument in favor of discontinuing the use of sand beds which will appeal to the practical highway engineer.

Monolithic Pavement Carries Heavy Traffic at Cleveland Plant

IN 1914 the paving at the ice-cream plant of the Telling Brothers Company, in Cleveland, was laid with brick on a mortar bed. The work was done by the City Paving & Construction Company under the direction of James Banwell, who reports that there is not a loose brick in the job to-day. The brick were tamped into the 6-in. concrete base and asphalt strip expansion joints were placed at frequent intervals. This pavement is subjected to the brine-drippings from ice-cream cans and is traveled by heavy trucks.



MONOLITHIC PAVEMENT, SUBJECTED TO HEAVY TRUCKING AT CLEVELAND ICE CREAM PLANT, HAS STOOD UP WELL

Other Examples of Mortar Bed Brick Pavement

ON the heavily traveled approach driveways and inclines at the Pennsylvania Terminal in New York City the bricks were bedded in cement mortar mixed 1:3. The bricks are of fire clay, made at Clearfield, Pa. On the inclines they are 7¼ x 2½ x 2⅜ in. with beveled edges, and no lugs. They were, however, carefully laid by ma-



BRICK PAVEMENT CARRIES HEAVY TRAFFIC AT PENNSYLVANIA STATION, NEW YORK

sons and separated so that the mortar or grout could be placed readily in the joints. This pavement, laid in 1910, has never been taken up for repairs. There are no cracks in it.

The city of Canton, Ohio, is using a 1-in. cement sand cushion on all track work on West Tuscarawas Street, which is now nearing completion.

The city of Baltimore, Md., for a long time has laid all brick gutters on streets paved with sheet asphalt, on a mortar cushion.

Cement-Sand Bed Used for Granite Block in Philadelphia

By C. B. FAIRCHILD
Executive Assistant, Philadelphia Rapid Transit Company

THE Philadelphia Rapid Transit Company has never laid any brick pavements on a mortar bed instead of a plain sand cushion, except in a few isolated cases which would be of little or no use as indicating the advantage or disadvantage of that method. George B. Taylor, engineer of this company, states, however, "that during the years from 1904 to 1907, in connection with some of our concrete track construction, we did pave between rails with granite blocks, which were laid on a dry mixture of cement and sand, in a proportion of about three of sand to one of cement, and after the blocks had been set and properly rammed, a coating of gravel was spread over the surface and the entire pavement flushed with water, the water serving the double purpose of flushing the gravel in through the joints and at the same time providing the necessary water to form a mortar of the sand and cement bed.

"This was done on several heavily traveled streets in the center of the city, a large part of which exists at the present time. The surface of the paving has been maintained in very good condition but, of course, the exceptionally heavy traffic of nine to twelve years has rounded the corners of the blocks."

VALVE EXAMINERS IN CINCINNATI in 1914 found 208 valve boxes covered. Four men devote their entire time to this work, which is largely required because the boxes are covered when street repairs are made.

Literature

For the Civil Engineer and Contractor

New Publications

PUBLIC UTILITIES—THEIR FAIR PRESENT VALUE AND RETURN. By Hammond V. Hayes, Ph.D., consulting engineer. Cloth, 5¼ x 8½ in. New York, D. Van Nostrand Company. $2 net.

BUILDING CODES—SOME PERTINENT SUGGESTIONS. By Virgil G. Marani, former building commissioner, city of Cleveland. Paper; 4 x 6 in.; 16 pages. Cleveland, published by the author, 1900 Euclid Avenue.

Helpful suggestions relating to fire protection for cities seeking reliable data in formulating a safe and sane building code. Urges strong effort to make general standards of engineering and architectural practice the accepted basis for all building codes.

Books Reviewed

Irrigation Practice and Engineering —Volume I

Author, B. A. Etcheverry, head of the Department of Irrigation, University of California. Cloth, 9½ x 6 in.; 213 pages; 77 illustrations. New York, McGraw-Hill Book Company, Inc. $2.

Reviewed by F. H. Newell

Head of Civil Engineering Department, University of Illinois, Urbana.

This, the first and presumably the smallest of three volumes being prepared by Professor Etcheverry, brings together in readily accessible form the result of the more recent investigations and experience in handling water used in irrigation. It starts with the assumption that the man who consults it has already had considerable experience in irrigation, and knows the principal facts concerning the use of water. It plunges into the fundamentals of distribution of moisture in the soil and the influence of the character of the soil upon the availability of this water for plant use. It then takes up and illustrates quite fully the effects which follow when water is applied to the soil and shows by well-arranged diagrams how the water percolates downward and laterally from the point of application.

Professor Etcheverry quotes quite fully from recent investigations on water requirements for irrigating crops and brings out, by diagrams, the fact that with a moderate amount of water good crops are obtained, but with more water the increase in yield is not in proportion to the amount used. On the contrary, a point is quickly reached where with more water the increase in yield stops or becomes negative. These conclusions on the subjects investigated are perhaps the most important, not only for the information of engineers in designing works, but even more for the manager of such works when built. Here the latter finds his more difficult problems, not in securing an adequate amount of water, but in convincing his customers, the irrigators, that while a little water is a good thing, plenty may be injurious to them and to their neighbors.

The time to apply water and the frequency of irrigation are discussed, leading up to what the engineer terms the duty of water, or the relation between area of land served and quantity used. On these points there have been brought together a wide range of data, convenient for reference.

Going further into details, the book discusses the preparation of the land for irrigation, the methods of distributing the water and concludes with some elementary facts and costs on pumping water for irrigation.

The treatment of the subject is simple and direct, enabling any man of fair intelligence to grasp the important features. At the same time the arrangement of the book facilitates the search of the busy engineer for facts and conclusions in his efforts to secure better use of water. A strong feature is the care with which the data have been arranged and the completeness of the illustrations. The subject which it treats is still in the making, and the book presents clearly our present stage of knowledge of a rapidly evolving phase of engineering and agricultural development.

Surveying Manual

Author, William D. Pence, professor of railway engineering, University of Wisconsin, and Milo S. Ketchum, dean, College of Engineering, and professor of civil engineering, University of Colarado. Leather, 4½ x 7 in., 388 pages. New York, McGraw-Hill Book Co., Inc. $2 net.

Reviewed by A. F. Comstock

Associate in Railway Engineering, University of Illinois.

The commendation with which this pocketbook has been received is attested by the fact that over 31,000 copies have been sold since the first edition was published in 1900. In this, the fourth edition, the authors have sought to increase the book's usefulness by appropriate revisions, by redrawing and enlarging the cuts, and by the addition of 130 pages of field and office tables. Two of the foregoing changes are particularly noticeable and doubtless will be greatly appreciated by the craft, i.e., addition of a complete set of tables, and enlargement of the lettering in the numerous sample field notes. The entire book has been reset, giving it throughout a clearer and more attractive appearance.

No deviation of note has been made in the text arrangement nor in the number of problems. Clearance and conciseness, which were so ably exemplified in previous editions, are well preserved in the present one.

New tables for meridian determination by observations on Polaris have been supplied. The field and office tables already referred to consist of five-place logarithms of numbers, logarithmic and natural functions, and a table of squares, cubes and roots—all conveniently arranged in the latter part of the book. Although there is but a trifling increase in the length of the book (the width remaining the same as formerly), the thickness has been increased by 136 additional pages over the previous edition. The obvious advantage of including the tables, however, more than offsets the disadvantage of greater bulk.

The authors are to be complimented on their latest efforts to maintain for this book the high standard of excellence achieved in previous editions.

Letters to the Editor

Comment on matters of interest to engineers and contractors will be welcomed

Reinforced-Concrete Footings Economically Designed

SIR: In your issue of Sept. 4, 1915, page 300, you have an article "Reinforced-Concrete Footings Economically Designed." In the Engineering Record, Feb. 14, 1914, page 185, the matter of footing design has been carefully gone into by the writer from the standpoint of the latest experimental information then available. Up to the time Bulletin 67 of the University of Illinois Experiment Station was published footing designing methods were very unsatisfactory. From the results of these experiments it is seen that the punching shear is not so reliable a basis of figuring as the diagonal shear.

By analysis it is shown, in the article mentioned above, that if we assume 40 lb. per square inch as the working value for diagonal shear, which is conservative value, then the punching shear varies from 120 to more than 220, depending upon conditions of loading, the diagonal shear being figured, as suggested in Bulletin 67, on a vertical section at a distance equal to the depth of the footing from the side of the column shaft.

By the use of diagram 3 in the abovementioned article it is a very simple matter to design a footing economically and safely. This diagram gives a value for K to be used in the formula $d=\sqrt{W/K}$, which is a similar formula to that often used in the design of beams. K varies according to the pressure on the soil and the unit load on the column section. For a soil pressure of 3000 lb. per square foot and a unit load of 500 lb. per square inch under the column shoe, K equals 640. Likewise, for a soil pressure of 6000 lb. per square foot and a load of 500 lb. per square inch on the column section, K equals 920.

Having found d, to which from 2 to 4 in. should be added, depending upon whether the soil is hardpan, or soft and liable to get churned up and nicked with the concrete, it is also easy to determine the necessary steel reinforcing, as given for various allowable soil pressures in a table on page 186 of the above reference.

Chicago. W. A. HOYT.

How Glass Is Graded

SIR: In answer to the question, "How is glass graded?" asked by one of your correspondents in your issue of Sept. 4, page 302, I would say that the best quality of common American window glass is designated as AA, the second quality as A, and the third as B. The AA is supposed to be as good as can be made by the cylinder process. Common window glass is known technically as sheet or cylinder glass, because it is blown in the form of a cylinder. It is then cut longitudinally and flattened on a stone. Sheet glass can be distinguished from plate glass, even at a distance, from its wavy appearance, a defect which cannot wholly be avoided.

Common sheet glass is graded without regard to quality, according to its thickness, as single and double strength. Double-strength glass is of uniform thickness of ⅛ in. Single-strength glass may be as thin as 1/16 in. in thickness and not uniform. Both single and double strength are sorted into three grades, the classification depending upon color, brilliancy and flaws.

Polished plate glass, the highest grade of window glass, is cast in large sheets and rolled on a flat table, while the common, as before stated, is blown. Plate glass ¼ in. thick weighs 3½ lb. per square foot. Common window glass ⅛ in. thick weighs 2 lb. per square foot. Maze, prismatic, wired and ribbed glass have their different classifications also. We also have rubber glass reinforced on the inside with strong wire cloth. M. MCEVOY.

Penn Yan, N. Y.

Air-Bound Filters

SIR: I would like to contribute the following discussion of Mr. Hoopes' paper on air-bound filters at Wilmington, Del., published in the Engineering Record of Sept. 4, page 282:

While water dissolves amounts of gas directly proportional to the pressure, these amounts are not directly proportional to the temperature, and, according to the best authorities, are indicated in the accompanying table.

SOLUBILITIES OF OXYGEN AND NITROGEN, AND AIR, CU. CM. PER LITER IN PURE WATER, AT VARIOUS TEMPERATURES AND NORMAL PRESSURE (760 MM.)

Temperature, Cent.	Fahr.	Oxygen (Winkler)	Nitrogen (Winkler)	Air (Bunsen)
0	32	48.90	23.48	24.71
5	41	42.86	20.81	21.79
10	50	38.02	18.57	19.53
15	59	34.15	16.82	17.95
20	68	31.02	15.42	17.01
25	77	28.31	14.32	14.02
30	86	26.08	13.40	12.75

The methods employed by Mr. Hoopes to make use of the negative head and remove the accumulations of air are ingenious. It is unfortunate that air leakages occur to complicate the problem. Filters should be designed to remain tight under varying temperatures. One group of filter designs known to the writer leaked at the rate of 150,000 gal. daily during the summer and 1,500,000 gal. daily during the winter.

In his design for the Brisbane (Australia) filters, Hazen placed an air chamber on the effluent line and planned to remove the accumulated gases from this chamber by pumping.

The Wilmington sand analyses show a gradual coarsening of the sand at the surface of the filter, and with this coarsened layer the initial losses of head have increased with corresponding decreases in yields. This is the reverse of what one would expect and the data point to some more remote cause of the decreased capacity. It is unfortunate that sand analyses of samples taken from different depths are not available for study. A 24-in. layer of sand of an effective size of 0.33 mm. should require about one-half the initial loss of head required by a sand of 0.24 mm. effective size. Although the losses of head at Wilmington have increased five-fold in five years, it does not seem possible that these increases have any connection with the size of sand at the surface of the filter.

ROBERT SPURR WESTON,
Consulting Sanitary Engineer.

Boston.

SIR: The article of Edgar M. Hoopes, Jr., on air-bound slow sand filters at Wilmington, Del., which appeared in the Engineering Record of Sept. 4, is of much interest. The following comments upon entrained air in rapid sand or mechanical filters may be of further interest to readers in this connection:

For air to become entrapped within a filter bed during filtration, a partial vacuum must be first established. The air so trapped, however, may have come out of solution from the water being filtered, or it may have been derived from leakage of air into the tank from the outer atmosphere. Air may come, of course, from both sources; but if air leakage is known to exist, and the air liberated is of considerable volume, it is probable that the amount coming out of solution is relatively small as compared with that which is leaking into the tank. Localized eruptions of air, when filtration ceases, would appear to be indicative of air leakage into the tank, while a general liberation of air uniformly over the whole surface might show that the air was coming out of solution in the water being filtered.

In the operation of the rapid sand filters at Cincinnati very little trouble has ever been experienced from the liberation of air within the filter beds. This is due probably to the methods of operating and to the practical absence of air leakage into the filter tanks when operating with a negative head. The tank units are divided by the central gutter so that two separate sand beds exist. The writer has seen air liberated from one side of the bed and not from the other, when the filtering process was stopped, and just as the applied wash water commenced to rise in the tank. In this case it is believed that this air is derived from leakage into the side of the tank showing the air, rather than from the water which had been filtered through that side.

Liberation of air from the filter beds occurs at this plant only during the summer months, and never during the winter months. The filtered water is always, either in winter or summer, from 0.3 to 0.5 deg. C. warmer than the applied water, the greatest difference being in the winter months. During the winter months, when the water is the most turbid, it is not possible to operate with negative heads, or at least with only very small negative heads, because of the poor quality of the effluent which would result. On the other hand, during the summer months negative heads may be safely permitted with no accompanying deterioration in the quality of the effluent.

Rapid sand filters may be so operated that they may easily become air-bound. This occurs if too great a loss of head is permitted, and if no attention is paid to a rapidly decreasing rate of filtration. The writer believes that leakage of air into rapid sand filters operating under a partial vacuum is likely to be the source of the greater proportion of the air entrained in the beds. J. W. ELLMS,

Superintendent of Filtration.

Cincinnati.

HINTS FOR THE CONTRACTOR

Details Which Save Time and Labor on Construction Work

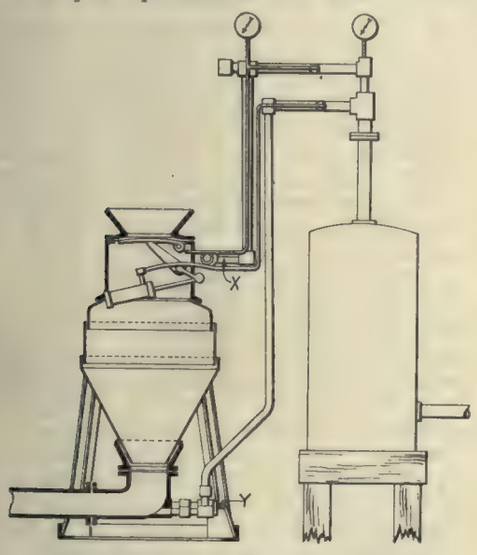
Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

[*Contributions to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

Proper Regulation of Air Prevents Clogging of Pneumatic Mixers

By H. A. LEEUW
Assoc. M. Am. Soc. C. E., New York City

PROPER application of an ample supply of compressed air has overcome clogging in the conveying pipe in placing concrete by the pneumatic method. This clogging has been the most serious drawback to the use of this method by mixing and placing concrete, which has developed until concrete has been placed at a distance of 2800 ft. at the Mile Rock tunnel in San Francisco, and raised to a height of 60 ft. in building piers for a bridge at Magnolia, W. Va.



HOW TO ADMIT AIR TO PNEUMATIC CONCRETE MIXER

Owing to the way in which different aggregates behave in feeding into the conveying pipe, the air has to be supplied differently for stone and gravel. The illustration shows a cross-section of the mixer and inlet pipes, which are designated by *X* and *Y*. To illustrate the above statement, when gravel is used, it has been found that it was necessary to admit air only through the inlet marked *Y*, as an application through both would cause the material to feed too fast into the conveying pipe, and would result in a clogged pipe. When stone is used, however, it is necessary to apply the air through both inlets. If only the inlet *Y* is used, the material will arch and then suddenly fall down to the discharge pipe, causing it to clog.

It is very important to have a sufficient volume of air to carry the concrete through the delivery pipe to the forms. When this has not been properly taken care of, the concrete will drop in the delivery pipe and the next batch will stick on this and clog the pipe. The tendency has been to underestimate the number of cubic feet of free air per minute required, as till lately there has been little information available on this subject. The following table shows the result of three years of study and practical experience. Present satisfactory installations are proving the correctness of these figures.

CUBIC YARDS OF CONCRETE PER HOUR, MIXER CAPACITY ½ CU. YD.

Actual amount of compressed air required, Cu. ft. of free air per minute	Length of Horizontal Discharge					
	100 Lin. Ft.	300 Lin. Ft.	400 Lin. Ft.	600 Lin. Ft.	800 Lin. Ft.	1000 Lin. Ft.
600.....	20	15	10	..	..	..
800.....	30	20	18	12	6	..
1200.....	40	30	25	20	12	8

It has been found that the character of the sand plays a more important part, with reference to the speed with which the mixture is carried through the pipe, than does that of the stone or gravel. A sharp, clean sand will require less air to move concrete mixed with it than one in which the percentage of loam or oxide of iron is high.

It has also been found that a pressure of 90 lb. per square inch gives the best results. This pressure, expanding into a 6 or 8-in. pipe, depending on the size of stone or gravel used, is reduced to a pressure averaging about 25 lb.

HOSE AT DELIVERY END REDUCES KICK

This high pressure has presented an obstacle to be overcome, as the delivery end must be securely fastened to take care of the kick resulting from this pressure. After considerable experimenting, it has been found that a hose, the lining of which is made of pure rubber to withstand the wear, and reinforced to take care of the thrust, when connected a short distance from the delivery end, acts as a shock-absorber, and allows the discharge end to be handled, so that the concrete is not all deposited in one place, but may be distributed in even layers.

The mixture of the concrete placed in this way has been found to be as perfect as that delivered by any of the mechanical mixers on the market. When, however, the volume of compressed air falls below the amount required, as shown in the table, the mixture shows a tendency toward segregation.

The pneumatic method is well adapted to tunnel lining, as it is possible to secure an increase of at least 50 per cent in speed with a corresponding decrease in labor. Accurate cost data are difficult to get, but the following represents the average case:

	Cents per cubic yard
Labor	12
Compressed air	26
Pipe and equipment	10
Overhead	3
Cost for mixing and placing	45

The usual labor crew consists of six men for an outfit which is placing concrete at the rate of 100 cu. yd. in a 10-hr. day.

Tilting Hopper Saves Labor on Concrete Job

By GEORGE W. DAVIDSON
General Foreman, Hennebique Construction Company, Middleboro, Mass.

A TILTING hopper, simple of construction, made it possible for one man to empty all the cement for the concreting of a reinforced-concrete water tower 173 ft. high and, at the same time, to thoroughly shake and tie up all empty sacks so that none were left loose to be scattered after the day's run. The hopper, which is shown in an accompanying illustration, was built on the job, of wood, and placed on the elevated platform. One man on the platform



ONE MAN, WITH HELP OF TILTING TROUGH, HANDLED BOTH CEMENT AND SACKS

emptied the cement necessary for one batch into the box. Cars loaded with the aggregates were pushed up on tracks alongside the platform. The hopper was tilted over and its contents emptied, and the car pushed on its way to the mixer. The man on the platform found ample time between cars to attend to the emptying as well as the shaking out of the bags and to pile them and tie them up in bundles as well.

Time Study Shows Expensive Defect in Cement-Handling Methods

TIME STUDIES on cement handling showed the Bridgeport Hydraulic Company that unloading took an undue length or time in hauling cement from Bridgeport, Conn., to the site of a dam under construction near that city. Automobile trucks with gondola bodies were used, being loaded and unloaded by hand. There was no reason apparent for the long time required for unloading, until the operations were studied more closely. Then it was found that in loading from the box car into the truck, the side of the truck away from the box car was filled first. The result of this was that, to such extent as the rows of cement sacks overlapped, those on the side away from the box car were wedged down. In driving up to the cement house it was found that the drivers turned this tightly-packed side of the truck next to the door, and that the unloading crew had been beginning always on the wedged side of the load. The result was that it took two men considerable time to pull out every sack in the first row unloaded. When the trucks were turned around, the sacks, of course, came out as easily and as quickly as they went in.

Things of this kind are not easily seen by the average straw boss, or even by more responsible foremen. For this reason, according to officials of the Bridgeport Hydraulic Company, time studies of this sort have proved very valuable.

Blocking of Concrete Bricks Used in Raising Steel Bridge

By R. C. HARDMAN
Colorado Springs, Colo.

IN RAISING a heavy steel highway bridge recently to a height of 5 ft. at one end only, blocking of concrete bricks or blocks was used instead of the customary timber blocking. As the bridge was raised from above by means of slings fitting over the nuts on the end pins, it was thought inadvisable to use the ordinary blocking which would have to be removed in its entirety in order to place the permanent concrete pedestals under the bridge shoe, thus leaving the bridge suspended in mid-air until the concrete has set sufficiently to receive its load. To obviate this more or less dangerous condition concrete block piers, made of 4 x 8 x 16-in. blocks of 1:2:4 concrete, were carried up directly under the bridge shoe as it was raised. In this way, the shoe was at no time more than a few inches off a firm bearing. The blocks were of such size and shape that a great variety of course arrangements could be made so that perfect bonding could be secured. The raising of the bridge was made in short lifts of 13, 32 and 15 in., the whole time consumed being 10 hr., which was distributed over three days. At the end of each lift the space between the block pier and the pedestal form was filled with a 1:2:4 concrete, level with the top of the pier, and the bridge brought to a bearing on the pier. By this means, no load was placed upon the fresh concrete. The blocks were laid up with approximately a 1-in. bed and joints, the pier showing a slight settlement as the weight of the bridge was applied to the fresh mortar bedding. The faces of the piers were purposely left as rough as possible by raking the joints, so as to secure a good bond with the concrete poured around them. Small piers forming a bearing for the lifting jacks were built along side the larger piers and incorporated in the pedestals in the same manner.

The blocks were made on a wooden bed in sets of twenty, two hundred being made in all to allow for breakage and imperfect blocks. They were allowed to cure for a minimum of two weeks before being used. At the end of each day's run of the mixer on other parts of the work, the block form was filled from the clean-up around the mixer and the last batch run, so that the cost could not be accurately kept. Approximately, however, the blocks cost 10 cents each.

The labor cost of raising the bridge and building the pedestals and piers was $15.34, the total cost being brought up to about $49 by the cost of material and special lifting apparatus.

Single-Line Cableway Pulls Tools from Louisville Lock

FOR HAULING TOOLS and small pieces of machinery out of the excavation for the lock at the head of the Louisville and Portland canal on the Ohio River the contractor devised the single-line cableway shown in the accompanying photographs. It is operated by a single drum motor-driven hoist. The lock was described in the Engineering Record of June 26, page 796.



ONE-LINE CABLEWAY

As the outer end of the carrying line is anchored at a point considerably lower than the bank end the frame is made so that one of the trolley wheels sets higher than the other, permitting the three pulleys, through which the combined lifting and pulling line is run, to set approximately level. The carrying line is of sufficient grade and the friction in the three-part line carrying the hook block is so small that the carriage will rest against the stop until the load is raised against the catch on the carriage, which can then be pulled up the grade to the side of the pit.

The carriage was designed and built under the direction of C. H. Wright, superintendent of the Ohio River Contract Company, which is building the lock for the U. S. Government.

Safety Pointers for Handling Carbide Tunnel Lamps

ALTHOUGH carbide lamps do not give off any dangerous gases, and are not ordinarily liable to explode, accidents which might produce serious results are apt to occur with them if they are carelessly handled. James W. Paul, in a circular issued to miners by the U. S. Department of the Interior, gives several rules which should always be observed if these lamps are to be handled without risk.

Carbide should never be stored underground, and the quantity carried down by each man should be limited. If the light has to be recharged below ground, the extra carbide should be carried in an air-tight metal box having a screw top. Glass jars are not safe containers for carbide, as they are easily broken; and if carbide is put in a copper container or lamp, especially the latter, it is liable to explode. Carbide or the refuse from the lamps should not be left underground or near any inflammable material. Where carbide cap lamps are used with the carbide container fastened to the belt of the wearer, the tube carrying gas to the lamp should be carefully looked after. If it should leak, the escaping gas is apt to ignite and seriously burn the wearer.

Because of their greatly superior light in proportion to their weight, especially the lamps made with reflectors, these lamps are coming into wide use among construction men and engineers on tunnel and subway work. It need not be pointed out that the precautions suggested by Mr. Paul for miners are equally applicable to construction work.

Holes Counted as They Explode by Using Delay Electric Caps

DELAY electric blasting caps are being put to a new "safety first" use which enables a blaster to count all the holes in a round, and make sure that all have gone off, according to the *Du Pont* Magazine. In the first hole an ordinary blasting cap is put. The second hole is fired by a delay blasting cap, the third hole by a second delay blasting cap, the fourth hole by a third delay blasting cap, and so on. All the caps are on the same circuit, and all are ignited by one operation of the blasting machine. The delay caps fire the charges in order and with a sufficient interval between explosions to permit of counting the shots so that the men doing the blasting can tell absolutely that every charge has gone off before they return to the cut.

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

Rock Slides Greatest Menace to New York Subway Work

Says Report of Davis and Quimby—Engineers of Public Service Commission Report Seventh Avenue Collapse Started by Blast

That New York City's subway work is being carried on in general in accordance with the best practice, that rock slides, such as occurred Sept. 25 on Broadway, at Thirty-eighth Street, constitute the "greatest and only serious menace" to be guarded against, that cross-bracing should be used wherever there is any doubt as to the strength of the rock foundation, that the permanent construction should be kept as near as possible to the headings, and that constant inspection of the temporary street supports is necessary, are the conclusions set forth in the report to the Public Service Commission by Edmund S. Davis, chief engineer of the Boston Transit Commission, and Henry H. Quimby, chief engineer of the Philadelphia Department of City Transit, made public Oct. 6. These men were retained by the Public Service Commission to make a report on the construction methods in use, and to recommend, in view of the recent failures of subway decking, changes to insure against a repetition of either accident.

This report, in respect to the type of bracing used by the contractor on whose work the two collapses occurred, agrees with the editorial opinion expressed on page 405 of the Engineering Record of Oct. 2. The report says, in part:

"With special reference to the method used by the United States Realty & Improvement Company, in whose work the two recent casualties occurred, we found that the sizes of the material used for the various members give ample strength for the loads imposed by the street traffic, and we are of the opinion that while in some cases details of the framing and bracing were found that are not in accord with the best practice, the greatest and only serious menace to the shoring and the public safety consists in the possibility of rock slides similar to that which occurred Sept. 26 on

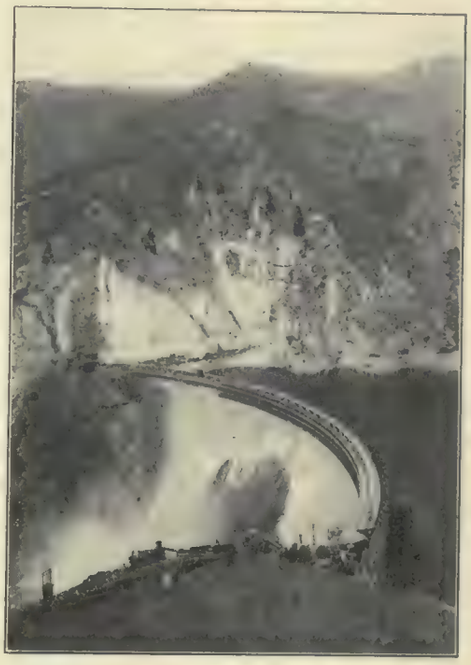
(*Continued to page* 462, *third column*)

Highest Dam Completed

To signalize the completion of the world's highest dam, the 351-ft. Arrowrock structure of the U. S. Reclamation Service's Boise project in Idaho, a harvest home festival and barbecue was held Oct. 4.

The Boise project, for which this dam stores water, embraces 240,000 acres, and settlers from various parts of the tract brought for the barbecue cattle, hogs, sheep and poultry, while others furnished fruits, grains and vegetables. Residents of the four counties, Ada, Boise, Canyon, and Elmore, including citizens from the cities, gathered for the celebration.

The dam contains 530,000 cu. yd. of concrete. Excavation was begun in July, 1912 and completed in August, 1913. Concreting was started Nov. 11, 1912.



ARROWROCK DAM, BEGUN IN 1912, COMPLETED AFTER THREE YEARS OF WORK

Commerce Commission Hears Railroads on Valuation

Presidents' Conference Committee Sets Forth Its Views of Fundamental Principles in Two-Day Conference at Washington

Depreciation and the so-called "intangible elements of value" proved to be the chief bones of contention at the valuation conference held by the Interstate Commerce Commission in Washington, Thursday and Friday of last week. Much attention was also given to the subject of land. Except for occasional questions by other interests which reflected their dissenting views, the railroads furnished all of the argument in the two-day session, basing their discussion on a 544-page brief previously filed with the commission. The State commissions had not prepared any formal argument.

The conference was called by the Interstate Commerce Commission to hear the views of those interested in the fundamental principles of valuation. About 125 attended—mostly railroad men, with a few representatives of State commissions. The railroads' case was presented by four of counsel for the Presidents' Conference Committee, G. S. Patterson, Pierce Butler, W. G. Brantley and Sanford Robinson. A. E. Helm of the Kansas Public Utilities Commission was the spokesman for the State commissions. The arguments of the railroads were presented under eight main heads: (1) Reasons for the Valuation Act, (2) cost of reproduction new, (3) unit prices, (4) depreciation, (5) the phrase "owned or used for the purposes of a common carrier", (6) land, (7) property charged to expenses or surplus and (8) other values and elements of value. One or two other subjects treated in the brief were not reached in the oral presentation.

Purposes of Valuation Act

Mr. Patterson, opening the discussion, said that the recommendations of the commission to Congress for the last twenty-five years indicated that the Valuation Act was deemed essential: (1) To obtain a trustworthy comparison between present value and original cost,



FINISHED STRUCTURE, CONTAINING 530,000 YARDS OF MASONRY, SERVES IRRIGATION PROJECT OF 240,000 ACRES IN IDAHO

(2) to use in rate questions, (3) in connection with taxation, (4) in determining a proper depreciation reserve, (5) in testing the accuracy of the carriers' balance sheets, (6) in standardizing railway statistics, and (7) in determining whether the railroads are under or over-capitalized. He urged that the values must be classified as well as ascertained.

Quantities and Unit Prices

Mr. Butler, discussing reproduction cost new, asserted, as the railroads held at the conference May 27-29 before the director of valuation, that this implied original topographic conditions, but construction according to present-day methods and prices and with present facilities other than the railroad itself. It also implied a construction program combining speed and economy. Briefly, then, he reviewed the main points made by the carriers last May relative to the inventory and the overhead charges. In determining quantities and classifications of materials he pointed out the need for historical data to establish facts not evident on the ground. In the question of contingencies he mentioned the use by some appraisers of contingencies of inventory as well as of construction, to take care of items bound to be overlooked.

Unit prices were discussed by Mr. Robinson. He held that "the prices to be used in the valuation should be arrived at by a consideration of prevailing prices, price tendencies and conditions affecting labor and material markets during a reasonable period of time next preceding and at the date as of which the valuation is to be made, due consideration being given to the existence or non-existence of active railroad construction during that period." "Weighted" averages, that is, averages based on unit price times volume, must be used rather than averages of prices alone, he held, inasmuch as high prices always accompany periods of heavy construction. He urged that no prices be applied, even tentatively, without full consultation with the carrier.

Depreciation

Depreciation was discussed by Mr. Brantley along much the same lines as at the May conference. He insisted that where there was no deferred maintenance there was no depreciation, that it was impossible for the numerous field men to "guess" how long a car or a bridge would remain useful. Questions put by representatives of the Government indicated that they deemed it mandatory according to the Valuation Act to record the "condition per cent" of the individual parts.

The meaning of the phrase "owned or used" was discussed briefly by Mr. Patterson, who held that the question of title was immaterial, only the use signifying; also that in the case of joint facilities each carrier should be treated as a separate entity, and all property jointly used credited to each carrier regardless of the other users.

Land

Mr. Butler, discussing land, followed the line of reasoning presented last May. He held that while the Minnesota rate decision did reject the use of speculative multipliers, it did not conflict with the railroads' views that values should be what it would now cost to acquire the land. He appealed to the Division of Valuation to examine carefully records made by the carriers' land committee in Chicago, showing the actual land costs for numerous lines recently constructed. He asserted that allowance of unearned increments was fully sustained by law.

As to property charged to expenses or surplus, Mr. Patterson stated that the doctrine excluding this was highly destructive to railroad practice. Railroad expenditures must be made at the most favorable times as regards unit prices and development necessities, which might be at the least favorable times as regards the raising of new capital.

Mr. Brantley urged the appointment of examiners to take testimony and settle disputed questions of fact prior to the reporting of any tentative valuations.

Other Values and Elements of Value

Mr. Robinson gave the same five "other values and elements of value" cited at the May conference, and, as at that time, conceded that it might be very difficult to estimate them separately, and that the railroads would not as yet undertake to say how they should be determined. Commissioner Hall asked whether these intangible values should always have a plus sign. Mr. Robinson thought they should unless it were conceded that the railroad ought not to have been built and would not be replaced if removed.

This closed the carriers' discussion. Before adjournment Mr. Helm explained for the State commissions that the recent appointment of their former designated spokesman, Milo R. Maltbie, to the staff of the director of valuation had left them unequipped to prepare a presentation of their views for the conference. He asked that the States be given a later hearing, but the Federal commission was unable to grant the request. The State commissions were therefore given sixty days to file a brief, and the carriers were allowed twenty additional days to reply to it. Chairman McChord pointed out that while the commission would not render any formal order covering the questions raised, the progress of the valuation work would necessitate orders from time to time on various matters under discussion.

Panama Canal May Be Closed a Month by Worst Slides Yet

What has proved to be by far the most serious blockade of the Panama Canal since its opening began Sept. 20 with a slide along the east bank of Gold Hill. Dredges were put to work at once, and it was first believed the canal could reopened in a week. Other slides have followed, the latest one reported occurring on the night of Oct. 2. As a result of this latest slide the Washington Bureau of the Panama Canal wired the collector of the port of New York that there were no definite prospects for reopening the canal before Nov. 1. It is stated that there are about ninety vessels at the canal entrances or in Gatun Lake awaiting passage.

It is reported that Major-General G. W. Goethals, who arrived at Panama Oct. 6, has withdrawn his resignation as Governor of the Canal Zone and will remain in charge until the condition of the canal will permit of his departure.

New Regulations Issued by Philadelphia Building Bureau

Recently issued regulations by the Philadelphia Bureau of Building Inspection in regard to reinforced-concrete construction require that the plans and specifications filed shall be accompanied by stress computations and descriptions in detail, including size, length and points of bending of all reinforcement, the qualities, proportions and methods of mixing the concrete and the dead and live loads each floor is designed to carry. No deviation of the construction from the approved plans shall be allowed except upon the written consent of the Chief of the Bureau of Building Inspection.

Every reinforced-concrete building shall be erected under the constant supervision of an inspector furnished by the owner or architect and acceptable to the Chief of the Bureau. The latter shall be empowered to stop any improper construction or cause removal of improper construction which he may consider dangerous.

Plans on file at the building shall be marked in ink to show the progress of the work and state the time and dates when concrete was deposited. The date on which the forms may be removed shall be indicated by the Chief of the Bureau, and record made of the date upon which the forms are actually removed.

Rock Slides Greatest Menace to New York Subway Work

(*Continued from page* 461, *first column.*)

Broadway at Thirty-eighth Street, and that the most need for reinforcement of the temporary structure is adequate support for all loose rock by providing either rakers or horizontal shoring, or by doweling into the solid rock, wherever the condition of the rock indicates liability of a stratum to separate from its bed.

"Longitudinal diagonal bracing is probably never needed except in the event of the accidental destruction of one or more of the bents, and as it is necessary to remove it before the permanent steel framework of the subway can be erected, it would seem that a continuous system of longitudinal diagonal bracing is scarcely justified.

"The lesson of the extensive collapse on Seventh Avenue, where the blast that caused the disaster perhaps directly destroyed only the nearest bents, would logically be that, as provision against the occurrence of an accident of any sort that may destroy one portion of the timbering, some diagonal bracing should be provided at such intervals as may be justified by the local conditions. If the permanent subway construction should be kept as close to the heading as is practicable and prudent, considering its liability to injury by blasts, manifestly very little of such longitudinal diagonal bracing will be needed.

"In the light of experience gained as a result of these accidents, both of which were of an unprecedented character, we make the following recommendations:

"(1) That throughout the present construction, at every point where the trench is in a rock with inclined strata, showing open seams or other evidence of actual or threatened disintegration, the sides be shored across the trench so as to form a continuous strut from side to side of the trench, with additional supports in the shape of raker braces if projecting portions of rock afford the necessary hold.

"(2) That an effort be made to systematize the work so that the sequence of operations will carry the work of excavation and the erection and concreting of the permanent subway structure close together, so as to require as little falsework and temporary decking of the street as possible.

"(3) That in future work preference be given to a type of timbering that will provide continuous needlebeams or struts from side to side of the trench, with the joints of the uprights firmly spliced to prevent buckling.

"(4) That a periodic inspection be made of every point of contact of shoring with the banks, as well as of all connections of members to insure continuous tightness and prevent deterioration of the timber work from vibration.

"In our tour of inspection we have found that, with the few exceptions noted, the work of subway construction is being prosecuted throughout in the most thorough and systematic manner. Considering the magnitude of the work and the great extent and variety of the operations, the instances of failure of any sort resulting from carelessness, or otherwise, in the conduct of it are remarkably few."

Blast Started Seventh Avenue Collapse

John F. Myers, engineer for the Public Service Commission of the second division, having charge of the section on which the Seventh Avenue collapse occurred, in reporting to the Public Service Commission on the probable cause of the accident, says:

"Looking over the work, I have formed the opinion that the blast had been the cause of the accident and that its force had caused the members forming the support of the street and trolley tracks to move to the south, and that this southerly movement was especially evident on the east side of the cut, which was that on which the blast was fired. I also felt

that this movement had, in all probability, been augmented by the fact that the trolley track, having had the supports taken from beneath it, had hung in a manner similar to a rope, and that this action by either pulling the posts, which were above the cross I-beams, to the north, or else pushing them to the south, had in turn augmented the movement which I believe the blast initiated, and when this disturbance of the track reached the point where the surface car was, its weight, added to that of the track, increased the force tending to move the supporting structure southward. The car, being a north-bound one, was on the east track, upon which side of the cut, as noted above, there is most evidence of this movement. The posts supporting the cross I-beams fell with their tops to the south and their bottoms to the north."

Robert Ridgway, engineer of subway construction for the Commission, in reporting on the same accident, agrees substantially with Mr. Myers, and adds that on the day of the Seventh Avenue accident the engineers of the Public Service Commission and the various contractors made, by his order, an immediate inspection of all street supports with the object of remedying whatever conditions might be found to be unsatisfactory.

Street Car Service Resumed on Broadway

The Broadway section which collapsed has not yet been redecked, but the east side of the street and the car tracks have been restored to grade, and through street car service has been resumed. Although the car tracks have been completely restored across the gap in Seventh Avenue, street car service had not been resumed by Oct. 6. The work of concreting the roof and walls of this section is being pushed, and will be completed before the street surface is restored. Both sidewalks have been opened to pedestrians at the scene of the Seventh Avenue accident, and one sidewalk at the Broadway collapse. The only blocks remaining closed to vehicular traffic are those from Thirty-seventh to Thirty-ninth Streets on Broadway and from Twenty-third to Twenty-fifth Streets on Seventh Avenue.

Damaged Pasadena Sewage Tank to Be Covered with Redwood

Because it is not considered advisable to spend any more money than is absolutely necessary on existing works until the sewage problem of Pasadena, South Pasadena and Alhambra has been settled, the roofing slab of reinforced concrete that was disturbed in the explosion of Aug. 26 will remain as it is, as it is considered that the amount of reinforcement in it makes it strong enough to last indefinitely. A roofing of redwood planks, however, will be placed over the shattered parts and this will be covered with earth to seal it and prevent odors from coming through.

The explosion was caused by a grass fire lighted by workmen on the sewer farm. About 6000 sq. ft. of the slab top was destroyed. The tank is 230 ft. long by 114 ft. wide, and on each of the two long sides there is a channel about 5½ ft. wide covered with 3 x 12 in. redwood planks, which have a dirt covering of 3 or 4 in., except at about every 15 or 20 ft., where there was a plank exposed with a ring in it to facilitate raising for examination of the sewage. The workmen had a fire completely surrounding the tank and it was apparent that the gas escaping from it was lighted simultaneously on both sides. The slab top is 3½ in. thick, reinforced with ⅜-in. rods and with an 8-in. reinforced-concrete beam at every 15 ft. At every 20 ft. along the long wall there are 8-in. reinforced-concrete walls running the short way of the tank. At the time of the explosion there was probably a gas volume of 80,000 cu. ft. Much of the slab sagged after the explosion and the retaining walls sustained fractures.

This report is based on information received from R. V. Orbison, city engineer or Pasadena.



DESTROYED SECTION OF PASADENA TANK COVERED WITH REDWOOD PLANKS



LOOKING ACROSS 114-FT. WIDTH—SLAB SAGGED ENTIRE DISTANCE

News of Engineering Societies

The American Society of Civil Engineers held a meeting in New York City Oct. 6. John Vipond Davies presented a paper on "The Astoria Tunnel Under the East River for Gas Distribution in New York City."

The Vermont Society of Engineers will hold a meeting at Springfield, Vt., Oct. 11-12.

The Philadelphia Association of Members of the American Society of Civil Engineers held its annual meeting Oct. 4. Dr. John A. Brashear, president of the American Society of Mechanical Engineers, spoke on "Contributions of Photography to Our Knowledge of the Stellar Universe." Officers elected for the ensuing year are: Edward B. Temple, president; Edgar Marburg and John Sterling Deans, vice-presidents; Henry H. Quimby, H. S. Smith and Col. George A. Zinn, directors; S. M. Swaab, treasurer, and W. L. Stevenson, secretary.

The Engineers' Division of the Chicago Association of Commerce has resumed its biweekly meetings, having held the first one Oct. 8 as a get-together session to discuss plans for future activities. Edmund T. Perkins is chairman of the division.

The Illinois Section of the American Waterworks Association will hold a one-day meeting in Chicago Oct. 19. During the afternoon the members will inspect the Wilson Avenue tunnel, the municipal shops and the municipal pier, all in the course of construction. Following a dinner at the Sherman House S. A. Greeley will speak on "Water Softening for Municipalities" and John Ericson will describe the construction of the Wilson Avenue tunnel and steel intake crib.

The Engineers' Club of Philadelphia will hold a meeting Oct. 19. Edward Wegmann, consulting engineer of New York City, will present a paper on "Ancient and Modern Water Supplies."



ONE OF THE WALLS ON THE WEST SIDE THAT WAS BADLY DAMAGED



VIEW DIAGONALLY ACROSS TANK GIVES AN IDEA OF ITS EXPANSE

Personal Notes

FREDERICK E. MORROW, formerly principal assistant engineer of the Chicago & Western Indiana Railroad and the Belt Railway Company of Chicago, has been appointed assistant chief engineer. Mr. Morrow was graduated from Purdue University in 1904. From June to November of that year he was in the engineering department of the Illinois Steel Company, which service he left to enter the engineering department of the Chicago & North Western Railway. He was successively rodman, instrumentman and assistant engineer with that road until April, 1907, when he was appointed field engineer in the division of track and roadway of the Board of Supervising Engineers, Chicago Traction. In April, 1910, he entered the Chicago & Western Indiana organization as office engineer. In March, 1913, he was promoted to be principal assistant engineer, in which position he had charge of the construction work of both the Western Indiana and Belt Railway, including the recently completed Clearing Yard.

W. H. C. RAMSEY, formerly connected with the Johnstown (Pa.) Water Company, has been appointed general manager of the York Water Company.

R. H. STODDARD, constructing engineer, of Portland, Ore., has been engaged by Le Doux & Le Doux of Portland to supervise the construction of the $100,000 temple for the Pocatello Elks, at Pocatello, Idaho. Mr. Stoddard made the structural designs for the building, which will be devoted exclusively to lodge purposes.

ABRAM B. DUNNING, who has recently been engaged in work for the Du Pont Land and Railway Company at Deland, Fla., has returned to Scranton, Pa., where he will assume practice as consulting and designing engineer.

W. J. SHERMAN COMPANY, consulting engineer, of Toledo, Ohio, has been retained to conduct investigations and make recommendations, accompanied by preliminary estimates of cost, for the development of an increased water supply for the city of Salem, Ohio.

J. D. STOKES, of Baker, Fla., has been appointed county surveyor of the new county of Okaloosa.

J. P. WALKER, formerly assistant engineer of the valuation department of the Atlantic Coast Line, at Petersburg, Va., has been appointed assistant superintendent of the Charleston division, with headquarters at Charleston, S. C.

AUGUSTUS W. JONES, formerly connected with the Robert Grace Contracting Company of Pittsburgh, has been appointed vice-president and general manager of the Carter Construction Company of St. Louis.

W. P. DANFORD, formerly city engineer of Durant, Okla., has been appointed assistant State engineer in the Oklahoma State Highway Department, with headquarters at Oklahoma City.

P. M. FOGG, formerly engineer in the U. S. Reclamation Service, has entered into partnership with E. E. Miller, consulting mining engineer, First National Bank Building, Denver, Col. Mr. Fogg was graduated from Swarthmore College in 1901 and began his professional work on the forces of the Pencoyd Iron Works. From this work he went to the Bureau of Filtration of the city of Philadelphia in 1901. From 1903 to 1906 he was engaged in drydock construction, and power house and shop erection work for the U. S. Navy at the League Island Navy Yard. He entered the Reclamation Service in 1906 as assistant engineer.

PHILIP E. LACEY, formerly city engineer of Bradentown, Fla., has been appointed district engineer of the Fifth District, De Sota County, Fla. In his new office he will have charge of road construction to a value of several hundred thousand dollars.

CHARLES H. FOOTE, contractor, specializing in cement and concrete construction, of Clifton, Ariz., has been appointed inspector for the Board of Trustees on the construction of the new Union High School at Duncan, Ariz.

J H. PRIOR, formerly assistant chief engineer of the Illinois Public Utilities Commission, has been appointed chief engineer, with headquarters at Springfield. He received his professional education at the Armour Institute of Technology and the University of Chicago. From 1905 to 1914 he was engineer of design of the Chicago, Milwaukee & St. Paul Railway,

New Chief Engineer of Illinois Public Utilities Commission



J. H. PRIOR

engaged in the design of all the structures of that company and on its 2000-mile extension known as the Puget Sound lines. In this capacity he made two of the earliest valuations of railroad properties required by railroad regulatory and taxing bodies; the valuation of structures of the Chicago, Milwaukee & St. Paul for the first Minnesota valuation in 1907 and the first South Dakota valuation in 1907. He was appointed assistant chief engineer of the Illinois Public Utilities Commission about a year ago.

GUY K. DOHNER has been appointed to a position on the engineering forces of the Atchison, Topeka & Santa Fé Railway.

KARL R. KENNISON, formerly principal assistant engineer to John R. Freeman, consulting engineer, of Providence, R. I., has been appointed assistant engineer on the staff of the Providence Water Supply Board. Mr. Kennison received his engineering education at Massachusetts Institute of Technology, from which he was graduated in 1908. From that date until 1909 he was in the inspection department of the Associated Mutual Fire Insurance Companies. During the interval between that work and the present appointment he was mostly in the employ of Mr. Freeman, engaged on various works, including the preliminary studies for the Mississippi River Power Company's development at Keokuk, Iowa, the Medina Irrigation Project in Texas and the Hetch Hetchy Water Supply for San Francisco.

SAMUEL MURRAY, formerly bridge engineer of the Oregon-Washington Railroad & Navigation Company, has been appointed chief engineer of that company, succeeding J. R. Holman, whose retirement on account of his health was noted in these columns, Sept. 11. Mr. Murray was graduated from the University of California in 1902 and entered railway service in September of that year as draftsman for the Southern Pacific at San Francisco. He continued in that service until 1906, when he was appointed chief draftsman in the office of John D. Isaacs, consulting engineer to the company, in charge of estimates and designs of railroad structures. Previous to his connection with the Oregon-Washington company he served as bridge engineer on the San Pedro, Los Angeles & Salt Lake Railroad.

A. H. SMITH AND L. A. BOULAY, consulting engineers, of Toledo, Ohio, who have been associated in business under the firm name of Smith & Boulay, Nasby Building, Toledo, for the past five years, will hereafter practise separately. The former will conduct business under the name of A. H. Smith Company, consulting engineer, Nasby Building, Toledo. The latter will be located in the Nicholas Building, and will continue in practice under the name of L. A. Boulay Company, civil and sanitary engineer.

CALVIN W. HENDRICK, formerly chief engineer of the Sewerage Commission of Baltimore and consulting engineer to the city, has been appointed chief engineer of that city. He first engaged in engineering work in 1881 as transitman on the Chesapeake, Ohio & Southern Railway. After seven years spent in railway work he became city engineer of Macon, Ga., which office he held until 1894. In 1895 he joined the staff of William Barclay Parsons, consulting engineer, of New York City, as assistant engineer on the preparation of plans for the Rapid Transit Railway Commission of that city. In 1898 he became engineer of sewers for that commission. Dr. Ira Remsen, a member of the Baltimore sewerage commission, in an address on the occasion of Mr. Hendrick's retirement from the commission, complimented him highly on his work as "builder of the new Baltimore sewerage system."

W. S. CONE, who has been for two and one-half years chief of the electrical division of the United States Reclamation Service Salt River project, has been appointed project manager to succeed C. H. Fitch.

A. N. KELLEY, irrigation manager for the Yuma project, has tendered his resignation to become effective Sept. 30.

PAUL R. PARKER has resigned from the office of chief engineer and works manager of the Yuba Construction Company of Marysville, Cal., to take charge of the equipment and operation of the Tin Bentong Wo Liability Company, an Australian tin dredging firm, with headquarters at Penang, Strait Settlements.

FRED W. LEPPER, superintendent of construction in the office of the supervising architect, U. S. Treasury Department, has been transferred from the supervision of the new post office building at Augusta, Ga., to take charge of the construction of the new building for the Department of the Interior at Washington, D. C. This structure, which will cover a lot 400 ft. on each side and will be seven stories high, will cost about $2,000,000. It is to be completed by Dec. 31, 1916.

R. M. BRINER, formerly assistant engineer in the office of the supervising engineer of the U. S. Reclamation Service, at Great Falls, Mont., has been appointed draftsman for the Baldwin Locomotive Works on work in connection with the new buildings being erected by that company at Eddystone, Pa.

A. KEMPKEY, consulting engineer, of San Francisco, has moved his office from the Balboa Building to the Hobart Building.

HERMAN L. WITTSTEIN, efficiency engineer of the Knox Motors Company, Springfield, Mass., has resigned from that office to become assistant to the management of the Standard Fuse Corporation at Paulsboro, N. J.

JAMES P. NELSON, a member of the valuation committee of the Chesapeake & Ohio Railway, has been placed in charge of the engineering work of that committee.

J. C. GARDNER has been appointed chief engineer of the East & West Coast Railway, with headquarters at Bradentown, Fla.

PERRY BARKER, fuel engineer, has opened offices and laboratories in the Oliver Building, Boston.

F. C. FRENCH, formerly designing engineer for the Anaconda Copper Mining Company, at Anaconda, Mont., has returned to Salt Lake City, where he was previously engaged in practice as consulting civil and mining engineer, and will open offices shortly for the purpose of resuming his practice there. He was graduated from Iowa State College in 1896 and served from then until 1899 as county surveyor of Humboldt County, Iowa, as rodman with the Iowa Central Railway, as leveler with the U. S. Geological Survey and as transitman with the Copper Range Railway successively. In the latter year he was appointed transitman on the forces of the Chicago & Northwestern, and, in 1901, assistant engineer in charge of single track construction in Wisconsin. Later he had charge of the surveys and cost estimates for the track elevation of the company's Mayfair Cut-Off in Chicago. He left this service in 1902 to become resident engineer for the Atchison, Topeka & Santa Fé, in which capacity he had charge of the construction of 25 miles of single track in Oklahoma and New Mexico. In 1903 he joined the faculty of Iowa State College as assistant professor of civil engineering, in which office he remained until 1906. During this period he was also associated with Dean A. Marston in the design of a water distribution system for Ames, Iowa and a waterworks system for West Side, Iowa. In January, 1907, he went to the Philippine Islands as senior inspector for the Philippine Railways, in charge of 100 miles of construction for the Government on the Island of Cebu. He returned to this country in the fall of that year and was appointed associate professor of civil engineering in the University of Utah. For the past three years he has been connected with copper mining properties in the Butte district, Mont.

R. B. VANSICKLE has resigned from the office of New York manager for the Casper Ranger Construction Company of Holyoke, Mass., to become assistant superintendent for Jacob A. Zimmerman & Sons, Inc. of New York City, on the construction of the new cotton warehouses and terminals at New Orleans, the design of which was described on page 402 of the March 27 issue of this journal.

E. B. GORE of Austin, Tex., has been reappointed as a member of the Texas State Board of Water Engineers by Governor Ferguson for a six-year term.

ROBERT L. BRUNET, formerly public service engineer of the city of Providence, R. I., has been made head of the new department created by the City Council, Oct. 4, to have charge of all public service engineering work.

ALEXANDER J. TAYLOR has resigned from the office of city engineer of Wilmington, Del., to enter the service of the E. I. du Pont de Nemours Powder Company. He was graduated from Delaware College in 1893 and has been in the city service at Wilmington since that time.

EDGAR M. HOOPES, JR., formerly chief engineer of the water department of Wilmington, Del., has been appointed city engineer, succeeding Alexander J. Taylor, whose resignation is noted elsewhere in these columns.

EDWARD S. SMITH, formerly State highway engineer of Idaho, has been retained as chief engineer of the proposed Yellowstone Park Highway, connecting Yellowstone Park with the existing State highway system. The work will be constructed jointly by the U. S. Forest Service, Fremont County and the State of Idaho, assisted by contributions from Mrs. E. H. Harriman, the Guggenheims and others. The road will be 60 miles in length. It is expected that the surveys will be completed by Nov. 1, so that construction may be started in the spring in order that it may be ready for the summer automobile tourist travel. Mr. Smith received his professional education at the University of Iowa and served on the U. S. Geological Survey and on the engineering forces of various railways until 1904, when he was appointed city engineer of Bloomfield, Iowa. In 1906 he returned to railroad work, in which he continued for four years. In 1910 he was appointed city engineer of Gooding, Idaho, and also engaged in private practice as irrigation engineer. He left this work to become State highway engineer, from which office he resigned, June 1, of the present year.

R. W. KNISKERN, formerly superintendent for the Thompson-Starrett Company of New York City, in charge of the completion of the Equitable Building, has become a member of the firm of Knap & Kniskern, building contractors, 520 Marquette Building, Chicago.

ROBERT F. OLDS, formerly civil engineer and superintendent in the Quartermaster's Department, U. S. Army, has resigned from that service to engage in consulting practice, along structural and hydraulic lines, with offices at the Mills Building, El Paso, Tex. He was graduated from the University of Maine in 1906 and served as draftsman in the frog and switch department of the Pennsylvania Steel Company until 1907, when he became instructor in geometry and surveying at Pennsylvania State College. Later in the year he joined the staff of Charles W. Fenn, civil engineer, of Portland, Me., in charge of field work in connection with the valuation of the plant of the Portland Water Company and on the survey and plan for a pipe line 18 miles long. He was appointed civil engineer in the Quartermaster's Department, U. S. A., in 1909, and, in that capacity, has been engaged on the construction of waterworks, barracks, officers' quarters, magazines, warehouses and other buildings in various parts of this country and in the Philippine Islands.

THEODORE F. BROWN, assistant auditor of the Star Union Line of the Pennsylvania system, was retired from active service, Sept. 1. He entered the service of the company, on the engineering forces, in 1860.

E. G. HOPSON, formerly supervising engineer of the United States Reclamation Service at Portland, Ore., has been appointed consulting engineer by Secretary of the Interior Lane. Mr. Hopson is retaining the same offices at the Central Building, Portland, and, in addition to such engineering work as may be required of him by the Government, will engage in a general consulting practice, dealing particularly with hydraulic problems.

ROBERT M. COOKSEY, principal assistant engineer of the paving commission of the city of Baltimore, has been appointed highway engineer of that city. He has been engaged in engineering work since 1900, for the past eleven years with the city of Baltimore. He was appointed principal assistant engineer to the paving commission in 1913

L. M. LAWSON, formerly project manager of the Rio Grande Irrigation Project of the U. S. Reclamation Service, has been transferred to the same position on the Yuma project at Yuma, Ariz.

CHARLES H. PRESTON, JR., consulting engineer, of Waterbury, Conn., has tendered his report to the manufacturers of the Naugatuck Valley on the feasibility of conserving water on a large basis in the upper Naugatuck drainage basin for equalizing the stream flow. The project, if completed, will be the largest undertaking of its kind in New England, entailing a cost of several million dollars.

Civil Service Examinations

United States.—Non-assembled examinations will be held Nov. 2 to secure eligibles for senior positions, grade 2, in the Federal valuation work under the Interstate Commerce Commission. The examinations are for senior civil engineer, senior structural engineer, senior architect, senior signal engineer, senior mechanical, senior electrical, senior telegraph and senior telephone engineer. In each case the salary limits are $1,800 and $2,700 per annum. All applicants must be 25, but less than 45; they must have had not less than four years of preliminary or apprenticeship training, or must be graduates of recognized technical schools, and must have had at least four years' experience in the work indicated by the title of the position. Acquaintance with methods of inventorying and cost-estimating of railway property is desirable, and applications must show that the applicant is "a person of good moral character and temperate habits, active, intelligent and discreet; of good speech and manner, qualified to address and confer with railway and public officials as occasion may require." Persons desiring any of the examinations should at once apply to the U. S. Civil Service Commission, Washington, D. C., or to other designated officials, for form 2039, stating the title of the examination for which the form is desired.

Attention is called to the fact that the junior examinations announced in this column last week are also for the Federal valuation work. Through an inadvertence on the part of this journal this point was not mentioned.

Illinois.—The recent inauguration of a sanitary engineering bureau in conjunction with the Board of Health has created several important engineering positions in this department. One of these on which announcement has been made is:

CHIEF SANITARY ENGINEER, salary from $250 to $500 a month, examination for which is to be held Nov. 6, application form to be on file Oct. 30. Candidates must be at least 30 years old and graduates of an engineering college. They should have five years' experience in a responsible position relative to sanitary work, as well as a thorough knowledge of the geography of Illinois. The duties of this position include the work of examining projects for water supply, sewage, garbage and other waste-disposal plants and investigating sanitary conditions of cities and rural communities, buildings, public and private institutions, etc.—in fact, the duties cover all work that might properly be expected of a sanitary engineering service.

St. Paul, Minn.—The Civil Service Bureau announces that examinations for the positions of junior civil engineer and two civil engineering draftsmen will be held Oct. 22, open to residents of St. Paul. Candidates for the first office must be 21 years old and graduates of a technical school, trained in the essentials of civil engineering. For the other two positions candidates for one must be 18 years old and for the other 21 years, the salaries being from $50 to $80 a month and from $85 to $100 a month respectively.

Examinations Previously Announced

Date		See Eng. Record
Oct. 13—	Aid, U. S. Bureau of Standards. Civil engineer and draftsman, Navy Department. Engineer, Indian Service....	July 3
Oct. 20—	Junior civil, junior structural, junior mechanical, junior signal, junior electrical engineers and junior architect, Federal valuation work, Interstate Commerce Commission, United States	Oct. 2

Computer Devised to Combine Quickness with Accuracy

The Ross Precision Computer, invented by Louis Ross, consulting engineer, of San Francisco, and manufactured by the Computer Manufacturing Company, 25 California Street, San Francisco, was devised with a view to combining the accuracy of logarithms with the



COMPUTER IS SIMPLE OF OPERATION

speed and convenience of a slide rule. It is claimed to solve expressions in which addition, multiplication and subtraction are involved with an accuracy of 1/1000 of 1 per cent. The system of graduations is uniform throughout, and is very simple. The length of scale is 120 times as great as that of the A and B scales in the ordinary 10-in. slide-rule. Though but 8 in. in diameter its scales are equivalent to those of a slide-rule over 100 ft. long. The Precision Computer has been devised to carry out computations to 5 decimals and to combine in the same instrument means for obtaining instant approximate results where desired. It consists of a finely graduated dial, with two radial indicators and a self-reading slide adjacent to one of the indicators. The dial gives an accuracy of 5 figures, while the slide gives instant results to an accuracy of about 3 figures. For approximate calculations the slide is sufficient for precise results, to a fine degree of accuracy; the dial is used, and the slide co-operates with it to check the result, to point out the precise answer under the slot-line, and to locate the decimal point in the answer. The dial gives numbers to an accuracy of five significant figures, the first three, as printed, the fourth by counting spaces, and the fifth by estimating tenths in the last fractional space. This system holds throughout the whole scale. To solve a proportion, the radial indicators are set over any two given numbers on the dial. Their position then represents the ratio of these numbers. The indicators are kept stationary and the dial is turned to bring any third number under one indicator. The number under the other indicator will be the fourth term of the proportion. By setting the data on the slider, a pointer shows the exact loop on which to read the answer. In simple multiplication or division the operation is identical, excepting that one of the three numbers is unity. The exact manipulations for setting the given numbers conveniently are given on the face of the computer.

At the left of the slot is a scale of equal parts. This co-operates with a similar scale at the extreme rim of the dial to give directly 5-place logarithms and anti-logarithms, without requiring any mental interpolation or effort. On the dial all the data and answers are always set and read under the slot-line, and at no other point, thus obviating doubt or ambiguity. To multiply and divide any series of numbers it is only necessary to set each of the numbers in succession under the slot-line. When the last number has been set the answer will appear under the slot-line. It is not necessary to read partial or intermediate answers in continuous proportions. Powers, roots, and other complex operations may be carried out either approximately by the use of the slide alone, or to a high degree of precision by using the dial.

The Precision Computer is made of metal throughout. The graduations are engraved on silvered metal surfaces like a surveyor's compass or transit. It is slightly over 8 in. in diameter and weighs less than a pound. The instrument is packed securely in a flexible case.

Combination Crowding Feature of New Revolving Shovel

The horizontal crowding motion said to be most desirable for making shallow cuts and tearing up paving is combined in the new Thew combination boom shovel with a shipper-shaft mechanism which also gives a jack-shaft crowding that enables the shovel to dump at wide radius and considerable height in handling trench and other kind of excavation.

The two crowding mechanisms are independent and non-interfering. Both are operated from the same crowding engine, which is simply changed in position. When using the horizontal crowding motion the long dipper handle must be removed, and when the shipper-shaft crowding motion is in use, the short dipper arm is chained to the boom structure after removing the dipper. All changes necessary can be made in less than three hours. The same dipper may be used with either crowding mechanism, but a special sewer trench dipper is furnished if desired.

The long dipper handle used in connection with the jackshaft crowding mechanism is made of a single piece of wood, 8 in. square, armored with steel plates and equipped on the under side with steel racks. These arms can be had in several lengths to suit the requirements of different kinds of work, depending on the depth of trench, dumping radius, or height of lift desired. The single dipper stick, in connection with the design of the boom, affords a combination thought to be unusually strong and effective. It is said that the single stick is less liable to get out of alignment or bow out of shape, besides being lighter and stiffer than a boom constructed in two parts.

The trussed and reinforced boom on the shovel is attached to the turntable by wide hinge castings, providing strength and rigidity. When the dipper is lowered into a trench, the dipper stick passes down between the side members or dipper-arm guide of the combination boom, thus distributing any side thrust encountered. This combination shovel affords the contractor a machine with which, it is plain, he can handle practically any kind of work encountered. Either kind of crowding motion may be incorporated when the machine is purchased, and the other mechanism may be purchased and added as occasion requires at a later date. A number of these machines have been in use for several months. Literature describing this new shovel will be sent by the Thew Automatic Shovel Company of Lorain, Ohio, to any one interested.

Business Notes

The Chicago Builders' Specialties Company, of Chicago, has moved its offices to the Lumber Exchange Building, 11 South La Salle Street.

The Fibre Conduit Company of Orangeburg, N. Y., has moved its New York City office to 101 Park Avenue.

The Marsh-Capron Manufacturing Company, manufacturer of concrete mixers, of Chicago, Ill., has moved its offices to the Lumber Exchange Building, Chicago.

W. E. Hardy, formerly connected with the Diamond Rubber Company and the B. F. Goodrich Company, in charge of their sales of mechanical rubber goods division, has been appointed sales manager of the Boston Belting Company, manufacturer of mechanical rubber goods, of Boston, Mass.

The Asbestos-Protected Metal Company, of Pittsburgh, has moved its Detroit office from the Chamber of Commerce Building to the Dime Bank Building instead of the Dunne Bank Building, as stated in these columns Oct. 2.

Trade Publications

The following companies have recently issued trade literature:

Phoenix Manufacturing Company, Eau Claire, Wis. Pamphlet, 7¾ x 11¼ in., 12 pages, illustrated. Covers the construction and operation of the "Centiped" tractor truck.

Novo Engine Company, Lansing, Mich. Folder 209, 3½ x 6½ in., illustrated. Hoisting outfits, D. H. type, equipped with single and double drums and single-speed, reversible and non-reversible engines. Double platform material elevators for building construction.

Central Supply Company, Minneapolis. Folder 307, 3¼ x 6 in., illustrated. Compares Byers black wrought-iron pipe with galvanized steel, shows advantages claimed, and illustrates specimens taken from pipe lines that have been in actual service many years.

Blaw Steel Construction Company, Pittsburgh. Folder 3½ x 6¼ in., illustrated. Shows many uses to which Blawforms have been put; Ashokan dam, New York subway system, sewer, curb, building and wall construction are included. Accompanying the illustrations is a brief description of Blawforms and their advantages.



NEW SHOVEL CAN BE USED FOR BOTH DEEP AND SHALLOW CUTS

Engineering Record

Circulation 20,000 copies. McGraw Publishing Company, Inc.

October 16, 1915

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Twenty-eight ton girder set with only 18 minutes' delay to traffic in rebuilding Ninth Avenue Elevated in New York City

Safe from Flames





BONANZA Cement Tile Roofing

1700 Fahrenheit was the temperature of the blast of flame directed against a Bonanza Roof for *one hour and five minutes.* The BONANZA TILE showed no signs of disintegration.

This test was made for the City of New York Bureau of Buildings and Bonanza Tile was approved as a fireproof roofing material.

It makes a building "fireproof" in fact as well as in name. Its life is only limited by the life of the building it protects, for Bonanza is not subject to corrosion or deterioration.

Ten years' service, during which many of the first Bonanza Roofs have been followed by repeat orders, are the best proof of Bonanza economy.

BONANZA CEMENT TILE are laid right on the steel purlins. They need no sheathing or temporary support. They interlock and overlap and require no fastening. A steel superstructure designed to hold a roof load of 45 to 50 lbs. per square foot will take care of Bonanza Tile.

Weather will not delay the job when Bonanza is used. The tile are thoroughly seasoned and the rubber cement used in laying is unaffected by cold or dampness.

Heavily reinforced. Tests show breaking load to be 350 lb. per sq. ft. Made in "SKY-LIGHT TILE" and FLAT TILE for roofs of light pitch.

Data Sheets Give the Details. Get a Set For Your Files.



Detail of Standard "BONANZA" Overlapping and Interlocking Tile

Color of tile.....Red
Size of tile.....26x52 Inches
Thickness of tile.....⅞ Inch
Surface exposed to weather, 21x48 Inches
Number of tiles per square of roof (100 sq. ft.).....12½
Weight per square foot.....13¾ lbs.
Channel purlins spaced four feet apart.

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Form of Valuation Report

GENERALIZATIONS as to the form of report to be made by the Division of Valuation of the Interstate Commerce Commission in connection with the evaluation of the carriers were presented at the conference in Washington last May. Further discussion of this important phase of the Government's gigantic undertaking appears in the brief recently filed by the railroads with the commission, although the subject was not reached at the conference two weeks ago. Mr. Jurgensen of the Minnesota Railroad and Warehouse Commission now offers on page 484 something tangible in the shape of forms which aim to record valuations on all of the various conflicting bases advocated, with or without depreciation, overhead and the like. The Engineering Record understands Mr. Jurgensen to be one of those who favor deducting everything deductible, and suspects that his valuation will be found in column 18 of the main sheet. One very apparent flaw in his attempt to show the claims of all interests is his failure to mention property used but not owned by the carrier. The forms should, however, serve as a basis for discussion, and are submitted for that purpose.

More Speed Records

THE Sheepshead Bay Speedway near New York City, the only track of its type in this country with scientifically designed curving banks on the turns, has proved to be the fastest in the world. On Sept. 18 a world's record of 5 min. 32 4-5 sec. for 10 miles, which is a rate of 108 miles per hour, was made. In the Astor Cup race on Oct. 9, the winner covered 350 miles in 3 hours 24 min. 42 sec., a rate of 102.6 miles per hour, another world's record for this distance. A crowd variously estimated at between 60,000 and 97,000 people witnessed the latter race, and found ample accommodations in the steel-frame grandstand and the timber bleachers, described in this journal Oct. 2. Incidentally, it can be stated in connection with a recent editorial criticising the track design for omitting clips to hold the timber surface, and a letter from one of the engineers stating that they were to be used, that these clips were replaced by using nails driven into the underside of the flooring and bent over the top flanges of the I-beam supports.

Safety in Steel Erection

WHAT may be done in the way of safeguarding the public and the workmen on steel erection is strikingly illustrated by the record of more than 6000 tons of steel erected at a rapid rate over congested streets without a serious accident, made on section 1 of the Manhattan elevated railway improvements in New York City, described elsewhere in this issue. This section is in the badly-crowded streets of the downtown jobbing district, where street-car, truck and pedestrian traffic is very dense. Nets hung beneath the structure under repair protected the street traffic from falling objects, a most fruitful source of accidents. All excavations for new column footings were carefully guarded. The elevated tracks themselves were at all times kept in first-class operating condition. The new steel, brought in by truck, was safeguarded when left on the street, and handled with skill when being moved. The rigging was done successfully, although the conditions were anything but favorable for safe rigging. This performance stands in sharp contrast to the unfortunate records for accidents made in erecting the frames for the two largest office buildings in the world, the Barr Building in St. Louis, and the Equitable Building in New York City, although the conditions on building erection, where the public can be largely excluded from the danger zone, are usually considered favorable for a low accident rate. The record of the elevated work shows plainly what can be done by a competent erector with skilled forces toward making a hazardous construction operation safe.

Chicago's Garbage Problem

IT is doubtful if the present city officials in Chicago will have the audacity to turn back any part of the garbage disposal plant to private parties. The widespread publicity which this subject has received indicates that the investigations by experts have so educated the editorial writers that they will keep their readers informed correctly just as soon as any attempt is made to put the money-making end of the problem ahead of service. After the health commissioner has finished his personal investigations of plants in other cities it may be that he will abandon his opinions as to remedies, namely, to separate the garbage reduction problem into two parts—the money-making end to go to a private contractor, who may or may not carry out the work in a sanitary manner, and the city to hold to that part of the process which provides most of the political jobs. More than $700,000 has been expended on the plant to date and more than $300,000 is estimated as an amount necessary to complete it. Why not put up the money and finish the plant before talking about deficits? The newspapers want experts to report on the possibilities of improvements under a business-like management, and they further ask that the report of the city waste commission, made two years ago, be restudied to see how nearly the recommendations of that document have been carried out. The local engineering societies in Chicago ought to endorse this plan and show their approval, if nothing else, for it is exactly what they would recommend. A few cities are able to handle garbage without mixing sufficient politics to make the process more noisome than it must be anyway. Chicago has a chance to do excellent pioneer work along this line, but she must turn the problem over to experts whose hands are not tied politically.

Large Contractors in Road Work

ONE noticeable effect of the stagnation in engineering construction is the extent to which large and financially strong contractors are entering the highway field. Formerly road work was done almost entirely by small "outfits," one-man organizations, which either specialized in road work or engaged in a variety of small engineering—small sewer, waterworks, drainage and bridge work. Now names which are powers in the big contracting world—builders of railroads, dams, huge water supply and sewerage works—will be found among the bidders for highway contracts. It is true in the East and in the Middle West. Moreover, while scarcity of work in other lines has brought these companies into the highway field, it is likely that they will withdraw only to a minor extent when big work is plentiful. Conference with the contractors and the equipment manufacturers indicates that they are in the field to stay. They are stocking up with road-building plant and are putting good men on the work for the purpose of educating them to the best methods. This development, the Engineering Record believes, is in the direction of highway progress. The engineers favor it. With more responsible contractors and more competent organizations lower costs and better work are assured. This does not mean that among the veteran small road contractors there were not competent men. As a class, however, they needed close watching, often lacked competence, and depended more on political influence than on good work to save themselves from serious trouble with the engineers.

Graphical Versus Analytical Methods

ALTHOUGH the question whether to use graphical or analytical methods of computation and analysis is often determined almost wholly by the personal preference of the engineer and his familiarity with the general procedure in the one case or the other, there are certain problems for which the graphical method is inherently superior.

For example, the external reactions for all cases of beams and arches supporting oblique loads can be more directly obtained by graphical diagrams. Further, the great advantage of influence lines for exact analysis in determining that position of live loading which will give maximum stresses at given sections is particularly evident in the analysis of indeterminate structures. The two articles by C. S. Whitney, one on page 324 of the issue of Sept. 11 on the fixed-end arch, and the other on page 486 of this issue, in which application is made to the reinforced-concrete conduit solved by Mr. Smith in the issue of May 22 by the method of least work and trial graphical diagrams, demonstrate the possibilities of purely graphical methods in both speed and accuracy. This journal agrees with Mr. Whitney's contention that, especially in the case of conduits in deep earth fill, the external loading is not known within wide limits, and that temperature effects are also largely indeterminate. Further, the assumed fixed ends in arch analysis are never absolutely rigid and unyielding. Refinements in accurate analysis are wholly unjustifiable for such problems. Mr. Whitney has checked the results of his graphical methods with analytical values within small percentages, indicating the possibilities of the graphical diagrams. If larger spans and loading occur, so that graphical methods become inadequate, the summations in his equations can easily be made analytically instead of using force and equilibrium polygons. The chief advantage of his method is the entire elimination of all trial polygons and trial lines in the graphical analysis. A similar method has been used for some time in Germany, and the obvious superiority of this analysis in directness and simplicity should commend itself to engineers in this country.

A Recipe and a Remedy

TAKE about 500 men from eight or nine adjacent States, dip them in the lore of road work, bring them together as delegates to a convention, season them with a number of papers which overlap in thought and are general in character, allow the whole to simmer for three days, and you have the recent Northwestern Road Congress. In justice to the convention it should be mentioned that a slight amount of seasoning was added in the form of short to-the-point talks by several speakers, but the papers were mostly of such a general nature that there was practically no discussion. Too much time was allotted to each speaker. As a result the entire schedule was blocked and many of the papers were not read.

The Northwestern Road Congress, and, for that matter, many other conventions of a similar nature could well afford to adopt the scheme followed by the National Council of Safety at its conventions, where the red and green electric light signal system for speakers is used. The speaker is allotted a certain time and about 4 min. before its expiration the green light on the chairman's table is turned on, flashing a warning to the orator to start his concluding remarks. At the expiration of the time limit the red light glows its message, "Stop." This has a fourfold effect. It does away with rambling reminiscences by the speaker; it keeps him hard at it driving home the points he wishes to make; it is a useful guide for those in the audience who are waiting for other papers, and it gives backbone to the average chairman, who hesitates to cut short a prominent speaker who has exceeded his time.

Will the time ever come when papers of a general nature will be tabooed at conventions where men go to get pointers and new methods? The symposium idea, where a number of men give their experience and advice on a single phase of any particular kind of engineering, would prove of value to those present and would render the convention proceedings of any organization a valuable addition to technical literature.

Are Engineers Becoming More Practical?

WHETHER the intellectual stimulus of the world, induced by the war, is affecting the engineer in the same way that it is affecting the general public is a problem impossible to solve in definite terms, but there are indications that engineers are sensitive to present-day conditions. Public library withdrawals indicate that the materialistic, commercial subjects bearing on economics are being studied as never before. Theodore H. Price, in the October *World's Work*, verifies these conclusions at the Chicago and New York libraries, where the largest demands are now along immediately practical rather than academic lines. "In its genesis," says Mr. Price, "the struggle was inspired by a desire for commercial dominion and, in its progress, it has become a test of economic endurance. It is quite logical, therefore, that it should bring commercial and economic subjects into the foreground and set people to thinking how they can repair the waste of the war while it lasts, profit by the commercial opportunities it offers, and pay the debts incurred when it is over."

It was reasonable to suppose that the engineer would respond to this stimulus to a much greater extent than would the layman and the following indications are that he has done so. As applied to himself the engineer in Chicago and elsewhere is beginning to support the newly formed material welfare organization, the American Association of Engineers. In fifteen days fifty-four men, including a past-president of two National societies, several consulting engineers and contractors of note, became members. The Western Society of Engineers recently devoted a whole evening to the discussion of the material welfare of its members.

From the general standpoint the papers read at the International Engineering Congress in San Francisco are a good criterion. John F. Stevens linked business principles with government railroads as a necessity. F. H. Newell discussed the question "Does Irrigation Pay?" and Logan Waller Page chose as his subject "Economic Factors All-Important in Rural Highways." Prof. George F. Swain urged still more practical methods in teaching engineering.

With the intensive, materialistic and economic pressures brought to bear on the European belligerents they have become more or less socialized in so far as their economic resources are concerned. This tendency is sure to spread when the war is over. It is, therefore, a good time for engineers, for their own welfare as well as for that of their country, with their training in organization and the economics of material things, to turn their energies more than ever into the larger spheres of citizenship. More engineers should become city managers and members of civic boards. When positions which call by statute for engineers are not filled from the ranks of technical men, as is now the case in Chicago, engineering societies are obligated to protest most emphatically, and, if need be, to start injunction proceedings against the city treasurer enjoining him from spending the taxpayers' money for salaries of unqualified men. Individual efforts would be futile. Co-operation is absolutely necessary to secure results in such cases.

Why the New York Subway Decking Collapsed

IN discussing the two recent subway construction accidents in New York the daily press has set forth many choice bits of reasoning in explanation of the collapse of the street decking described in the Engineering Record of Sept. 25 and Oct. 2. These arguments agree only in the matter of reflecting on the engineering profession. As told to the coroner's jury, the story of the blasting foreman, who said he removed several small pieces of blocking near the heading before firing the fatal blast, has been seized on as a complete explanation of the collapse on Seventh Avenue by a zealous Brooklyn editor, who asks why the engineers failed to discover, amid the general wreckage, that this blocking had previously been in place and had been removed before the blast was fired. The report of the commissioner of accounts of New York City, made to the Mayor, has been widely exploited because it scores the type of street support used on the sections affected as "entirely unsuited for the purpose for which it was designed." Nevertheless, of the three sections where this type of timbering was used, 36 per cent of all work on one, 42 per cent on another and 65 per cent on the third—the section where the worst collapse occurred—had been completed on Sept. 1. This means that the "unfit" street support had actually supported the streets over these sections for the greater part of the excavation required on them.

It is easy to condemn a system of construction after it has failed. This journal was able to do that in pointing out editorially, in advance of the daily press and the reports of various investigating bodies, the need for more X-bracing in the structure which failed. The public is even now blaming the engineers—and justly—for not having foreseen and forestalled this accident. To do this latter is much more difficult, and that it has been done successfully

on the great majority of the subway sections now being built is agreed by all the reports yet made public by competent investigating bodies.

The point about the accident on Seventh Avenue overlooked by the commissioner of accounts, the press, and so far by the coroner's investigation, and pointed out in this journal at the time of the accident, is the fact that the car which fell into the cut had no business where it was, and that its weight undoubtedly contributed to the extent of the collapse. Whether the fault was that of the blasting foreman, of the motorman, of the flagmen, or of general practice, it was criminal negligence to allow a car full of passengers to stand over a section of street on temporary supports while a blast was being fired beneath. It is well to talk of what engineers may do to prevent accidents of this sort, but it must be remembered that the very existence of a red flag block about a zone where a blast is being fired is proof that such work entails risk, however slight that risk may be made. Entirely aside from the safeguards the engineers may be able to provide, the city officials, the press and the public have it within their power to protect the public from personal injury and loss of life resulting from blasting accidents by demanding red flags blocks of the proper extent when such work is being done, and by seeing that proper attention is paid to them.

More Engineers Wanted for Federal Valuation

ANNOUNCEMENT was made last week in the "News of the Week" of this journal that a new set of non-assembled examinations would be held for the senior technical positions, grade 2 only, on the Federal valuation work. The Division of Valuation, recognizing the magnitude of its task and the certainty of adverse criticism if the work should be entrusted to incompetent men, has proceeded carefully and slowly with the organization of its forces. At present there are about 875 engineers in the work. Men who passed the 1913 examinations and have not been called to duty need not think that there is no chance for them. The regulation does, however, stipulate that eligibility lists shall expire after one year unless extended by the Civil Service Commission, and while the 1913 lists have heretofore been so extended it is likely that they will now be allowed to expire. Therefore every man on the list who still desires to get into the work and considers himself well qualified would do well to take the examination again and strive to obtain a higher rating.

New and old applicants alike should remember that in non-assembled examinations of this character the examiners must necessarily depend almost entirely on the candidate's own story. While the Division of Valuation can easily run down false claims when making its selections from the certified lists, the original examiners cannot be expected to fill the gaps left by too modest applicants who have failed to tell of their achievements. It has been suggested that some of those who were disappointed in their ratings two years ago may have taken too much for granted and failed to give specific information. Titles, especially in railway service, mean little. Division engineers on some roads have maintenance only, on others construction only, on still others both. Assistant engineers may be anything from high executives to senior draftsmen. Work done is far more significant than titles held. Attention is called to a paragraph that appears in each announcement:

"Great care should be taken to make the statements in the application form complete and correct in all details, as no additional or amended statements will be accepted by the commission that have not been received within thirty days after the date of the examination. Applicants should state fully all experience having any bearing on their qualifications for the position, although part of it may be of a character not herein mentioned. Especial weight will be given to experience in valuation and unit cost work."

In this connection it is suggested that certain information of a non-technical nature is not without value to the examiners. If an applicant has bought land, or administered an estate, or managed a business, he should record that fact.

If a man is about equally qualified in two or three lines it is not necessary for him to choose which examination to take. He should take all for which he is qualified. He might, for instance, try for civil engineer, structural engineer and architect, and qualify for all three. Of course, a wild attempt to get into the service somewhere by trying all of the examinations would only stamp a man as a jack of all trades and master of none, but genuine qualifications in two or three lines would doubtless enhance his general value. The Division of Valuation wants broad men, with good perspective and balance.

As the applications must be in by Nov. 2 it behooves all who mean to apply to get at it at once.

Depth of Trickling Filters and Its Relation to Efficiency

EXPERIENCE with sewage trickling filters of different depths has shown that deep filters are relatively more efficient than shallow filters. A filter 10 ft. deep, for example, can be operated at a rate considerably more than double that of a filter 5 ft. deep and made to yield as good an effluent. In some cases doubling the depth has increased the rate of efficiency as much as five times. For some time this has been a puzzle to sanitary engineers, but the true explanation seems to have been given by H. W. Clark, director of the division of water and sewage laboratories of the Massachusetts State Department of Health. In a paper presented to the sanitary engineering section of the American Public Health Association at its recent meeting in Rochester and printed on page 477 of this issue, he explained that the phenomenon is one resulting from the laws of hydraulics; it is a physical, not a chemical or a biological matter.

In any filter some of the liquid courses through the main channels in a relatively short time, while part of it is held in the smaller channels because of increased friction and capillarity, and thus takes a longer time to pass from the top to the bottom. In any filter the effluent is a mixture of liquids that have passed quickly and those that have passed slowly—that is, a mixture of liquids scantily purified with liquids well purified. By dosing beds with salt Mr. Clark found that in the shallow filters there was a much larger proportion of the liquid which had passed the filter rapidly. In one experiment it was found that 50 per cent of the salt applied appeared at the outlet and mingled with the effluent in 12 min. in the case of a 5-ft. filter, but that in a 10-ft. filter of the same material operating at the same rate it took 1¾ hours for an effluent containing 50 per cent salt to reach the underdrains. In various other ways experiments were made to establish the point.

This idea is not new in filtration. It was studied in the early days of the Lawrence Experiment Station, but appears to have been lost sight of. It is more important in beds of coarse material, like trickling filters, than in fine sand beds.

The subject opens up some interesting topics for discussion. Filter effluents must be regarded as composite liquids, as mixtures of large proportions of waters thoroughly purified with small proportions of waters purified less thoroughly. The efficiency is a measure of the ratio of the one to the other. That there must be differences between coarse sands and fine sands in this respect is obvious, and it is also obvious that it is the finer particles of the sand filling in the spaces between the larger grains that determines the time of percolation and, accordingly, the rate of mingling of the current threads within the filter. It was for this reason that the effective size of filter sand was established near the lower sizes of the constituent grains instead of at the size of the median grain. In the case of trickling filters no effort has been made to control the time of percolation except by altering the depth and the limiting sizes of the grains. Perhaps the ideas represented by the terms "effective size" and "uniformity coefficient" cannot be applied to broken stone, but it would be well to have this subject more carefully studied.

If a filter effluent is a composite of small volumes of liquids imperfectly filtered with large volumes perfectly filtered, wherein does this differ from the dilution of raw sewages with clean river water? That there are some differences is obvious, the larger particles of suspended matter being completely removed in the one case and not in the other; but what about bacteria and dissolved organic matter? There are important questions here involved which the opponents of the dilution method would do well to consider. Mr. Clark's paper should stimulate anew the interest in the physical problems of water and sewage purification as well as the relations between hydraulics and the chemical and biological processes in purification plants of all kinds.

Section of New York Elevated Rebuilt Under Heavy Traffic Without an Accident

Complicated Layout Made Planning of Erection Difficult—Top Flanges Removed to Set Girders—Close Quarters Required Special Rigging

DURING the eleven months prior to September the elevated lines centering at Chatham Square in New York City have been entirely rebuilt at a uniformly rapid rate to accommodate a new and enlarged track layout. This work involved placing 6076 tons of steel, and was done without holding up a single train on these lines, which were operated on 90-sec. headway, without killing or seriously injuring a single workman or a single passer-by in this congested district, and without delaying street traffic at any time more than 18 min. The highest tonnage of steel set in any one month was 1159 tons placed in June, 1915.

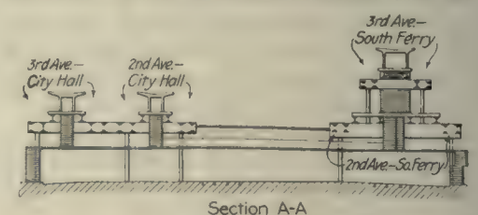
This part of the Manhattan elevated improvements, known as section 1, included some of the heaviest and most difficult replacement work of all the New York elevated improvements. At Chatham Square the Second and Third Avenue elevated lines come together, and extend south in two branches, one to South Ferry and one down Park Row to Brooklyn Bridge. Section 1 includes the elevated lines for a short distance above Chatham Square on the Bowery, and the lines below Chatham Square on Park Row to the end of the line at Brooklyn Bridge, and on the New Bowery and Pearl Street to the Franklin Square Station.

The construction on Pearl Street, the New Bowery and the Bowery involved a double-track "hump" which will carry trains over the tracks at Chatham Square for operation from the Third Avenue line to South Ferry. The work at Chatham Square Station and on Park Row involved a nearly complete renewal of the old structure, changes in the location of platforms and in the alignment of tracks, and the building of a four-track structure on Park Row which starts with all four tracks at grade and ends at Brooklyn Bridge in a double deck.

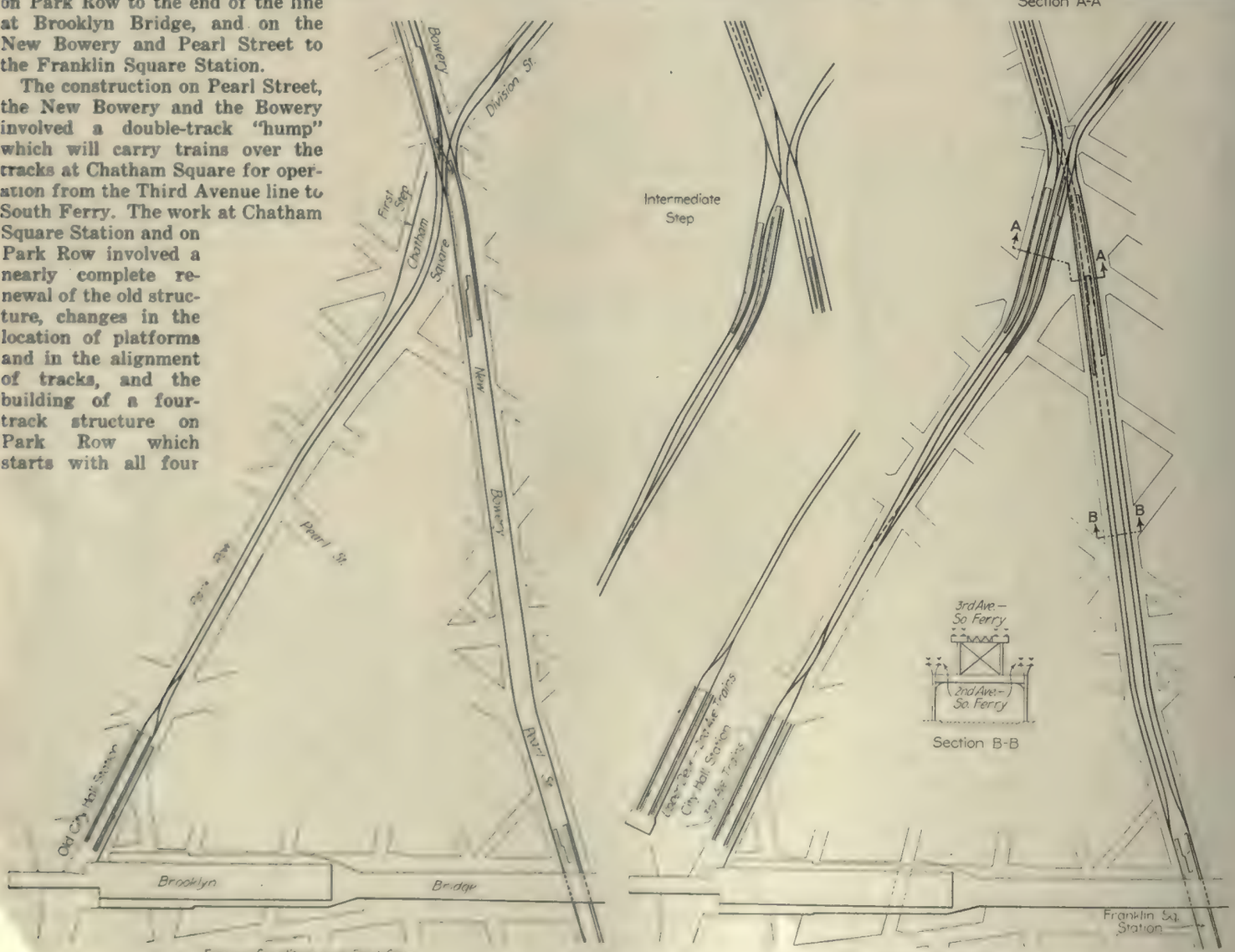
ORDER OF CONSTRUCTION CAREFULLY PLANNED

The layout of the old and new tracks is shown in the accompanying drawing. The two west, or lower-deck, tracks on Park Row will be used for Third Avenue trains, while the two east, or upper-deck, tracks will connect with the Second Avenue line. The problem of where to start work so as to secure uniform progress and keep a large enough force to insure rapid completion effectively employed at all times was a complicated one. It received considerable attention from the engineers of the Interborough Rapid Transit Company, and the main features of the erection scheme first outlined were carried out with little change and with great success by the contractors.

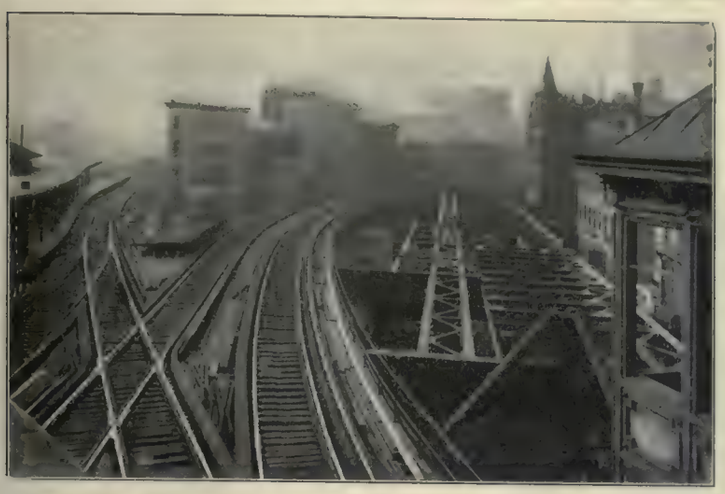
First, the old signal tower on the west side of Chatham Square, which interfered with the new southbound Park Row tracks, was taken down and replaced by a new structure at the corner of Division Street and the Bowery. Next, a stiffleg derrick set the first panel of steel at the north end west of Chatham Square and erected on it a traveler, facing south. This traveler then erected the new southbound Third Avenue track, the girders under the new west platform and part of the new west center track down to the lower end of the platform. From this point the new cross-girders, columns and stringers required to join on to the existing tracks were put up with a ginpole by a hoist on the street. The southbound Third Avenue track was then connected and operated, while a "jinny-wink" set east of the new platform took out the old southbound track and finished setting steel for the new track east of the new west platform. This track was then put in service for northbound traffic, leaving the old sweep across the center of the Square entirely clear for reconstruction. The derrick was set up again where it could replace the north panels of this sweep. As soon as this was done a large traveler was erected which put in the two east tracks and followed them down to the end of the double deck at Brooklyn Bridge. The "jinny-wink," moved over from the new northbound track, backed away from this traveler, removing the old steel, to the



Section A-A



COMPLICATED SECTION WAS REBUILT IN A YEAR WITHOUT SERIOUS ACCIDENT AND WITH NO DELAY TO TRAFFIC



FIRST STEP, PARK ROW LINE FROM CHATHAM SQUARE



INTERMEDIATE STEP, PARK ROW BELOW CHATHAM SQUARE

point on Park Row near Pearl Street where the old structure ran into the two tracks in operation. Here the "jinny-wink" was taken down.

Meanwhile, starting at Pearl Street and working south, a crew armed with ginpoles and hoisting engines were shoring the existing track stringers, reinforcing or replacing the old cross girders, and erecting double-deck columns in place of the old ones.

Work on New Bowery

The largest traveler used on the section was started at the south end of the "hump" on the New Bowery line. It moved north, replacing the old cross girders and erecting the double-track "hump" on them across Chatham Square and up the Bowery to the end of the section near Pell Street.

Much temporary work was also required while new bridges, stairs and platforms were being built for handling passengers, both at Chatham Square and at Brooklyn Bridge.

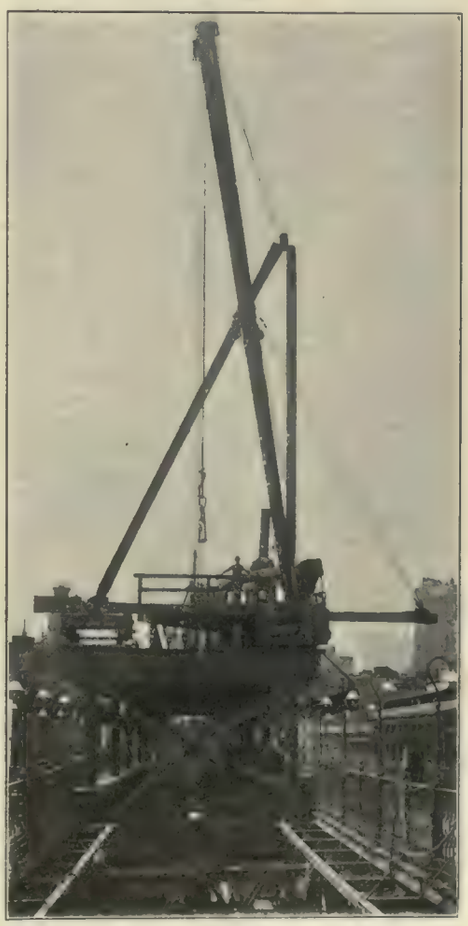
Erection Proceeds Backward

In putting up a new structure, the columns are generally erected first, then the cross girders and finally the stringers. In the erection on Park Row this order was exactly reversed. The stringers, which, for the lower deck, were the old ones, were already in place. They were blocked up on girders spanning the street on both sides of each bent, which were carried on timber towers. At one time during the erection there was actually a greater weight of steel in this falsework than in what was left in place of the elevated structure itself. The old cross girders and columns were taken out while the tracks were supported in this way without in the least disturbing traffic.

The new cross girders were put up in advance of the new columns, as the brackets on the latter would not have let the girders go up if the columns had been placed first. To get these girders past the ends of the adjoining stringers the top flanges of some of them had to be taken off. The girder would be raised to clear street traffic by a ginpole at each end, and blocked up from the towers supporting the track. The top flange would then be lifted off complete, and tilted so that it could be wriggled or rolled up between the ends of the stringers and put where it belonged. The rest of the girder was then raised after it, assembled and blocked in place, and connected to the stringers. The columns were then set, the two-story ones being handled all in one piece.

"Chicago Derricks" Work Well

Where the top flange could not be placed by this method, it was slid in from the end after the rest of the girder was erected. For this service a "Chicago derrick," made by stepping one of the ginpoles against the last column set, and guying it back to the



TRAVELER ON NEW BOWERY

column so that it could be used as a boom, proved useful. When clearances would not allow this method, the top flange would be taken entirely apart, the angles worked up through the ends of the stringers, the rest of the girder set, and the wide, thin cover plates rolled in from one end. This was done by curling the plate, entering one end, holding up the middle of the plate near the entering point with the "Chicago derrick," and holding down the tail of the plate with a set of falls to make it clear adjoining buildings. The plate would then be dragged around this curved path with another set of falls, feeding into place like a stiff ribbon.

A number of these cross girders were received "knocked down," and each piece, consisting of cover plates, flange angles and web in three sections, was erected separately, the girders being assembled and riveted in place. This method was necessitated by the narrowness of the street and the arrangement at some points of the shoring required to support the track stringers.

The largest girder set, at Duane Street and Park Row, weighed 30 tons, and required 18 min. to drag it into place, raise it clear of traffic and block it up on the timber towers.

Tall Ginpoles Used

The gin poles used on this work had to be leaned toward their load and handled on a main guy and two side guys, as the narrow street gave no room to spread out guys in the usual fashion. This rigging was carefully done, and handled very successfully. In one instance a 56-ft. ginpole was required. Many of the tallest columns, however, some weighing 8 tons, were set with 35 or 40-ft. ginpoles, made of single-length 12 x 12-in. timbers. Where it was not possible to set a pole at each end of a girder to raise it, two sets of falls on each side, making a pair at each end of the girder, were used. Each pair was joined by a short sling passing under the girder, and the upper block of each set of falls was hitched to a beam resting on the elevated structure itself.

Pearl Street Girders Erected in Three Parts

Two of the new girders under the Chatham Square station were slid into place from one end on blocking. The old elevated on Pearl Street and the New Bowery, like that on the Bowery, consisted of two independent tracks, each carried on top of a row of columns at the side of the street and connected at intervals by cross bracing. These columns were reinforced at the top and connected by cross girders which carried the double-track "hump." The middle sections of most of these girders on Pearl Street, which rested on top of the old columns, were spliced in the field to the end sections. The ends were raised over the street and slid on top of the columns between the old stringers. The



"HUMP" ON NEW BOWERY STARTED, RECONSTRUCTION ON PARK ROW WELL ALONG

middle sections could then be raised and connected to the two ends.

On the New Bowery, where the old track grade is well above the street, the new girders framed into the sides of the existing columns, instead of resting on top of them. Here brackets were first riveted to the posts. The girders were then landed on these brackets, and the end-connection angles and bottom flanges drilled to match in place. On account of the irregularities of the old structure, which has been in service thirty-seven years, this work could not possibly have been done in the shop. Much of the old steel had to be plumbed and realigned. Nearly every pair of old track stringers on Pearl Street had to be cut off or lengthened, and many of them dragged endwise for short distances to match up with the new steel. This feature of the work had been carefully measured and detailed, and worked out very accurately.

EQUIPMENT USED

Two of the main travelers and the derrick were equipped with electric hoists, while the third traveler, which built the New Bowery "hump," had a steam hoist. Three electric hoists and several steam hoists were used on the street to operate the ginpoles and "jinny-wink." These were moved by running the hoisting line out ahead and dragging them along on their skids. Compressed air was supplied all over the section through 3-in. lines by a 310-ft. compressor. This was located, with a boiler, on the street under the Chatham Square station. Wire-rope slings were used in preference to chains in all rigging, and the contractors are well satisfied with the results from a safety point of view.

The Manhattan elevated improvements are being designed and supervised by the Interborough Rapid Transit Company, George H. Pegram, chief engineer, F. W. Gardiner, principal assistant engineer and S. Johannesson, general assistant engineer. H. C. Soest is assistant engineer in charge of section 1. The contractors for this work are the T. A. Gillespie Company, executive, the Terry & Tench Company, Inc., and the Snare & Triest Company. Edward J. Govern, vice-president of the T. A. Gillespie, Company, has general direction of the work. H. D. Robinson is chief engineer for the Terry & Tench Company, Inc., and several sections, including section 1, are in direct charge of W. R. Coppage, superintendent for the same company. J. T. Watkins has had charge of the erection of section 1.

Draw Diagrams for Beams Reinforced for Compression

W. W. Clifford and C. H. Mangold Give Graphical Solution for Formulas of Joint Committee Which Are Useful in Investigations

THE DISCUSSION published by W. W. Clifford and C. H. Mangold in the September *Journal* of the Boston Society of Civil Engineers of a paper on "Some Special Methods of Reinforced-Concrete Design" in the same issue by M. J. Lorente, presented Sept. 15, contains useful graphical diagrams for the investigation of beams reinforced on the compression side.

The accompanying graphical solution of the standard formulas for k and j (using standard notation) has been found to be simple and useful. These are curves giving j with p' and k as co-ordinates superimposed upon similar curves for p. The curves given are for three values of d'/d, 0.05, 0.10 and 0.15, which will cover most practical cases. The curves for the value of d'/d next larger than the actual value will give a small percentage on the side of safety, and be well within the precision of the actual work. For special cases interpolation between the curves is easily made.

As an example of the use of the diagrams, assume the investigation of a beam which has an external bending moment of 1,625,000 in.-lb., $d'/d = 0.10$, $d = 21$ in., $p = 0.025$, $p' = 0.02$, and an area of tension steel of 6.30 sq. in.; n is assumed to be 15. Entering the middle group of curves ($d'/d = 0.10$) at the top, where the value of p' is 0.02, and dropping vertically downward to the $p = 0.025$ curve, we read $k = 0.45$ and $j = 0.876$. Then

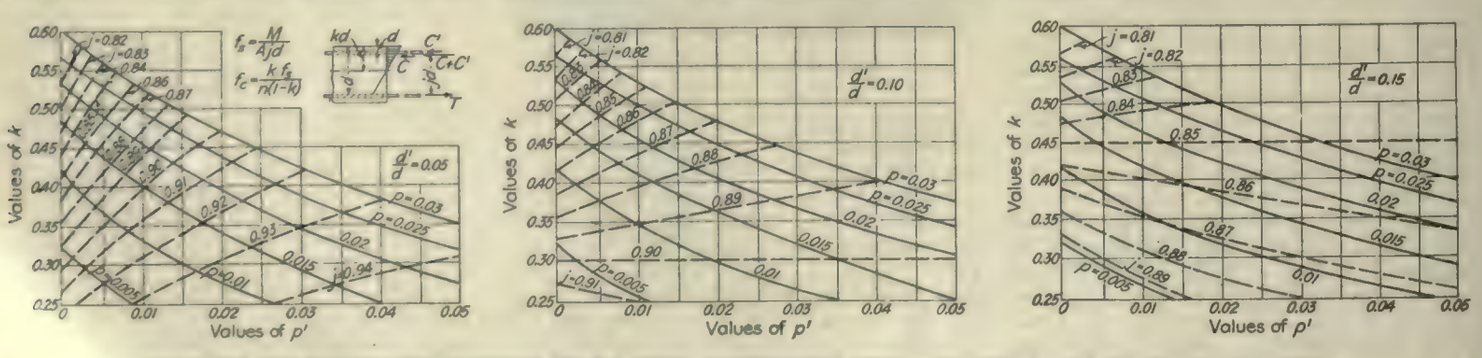
$$f_s = \frac{M}{Ajd} = \frac{1{,}625{,}000}{6.30 \times 0.876 \times 21} = 14{,}000$$

and

$$f_c = \frac{kf_s}{n(1-k)} = \frac{0.45 \times 14{,}000}{15(1-0.45)} = 763$$

Illinois Utilities Commission Adopts Water Service Rules

ILLINOIS water service rules were recently adopted by the Public Utilities Commission. Some of them are as follows: Recording pressure gages must be maintained in towns of 300 population or more. Meter bills must show the amount of water falling between each pair of limits where a sliding scale is in effect. Consumers and fire departments must be notified six hours in advance if the service is to be interrupted. Meter-testing facilities must be provided unless specifically excused. Limiting errors for one-eight and one-half flows are 4 per cent, and for full flows, 2 per cent. The frequency of tests is as follows: ⅝-in. meters every ten years or after passing 100,000 cu. ft.; ¾-in. meters in eight years, or 150,000 cu. ft.; 1-in. meters six years, or 300,000 cu. ft.; and all large meters every four years. A free test may be granted a consumer if the meter have not been tested within a year. The fee for 1-in. sizes and smaller in service less than twelve months is $2. For sizes up to 2 in. the charge is $5. If the meter is more than 2 per cent fast the utility shall pay the consumer the amount of the fee.

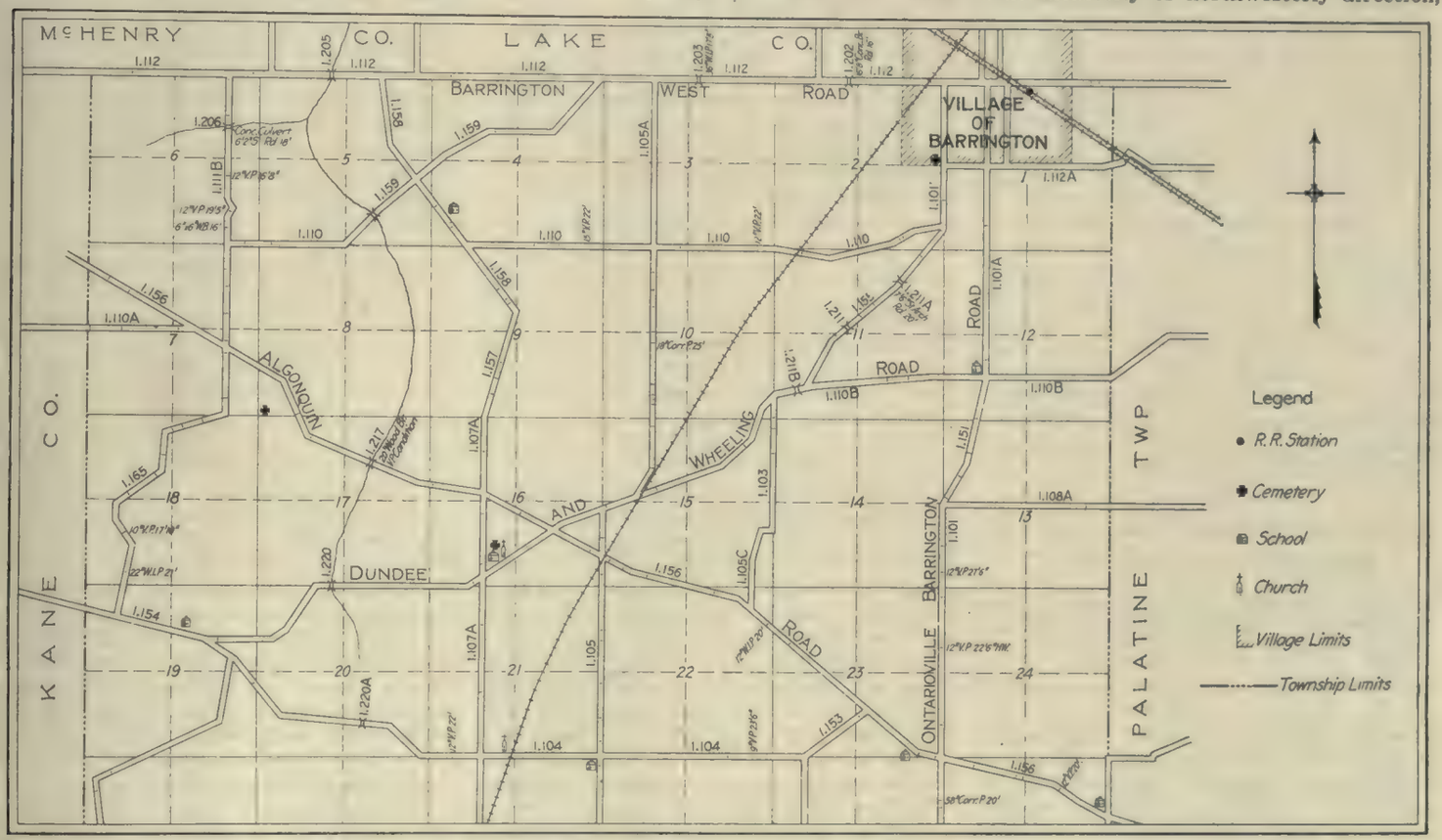


DIAGRAMS FOR REINFORCED-CONCRETE BEAMS WITH COMPRESSION STEEL—FORMULAS AND STANDARD NOTATION

Highway Superintendent of Cook County, Illinois, Simplifies Filing System

Road and Bridge Plans Are Indexed by Logarithmic Designations Which Show Their Precise Location in the County

ALL DATA relating to roads and bridges in Cook County, Ill., are filed relative to their location in the county, rather than to their name. This method was selected by George A. Quinlan, county superintendent of highways, for the reason that in discussing a bridge one usually looks on a map to find its location. Finding it on the map, by the Cook County system, locates it in the file. This is accomplished by means of a numbering scheme in which by the arrangement of numbers in a logarithmic form one can tell the township, section and number of the bridge. Thus, when a farmer from Barrington township wanders into the office to see the county superintendent about "that bridge near the Methodist Church west of the railroad," the superintendent goes to a large county map on the wall and finds that the bridge is in section 20. He then combines the township and section numbers, obtains the logarithmic file number and within a minute or two after the farmer's question has all data relative to the bridge in question at hand.



THIS SAMPLE MAP OF PART OF BARRINGTON TOWNSHIP SHOWS HOW THE NUMBERING SYSTEM IS APPLIED

Applying the Numbers

For bridges a characteristic or index number is given to each township in the county, according to its position alphabetically; thus, Barrington is labeled No. 1, Bremen No. 2 and Calumet township No. 3. The mantissas reserved for the bridges in a township are from 0.200 to 0.299. These figures are placed so that the digit before the decimal point indicates the township and those following designate the section number. Thus, a bridge in Barrington township, section one, would be labeled 1.201.

It frequently happens that a bridge is constructed on a section line. In order to prevent cross filing of a bridge in one township in two sections it was decided that a bridge or culvert on section lines would take the number of the section south or west of it. Thus, a bridge in Barrington township on the east-and-west line between sections 17 and 20 would be 1.220, although it is partly in section 17. This rule is also applied to a bridge that lies on the dividing line of a township. If there is more than one bridge in a section the letters *A, B, C* or *D* follow the section number when the bridge is on an east-and-west road, and *M, N, O* or *P* when it is on a north-and-south road.

Where culverts or bridges are let by contract, if more than one is built in the same township, although they are in various sections, the contract is filed under the general heading of bridges for the township and takes the designating number of the township, such as 1,200. A note stating that the culvert will be found under that particular general classification is filed under its proper location.

How Roads Are Designated

Correspondence relative to road contracts and plans is filed in somewhat the same manner as for bridges, that is, each township has its number. The roads are numbered according to their direction and location. The mantissas of township roads range from 0.100 to 0.199. All roads running north and south are given an odd number. Unless they are on section lines there is added the classification of *A, B, C* or *D*, relative to their position with respect to the distinguishing section-line road. For example, the first north-and-south road in Barrington township would be 1.101 and would be on the west section line of the first sections of that township. Then 1.101A would be the first road to the right of it in the same section. If a road runs along a section line for one mile, and is then closed and extends east or west, the number ceases when it turns off.

In view of the fact that there are at the most seven section lines to a township, those roads running north and south would have mantissas from 0.101 to 0.113. The roads east and west would have from 0.102 to 0.114. For roads that run diagonally, in a northeasterly or northwesterly direction, mantissas above 0.150 are used—odd for those running in a northwesterly direction and even for those running northeasterly.

Classifying the Roads on Cards

In the inspection of roads it was the intention to submit an annual report, and in this to state the condition of all highways in the county and show the materials of which the various roads were built. To get these data a map of the county, drawn to a scale of 1 in. = 1 ft., was cut up into its respective townships and pasted on cloth. These cloth-backed township maps have been bound loosely about pocket size, and every time a road is traveled there is marked on the map in ink the material of which the road is made and its approximate length as shown by an automobile speedometer. At the end of the day a road-inspection card is made out, and separate cards are made out for each classification of the road. These cards are then filed in a small index, and are located according to the number.

Complete information in regard to each bridge is filed in an envelope on bridges.

However, for handy indexing and a thorough idea as to the condition of each bridge and date of its last inspection, a bridge-inspection card is kept. This card is filed in an index system of bridges and by its number can be found readily when needed. It is also cross filed, so that when the bridge is inspected the following year only a report as to its condition and general information need be made on the inspector's card. On the back of the bridge card a small sketch of the existing structure is drawn with a few essential dimensions. Photographs of the bridge are taken from time to time and attached to the card. A postcard autographic camera is used and the notation on the film is printed out.

For construction reports on all bridges built at the expense, whole or in part, of the county, the inspector in charge fills out a daily postcard report. This report gives the number of hours worked and the percentage of the different elements of the work completed. As soon as these daily reports are received they are tabulated and pigeon-holed under the name of the job. When the work is finished the cards are taken out, tied together and filed in a compartment reserved for completed bridges.

The inspector also keeps a book of the labor record of the job for the various items, material and piling data, as well as gravel and sand tests. In the back of the book are the instructions from the engineer relative to the work. A separate book is kept for each job, and when the work is completed the daily cards are checked with the bridge cost-record book. The data contained is also placed on cost-record cards, which are posted weekly.

Bumping Posts That Do the Work Demanded

Steel Buffer Anchored to Heavy Blocks of Concrete Prevents Runaway Cars from Crashing Through Into Waiting Room

WHEREVER there are stub railroad tracks trains or moving cars are bound to overrun their ends occasionally. In passenger terminals this is obviously fraught with danger to the users of the station; there have been instances of persons on the concourse being run down and killed, and even of trains passing entirely across the concourse and crashing into or through the station building. On the other hand the time element in the movement of trains into such terminals is usually vital, and the trains must be got in quickly. Hence when the Hoboken terminal of the Delaware, Lackawanna & Western Railroad was built it was assumed that there would be occasional accidents and an attempt was made to provide a mass that would take a heavy shock. The success of the design has been such that similar posts were used in the trainshed of the Grand Trunk Railway at Ottawa, that of the Chicago & North Western Railway at Chicago, the new Lackawanna station at Scranton and the Jersey City terminal of the Central Railroad of New Jersey recently rebuilt. They are also being installed in the new Buffalo terminal of the Lehigh Valley Railroad. The latest proof of the effectiveness of this type of bumper occurred Aug. 17 at the Hoboken terminal, when a string of six steel coaches struck one of the posts a terrific blow and raised its outer end several inches, but stopped instantly with injury only to the post and the end coach.

Fig. 1 shows the details of the latest design for this type of post where a pile support is required—that to be installed for some of the tracks at Buffalo. The Hoboken and Jersey City posts differ only in minor details. The post consists essentially of a steel built-up block provided with an ordinary Ellis bumping head and securely anchored to two large blocks of concrete, which in turn are anchored to piles, the heads of which are embedded in and anchored to the concrete. Thus the entire mass is monolithic, and unless it is broken in two it cannot be moved far without pulling or shearing the piles. The bumping head is high enough to catch the car body instead of the coupling.

COST OF BUMPER

The depths of the blocks will of course depend on the elevation of top of rail above continuous water to protect the piles. The Buffalo design calls for 19.1 cu. yd. of concrete per bumper, which should cost less than $200. In all of the designs where piles are used there are ten piles per bumper, which would cost about $100. The actual steel used at Jersey City was 7764 lb. per bumper. Under average conditions this would cost approximately 3½ cents per pound in place, or $270 for the steelwork. Hence the cost of the complete bumper would be about $600.

Part of the Buffalo terminal is on hard ground where no piles are required. Here the concrete base will be of the design shown in Fig. 2, with the two blocks of concrete combined into one long, shallower strip involving about the same amount of concrete. With the piles eliminated the cost of this type would be about $500.

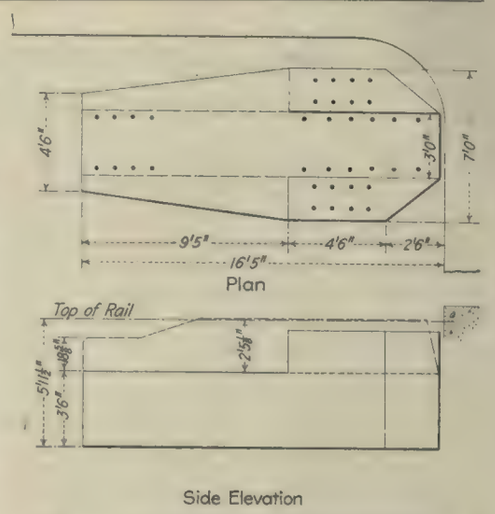


FIG. 2—SUBSTRUCTURE WITHOUT PILES

Still another variation in the substructure is found on the south tracks at Hoboken, which come outside an old bulkhead crossing the ends of the tracks diagonally. The triangle outside this bulkhead is on new fill carried on a heavy platform at the water level, and the bumpers rest directly on the platform.

The bumper struck Aug. 17 was one of those on the old fill. The train consisted of six engineless steel coaches which were being shunted into the trainshed, and while their speed is more or less conjectural, it has been estimated at nearly 12 miles per hour. The Ellis head was broken, the top of the steel block was somewhat battered, and the entire structure was driven ahead about 6 in. and slightly rotated, the outer end rising about 4 in. The end of the coach was also somewhat crushed and the rails were bent, shearing off some of the fastenings, but the train did not ride the bumper, and the picket fence bounding the concourse was not touched.

The effectiveness of the bumper was also shown last year at the Jersey City terminal when a five-car train with locomotive ran head on into one of them. There was no rotation, the mass simply pushing ahead 2½ in., the piles evidently being driven ahead with the rest of the mass.

The bumpers at Hoboken were designed and constructed under the direction of Lincoln Bush, consulting engineer, of New York City, who was at that time chief engineer of the Delaware, Lackawanna & Western Railroad. Mr. Bush also designed those for the Scranton, Jersey City and Buffalo stations, his design also being used at the other points noted.

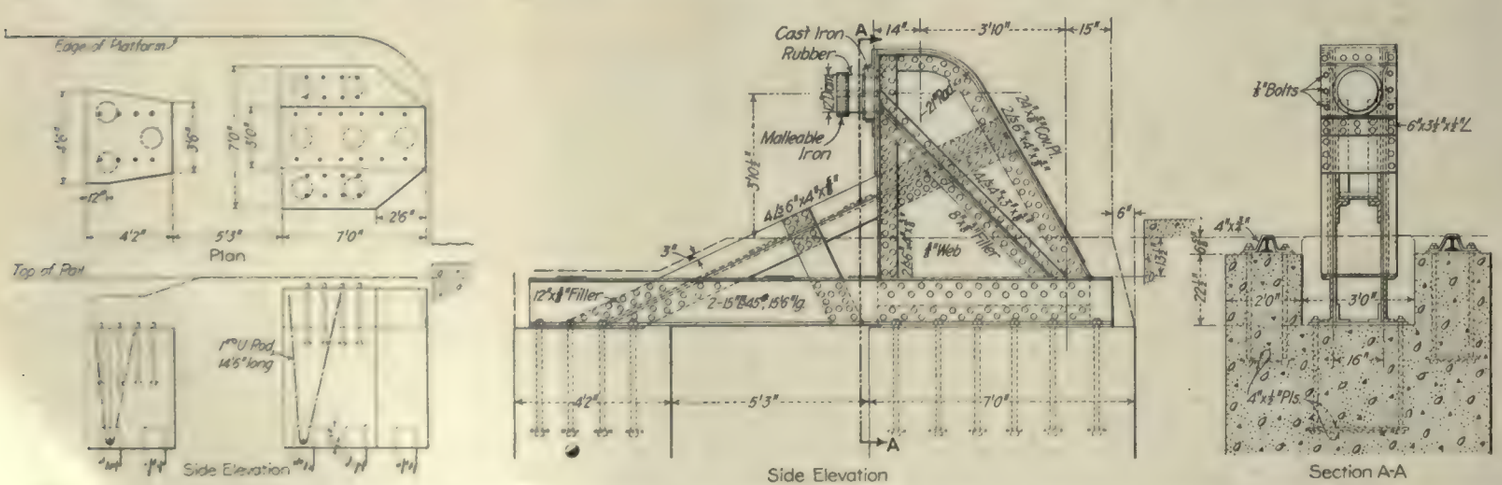


FIG. 1—SUBSTRUCTURAL AND SUPERSTRUCTURAL DETAILS OF ORDINARY TYPE OF BUMPER CARRIED ON PILES

Paving a Leading Factor in City Betterment

Abstracts of Papers by Clarence D. Pollock, Ellis R. Dutton, R. M. Cooksey, and W. C. Perkins, Presented This Week at Convention of American Society of Municipal Improvements Held in Dayton, Ohio

Napped or Recut Granite Paving in Baltimore

By R. M. COOKSEY
Principal Assistant Engineer, Baltimore Paving Commission

THE first work undertaken along this line was the re-heading and re-jointing of old blocks. This did not prove satisfactory, for in re-heading it was often necessary to cut as much as 2 in. off the depth in order to save the thickness in a case of badly rounded blocks, resulting in the block being made too shallow. This method also made the cutting expensive, as, in order to secure a well dressed head, it was necessary to use a pointing tool, making the work of the cutter slow, and, of course, the price of the cutting higher.

The old blocks which are used for this work vary in size as follows: 8 to 14 in. long, 4 to 6 in. wide and 6 to 8 in. deep, and all of the above varying sizes are often cut and used on the same piece of recut paving. The specifications for redressing the blocks are as follows:

"The contractor will assort, clean, split, reel and redress the blocks so as to have rectangular faces, free from bumps, with straight edges on the tops, ends and sides, so as to form, when laid close, joints not exceeding ¾ in. in width. The blocks are not to be over 6 in. in depth."

As we nap practically all of the blocks, with the exception of a few which are used as starters in order to break the joints, the average block laid on recut work in this city is about 6 in. long, some of them running as short as 4 in. and all will average about forty-two to the square yard. In using the napped block throughout, we find that we obtain a surface equally as good as we have ever gotten by using a new granite block, and at a cost of about two-thirds of that of new granite.

There still exist in this city about 700,000 sq. yd. of old granite pavement on sand foundation, so that this city will no doubt continue to replace this pavement with a more suitable material, and recut the blocks so secured, placing them in heavier traffic sections.

Quite a large yardage of this pavement has been laid, using a bituminous filler, and, though it gives a very good pavement, it does not compare favorably with cement filled work. As the blocks are of such various depths, ranging from 4 to 6 in., we find it difficult to maintain a good surface where the bituminous filler is used. In future work of this class we propose to use a cement mortar bed in place of the sand cushion, and the writer believes that this will be a decided improvement, for the cement filled as well, as for the bituminous filled work.

In connection with the recutting of the old block, there are, of course, a great many blocks taken from the streets which are too small to recut. These blocks are culled and are used on a concrete foundation with cement filler for alley paving in the heavy traffic districts. This takes care of a great deal of the waste from the old original paving, and it furnishes a cheap, heavy construction for alleys and narrow streets. Where a street is being paved, carrying with it a railway area, in order to take care of the shallow blocks which are cut, the concrete base is raised within this area and the shallow blocks are culled out by the pavers when they are paving the city area. These are immediately placed in the railway area, and in this manner a uniform cushion is obtained under the blocks.

Joint Fillers for Granite Block

By CLARENCE D. POLLOCK
Consulting Engineer, New York City

THE requisites of a good filler are, that it should hold the blocks firmly in position, remain permanently in place, afford support to the edges of the blocks and thus prevent chipping and consequent rounding of the tops of the blocks. It should be easy to apply, reasonable in price, and a material which will permit of traffic directly after it has been placed in the joints of the pavement.

Portland cement grout complies with all these requirements except the last. This is a very considerable defect on important streets in the larger cities, and in general prevents its use in such places. But wherever the conditions are such that the work can be blocked off for the proper setting of the cement, both in the first construction of the pavement and whenever trenches are repaved, a Portland cement grout, conscientiously made and applied as specified in the standard specifications of this society, will give most satisfactory results. It is necessary to pay very close attention to the details in order to insure uniformly good results. In general, a machine-mixed grout is much better than one mixed by hand. If the work is carried on under a hot summer sun, the surface should be kept moist by sprinkling for at least 3 or 4 days after the grout has been poured. Sand or earth spread over the pavement and sprinkled with a hose every evening is a good method of "curing" the joints. Grout joints cannot be made satisfactorily in cold or freezing weather.

Bituminous fillers overcome the faults of a cement filler, but they have faults of their own. One that is suitable in the summer season is usually too brittle in the winter, and it breaks out under traffic. The bituminous fillers given in the society's granite specifications are used in combination with fine gravel. This has not proved a very efficient method of filling the joints. In using fine gravel, the bituminous filler tends to mat on top of the gravel, and does not go down into the small voids in the gravel. Traffic picks out the filler from the top of the joint, and then the joint is little better than the old style sand one. Much better results have been obtained by using coal tar pitch, asphalt, or a mixture of the two, in combination with sand, the sand not to exceed 50 per cent of the total.

The writer has obtained better results with asphalt fillers, and mixtures of asphalt and coal tar fillers than with tar alone. It seems to be practically impossible to obtain a straight gas-tar filler which will not crack and be brittle in cold winter weather if it is not too soft in hot summer weather. The old mixture of 100 parts of coal-tar pitch and 20 parts of asphalt, which was used as long as 20 years ago in Brooklyn, has given much better results in work which has come under the observation of the writer than the straight coal-tar pitch. Good results have been obtained with straight asphalt fillers also.

It is desirable that experiments be tried using various mixtures of asphalt and coal-tar pitch, and also using straight asphalts in combination with as much sand as the bitumen will carry satisfactorily. The finer and more uniform the sand the better the results seem to be. A sand which will pass a 10-mesh screen should be used.

There is demand for a bituminous filler that will flow into the joints readily, and stay there permanently. It should have sufficient body when cold to give a fair amount of support to the edges of the granite blocks, and protect them from the abrasion of heavy metal tire traffic. The mixture with hot sand before pouring has been a great help in improving the bituminous filler. The next step should be a determination of the proper bitumen or mixture of bitumens.

Experiences with Creosoted Wood Block Paving

By ELLIS R. DUTTON
Assistant Engineer, Minneapolis, Minn.

FROM all the observations of the use of different woods it would appear that the yellow pine used in 1902 was the best for the purpose under rather heavy traffic, but the tamarac used later shows up very well on lighter traffic streets. As you are aware, Minneapolis is a great lumber center, and in 1903 the lumber interests thought it was a reflection on them that the city should import longleaf pine from the South to use for paving, and prevailed on the City Council to use the northern Norway pine. I did not think this advisable at the time, and time and experience shows that it was not. The hardness or density of the block varied so much that the wear was uneven.

On Central Avenue, which was paved in 1905, and where the traffic is the heaviest in the city, the blocks have worn down about 2 in.

The total average wear up to the present time on the 1902 longleaf pine has been about ⅛ in. and on Norway laid in 1903 about ⅜ in. under practically the same condition.

In the Government experimental block laid in Minneapolis in 1906, the results are similar to those mentioned above, although there were many more varieties of wood used. A wood in which the fiber is not stiff enough to withstand the traffic and pounding, begins to broom up and lay over in the direction of the traffic. It will soon wear away and cause depressions in the pavement.

From all the data at hand and observations and reports from other places, it seems unwise to creosote and use for pav-

ing purposes any wood except that which has proved to be the most durable and which can be procured at a reasonable price. It does not pay to use a wood because it is cheap, as the cost of repair and renewal soon overcomes the cheapness, and in the end makes it the most expensive.

These remarks have all been on the defects in creosoted wood blocks and may leave a wrong impression in some persons' minds as to the most excellent quality of such pavements. I would say that there are in the city of Minneapolis to-day about 1,500,000 sq. yd. of creosoted wood blocks, and that the yardage of the defective pavements mentioned is only 27,730 sq. yd., or 1.85 per cent of the total. The cost of maintenance and repairs of creosoted wood blocks for the year 1914 was only 0.09 cents per square yard on the total yardage. Even the low cost was not all entirely due to the failure of the blocks themselves, but was caused by other defects, so that this cost could be reasonably reduced 50 per cent and still be charging creosoted wood blocks with all that they should stand.

Vitrified Brick Construction—Streets and Roads

By W. C. PERKINS
Chief Engineer, Dunn Wire-Cut Lug Brick Company

MANY failures occur in brick pavements which can be traced to the non-uniformity of the sand cushion or to a cushion not properly compacted. Many engineers take the ground that the only function of the sand cushion is to provide a uniform bearing for the brick wearing surface—the smooth compacted sand taking care of any inequalities of brick or any variation of the foundation. We believe that the thickness of the bed of sand should be as small as possible, never over one inch.

Resiliency of Confined Sand Under Traffic

It is claimed that a grouted brick pavement should have a cushion so as to give it "resiliency" under traffic. We question if sand confined between a concrete foundation and a brick wearing surface has any real elasticity. We grant it may yield, shift or be compacted by traffic weight on the wearing surface of the pavement and that the cement grouted wearing surface will of itself spring back; but the sand will not follow, and we have a small air space between the sand and the grouted brick wearing surface. This can be easily demonstrated by a hammer survey of any cement grouted brick street laid on a sand cushion. The hollow spaces are readily located. These areas may be separated by solid areas where as yet the cushion has not left the pavement. The bond at these hollow spots may be intact and show no distress, but these areas become weak spots in an otherwise good pavement and eventually there may be a settling or a breaking of the cement bond.

It has also been claimed that a sand cushion prevents the crushing of the brick wearing surface under the weight of traffic. Mere weight does not crush a grouted brick pavement laid on a solid foundation, provided it has a firm bearing or bed for the brick. If paving brick manufacturers cannot make a paving brick that will bear the crushing force of street and highway traffic, they had better stop making brick.

Good Results Hard to Obtain

Again, in actual construction, while we may give elaborate directions as to how the sand cushion is to be rolled and struck with a template, we find that to obtain good results in the field is almost impossible, and we have an unstable layer of sand varying in compactness and thickness between a solid foundation and a solid wearing surface. There is also the hazard of the sand working up between the joints of the brick and thus weakening the bond when the pavement is grouted. A rolled wet sand cushion, if it dries out after the bricks have been laid, will undoubtedly shrink and then leave hollow spots under the wearing surface.

Try Sand and Cement Cushion

In view of all the hazards of using sand for the bedding course, engineers are beginning to turn to the use of a mixture of cement and sand. Mr. Compton, chairman and consulting engineer of the Baltimore Paving Commission, last year made laboratory tests of a cushion mixed 1 to 3, 1 to 5, 1 to 8 and 1 to 10, cement and sand, and adopted for all brick paving work this year in Baltimore a cement sand bed mixed 1 cement to 5 sand. The sand and cement are thoroughly mixed dry and then handled the same as an ordinary sand cushion. The bricks are then laid, rolled and inspected, and the pavement wet down for grouting. This adds moisture to the cement-sand bed and eventually the cement-sand bed becomes hard and practically joints the brick wearing surface to the foundation. The rolling of the brick wearing surface is kept up even with the paver. This is an advantage, for if with a cement-sand bed the paving is rolled and not grouted and we have rain, no harm is done, in fact the rain will set up the cement-sand bed. On the other hand, there is always a hazard when it rains on brick laid on sand cushion and not grouted, as the sand is apt to come up in the joints from the wash, necessitating the relaying of sections of the paving. In Baltimore, Lexington Street, the area from Calvert Street to Liberty Street, was paved with brick in 1906, on a 4-in. concrete base, using a ½-in. mortar cushion, mixed 1 to 3. Mr. Compton states that this street stood up splendidly and that no complaint has ever been made as to noise. During the last three years the street has been all "shot" to pieces by sewers, gas, water, steam heating lines, etc., so that at present it is in bad shape from "cuts," but there were absolutely no failures caused by the original construction.

Another example of the durability of a grouted brick pavement laid on a cement-sand bed is furnished by the paved approaches to the Pennsylvania Railroad Terminal in New York City. These approaches were paved in 1910, the bricks being laid on a cement-sand bed mixed 1 to 3. The pavement to-day shows no signs of deterioration except along the curbs where the wheels of heavy loaded wagons skidding down the inclines have cut into the bricks.

Theoretical Type

The theoretical type of construction is that developed by W. T. Blackburn of Paris, Ill., who, assisted by Mr. Parrish, a local contractor, is laying the brick wearing surface direct on the freshly laid concrete foundation. An article by Mr. Blackburn on this subject was published in the Engineering Record of July 10, page 54.

The advantages claimed in using the cement-sand bed or the new type of construction as developed by Mr. Blackburn are: Elimination of the hazard of the sand cushion, as the pavement will not be injured at any time by rain, the wearing surface, with the exception of the filler, being completed each day. If a rainstorm intervenes no damage is done, as there is no sand cushion to become saturated and cause worry about rolling the brick surface. Each brick in the wearing surface will be assured a cement bond its entire depth, for if the cement sand should work up in the joints, it will set up and prevent the shearing action which tends to crush the top of the brick. There is no chance for the bed to shrink or shift away from the bottom of the brick wearing surface, as the brick is firmly bedded in the cement sand or held in the mortar of the concrete base. Where these pavements have been laid there seems to be a total absence of any rumble under traffic. Slight settlements and breaking of bond due to non-uniformity of sand cushion are eliminated.

Test Concrete Poured 700 Feet Through Vertical Pipe

Standard Cylinders Generally Show Greater Strength for Poured Concrete at Moodna Siphon than for Mixer Concrete

COMPRESSIVE TESTS of standard 8 x 16-in. cylinders have been made for the New York Board of Water Supply for the purpose of determining the effect on the quality of concrete when dropped through a vertical pipe 700 ft. long at the supplementary shaft and tunnel of the Moodna Siphon, described in the Engineering Record of April 24, 1915, page 514. The results, reported in the monthly bulletin of tests made in New York City laboratories for July, are given in the accompanying table.

While the tests are few and are not conclusive, the concrete was evidently not injured by this unusual treatment. All of the specimens at the earlier ages are stronger for the poured concrete than for the concrete from the mixer. At the age of 32 days one result for the mixer concrete is seen to be much higher than the two tests of concrete from the forms. The materials were Alpha cement, granite screenings and crusher-run granite in the proportion of 1:2:4.

Compressive Tests of Standard 1:2:4 Concrete Cylinders—New York Board of Water Supply

Description	Strength, lb. per sq. in. 21 days	22	30	32
From form in tunnel..	3,255	2,945	3,070	2,890
				2,495
From mixer at top....	3,095	2,855	1,940	3,220
	3,000	2,835	2,085	

BRITISH COLUMBIA LUMBER COMPANIES have formed an association at Vancouver, B. C., for the purpose of exporting lumber direct from the mills to markets throughout the world. The combined production of the mills represented is said to be approximately 1,000,000 ft. b.m. per day. Quotations will be made to include a guaranteed freight rate so that buyers will know the exact delivery price. The association announces that it will maintain a certain quality standard and adopt a brand under which its products will be sold.

Economy of Deep Sewage Filters Explained on Basis of "Held" Water and Hydraulics

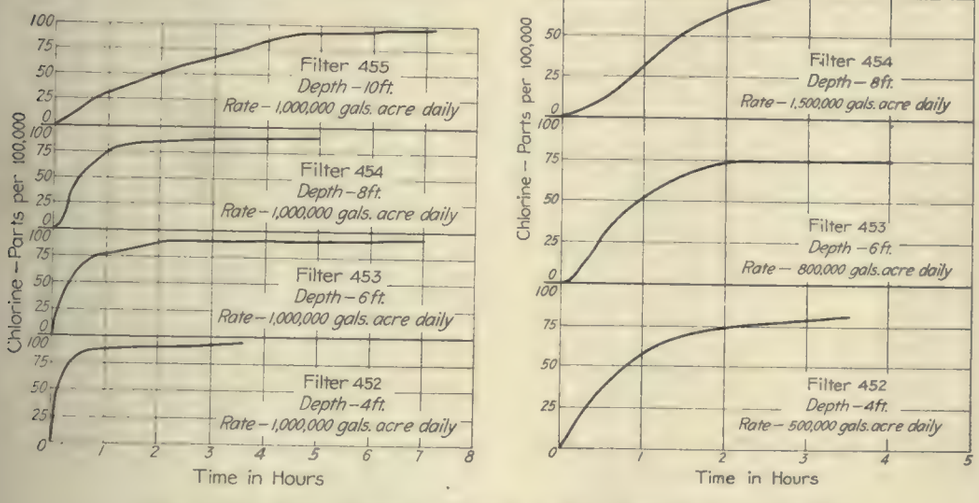
Paper by H. W. Clark, Chemist in Charge of Lawrence (Mass.) Experiment Station, Presented at Convention of American Public Health Association at Rochester, N. Y.

IN an article entitled "The Depth of Filtering Material and Trickling Filter Efficiency," read before the Boston Society of Civil Engineers last winter, I presented the rate-efficiency results of a number of trickling filters which have been in operation at the Lawrence Experiment Station for periods of from two to sixteen years. In that paper I showed that, judging from the Lawrence data, a trickling filter 10 ft. in depth could receive sewage at a rate at least six or seven times as great as a trickling filter 4 ft. in depth and still produce an effluent purified as well as the effluent from the shallow filter. Further, a trickling filter 10 ft. in depth could be operated at a rate at least five times as great as a 5-ft. trickling filter and give equal purification results. That is to say, doubling the depth of a trickling filter increases its rate-efficiency at least five times. This being so, I urged the great economy resulting from the construction of deep instead of shallow filters of this class.

The accompanying table illustrates the rate and results of the operation at Lawrence of four trickling filters, 4, 6, 8 and 10 ft. deep, respectively.

Hydraulics of Filter Flow

After looking at these results the question, of course, arises as to the cause of the great rate-efficiency of the deeper filters. Why should a filter 10 ft. deep allow not simply a rate two and one-half times as great as a 4-ft. filter with equal purification but a rate five or six times as great? The explanation, when worked out, is comparatively simple and shows these striking results to be due simply to the hydraulics of the flow of the sewage through the filtering material. Twenty-five years ago in the first special report of the Lawrence Experiment Station, the flow of water through sand filters was described (Special Report for 1890, "Purification of Sewage and Water," by Hiram F. Mills, C.E., page 18). This description, based upon experiments then made, showed that when water or sewage is applied to a sand filter which, at the time of application, contains much water in its interstitial spaces, some of the applied water will, especially in filters of coarse sand, pass by the held interstitial water instead of pushing it before it and appear at the filter outlet ahead of a large percentage of the held water. This held water is really partly interstitial water and partly absorbed water; that is, water held or absorbed by the organic matter lodged in the filters.



TIME OF PASSAGE THROUGH FILTERS UNDER DIFFERENT CONDITIONS

Now the rate and purification results in the operation of trickling filters of different depths have to do with this flow of water and the *progressive mixture* of the applied with the held water in filters of broken stone or other coarse material and with filtering depths varying in the cases cited in this paper from 4 to 10 ft. In the early work only sand filters 5 ft. in depth were studied.

In this recent work I have revealed a factor not noticed in the sand filter studies of twenty-five years ago, which affects the results very materially. This is the simple fact, made clear by the recent work, that the deeper the trickling filter up to a certain point the greater the tendency of the applied water to mix or mingle with the held water instead of passing by this held water. This tendency to mingle as the filter depth increases and to push the held water toward the underdrains is great enough to cause a large percentage of sewage passing through a 10-ft. filter to be not simply twice as long in passing as through a 5-ft. filter but five or six times as long. Conversely, the rate of the deep filter may, on account of this condition, be from five to six times that of the shallow filter with equal purification results. This is illustrated by the accompanying diagrams.

Experiments at Lawrence

We have on these diagrams data from experiments made by me at Lawrence in regard to the flow through the four trickling filters; the rate and purification results are shown in the table for filters 452, 453, 454 and 455, which are 4, 6, 8 and 10 ft. deep, respectively. On the first diagram, we have the results shown when each filter was being operated at the rate of 1,000,000 gal. per acre daily. In order to determine the time of passage of the water or sewage through the filters operated at this rate and the degree of mingling of applied and held sewage, enough salt was placed at a definite time in the applied sewage to raise the chlorine 100 parts in 100,000, this amount, of course, being readily detected in the filter effluent. Increased chlorine in the effluent, due to the large application, was detected with equal readiness.

After the application of this salt sewage to each filter, samples of the effluent were collected every few minutes for the determination of chlorine. An examination of the diagrams will show that 50 per cent of the salt sewage applied to filter 452 appeared at its outlet in about 12 min. mingled with 50 per cent of the held sewage; that is, the chlorine had increased to 50 parts or more in 100,000 parts. With the 10-ft. filter operating at the same rate, 1¾ hr. elapsed before an effluent containing 50 per cent of the salt sewage reached the underdrains; that is, instead of being two and one-half times as long or 30 minutes, most of this salt sewage was nine times as long in passing the deep as in passing the shallow filter. The results are given with four filters and, for clearness, the flow may be summarized as follows:

Results Summarized

With a 4-ft. filter, as stated, 50 per cent of the salt sewage appeared at the outlet in 12 min., 75 per cent in 18 min. and the remainder came slowly mingled with the "held" sewage through many hours. With filter 453, 6 ft. in depth, 50 per cent appeared in 18 min., 75 per cent in 42 min. and the remainder appeared as with the first filter mingled with the held sewage through many hours. With filter 454, 8 ft. in depth, the elapsed times were 48 min. and 1½ hr., respectively, while with the 10-ft. filter, as stated, the elapsed times were 1¾ hr. and 3½ hr., respectively.

In other words, with equal rates of operation 50 per cent of the sewage applied to the 4-ft. filter reaches the filter outlet mingled with 50 per cent of the held sewage 12 min. after its application, while with the 10-ft. filter 125 min. elapse before 50 per cent of the applied salt sewage reached the filter outlet mingled with 50 per cent of the held sewage.

It follows, then, that at this rate, 1,000,000 gal. per acre daily, 50 per cent of the sewage is subjected at the most to only

Average Analyses of Filter Effluents. March-June, 1915

(Parts in 100,000)

Filter No.	Depth of filter (feet)	Rate, gallons per acre daily	Ammonia, albuminoid			Chlorine	Nitrogen as		Oxygen consumed	Per cent of samples stable
			Free	Total	In solution		Nitrates	Nitrites		
452	4	490,375	1.6375	.3413	.2180	12.55	1.15	.0045	2.30	80
453	6	784,625	1.8688	.2663	.1880	12.55	1.19	.0313	1.90	100
454	8	1,471,250	1.6687	.3862	.2200	12.10	1.45	.0067	2.25	100
455	10	3,200,000	1.7625	.2625	.2040	11.85	1.49	.0017	1.90	100

12 min. bacterial action in the 4-ft. filter, while in the filter 10 ft. deep, 50 per cent receives, at the most, 125 min. bacterial action.

Now to reverse the application of the data gained in this way, these four filters were operated at rates of 500,000, 800,000, 1,500,000 and 2,500,000 gal. per acre daily at the time of a second experiment. Applying salt sewage as before and collecting and determining the chlorine in samples from the outlets made clear, as will be seen by an examination of the diagrams, that with these rates the applied and held sewage were about equally intermingled, and hence were about equal periods of time in passing through each filter. Through the shallow filter operating at a rate of 500,000 gal. per acre daily, 50 per cent of the salt sewage appeared in 50 min.; through the 6-ft. filter, operating at a rate of 800,000 gal. per acre daily, 50 per cent appeared in 55 min.; through the 8-ft. filter, operating at a rate of 1,500,000 gal. per acre daily, a little divergence was noted owing perhaps to slight clogging in this filter, as 50 per cent of the applied salt sewage was 77 min. in reaching the filter outlet, but through the 10-ft. filter, operating at a rate of 2,500,000 gal. per acre daily, 50 per cent of the salt sewage reached the filter outlet in 1 hr.; that is, filter 455, two and one-half times as deep as filter 452 and operated at a rate five times as great, gives equal time for sewage purification to occur as given by the shallow filter operating at one-fifth the rate, and hence equal purification. It is evident, moreover, from the diagrams that the rate of the deep filter could have been at least 3,000,000 gal. per acre daily.

These results show very clearly the reasons for the great economy of deep compared with shallow trickling filters. These filters are constructed of stone between ¾ and 1½ in. in diameter. Filters of larger or smaller stone allow differing times of passage and degree of intermingling, hence different but comparative results.

ONE TWO-HUNDREDTH OF AN INCH is the limit of inaccuracy allowed in the 72-in. lens now being ground for the Government observatory at Victoria, B. C.



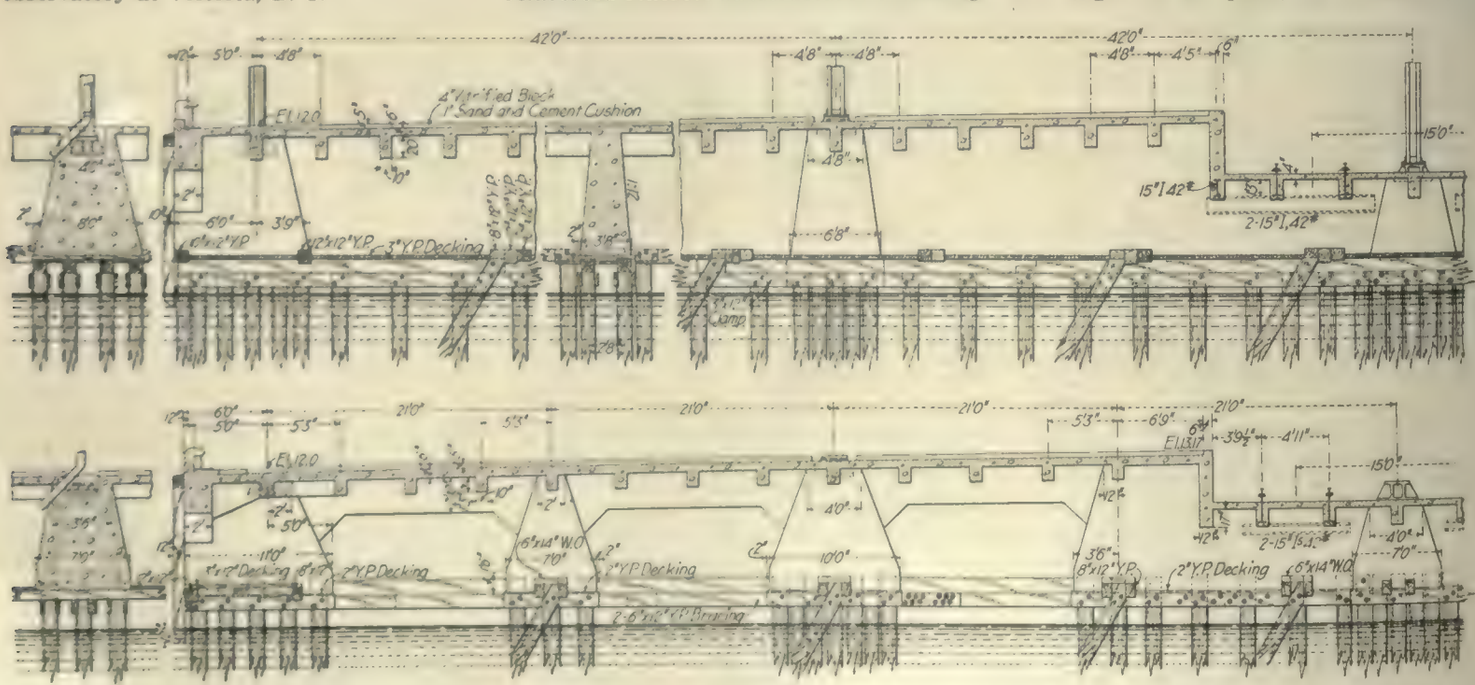
SHORE ENDS OF PIERS, JUNE 25—PIER 40 IN FOREGROUND, PIER 38 BEYOND

Philadelphia's Southwark Piers Completed

Twin Structures Are 180 Feet Wide and Unusually Light—Represent Two Types of Pile-Supported Reinforced-Concrete Substructures

TWO PIERS, known as the Southwark piers, have recently been completed in Philadelphia, and are scheduled to be formally accepted to-day. While there has this summer been begun a much larger pier—the first of a group, known as the Moyamensing group, which will ultimately give the city a continuous municipally owned waterfront development of more than a mile (see the article on the South Philadelphia improvement, in the Engineering Record of Sept. 11, page 327)—the Southwark piers nevertheless represent the best yet built by the city, are unusually wide and light, and are of further interest in that while they are virtually alike in size, appearance and facilities, their substructures are unlike, typifying two of six types investigated by the Department of Wharves, Docks and Ferries. Both piers are of the general Philadelphia type of construction (see abstract of paper, "American Wharf Design," by W. J. Barney, in the Engineering Record of Oct. 3, 1914, page 382), with reinforced-concrete substructures extending down only to low water, and carried on wooden piles. The superstructures are of structural steel, with reinforced-concrete facing.

The Southwark piers, otherwise known as piers 38 and 40, are located along the Delaware River at the foot of Queen and Christian Streets. They are 550 ft. long, 180 ft. wide and 200 ft. apart in the clear—not as wide as the department advocates, but as wide as the available space would allow, and much wider than is commonly found. The piers have two decks, with numerous elevators and chutes of various kinds between decks. Two railroad tracks down the middle of each pier connect direct with the belt line on Delaware Avenue, and the lower deck is raised to the level of the car floor by ramps at the shore end. The floors are designed for unusually heavy loading, 600 lb. per square foot on the lower deck and 400 lb. on the upper. Other features of the structures are the cargo-hoist frames projecting above the roofs, and running the full length of the piers, the unusual pro-



HALF SECTIONS OF TWO SUBSTRUCTURE TYPES—TYPE A, WITH CROSS WALLS, ABOVE—TYPE E, WITH HEAVY CROSS BEAMS, BELOW



TIMBER WORK FOR PIER 38 BEFORE PLACING OF CONCRETE



CROSS WALLS OF PIER 40 IN COURSE OF CONSTRUCTION

vision for light and the architectural effects produced in the concrete head walls.

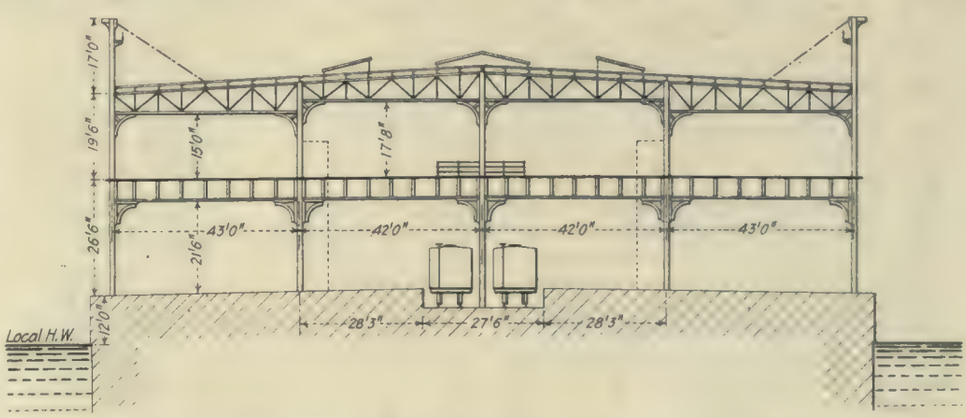
TWO SUBSTRUCTURE DESIGNS CHOSEN FROM SIX INVESTIGATED

Sixteen months ago, before the piers were started, bids were asked on five different designs of substructure. Of the five, and the sixth submitted by one of the bidders (see Engineering Record of June 6, 1914, page 638) it was found that while the cheapest was that using pile bents carried up above low water to the floor level, the possible saving was not sufficient to justify such a short-lived structure; and while the bulkheaded solid-fill types were shown to be the cheapest for piers 200 ft. wide or wider, for the 180-ft. width the types depending wholly on concrete above low water were shown to have the advantage. Two of these types—type A, using cross walls on submerged timber platforms, and type E, using concrete pedestals connected by heavy concrete cross beams, showed so little difference in cost that it was decided to build one of each. Pier 40 is of type A and pier 38 is of type E. The superstructure for the connecting bulkhead shed, which is 35 ft. wide and one-story only, is also of type E.

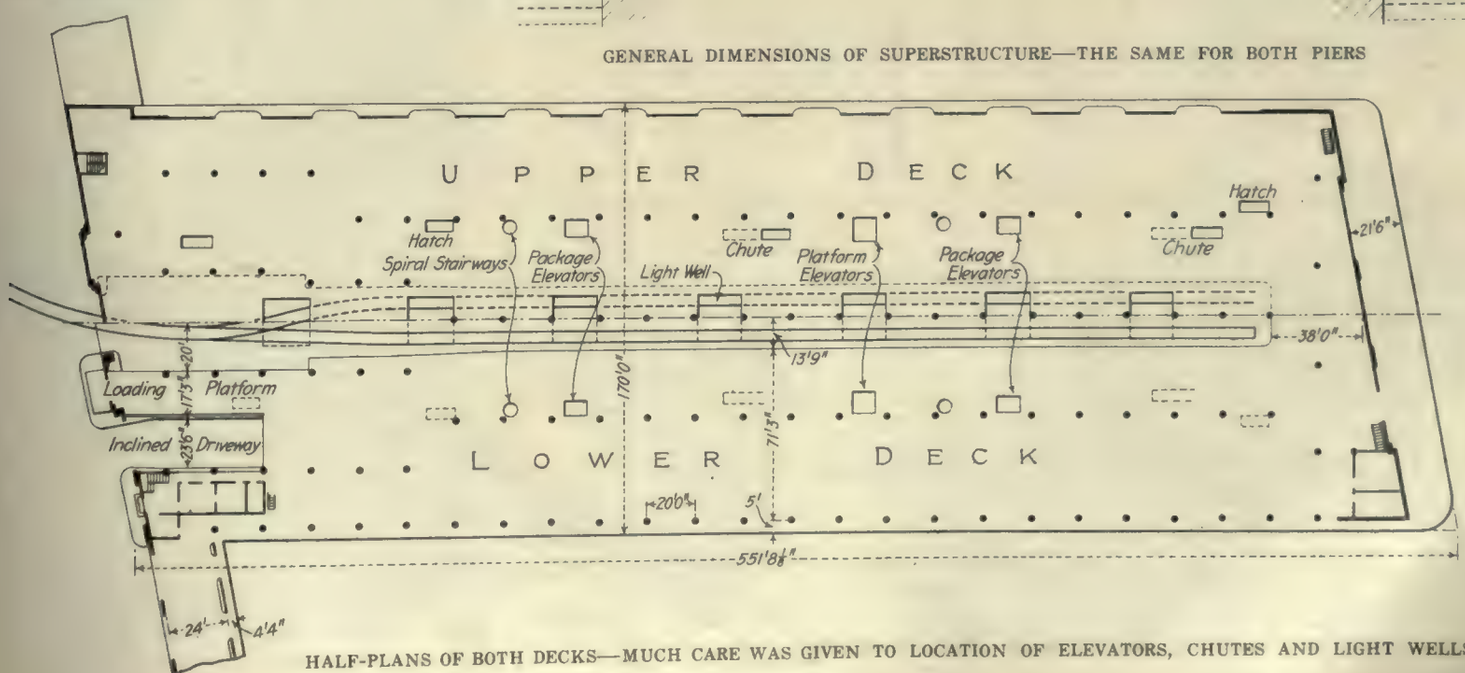
Typical transverse half-sections of the substructures of the two piers are shown. In pier 38 heavy pedestals come under the outside and quarter-way columns, lighter pedestals come midway between these, while elongated masses of concrete carry the center columns and the tracks. The bases of the exterior pedestals are 7 x 11 ft., the next set are 7 x 7, those carrying the quarter-way columns are 10 x 11, and the long sections under the tracks are 4 ft. 8 in. wide except where they widen for the center columns. The supporting piles are bedded in the concrete, which is further held by a 2-in. yellow-pine decking. The cross walls in pier 40 are uniformly of the section shown, except at the ends, where they are of the enlarged section shown. They require a heavier supporting platform, the decking being 3 in. In both types the bents are spaced 20 ft. on centers.

One of the photographs shows the pile and timber foundation of pier 38 before the placing of the concrete. The various sizes of pedestals required different numbers of piles in clusters, the total number per bent being 120 vertical and from sixteen to twenty spur piles. Pier 40, on the other hand, with a double row of piles the full length of each cross wall, but with fewer piles under the columns, required 126 vertical and from sixteen to twenty spur piles per bent.

Another difference in the two types is in



GENERAL DIMENSIONS OF SUPERSTRUCTURE—THE SAME FOR BOTH PIERS



HALF-PLANS OF BOTH DECKS—MUCH CARE WAS GIVEN TO LOCATION OF ELEVATORS, CHUTES AND LIGHT WELLS

the spacing of the floorbeams. This is made 5 ft. 3 in. in pier 38 to bring an even number of beams in each 21-ft. panel, but in pier 40, where the panels are 42 ft., the beams are spaced 4 ft. 8 in., making nine to the panel, and are consequently lighter. Details are shown of a typical girder and beam of pier 38.

In both types the bents are braced by arches at the pier face as shown in one of the photographs, and by timber at various intervals at the water level.

TRACK RAILS DIRECTLY ON I-BEAMS

Originally it was intended to lay the center tracks in the usual way on crossties across the I-beam supports, but it was afterward decided to lay them as shown directly on the I-beams. They are fastened by pairs of hook bolts spaced every 2 ft. Details are shown of the combination beams and walls which form the sides of the depressions for the tracks. It will be noted that in pier 40 an I-beam is used at the base, while in pier 38 it is not.

The piers project riverward 21 ft. beyond the ends of the pier sheds. The two piers are similarly constructed at this point. A heavy (6-in.) pile-supported platform the full width of the strip carries a wall under the end of the shed and another at the end of the pier, and the intervening space is filled with earth and paved with a 4-in. concrete slab.

SUPERSTRUCTURES

In general the pier sheds are of standard mill-building construction. The girders carrying the upper deck are designed for possible future tracks, but the floorbeams are uniformly designed for a loading of 400 lb. per square foot, and if the tracks were laid the beams under them would have to be replaced by heavier ones. Features of the superstructure are the numerous platform and package elevators, chutes, hatches and stairways, which are shown on the general plan and make for the economical operation of the piers; the openness of the sides of the sheds giving virtually one continuous doorway on the lower level, and wide openings on the upper; the cantilevering of the upper deck out through the doorways to facilitate loading; the large skylights, and the light wells under them in the upper deck, making both decks very light; the ornamental concrete work at the ends of the sheds, shown in one of the photographs; the roof design, in which corrugated iron laid directly on the purlins carries the concrete roof slab, and the cargo hoist.

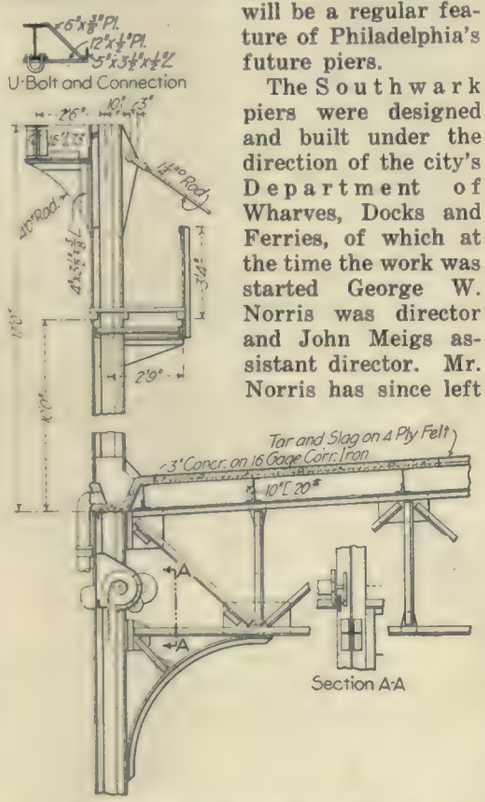
CARGO HOIST

Details are shown of the cargo hoist. The U-bolts are spaced 6 ft. each side of each bent, bringing them 8 and 12 ft. apart respectively. The Bethlehem girder beam supporting them is braced between bents by ½ x 3-in. diagonal bars in addition to the bracing furnished by the plates holding the U-bolts. This arrangement of U-bolts to which hoists may be attached at any point along the pier, convenient access being afforded from the walkway, has been accepted in both Philadelphia and New York as one of the most flexible and effective devices to facilitate the transshipment of cargo, and will be a regular feature of Philadelphia's future piers.

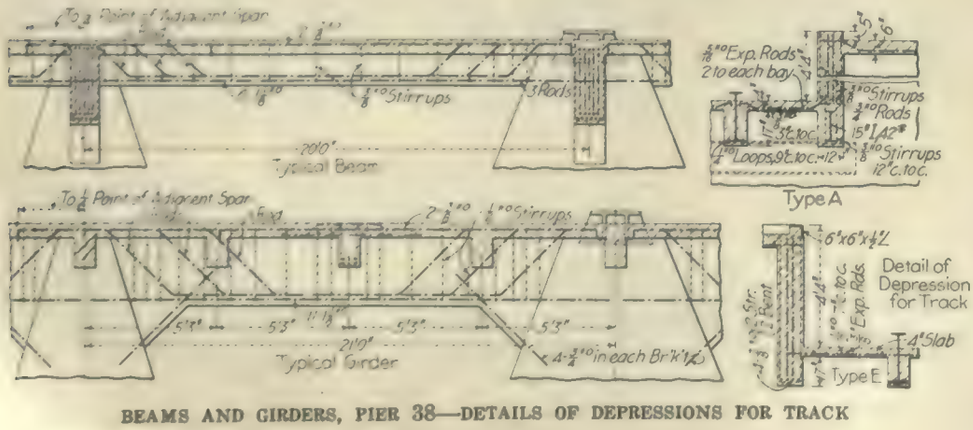
The Southwark piers were designed and built under the direction of the city's Department of Wharves, Docks and Ferries, of which at the time the work was started George W. Norris was director and John Meigs assistant director. Mr. Norris has since left the department and Mr. Meigs has become director. The contractor for the construction work was Snare & Triest, Inc., of New York City.



SIDE VIEW OF PIER 38, MAY 27—NOTE CARGO HOIST RISING ABOVE ROOF



ROOF AND CARGO HOIST DETAILS



BEAMS AND GIRDERS, PIER 38—DETAILS OF DEPRESSIONS FOR TRACK

Idaho Court Overrules Depreciation Deduction

State Supreme Court, in Pocatello Water Case, Says Deterioration May Be Ignored If Plant Is in Good Operating Condition

THIS JOURNAL has repeatedly contended that the depreciation of the physical plant of a public utility, so long as service remains unimpaired and there has not been utter failure to provide for the necessary renewal of large units, is purely a stockholders' liability, and should not be deducted from cost figures to determine value. Support to this contention seems to be given by a recent decision of the Idaho Supreme Court relative to the Pocatello Water Company. The decision reversed the State Public Utilities Commission, who had deducted $77,000 for so-called "accrued depreciation." Believing in the reproduction-cost-less-depreciation principle for this class of cases, the court nevertheless saw no conflict between this principle and the disregarding of theoretical depreciation unaccompanied by deterioration of service. The court said in part:

"So far as the question of depreciation is concerned, we think deduction should be made only for actual tangible depreciation, and not for theoretical depreciation, sometimes called 'accrued depreciation.' In other words, if it be demonstrated that the plant is in good operating condition and giving as good service as a new plant, then the question of depreciation may be entirely disregarded."

DEPRECIATION THE INVESTOR'S LIABILITY

The decision of the court practically sustains the minority report of A. P. Ramstedt of the commission, in which he said:

"Physical depreciation, resulting from use, decay and the action of the elements, is a constant factor commencing simultaneously with construction and ending with replacement. A person having invested his money in a continuous business enterprise for the benefit of others must always be ready to replace the constructive portions of his plant as they wear out. A person having embarked on such an enterprise is justly entitled to compensation to cover this depreciation in addition to a fair return, over and above expenses, upon the reasonable value of the property. Allowance for de-

preciation cannot, in my judgment, be considered as profit or an earning factor in the business. The fact that the amount he has received from the public at any time is either greater or less than the amount which he has expended for replacements, if the allowance for depreciation is correctly computed, does not affect the returns to which he is justly entitled on his original investment. He is entitled to a fair return on his investment and to hold the undepreciated property, or its equivalent in value, which he has employed for public use.

"The fact that in an investigation of the petitioner's property, undertaken at this particular time, for the purpose of fixing rates, it is found that the market value of his physical property employed for public use has depreciated $77,188.39 does not, in my judgment, justify the commission, in its determination of a fair value for rate purposes, to deduct the amount of depreciation from the present estimated cost of reproducing the property new, and thereby reduce the earning power of his property. The petitioner has undoubtedly in the past twenty years made such replacements from time to time as the public service demanded, and must at all times be prepared to make such replacements as the public service justly demands. I cannot see how we can justly decrease the earning power of his property by decreasing the investment on which he may earn a fair return. Whenever the time comes when any great amount of replacement is necessary, and that may be at any time, he may be required to expend all that he has ever received to cover depreciation, besides a good portion of his earnings."

A Whalebone Sidewalk

THE accompanying photograph shows a sidewalk, made from the bones of whales, in front of the old San Carlos Mission at Monterey, Cal. The structure was built in 1794, but no records are available to show when the sidewalk was laid. Tradition has it that the walk was laid at the same time as the structure was built or shortly thereafter. The pieces in the foreground in the accompanying view are vertebræ, but long bones are also used, and in fact are employed for working out various designs in the sidewalk. Of course, there is only pedestrian traffic over it.



WHALEBONE SIDEWALK LAID IN 1794

The gentleman at the extreme left of the picture is the city engineer of San Francisco, M. M. O'Shaughnessy, while the nearer of the two figures in the center is José R. Villalon, commissioner of public works of Cuba.

Milwaukee's Activated Sludge Plant the Pioneer Large-Scale Installation

T. Chalkley Hatton, Chief Engineer of Sewage Commission, Discusses Design of New Works and Probable Operating Costs

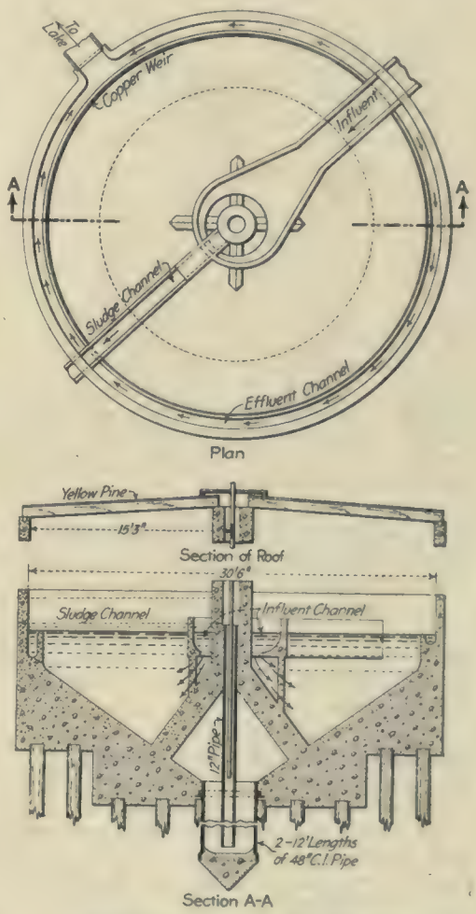
BASING a decision on the results of experimental work costing $65,000, the Milwaukee Sewerage Commission is building the world's pioneer large-scale plant for the treatment of sewage by the activated sludge process. The new works comprise eleven circular 30-ft. concrete tanks of the continuous flow type, designed to treat 1,600,000 gal. of sewage daily with a 4-hr. period of aeration and a 25 per cent activated sludge content. A feature of the plant is the diffusion of air at the tank bottoms by porous quartz sand plates. The works, which are being constructed for the purpose of trying out the process on a normal size unit, so that the city may be guided in the ultimate expenditure of $3,000,000 on its sewerage system, were described by T. Chalkley Hatton, chief engineer of the Milwaukee Sewerage Commission, at the convention of the American Society of Municipal Improvements, held in Dayton, Ohio, this week. The following extracts are from Mr. Hatton's paper:

EXPERIMENTS INDICATE SUCCESS OF CONTINUOUS FLOW TANK

The operation of experimental tanks, placed in operation last March, clearly demonstrated that it was possible to treat the sewage of Milwaukee by the activated sludge process on the fill-and-draw method, when the temperature of the sewage was 50 deg. Fahr. or more, at less cost than by any other process with which the commission had been experimenting, taking into consideration the character of effluent obtained. Having determined the availability of the fill-and-draw method, it was determined to try the continuous flow method. Activated sludge was obtained for seeding this tank partially from the Imhoff tank and from fresh sewage. The Imhoff tank sludge, which is anaerobic and which must be converted into aerobic sludge before activated sludge is produced, was run into the new tank; to this was added fresh sewage every 8 or 10 hr., and the mixture aerated by blowing air through it under about 5 lb. pressure. At the end of 6 or 8 hr. the air was turned off, sludge allowed to settle, the supernatant liquor drawn off, fresh sewage added to the capacity of the tank and the aeration repeated.

This process was continued until the tank contained about 30 per cent of its capacity of good activated sludge. It required about 33 days to seed this tank in the manner described, whereupon it was started upon the continuous flow method. This was begun during the first week in July of this year and has been continued without material interruptions since.

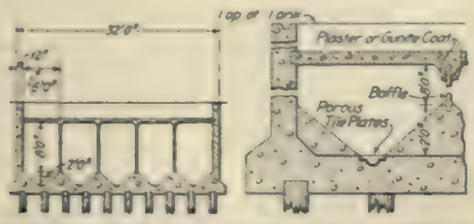
From the beginning of the tests remarkable results were secured, according to Mr. Hatton. With a rough screened sewage containing from 1,000,000 to 7,000,000 bacteria per cubic centimeter, 250 p.p.m. of suspended matter, 30 p.p.m. organic nitrogen and 120 p.p.m. oxygen consumed, an effluent was produced containing a 99 per cent removal of bacteria and suspended matters, 12 to 14 p.p.m. nitrates, stable after 5 days and clear as the lake water,



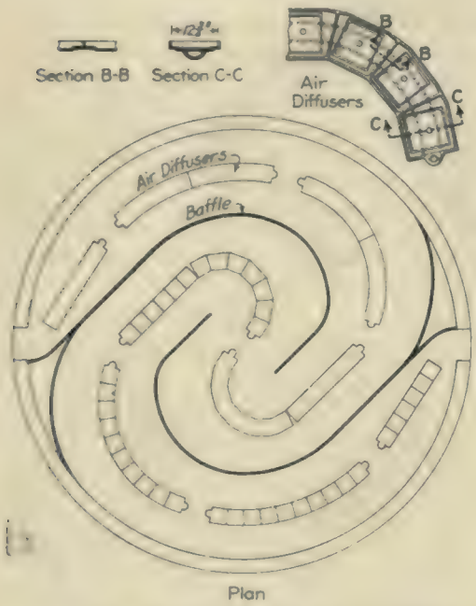
SEDIMENTATION TANK DETAILS

leaving a sludge containing 5.45 per cent of ammonia, 1.34 per cent of available phosphoric acid and 0.23 per cent of potash, worth as a fertilizer $9 a ton based on dry weight.

This was accomplished with 1.77 cu. ft. of air per gallon of sewage treated, costing $4.43 per million gallons based on air at $2.50 per million cubic feet compressed to 5 lb. pressure, which is the guaranteed cost where large units are used, and includes all overhead charges and boiler room labor, but not outside plant or engine room labor. Experiments now under way indicate that the volume of air can be very much reduced. In considering the cost of this process the character of effluent obtained must not be lost sight of. The effluent above described is of far higher standard than any yet obtained from any of the processes with which experiments have been conducted at



ARRANGEMENT OF BAFFLES AND AIR DIFFUSER PLATES



BAFFLES DIVERT FLOW OVER AIR DIFFUSERS IN TANK BOTTOM

the Milwaukee testing station, and much higher than is ordinarily required. If the standard is reduced the cost will be reduced in direct ratio.

In view of the foregoing record of results obtained by this process, either by the fill-and-flow or continuous flow method it is not surprising that the Sewerage Commission felt warranted in expending $65,000 trying out the process on a large size unit, before adopting it as a plant which would ultimately cost in the neighborhood of $3,000,000.

One of the principal reasons for building the large unit was to determine how much low temperatures of the winter would affect the process, what methods would have to be used to overcome this effect and what they would cost. The foregoing results have all been obtained with sewages varying in temperatures from 50 to 70 deg. Fahr., whereas the winter sewages run down to 42 deg. Fahr. for short periods. It is well known that low temperatures seriously affect the efficiency of nitrifying organisms, but to what extent cannot be determined until a fair trial is made, and the contemplated plant may show that some artificial heat will have to be applied to some portion of the process during the extreme low temperature periods.

DESCRIPTION OF PLANT

The plant consists of eleven circular reinforced-concrete tanks 30 ft. inside diameter by 13 ft. maximum depth, supported upon a pile foundation due to the instability of the soil. Tanks 1 to 6, inclusive, are the aerating tanks in which the sewage mixed with the activated sludge is aerated by means of air forced in under 5 lb. pressure. Tank 9 is the sedimentation tank, and tanks 10 and 11 are the activated sludge tanks. The drawings show details of the aerating tanks with their curved baffles, the manner of sloping the bottom of the running through channels so as to avoid the deposition of sludge, and the manner of placing the air diffusers. The sedimentation tank is the only tank to be roofed over. The roof is necessary to prevent ice forming about the edges of the circular weir, which would set up uneven currents. This tank has a radial flow, and is designed for a 25 min. sedimentation period at a 2,000,000-gal. rate.

The two sludge tanks are similar to the aerating tanks except that they are each made into two separate compartments by stop planks connecting the two ends of the baffle walls. Their pipes and diffusers are placed in the same number and manner as in the aerating tanks.

Wooden rectangular troughs are built part way around each tank to control the direction of the flow of liquor, and stop planks are arranged so that any one or series of tanks can be cut out. The sewage from 250,000 people, to which is added the sewage from the packing house district, passes out to the lake through a 20-ft. wide open channel alongside of the proposed plant.

In this channel a weir is constructed 20.35 ft. long, which maintains a depth of about 3 ft. of liquor for 40 ft. back of the weir. This is the grit chamber in which the heavier solids from the street washings are deposited, as the sewers connected with this large intercepting sewer are of the combined type. The weirs have been so arranged as to provide a flow through the plant to correspond with the fluctuations of flow through the main sewer, and the air applied to the sewage will be automatically regulated to correspond with this flow. Self-recording air meters will be installed to determine the volume and pressure of air used.

The sewage, after passing the plant weir, enters tank 1, where it comes into immediate contact with the air and the activated sludge, with which the tank has been originally seeded. It is designed to use 25 per cent of this activated sludge at first and to increase or diminish it as the operation shows necessary to get the most economical results.

Passing through tank 1 the liquor, mixed with the sludge, enters tank 2, when it is again aerated and further mixed with the sludge contained in that tank, and so continues until it passes, with the sludge mixed with it, into the center channel of tank 9. Here the sludge settles out to the bottom of the tank, the clear liquor passing

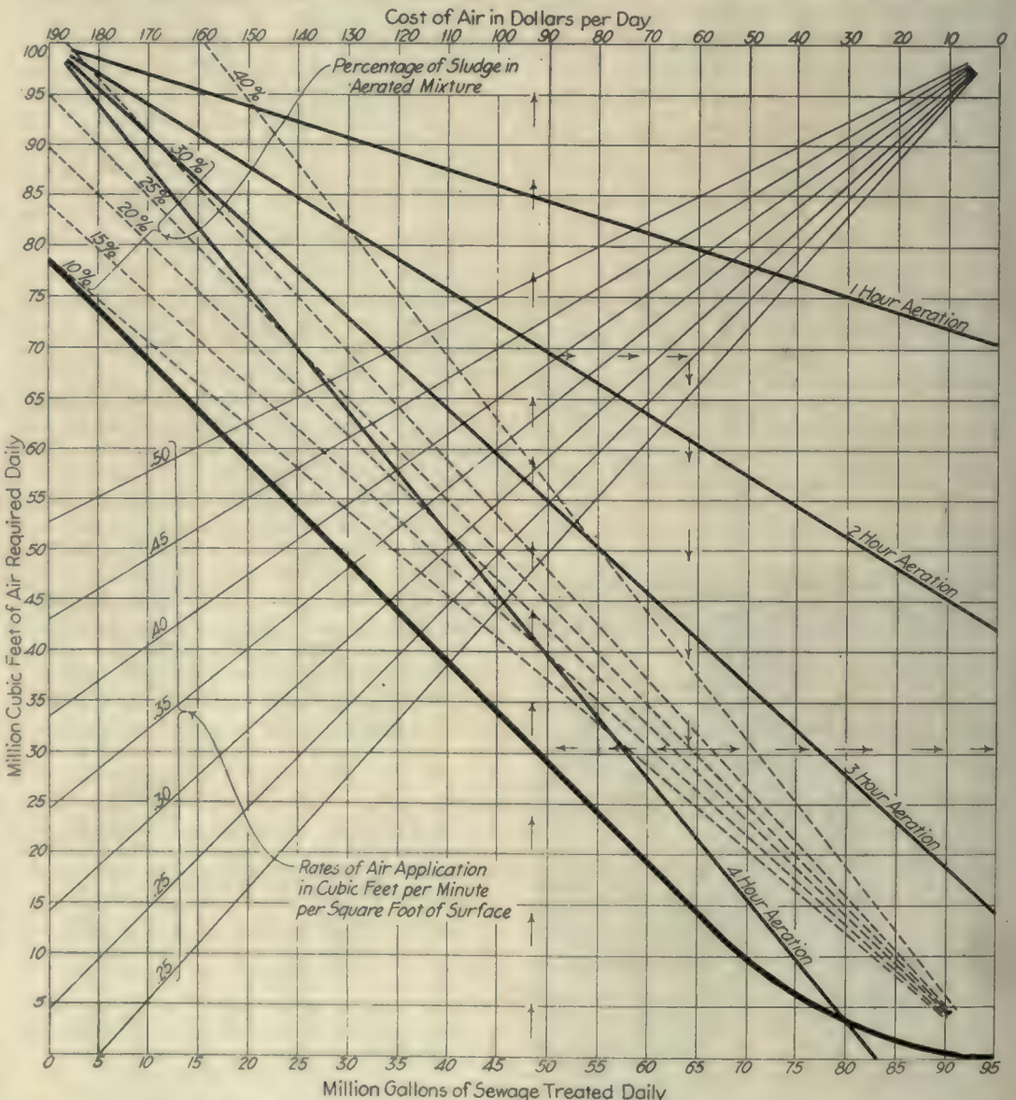


DIAGRAM 1—COST AND QUANTITY OF AIR FOR ACTIVATED SLUDGE PROCESS

Note.—The amount of air used per million gallons of sewage is based upon the use of a tank of 9 ft. average depth. The final cost of aeration is, however, nearly independent of the depth of tank if the rate of aeration per square foot of tank surface remains constant as if the depth were doubled the volume of air per gallon of sewage would be halved but its pressure doubled.

These arrows show the procedure for 50,000,000 gal. of sewage, 2 hours aeration, 0.25 cu. ft. per million rate of air application and 25 per cent of sludge.

Instructions.—Begin at the bottom of the diagram with the number of gallons of sewage treated daily. Run vertically to the selected period of aeration, then horizontally, to the selected rate of air application, then vertically to the percentage of sludge, then horizontally to the heavy curve and thence vertically to the cost in dollars per day. To find the amount of air in millions of cubic feet per day run horizontally to the left instead of to the heavy curve.

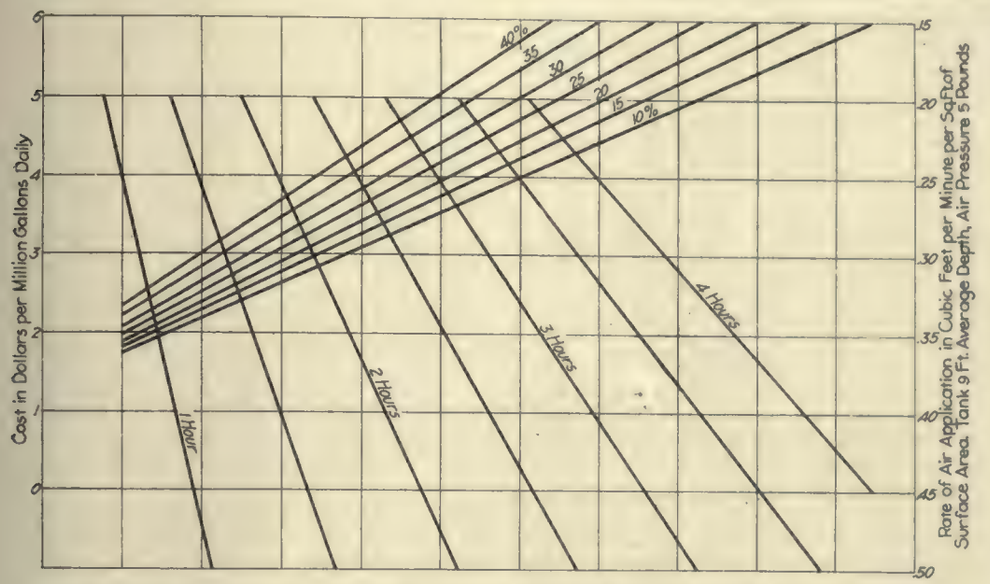


DIAGRAM 2—COST OF ACTIVATED SLUDGE TREATMENT FOR 50,000,000 GALLONS

Note.—Costs as shown embrace all operating costs, interest charges and operating costs including boiler room labor, but excluding engine room and plant labor. Tankage is provided for 1½ times the average daily flow and the sedimentation period is ½ hour. Pumping of sludge is figured in as 30c per million gallons of sludge pumped on the basis of 10c per million gallons one foot high.

Instructions.—Select the required rate of air application on vertical line to the extreme right. Run from this point horizontally to the left to the required period of aeration, then run vertically to the required percentage of sludge in the mixed liquor, and thence horizontally to the left for the cost in dollars per million gallons of sewage treated.

over the circumferential weir to the lake.

The sludge settles to a deep well built in the bottom of the settling tank, and is discharged by gravity into sludge tanks 10 or 11, where it is aerated for such a period as may be necessary to maintain the nitrogen cycle. From these sludge tanks the sludge passes to an 18-in. cast-iron pipe sunk vertically in the ground with its base about 28 ft. below the height of the liquid in the sludge tank, and from this pipe it is pumped by air into the fresh liquor trough, entering tank 1 with the raw sewage and again passing through the process.

That portion of the activated sludge in excess of what is necessary to maintain the proper percentage in the aerating tanks is pumped out of the sludge tanks from time to time and dewatered and will be used as a fertilizer. The method of dewatering has not yet been decided upon, but will probably be by means of the sludge press or vacuum wheel. The deep chambers connected with the settling tank and sludge tanks are for the purpose of dewatering the sludge as much as possible by weight, and thus avoiding the pumping of unnecessary liquor through the process.

It has been found by the experiments conducted that the success of the continuous flow method depends upon maintaining good activated sludge at all times in the tanks treating the fresh liquor. By aerating the sludge to a higher degree than the whole body of the liquor, air is saved because only 25 per cent of the entire mixture is thus given an additional aeration.

The plant, as designed, can treat 1,600,000 gal. of sewage per day with a 4-hr. period of aeration and with a 25 per cent activated sludge content. From present indications it will be able to treat the sewage satisfactorily, when the temperature is 50 deg. Fahr. or over, at a much higher rate, but this is yet to be determined on the large scale. In order to overcome some of the effects of low temperature it is designed to pass the condensing water from the present sewage station adjacent to the new plant through coils of pipe hung to the inside perimeter of the two sludge tanks, inducing circulation by a circulating pump built in the condenser discharge line. This water is now discharged into the river at a temperature of about 100 deg. Fahr.

The power plant for producing the air necessary for operating the plant consists of two positive pressure rotary blowers each having a capacity of 2400 cu. ft. of free air space per minute compressed to 6 lb. pressure and belt driven from two alternating current variable speed motors each of 75 b.h.p. Only one unit will be required for operating the plant. Two are provided to avoid possible interruptions.

One of the questions which would immediately arise in the mind of the engineer is why were circular tanks designed in preference to rectangular. These tanks were designed before any results had been obtained from the continuous flow method, and Mr. Hatton felt there were only two processes available for satisfactorily treating the sewage of Milwaukee. The activated sludge process with continuous flow or fine screening followed by Imhoff tank sedimentation, followed by chlorination. If the former process proved a failure the latter would have to be adopted. The tanks were therefore designed so that they could be used as the digestion chambers for an Imhoff tank installation by removing the sloping bottoms and baffle walls.

RECTANGULAR TANKS BEST

It is quite probable that rectangular tanks will better fit the conditions required to carry on the process. One advantage is that the air diffusers can be placed across such a tank at right angles to the direction of flow, thus avoiding possible short circuiting of the liquor; another is the better convenience of placing the air piping system and avoiding placing any pipes in concrete; and a third is cheaper forms for construction. But whatever form of tank designed the width of the running-through channel should not exceed 6 to 8 ft. to get the most economical disposition of the air.

Many experiments have been conducted with a view of determining the best form of air diffuser, and others are now being carried on. So far the Filtros plate seems to give the best result. This is a composition of quartz sand and some character of cement to bind it together. The sand is ground to an uniform coefficient to give any desired porosity and, after adding the cement, is burned in a furnace. The plates come any size or shape desired and at any thickness. In the Milwaukee plant a plate 12 in. square by 1½ in. thick is being used and has a capacity for passing 2 cu. ft. of air per square foot at 2 in. water pressure. The porosity is 33.27 per cent by voids. This material is manufactured by the General Filtration Company, Inc., of Rochester, N. Y.

It has been found very important to maintain as far as possible an even diffusion of air throughout the body of the liquor. That is, every square foot of plate should contribute its share of free air. To this end orifices are provided to be set in the casting under each Filtros plate. Each orifice is designed to pass the required volume of air under a predetermined pressure.

COST

Of course one of the most important factors to be determined in treating sewage by the activated sludge process is the cost, and the writer presents herewith an estimate of the cost so far as it has been determined from the experiments so far conducted.

In considering this phase of the question it should be first realized that such effects upon cost as low temperatures might have has not been determined; that, with this exception, sufficient data have been secured to accurately determine how much air is required to treat the sewage and sludge to produce a certain standard of effluent from the Milwaukee sewage, and guarantees from well-known manufacturers of blowers, engines, turbines and motors have been secured as to the efficiency of the several apparatus they will undertake to furnish for the final treatment plant.

General dimensions of aerating, sludge and settling tanks have been determined with reasonable accuracy based upon the various periods of aeration and sludge content shown upon the diagrams. These diagrams have been prepared for determining the cost of treating a daily average of 50,000,000 gal. of sewage at Milwaukee, with coal worth 1 cent per 82,000 B.t.u, the price now being paid by the City Water Department, but from the diagrams the cost for other rates of flow can be determined.

It is clearly demonstrated, however, that the smaller the plant the higher the cost for treatment due to the less efficiency in operating small-size blowers, and reciprocating engines and small motors instead of large-size blowers, steam turbines or large motors. It may be that this cost can be considerably reduced by using oil or gas engines in driving the smaller units.

Diagram 1 shows the cost of producing the air per million gallons treated per day under varied conditions as to period of aeration, rate of air application per square foot of tank surface and percentage of activated sludge maintained in the tanks. This cost includes all boiler room labor and all overhead charges such as interest, sinking fund and depreciation.

Diagram 2 includes the cost of the plant for treating the sewage, which cost includes all overhead charges such as interest, sinking fund and depreciation. The only labor cost included is boiler room labor, the engine room and plant labor not

being included for want of sufficient information.

These diagrams are based upon rectangular tanks holding an average depth of 9 ft. of liquor, the depth which has so far seemed most applicable to the Milwaukee situation.

In Milwaukee the most satisfactory results have been obtained by using 0.25 cu. ft. of air per minute per square foot of tank surface, a period of 4 hr. aeration with a sludge content of 25 per cent. By referring to diagram 2 it will be seen that this treatment will cost $5.30 per million gallons treated, exclusive of engine room and plant labor and the disposal of the sludge. If a lower standard of effluent is required and a 3-hr. period of aeration only is required with 20 per cent sludge content and the same rate of air supply, the cost will be seen to be $3.95 per million gallons treated.

Mr. Hatton believes he is warranted in the statement that the above costs are much below the cost of producing an equal standard of effluent from any other process of sewage treatment applicable to a large United States municipality. It seems quite within the bounds of reason to anticipate that there will be sufficient recoverable value in the sludge to pay for its final disposition at least, so that the cost of this portion of the process need not be taken into consideration when comparing it with the cost of treating sewage by any other process.

How Consistency and Age Affect Strength of Mortar

Natural-Sand vs. Ottawa-Sand Tests Discussed in Connection with Standard Requirements for Equal Strength

TESTS of 2-in. mortar cubes made in the Materials Testing Laboratory of the Public Service Commission in New York City seem to show that Ottawa-sand mortar acquires its strength more rapidly than mortar made from natural sand, which is generally graded from fine to coarse. This fact helps to explain the erratic comparative results obtained, and is of importance in connection with the usual requirement that natural-sand should equal Ottawa-sand mortar in strength. It has further been proved by tests that the relative strengths are directly and largely affected by both consistency and age when tested.

Explanation of Erratic Results

Many cases of fine-sand specimens which were acceptable at 3 days or 7 days but failed at 28 days in comparison with standard Ottawa sand have been observed. The most notable case was a sample of fine sand which showed 141 per cent of the strength of Ottawa at 3 days, 122 per cent at 7 days and only 98 per cent at 28 days. The analysis of this sand shows the following percentages passing the sieves given: No. 4, 100; No. 8, 97; No. 16, 77; No. 30, 44; No. 50, 14, and No. 100, 4.

It is suggested that a possible explanation of erratic results is the effect of fineness and grading on time of setting and the much more rapid gain in strength of the Ottawa-sand mortar. That many sands show great variations in comparison with standard Ottawa sand has been fully proved by the very extensive tests on subway construction work made by the Materials Testing Division. The results of relative test averages for ten tests of ten specimens each show that at 3 days natural sand specimens averaged 126 per cent of Ottawa sand, at 7 days 128 per cent, and at 28 days 120 per cent. These results tend to prove that Ottawa-sand mortar acquires strength more rapidly than natural-sand mortar.

Prof. L. J. Johnson also cites a case as follows: In a sand sample the strength in tension as 1:3 mortar showed 113 per cent of that of Ottawa sand at the age of 4 days, and only 82 per cent at 28 days.

Effect of Consistency

Another cause of relative decrease in ratio at the later ages is in the consistency of the mortar; slightly wetter consistency for the natural-sand mortar has a much larger effect in decreasing the strength at early ages than at later ages, and the effect on graded-sand mortar is greater than on Ottawa-sand mortar. Satisfactory sands may sometimes be rejected due to failure to realize the effects of the consistency. The accompanying table shows the effect of a variation of only 1 per cent in the water used.

COMPRESSIVE TESTS OF 2-IN. CUBES—PROPORTIONS 1:3—CONSISTENCY, WET—AVERAGE RESULTS IN PERCENTAGE OF OTTAWA-SAND MORTAR

Age in Days	Ottawa Sand, 14.9 Per Cent Water	Natural Sand, 16.4 Per Cent Water	Natural Sand, 15.4 Per Cent Water
3	100	122	148
7	100	119	117
28	100	112	111

Owing to the above-mentioned causes of variation, the sands tested by the Materials Testing Division are not rejected if they fall within the following limits below the strength of mortar cubes of Ottawa sand: 10 per cent at 4 days; 5 per cent at 7 days, and 1 per cent at 28 days. The operators have been instructed to guard against the effects of wetter consistency in the natural-sand specimens by always making them slightly drier than the standard Ottawa-sand specimens.

Form Proposed for Federal Valuation Report

Ready Comparisons of the Net Results of All Conflicting Theories the Aim of the Skeleton Tables Suggested

By D. F. JURGENSEN

Engineer, Minnesota Railroad and Warehouse Commission, St. Paul

SO MANY perplexing questions are involved in the completion of the task imposed upon the Interstate Commerce Commission by the valuation act that it would seem advisable to prepare a tentative form of inventory which might be used for the purpose of classifying the various methods now being proposed for the purpose of arriving at the ultimate question, "fair value." Some hold that "fair value" should be determined by the so-called "reproduction or replacement" method, and the advocates of this method are again divided into those who assert that reproduction implies allowances for cost of acquisition, consequential damages, contingencies, engineering expenses, interest during construction and many other items, while others contend that the "cost of reproduction" should be limited to the ascertainment of the present value of the items of property actually in existence, which it is held is the true interpretation of the decision of the U. S. Supreme Court in the Minnesota rate cases.

Another controversy has arisen with reference to the purpose to be served by the valuation, or to what use the valuation may be put after it is made. In this connection there seems to be a difference of opinion whether or not the term "fair value" means one amount when used as a basis for rate making, and another amount when used as a basis for sale or condemnation, and perhaps still another when used as a basis upon which to adjust capitalization.

Inventory to Express Views of All

The inventory on the opposite page aims to suggest a form in which each of these views, as well as other contentions not necessary to specify, may find full expression. The thought underlying the suggestion is that in advance of the ascertainment of all of the facts and circumstances it is difficult, if not impossible, to come to a definite conclusion as to the propriety of the contentions advanced, or the proper solution of the problem involved. If, however, an inventory of the property was prepared which would place in parallel columns the facts and items depended on to substantiate each contention advanced, it would, it is submitted, go a long way toward the solution of the question, and would, at least, simplify the work of the commission.

The accompanying inventory is naturally a mere skeleton; the amounts used for illustration have been arbitrarily selected. The inventory is not presented as an actual inventory of the property of any carrier, nor is it at this time presented as the final inventory or tabulation to be adopted by the commission. It is suggested as a "working form," and one which is probably adapted to be used for the tentative or proposed valuation specified in the valuation act, to be first submitted by the commission for criticism and to be perhaps modified after the hearing provided for in the act.

Explanation of Forms

The first four columns of Sheet 1 are self-explanatory. Column 5 applies only to transportation lands. Column 6 gives the "cost of reproduction new" of all properties, including items contended for by those who advocate the inclusion of cost of acquisition. Column 7 records "present value new" of physical properties in existence and devoted to or held for transportation business. Column 8 gives actual existing depreciation in the transportation plant as compared with the plant if it were new, and column 9 records the total "actual present value" of the transportation plant, based on columns 7 and 8.

Columns 2 to 6 refer to all property owned by the carrier; the subsequent columns refer only to that devoted to or held for transportation purposes. The total amount of this property is found in column 7, and in the subsequent columns deductions are made upon different bases, each column showing the total actual "present value" of the items included upon the particular basis used for that column.

It is proper to say that each column in Sheet 1 subsequent to column 9 is based upon actual present value as given in column 9, and that the basis adopted for column 6 has not been carried into any of the subsequent tabulations.

Sheets 2, 3, 4, 5 and 6 are analyses of the items found in Sheet 1, and require no detailed explanation.

SHEET 1—PROPOSED SKELETON FORM TO BE USED IN PREPARATION OF "TENTATIVE VALUATION OF COMMON CARRIER PROPERTY" SPECIFIED IN VALUATION ACT OF MARCH 1, 1913

Item	ALL PROPERTY OWNED: Original cost	COST OF REPRODUCTION NEW: Appreciation	Present value new	Cost of acquisition and consequential damages	Total	PROPERTY DEVOTED TO OR HELD FOR TRANSPORTATION BUSINESS: Present value new, as in col. 4	Depreciation	ACTUAL PRESENT VALUE: Total	As in col. 9, omitting granted right-of-way and land held for future	As in col. 10, carrying easements at cost	As in col. 11, omitting construction and equipment acquired from operating expenses	As in col. 12, omitting construction and equipment acquired from surplus earnings	As in col. 13, omitting adaptation and solidification of roadbed	As in col. 14, omitting construction and equipment donated by counties and municipalities			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1—*Lands* devoted to transportation business (classifiable under I. C. C. classification "I—Road")	$3,000,000	$6,500,000	$9,500,000	$12,000,000	$21,500,000	$9,500,000		$9,500,000	$7,350,000	$7,000,000	$7,000,000	$7,000,000	$7,000,000	$7,000,000			
2—*Construction* (including all items under I. C. C. classification "I—Road", except *Land*)	15,000,000	*14,500,000	27,900,000		*29,500,000	27,900,000	$5,300,000	*24,200,000	24,200,000	24,200,000	21,400,000	17,400,000	15,800,000	11,800,000			
3—*Equipment* (including all items under I. C. C. classification "II—Equipment"	9,600,000	3,400,000	13,000,000		13,000,000	13,000,000	3,900,000	9,100,000	9,100,000	9,100,000	8,330,000	7,730,000	7,730,000	6,870,000			
4—*III—General Expenditures* (as in I. C. C. classification "Investment in Road and Equipment").	700,000	3,900,000	4,600,000		4,600,000												
5—*Miscellaneous Properties Owned* (but not devoted to transportation business)	13,430,000	28,700,000	42,130,000		42,130,000												
Totals	$41,730,000	$57,000,000	$97,130,000	$12,000,000	$110,730,000	$50,400,000	$9,200,000	$42,800,000	$40,650,000	$40,300,000	$36,730,000	$32,130,000	$30,530,000	$25,670,000			

*Includes $1,600,000 for "adaptation and solidification" of roadbed. See Sheet 3. Adaptation and solidification do not obtain in a new roadbed and are therefore omitted in columns 4 and 7.

SHEET 2—ANALYSIS OF ITEM 1—LANDS DEVOTED TO TRANSPORTATION PURPOSES—(CLASSIFIABLE UNDER I. C. C. CLASSIFICATION "I—ROAD")

How obtained	Original cost	Present value	Cost of acquisition and consequential damages	Cost of reproduction new
1	2	3	4	5
Granted	Nil	$1,500,000	$3,000,000	$4,500,000
Condemned	$100,000	400,000	400,000	800,000
Purchased and used	2,600,000	6,900,000	7,900,000	14,800,000
Purchased and held for future use	300,000	650,000	650,000	1,300,000
Easements in public streets	Nil	50,000	50,000	100,000
Totals	$3,000,000	$9,500,000	$12,000,000	$21,500,000

SHEET 4—ANALYSIS OF ITEM 3—EQUIPMENT—(INCLUDING ALL ITEMS UNDER I. C. C. CLASSIFICATION "II—EQUIPMENT")

How obtained	Original cost	Present value new	Depreciation	Actual present value
1	2	3	4	5
Capital account	$8,000,000	$9,810,000	$2,940,000	$6,870,000
Surplus earnings	700,000	870,000	270,000	600,000
Operating expenses	900,000	1,100,000	330,000	770,000
Cash donations from counties and municipalities	Nil	1,220,000	360,000	860,000
Totals	$9,600,000	$13,000,000	$3,900,000	$9,100,000

SHEET 6—ANALYSIS OF ITEM 5—MISCELLANEOUS PROPERTIES OWNED BUT NOT DEVOTED TO TRANSPORTATION BUSINESS

Class	Original cost	Present value new	Depreciation	Actual present value
1	2	3	4	5
Lands not classifiable under I. C. C. Classification "I—Road"	Nil	$10,000,000	None	$10,000,000
Mine property	$70,000	700,000	None	700,000
Securities of other carriers	7,000,000	10,000,000	None	10,000,000
Securities other than of carriers	1,000,000	5,000,000	None	5,000,000
Amusement resorts	60,000	80,000	$40,000	40,000
Hotels	300,000	350,000	150,000	200,000
Stores and supplies	3,000,000	3,500,000	None	3,500,000
Franchises	Nil	10,000,000	None	10,000,000
Unclassified assets of various kinds	2,000,000	2,500,000	None	2,500,000
Totals	$13,430,000	$42,130,000	$190,000	$41,940,000

SHEET 3—ANALYSIS OF ITEM 2—CONSTRUCTION—(INCLUDING ALL ITEMS UNDER I. C. C. CLASSIFICATION "I—ROAD," EXCEPT LAND)

How obtained	Original cost	Present value new	Depreciation	*Adaptation and solidification of roadbed	ACTUAL PRESENT VALUE: Including adaptation and solidification of roadbed	Omitting adaptation and solidification of roadbed
1	2	3	4	5	6	7
Capital account	$10,000,000	$15,514,000	$3,000,000	$886,000	$13,400,000	$12,514,000
Surplus earnings	3,000,000	4,636,000	900,000	264,000	4,000,000	3,736,000
Operating expenses	2,000,000	3,114,000	500,000	186,060	2,800,000	2,614,000
Cash donations from counties and municipalities	Nil	4,636,000	900,000	264,000	4,000,000	3,736,000
Totals	$15,000,000	$27,900,000	$5,300,000	$1,600,000	$24,200,000	$22,600,000

*Adaptation and solidification do not obtain in a new roadbed.

SHEET 5—ANALYSIS OF ITEM 4—III—GENERAL EXPENDITURES, AS IN I. C. C. CLASSIFICATION OF "INVESTMENT IN ROAD AND EQUIPMENT"

Item	Original cost	PRESENT VALUE NEW: *Basis "A"	†Basis "B"	Depreciation (On assumption that III—Gen. Exp. constitutes part of cost of physical property)	ACTUAL PRESENT VALUE: Basis of col. 3 and col. 5	Basis of col. 4 and col. 5
1	2	3	4	5	6	7
Organization expenses	$30,000	$200,000	$171,000	$34,200	$165,800	$136,800
Law expenses	20,000	130,000	115,000	23,000	107,000	92,000
Taxes	50,000	330,000	287,000	57,400	272,600	229,600
Interest	200,000	1,310,000	1,143,000	228,600	1,081,400	914,400
Commissions	300,000	1,970,000	1,713,000	342,600	1,627,400	1,370,400
Other expenses	100,000	660,000	571,000	114,200	545,800	456,800
Totals	$700,000	$4,600,000	$4,000,000	$800,000	$3,800,000	$3,200,000

*Basis "A" computed on cost of acquisition and consequential damages as to lands.
†Basis "B" computed on only "present value" of lands.

Reinforced-Concrete Conduit Analysis Simplified by Theory of Displacements

Conduit Designed by W. M. Smith in Engineering Record of May 22, Using Least-Work Theory, Is Here Analyzed by Shorter Graphical Methods

By C. S. WHITNEY

Steel Inspector for Gustav Lindenthal, Consulting Engineer, New York City

AN ARTICLE by W. M. Smith in the Engineering Record of May 22, page 648, described a method of applying the theory of least work to the analysis of reinforced-concrete conduits. The same problem can be solved by the graphical application of the theory of virtual displacements outlined in the writer's previous article in the issue of Sept. 11, page 234. This problem is a comparatively difficult one because of the large number of oblique forces and the shape of the section, but the true pressure line can be located quite accurately in less than twelve hours by one familiar with the graphical method.

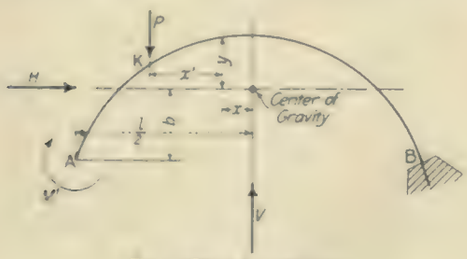


Fig. 1 – Fixed Arch Notation

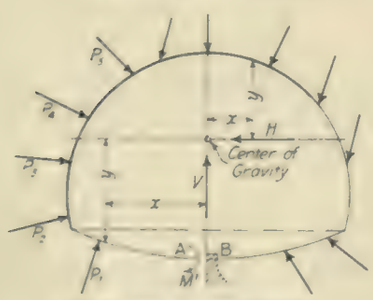


Fig. 2 – Application to Conduit

THEORY SAME AS FOR FIXED ARCH

The theory involved is the same as that explained in the article by the writer referred to above on the analysis of fixed elastic arches. The equations are similar to those there derived; H is the horizontal and V the vertical component of the reaction and M is the bending moment at the left end. Neglecting the effect of temperature, rib shortening and shear the reactions are given by the following formulas, which assume that the arch ring has been divided into small lengths so that the values of $\Delta s/EI$ are equal. (See equations 4 of previous article.)

$$\left.\begin{aligned} H &= \left(\sum_A^B M_1 y\right) \quad \sum_A^B y^2 \\ V &= \left(\sum_A^B M_1 x\right) \quad \sum_A^B x^2 \\ M' &= \left(\sum_A^B M_1\right) \quad n \end{aligned}\right\} \qquad (1)$$

The term M_1 is the moment at the center of the divisions of the rib produced by the external loads, excluding the reactions, on the arch rib considered as acting as a simple cantilever fixed at the right-hand end only. In the preceding article, the value of M_1 was equal to Px' because the effect of a single vertical concentrated load was being considered in order to obtain influence lines for moving loads.

It should now be observed that the arch rib may be curved completely around in the shape of a ring without in any way affecting the equations involved. If the abutments are drawn near together as in Fig. 2 at A and B, the equations for H, V and M still give the reactions at left end A. The moment M_1 is the moment of the external forces P_1, P_2, etc., about the given point x, y. The value of M, as before, is

$$M = M' + Hb - Vl/2$$

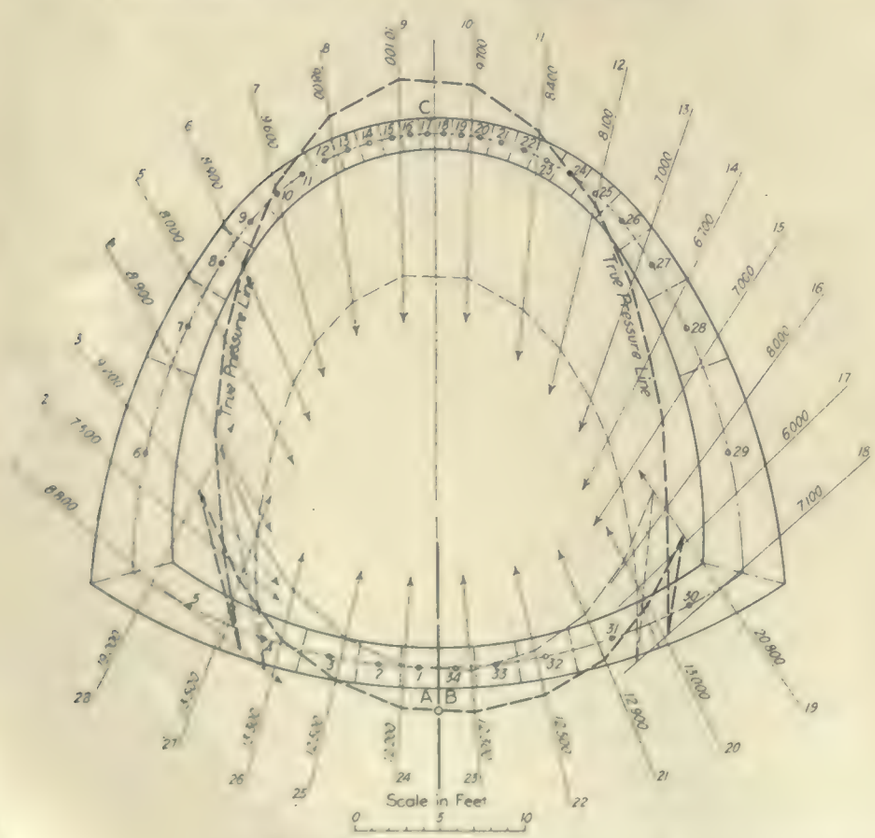
THEORY OF VIRTUAL DISPLACEMENTS

Imagining the invert cut at the center and considering the conduit as a curved cantilever fixed at B, the theory of virtual displacement requires that the total changes in relative deflections and angle shall be zero, and the equations 1 were derived in the preceding article to satisfy this condition. The values of H, V and M are in this case the thrust, shear and moment at the center of the invert.

The values of x and y are measured algebraically from the vertical and horizontal axes passed through the "center of gravity" of the divisions of the arch ring. In locating this "center of gravity," the divisions are all given equal weight because the values of $\Delta s/EI$ are all made the same. The summation of the values

$$\sum_A^B M_1 x, \sum_A^B M_1 y, \sum_A^B x^2 \text{ and } \sum_A^B y^2$$

proceed around the arch from the free end,



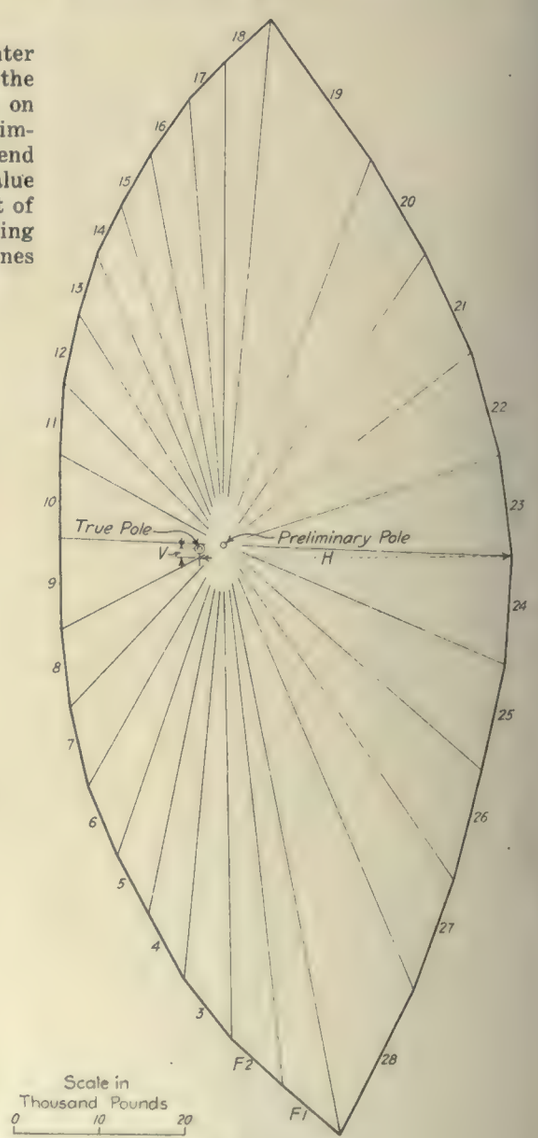


FIG. 3—LOADING ON CONDUIT—TRIAL AND TRUE PRESSURE LINES CONSTRUCTED BY FORCE POLYGONS

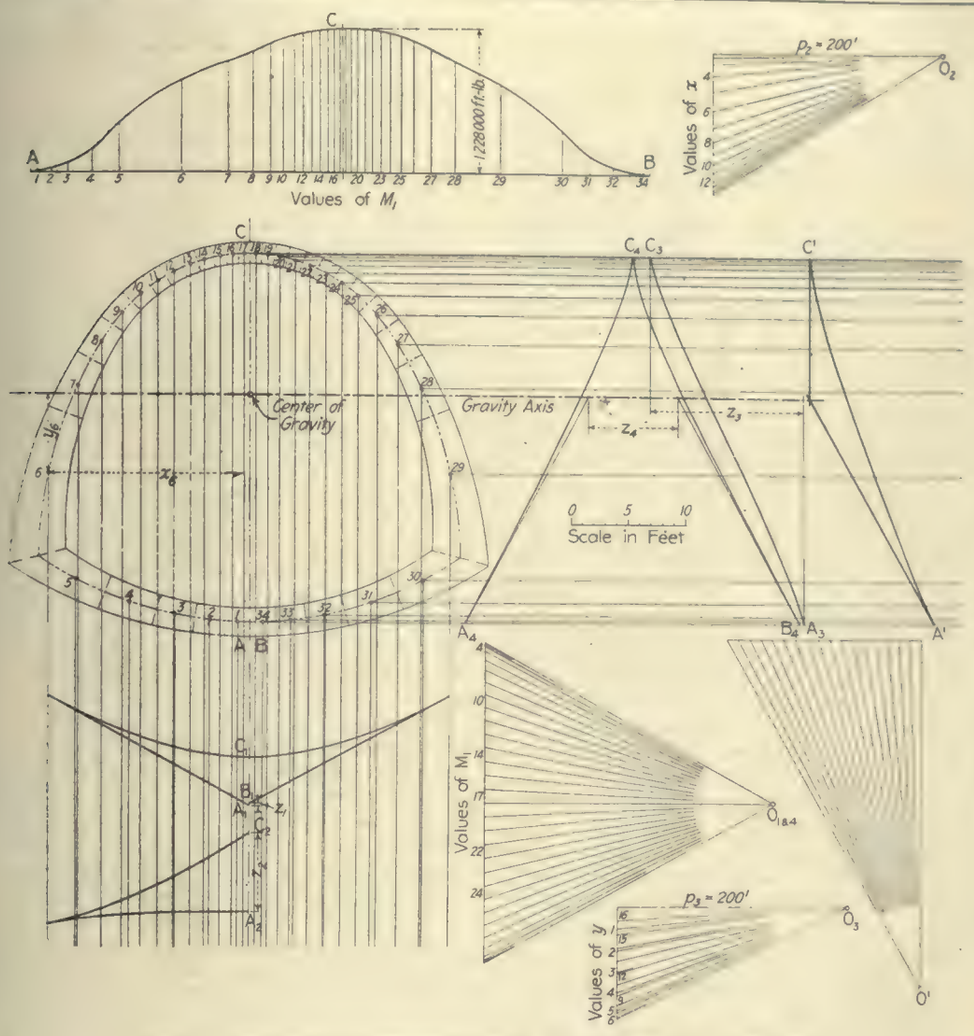


FIG. 4—GRAPHICAL DETERMINATION OF VARIOUS SUMMATIONS

and their values may be obtained easily and accurately by the graphical method explained in Church's "Mechanics of Engineering" or other texts on graphics. The summation is effected by means of funicular polygons.

APPLICATION OF THEORY—GRAPHICAL SOLUTION

All of the graphical work involved in the location of the true pressure line of the conduit for the assumed condition of loading is given in Figs. 3 and 4. In order that a check might be had, the same condition of loading was assumed as used by Mr. Smith and the results agreed very closely with his except in the case of the shear, which he did not investigate, because the load of the conduit is nearly symmetrical.

The procedure is as follows: The conduit is first laid out and divided up as in Fig. 3, so that the values of $\Delta s/EI$ are all the same. The lines of action of the forces acting on the conduit are then drawn in and the force polygon is constructed. The invert is assumed cut by a vertical section at the center; the end B is considered fixed and A free. Since the end A is free the bending moment there must be zero, and the equilibrium polygon is therefore started at the neutral axis at the section cut. Any convenient position of the pole may be selected, as the first equilibrium polygon is used only to determine the moments in the bent cantilever due to the earth pressure. By means of the force and equilibrium polygons, the moments M_1 at the center point of each of the divisions of the arch are computed, and the resulting curve of moments is given at the top of Fig. 4.

The arch rib is again laid out for use in determining H, V and M, and the center points of the divisions are projected in parallel lines to the right and downward for the construction of the funicular polygons, Fig. 4. In order to locate the gravity axis, the rib divisions are treated as equal forces acting horizontally and their resultant is located by the ordinary graphical method. The force polygon with pole at O′ and the funicular polygon A′B′ were used for this purpose. When this axis is located the values of y may be measured from it. The values of x are measured from the vertical axis through the center-of-gravity point.

DETERMINATION OF THRUST

The two summations $\sum_A^B M_1 y$ and $\sum_A^B y^2$ are obtained from the two funicular polygons A_1B_4 and A_2C_2. The values of M_1 from the M_1 curve are laid off on the load line of a force polygon, and a convenient pole is chosen ($O_{1 \text{ and } 4}$). The funicular polygon A_1B_4 is drawn with its sides perpendicular to the rays of this force polygon. The value of $\sum_A^B M_1 y$ is equal to the length z_4 multiplied by the pole distance $p_{1 \text{ and } 4}$ of the force polygon. In the same way $\sum_A^B y^2$ is obtained. The values of y are laid off algebraically on the load line of the force polygon whose pole is at O_3. The funicular polygon A_2C_2 is constructed with sides perpendicular to the corresponding rays. Since the arch is symmetrical, only one-half of the funicular polygon need be drawn. The value of $\sum_A^B y^2$ is then $2z_3p_3$, and

$$H = \frac{\sum_A^B M_1 y}{\sum_A^B y^2} = \frac{z_4 p_{1 \text{ and } 4}}{2 z_3 p_3}$$

If found convenient, the pole distances can be made equal and will then cancel out. The numerical value of z is, of course, measured to the same scale as the arch, and that of p to the scale of the load line.

DETERMINATION OF SHEAR

The vertical shear at the center of the invert is found in the same manner as H. The value of $\sum_A^B M_1 x$ is taken from the funicular polygon A_1B_4 drawn with sides parallel to the rays of the M_1 force polygon (pole at $O_{1 \text{ and } 4}$) and is equal to z times p_1. The value of $\sum_A^B x^2$ is taken from the funicular polygon A_2C_2 drawn with sides parallel to the x force polygon with its pole O_2.

Only half of the funicular polygon is drawn, because of symmetry, and

$$\sum_A^B x^2 = 2 z_2 p_2$$

Therefore

$$V = \frac{\sum_A^B M_1 x}{\sum_A^B x^2} = \frac{z_1 p_1}{2 z_2 p_2}$$

Because of the symmetry of loading the shear V is quite small in this case.

DETERMINATION OF MOMENT

The moment M' is equal to $\left(\sum_A^B M_1\right)/n$, in which n is the number of divisions of the arch ring (thirty-four in this case). The term $\sum_A^B M_1$ can be measured directly from the M_1 load line. The true moment M is equal to $M' + Hb - Vl/2$, which reduces to $M' - Hb$ in this case, because l, the distance between the ends of the arch, is zero, and H is negative.

The numerical results obtained at the center of the invert of this conduit are as follows:

Thrust:

$$\sum_A^B M_1 y = 7.90 \times 25{,}000{,}000 = 197{,}500{,}000$$

$$\sum_A^B y^2 = 2 \times 13.28 \times 200 = 5310$$

$$H = 197{,}500{,}000/5310 = 36{,}800 \text{ lb.}$$

Shear:

$$\sum_A^B M_1 x = 0.12 \times 25{,}000{,}000 = 3{,}000{,}000$$

$$\sum_A^B x^2 = 6.75 \times 2 \times 200 = 2695$$

$$V = 3{,}000{,}000/2695 = 1100 \text{ lb.}$$

Moment:

$$\sum_A^B M_1 = 27{,}400{,}000$$

$$n = 34$$

$$M' = 27{,}400{,}000/34 = 806{,}000 \text{ ft.-lb.}$$

The distance from the center of gravity

to the pressure line at the center of the invert is

$$M'/H = 806{,}000/36{,}840 = 21.87 \text{ ft.}$$

which brings the pressure line 2.5 ft. below the neutral axis.

Knowing the values of H and V and the location of the true pressure line below the center of the invert, the true pole can be located and the true pressure line drawn in. The value of V in this case was not determined very accurately, because of the small scale used, but it is small and relatively unimportant. The thrust and position of center of pressure check those obtained by Mr. Smith within 2 per cent.

EFFECT OF RIB SHORTENING AND TEMPERATURE

The effect of change of temperature on the conduit is to increase or decrease the size of all parts in the same proportion; and, if the conduit were not surrounded by material which resisted the expansion, no stresses would be produced by temperature change. The effect of expansion must be to increase somewhat the pressure of the surrounding earth, but to what degree it would be impossible to estimate, and the writer is at a loss to see how the temperature stresses can even be approximated. The entire rib is under a heavy thrust and the effect of rib shortening would therefore be small.

The consideration of temperature and rib-shortening stresses in a conduit in an earth fill would seem to be a useless refinement when the external forces are of such an indeterminate nature. A conduit subjected to hydrostatic pressure would present a very nice problem, but the pressures in an earth fill are an entirely different matter. No experiments have revealed any accurate law by which the pressures in a deep fill, affected so much by arch action and varying conditions, can be figured. It would therefore seem sufficient to estimate the pressure as carefully as possible, as Mr. Smith has apparently done, and to determine the true pressure line without any undue refinements.

In spite of the simplicity of the graphical application of the theory of virtual displacements which has been explained, the writer has not been able to find a single record in English of its use in solving such a problem as that presented by the reinforced-concrete conduit. This may possibly be attributable to the tendency of American engineers toward analytical methods which involve no drafting, and many may receive the impression from the appearance of Fig. 4 that too much graphical work is involved for accurate results. This is not true, because there are easy checks and less possibility of gross error, and the results can easily be brought within the common standards of accuracy. The basic assumptions made in the application of the general theory of elasticity to such structures are themselves productive of much greater error than any reasonable error which could be made in the graphical constructions.

NATIONAL FORESTS RECEIPTS, during the year ending June 30, amounted to almost $2,500,000, an increase of more than $40,000 over the preceding year. Timber sales amounted to $1,164,000, a decrease of about $79,000 from the amount received during the last year, but the water power receipts and the grazing receipts showed increases of about $42,000 and $127,000 respectively.

Recent Legislation for Water Conservation Reviewed and Criticised

Morris Knowles Makes Comparison of Various State Laws and Gives the Principles of Wise Legislative Enactment

SUGGESTING the fundamental principles for the type of conservancy legislation most to be desired, Morris Knowles, member of the Pittsburgh Flood Commission, presented before the recent National Drainage Congress a paper entitled "Wise Water Conservation Legislation," which contains a comparison and critical review of the recent legislation in various States. The following extracts contain his more important statements and conclusions:

Never before in the history of our country has there been so much attention directed to legislation on matters connected with flood prevention, water conservation and stream regulation as during the past two or three years. The great overflow in the Mississippi Valley in 1912 and the widespread damage by the great storm of 1913 appeared to have been effective in arousing the public to the need of governmental action on these subjects. A compilation of the bills that have been under consideration and the acts that have been passed in the various State and National legislatures during the past three or four years would be extremely interesting and helpful. A few instances typical of various forms of legislation that have been adopted will be referred to as examples.

PENNSYLVANIA CONTROL OF WATER

In 1913, under the influence of the public agitation subsequent to the flood of that year, the Pennsylvania Legislature enlarged the powers of the Pennsylvania Water Supply Commission, established about ten years ago, by giving it more extensive authority with respect to the construction and maintenance of dams and the power to require correction of defects in existing structures, and authorized a complete inventory of the water resources of the State, a study of the flood problem, consideration of possible locations of dams for stream regulation and water conservation, and the study of a public policy for the equitable distribution and marketing of public waters.

In the State of New York a conservation commission of three members was established several years ago, and by successive amendment and additions to the conservation law this commission has acquired unusually extensive powers in connection with hydroelectric development, stream regulation, supply of water and drainage. The act was amended in several important particulars during 1913, and in 1915 important amendments were adopted relative to the regulation of streams by storage reservoirs and reducing the number of commissioners to one.

POWERS OF NEW YORK COMMISSION

The powers of this commission include the right of entrance, the right of eminent domain, and authority to construct projects, provide money by bond issue and assess the costs by taxation in proportion to benefits. The commission may originate projects for hydroelectric development and may undertake stream regulation and drainage projects for which petition is made in accordance with the law. It is also given complete supervision over storage-reservoir projects undertaken by local districts organized under the 1915 amendment.

The unusual feature of the act, apart from the broad powers of the commission, is the small measure of power left with the inhabitants and local officials of the community affected, except in the case of storage projects under the 1915 amendment. When improvement of a stream by other means than reservoirs or drainage improvements are petitioned for by any county, city, town or village, it rests entirely with the commission whether or not public health and safety warrant the undertaking of the projects by the State, and thereafter the commission has entire control of the planning, financing and construction of the project and the distribution of the cost.

The 1915 amendment changes these provisions as to projects for river regulation by storage reservoirs, and in this branch of the subject is the best piece of such legislation with which the author is acquainted. It provides for the organization of river-improvement districts, with resident freeholders as directors, and endows the board of directors with all of the powers granted to the conservation commission in connection with other work under the act. Avoidance of conflict and a consistent State policy are assured, however, by requiring the approval of the commission at every step. The only criticism of this part of the act is its restricted application.

OHIO CONSERVANCY LAW

The Ohio conservancy law, which has attracted so much attention, attacks the proposition from an entirely different standpoint. A given number of property holders may petition for the organization of a conservancy district and the courts of common pleas of the counties affected must determine upon hearing whether or not the organization of the proposed district is in the public interest.

When such a district is organized its directors are endowed with powers almost as far-reaching as those of the New York Conservation Commission. The plan of their project is subject to the approval, after hearing, of the courts of common pleas, which may also hear protests against the assessment of benefits by the board of appraisers appointed by the court upon recommendation of the district directors. The districts are given the right of eminent domain, authority to issue bonds and construct and operate conservancy projects, and the right to levy assessments in proportion to benefits upon the property within the district.

INDIANA LEGISLATION OF 1915

The Indiana legislation, which resulted in 1915 from the floods of the preceding years, is a mingling of adaptations of the Ohio act. Five bills were passed by the 1915 Legislature, authorizing the organization of various kinds of flood-prevention and drainage districts and allotting various degrees of authority to the district directors and the circuit courts of the counties

involved. Three of the acts were passed for the benefit of the cities of Fort Wayne, Indianapolis and Peru, respectively, and practically authorized these cities to carry out flood-prevention work, leaving the planning entirely within their power, and to assess a portion of the cost upon all or part of the counties in which they are situated.

A drainage-district act was adopted permitting the organization of drainage districts by circuit courts upon the petition of a majority of the property owners or resident owners of a majority of the acreage lying within the proposed district. A general act was passed covering flood prevention in cities of the second, third, fourth and fifth classes, and incorporated towns.

COMPREHENSIVE POLICY NEEDED

The Pennsylvania law lays proper stress upon the needs of thorough investigation and upon the formulation of a comprehensive State policy with respect to the conservation and utilization of its water resources; it is defective, however, in that it hinders private development by depriving it of the right of eminent domain, and in that it provides no means by which local, public and private interests can be organized with suitable powers for conservancy work. By the failure to provide appropriations in 1915, it has made impossible a continuous program to complete investigations, and therefore does not assure a comprehensive State policy at a time when stream regulation is sorely needed in order to prevent repetition of flood disasters and also to provide for the utilization of the one inexhaustible power resource which this great mineral State possesses.

The New York law assures harmonious policy by placing the control of private projects, as well as the inception and execution of public conservancy projects, in the hands of a single State commission and endows that commission with ample powers of the most far-reaching kind. And as to storage-reservoir projects, with the exception of certain minor details, it approximates closely to the legislation which the author considers ideal.

The Ohio law endows local authorities with powers almost as comprehensive as those of the New York commission with relation to the inception, financing and construction of projects. It fails, however, to provide the assurance of harmony and consistent policy provided by the Pennsylvania principle of commission approval of private projects and the New York principle of complete central control, and substitutes therefor an unsatisfactory scheme by which the already overloaded courts are given the burden of deciding upon issues raised at hearings by the various interested parties.

TYPES OF CONSERVANCY LEGISLATION THAT ARE MOST DESIRABLE

Enough has been said to suggest the principles which seem most important as a foundation for the type of conservancy legislation which is most to be desired and which is as yet without representation on the statute books of America. Such legislation should make ample provisions for the study of the problems of conservancy and river regulation and the formulation of a comprehensive policy which will treat each stream as a unit from its source to its mouth, and take into account all the possible uses of water; it should encourage private initiative by granting, under State and Governmental control, the right of eminent domain and other appropriate powers, and it should give scope to civic enterprise by providing for the organization of conservancy projects under the direction of local authorities with powers of the most far-reaching kind.

Finally, all wise legislation should assure the correlation of various projects within the same drainage basin and the harmony of all such projects with public policy and a comprehensive public program for the utilization of water resources by the establishment of State and National commissions with adequate supervisory powers and full authority to control local districts to this end.

Letters to the Editor

Comment on matters of interest to engineers and contractors will be welcomed

Longest Tunnel in America

Sir: I note on page 264 of the Engineering Record of Aug. 28 that the Rogers Pass tunnel, having a length of 26,400 ft., is reported to be the longest tunnel in America.

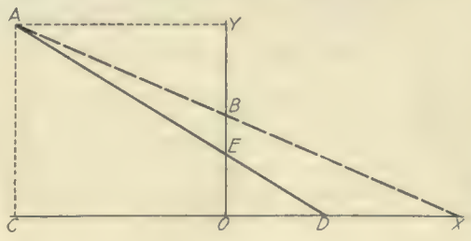
I am forwarding under another cover a marked copy of the Thirteenth Annual Report, page 406, giving a table of tunnels, built, under construction and proposed by the Reclamation Service. You will note that the Gunnison tunnel, already constructed, is 30,645 ft. in length.

MORRIS BIEN,
Acting Director, U. S. Reclamation Service.
Washington, D. C.

[Attention is also called to the 18-mile city aqueduct tunnel for the new Catskill water supply for New York City. Ordinarily, however, when tunnels are mentioned one thinks of railroad tunnels, and the Rogers Pass bore is believed to be the longest railroad tunnel in America.—EDITOR.]

To Construct Nomographic Charts for Kutter's Formula

SIR:—I have read with great interest in your issue of June 26, page 809, the article on the use of nomographic charts, and it has occurred to me that it may be news to many of your readers who are interested in sewerage that similar diagrams may be constructed for the solution of Kutter's formula of discharge.



The diagram is illustrated in the figure herewith, and is used to obtain the value of the constant c in the formula $v = c\sqrt{RS}$, where v is the velocity in feet per second; R the hydraulic mean depth, and S the sine of the angle of slope. In this equation

$$c = \frac{l/n + (a + m/S)}{(a + m/S)n/\sqrt{R} + 1}$$

where a, l and m are experimental constants determined by Kutter as 41.66, 1.811 and 0.00281 respectively, in English measure. Of course n is the so-called "coefficient of roughness."

In the figure OY and OX represent the ordinary axes of rectangular co-ordinates. Mark off OD to any chosen scale to represent l, and OE to represent l/n. Then

$$\tan \angle OED = OD/OE = n$$

Mark off EY to represent $a + m/s$ to the same scale that OE represents l/n. Then OY represents $l/n + (a + m/S)$. Draw YA parallel to the axis of X to cut DE produced in A, and draw AC parallel to the axis of Y. Then

$$\angle AEY = \angle DEO = \tan^{-1} n$$

and

$$CO = AY = YE \tan \angle AEY = (a + m/S)n$$

Mark off OX to represent $\sqrt{R}$. Then

$$CX = (a + m/S)n + \sqrt{R}$$

Join AX, cutting OY at B. By similar triangles

$$\frac{OB}{\sqrt{R}} = \frac{AC}{CX} = \frac{OY}{CX} = \frac{l/n + (a + m/S)}{(a + m/S)n + \sqrt{R}}$$

Therefore

$$\frac{OB}{\sqrt{R}} = \frac{l/n + (a + m/S)}{(a + m/S)n + \sqrt{R}}$$

$$OB = \frac{l/n + (a + m/S)}{(a + m/S)n\sqrt{R} + 1}$$

This is the value of c. In preparing the diagram care must be taken with the scales. Those along the axis of X are to the scale of l. Those along Y may be to any other convenient scale.

Tables of the various values of $a + m/S$, l/n and $\sqrt{R}$ are given in Moore's "Sanitary Engineering."

G. S. COLEMAN.
Manchester, England.

Longleaf Pine Specification Should Include Density Test

SIR:—I want to thank you for the commendation of the work of this laboratory in your editorial "Visual Identification of Longleaf Pine—Its Importance," in the Engineering Record of Sept. 18, page 342.

It appears desirable to make further comments on the relation of identification of longleaf pine to the density classification of the Southern pine used in the grading rules. For a great many years the term "longleaf pine" has been used to designate the best quality of the Southern pines, and whenever a shipment of timber did not come up to expectations it at once was classed as not true longleaf, the idea being that all true longleaf was of good quality when free from defects, and that commercial longleaf admitted all true longleaf (*Pinus palustris*), and the best timbers of the Southern pine.

The above view of the subject is not altogether correct. True longleaf pine averages stronger and better than most of the other Southern pines and will, undoubtedly, furnish most of the timbers of the new select

structural grade of the Southern Pine Association. Tests on pieces clear from defects have shown, however, that a small per cent of the longleaf pine is to be classed with the poorer grades of shortleaf and loblolly for strength, and some of the loblolly and shortleaf is to be classed with the better grades of longleaf. Some pieces of true longleaf are so lacking in density (and this is generally true of other species) that were we to waive the density requirement a timber having maximum defects allowed in the select structural grade would have only about two-thirds of the strength of the poorest timber that should be admitted, and only about 45 per cent of that of the average timber of the grade. Furthermore, it would be expected to fail in less than a year with a dead load producing a stress of 1600 lb. per square inch.

The point that I have endeavored to make is that the density classification is necessary even though one is able to distinguish the species, and the fact that one has true longleaf-pine structural timbers comparatively free from defects does not offer an absolute guaranty of the strength and durability of those timber; but by using the pith-identification method with the density requirements, one is sure of getting not only true longleaf pine but a very good grade of this timber.

HOWARD F. WEISS,
Director, Forest Products Laboratory.
Madison, Wis.

If Decimals of Degree Why Not Decimals of Full Circle?

SIR: The new railroad engineers' field manual by Prof. William G. Raymond, of the State University of Iowa, in which the author attempts to introduce the decimal division of the degree in lieu of the sexagesimal, is deserving of the greatest success. Whether the apparent antagonism of the engineering profession toward radical changes of this nature will allow it to have such success is problematical. Numerous and varied criticisms and objections have been, and doubtless will be, made to the proposed change.

The writer has but one criticism to make, and that is that Professor Raymond did not go far enough. If, as the author asserts, the decimal division of the degree is an advantage, why would not the decimal division of the circle be an added advantage? If not desirable to divide the quadcircle decimally, why not divide the quadrant, as the writer has seen done in certain European instruments? As Professor Raymond proposes, the degree has 100 divisions while the quadrant still has 90 and the circle 360, just as there are still 12 in. in a foot and 3 ft. in a yard. The writer would favor dividing the circle into 100 divisions. This would be no more radical than merely dividing the degree; no more so than using tenths of a foot instead of twelfths. A degree, or whatever it might be called, would be much larger than the present degree, but the size of the unit is of no consequence if its divisions are made small enough. In the decimal system, naturally, there is no limit to divisibility. It certainly would make no difference, so far as accuracy is concerned, whether we call a certain angle 22 deg. 30 min. or 6.250 deg., both of which would represent one-sixteenth of a circle. With the decimal system throughout we could have an angle designated by any number of decimal places, whereas in the present system if we divide beyond seconds our only recourse is decimals. Why not do it all by decimals?

As Professor Raymond says, there are almost no solutions of curve problems in which it is not necessary at some time to translate degrees, minutes and seconds to decimals of a degree and vice versa. In a lesser measure this is true of all surveying work. But even if it were not true, the change proposed would be justified by the saving in time and the eliminating of the chances of error in the simple processes of addition, subtraction, multiplication and division. And it would certainly be much simpler to find the angle between 12.243 deg. and 43.675 deg. than it is between N 44 deg. 4 min. 29 sec. E and S 22 deg. 46 min. 12 sec. E—the former representing the same angle by the full decimal system that the latter does by the antiquated system surviving from the days of the archaic compass and Jacob's staff. Compare the multiplication of 0.5723 by 1.234 deg. with the multiplication of 0.5723 by 4 deg. 26 min. 33 sec.

The superiority of the decimal system as advocated by Professor Raymond is so pronounced that it is sincerely hoped by the writer that it will be generally accepted by the profession. It is also hoped that the professor will continue his labors along the lines suggested herein, giving us full tables based on the decimal division of the entire circle with the necessary new unit names.

In view of the many ill-fated attempts to introduce the metric system into the United States, the writer is inclined to take the pessimistic view that Professor Raymond's efforts are doomed to failure. It is clearly time, however, that the profession ceases its poring over handbooks to find how many gills there are in a pint, or how many cubic feet in a perch. The time and energy wasted in finding one-fifth of 1 ft. 7¾ in., or six times 4 lb. 5½ oz., is enormous, and the efforts made in dividing 67 deg. 46 min. 37 sec. by 14 can just as well be spent at some more profitable task.

R. C. HARDMAN.
Colorado Springs, Col.

Lettering Land Sections for Federal Valuation Maps

SIR: In the Engineering Record of June 26, page 814, I noticed a letter from L. W. Duffee in regard to lettering land sections for maps to be used in connection with the Federal valuation work. I would like to make a few criticisms of some of Mr. Duffee's conjectures, which I do not believe apply to modern railway drafting. In my experience, which covers about fourteen years with a number of the leading railroads of the country, I have found only in a very few instances where railroad engineers follow the system suggested by Mr. Duffee, that is, lettering upside down on tracings.

The map order of the Interstate Commerce Commission requires all maps to have a north point on them not less than 5 in. in length, and on all maps where the land has been sectionized the order requires that the number of all sections be shown according to the American Railway Engineering Association's standard specifications, that is, with the section number in the center of the section with township and range. It would seem to me that it would cause a lot of confusion and be a waste of a lot of valuable time to letter the maps so as to indicate north by such.

We have here on our line something more than 1200 miles of alignment maps on a scale of 400 ft. to 1 in. and hundreds of station maps on a scale of 100 ft. to 1 in. to make, and it would cost this road at least 1 per cent more to indicate north by the lettering shown on the tracings.

Mr. Duffee refers to the Government township plats as an example. I would like to state that all of these plats are made in standard-sized sheets with the top of the sheet indicating north, and it is much better to letter the plats so as to indicate north; also, it is not necessary to put the north point on a map or plat of this kind, and it is never done.

L. M. MACARTHUR,
Chief Draftsman, Engineering Department of Valuation, Mobile & Ohio Railroad.
Mobile, Ala.

Odor Nuisance Abated Following Court Trial

SIR: The criminal suit of the Commonwealth of Pennsylvania vs. Grays Ferry Abattoir Company was tried at Philadelphia, Sept. 27-29. The Commonwealth charged the abattoir company with maintaining a nuisance due to objectionable odors originating at its plant, located at Grays Ferry Road and the Schuylkill.

A large number of witnesses were summoned by both sides and there was much testimony given to show that odors, variously described as that of burning flesh or heated animal matter, had been traced to the plant of the abattoir company.

On the third day of the trial Judge Bregy called a recess, and a conference was held between lawyers on both sides, representatives of the abattoir company and experts called by the Commonwealth, including Dr. Joseph Shears, sanitary expert, Board of Health, New York City, and the writer. The company then agreed to make whatever correction was necessary at its plant to comply fully with the regulations governing bone-boiling establishments and depositories of dead animals. This included means of controlling objectionable odors by providing a tight building and mechanical equipment for the treatment of the odors and for supplying ventilation. An agreement was drawn up stipulating that plans and specifications would be submitted in three weeks and the work completed 60 days from date of conference.

Upon the reopening of Court the abattoir company pleaded nolo contendere. This plea was approved by the Court and the jury dismissed.

This case is important in that a successful attempt was made to relieve residents in the vicinity of West Philadelphia and the east side of the Schuylkill River from a very annoying nuisance. The outcome of the suit will doubtless lead to further actions looking toward the control of objectionable odors from industrial plants in the city.

GEORGE H. SHAW,
Sanitary Engineer, Bureau of Animal Industry, U. S. Department of Agriculture.
Washington, D. C.

CEMENT to a total of 87,257,552 bbl. was produced in this country in 1914, according to the U. S. Geological Survey.

HINTS FOR THE CONTRACTOR

Details Which Save Time and Labor on Construction Work

Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

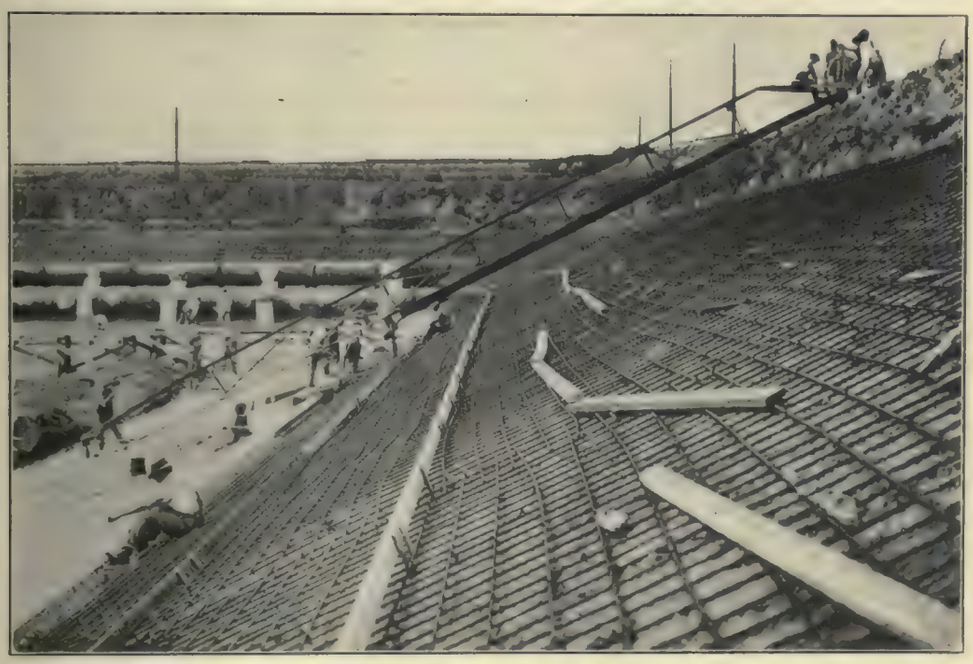
[*Contributions to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

Trussed-Steel Chute Places Concrete Economically on Slope

By HOMER V. KNOUSE
Construction Engineer, Metropolitan Water District of Omaha

THE INCLINED steel truss, rolling on wheels at the top and bottom, shown in the accompanying photograph, carries steel chutes made in 2-ft. removable sections, and has proved very economical in concreting in 5-ft. horizontal strips the sides of a reservoir basin at Omaha.

In constructing an earlier basin, No. 3 of the Walnut Hill reservoir, during the summer of 1914, it was found that 5 ft. was the maximum width for horizontal courses on the slope if concrete of the proper consistency to incase reinforcing was to be placed without sliding. It was thought advisable to pour a complete course each day to reduce the joints to a minimum, and as the average length of a course is about 1000 ft., frequent and rapid moving of the chutes was necessary. A wooden chute of semi-flexible construction in 5-ft. lengths was used on the first basin, but was replaced with considerable saving by the steel-trussed chute shown, on the next basin built, which is an addition to the Florence Station of the water district.



ROLLING CHUTE GIVES WIDE DISTRIBUTING RANGE AT SMALL EXPENSE

The steel truss supports the chute from its lower chord, and is mounted on wheels at each end which are attached through trunions or castors to permit greater latitude of movement when passing around the curves at the corners of the basin. The chute is built in 2-ft. lengths without circumferential riveting, which permits the removal of sections in a few minutes' time when a course is completed, or when it is necessary to change the point of discharge. The upper section of chute is flared so that a 6-cu. ft. concrete car can dump its load directly into the chute.

Two 36-in. supply pipes which cross the north end of the basin made it necessary to raise the lower end of the chute while pouring this side, and the elevated runway shown at the left in the illustration was provided for this purpose. The lower end of the truss is raised to this platform by a light derrick. The weight to be raised each time was about 1 ton, as the chute and truss when empty weigh about 4000 lb.

With this arrangement a considerable reduction in the number of men necessary to handle the concrete was possible. Not only is the chute easier to handle, but the point of discharge may be regulated closely, so that little spreading of concrete inside the form is necessary. Further work of a similar nature is contemplated by the Metropolitan Water District of Omaha, which built the basins described, and it will be possible to modify the chute for this work at slight additional expense.

Dry, Coarse Sand Best for Cement Gun in Wet Climate

CLOGGING, due to large sand particles, wet sand, and wet air, was the principal trouble encountered by Maj. W. G. Caples, Corps of Engineers, U. S. Army, in using the cement gun to build concrete revetments for the protection of levees on the lower Mississippi River. It was also proved on this work, described by Major Caples in a paper on page 650 of the *Professional Memoirs* for September-October, 1915, that a 4-in. layer of concrete could be made in place on the levees by first spreading gravel to that thickness and then applying gunite. This penetration, however, could only be obtained at reasonable expense with the gravel from a certain pit, which passed a 2-in. screen and was all retained on a ¾-in. screen. For other locations a revetment 2 in. thick of plain gunite was used.

Wet sand forms lumps with the cement before it reaches the gun, and causes the cement to set in the gun, destroys the gaskets, clogs the feed wheel and causes a great deal of trouble. As the extent of the work made heating the sand expensive, it was stored in small conical piles where it could drain easily. The dry sand and cement were mixed and passed through a ½-in. screen before being fed to the cement gun.

Wet air and foggy weather caused the cement to set in the passages of the gun and made their cleaning difficult. This condition was helped by using coarse sand, having many particles just passing the ½-in. screen, which scoured out the gun and kept the cement coating from accumulating in the passages.

Home-Made Machine Cleans Cement Bags at Big Saving

A MACHINE for cleaning cement sacks, which cost $900 to make, displaced three men and effected an annual saving of $2172 for the maintenance-of-way department of the Cleveland Railway Company, Cleveland. The machine is composed of four essential parts: motor, drum, exhaust fan and dust collector. The motor drives the exhaust fan and the cleaning drum through a set of reduction gears. The octagonal drum is 5 ft. wide and 12 ft. in diameter and is constructed with wooden sides with a ½-in. mesh screen on the periphery. It is mounted on a shaft in a room, which is as near air-tight as possible. The motor revolves the drum at the rate of about 10 r.p.m. At one of the upper corners of this room, which is practically filled by the drum, an air intake is installed. At the diagonally opposite corner on the floor an outlet leads through the exhaust fan to the dust collector. As the drum revolves the exhaust fan draws the air through the drum, removing the cement dust, which is deposited on the floor of the room. Only a small amount of cement is drawn out of the room and deposited in the dust collector. One thousand sacks are placed in the drum at one time and revolved for 30 min. A period of 5 min. is allowed for the dust to settle before the sacks are removed.

Heretofore the company found it necessary to detail three men to clean cement sacks. These men beat the sacks against a post, but they made no attempt to save any considerable quantity of the cement. They each received 20 cents per hour and they cleaned approximately 1000 sacks a day. As an average of 250,000 sacks of cement were used per year, considerable time was consumed by the men in cleaning sacks. It was found that 1000 empty cement sacks weighed 1313 lb., but after being machine cleaned they were reduced in weight by 707 lb. The freight rate on sacks returned from Cleveland to the cement mill was 8 cents per hundred, hence a saving of 56 cents per 1000 sacks in the freight

charges was obtained. This represented a total annual saving in freight alone of $120. In addition the 707-lb. reduction in weight represented cement salvaged from the empty bags. In other words, 442 bbl. of cement represented the annual saving from 250,000 sacks. At $1.25 per barrel, this meant an annual saving of $552.52. Besides these two items, the three men employed in cleaning the sacks were eliminated, hence another saving of $6 per 1000 sacks was made, or $1500 a year. Thus the cement-sack-cleaning machine saved $2172 a year, or more than twice the original cost of the machine.

An adjoining storage room was equipped with a special sewing machine for mending torn bags. During the winter months one of the men in the concrete gang who had become an expert at patching bags mends between 200 and 250 sacks a day for which he receives $2. A cement-sack-bundling machine also forms part of the equipment of this storage room. Charles H. Clark, engineer maintenance of way, invented the bag cleaner.

Cableway Carries Curved Reinforcing Bars Up Steep Hill

By GEORGE W. DAVIDSON

General Foreman, Hennebique Construction Company, Middleboro, Mass.

THE LIGHT cableway shown in the accompanying illustration was used to advantage in transporting up a steep hill 48-ft. curved reinforcing bars used in the construction of a large reinforced-concrete water tower. The bars were 1¼ in. diameter bent to a radius of 21 ft., half the diameter of the water tower. Teams could not negotiate the hill, and because of the shape and size of the bars they could not be loaded on any small vehicle. It took six men to carry one of the bars up the hill. To overcome this difficulty, a ⅝-in. cable was drawn taut over shear-legs on the line of travel from the base of the hill to the bottom of the tower. On this was mounted a single-wheel trolley from which a short tackle was suspended. With this rig two rods at a time are raised clear of the ground and quickly pulled up hill. The cableway is operated by three men.



WITH THIS RIG 3 MEN HANDLED 12-MAN LOADS UP HILL TOO STEEP FOR TEAMS

This water tower, which is 173 ft. high, is being built by the Hennebique Construction Company, for whom the writer is general foreman.

Forms Built Before Supporting Falsework for Concrete Bridge

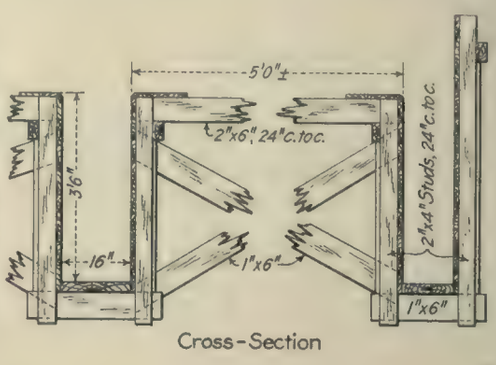
By R. C. HARDMAN

Colorado Springs, Col.

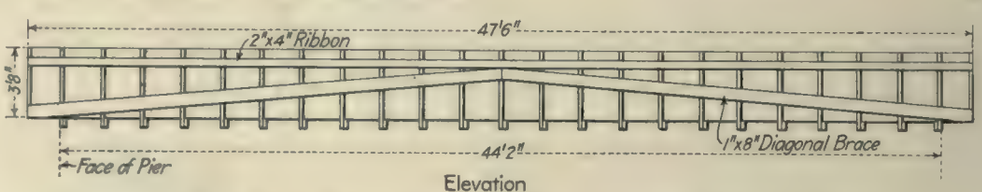
IN THE construction of a bridge superstructure consisting of long-span girders of reinforced-concrete, it was not desirable to erect the supporting falsework in advance of the girder and slab forms. A form design was worked out which would permit of the entire deck form being temporarily self-supporting. After this was erected, it was used to raise the falsework to support itself till the concrete had set.

The spans were of various lengths, the longest being 44 ft. 2 in. clear span and 31 ft. above the ground. The largest girder was of this length with a section of 16 x 42 in., the form being 47 ft. 6 in. long with a bearing of 20 in. on each pier. The type of form is shown in the accompanying sketch. The form sides, consisting of 2 x 4-in. verticals spaced on 24-in. centers, and 1 x 6-in. lagging, were built flat upon the ground in pairs. On the outside face of each was spiked a 2 x 4-in. ribbon to receive the floor joists according to customary practice. In addition, however, there were placed two diagonal braces of 1 x 8-in. plank running from near the middle of the top to the ends of the bottom of the form. These were securely spiked to each stud so that they would be able to resist either compression or tension.

In erecting, a pair of sides were placed between piers approximately under their location above, their bottoms fastened by means of 1 x 6-in. cleats as shown, the 2-in. girder bottom placed and temporary cleats nailed across the form at the top as spacers, so that the form for the girder was complete on the ground. A portable gin-pole having a hand windlass at its bottom was used for hoisting the form into place. This was done by a line around the middle of the girder form, which placed the diagonals in tension. As the over-all length of the form was greater than the clear distance between piers, the form had to be tilted in raising.



Cross-Section



Elevation

FORMS RAISED FIRST, THEN USED TO ERECT OWN SUPPORTING FALSEWORK

In building some of the shorter span forms, the 1 x 8-in. diagonals were dispensed with. When all the forms for one span were placed in position the floor joists were placed to tie the deck together, and a single post was put in position under the middle of each girder to take care of the deflection. The diagonal braces between girders were next put in place, which gave the entire superstructure great stiffness.

Just before concreting the span, the supporting posts were erected. This was done by means of a hand-line from the deck. The posts were, for the most part, doubled 2 x 6's with a 4 x 4-in. cap at the top, and were easily handled. When erected they were fastened at the top by a nail through the girder bottom. After all posts were in place the form was brought to exact grade by wedges driven at the bottoms of the posts. The lateral and diagonal braces were then placed on the falsework and the floor lagging placed on the deck. After being wired the forms were ready to receive concrete.

The weight of the largest forms was approximately 1600 lb., and when in place they deflected about a foot at the middle. Longer forms than the one shown were handled from the deck. These, however, were for one face of a girder only. The largest of these was 70 ft. long and 5 ft. wide, built of 2 x 4's with 1-in. lagging. They were handled by two small jibs operating at the quarter points, lateral stiffness being given by hand-lines at each end.

LIME RECLAMATION at the Columbus softening and purification works is being experimented with on a large scale. Charles P. Hoover, chemist in charge, has installed a $1000 plant consisting of a thickener, dewaterer and a rotary kiln, 20 ft. long and 3 ft. in diameter.

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

Continued Slides Make Time of Panama Canal Opening Uncertain

A cablegram dated Oct. 12 has been received by Major F. C. Boggs, at Washington, from the Governor of the Panama Canal, advising that continued movements of sliding material make it impossible to predict any approximate date of re-opening the canal. The dispatch said:

"Mass of material involved in the break of Oct. 14, 1914, which had been sliding gradually into prism, moved precipitately. This, combined with a similar movement from the break which occurred just opposite on the west bank in August, causes present conditions.

"Length of channel involved 1300 ft., of which 200 ft. has present width of 25 ft. and depth of 3 to 15 ft.

"For week ending Oct. 9, 209,000 cu. yd. of material were dredged, but as the movement continued the result has been to maintain only what slides left in the first instance. Canal is therefore physically closed temporarily.

"On the east side the bank is upward of 300 ft. above canal level, and on the west side varies from 300 to 400 ft. above. Material, in settling and moving, creates earth waves with deep depressions behind, those being some 500 to 600 ft. from the canal prism, with elevations of 60 to 80 ft. above water surface.

"These waves undoubtedly counterbalance the weight of the broken mass on either side, and, when removed, may cause another similar movement; hence the impossibility of making any prediction as to the date of reopening until after the waves which now block the channel have been removed and the action of the remaining material determined. Heavy rains materially affect the movement.

"Whether light draft ships can pass in advance of 30-ft. draft ships must depend on conditions when a reasonably secure channel is attained."

Four Thousand Take Part in Dedication of Arrowrock Dam

The great interest shown in Arrowrock Dam, near Boise, Idaho, completion of which was noted in this journal last week, was manifested by the fact that 4000 visitors took part in the formal dedication held, Oct. 4. Governor Alexander of Idaho in an address classed the structure as one of four great engineering achievements—the Panama Canal, the Panama-Pacific International Exposition, the Dalles-Celilo Canal and Arrowrock Dam—completed in the present year, and added that, with the exception of the Panama Canal, it represented the largest expenditure made by the National Government during the last six years.

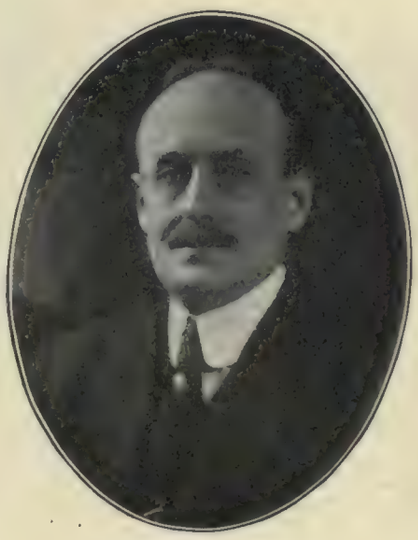
D. R. Hubbard, president of the Water Users' Association, paid glowing tribute to F. E. Weymouth, supervising engineer, U. S. Reclamation Service, Charles H. Paul, construction engineer, and James Munn, superintendent of construction, who had charge of the work, and all of whom were present at the ceremonies. J. H. Lowell, first president of the Water Users' Association, who was instrumental in the launching of the project gave a brief outline of its history.

The dam was completed nearly two years ahead of time at a saving of more than $2,500,000 on the original estimate. According to figures furnished by Charles H. Paul, the total amount of concrete reached 610,600 cu. yd., instead of 530,000 cu. yd., as stated in last week's issue. The excavation amounted to 683,000 cu. yd. The height of the dam from the lowest point of the foundation to the top of the parapet is 348.5 ft. Its length at the top is 1100 ft. and its width at that point 16 ft. At the base it is 240 ft. thick. Excavation was carried 90 ft. below the river bed to solid granite. The area of the foundation is about 1 acre. The reservoir has a capacity of 79,600,000,000 gal. Work on the excavation was started in July, 1910.

Baltimore's New Chief Engineer

Calvin W. Hendrick, whose appointment as chief engineer of the city of Baltimore was announced in these columns last week, enters upon his new duties with a very intimate knowledge of local public works. In fact, it was under his direction, as chief engineer of the Sewerage Commission, that the city's most important improvements, including the comprehensive system of sewers, the treatment works on the Back River and the huge pumping station, have been constructed and placed in successful operation. Mr. Hendrick has manifested his interest in the physical betterment of Baltimore in many other ways. One of his most notable works, perhaps, was the conversion of Jones Falls, a filthy sewage-laden stream which had been an eye-sore for years, into a covered concrete conduit supporting an imposing boulevard. This single piece of construction was of immeasurable benefit to the city, for it not only removed a nuisance but effected a large increase in property values in the vicinity. The Jones Falls improvement is described in the Engineering Record of May 1, page 544.

Leaves Sewerage Commission to Become Chief Engineer of City of Baltimore



CALVIN W. HENDRICK

Mr. Hendrick has always been a firm believer in letting the people know about the city's engineering work and as a result of his policy it is safe to say that in no city has the public a better appreciation of the value of the engineer in civic improvement than in Baltimore. His promotion to his present position of larger responsibilities is an unmistakable mark of the appreciation in which his former work is held. Now that the sewerage system and disposal works are completed Mr. Hendrick's responsibilities in connection with that improvement have been greatly lessened and he will have time to devote to his new duties.

Road Officials Gather at Cedar Rapids, Iowa

Second Northwestern Road Congress Has Attendance of About 500 at Three-Day Session to Discuss Highway Problems

About 500 men interested in all phases of the road problem attended the second annual convention of the Northwestern Road Congress, held at Cedar Rapids, Iowa, Oct. 4 to 7. Delegates were present from Illinois, Indiana, Michigan, Wisconsin, Iowa, Missouri, Minnesota, and North and South Dakota.

The program, as published in Engineering Record of Sept. 11, page 339, was carried out. The Wisconsin, Iowa, and Minnesota Highway Commissions, and Milwaukee County, Wis., as well as twenty-seven manufacturers of road equipment and material, had exhibits.

A feature of the program to those interested in ways and means for awakening a community to a keen desire for good roads was a paper by J. P. Clarkson, of Jasper County, Missouri. Mr. Clarkson had a message worth while and he delivered it. H. J. Kuelling, Milwaukee county highway commissioner, gave a brief but valuable talk on concrete roads. The paper read by Rodney L. Bell, division engineer of the Illinois Highway commission, was published in abstract in the Engineering Record of Oct. 9, page 453.

Officers elected for the ensuing year are as follows: President, John Hazelwood of Wisconsin; first vice-president, A. D. Gash of Illinois; second vice-president, J. H. Mullen of Minnesota; third vice-president, F. W. Buffum of Missouri, and secretary-treasurer J. L. Long of Iowa. A board of directors composed of S. A. Bradt of Illinois; A. R. Hirst of Wisconsin; T. H. McDonald of Iowa; T. S. Brown of North Dakota; W. R. Phillips of South Dakota; J. P. Clarkson of Missouri; H. M. Johnson of Michigan, and W. B. Neuman of Indiana, was elected. Detroit, Chicago and Minneapolis presented their claims for the next convention. Decision rests with the board of directors.

Exhibit Shows New Yorkers How Their Streets Are Cleaned

The New York Department of Street Cleaning initiated last year an exhibition of street-cleaning apparatus and appliances which was so successful that a second exhibit was staged this week. The parade on Tuesday was the finest in the Department's history, and included the twelve new 10-ton motor trucks with their various tractor appliances that are to be used in the "model district" between Fourteenth Street and Forty-second Street from Sixth Avenue to the Hudson River.

The exhibit, held at the First Field Artillery Armory, Broadway and Sixty-eighth Street, contains the latest developments in all street-cleaning appliances, snow plows, dumping trucks, sand spreaders, oil sprinklers, etc. Many firms from all over the country have sent their most efficient apparatus for inspection and comparison. The Department has organized a series of tests under actual service conditions—flushers on Wednesday, sweepers on Thursday and the various conveyances and carts on Friday. A model of the covered dump for delivering refuse to scows, described in the Engineering Record of Sept. 11, page 315, is exhibited. Many colored posters submitted by public school pupils in competition for prizes offered by the Department form an interesting feature of the exhibits, and illustrate a promising method of arousing general interest on the part of the public. Moving pictures of street cleaning, police and fire-fighting activi-

ties in New York City are shown in the evenings.

A meeting of the many officials present from the various cities in both this country and Canada convened on Friday morning for the purpose of forming a Street Cleaning League to organize annual parades and exhibitions, and for interchange of new ideas on the most economical and efficient methods and appliances for keeping cities clean. John T. Fetherston, street cleaning commissioner of New York City, has been active in initiating this movement. J. R. Buchanan is director of the exhibition.

Court Upholds Present Water Rates in Denver

No reduction in water rates will take place in Denver. The Federal District Court last week fixed the value of the property of the Denver Union Water Company at $13,415,899, a figure which will not permit the lowering by 21 per cent asked for by the city. The findings sustain the present rates and in effect confirm the title of the company to its water rights. It also puts an end to the foundation for the idea of the city building a competing plant and seizing the company's water without compensation.

Prominent engineers representing the city and company brought in a valuation of $14,400,000 a few years ago. The present valuation excludes from the rating base branches of considerable value independent of use for the city supply. The principal items of the present valuation are: Distribution system, $3,450,000; water rights, $2,950,000; Cheeseman dam, $1,121,000; Platte Canyon conduits and filters, $2,410,000; 8400 acres of land around dam, $638,000. The amount of preferred and common stock is $7,500,000, and of bonds, $12,000,000.

Florida's Road Department Formed

The State Road Department of Florida, which was created by a recent act of the Legislature, has become an actuality by the appointment of the five members that constitute it by Governor Trammell. Those appointed are: F. O. Miller, president of the Florida State Good Roads Association; Edward Scott, civil and highway engineer, of De Soto County; W. J. Hillman, honorary president of the Florida State Good Roads Association; J. D. Smith, banker, of Marianna, and M. M. Smith, banker, of Orlando.

The members of the department receive no compensation other than the expenses incurred in the performance of their duties. Headquarters will be at the State Capitol at Tallahassee. The duties of the department are to collect data and information as to all the roads in the State and, where practical, to have maps made; to investigate and gather information as to suitable material for road building in the different localities in the State; to furnish information free to county commissioners, and to supervise the methods and expenditures of the various counties.

The department will appoint a salaried State road commissioner and such assistants and clerical employees as are necessary. The commissioner and his assistants will visit and inspect the roads in the different counties and furnish technical advice and assistance without expense to such counties, except for traveling.

Ashland, Wis., to Have $3,000,000 Concrete Ore Dock

The heavy demand for iron is said to have hastened action in regard to the construction of a $3,000,000 concrete ore dock at Ashland, Wis. Plans for the new dock have been completed and work will be started in time to have the structure ready for navigation when the season opens next spring. The present dock will be torn down as soon as navigation is over for 1915.

Another Step in the Procedure to Widen Twelfth Street, Chicago

Legality of the Chicago city ordinance calling for the widening of Twelfth Street from Michigan Avenue to Ashland Avenue, it is expected, will be decided shortly by the Superior court. This is the last step before the actual trial of the case, which will determine the awards to be made to property owners whose property is taken and the assessments of those owners who will be benefited by the public improvement. The awards to be distributed to property owners total $3,056,144, and are estimated on the proposed widening of the south side of Twelfth Street 68 ft. from Michigan Avenue to State Street; 52 ft. from State to Canal Street and 42 ft. from Canal Street to Ashland Avenue. Actual work it is thought will be started in about 8 months.

Markers Placed for the Post-Convention Trip

As mentioned editorially in this journal on Sept. 25, the arrangements made by the San Francisco local committee for the post-convention trip of the American Society of Civil Engineers were most complete. The accompanying view shows the mileage marker at one of the points of interest on the automobile road from Santa Cruz to San José. The view does not show the small lettering on the marker, which indicated that its purpose was as a guide in the post-convention trip. The accompanying view was taken by Lazarus White of Smith, Hauser & McIsaacs of New York. Mrs. White is in the rear seat.



MILEAGE MARKERS ON ROUTE OF POST-CONVENTION TRIP, SAN FRANCISCO

Efficiency Society in Convention Taboos "Red-Tape"

At its third annual fall convention, held at the Lake Placid Club, Essex County, N. Y., Sept. 17-19, the Efficiency Society voiced a protest against "red-tape" masquerading under the convenient disguise of "system" and advocated strongly the promotion of efficient citizenship involving some form of compulsory military service.

While many of the papers were of particular concern to the production engineer, shop superintendent or manager of works, there were several also which were of interest to the office man, be he interested in engineering drafting, design, estimates or investigation. Of especial interest to engineers were two papers, one dealing with the abuse of "system" and one upon efficient citizenship.

The former was by John Calder, entitled, "System and Its Abuse." The author, himself a long-time advocate of efficient system, pointed out the danger of cumbersome red-tape which destroys its usefulness and the business which it hopes to benefit. While a certain amount of system is desirable in all ventures he pointed out that it should never cost more than the savings or earnings secured by its use. The lack of earning value of records which are not made promptly available as guides to future operations was noted and the distinction between those methods which relate to routine operations, and those which aid in increasing the output and enlarging the opportunities of the business were pointed out.

He advocates a scientific study of all facts connected with any enterprise as the basis of any system and urges the sympathetic cooperation of all affected by its operation, both executive and employe, if best results are to be secured, rather than the arbitrary enforcement of any rigid requirements without possibility of alteration or amendment.

The other paper was by Mr. Miles M. Dawson, consulting actuary of New York, entitled, the "Promotion of Efficient Citizenship." It was pointed out that one of the serious drawbacks was that we have been gaging the efficiency of the individual from the standpoint of service to himself and not from that of service to others.

One of the most difficult qualities for any American to acquire Mr. Dawson said, is efficient citizenship and this point of view, after all, should particularly appeal to the engineer. Because of his training and habits of thought he should analyze closely all results and not be led astray by fulsome phrases.

It was the interest in citizenship in general and all matters of governmental function, many of the wastes of which are particularly well known to the engineer, upon which stress was laid by the author. How we have encumbered ourselves with bureaus and commissions and check legislative functions instead of concentrating duty and authority in the few. But of even more accute concern to the engineer, in these days of discussion of military preparedness, was the consideration of the wisdom and helpfulness of obligatory military service in the promotion, first, of the individual efficiency, and, second, of National efficiency.

Road Men Would Spend $10,000,000 for Illinois Cross-State Roads

Several down State road organizations have asked Governor Dunne of Illinois that he include in the call for a special session of the Legislature (should such action be necessary) a proposition for issuing $10,000,000 in State bonds for constructing a north and south and two east and west roads across the State. No action has been taken in the matter, because it has not been definitely decided to call a special session of the Legislature.

The State Highway Commission has been using its influence to interest the various counties in the county bond issues for building the designated State-aid roads. The new law passed at the last session of the Legislature made it possible for the counties to use their regular allotments of State-aid money for paying off one-half of the cost of construction of bond-issue roads and turning them over to the State for maintenance. It is believed that the commission would prefer to see roads built in this manner rather than by a State bond issue.

However, the matter has never been acted upon by the State Highway Commission and it is possible they would get behind such a movement as that proposed if it were properly launched and some provision were made for defraying the necessary inspection, engineering and administrative expenses connected therewith, as the appropriations are now totally inadequate to handle such a matter.

Washington Levies $2,578,193 in Taxes for Highway Purposes

The State Board of Equalization of Washington has levied taxes amounting to $2,578,193, payable by counties next year, for highway purposes. The total is made up of $1,031,277 for highways to be constructed under the supervision of the State Highway Department on previously located routes and $1,546,916 for paved surface or gravel permanent roads to be constructed under the direct supervision of counties.

News of Engineering Societies

The Engineers' Society of Western Pennsylvania will hold a meeting in the society rooms in the Oliver Building, Pittsburgh, Oct. 19. Willis Whited, bridge engineer of the Pennsylvania State Highway Department, will speak on "The Mathematical Treatment of the Elastic Arch." At a meeting of the structural section to be held Nov. 2, Prof. Charlees M. Spofford of the Massachusetts Institute of Technology, will speak on "Highway Floors."

The Colorado Association of Members of the American Society of Civil Engineers was addressed Oct. 9 by S. B. Williamson, chief of construction, U. S. Reclamation Service, on "The Reorganization of the Reclamation Service and Its Purpose." The newly elected officers of this association are: John E. Field, president; Roger W. Toll, vice-president, and L. R. Hinman, secretary-treasurer.

The Chicago Association of Commerce, Engineers' Division, resumed its by-monthly meetings Oct. 8 with an informal address by Prof. F. H. Newell on the welfare of the engineer. Following his talk suggestion was made to offer a cash prize to engineering students for the best paper on a proper method of diffusing engineering information to the layman public. The association will be asked for $100 for the prizes, a proposition Edmund T. Perkins, chairman of the division, was of the opinion the association would gladly foster.

Personal Notes

J. J. ROCKWELL has rejoined the staff of the McGraw Publishing Company in the capacity of advertising counsellor to the company and its customers, and will make his headquarters at the company's general offices in New York. Since Mr. Rockwell's previous association with the McGraw Publishing Company (during the years 1910 and 1911) he has been engaged in the advertising agency business in Chicago in connection with the Crosby-Chicago Advertising Agency. In earlier years he was associated with the Mahin Advertising Company and the Long-Critchfield Corporation, both well known advertising agencies in Chicago, and is well known in advertising circles throughout the country. His work as an advertising expert has frequently excited highly favorable comment and his long experience in the general agency business, as advertising manager in publishing fields and as counsellor for advertisers in many lines of business, with his special and unusual experience in industrial and technical fields should enable him to be of peculiarly valuable service to the Engineering Record and its customers.

T. MCLEAN JASPER, formerly secretary to the Chicago City Waste Commission, and previous to that assistant engineer with Alvord & Burdick, has been given a commission in the Royal Field Artillery, England, in charge of a battery. He has been in the artillery training camp at Salisbury since July. As each battery is given about six months' training, he will probably not be sent to the Continent before Christmas.

F. R. JUDD, assistant engineer in the bridge and building department of the Illinois Central Railroad, has been appointed engineer of buildings. Mr. Judd has been, with the exception of a few months, continuously in the service of the Illinois Central for the last sixteen years.

C. C. WESTFALL, assistant engineer in the bridge and building department of the Illinois Central Railroad, has been appointed engineer of bridges. Mr. Westfall was graduated from the University of Illinois in 1907. With the exception of eight months, when he was in North Dakota as chief engineer of the Midland Continental Railroad, he has been connected with the Illinois Central since that year.

MARO JOHNSON, heretofore engineer of bridges and buildings of the Illinois Central Railroad, has been detailed on special work by that railroad and the bridge and building department split into separate departments, the new heads of which are noted elsewhere in these columns.

RALPH HILSCHER, assistant engineer with the State Water Survey, University of Illinois, has resigned to join the staff of C. G. Gillespie, director of the bureau of sanitary engineering of the California State Board of Health. Mr. Hilscher was graduated from Massachusetts Institute of Technology.

VICTOR R. WALLING has been appointed principal assistant engineer of the Chicago & Western Indiana Railroad Company in charge of construction and maintenance. He was graduated from Kansas University in 1901 and from that year until 1912 was with the Greene Cananea Copper Company, except for a short term with the Southern Pacific. With the copper company he rose from draftsman to first assistant engineer and superintendent in charge of railroad, maintenance and operation and mill and smelter construction.

JAY ROSSITER, assistant engineer in the Chicago water pipe extension division of the bureau of water, has been made engineer of the division of track elevation. Since leaving the Armour Institute of Technology, where he received his professional education, he has been connected with the Chicago city engineer's office continuously, except for a 2-year period of service in the Philippines as assistant engineer for the Bureau of Public Works and 1 year as a contractor's general superintendent of construction on the Algoma Central Railroad in Canada. For a year previous to his going to Armour Institute he was in the engineers' corps of the Illinois Central Railroad Company.

HOLBERT W. FEAR, formerly junior engineer in the water resources branch of the U. S. Geological Survey, has been appointed to a similar position on the forces of the New York Public Service Commission, First District.

D. M. COOK, formerly connected with the Detroit Edison Company appraisal work, has been appointed inspector on concrete bridge and pavement work and sewer construction for Windes & Marsh at Winnetka, Ill. In the near future he will be appointed assistant to the village manager.

EDWARD SCOTT, civil and highway engineer of Arcadia, Fla., has been appointed a member of the recently created State Road Department.

C. H. VAUGHAN, formerly second vice-president and chief engineer of the Penn Bridge Company of Beaver Falls, Pa.; H. R. Hortenstine, formerly contracting manager of that company, and J. O. Childers, who had charge of the erection of the Panama Canal lock gates for the McClintic-Marshall Construction Company, have purchased the plant and assets of the York Bridge Company of York, Pa., and will operate under the name of the York Bridge & Construction Company. It is expected that the plant, which has a capacity of about 7000 tons per year, will be ready to operate next month, after which time the company will engage in the manufacture and erection of steel bridges, buildings, lock gates, coal tipples and breakers, and all kinds of structural steel work.

JOHN T. WHISTLER, who has been with the Reclamation Service, with headquarters at Portland, Ore., since 1905, has been appointed engineer on the International Boundary Waters Commission, the body that settles disputes regarding authority over waterways on the Canadian border. Mr. Whistler was in charge of the Umatilla project for the United States Government, and since the completion of that work has devoted his time to other Government irrigation interests in Oregon.

WIXSOM & COGHLIN, contractors for sewers and pavements, have opened an office in the Spitzer Building, Toledo, Ohio. Mr. Wixsom has been in municipal contracting for twenty years, with headquarters at North Baltimore, Ohio, and Mr. Coghlin has been engaged in private enterprises developing real estate additions in the South.

D. W. COLE, project manager of the Truckee-Carson project at Fallon, Nev., for the past 5 years, is leaving the Reclamation Service to attend to personal interests. The Lower Carson storage dam, later known as the Lahontan dam, was constructed during Mr. Cole's term of service, designs having been prepared in the project office in the fall of 1910. The dam was completed June 30, 1915, and the cost is said to have been $100,000 less than the estimated cost, which was approximately $1,530,000. Mr. Cole was instrumental in securing Government control of the Lake Tahoe outlet by supplying the necessary engineering data for bringing about a satisfactory settlement, the case being tried by the U. S. District Court at San Francisco and made final on June 28 upon payment to the Truckee River General Electric Company of the stipulated value of the condemned property.

R. S. RANKIN, formerly connected with the U. S. Steel Corporation on the design of new works at Duluth, has been engaged by the city of Minneapolis to carry on the leakage survey of the municipal waterworks recommended by F. W. Cappelen, city engineer, as was noted on page 399 of the Sept. 25 issue of this journal. Mr. Rankin, who is a graduate of the University of Minnesota, is already familiar with the Minneapolis waterworks system, having been two years in the city's employ on the construction of the new filtration plant, previous to his engagement with the steel corporation.

EDWARD J. DUCEY, formerly junior highway engineer with the U. S. Office of Public Roads and instructor in civil engineering at the Georgia School of Technology in charge of highway work, has been appointed instructor in civil engineering at Pennsylvania State College.

A. H. DAVISON, formerly chief of party in charge of field engineering and layout of power canal and new concrete dam for the Turners Falls Power & Electric Company, Turners Falls, Mass., has been appointed junior engineer, water resources branch, U. S. Geological Survey.

J. FRANK BOWEN has been reappointed superintendent of highways and city engineer of the town of Manchester, Conn.

H. G. OVERHOLT, formerly engaged in contracting in southern Minnesota under the firm name of Minnesota Concrete Engineering Company, has been appointed assistant superintendent on the construction of a large reinforced-concrete factory building at Oklahoma City. Previous to entering the contracting business, Mr. Overholt was connected with the engineering department of the Chicago, Milwaukee & St. Paul Railway.

L. M. MITCHELL, formerly inspector on the concrete viaduct being constructed jointly by the Chicago & Northwestern Railroad and the Minneapolis & St. Louis, has been transferred to Oskaloosa, Iowa.

BLAKE TAYLOR, formerly special district road engineer in charge of road construction in Wetzel County, W. Va., has been retained to take charge of the street improvements about to be made at Berkly Springs, W. Va.

HAROLD M. LEWIS, formerly resident engineer on the construction of a sewage system and waterworks extensions at Charleston, Mo., is now in the office of Charles W. Leavitt, civil and landscape engineer, 220 Broadway, New York City. Up to the outbreak of the European war Mr. Lewis was on the staff of the Emscher Genossenschaft at Essen, Germany.

L. A. BOULAY, consulting engineer of Toledo, Ohio, and formerly a member of the firm of Smith & Boulay of that city, has been appointed county sanitary engineer of Lucas County, Ohio.

W. C. SPENCER, formerly resident engineer on concrete road construction for the Orange County (Cal.) Highway Commission, has been appointed resident engineer on the same class of work for the highway commission of Riverside County.

L. PERTSOV has joined the staff of I. F. Stein, consulting engineer, Old Colony Building, Chicago.

D. C. SHERMAN, formerly structural engineer with the Morris Sherman Company of Chattanooga, has been appointed structural engineer for the J. E. Moss Iron Works of Wheeling, W. Va.

LLOYD RUNKLE has been appointed city engineer of Tiffin, Ohio.

BENITO R. ORDONEZ, formerly draftsman with the Burr Company of Champaign, Ill., has been appointed research fellow in the engineering experiment station, department of railway engineering, at the University of Illinois.

J. L. JACOBS, formerly engineer in charge of the Municipal Efficiency Division of Chicago, has opened offices in the Monadnock Block, Chicago, to engage in consulting practice, specializing in service and efficiency surveys, management, appraisals and cost accounting, either for industrial or public institutions. He was graduated from Sheffield Scientific School, Yale University, in 1907, and remained in New Haven, engaged in graduate work and city surveying and examinations of buildings until 1908, when he became assistant engineer with J. A. Kirby & Sons, civil engineers and surveyors, of Port Chester, N. Y., on municipal and sanitary engineering work. In 1909 he was appointed designer and detailer of concrete constructions in the bridge and building department of the Chicago, Milwaukee & St. Paul Railway He left this work in 1911 to accept an appointment with the Civil Service Commission of Chicago, assisting in investigations of conditions of employment, organization, management and systems used in city departments. He was appointed engineer in charge of the efficiency division in 1911.

H. K. MCCAY, formerly city engineer of Baltimore, has been appointed harbor engineer of that city.

C. S. SALE, formerly editor for the Chicago association of the commerce committee of investigations on smoke abatement and electrification of railway terminals, has been appointed assistant to the director of the engineering experiment station and instructor in civil engineering at the University of Illinois. He was graduated from Purdue University in 1906 and served as assistant engineer on the Florida East Coast Railway from that date until 1907, when he was appointed associate editor on the *Railway Age Gazette*. In 1909 he became sales manager of the Blount Plough Works of Evansville, Ind., and in 1910 became connected with the Municipal Engineering Company at Indianapolis. He was appointed editor for the Chicago association of the commerce committee in 1913.

FRED L. WEEKS, formerly assistant engineer, maintenance-of-way of the Great Northern Railway at St. Paul, has been appointed computer on the forces of the Interstate Commerce Commission, Division of Valuation, at Kansas City Mr. Weeks was graduated from Sheffield Scientific School, Yale University, in 1911 and has been in the employ of the Great Northern from that date until the present appointment.

FRANK L. HERBERT, cashier and purchaser of the Bowers Southern Dredging Company of Galveston, has been transferred from Norfolk, Va., on the completion of the company's work at that city, to Miami, Fla.

CAMILLO WEISS, formerly connected with the Guerber Engineering Company of Bethlehem, Pa., has been appointed research fellow in the engineering experiment station, department of civil engineering, at the University of Illinois.

STELLER ENGINEERING COMPANY, engineers and contractors, Loan & Trust Building, Milwaukee, has been retained to prepare plans and specifications for the proposed waterworks and sewerage system for Pulaski, Wis.

FRANK ALLEN KIRKPATRICK, who for the past year has been doing research work in ceramics at the University of Illinois, has been appointed research fellow in the engineering experiment station, department of ceramic engineering, at that university.

L. A. POCKMAN of San Francisco has been appointed safety engineer of construction for service with the safety department of the industrial accident commission in Los Angeles, Cal. Mr. Pockman will have under his supervision the safety of men employed in sewer construction and similar work.

FRANK BACHMANN, formerly of the Illinois State Water Survey and for the past five years assistant chemist and bacteriologist at the sewage testing station of the Sanitary District of Chicago, has been appointed analyst of the sanitary division of the California State Board of Health, with headquarters at Berkeley, Cal.

Obituary Notes

HENRY C. SHAW, vice-president of the A. Garrison Foundry Company, died Sept. 27. He was born in Pittsburgh in 1854 and was graduated in civil engineering at Rensselaer Polytechnic Institute.

THOMAS HOVENDEN, general superintendent for W. W. Lindsay & Company, engineers and contractors, of Philadelphia, died at Plymouth Meeting, Pa., Sept. 19. He was born in 1882 and was graduated from the University of Pennsylvania in 1903. His first engineering work was as assistant on the engineering forces of the maintenance-of-way department of the Baltimore & Ohio Railroad. In 1904 he was with the Latta & Terry Construction Company on the location and construction of the concrete seawall at the U. S. Naval Academy, Annapolis, Md. From this work he went to the University of Pennsylvania as instructor in civil engineering. He became connected with W. W. Lindsay & Company in 1905 and remained in that company's service continuously.

THOMAS P. FOWLER, former president of the New York, Ontario & Western Railway, died Oct. 12 at his home at Warwick, N. Y.

A. S. F. BERQUIST, civil engineer and inventor of the Berquist patent suspension bunker for storing coal, ore and similar materials, died in New York City Oct. 7. He was born in Sweden in 1863 and came to the United States in 1886, after being graduated from the University of Lund, Sweden. His first engagement in this country was with the Baldwin Locomotive Works, where he remained until 1892. For the next five years he served as chief draftsman and engineer in the construction department of the Spreckles Sugar Refining Company at Philadelphia on the erection of warehouses, pier sheds and overhead tracks for trolley operations. While engineer for the American Coffee Company in Brooklyn, N. Y., from 1897 to 1900, he invented the suspension bunker which bears his name. After this engagement he served as assistant engineer for the Rapid Transit Subway Construction Company of New York City in charge of metal structures and steel erection. At the time of his death he was chief engineer for the Berquist Patent Suspension Bunker Company of Brooklyn.

Civil Service Examinations

United States.—An open competitive examination for surveyors and transitmen in the General Land Office will be held, Dec. 8 and 9, at the usual cities throughout the country. The salaries for these positions are stated to be from $100 to $110 a month, for transitmen, and from $125 to $150 a month for surveyors. Applicants must be 19 years or older and should have specific knowledge in mathematics and surveying. Forms (1312) may be secured by addressing the United States Civil Service Commission at Washington, or any of the civil service boards at the principal cities and stating the title of the examination for which the form is desired.

Massachusetts.—An examination for the position of investigator and examiner, highway commission, at a salary of from $1,200 to $1,500 a year, will be held Oct. 28. Candidates competing for this position must have experience and training in the construction and operation of automobiles in their relation to public highways. Application blank, which must be on file Oct. 20, may be secured from the Civil Service Commission, Room 151, State House, Boston.

Another competitive examination for sanitary engineers will be held in Boston Dec. 6, open to residents of the State. Application form (No. 1), which may be secured from the Civil Service Commission, State House, Boston, should be sent to the commission's office at once, for a notice to appear at the examination will not be sent to those who have failed to have their forms on file at least ten days previous to the examination.

New Jersey.—The Board of Health announces that an examination for assistant sanitary engineers to fill several vacancies in the engineering corps of the department will be held on Nov. 10. The examination is open to residents of the State. Those who are interested should communicate immediately with Gardner Colby, New Jersey State Civil Service Commission, State House, Trenton.

New York.—An examination for an engineering draftsman, salary from $1,201 to $1,500, will be held on Oct. 30. Candidates must be at least 21 years of age and must have had two years' experience. The examination is open to non-residents of the State, who, however, are subject to the provision that in case the eligible list contains the names of three or more residents these shall be preferred. Application blanks must be on file by Oct. 20, and no blank will be mailed after Oct. 18. Further information may be secured by applying to the State Civil Service Commission, Albany, N. Y., stating the position for which the information is desired.

California.—The State Civil Service Commission announces the following examinations open to residents of the State:

CIVIL ENGINEER, Grade 4, salary from $200 to $300 a month, to be held Nov. 13. Applicants must have had at least 10 years' experience in engineering work, part of which should have been relative to highway construction. Following this examination will be an oral interview by which the eligibility of the applicant will be predicated.

ENGINEERING DRAFTSMAN, Grade 2, salary from $1,200 to $1,800 a year, to be held Nov. 26-27, forms to be on file Nov. 20. Applicants must be 21 years old or over and must have at least two years' experience.

MECHANICAL ENGINEERING DRAFTSMAN, salary from $1,200 to $1,800 a year, to be held Dec. 10-11, forms to be on file Dec. 4. Applicants must be 21 years old and must have had two years' experience.

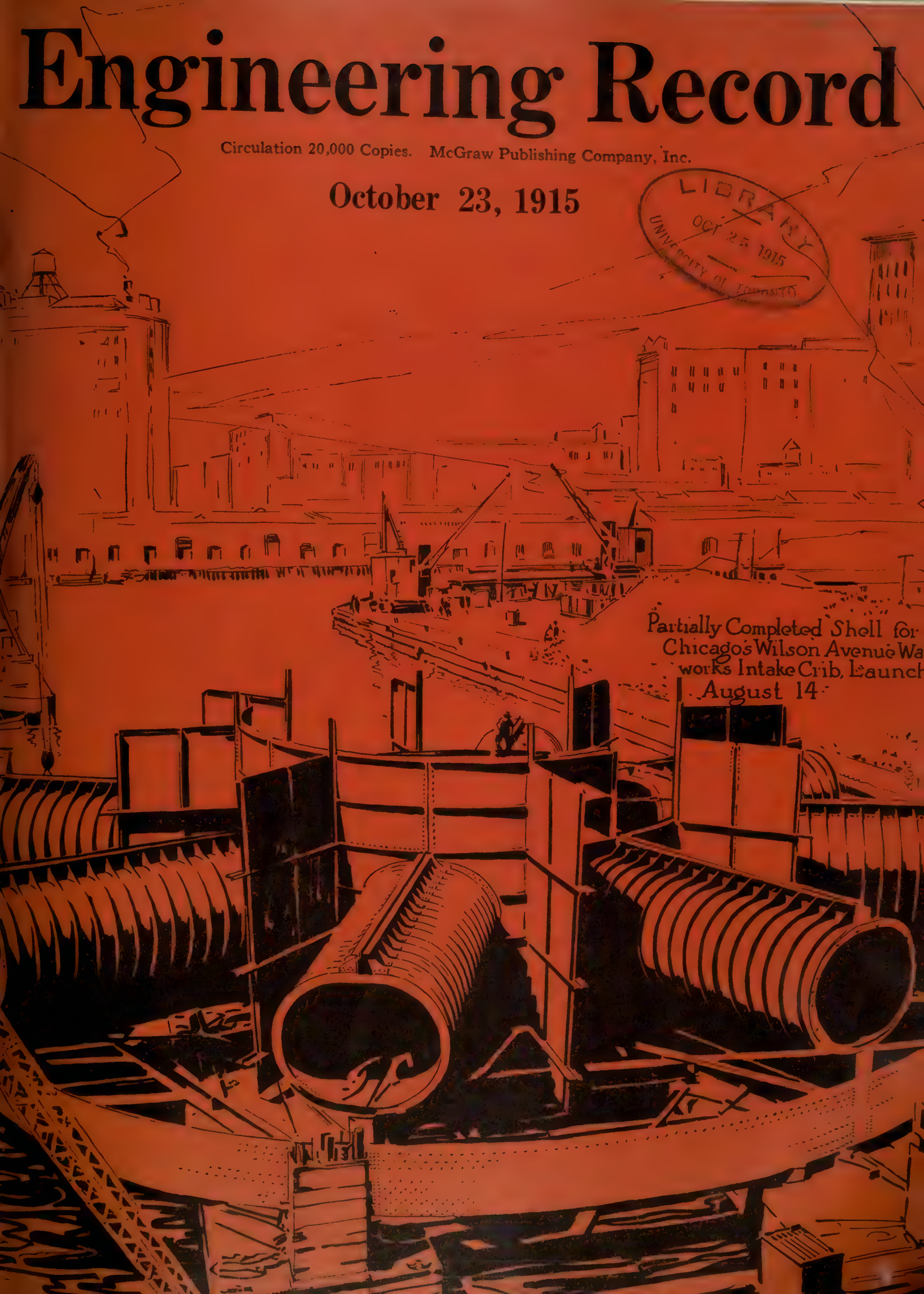
Candidates for these positions should apply now for application forms and other information to the Civil Service Commission, Forum Building, Sacramento; Ferry Building, San Francisco, or Hall of Records, Los Angeles.

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Public Speaking Again

COMMENT has been made several times in these columns regarding the value to the engineer of facility as a public speaker. The appreciation of its value is growing rapidly, and at a recent meeting the San Francisco Association of Members of the American Society of Civil Engineers referred the subject to its board of management, suggesting the advisability of offering a course in public speaking for the members. The idea, as proposed in a motion, was that a competent instructor might be engaged to prepare and give a course along lines especially adapted to the requirements of engineers. It is needless to comment at length upon this suggestion. It should meet with hearty approval, and it would not be surprising if, in case the course is established, the enrollment, proportional to the membership of the association, should be very large. The suggestion may well be taken up by other associations of engineers. There are few things they can do which are likely to prove more beneficial to the members as individuals.

Galveston Repairs Storm Damage

RESOURCEFULNESS has ever been a marked characteristic of the civil engineer, and his services at Galveston after the storm have justified the confidence in his ability to think and act quickly in an emergency. Mr. Van de Greyn's account, on page 500, of how the hurricane's recent damage is being repaired makes interesting reading. When the causeway was washed away the people of the city were, in fact, marooned, for Galveston is located on an island a long distance from the mainland. The situation was grave, indeed, for the water supply pipe had been snapped in two by the waves and there was immediate need for food and emergency supplies of all sorts, which could be delivered only by the comparatively slow medium of boats. The engineers buckled down to their work, however, and in 17 hr. had water flowing through a new pipe line, laid temporarily on the causeway wreckage. In less than a week a long timber trestle had been constructed to carry railway traffic across the bay, and other repair work is being prosecuted rapidly. It appears that comprehensive plans for additional protection of the city against wind and wave are being formulated and that further work on the sea-wall, to prevent the wash from blowing inland and scouring out the area back of the wall, may be undertaken. On this matter of increasing the sea-wall's efficiency it would be well for the local authorities to give careful consideration to the recommendation made by Dr. Elmer L. Corthell in the Engineering Record of Oct. 2, page 426. He suggested that a solid parapet, in the form of a curved overhang, be anchored to the top of the wall so as to throw the wave mass seaward after it strikes the barrier. This improvement, together with the filling in of certain low-lying areas, would offer effective protection against future storms.

Practical Reasons for Lug Angles

ALTHOUGH the principle conclusion of Professor Batho, as the result of careful tests on the value of lug angles for the end connections of tension members, reported on page 512 of this issue, is that such angles are valueless and cumbersome, it should be pointed out that there are practical reasons for the use of short connection angles of this type. In many cases the joint detailing is much simplified by avoiding long, single lines of rivets in the connection plates, and the advantages in smaller gussets tend to offset the cost of using lug angles. In roof trusses, especially, where the top chord members are usually composed of one web plate and two angles, some of the web members can be connected with sufficient rivets to a comparatively narrow web plate only when lug angles are used. While it is evident from the results of the tests that no appreciable difference in uniformity of stress is produced by the lug angles, there is no reason why they should not be used whenever local conditions at the joints are improved. The compressive stresses found in the single-angle members under tensile stress impressively demonstrate the fact that a large element of bending exists in single-angle tension members connected to end gusset plates. It is worthy of note that the special form of mirror extensometer used, and described on page 514, has apparently many advantages in accuracy and facility of application in the laboratory.

Harbors in the West Indies

THE sublime faith of the inhabitants of most of the cities in the West Indies having good, or even fairly good harbors, in the belief that the full opening and utilization of the Panama Canal will give them ports of world-wide importance, increase their populations to unbelievable numbers and treble real estate values has amused more than one traveler. It was on the strength of this belief that the people of Cienfuegos, Cuba, insisted that the Government improve its harbor and that the expensive sewer system and waterworks recently constructed there were undertaken. Even backward, revolution-ridden, Port au Prince, Haiti, was stirred to activity, with the result that a splendid 2300-ft., reinforced-concrete wharf was built amid the rusting hulls of the sunken ships that were formerly the most noticeable feature of the bay. The claims of some of these cities are, without question, logical and justified to a considerable extent. Enough so, in fact, to make it seem that the engineer could render a great service in capitalizing their confidence. If faith was strong enough in Cienfuegos to result in the expenditure of several million dollars on new construction years before the Canal was completed and vital enough to make the Government of Haiti forget for the moment its antipathy to anything resembling progress and its rigid avoidance of anything that might attract Caucasians to the island, and grant a concession for a modern wharf on very liberal terms, surely it is of sufficient moment to justify the engineer in at least considering the question. A sentiment toward an intelligent and comprehensive plan of improvement, so as to be in a position to derive the full advantages their situation affords them, should be easy to arouse in most cities whose claims are justified. A good service could be rendered the others in demonstrating to them the fallacy of their beliefs.

Federal Policy a Construction Impetus

COMING from an official source, the statement that the United States Government will protect, by suitable legislation, industries developed here to supply products the importation of which has been cut off by the European war is of great importance to engineers and contractors. This announcement, by Dr. Edward Ewing Pratt, chief of the Bureau of Foreign and Domestic Commerce, made before the Society of Chemical Industry at New York Oct. 22, opens the way for capital to embark on the construction of plants for manufacturing not only dyes, but also a wide variety of other products heretofore imported, without fear that unfair foreign competition after the war will wipe the investment out. This fear has throttled such enterprises and caused a stagnation in privately-financed construction at a time when all other lines of business were beginning to show marked improvement. If there is confidence that Congress will back up this announced policy of the Administration by the necessary legislation there will be a flood of money seeking investment in many lines of industry made profitable by this action. The privately-financed construction of industrial plants that would follow the establishment of the Government's policy on this question would mean a real awakening in engineering and construction lines that have been practically dead for the past

fifteen months. The Engineering Record welcomes the announcement of Doctor Pratt that "It is our desire that the United States shall have independent and self-sufficing industries," and, "I hope that the time has arrived when we can do away with our industrial crutches." Engineers and contractors are only too ready to design and build the plants and industrial centers that will accomplish this result, when capital is safeguarded in financing the projects.

Standardizing Paving Specifications

IN SUCH an important matter as the adoption of standard paving specifications by a national organization of city officials the practice of basing final action on a vote of those in attendance at a convention, as was done by the American Society of Municipal Improvements at its meeting in Dayton last week, is open to very serious objection. Such decisions, especially if they are reached during the final sessions of a long-drawn-out program, when every one is weary of listening to further discussion and many have departed on their homeward journeys—leaving a mere handful present—can not be considered as truly representing the opinion of the society at large.

It would seem that in matters affecting standards of paving practice throughout the country the final word should be said only after a canvass of the entire membership by letter ballot, after the committee report has been received. Without touching upon the desirability of making a patented bituminous pavement a standard, as was done at Dayton, it should be noted that no agreement could be reached by the sub-committee, which submitted both a majority and minority report, that the general committee, refusing to approve the majority report, submitted both reports to the convention, and that the minority report was substituted for the majority report by an exceedingly close vote, indicating very clearly that there was a decided difference of opinion even among the few members present as to the propriety of the action taken.

The argument that the men whose opinions are worth while attend such conventions and that, therefore, a vote from the floor represents the views of the best in a society loses its force under the conditions which existed at Dayton during the concluding sessions when interest lags. The remedy is shorter convention periods, terse papers with restrictions as to length of time allotted for presentation, and, in the case of such an all-inclusive organization as the American Society of Municipal Improvements, section meetings for highly specialized subjects. Mr. Folwell presented at the meeting an excellent digest and recommendations for committees, with more clearly defined limits; this is a long step in the right direction. The highly specialized work of the asphalt chemist is not of particular interest to the sewage treatment expert, but specifications based on the work of these men are of vital importance to city officials depending on the society for efficient standards. They should, therefore, be adopted only after the most careful and thorough consideration and should represent the views of the majority of the members and not those of a small group, as expressed by a vote from the convention floor at the eleventh hour.

New Eligibility Qualifications for Engineer Officers

FEW civilian engineers are acquainted with the fact that membership in one of the four national engineering organizations, civil, mining, mechanical and electrical, is held as an alternative educational qualification in the examination of candidates for commissions as officers of volunteer engineers. The announcement was made in General Order 50, 1915, of the War Department issued Aug. 25 as an amendment to General Order 54, 1914. Candidates for positions on the list of eligibles are required to appear before boards of officers of the Corps of Engineers and of the Medical Corps, U. S. A.

Following satisfactory physical and moral examination, the board questions the candidates generally as to their experience and then examines into their technical qualifications. On such evidence the board arranges candidates in order of merit and then recommends them for the grades to which they appear to be fitted. For the grade of lieutenant one must be an engineer in active practice of his profession or some business immediately connected with or concerned in engineering matters. He must either hold the grade of junior engineer, civil, electrical or mechanical, or higher grade in the civil service, be a graduate of an approved engineering college, or be a junior member of the American Society of Civil Engineers, member of the American Institute of Mining Engineers, member of the American Society of Mechanical Engineers or associate member of the American Institute of Electrical Engineers, or he must be or have been a non-commissioned officer of the grade of sergeant or higher from one of the regular battalions of engineers.

Among other alternative qualifications that of associate membership in one of the national organizations is named as necessary for the grade of captain and full membership is demanded for field officers. There are other requirements as to knowledge of military regulations for captains, and examinations are required for the grade of field officer. To become enrolled on the list for positions on the military railway staff or with railway troops candidates may submit evidence of their actual employment in corresponding positions upon a first-class railway.

Inasmuch as many engineers in and out of the national societies have signified their intention to co-operate with the War Department this order gives them an opportunity to be enrolled as lieutenants without having had military training. Undoubtedly there will soon be available a means whereby engineers too busy to attend training camps can obtain at least a correspondence course of instruction in field service and army regulations. This would enable one qualified by education and civil experience to be listed as a captain. For higher rank very rigid examinations are necessarily required and the civilian could not pass them without military experience. That the members of the engineering profession feel the need of actual military experience keenly is attested by the fact that nearly 10 per cent of the 500 men in the citizens' training camp at Fort Sheridan, Ill., were engineers. There are many more who would go were it possible to do so. General Order 50 gives these men a chance to do something.

Cost and Value of Utilities

SO MUCH has been said and written on the subject of the fundamental principles of valuation that one is sometimes inclined to doubt whether there is anything new to be said, and to wonder whether it would not be best to say nothing more until time has dispelled the fog and enabled all engineers, at least, to see alike. Mr. Binckley, however, on page 515 of this issue, presents a phase of the problem that has at least been given much less attention than some other phases no more important. The burden of his argument, in short, is that "value" involves much besides "cost" or "investment," and that judgment alone, unaided by any formula or scale of measurement, can determine the difference. In other words, his discussion relates to "other elements of value," to use the expression coined by Congress in the Valuation Act—but not the "other elements of value" claimed by common carriers, because he hardly mentions the railroads.

Therein, the Engineering Record believes, lies one of the chief defects of Mr. Binckley's discussion as it stands. While he has shown in a private letter that he fully recognizes the importance and complexity of the differences that exist between the local-monopoly class of utility, typified by the water company, and the widespread-competitive class, typified by the trunk-line railroad, it is rather unfortunate, owing to the common failure even among engineers to perceive these differences, that he did not point them out in his article and explain that his theories fit the former class much more closely than they do the latter. Then, also, he accepts as established the "less-depreciation" doctrine, which this journal believes is contrary to reason and will ultimately be applied only to properties that have been allowed to sink to decrepitude without any provision for or possibility of the necessary renewals.

Four questions are propounded by Mr. Binckley as having vital bearing on value without entering into cost: Is the property, or can it be, a monopoly? Was there great hazard of loss at the start? Have past profits been ample or meager? Is the property likely to become obsolete?

Obviously the first question does not fit the railroad—the average railroad. Many roads do enjoy monopolies at present, but they are not guaranteed, and wherever there is traffic worth while there are pro-

moters striving, and often succeeding, to get a slice. But for the water company controlling the only source of potable water, or the power company controlling the only waterfall, the possession of the monopoly is a very durable and valuable asset, which may not fairly be overlooked in the valuation.

The second question fits every class of utility. Mr. Binckley pictures the irrigation project put through in the hope of developing the production of citrus fruits, and it is perfectly reasonable that in return for the risk of total loss the investors be given an opportunity to make more than ordinary profits. Otherwise the money would remain in conservative investments, and such developments would never be put through. He does not mention the great railroads over the Rockies, yet most of them represent the extreme in hazard of investment, having been pushed far ahead even of civilization. It does not seem unreasonable that these assumptions of risk should be considered elements of value.

Mr. Binckley's idea of the significance of this element for purposes of sale seems to lead to confusion. He states that for such purposes the question of risk should not enter. This means, however, either that the purchaser, without paying anything for it, may acquire a claim to increased earnings due to somebody else's risk, or that with the transfer of ownership the property should suddenly lose some of its earning value. It seems more equitable that this element of value due to original risk should go with the sale and be paid for as something permanently a part of the property.

The third question leads to that sadly misunderstood term, "going value." There are those (including courts, unfortunately) who would make it vary inversely as past profits, so as to represent past deficits in earnings—in which case the skillful management which has minimized such deficits is penalized, while the extravagant and blundering management which has failed to make the property profitable may claim a staggering addition to value. It seems much more fair to estimate what it reasonably ought to have cost to bring the property to a paying basis, and add that amount as a definite, *tangible* element of value. Mr. Binckley does not make his views on this question very clear.

The fourth question, relative to obsolescence, does not seem to fit the railroad, and its significance concerning any utility is open to doubt. Sympathy for the owners of the steam power plant who have their business taken away when the near-by water power is developed will likely be tempered with the thought that the builders of the steam plant should have utilized the water power themselves. It might, however, have required a large amount of money and a chance to reach a much larger field to make the use of the water power profitable, and probably some measure of protection is desirable to encourage small developments before the large ones are feasible. But no sympathy is wasted on the railroad that becomes obsolete. It is forced by competition to match to some extent the service of its rivals, or, if there be no competition, it is forced by law to provide certain minimum facilities. Damage done it by water or electric-railway competition is regarded with holy glee, and it cannot even acknowledge itself beaten and go out of business. And none of these considerations appears to have any bearing on the valuation of the property, unless indirectly in increasing promotional expenses.

Promotional expenses, by the way, together with discounts on securities and interest during construction, answer to some extent Mr. Binckley's second and fourth questions. Prospective investors and lenders will naturally demand higher rates of return for greater risks, and these concessions become elements of actual cost that belong in the appraisal itself.

Mr. Binckley's closing appeal for a fairer attitude toward public utilities is not novel, but is nevertheless worth reiteration. The Engineering Record holds no brief for past maladministration of utilities. It does believe, however, that the punishment has already exceeded the crime and has almost wholly failed to differentiate between good and bad management, and that public expediency demands that something be done to dispel the present fear and uncertainty of the potential investor.

Coast Defense Needs

ADEQUATE protection for our coast cities is one of the fundamentals of preparedness, and since this subject is largely within the province of the engineer, albeit the military engineer, it seems desirable to point out the nature of the changes that are needed to put our coast defense system on an adequate basis and to emphasize the urgent necessity for doing this immediately.

It is a regrettable fact that our coast-defense system has been built up and maintained by spasmodic construction. Several times in the history of the United States the fortifications have been brought up to date and then almost nothing has been done for many years until the equipment was sadly obsolete and ineffective against the latest naval armament. This has been due entirely to natural conditions. Since naval vessels wear out in from 15 to 20 years and must be replaced, it has been the custom to build ships, not in large numbers, but a few at a time, so that a fleet represents a gradual evolution up to and including the very latest type. Fortifications, on the other hand, do not progress except by long bounds. Moreover, their apparently permanent character creates the false impression that they are as effective as when new. If naval armament did not improve this belief would be true.

As a matter of fact, during the past 15 years there has been no substantial improvement in the armament of the coast defense of the United States proper, and with the possible exception of two mortars in Boston harbor, each with a range of 20,000 yd., the most powerful guns mounted anywhere along our coast line have a fire control system based on a maximum range of about 12,000 yd. The grave danger of this condition is apparent when it is realized that the latest dreadnaughts of all nations carry guns with a practicable range of 20,000 yd., so that there is a zone of about 8,000 yd. within which dreadnaughts can operate against our fortifications while lying safely beyond the reach of the present coast-defense guns and mortars. It is understood that an effort is being made to alter gun carriages and reduce the weight of certain projectiles so as to attain an increase in range of several thousand yards with the coast defense armament that we now have installed. These, however, are changes that would require time, and even after the necessary computation, experiment and manufacture of ammunition, and assuming that it were a complete success, there would still be a zone in which hostile guns could safely and effectively operate against our batteries.

The remedy for the present unfortunate state of affairs is plain enough. It consists of mounting a few of our latest type rifles and mortars which have a range of 20,000 yd. at points which will cover the 8,000-yd. zone referred to. To do this would be to do very little—the very least that could reasonably be done—but it would afford partial protection. With a few pieces covering the outer zone, military authorities confidently assert that the risk to besieging dreadnaughts would be so great as to discourage attack. In most cases the higher power armament which the land fortifications require would need to include two to four guns and four to eight mortars covering the deep sea approaches to the principal harbors. Thus, taking San Francisco as an example, a complement of two rifles and four mortars would be required on either side of the entrance to the harbor, probably an installation at Fort Miley and another at Fort Barry. To the cost of these batteries, which might be about $250,000 for each gun and its emplacement and the same for each two mortars and their emplacements, a sum sufficient for supplying them with a proper amount of reserve ammunition and an adequate annual allowance for target practice should be added.

Finally, it must be remembered that even with this addition the fortifications of San Francisco, or any other harbor, would not be "completed" in the sense of finality. The use of the word "completed" in the reports of recent government boards, which have studied coast defense in order to make recommendations to Washington, is very unfortunate, to say the least, because it has helped to sustain the false sense of the security afforded by the land fortifications. Coast defenses are adequate only when they have range and power comparable to that of naval armament that may be trained upon them. Since naval equipment is being constantly improved, we are inconsistent in allowing land batteries to remain for long periods of years without any expenditures whatever.

Public sentiment would not permit such a condition to persist long if the danger were generally known and fully appreciated. It is time to pay for coast defense a premium which is long overdue.

Rush Work After Storm Restores Galveston's Water Supply and Rail Connections

Temporary Pipe Line Laid Across Causeway Wreckage in 17 Hours —Timber Trestle for Traffic Across Bay Built in One Week

By E. B. VAN DE GREYN
Consulting Engineer, Houston, Texas

WITH the passing of the storm of Aug. 16 and 17, which demolished portions of the causeway at Galveston, Tex., cut off the water supply and destroyed communication by rail between the island city and the mainland, as described in the Engineering Record of Aug. 28, page 271, the work of reconstruction was begun immediately. Every resource at the city's command was called upon, with the result that in 17⅓ hr. after work was begun water was flowing across the bay through a hastily built pipe line laid on what was left of the causeway. It took only 7 days for an army of workers to construct a mile of timber trestle to restore railway connections across the bay, and the work of repairing the damaged boulevard behind the seawall is progressing rapidly. These are the repairs for which there was the most pressing need, and while the principal efforts have been directed toward these there are under consideration several plans for the more complete protection of the city against the onslaughts of wind and wave.

LAY PIPE LINE IN 17 HOURS

The restoration of the water supply, which was interrupted by the breaking of the 30-in. supply line on the causeway, was the first work undertaken. Before the causeway was built the water from Alta Loma was carried through a 30-in. pipe laid on the bottom of the bay nearly parallel to and about 600 ft. southeast of the present causeway. When the causeway was constructed a new 30-in. line was laid in the fill along its entire length, being submerged, of course, at the lift span. The new line was connected at the island and mainland ends with the old 30-in. line and gate valves were installed at these points so that water could be pumped through either line.

The washing out of the sand filling during the storm caused bad breaks in the 30-in. causeway pipe line at the north and south ends of the arches, and also several smaller breaks where the protected roadway was washed out. The removal of the sand filling lowered the pipe bodily until it was covered with from 2 to 7 ft. of water. At first it was thought that the old submerged line was uninjured, but after the valves were opened it soon developed that there were serious breaks in that line somewhere in the bay.

On Aug. 21 advice was asked of I. A. Cottingham, chief engineer of the Sunset Central Lines. He recommended, in view of the necessity for immediate relief, the construction of a temporary 8-in. line across the causeway. A committee of citizens later in the day went to the causeway with a letter addressed to him and Mr. Pettibone of the Santa Fé railway, turning over to them the job of getting water into Galveston.

An order for necessary pipe and fittings was at once sent back to Galveston and wired to the Southern Pacific office at Houston. Two miles of pipe were loaded and in Texas City by daylight the next morning, Sunday, Aug. 22. By Monday morning two Southern Pacific bridge gangs, city water service men, a strong force of Santa Fé men, who had been ordered by Mr. Pettibone to report to Mr. Cottingham, and the pipe, were at the causeway. Pending the arrival of the pipe from Houston an investigation was made to discover the extent of the breaks in the old submerged line. It was found that 600 ft. of the old main opposite the northerly end of the arches was displaced and about 200 ft. at the southerly end of the arches was missing. These sections were evidently snapped off by the excessive current through the causeway arches due to the restricted waterway between Galveston Bay and the Gulf.



TEMPORARY WATER PIPE LAID OVER CAUSEWAY WRECKAGE IN 17 HOURS

FIVE GANGS LAY PIPE

When men and pipe arrived on Monday morning Mr. Cottingham took active charge of the laying of the 8-in. line. Pipe laying was started from both ends of the causeway arches, from the island end and the mainland end and at an intermediate point between the mainland end and the northerly end of the arches, making five separate gangs. The pipe was laid on the concrete coping which caps the concrete sheet piling on the westerly side of the causeway, and was tied down with heavy wire to the concrete stubs where the steel tie rods came out of the coping. As the pipe-laying gangs met, the pipe was connected up with sleeves made up of sections of 10-in. pipe, the joint being sealed with lead; 3700 ft. of pipe was laid at the mainland end and 1700 ft. at the island end of the causeway. The 8-in. pipe was connected by plugging the ends of the 30-in. pipe with boiler iron caps, made in the Houston shops of the Southern Pacific railway, and tapping the ends of the 8-in. pipe in the center of the plugs. Water was ordered turned on through the 5400 ft. of temporary line at 2.20 p. m. Tuesday, Aug. 24. The laying of the 5400 ft. of pipe and the making of the necessary connections was accomplished under these adverse conditions in 17⅓ hr.

When water was thus secured, City Water Commissioner Shay started the work of repairing the submerged main. The missing sections were filled in with 20-in. flexible joint dredge pipe. At the free ends of the 30-in. pipe connection was made by divers. After slipping the end of the 20-in. pipe into the end of the 30-in. pipe the space between was packed. A submerged cofferdam was built of sacks of cement and filled with cement from other sacks lowered to and slit open by a diver. The connection was thus surrounded, and after the cement had been allowed to set water was turned through the submerged main on Sept. 5.

In the meantime the 3700 ft. of 30-in. causeway pipe line from the mainland to the north end of the arches was being patched and leaks stopped by other city forces. Along the 1700-ft. section at the island end a second 8-in. line was laid alongside the first, and on Sept. 5 water was turned through these lines at the same time as through the submerged line. This gave Galveston an ample supply. Work of repairing the leaks in the 1700-ft. length of 30-in. causeway line was carried forward, and on Sept. 19 water was turned through this line. Mr. Shay found that the submerged line drew water out of the causeway line. The submerged line, therefore, was cut off and all water is now being delivered to Galveston through the 30-in. line along the causeway.

QUICK WORK ON RAILROAD TRESTLE

Although Galveston, after the storm, had boat service which supplied food, it was imperative that rail connection with the mainland be restored as quickly as possible. An army of men was at once put at work getting tracks in shape leading to the causeway. The building of a single-track creosoted pile trestle was commenced as soon as equipment and materials could be delivered to the causeway. The Santa Fé Railway undertook the building of the 3700 ft. at the northerly end under direct charge of W. E. Maxin in the field, and the Southern Pacific handled the 1700 ft. at the southerly or island end under direct charge of Mr. Cottingham. On the 1700-ft. section a railroad driver was used at the island end and a slip or skid driver was started from the southerly end of the arches. For the 3700-ft. section a railroad driver was started from the mainland end, a skid driver from the northerly end of the arches, and another skid driver started on cribbing at an intermediate point. Materials were brought in on barges and floated to the drivers. A temporary track laid outside and to the east of the approach and extending out from the mainland was also used for bringing materials. Bents were 14 ft. on centers, four piles to a bent. Driving was carried on day and night with two 12-hr. shifts. In 7 days 5400 ft. of pile trestle was built ready for

train service. With the wreckage of the causeway approaches interfering with progress, those in charge must be credited with a record job. Galveston owes much to the railway officials and men who worked so efficiently to relieve the immediate needs of the city.

Steam lines and the Stone & Webster interurban line from Houston are now operating over the pile trestle. The interurban cars are taken back and forth across the trestle by locomotive. The Stone & Webster Company is now constructing a trolley pole line next to the trestle to enable cars to operate across it under their own power.

BOULEVARD AND SEAWALL

Work on the damaged boulevard along the seawall was started soon after the storm. Scoured out places back of the wall are being filled. The brick from the damaged pavement are being piled and cleaned. Where concrete had been used for pavement base the concrete is being broken up and thrown over the seawall at the toe of the wall. In places the filling was removed during the storm from under the toe of the seawall immediately in front of the sheet piling and it is necessary that it be refilled under and against the toe of the wall to prevent teredo attacks on the piling. The broken concrete is being deposited to help hold the new filling.

Work on the streets and the moving and filling in of sand is steadily going on. In general it is only along the far seawall boulevard and a short distance inland that such work is necessary.

PLANS CONTEMPLATED

Up to the present date it is understood that no definite plans have been adopted for the more complete protection of the city and for the reconstruction of the causeway, although several plans have been and are being considered and discussed. In general, the problems to be met are as follows:

The seawall demonstrated its ability to stand the storm of last August. The boulevard and fill back of wall, however, was scoured out by water blown over the top of the wall. The new plans, therefore, will prevent such water from going on over into the city and the consequent scour or wash of the pavement and fills back of the wall.

Districts beyond the protection of the seawall have shown their need of similar protection and in all probability the seawall will be extended or other protective works built for the protection of these districts.

The downtown section of the city is subject to the dead or back water during storms such as that of last August. This is to be overcome by raising the grade in the downtown district or some other method affording either partial or total protection.

The weak point in the causeway was the fill in the so-called protected roadway approaches. The fill was protected from all sides except the top and it was from there that the storm water started the destruction. Another significant feature brought out by the storm was the fact that, before the approaches gave way, the water was much higher first on one side and later on the other as the storm center approached and passed the coast line. The question arises, How much of the high water in Galveston was due to the damming by the causeway of the water between the bay and the Gulf?

Three of the plans tentatively considered are: First, an all-arch causeway necessitating expenditure of about $2,000,000; second, more substantial protected roadway approaches costing about $1,500,000; and, third, creosoted timber approaches with solid timber floor supporting ballast and pavement (no estimate).

The question of location, etc., of the water mains across the bay would naturally depend on the final plans for the causeway. Whatever is done on the works contemplated will entail great expense and the citizens and officials will doubtless consider all features carefully, since the sentiment appears to be that whatever is done should be thorough.



GALVESTON'S HASTILY BUILT TRESTLE CONNECTION WITH THE MAINLAND

Fall River Mills Will Benefit by $3,000,000 Water and Sewerage Project

Plans of Fay, Spofford & Thorndike Provide for Three-Story Conduit Separating Hot Wastes, Cold Condensing Water and Surface Drainage

BY means of a $3,000,000 project, involving a three-story concrete conduit with separate channels for hot waste water, cold condensing water and surface drainage —all combined in a single structure tapping Watuppa Pond—the Quequechan River nuisance in the crowded mill district of Fall River, Mass., will be abated, 146 acres of valuable land will be reclaimed for commercial purposes, the city's great industrial plants will enjoy a practically unlimited supply of water, and the water itself will be converted from a warm, filthy stream into a cool, clear flow. These, in brief, are a few of the advantages which will be realized by the plans of Fay, Spofford & Thorndike, consulting engineers, of Boston, which have just been submitted to the City Council of Fall River by the Watuppa Ponds and Quequechan River Commission, created in 1913 for the purpose of improving the Watuppa Ponds and eliminating nuisances along the Quequechan River, which has been a recognized source of danger to the public health for many years. The pollution of the river has reached a stage likely to result in epidemics if not taken care of by a proper system of sewerage. The redeeming of the land steeped with noxious infection, and the drainage of areas hitherto included in unhealthy surroundings will remove a great menace, bring into the market areas of taxable property open to development, and provide important improvements in the water supply for industrial and condensing purposes.

RIVER CONDITIONS OBJECTIONABLE

The abatement of the Quequechan River nuisance is one of the most pressing problems in sanitation in Massachusetts. The Watuppa Ponds to the east of the city together constitute the largest body of fresh water in the State, having a total length of 8 miles, a total area of about 5.25 sq. miles, and draining a watershed of about 27 sq. miles. These ponds are at an elevation of about 130 ft. above tidewater, and are drained by the Quequechan River, which, from its source at the outlet of the South Watuppa Pond at the Sand Bar, flows practically level for about 2 miles to Pleasant Street, and then in the last half-mile of its course drops through a succession of falls to tidewater.

Many industrial plants are located along the river between the Sand Bar and Watuppa dam. By direct discharge or by the overflow of cesspools sewage from 16 miles, employing thousands of operatives, reaches the river. Much surface drainage also finds its way into the stream, the overflowed flats of which contain a large amount of sludge and other wastes, with rank vegetation which is stimulated by the heating of water when discharged through the mill condensers. Certain sewers in the vicinity of the river now are discharged into it through relief outlets. Below the Watuppa dam the larger portion of the stream is covered by streets and buildings, and the condition of the river is such that in many places it cannot be traversed by human beings. Shut-downs have occurred at various mill power plants during periods of low water, due to the high temperature of the water supplied to the condensers, to its scarcity, or to clogging of intakes. The domestic water supply of the city is drawn from the North Watuppa Pond, and the

proposed improvements are planned with due regard to present and future requirements.

MAIN FEATURES OF NEW PLANS

The plans presented by the commission and developed by its consulting engineers in general provide the following:

(1) The construction of a main conduit from the vicinity of the Sand Bar along the river to a point just above the Watuppa dam, to provide for the flow of the river and for the supply of water to the mills for condensing, washing and other purposes; (2) a system of sanitary sewers discharging into tidewater to take the sewage and wastes from the mills which are now discharged more or less directly into the river; (3) a system of surface water drains to relieve the existing overtaxed combined sewers; and (4) the filling of certain areas of flats on either side of the proposed conduit to a height at least equal to full pond level of the South Watuppa Pond.

The plans provide for the complete separation of hot and cold water. A constant supply of cold water much larger than the present minimum flow of the river will be discharged downstream in dry seasons. There will be an ample supply of cold water to all the principal mills along the stream by making available water stored in the South Pond at depths lower than that to which it is now possible to draw the pond. Finally, the hot water from the mill condensers will be returned to the South Pond, where it will be cooled and made available for further use. The design contemplates a main conduit consisting of a single structure with three separate channels, superimposed. In this conduit the cold water channel is placed at the bottom and the hot water channel at the top of the structure, and between the two is a surface water channel for the removal of storm water from the watershed draining to the river to an outlet below the Watuppa dam. Thus the flow in different compartments of the conduit will be in opposite directions.

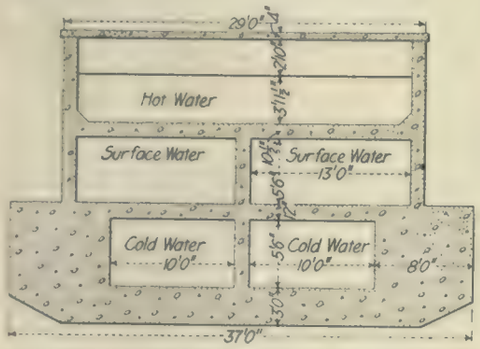
The inlet for cold water and the outlet for hot water are widely separated, and provision for oil separation is made at the discharge of the hot water duct. It is also planned to turn the hot water into either the surface water channel or the cold water channel when needed to prevent the interference of ice. Another feature is an overflow into the South Pond from the surface water channel in case the latter should become surcharged in an excessively heavy rain.

At the lower end of the conduit near the Watuppa dam structures are provided for the discharge of water down the old channel of the river, estimated to have a carrying capacity of 250 sec.-ft., and a new outfall sewer having a capacity of 535 sec.-ft. is to be provided for the removal of sewage and storm water. This new sewer can be used in emergencies for the removal of flood waters from the South Pond, and is to find outlet in the Taunton River at tidewater.

SEWERS AND DRAINS

The plans for sewerage and drainage provide for the separation of sewage from storm water in the valley of the Quequechan River and for maintaining separate systems in this valley in the future. At first, however, it is proposed to construct only such sewers as are necessary to effect a partial separation, preventing a mingled overflow into the Quequechan River. The plans have been approved by the State Department of Health, and under the scheme presented the mills below the Watuppa dam will have every day in the year an available supply of water more than double that which it is possible to obtain at present during the dry months. The character of the water will also be entirely changed. Instead of being hot and filthy it will be cold and clean, with a practically unlimited supply for the mills above the dam. The redemption of the flats will make available 146 acres for commercial purposes.

By filling the flats, as proposed, water storage capacity of about 250,000,000 gal. will be lost. This will be offset many times over by the greater storage made available in the South Pond. At present it is not possible to draw the South Pond down more than 4.5 ft. below full pond level, thus



CONDUIT IN WHICH HOT AND COLD WATER WILL OCCUPY SEPARATE CHANNELS

utilizing a storage capacity below full pond of less than 2,250,000,000 gal. It is planned to utilize a storage capacity of 3,750,000,000 gal. by drawing down South Pond to a depth 8 ft. below full pond, or an increase of nearly 70 per cent, which is six times the storage lost by the filling of the flats. The Quequechan River flow falls as low as 8,000,000 gal. per day, and sometimes less in dry years, whereas with a deeper channel and better regulation a constant flow of at least 20,000,000 gal. can be obtained at all times.

The adoption of the scheme provides for the ultimate construction of 60 miles of sewers, which, when completed, will properly drain areas in Fall River now without sewer sanitation. Only 5 miles of sewers need be built at the outset. The outfall sewer is designed to care for a flow of 450 sec.-ft. in excess of the maximum flow of the sewers contributing to it. After the proposed improvements are completed it will be possible to draw off water from above the Watuppa dam to the Taunton River at the rate of 700 sec.-ft. or nearly three times the previous rate. The cold water and surface-water channels in the main conduit have a still greater capacity for flood discharge, affording increased safeguards against threatened rises in the pond.

As most of the schemes previously proposed for a conduit contemplated the building of a water-tight dam at the Sand Bar, a large number of borings was made in the attempt to discover a suitable site for such a dam. It was found that on account of unsatisfactory foundation conditions, such a dam would cost $60,000, while a cut-off can be built at Quequechan Street at a cost of less than $2,000. The saving on this one item pays for the cost of underground explorations many times over.

In studying the question of drains for surface water, it was early apparent that main surface water drains or conduits would naturally be built along the routes of the proposed cold-water conduits. It was found to be far more convenient as well as economical, wherever a surface-water conduit was needed, to combine it with the cold-water and hot-water conduits into a single structure. This led to the adoption of the three-level type of conduit. The cold-water channel is placed at the lowest level where it will always flow full; the hot-water conduit is placed at the top, so that the discharge from the mill condensers will be returned by gravity to the South Pond; and the intermediate level is utilized for surface water. The main conduit is, in general, to be built level for its entire length; the floors of both the cold-water and surface-water conduits are level, and the floor of the hot-water conduit slopes slightly toward the South Pond. The main and branch conduits are to be built of reinforced concrete.

HOT AND COLD WATER SEPARATED

The separation of the cold water, hot water and surface water in different channels is preferable to the combination of any two of them in a single channel. Were the hot water discharged from the mills admitted to the channel containing the cold water, it would not be possible to keep the water supplied to the mills cool and free from oil. With separate channels, water that has passed through the mill condensers can be clarified and cooled, and rendered as useful as before entering the condensers. If surface water were admitted to the channel carrying cold water to the mills the latter, in times of storm, would be supplied with water containing both grit and organic impurities, for in the narrow confines of a conduit it is not possible to keep the water supplied to the mills diluted or to settle out the impurities. There would also be danger of flooding the mills during heavy storms. The admission of surface water to the hot water channel is equally undesirable. As the mills above the Watuppa dam are already drawing from the river more than the maximum allowable steady draft upon the South Pond it is necessary that the water thus used in the mill condensers be saved and returned again to the pond. The State Board of Health objects to the admission of storm water from the Quequechan watershed to the pond. The separation of the three classes of water has proved so important that in addition to the separation of channels in the conduit the points at which these channels connect with the pond have been widely separated.

In the type of conduit proposed, the cold-water channel is placed at a level wholly below the lowest elevation to which it is proposed to drain the South Pond. The conduit will therefore be kept filled at all times with cold water, and as the water will flow under pressure, it will rise in every mill intake substantially to pond level. In the combination conduit proposed, the cold-water channel can be located at a low level with substantially the same cost as if built at a higher elevation. The avoidance of complex connections is insured by the three-level design. This type of conduit occupies minimum ground area, reducing the cost of foundations. With the single structure, in which the cross floors serve at both top and bottom as conduit walls, a saving in material is effected, with

a further saving from the fact that the two cross floors act as braces. By utilizing for the surface water conduit the space between the hot and cold water conduits that otherwise would be wasted a saving is effected which would at least equal the entire cost of constructing a large, independent surface-water drain along the valley from the Sand Bar to the Watuppa dam.

CONDUIT DESIGN

In the design of the main conduit, except in rock excavation, the base below the level of the bottom of the surface-water conduit is made broad and heavy to resist possible unbalanced lateral pressure on the side and possible upward pressure from water below. But little reinforcement is required here, and the broad base furnishes a suitable distribution of the weight of the conduit over the underlying earth. Above this base the vertical side walls and floors of the surface-water and hot-water conduits are of thin, reinforced concrete construction of an economical type. In the larger sections, where side walls are widely separated, a center reinforced concrete wall is used as an intermediate support for the floors of the surface-water and hot-water channels. Openings are to be provided at intervals in these center walls to equalize the flow. The hot-water conduit is covered with a reinforced concrete roof to protect the public, keep out intruders, to prevent the channel's becoming a nuisance by the accumulation of refuse, and to reduce the liability of freezing. In rock excavation a smaller base section will suffice. Except for variations in size and in the omission in certain cases of the surface-water channel, the branch conduits are in general similar in construction to the main conduit above described.

The usual provision for expansion is to be made in both main and branch conduits, joints being watertight. In addition to the vertical expansion joints provision is also to be made for the expansion of the hot-water conduit independently of the remainder of the structure beneath it. Not only will the hot-water conduit be separated from the surface-water conduit by horizontal expansion joints, but the reinforced-concrete beams supporting the roof are to be cast independently of the walls and the roof slabs are to be independent of both.

BASINS AND OTHER DETAILS

Detailed designs have been prepared for oil-separating and cooling basins, grit chambers, manholes and mill connections. At present the mills above the Watuppa dam, when operating at full capacity, develop a total of about 55,000 hp. and consume about 30,000,000 gal. of water daily, mainly for condensing purposes. At flood times there is no difficulty in securing ample water of satisfactory temperature, but with the limited flow of the stream during dry seasons re-use of the water becomes frequent, with decided disadvantages from the power production standpoint. The scheme proposed assumes that ultimately 125,000 hp. will be developed in the mills, and that a draft of 75,000,000 gal. per day will be required. In general, it will be necessary to provide new channels to carry the water from the present mill condensers to the hot-water conduit. The intake pipes are to be of reinforced concrete, designed to take water from either the cold or surface water conduits or both, and the discharge pipes will be of wooden flume construction for the time being.

The general scheme of construction contemplates the building of the main conduit and its branches in the dry, the site being inclosed by dikes. Continuous service to the mill plants will be rendered throughout the construction period, principally by wooden flumes of temporary character. The outfall sewer will first be built, to drain the excavation for the conduits before their construction begins. Detailed estimates of construction cost have been prepared and are published in the report. Summarized these are: Main conduit, $1,655,945; initial sewers, $290,835; drains for surface water, $162,725; filling flats, 1,260,000 cu. yd., $483,000; total construction cost, $2,592,505. Damages and general expenses bring this to $2,942,505. The estimated total net cost of the initial improvement, taking into account the sale of land reclaimed and assessments, is $1,142,505.

$3,000,000 Needed for Improving Boston's Streets

Report of Finance Commission a Survey of Present Conditions and How They Can Be Bettered—Shallow Granite Block Advocated

RECOMMENDING an expenditure of about $3,000,000 for pavement improvements and advocating a change in grouted granite block construction, whereby a 4-in. instead of a 6-in. depth of block would be used, the Boston Finance Commission, through Guy C. Emerson, consulting engineer, has submitted to the Mayor and City Council a report on the betterment of the city's streets. Since 1913, the report states, there has been a deterioration in the streets, principally in main thoroughfares, and the foregoing sum will be required, in addition to the usual yearly appropriation, to place the street surfaces in a proper condition. Of this amount, about $1,000,000 must be expended to repave portions of the streets between street railway tracks.

PAVING CLASSIFIED

Exclusive of areas occupied by street railway tracks, there was a total of 11,009,322 sq. yd. of pavements on accepted streets in Boston on Feb. 1, 1915. Of this area 2,323,673 sq. yd. was stone block; 175,868 sq. yd. was wood block; 110,863 sq. yd. was brick; 7,825,952 sq. yd. was macadam; 531,074 sq. yd. was asphalt bitulithic; and 41,892 sq. yd. was cobblestone and wood plank. There are about 584 miles of public ways in Boston under the charge of the Department of Public Works, 45 miles of roads in charge of the Park Department, and 250 miles of private ways which have been opened for traffic under consent of the street commissioners, but which are maintained by abutters.

Discussing various forms of paving, the report states that granite block paving filled with a mixture of Portland cement grout and sand could be easily improved and cheapened by using a block of 4-in. depth or less, on a concrete base, instead of the customary 6-in. depth. This would allow smaller joints and smoother surfaces, with improved filling and decreased cost. The extended use of such improved pavements in Boston has been prevented by the need of easy replacement in connection with the work of public service corporations on their underground structures, and the drawbacks of slipperiness.

Up to 1910, the guaranty period on asphalt pavement in Boston was usually ten years, but on request of the contractors this was reduced to five years, as in many other cities. Some of the asphalt pavements laid since 1910, according to the report, indicate that the reduction in the length of the guaranty was a mistake, as extensive repairs have been required. Asphalt has been used to the greatest degree in the Back Bay district. In this part of the city the streets are filled over marsh areas and are continually settling, with consequent breakage of pipes and other structures underground. Constant digging up and relaying shortens the life of the pavement and great care is needed in construction. The asphalt pavements now being laid in Boston are exclusively of the bitulithic type.

WOOD-BLOCK PAVING IN BOSTON

Wood block paving was begun in Boston in 1900 on Tremont Street, between Park and West Streets. The blocks were of long-leaf yellow pine, 4 in. wide on the face and 4 in. deep. This material was saturated under heat and pressure with a mixture of creosote oil and rosin, to the amount of about 20 lb. per cubic foot of wood. The pavements were high-priced, but had more of the qualities of a perfect pavement than any other pavement so far used, with the possible exception of asphalt. The experiments were so satisfactory that large areas have since been laid and are being laid. Unfortunately none of the more recent pavements, the report states, has been as satisfactory as the first. The sample on Tremont Street, now about 15 yr. old, is probably the best wood pavement in Boston, and from present indications it will outwear much of the wood pavement now being laid. Recent experience shows that it is doubtful if the wood blocks now being laid will last 5 yr. with the demands of traffic downtown, as the quality of materials is said to have deteriorated greatly. In some cases the long-leaf yellow pine, an inferior wood, has been substituted for the short-leaf variety. Smaller blocks are laid, 3 in. on the face instead of 4 in., and the standard depth is now 3.5 in. instead of 4 in. On some streets gumwood was tried, but this required too extensive repairs.

Further experiments with brick paving are desirable, especially on streets devoted to various branches of the automobile business.

REPAIRS NEEDED AND COST

The street areas needing repairs on Aug. 1, 1915, covered relaying 84,170 sq. yd. of granite; repaving 199,680 sq. yd. of granite; resurfacing 863,750 sq. yd. of macadam; resurfacing 4510 sq. yd. asphalt; repaving 470 sq. yd. of brick; total, 1,152,580 sq. yd. This means that 10.47 per cent of the total street area is in need of repair. The estimated cost of doing this work per square yard is: For relaying granite block pavement, 0.75 cents; repaving granite block, $4.75; resurfacing macadam, $1.10; resurfacing asphalt, $1.50; and relaying brick, $1.75.

The reasons for the deterioration of the streets since 1913 include decreased appropriations, increased amount necessary to be expended for old-age pensions, decreased efficiency of the day labor force, and decreased liberality of street railways with respect to inter-rail and bordering pavements. In the past ten years the length

of streets to be maintained has increased from 503 to 590 miles, with no material increase in appropriations for maintenance. Non-productive old-age pensions total $44,000 for the present fiscal year. For the present year the amount available for street maintenance is about $1,155,000, or about $237,000 less than for 1914. In 1912 the cost per mile for resurfacing macadam was $8,828, or 72 cents per square yard, and in 1914, $15,847, or $1.10 per square yard. Not over 6 per cent of this item may be due to increase of wages for the labor force amounting to 25 cents per day, taking effect in 1913, and another small percentage to the use of a greater quantity of bituminous binder in the last two years. These two items probably do not amount to an increase of over 15 cents per square yard, between 1912 and 1914, and the greater part of the increase is therefore laid to the inefficiency of the labor force and to poor supervision. This increase in the cost of resurfacing macadam streets resulted for 1914 in the expenditure of 39.8 per cent of the total appropriation for such work, against an expenditure of 28.2 per cent in 1912.

PAVING BETWEEN TRACKS

Many of the streets occupied by the tracks of the Boston Elevated Railway, according to the report, are practically impassable to automobiles and light teams, the traffic being concentrated on the narrow strips on each side of the tracks; deterioration, therefore, is rapid. There are about 188 miles of single track on regularly traveled streets. In the city proper and districts where other than macadam paving is used, the paving of the company's tracks is in general kept in approximately the same condition as the pavements in the remaining portion of the street. In macadamized districts it is the practice of the company to pave an area of the street about 15 ft. wide, in which its tracks are placed, with granite block pavement laid directly upon the soil or upon the ties. Old style blocks, often badly worn, are used. The paving between the ties invariably settles badly.

About 36.1 miles of double track are in such condition that the pavements are not used by vehicles, whenever it is possible to use the sides of the streets. The local area of tracks needing repaving is about 305,000 sq. yd. If this were to be replaced with modern granite or wood block pavement laid on a concrete foundation, the cost would be about $925,000. The remedy appears to be an arrangement whereby the company would discontinue the laying of inferior pavement, repaving and new work being done in harmony with the paving of the adjoining street area. The amount received annually by the city in special taxes from the company, if applied to the maintenance of pavements in streets where tracks are laid, would probably be more than adequate to keep the entire surface of the streets in permanent repair. It would be economical, according to the report, for the city to repave the entire street areas, including those occupied by tracks, to fit the entire street for the use of vehicles, instead of depending on the street railway to pave the track areas in such manner and with such materials as it sees fit. On account of changing conditions in various parts of the city, caused by the invasion of business into residence districts considerable areas of macadam should also be repaved with a permanent pavement.



STEEPEST GRADES CAN BE NEGOTIATED EASILY BY AUTOMOBILES

Build Scenic Highway up Pike's Peak

Forest Service Permits Private Capital to Construct Toll Road Having 19 Hairpin Turns and 10 Per Cent Ruling Grades

AUTOMOBILES can now ascend Pike's Peak, Colorado, over a new 20-ft. scenic highway having 10 per cent ruling grades, a maximum curvature of 96 deg. and hairpin turns of 60 and 40-ft. radii. Starting from Cascade, a small town 12 miles from Colorado Springs on the Pike's Peak Ocean-to-Ocean Highway, the new 18-mile road follows closely the old Government carriage road built by army engineers more than 20 years ago to connect with the observation station maintained at the summit. The road is wholly within the Pike National Forest and was built and will be operated by private capital under rules and regulations laid down by the U. S. Forest Service to protect the public. Its location was shown in a map accompanying brief notes regarding the new route published in the Engineering Record of June 19, page 769.

This is one of the many enterprises which the Department of Agriculture has been fostering to promote the "See America First" idea. Tourists may use their own machines on the new road, but the operating company has provided a fleet of cars running on schedule from Colorado Springs. The Government has insisted that brakes and engines on all cars be inspected rigidly at Cascade and at the summit. Service cars will also patrol the route, and a paralleling telephone line will make assistance quickly available.

RISE OF 6678 FEET

Starting at Cascade, which is situated in the mouth of Cascade Canyon, at an elevation of 7415 ft. above sea level, the 6678-ft. rise to the peak is continuous with the exception of two light adverse grades. More



WIDE-TIRED MOTOR TRUCKS ROLLED ROAD WHILE HAULING SUPPLIES



AT MILE 10 AN IMPRESSIVE PANORAMA IS UNFOLDED



DISINTEGRATED GRANITE IS USED FOR ROAD CONSTRUCTION

than one-half of the distance is on 10 per cent grades, the average ascending grade being 7.4 per cent. The alignment for most of the distance is curved and the average curvature is 40 deg. While the standard width is 20 ft., providing for a double track the entire length, the roadbed is widened to 26 ft. on the sharpest curves, and turn-outs are provided at intervals for observation and repairs. Six water stations are spaced at intervals of 3 miles.

Route Follows Old Road

The first 2 miles constitute one large switchback used in order to gain elevation and enter Cascade Canyon just ½ mile above Cascade. In this section the alignment deviates from the carriage road, adding 1246 ft. to eliminate three bad uncompensated curves and to reduce the grade to 10 per cent. At Toll Gate Point, near the end of mile 2 a center fender or curb of concrete 15 in. high was placed on a sharp turn made at the foot of an adverse grade to separate the opposing lines of traffic. Mile 3 follows water grade up the south fork of Cascade Creek, and in miles 4 and 5 an ascent is made to the divide between this and the Crystal Creek watershed by ½ mile of 10 per cent grade and then a series of 10 per cent and lighter grades. Near the end of mile 5 Crystal Creek summit is gained, and then in mile 6 the creek is crossed at a watering station, where all traffic is inspected. Ascending from this brook the route leads to the next divide, along which is gained the foot of the main Pike's Peak range. In mile 7, after ½ mile of undulating grades, begins the real climb to the foot of the range.

Glen Cove, at the end of mile 11, is a 160-acre tract of fairly flat land, making a natural retreat or resting place. It lies at the foot of the main Pike's Peak range and is at El. 11,450, the last of the timbered area, and furnishes an ideal spot for a tourist hotel for those desiring to ascend the peak at sunset or sunrise.

Ten Switchbacks

Leaving Glen Cove the last ascent to the range for the next 3 miles encounters a series of ten switchbacks or hairpin turns, six in two W's, with two preceding and two following. A 4 per cent compensation is applied to the 40-ft. radius curves and 6 per cent to the 60-ft. radius curves. This alignment is up the nose of the range, and is practically the only route over which the top of the range can be reached, for on all other routes proposed there is sloping country existing at angles of repose which do not afford safe, permanent or economical road-bed sections. This nose lies between the precipices which make up the confines of Glen Cove and the sheer walls of the Bottomless Pit on the east side of Pike's Peak. From many observation points on these curves are visible views of the plains to the north and east, estimated to cover 60,000 sq. miles, an area larger than the State of Illinois. Miles 15 to 17 follow the range on 4 to 10 per cent grades; the last mile contains three switchbacks, by which the summit it gained.

The cross-section of the road-bed is a parabolic curve, tangent to the outside, being 0.4 ft. higher on the outer edge on tangents and 1¼ ft. on curves. All of the sharper out-curves are super-elevated for 15 miles per hour. A surface ditch, dug continuously along the inner edge of the road, leads the water alongside the roadway to culverts. The inner banks are cut to slopes of 1 to 1 or steeper depending on the material, and the outer embankments are 1 to 1½ slopes, ending in dry masonry toe-walls. Masonry parapets for guard rail walls on curves, 2½ ft. high and 18 in. wide, are provided as needed.

Five bridges of 10-ft. span are of the reinforced concrete ballasted deck type with I-beams in the concrete floor slab and the balustrades acting as through girders. They are designed to support a live load of one 5-ton motor truck and two 12-passenger buses, all loaded. They are located only on tangents and can be seen at least 300 ft. away. For smaller openings Armco corrugated pipe culverts set with concrete head walls are used mostly, together with a few concrete box culverts. The minimum "sight distance" has been fixed at 200 ft., except in two places, where 125 ft. has been all that could be obtained. The average is 400 ft.

Surface Is Disintegrated Granite

For most of the way a natural surfacing material existed on the ground. It consists of a disintegrated granite containing various percentages of clay. The proper



MILE 4—ROUNDING TURN ON A TYPICAL BOULDER FIELD

mixture was secured by a distribution of the granite and clay for the mixture by a motor truck. No other road machinery was used beyond ordinary slip scrapers, fresnos and one blade-grader for finishing the grading. Excavating and rock drilling were carried on by hand.

Maintenance began with the completion of the first mile, for all supplies for the camps and all materials had to be transported over the completed road. For this hauling wide-tired White trucks, which acted also as road rollers, were employed. Snow-plows driven by caterpillar tractors are contemplated to lengthen the season as much as possible. Occasionally there are heavy snows on the upper reaches even in mid-summer.

The location and construction was carried out along lines similar to those used in railroad work, the usual estimates, maps and profiles being worked up following the locating survey party. In the latter there were ten men, while the three construction residencies had a corps of three men each.

The grading was done by contract with William Flick of Denver. Bridges, culverts and pipes were built by company force under the direction of Shelby Hare, superintendent of bridges, reporting to A. G. Allan, chief engineer of the Pike's Peak Auto Highway Company. A. E. Palen was detailed by the Office of Public Roads as district highway engineer for the Forest Service.

The road was laid out and designed according to standards set forth by the Forest Service. The requirements of the survey, plans and specifications to be presented and acted upon, and also those requirements for the many various physical features to be used in the construction as well as the general location, were studied and decided upon by the engineer representing the Forest Service before they were approved by the district forester and the construction started. The Government of the United States, acting through the Forest Service, took a very keen and active interest in the promotion of the project and in the prosecution of the construction, as well as in obtaining the highest practical grade of results that were possible to be had with the most economical first cost in order to make the road safe and serviceable to travel and a practicable one to maintain.

Concrete Eliminates Soft Spots in Railway Roadbed

Slabs Easily Placed and More Effective than One-Man Stone for Stretches Where Tile Drains Are Not Feasible

By J. T. BOWSER
Maintenance of Way Department, Queen & Crescent Route, Danville, Ky.

MAINTENANCE-OF-WAY officials on many roads are familiar with the soft spots which develop, due to inadequate drainage, in cuts in roadbed where the material consists of certain kinds of clay. Many of these are scarcely more than a rail or two in length and are usually due to lack of proper drainage. In nearly all cases they can be economically remedied by the use of drain tile, but in some cases where there is only a small place in a long cut, the expense of carrying the tile drain to some point where the water can be disposed of is so great that other means must be found to remedy the trouble. The practice of many section foremen to remedy such places by placing one-man stone under the ballast bed after removing the material in the roadbed to a small depth is, at best, only a temporary remedy, and the place will continue to give trouble each year in the early spring. An improvement of this practice by using concrete has been found to eliminate this trouble entirely, and in cases where this method has been used the improvement promises to be permanent.

The method consists in the casting, in place, of a concrete slab under a part or all of the track where the soft place is located. This at first sounds expensive. No forms are required, however, reinforcement is not absolutely necessary, the mixture is comparatively lean, and work can be handled by the section forces. Consequently the expense is not out of proportion to the advantage gained.

How to Place the Slab

The construction of the slab can be handled quite economically as follows:

The width of the roadbed permitting, the track is lined away about 1 ft. from the side on which the spot gives the trouble. (As a rule these spots affect one side only.) The ballast is then removed from the space in which the slab is to be placed, back about underneath the near rail. An excavation is then made in the roadbed to a depth of from 2 to 3 ft., and concrete is placed in the excavation up to, or a few inches below, the level of the road bed. The inside edge of this concrete is left quite rough to insure a good bond with the balance of the slab, which is placed later.

When this section has set the track is lined back to normal and the ties are blocked up on the completed section of the slab. Alternate ties are then removed to facilitate the excavation under the track. This excavation is usually made back to or slightly beyond the center of the track, depending on the nature of the soft spot. Concrete is then placed in this excavation, care being taken to cleanse the inner edge of the completed section, so that the bond may be as nearly perfect as possible. When the second section of the slab has set, the track is put up on ballast and the outer edge of the slab is covered with earth so that no difference in the roadbed is shown.

If the material in the roadbed is very soft, longitudinal reinforcement may be necessary, but as the ballast seems to distribute the load quite evenly, there appears to be little chance of the slab breaking. In fact, little trouble would result from such breakage, as the weight of the slab would probably hold it practically in place.

This construction is hardly adapted to long soft places, but for pockets of a rail or two in length it seems to serve the purpose admirably. While these pockets usually give trouble only on one side of the track, but where both sides are affected, the operation can be repeated from the opposite side. The ballast is thus given a solid bearing, and with the loads distributed over a large area the soft material is not so readily displaced and there is little or no settlement.

THE LOUISIANA HIGHWAY DEPARTMENT, in its latest annual report, recommends that the one-fourth of one mill tax be increased to one mill. The present tax, which is the department's sole source of revenue, amounts to $125,000 per year.

Urges Treatment of District of Columbia Sewage

In Latest Annual Report Superintendent Asa E. Phillips Discusses Plans for Sewerage District and Waste Utilization

RECOMMENDATIONS for the installation of sewage treatment works and the creation of a metropolitan sanitary district are the chief features of the annual report of Asa E. Phillips, superintendent of the sewer department of the District of Columbia, for the fiscal year ending June 30. Mr. Phillips says, in part:

An important part of the year's work involved a preliminary study and outline plans for sewage treatment works for the District of Columbia. This work has been advanced on account of the great importance of securing a suitable site in advance of development in the very limited area within which these works must be located. Several years will be required for the development of the plans for the works, but it is considered essential that a suitable area of sufficient size for future development be secured without delay.

Not less than 12,000,000,000 gal. of untreated sewage was discharged into the Potomac River by the District of Columbia during the past year. Hundreds of tons of removable organic and other matter, possessing a certain economic value, represents part of the burden carried by the river waters under the existing method of sewage disposal. With the increasing population and the growing demand for greater refinement in the disposal of the sanitary waste of cities it is believed not too soon to begin the preparation of plans for sewage treatment works for the removal and utilization of this waste material.

The pollution of streams discharging from adjacent Maryland towns is now very apparent and is steadily increasing. The subject has been a matter of investigation by the Maryland State Department of Health and the Bureau of Sanitary Engineering and a comprehensive report advising the creation of a sanitary district and providing for measures of relief in co-operation with the District of Columbia was submitted to the State Legislature at its session January, 1914, but no legislative action was taken on this report. In view of the legislative action authorizing the Maryland State Department of Health to order the installation of sewerage systems in towns bordering on the District of Columbia, it is considered advisable that legislative authority be obtained from Congress authorizing the Commissioners of the District of Columbia to enter into agreement with the State authorities to secure the abatement of these conditions, which within a comparatively short period, it is believed, will become sufficiently serious to constitute a nuisance.

The interests of the District of Columbia are so immediate and the conservation of the purity of these streams so important as a measure of protection to the great national parks through which they flow, that in the interest of public health and sanitation it is necessary that some adequate remedy in the form of a metropolitan sewerage district be applied.

THE MANUFACTURE OF CEMENT IN CALIFORNIA plants where electrical energy is used is estimated to require an average of 1 hp. per barrel of cement produced.

Virgin Country Renders Concrete Pipe Line Construction Difficult

Central Casting Yard Supplied Lengths for 42-Inch Line More Than 27 Miles Long — Narrow-Gage Line Transported Sections to Place

By BOYD EHLE, M. Am. Soc. C. E.
Of the Sanderson & Porter Engineering Staff—Resident Engineer, Sooke Lake Water-Supply System

IN AN EARLIER article (see the Engineering Record of Oct. 2, page 406) the writer described some of the features of the new Sooke Lake water-supply system for Victoria, B. C., and gave costs on some of the work. The chief feature of interest in this project was the reinforced-concrete flow line made of lock-joint pipe, 42 in. in diameter, and used up to heads of 90 ft. with satisfactory results. The line is 27.3 miles long, winding through inaccessible mountainous country. This article will discuss the construction of the concrete line.

EXCAVATION

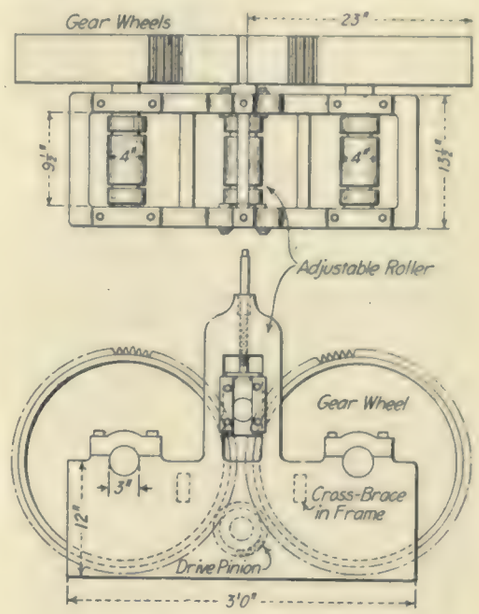
When the use of a wood-stave pressure conduit was found inadvisable, the reinforced-concrete pipe was built as a flow-line conduit laid on an 8-ft. roadbed, excavated along the grade contour. This increased the estimated quantities of excavation to 270,000 cu. yd., 47½ per cent of which was earth. The original contractor did 80 per cent of the earth and 95 per cent of the rock before his failure. As much as possible of the grading had been sublet to station men. The work, except for a few through cuts, was generally side-hill excavation and only the usual simple hand tools that could be easily packed in were used. At the deep cuts light cars and track were used. The rock for about 2½ miles from Sooke Lake was schistose and the remainder hard trap.

When the engineers took over the work, the excavation was pushed to completion as rapidly as possible. Track material and equipment were ordered for a 2-ft. gage construction railway on the flow-line grade, for which temporary log trestles were built across the drainage crossing. A cable incline tramway, 2225 ft. long, with a rise of about 450 ft. was built to give access to the flow-line grade at Coopers Cove, a point about 17½ miles from Sooke Lake, the head of the line. Yard tracks at the foot of the incline ran to a wharf on tidewater at Sooke Harbor, and extended through the pipe manufacturing plant. Three 10-ton donkey engines and about seventy flat cars were used. About twenty-five of these cars had been converted from dump cars used in the excavation, and the remainder were built as required.

CONSTRUCTION TRESTLES

The plan of the temporary trestles is shown in one of the drawings. These trestles were rapidly and economically erected by handwinch power and a truss boom (also illustrated herewith) on rollers. The bents were framed on the ground and lifted to place. These trestles were located close to the downstream side of the permanent concrete trestles. The only sawed pieces used in the trestles were the 4 x 6-in. bridge ties and guard rails. All the important trestles had water barrels, were floored, and had sand filled in between the tracks for protection against fire from the engines.

The construction track was of 20-lb. rail and split ties of Douglas fir on rock ballast.



RAIL BENDER FOR CONSTRUCTION TRACK

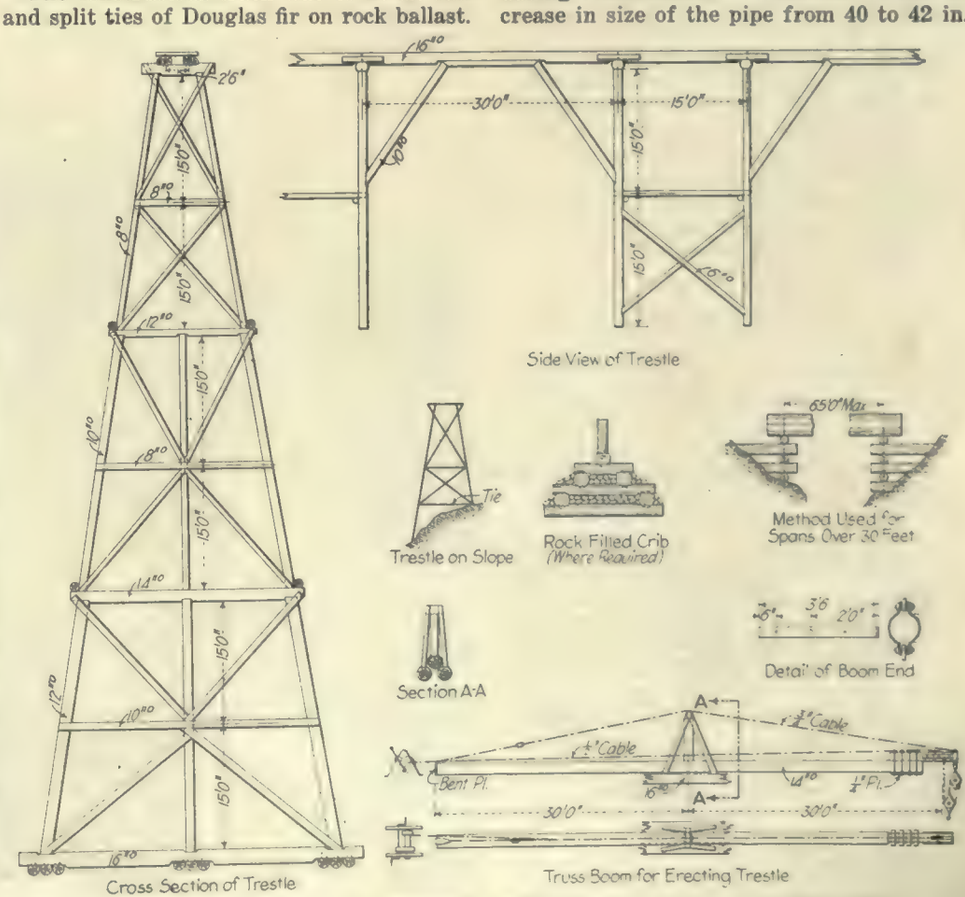
Side tracks were cut in wherever they could advantageously expedite the work. For the curves the track rails were bent by the primitive but very effective way of laying them on abutments, bending them with levers at the quarter points to the required shape and hammering them from each end up to these points until they took a set.

CONCRETE TRESTLES

As fast as the railway was available the concrete aggregate, reinforcement bars, lumber, etc., were hauled out and the permanent drainage structures were started. The concrete trestles, generally on sharp curves, were the chief item, and several small modifications were made in the plans during construction. On account of the increase in size of the pipe from 40 to 42 in.



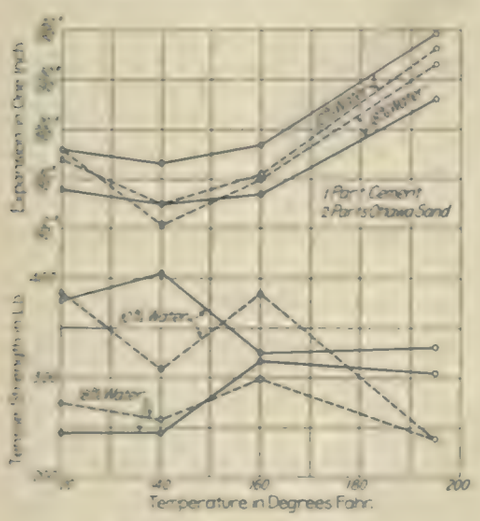
ROUND TIMBER TRESTLES BUILT FOR TEMPORARY WORK



TRESTLE BENTS, ON 30-FOOT CENTERS, WERE ERECTED WITH A TRUSSED BOOM

four saddles were used on the 15-ft. spans and the reinforcement increased. The span was increased to 30 ft. over the large creeks. The trestle legs were made 12-in. square throughout, in order to avoid the difficulties and uncertainties of making the reinforced concrete in smaller sections in the long posts.

As the work was extensive it was carefully systematized. The first gang excavated the footings and set the concrete foundation pedestals, followed by the carpenter gang erecting the forms, then the



CEMENT MORTAR TESTS

Full lines indicate briquettes steamed for three hours immediately after mixing.
Dash lines indicate briquettes set in air for three hours after mixing and then steamed three hours.
All briquettes placed in water, one hour after steaming, for remainder of period.

steel erecting gang, and finally the concrete gang. The forms were made as simple as possible to knock down for use again. All steel for the legs was made up in units and erected entire. The concrete gang had a 4-cu. ft. Little Wonder mixer with loading attachment, mounted on wheels. The mix was delivered to concrete buggies, running on the deck of the trestle forms and chuted to place through 10-in. sheet-iron pipes. The concrete trestles with the concrete pipe in place made a fine show and, all in accord with the permanent character of the concrete dams, were particularly pleasing to the city officials and taxpayers.

CONCRETE PIPE

After the failure of the original contractor, the city relet the work of fabricating and laying the 42-in. concrete pipe to the Pacific Lock Joint Pipe Company, of Seattle. Although concrete pipe heretofore had been extensively used in sewer work, no job of like magnitude and difficulty had been undertaken for a water-supply conduit, so that former methods were found inadequate and the new ones initiated by the contractor were gradually changed and sifted down to an efficient system, interesting and productive of excellent results.

The contractor first graded the pipe yard at the foot of the cable incline and adjacent to the wharf at Coopers Cove. An excellent concrete aggregate was delivered in scows from the Albert Head deposit to the Coopers Cove wharf and unloaded into storage by a derrick and grab bucket. Vancouver Island Portland cement was delivered in sacks direct from the mill to storage warehouses on the wharf. A 1:2:4 mix was used for the pipe, with the coarse aggregate limited to ½-in. diameter gravel.

There were 75 sets of forms, with 216 bases for the flow-line pipe having 3-in. shell, and 12 sets of forms with 32 bases for the siphon pipe having 4½-in. shell. All pipe was fabricated in 4-ft. lengths. The reinforcement used in the flow-line pipe was style 6, triangular mesh made by the American Steel & Wire Company, which has 0.043 sq. in. of ring reinforcement in sectional area and 0.025 sq. in. longitudinally per foot of pipe wall. Square steel bars were used for the ring reinforcement of siphon pipe according to Table 1.

Six 1⅜-in. square bars were used longitudinally and the ring reinforcement was spaced by light longitudinal wires, so that it would not be moved when tamping the concrete.

FORMS

The inner and outer forms are of 3/16-in. plate. The outer form is in three and the inner in four equal cylindrical sections. On these sections are riveted short angle-iron lugs to hold the spacing and clamping rings that stiffen the forms. The sections of the cylindrical form are held together at the seams by the lap and by short slotted angle-iron clamps that drop over a rivet head on each section of the forms.

The pipe is cast with the bell end down, and to leave the projecting wire for the Merriweather lock joint, the reinforcing ring is set in an annular space of the base plate which is then filled with sand. A separate short reinforcing ring is placed outside to reinforce the projecting bell. A circular sheet-iron plate is placed on the top of the forms on which the concrete is dumped and the tampers stand. The concrete is distributed from the plate to the annular space between the forms by a sweeping push of a shovel. The tamping bars are like heavy hoes with a shank about 4 ft. long and the blade bent in line with the shaft. The tamper puddles the concrete and forces the coarse aggregate away from the forms.

It was found at first that the forms had a tendency to spring at the seams, causing unequal thickness of shell which made offsets at the joints in laying. Various schemes were tried to obviate this trouble and finally light wood cross braces at right angles were used inside the forms, placed against the seams. At the top, bent spacing hooks were hung in the annular space to give the precise thickness of shell.

TABLE 1—BAR REINFORCEMENT FOR SIPHON PIPE

Head, Ft.	Spacing, In.	Size, Sq. Bars, In.
0–20	3½	¼
20–40	3½	⅜
40–60	4½	½
60–80	3½	½
80–100	4	⅝

These were removed when the pipe was moved to the steaming shed.

Three special bevel pipes were used in laying the curves, made by dropping the spigot ring on one side to give ¾, 1½ and 2¼-in. taper in the diameter of the pipe. These bevel pipes made all the curves of the line layout with a limiting bend of 3 deg. at the joints without leaving any appreciable roughness.

STEAMING

An interesting and critical feature of the contractor's work occurred in the use of steam for quick curing of the pipe in order to economize in the number of forms and yard space. In the first layout of the plant, separate mixers were used at three points, fed by scoop measuring barrows with sheet-iron partitions. The mixed concrete was wheeled up an incline to a platform along which at right angles ran the movable platform on rails, high enough to pass over the forms. Canvas tarpaulins, fitting over four pipes, were then placed and steam allowed to leak from perforated pipe under this hood for about 2½ hr., when the pipe was dumped off the base and rolled out in the yard on plank runways to cure. The steaming temperatures ran up to 180 deg. Fahr. or more, which, at times, caused



MOLDS FOR CONCRETE PIPE BEING FILLED IN THE CASTING SHED



AMPLE SPACE WAS PROVIDED FOR CURING THE PIPE SECTIONS

trouble, as the heat from the chemical action of setting tended to boost the temperature over the boiling point. A drawing herewith shows the characteristics of steam briquettes. These early methods led to a large number of cracked pipes being culled by the inspectors.

CENTRAL MIXING PLANT

With the advent of a new superintendent, the plant layout was remodelled, making a central mixing plant (see drawing) with three mixers under storage bins at the wharf. These fed measuring boxes that were tipped into the mixers. Adjacent to the mixer plant was the mixing platform with tracks on both sides, on which were placed the flat cars carrying the forms. The tampers worked on each side of the platform alternately. As the molds on one side were full, the cars were hauled into the first steaming shed and given 3 hr. steaming with the forms on, then hauled out to the stripping platform at the far end where the forms were stripped. The pipe, setting on its base on these cars, was then hauled into a second shed and steamed for about 4 hr., after which they were lifted off their bases by a chain block traveling on a light gantry crane. The cable from the hook of this block passes through sheaves at the ends of a sheet-iron band for lifting and tilting the pipe on the side for rolling out in the yard.

The new scheme of work produced good results and the number of culls was very small. The surface of these pipes was very smooth. At times there was small pitting, the cause of which remained obscure, although the subject of wide speculation. It apparently was due to some obscure conditions of the oil used in coating the forms in combination with temperature conditions and other factors. They appeared and disappeared without any definitely assignable reason. This effect was generally negligible. A little thin mortar was at times wiped into them if they were too noticeable. Generally, "skid" oil was used in wiping the forms, although other combinations were experimented with to stop the pitting. After curing in the yard two weeks or more, depending on the degree of cold, the pipe was rolled to a chain block gantry and loaded onto flat cars with longitudinal pillow slats on the side built up to conform to the curve of pipe.

TRANSPORTATION

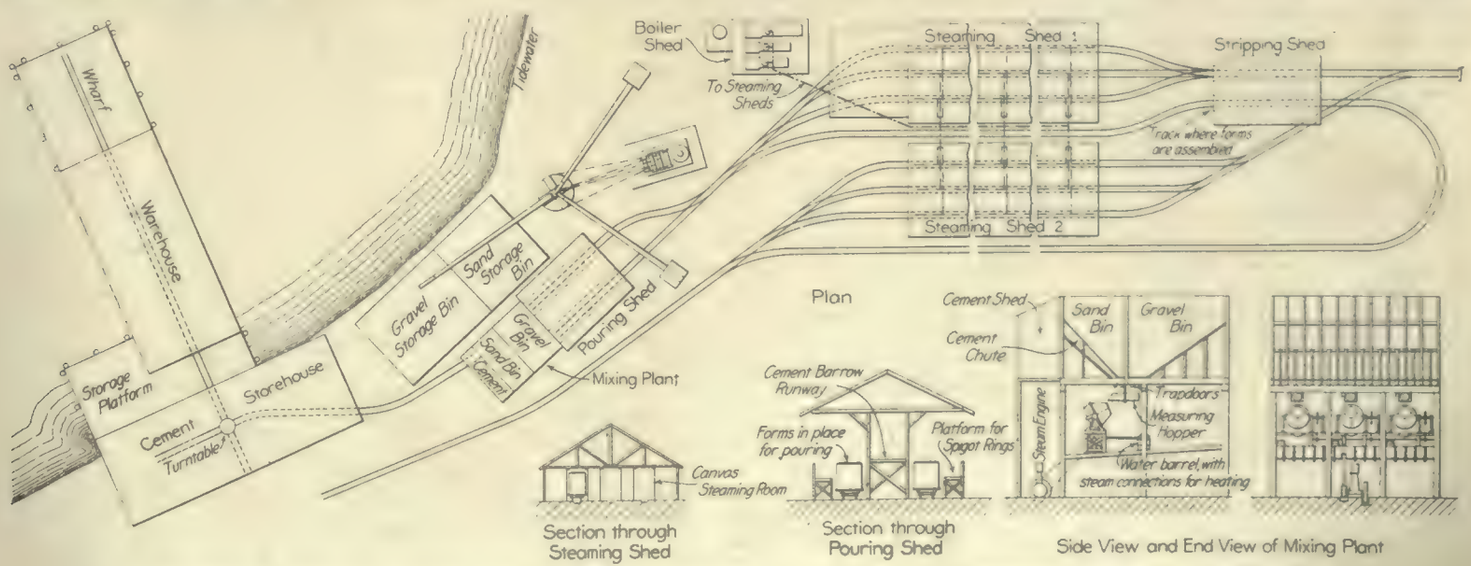
In the early stages of the work, when the contractor was looking for the causes of the culls, various methods of padding the pipe against shock in transportation were used. The trouble, however, was due generally to inadequately cured pipe, damaged by handling in the yard. It was realized later that there were no transportation troubles with well-fabricated and cured pipe. From 150 to 160 four-foot sections of pipe were made each 8-hr. shift.

From the Coopers Cove yard at the head of the incline the pipe trains were run each way to the end of track and unloaded onto the ties, after the rails were taken up, by chain blocks hung from pipe tripods. The pipe was rolled to place at the end of the conduit along the ties laid end to end along the grade.

LAYING

Various attempts to use an overhead trolley system for laying the pipe were disappointing, chiefly because of the numerous curves in the line, and a pipe tripod with a chain block having a long horizontal pipe-laying hook was finally used. This hook worked well on the straight pipe but too much time was lost in fitting the specials to place, as they generally had to be revolved on their axis to match the bevels. A suggestion of the consulting engineer, Mr. Meredith, to use rollers on a rod in the hook, operated by a handle, was tried, expediting the laying and giving better jointing. The pipe was lined in by the foreman approximately to the center line. Each pipe section was set to grade by a levelman and held in place while being tamped up tight with ballast bars. A hole was broken in the top of the pipe shell for pouring in grout. Back of the pipe-laying gang, thin flat jointing bands, 6-in. wide, were placed over the inside of the joints of the pipe and expanded to place by a cam lever. The invert part of the jointing had to be put in by hand as the grout would not run across it. Grout was then poured in from a coal scuttle back of the bands and allowed to set. When the liquid was removed, the joint work was scraped and plastered.

Laying the six siphons with 4½-in. shell pipe introduced no exceptional features.



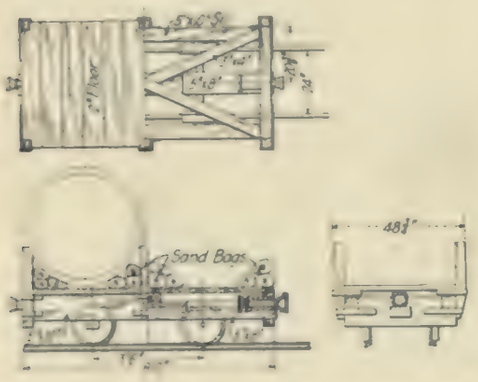
PLANT FOR MAKING CONCRETE PIPE WAS CHARACTERIZED BY ROUTING ARRANGEMENT WHICH AVOIDED DELAYS

Skid timber tracks were laid down the slope on which the pipe section, mounted on sleds, were skidded to place. Small guyed shear-legs were used in jointing the pipe. All siphons were anchored heavily at the foot of the inclines on either side of the valley to prevent creeping downhill. An interesting feature of the trestle design at the siphons and elsewhere was the use of saddle blocks with a grouting recess. These blocks were tied together by long rods and were free to move on the concrete crossbeams to accommodate temperature movements.

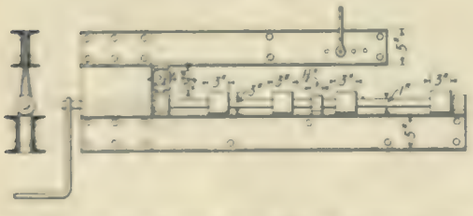
OBSERVATIONS ON MAKING AND LAYING LOCK-JOINT CONCRETE PIPE

These observations on the making and laying of lock-joint concrete pipe may be of service to others having it to do.

Manufacturing.—First see that the forms are well cleaned, then well oiled with a mixture of about one-half green skid and one-half black oil. Be careful that this coat of oil is thin enough, but not too fluid. See that the forms are set perfectly



SMALL CARS TRANSPORTED THE PIPE SECTIONS ALONG THE GRADE



THIS HOOK ALLOWS PIPE TO BE LIFTED AND TURNED ABOUT ITS AXIS SO TOP IS UP

cylindrical and well braced to remain true when concrete is tamped in them. See that the shell space is of even thickness on all sides, and that the form sits properly on the base so that the bell is of even thickness on all sides. See also that the spigot rings are properly placed so that the spigot is of even thickness on all sides, and that the lock-joint mesh projects its proper distance in both the bell and spigot, so as to avoid trouble in laying.

Pour a small batch of mortar first, continuing with the regular concrete mix to the last foot at the top, and then stiffen the mixture. The concrete should be extra well tamped or puddled to eliminate air bubbles and secure an extra smooth surface. When pipe is steam cured about 135 or 150 deg. is the most satisfactory temperature. Steam about 3½ hr., then strip the forms and steam again for 3½ hr. This applies to a 3-in. shell; the time would vary with the thickness of shell. When steam cured pipe should be kept well sprinkled and not laid until it is at least two weeks old. The required time of curing varies with the temperature.

In removing the pipe from bases it should be raised vertically about 1 in. and the base should be jarred loose by tapping evenly on opposite sides, after which the pipe can be raised up by the chain blocks until it clears and then turned over on its sides and rolled to the yard for curing. See that the bell and spigot are properly curved to avoid breakage.

Laying.—The pipe should be carefully laid to the proper grade and set with a Wye level, and the general alignment should be kept as near as possible to the exact center line of the grade.

Care must be taken that the pipe is well packed under the full half circle when laid in trench and backfilled. When laid without backfill the full under quarter circle must be well packed with ballast. See that the part directly under the pipe is well filled and tamped, leaving no vacant spaces.

On the inside the pipe must line with each other perfectly at the joints to prevent roughness of the inside surface, which would affect the flow. If there are any irregularities in the pipe circumference these should be laid on top where they will cause the least resistance to flow.

Jointing.—Joints should be well pointed up on the outside at least 24 hr. ahead of pouring. They should be well cleaned, washed out and wet down with water before pouring concrete. The locking wires must be well straightened out in place. Care must be taken that they have their proper lap. When the wires are too long and will not properly lie flat in the bell they should be cut loose from the head wire and wound around it at the proper distance. Wires should extend as near perpendicular as possible from the spigots and bells. Where loose ballast is used and the pipe cannot be pointed on the under side the bottom quarter of the joint can be put in with a stiffer mortar and worked down in place to insure getting it well in between the spigot and bell and leaving no voids or loose mortar.

The inside band form is then placed, the sides well clayed up to prevent leakage. The joint is poured with a sloppy mortar that will readily run into place. This should be puddled with a soft No. 8 wire to insure its settling. As soon as the joint is set sufficiently remove the band and scrape down the joint until it is slightly below the surface of the pipe. Then wet the joint down and plaster a thin coat of neat cement over it until it is a trifle above the surface of the pipe, leaving the cement to set until it is fairly hard. Then scrape the plaster down even with the surface of the pipe, and rub well with a coarse sack or brush. If the pipe is a little hollow on the side of the joint the plaster should not be permitted to run out over the smooth surface of the pipe.

In making pressure joints the smooth surface of the pipe should be chipped off for about 1½ in. each side of the joint and about ¼ in. deep before the joint is poured. The joint must not be filled beyond the chipped part. After the joint sets the entire recess is filled with a neat cement plaster a little above the surface of the pipe and then scraped off and finished the same as the regular joints.

The pipe should be well cleaned of all construction dirt and waste, as there is usually enough unset cement in this refuse to make it adhere to the bottom of the pipe.

TABLE 2—COSTS OF CONSTRUCTING 42-IN. CONCRETE PIPE LINE

Earth Excavation, Flow-Line Grade (128,590 Cu. Yd.)

	Per Cu. Yd.
Labor	$0.543
Materials	0.036
Camp	0.011
	$0.590

Rock Excavation, Flow-Line Grade (141,647 Cu. Yd.)

	Per Cu. Yd.
Labor	$1.24
Supplies	0.46
Camp	0.09
	$1.79

Concrete Trestles, Flow-Line, 1120.67 Cu. Yd. Concrete; 93,700 Lb. Steel Rods

	Per Cu. Yd.
Cement	$3.50
Sand	1.70
Gravel	3.20
Steel	2.80
Forms	10.09
Mixing and placing	3.14
Placing steel	1.21
Moving plant	1.16
Cleaning up	0.65
Sum	$28.68
Excavating footings	2.20
	$30.88

Two-Ft. Gage Track, 20-Lb. Rails

	Per Mile
Rails	$1,513.00
Laying	348.00
Ties	171.00
Ballast	318.80
Plant charge	240.70
Material	129.60
Camp	100.90
	$2,722.00

Reinforced-Concrete Pipe, 42-In. Diameter; 3-In. Shell; 144,000 Ft. (From engineers' cost accounts)

	Per Ft.
Fabrication	$0.7529
Material	0.8294
Laying	0.4168
Hauling	0.3062
Construction railway	0.859
Sum	$3.1643

Table 2 gives the cost of the pipe line work, taken from the records kept by the engineering force.

PERSONNEL

The work was done under the direction of C. H. Rust, M. Am. Soc. C. E., city engineer and water commissioner of Victoria. Wynn Meredith, a member of the firm of Sanderson & Porter, of New York and San Francisco, was consulting engineer, and the writer was resident engineer.

TURBULENCE EFFECTS REAERATION of streams with depleted oxygen content, and several "boils" or mere overturns are considered more efficient than a single large fall. The conclusion is one reached from the investigations now being made by the U. S. Public Health Service on the Ohio River. Reaeration is conditioned among other things upon the degree of turbulence of the stream. In quiescent water a diffusion gradient is established which practically stops reaeration. The effect of dams and rapids in increasing aeration is not so much dependent upon the momentary exposure of the water but is largely due to the mixing action whereby the diffusion gradient is broken up and reaeration permitted to proceed. In artificial canals turbulence is avoided as largely as possible. The effect of a single dam upon reaerated water has been shown to be equivalent to a large increase in initial dilution. Where dilution is for any reason limited, the capacity of sluggish and non-turbulent streams can be greatly augmented by providing an artificial turbulence at certain points in their course. Such turbulence need not be of the character of a fall, nor need it cause a serious loss of head.

How Shall Patented Materials or Processes on Public Works Be Handled?

George C. Warren Takes Issue with Views of S. Whinery as Expressed in Recent Article in Engineering Record—Mr. Whinery Replies

IN the Engineering Record of July 17, page 73, there was published an article by S. Whinery, consulting engineer, of New York City, dealing with the relations of contractor, State or city and patentee of materials or processes used in public works construction. Mr. Whinery called attention to abuses existing under present conditions, where the contractor deals directly with the patentee, and, as a remedy, advocated the payment of all patent royalties by the State or city. To Mr. Whinery's proposal, George C. Warren, president of Warren Brothers Company of Boston, which controls the patents for Bitulithic pavement, has taken exception. Mr. Warren's communication is given below and is followed by Mr. Whinery's reply.—EDITOR.

George C. Warren's Letter

The full text of Mr. Warren's letter follows:

"In an article on patented processes and materials in public work, published in the Engineering Record of July 17, page 73, S. Whinery makes the points briefly outlined as follows:

"1. Forcefully outlines the inherent right of the patentee to the monopoly of his invention: 'An invention protected by a patent is as much the property of the patentee as his real estate or his chattels. Neither his neighbor nor the public may deprive him of such property, nor can the State appropriate or use his invention without his consent.'

"2. Properly objects to the patentee having a monopoly, through his patent, of portions of the general construction not covered by the patent. This objection is overcome by the Bitulithic license mixture agreement invariably filed with all municipalities desiring to lay the Bitulithic pavement, offering to deliver that portion of the pavement covered by the patent; i.e., the Bitulithic surface mixture, manufactured and delivered hot at the mixing plant of the patentee, at a uniform price to any contractor who may desire to bid on the contract as a whole.

"3. Outlines a danger of fixing in advance a price for the patented article that the patentee is not a party to the paving contract and is not required to furnish material under certain specifications.

"In the case of Bitulithic license mixture agreement this danger is overcome because that agreement provides that the material shall be manufactured according to the specifications of the paving contract, just as the manufacturer of paving brick, although not a party to the paving contract, is required to manufacture and furnish product in accordance with the specifications thereof, the only difference in this respect being that in the case of Bitulithic the municipality makes a definite binding contract for the manufacture with the party who is most experienced, most responsible and most interested to accomplish success in the manufacture of that particular article; i.e., the owner of the patent, whose very existence depends on integrity of result.

"4. Recommends that the State or municipality, as the case may be, contract direct with the owner of the patent for the use of the patent on a royalty basis.

"Mr. Whinery overlooks the facts that:

THE "FLAT ROYALTY" BASIS

"A. It seldom happens that any patent is successfully developed on a 'flat royalty' basis, and this is especially true when the patent covers a manufactured product requiring skill, experience, heavy plant investment, technical knowledge, and, last but not least, an inherent interest vital on the part of the manufacturer in the success of the product.

"In many cases the inventor personally receives only a fixed royalty but almost invariably in such cases he has surrendered the right of manufacture to one or more parties equipped to properly handle the development and they are granted, by the inventor, the right of manufacture and sale, which the Government has bestowed on the inventor. If there has ever been a case of successful development under any patent on the basis of the inventor surrendering his right of manufacture to the public on a 'flat royalty' basis, we have never heard of such a case. On the other hand, it can be readily shown that in the case of municipalities which have insisted on such surrender of right of manufacture to the public and the demand has been locally acceded the development under such license has been either nil or the results very unsatisfactory to the public.

"It is very certain that in the case of the Bitulithic pavement it would have never even secured a successful start and would have 'died a-bornin' if its manufacture was subjected to the ruinous competition of either inexperienced manipulators or the powerful competitive interests which, as it is, have expended hundreds of thousands of dollars in every conceivable way, however unfair, to defeat and prevent its success.

SUCCESS OF INVENTIONS

"B. To make a success of a new invention requires the combined and constant application of financial interest and investments; sacrifice of time and ability, and absolute faith in and desire for final success, notwithstanding many discouragements which are certain to come, however little they may be foreseen and however much they may come from unanticipated sources or causes.

"All of this is well recognized in the Federal constitution and laws with respect to patents, in giving the patentee the 'exclusive right of manufacture and sale' for a period of seventeen years—a period which the law contemplates is sufficient to enable the patentee to overcome such obstacles, perfect his invention and give him a reasonable opportunity for return for the valuable product of his 'brain and brawn' which after the brief period of seventeen years, he dedicates to the public.

"C. However important may be the question of ultimate competition in the manufacture of the patented article the fostering care of the Government during the period of development and discouragement is vastly more important and is well recognized by the patent laws of every civilized government of the world, which has made any substantial progress in development during the past two centuries. In no case does any considerable portion of the public object to the operations of a patent during its development stage—the period of anxious worry on the part of the patentee. It is only after the patentee or his licensees have invested their capital and energy at great risk and have proved the practical success of the article and begin to get returns on that investment, that a portion of the public reach a period of thought that the patent is iniquitous, that there is nothing new or patentable in the 'so-called invention,' and that the public always has used the invention now so common and well understood. Such thought on the part of a minority is almost universally engendered by the competitors of the patented article, who would not have been willing to take the necessary risk of development, but, at this stage of proved utility and success, chafe under the conditions that they are not reaping any part of the advantage which the Government has granted to the inventor.

TROUBLE IN STATE PARTICIPATION

"Mr. Whinery's suggestion that the State pay a royalty per unit, and that the patentee himself can bid with other contractors on the same basis for the work, carries with it more trouble than the present method of a license agreement and at the same time does not improve the condition. Assuming that a certain royalty has been arranged with the State, the amount of this royalty is just as much subject to favoritism on the part of the patentee as it is if the royalty is simply paid by the contractor or included in the price paid for the manufactured patented article. Furthermore, the State may accept a royalty and not specify the material at all, thus entirely excluding the patentee's profit, or the contractors may, in order to defeat the patentee, refrain from bidding on such patented construction unless the patentee is permitted to protect his interest by himself bidding for the whole work.

"A State royalty, strictly speaking, does not put the contractor on equal basis with the patentee for the patentee can always be willing to take less profit than the actual royalty which will have to be paid by the contractor and thus secure the work. It stands to reason, however, that the contractor is not going to forego his assured income from royalty and bid less than a reasonable profit for the completed work. Consequently there is an equitable basis of competition between the general contractor and the patentee if the patentee elects to bid for the construction in which his patent is used.

"The courts have decided this question as shown by the following extract from decision of the Supreme Court of Louisiana:

" 'Where such a document is filed all prospective bidders are placed on the same footing, and the situation is precisely the same as if a patented process did not have to be used, except that 25 cents per yard additional must be figured into the cost of fulfilling the contract. But all competitors are under the same necessity of making this addition to their estimate, and hence no inequality is created.'

"Again a competitive contractor may purposely lay bad work in order to de-

stroy the good name of a patented construction or he may not have the necessary skill and experience to insure high grade construction. The only adequate protection that the patentee has is to supply the material to all responsible contractors at a fixed reasonable price and have the same manufactured under their direction."

S. Whinery's Reply

A copy of Mr. Warren's letter was submitted to Mr. Whinery, whose reply follows:

"I am pleased to have the opportunity to read and comment upon the communication from George C. Warren, relative to the article prepared by me on the subject of the use of patented materials and processes upon public work. The purpose of that article was to consider and suggest a preventive remedy for the abuses that have crept into the practical use of patented articles and processes upon public work, and especially upon road and pavement work.

ABUSES EXIST

"Mr. Warren's comments on the article are in the nature of a plea for patentees in general, with special reference to one patented pavement. That the abuses, some of which I referred to in my article exist, no one will deny. There are unscrupulous and dishonest as well as honest patentees and contractors, and the public officer must guard the public against the machinations of the former class, even though some hardships result to the latter. (Here, as in the previous article, I use the word 'patentee' as embracing his agents, licensees or assigns.)

"By far the most important, because the most serious in results to the public, of these abuses is the practice, under cover of patent rights, of the patentee himself, or in collusion with unscrupulous contractors, extorting excessive and unreasonable prices and profits from the public, by well known schemes outlined in my article. Mr. Warren does not allude to this phase of the subject, though it must have been in his mind. It would be interesting to know his views about it, and whether he has an effective remedy to suggest.

FILING OF PRICE INEFFECTUAL

"It is certain that the public filing of a price at which a patented article will be supplied to all contractors is ineffectual unless some way can be devised to insure that the price named is a minimum, or that will prevent the patentee from secretly naming to a favored contractor a price so much below that publicly named as to give that contractor a controlling advantage in bidding, if not to create a real monopoly. Had the Court, whose opinion Mr. Warren quotes, been advised of the fact that this device of naming a price for all contractors is, in fact, often successfully used to defeat its avowed purpose, the decision would probably have been different.

"Mr. Warren expresses the opinion that the remedy proposed by me—the payment to the patentee directly by the State of an agreed upon royalty—would lead to more trouble than does the present practice, intimating that the royalty received might be shared with a favored contractor. It is difficult to understand what benefit the patentee could derive from such a division of the royalty; presumably the work would be awarded to some contractor and the patentee would get the full royalty. Furthermore, competent officials would not agree to pay a royalty so excessive that the patentee could afford to divide it with any contractor, or which, if so divided, would materially affect the prices bid.

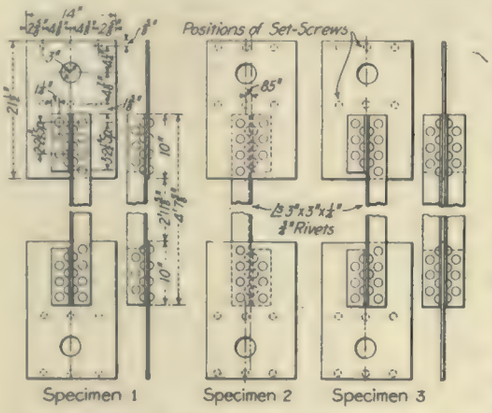
"If Mr. Warren, in the paragraph marked C, really means to say that the public should submit to being defrauded by unscrupulous patentees and contractors in order to afford opportunity for the development of any invention, however important, few will agree with him. In so far as he urges such fair, just and even liberal treatment for the patentee and his inventions as is consistent with the public welfare, no right-minded person should disagree with him."

[*In an early issue the phases of this subject, as they relate to patents for concrete bridge construction, will be discussed by Daniel B. Luten, with a reply by Mr. Whinery.*—EDITOR.]

Tests Prove Lug Angles Valueless for Insuring Uniform Stress Distribution

Measurements of Variation in Strain Across Single and Double Angle Specimens Under Tensile Stress Reported by Professor Batho

THAT LUG ANGLES for the end connections of angles to gusset plates really serve very little useful purpose and that the slight effect which they have cannot be predetermined is one of the conclusions reached by Cyril Batho, assistant professor of applied mechanics, McGill University, Montreal, as the result of a series of tests



SPECIMENS USED IN EXPERIMENTS

reported in a paper in the August issue of the *Journal* of the Franklin Institute. The simplified form of mirror extensometer used gave results of great uniformity and accuracy, reading to 0.00001 in. He concludes that the usual assumption of planar distribution of stress is justifiable for such members as were tested, and that the ordinary theory may be applied to an analysis of stress distribution across such members.

Reference is made to a previous paper by the author published in the *Transactions* of the Canadian Society of Civil Engineers, Vol. 26, page 224, and to the theory of eccentric stress developed by Prof. L. J. Johnson in the *Transactions* of the American Society of Civil Engineers for 1906, page 169. The tests reported by Professor McKibben in the *Proceedings* of the American Society for Testing Materials, Vol. 6, page 267, and Vol. 8, page 287, are cited as showing similar results for the effect of lug angles when such tension members are tested to the breaking point.

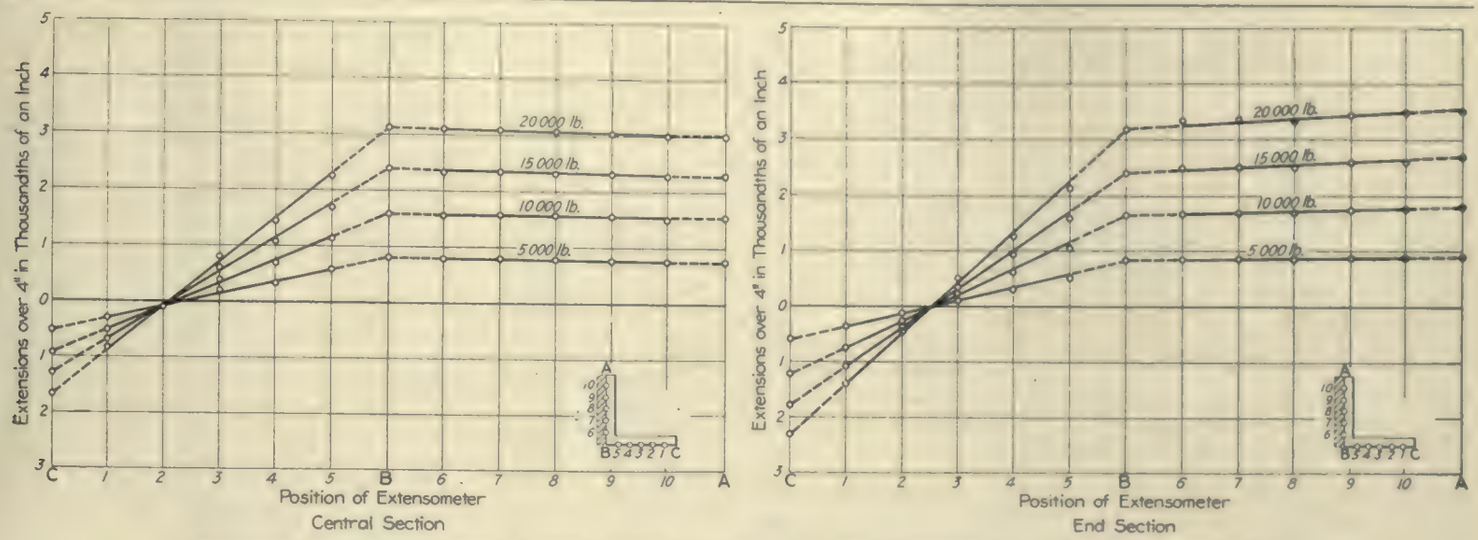
The condensed abstract which follows gives a description of the tests and principal conclusions reached by Professor Batho, but omits the extensive theoretical discussion. The essential variation in these experiments from the similar series previously made at the McGill University laboratory is in the use of special grips made to afford restraint for the end gusset or connection plates to which the load was applied. The chief object, however, was the investigation of the effect of lug angles.

TEST SPECIMENS AND MEASURED STRAINS

Experiments were made on three specimens, two single-angle members and one double-angle member shown in the accompanying drawing. All were the ordinary shop product made by the Dominion Bridge Company of Montreal, and the angles were of uniform sections, 3 x 3 x ¼ in. The end

TABLE 1—STRESSES CORRESPONDING TO MEAN EXTENSOMETER READINGS FOR SPECIMENS WITHOUT LUG ANGLES

	Total Load, Lb.	Stresses in Lb. per Sq. In. at Points									
		1	2	3	4	5	6	7	8	9	10
		Specimen 1—Area 1.60 Sq. In. E = 29,100,000									
Central section	5,000	— 2,030	— 580	1,380	2,690	4,290	5,750	5,680	5,600	5,530	5,390
	10,000	— 3,640	— 730	2,760	5,390	8,440	11,490	11,490	11,330	11,200	10,830
	15,000	— 4,940	— 800	4,290	8,000	12,420	17,000	17,000	16,880	16,800	16,380
	20,000	— 6,030	— 730	5,810	10,690	16,420	22,470	22,400	22,240	22,240	21,780
Section 2½ in. from end plate	5,000	— 2,690	— 870	650	2,260	4,290	5,750	5,670	5,600	5,520	5,380
	10,000	— 5,390	—1,960	1,530	4,510	8,440	12,160	12,220	12,380	12,720	12,720
	15,000	— 7,930	—2,620	2,470	6,840	12,420	18,180	18,270	18,320	18,920	18,990
	20,000	—10,100	—3,270	3,640	9,240	16,420	24,210	24,280	24,210	24,850	25,100
		Specimen 3—Area 3.08 Sq. In. E = 30,100,000									
Central section, left	15,000	4,220	4,360	4,660	4,890	5,190	5,340	5,410	5,260	5,190	4,960
	20,000	5,650	5,850	6,320	6,470	7,000	7,070	7,150	7,070	7,000	6,760
	25,000	7,070	7,380	7,830	8,050	8,650	8,880	8,950	8,880	8,800	8,500
	30,000	8,430	8,880	9,410	9,860	10,390	10,600	10,680	10,600	10,530	10,380
Central section, right	15,000	3,990	4,510	4,890	5,260	5,790	5,650	5,490	5,120	4,820	4,440
	20,000	5,340	6,020	6,550	6,920	8,280	7,670	7,230	6,920	6,400	6,020
	25,000	6,780	7,450	8,200	8,730	9,480	9,480	9,180	8,580	8,050	7,520
	30,000	8,130	8,950	9,790	10,430	11,410	11,420	10,990	10,220	9,860	9,180
Section 2½ in. from end plate, left	15,000	3,080	4,280	5,420	6,170	6,620	6,320	5,640	4,960	4,580	3,980
	20,000	4,290	5,720	7,150	8,280	8,730	8,420	7,680	6,770	6,090	5,340
	25,000	5,340	7,220	9,180	10,300	10,990	10,460	9,470	8,570	7,670	5,690
	30,000	6,620	8,740	10,900	12,490	13,220	12,500	11,500	10,150	9,250	7,960
Section 2½ in. from end plate, right	15,000	2,860	3,990	5,110	5,800	6,250	5,950	5,560	4,960	4,660	4,220
	20,000	3,990	5,490	6,850	7,900	8,280	7,900	7,370	6,620	6,170	5,650
	25,000	4,970	6,920	8,650	9,780	10,380	10,000	9,260	8,350	7,670	7,070
	30,000	6,100	8,280	10,440	11,890	12,490	12,030	11,200	10,090	9,180	8,500



MEASURED STRAINS AT POINTS ACROSS SECTION OF SINGLE ANGLE WITHOUT LUG ANGLES—SPECIMEN 1

connection plates were 14 x ⅜ in. x 1 ft. 9½ in. long and were restrained from turning by six set screws on each side as indicated in the figure. In order to determine the distribution of stress under different loads at the central cross-sections of the specimens and also at sections near the end plates, extensometers were used with their 4-in. distance pieces set parallel to the axis of pull, so that the strains measured were mean strains over that length. Readings of the extensometers were taken at ½-in. intervals over the outside face of the angles as shown in the diagram, the extensometers being arranged first with the mirror at the lower end and then at the upper end and the mean of these readings taken to eliminate errors due to the bending of the specimen. The uniformity of the results was remarkable. It was found that the specimen could be taken out of the machine and replaced without the extensometer readings for a given loading being appreciably altered.

EXPERIMENTAL RESULTS

Complete diagrams and tables give the measured strains and corresponding computed stresses with comparisons. The accompanying diagrams and Table 1 for specimens without lug angles indicate the general character of the results. Tension is plus and compression minus. In discussing the restraining effect of the end plates it is pointed out that the restraining couple perpendicular to the end plates is small for the single-angle member, and the specimen may be considered practically free to bend perpendicularly to the end plates. The case of the double angle is quite different. The two angles, back to back, prevent each other from bending perpendicularly to the end plates, and the result is an almost complete fixing in that direction, considerably decreasing the ratio of maximum to mean stress over the section.

There is a fair agreement between the results for specimen 1 and specimen 2, although the line of pull on the end plate is different in the two cases, being shifted to the center of gravity of the angle in specimen 2.

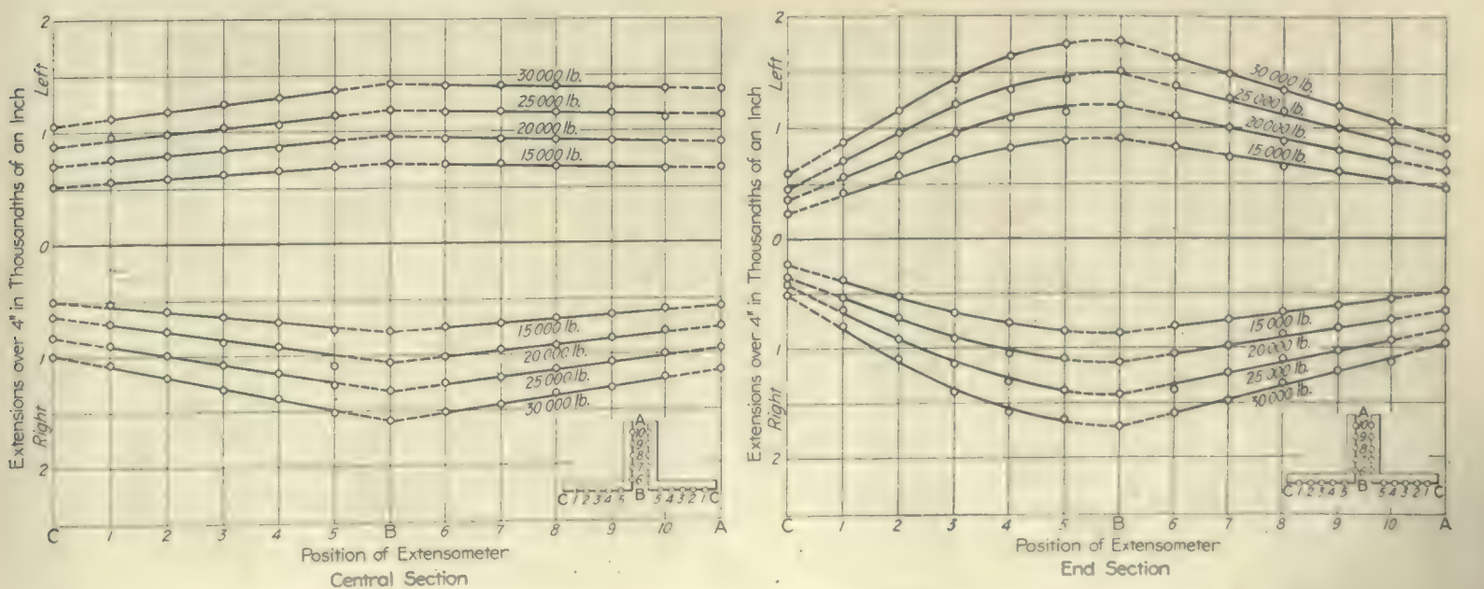
It is often asserted that lug angles considerably reduce the ratio of maximum to mean stress in the member, some authorities going even so far as to say that when a lug angle is used the stress is practically uniformly distributed. A glance at Table 2 will show how far this is from the truth.

TABLE 2—EFFECT OF LUG ANGLES ON RATIO OF MAXIMUM TO MEAN STRESS AT CENTRAL CROSS-SECTIONS

Total Load, Lb.	Specimen 1: Ratio of Maximum to Mean Stress, With Lug Angle	Specimen 1: Ratio of Maximum to Mean Stress, Without Lug Angle	Specimen 1: Per Cent Change Due to Lug Angle, Increase	Specimen 2: Ratio of Maximum to Mean Stress, With Lug Angle	Specimen 2: Ratio of Maximum to Mean Stress, Without Lug Angle	Specimen 2: Per Cent Change Due to Lug Angle, Decrease
5,000	2.08	1.96	6.1	1.95	1.95	0
10,000	2.05	1.86	10.2	1.83	1.93	5.2
15,000	2.00	1.82	9.9	1.82	1.90	4.2
20,000	1.94	1.79	8.4	1.78	1.83	2.7

	Specimen 3: Double Angle, Left: With Lug Angle	Without Lug Angle	Decrease	Specimen 3: Double Angle, Right: With Lug Angle	Without Lug Angle	Decrease
15,000	1.06	1.11	4.5	1.19	1.22	2.5
20,000	1.06	1.11	4.5	1.19	1.24	4.0
25,000	1.05	1.10	4.5	1.18	1.23	3.2
30,000	1.05	1.10	4.5	1.18	1.23	3.2

The ratio of maximum to mean stress in specimen 1 is actually greater by about 8.4 per cent with the lug angle than without it. In the case of the double angle the stress in one leg is decreased about 4.5 per cent and in the other 3.2 per cent. It is thus evident that the effect of the lug angle is very small, and that the angle is practically worthless for the purpose of distributing the stress more uniformly. It thus appears that lug angles are of very little



MEASURED STRAINS AT POINTS ACROSS SECTION OF DOUBLE ANGLES WITHOUT LUGS—SPECIMEN 3

practical value and are unnecessary, expensive and cumbersome additions to the end connections.

Summary and Conclusions

The chief conclusions of the author are:

1. That the only practicable experimental method at present available for investigating the distribution of stress in built-up members is by means of some form of extensometer, and that the simplified mirror extensometer used in the tests described is very suitable for this purpose. (This instrument is described in the article which follows.)

2. That the assumption of a planar distribution of stress is justifiable in such members as are considered here, except perhaps close to the end connection, and that the ordinary theory may therefore be applied to an analysis of the distribution of stress in these members.

3. That in single and double-angle tension members connected at their ends by means of rivets to wide and rigidly held gusset plates the stiffness of the gusset plate in its own plane has a considerable effect on the distribution of stress in the member.

4. That in such members lug angles are of very little, if any, value for the purpose either of giving a more equable distribution of stress in the member or of increasing the effective length of end connections.

5. That a slight change in the line of application of the load to the gusset plates does not materially affect the distribution of stress in the member, except possibly close to the end connection.

6. That the experiments on double angles bear out the theory that such members do not act as a single piece bending as a beam.

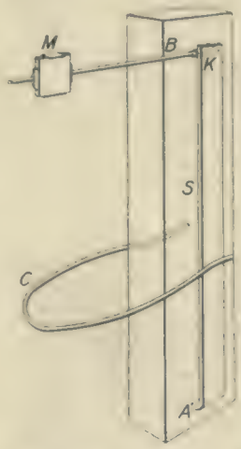
Simplified Form of Mirror Extensometer Developed

Professor Batho Describes a Simple and Accurate Instrument Used at McGill University Testing Laboratory

THE RECENT development in the field of direct measurement of local stress variations by means of extensometers has been notable. The modified form of the Marten's type of instrument as used, designed and constructed in the McGill University Testing Laboratory is described by Professor Batho in the article on tests on lug angles in the August issue of the *Journal* of the Franklin Institute. These instruments have been proved capable of giving very accurate and uniform results.

The principle of the instrument is shown in the accompanying figure. It consists essentially of a double knife edge, *K*, which fits between the specimen under test, and a V groove in one end of a steel strip, *S*, which is in contact with the specimen at *A*, and is pressed against it by means of a clip, *C*. The change in the length of the specimen between *A* and *B* causes the knife edge to tilt, and the tilt is measured by means of a telescope and scale, the scale being reflected in a mirror, *M*, attached to the knife edge.

In the actual instrument the steel strip is ⅜-in. wide and ⅛-in. thick, the length *AB* being chosen to suit requirements. The end *A* is turned at right angles and brought to a sharp edge so that it may not slip on the specimen. The knife edge is of hardened steel about 0.18 x 0.12 x 0.45 in., and the mirror is attached by means of a piece of steel knitting needle. The mirror is held in a clip of thin sheet steel which is arranged so that it can slide and rotate on the needle, a thin copper strip protecting its back from injury. This clip permits of a small amount of lateral adjustment. The mirror is about ½ in. square and must be as truly plane as possible, as otherwise there will be an error introduced when the image of the scale moves to a different part of its surface, as it must do if the specimen deflects at all during the test. It is estimated that the instrument reads accurately to 0.00001 in.



The kind of telescope used affects greatly the facility with which readings may be taken. The McGill University Testing laboratory telescopes are adjustable vertically and horizontally, besides moving bodily about a vertical axis. They are carried on specially made stands permitting any kind of adjustment to be made with ease. If the direction of *AB* remains unchanged during test, the difference of the scale reading between two loads will be an accurate measure of the strains for the given-load difference, but if *AB* alters in direction this will not be the case. If, however, two readings are taken, one with the extensometer in the position shown and the other with the knife edge at *A* and the sharp edge of the strip at *B*, the mean of the two will be correct.

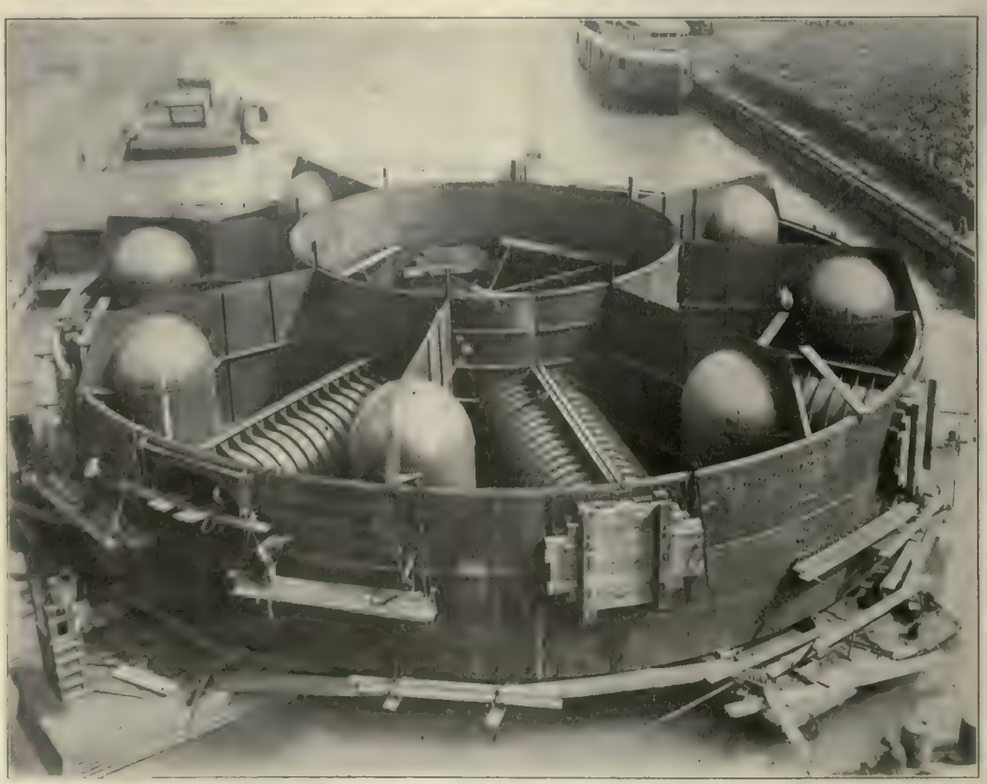
In the opinion of all who have worked with these instruments they are the most simple, practical and accurate extensometers in use.

Shell for Wilson Avenue Crib Floated to Place

THE steel shell for the substructure of the Wilson Avenue tunnel, which was launched on its own flotation chambers Aug. 14, is shown in the accompanying photograph. The shell was supported on scows with its eight buoyancy chambers in place, and men are seen at work bulkheading the intakes which are essential to provide a sufficient air column to keep the shell afloat when the remainder of the steel has been placed. As shown in the drawing of the shell in the Engineering Record Jan. 23, page 103, the straight portion is 17 ft. high, but the shell height is to be increased 28 ft. by an inclined deck.

Erection of the shell was started on a long scow as a backbone and four flotations pontoons, two arranged on each side, making a double cross. The scow is 106 ft. long, 26 ft. wide and draws 7 ft. of water. The pontoons are about 15 x 30 ft. in plan. To remove the scow and pontoons the crib was towed out beyond the mouth of the Chicago River into the outer harbor where the water is 25 to 30 ft. deep. Here the scow and pontoons were filled with water and then pulled out with a tug. The decks were prepared with inclined boards to facilitate this action. The shell sank to a depth of about 11 ft., the water rising to a point about 1 ft. below the top of the intakes. The shell was then towed back to the slip.

The Fitzsimons & Connell Dredge & Dock Company has the general contract for the construction of the crib. The Ketler-Elliott Erection Company is erecting the steel work which is 80 per cent completed and is furnished by the Chicago Bridge & Iron Works. The design of the tunnel system to the crib was made under the direction of John Ericson, city engineer, M. B. Reynolds, engineer of waterworks design and H. S. Baker, assistant city engineer. All construction work is under the immediate supervision of Henry W. Clausen, engineer of waterworks construction.

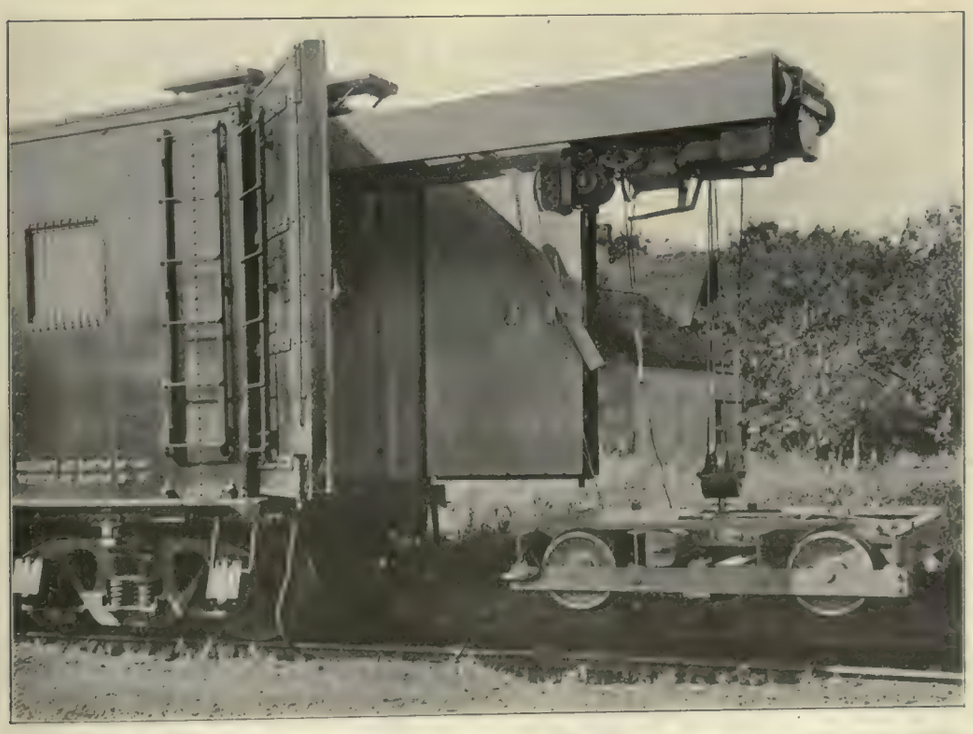


PLACING BULKHEADS IN INTAKES OF CHICAGO CRIB FOR WILSON AVENUE TUNNEL

Pennsylvania Builds New Scale-Testing Car for Government

ACCOMPANYING are photographs of a special scale-testing car recently completed for the U. S. Bureau of Standards by the Pennsylvania Railroad at its shops in Altoona, Pa. The car, which is No. 2, is similar in operation to No. 1, described in the Engineering Record of Oct. 25, 1913, page 460. Its purpose is to transport test weights and other apparatus necessary for determining the accuracy of scales. These weights are handled by means of a crane bridge, equipped with a trolley and hoist, which can be projected out of one end of the car. The general construction of the car is the same as that of the Pennsylvania Railroad standard X-25 box car, with minor changes to the superstructure, including end doors at the crane end, windows and a swinging side door, and the strengthening of the underframe by means of body bolsters, thereby raising the capacity to 140,000 lb. All machinery and interior equipment, such as generating plant, crane, weights and electric truck, were installed by A. H. Emery of Glenbrook, Conn.





ALL-STEEL SCALE-TESTING CAR BUILT FOR THE BUREAU OF STANDARDS BY THE PENNSYLVANIA RAILROAD

Why Appraisal Is Not Valuation

At Least Four Considerations Which Cannot in Any Wise Be Measured Have a Vital Bearing on the Value of a Public Utility

By GEORGE SYDNEY BINCKLEY
Consulting Engineer, Los Angeles

INSTRUCTION in the process of appraisal or valuation is not the purpose of this article. This subject—one of the most complex in its necessary detail with which the engineer has to deal—has formed the basis of some of the most thoughtful as well as many of the most wearisome papers that have been published within the last few years. Much as the subject has been discussed, however, certain fundamentals seem to have failed of recognition by most of those who have dealt with this problem in its many aspects. It often happens that the mere fact of too intimate proximity obscures rather than illuminates the broad principles involved in any problem, and it is not unlikely that the treatment of the subject of appraisal and valuation has suffered from this same cause. Leaving aside, then, the minutæ and even the broad principles of the processes involved in the laborious work of appraisal, it is the purpose of this article to outline or to emphasize only the fundamentals essential to equitable and well-balanced results.

One of the most striking weaknesses in the field of logic and applied mathematics is exhibited by the construction of an elaborate result by strict and formal methods, upon a substructure of assumption, doubt or actual error. In economics, ethics and philosophy this is so common that often two equally competent, methodical and conscientious students will arrive at opposite conclusions. Their method and process may be above question, but their basic assumptions are widely different. So also it is in engineering, for instance, where the problems of dam design are dealt with. Following basic assumptions of certain values, one man will, on purely theoretical grounds and by rigid mathematical processes, arrive at a result that satisfies him completely. Another, rejecting as uncertain or dangerous all but those elements whose values are known within rather narrow limits, proceeds by simple processes and with a generous regard for practical considerations to design a structure that his judgment tells him is safe. He is probably not quite so well satisfied with his result as his more highly theoretical brother, but his dam is generally the more trustworthy. The first is a mathematician's dam—the second an engineer's dam, as Sir Benjamin Baker so aptly put it.

Rigid Processes on Dubious Assumptions

The application of rigid and elaborate processes to the interpretation of clouded, doubtful or ill-balanced assumptions is certainly to be found, more often than not, perhaps, in the appraisal or valuation methods most in vogue at the present time. The task is not merely mathematical or actuarial, but to a far greater degree judicial, and fair and impartial judgment can only be founded upon a clear recognition of the fundamentals involved.

If the appraiser or valuer is to possess the true and undistorted mental perspective that is essential to even reasonable accuracy in the final adjustment, he must recognize, weigh and digest what the writer believes to be a fact of fundamental importance. This fact may be stated by saying that the work of appraisal of the present physical value of a property, based upon cost, deterioration and appreciation, is a problem preliminary to and wholly independent of the valuation of the property for purposes of sale or for fixing rates for service. This principle the writer believes to be of controlling importance. Its significance cannot be ignored. The problem of appraisal, complex as it is, should not for an instant be confused with the subsequent problem of valuation. What a thing has cost—what it would cost to duplicate in the physical sense—is by no means a measure of its value.

The problem of appraisal may be dealt with by fairly strict mathematical processes, tempered with a large proportion of

common sense and individual judgment. The appraiser must be experienced through actual participation or long observation, in the class of business involved. His methods, when a definite basis exists, must be exact, strict and as simple as possible. Temperamentally, he should be of a fair, open and judicial mind, for it must be remembered that he must weigh and interpret those very general data upon which the element of depreciation or appreciation must be decided.

Four Questions Following Appraisal

But when the complex work of appraisal of present physical value is completed—when the original cost or recorded capital expenditure is scaled down by consideration of deterioration or increased by betterments or appreciation in the value of real estate—an entirely separate task begins. Knowing as accurately as determinable the present physical value of the property in terms of capital account as affected by deterioration or appreciation, a set of problems must now be dealt with whose values are incommensurable with those already determined, although frequently of controlling importance in the final result. The valuer will be faced with certain questions profoundly affecting his conclusions, although incapable of expression in numerical terms. For instance, some few of the typical questions may be considered:

First.—Is the property as developed or capable of being developed, a natural monopoly?

Second.—Was there great hazard of loss involved in the investment required for the development of the property and bringing it to a paying basis?

Third.—Have the past profits of the enterprise been meager, moderate or very great?

Fourth.—Is the property as a whole or to an important degree likely to become obsolete within a short time?

Natural Monopolies

As one of the fundamental questions to be considered by the valuer, take the first of those propounded above: Is the property a natural monopoly?

Take for example a small city—a mining town for instance—having but one source of potable water, which is owned by the water company. This water is valuable in proportion to its scarcity and the demand for it. Assume that the initial cost of the development was low, and that the cost of extension was easily met from the profits, so that the original investment is small relative to the income-producing power of the property. Here we have a natural monopoly. The slender stream of water is natural wealth as truly as the ore in the mines. The fortunate owner of the only water supply available can hardly be expected to regard as just a limitation of say 6 per cent on his actual investment, when the great value and importance of his property to the community is considered. The owner of a valuable mine is fortunate in his investment. The owner of the water supply which makes the operation of the mine possible must also be considered as fortunate, and to deprive him of the natural fruits of his foresight and good fortune is not just. Hence the valuer must recognize the unusual natural value of this property in deciding its proper earning power or its value for purposes of sale.

Let us now consider the second question: Was there great hazard of loss involved in the investment?

In this case, we may consider an irrigation project, in which lands, arid and remote but believed capable of development for the production of citrus fruits, are supplied with water from a distant source through a costly conduit. This is representative of a condition by no means unusual. With great faith in the lands to be irrigated, and believing that the proposed water supply is adequate, men may be assumed to have invested a large sum, only to find in the end that but a small part of the water supply anticipated is actually to be depended upon. The irrigable area is restricted, and the investment proves to be very heavy in comparison with the results attained. It is plain that in this case a natural limitation exists in the crop-producing value of the water. If too high water rates are charged, farming cannot be profitably carried on and the income will be curtailed. On the other hand, unless rates representing about "all the traffic will bear" are in force, there will have resulted the development of an important productive area, with permanent profit to its inhabitants and the State, at the uncompensated expense of the investors in the water system.

Here the question of actual loss must be considered. It may be wholly impossible to fix rates that allow of profitable farming operations and yet give even a very moderate return on the actual investment. In such a case, justice demands that the rates be left as high as commercially possible, and a certain loss must be endured by the investors. But suppose that the project was successful, although attended by great hazard of loss. Assume the development of lands that, if found suitable for citrus crops would be very valuable, but that, if found unsuitable for such crops, would be unable to bear the water rates necessary for even a fair return on the investment. This is a condition not at all unusual in its essentials. Here we have a successful operation, but one of a hazardous character. Is it proper to limit the earning power of this hazardous but eventually successful investment to the same amount that would be proper in a development involving no considerable risk?

Big Risks Demand Higher Returns

It is perfectly plain that if insisted upon this will effectually block the development of any public service project involving hazard of loss. It is idle to expect an investor to make a risky investment when he can secure the same return upon one that is safe and conservative. It must not be forgotten that many of the most valuable and successful enterprises that are now serving the public were attended with great hazard, and, rising among the wrecks of many failures, represent the most monumental courage, faith and foresight on the part of the investors. The importance of a policy under which this class of investment is encouraged is not to be underestimated, especially in a country of such undeveloped resources as our own.

So it must be admitted that the element of hazard must enter into the consideration of proper returns upon an investment. But it is also true that for purposes of sale this element cannot enter except in so far as it is properly recognized as a factor in its earning power. It is thus seen that while in the case of a hazard which has resulted in partial loss of the capital invested as high a rate as possible is justified, a valuation for purposes of sale could only allow an amount consistent with the actual earning power of the investment.

Past Profits

The third question—that involving the history of the profits realized by the enterprise—is important for the purposes of both rate fixing and sale valuation. If the property happens to be a natural monopoly, this importance is relatively much less, yet the character of past profits must in some sense guide the valuer, as an increase in rates is always difficult to accomplish even where considerations of equity demand it, and on this account alone an otherwise valuable property may have to suffer in sale value. If not a natural monopoly, resentment at even properly increased rates may induce ruinous competition, and here again the value of the property may be impaired or even destroyed. The income-producing power of a property as well as its sale value is thus seen to be inevitably affected by its past record as to profits.

Possible Obsolescence

The last of the four questions—that relating to obsolescence—is one that must be considered in the light of natural limitations and contemporary progress in the arts involved. A high-class steam power plant for the generation of electric current may represent a large investment, may have suffered but little deterioration, and may be of high efficiency in its class. Yet its complete obsolescence may be threatened by an undeveloped water power near by.

This is a case of hazardous investment, made in response to the needs of the community served—a condition that must be recognized and considered in fixing rates so as to reduce this hazard as far as possible, and, pending final obsolescence, provide adequate compensation from the public who have benefited by the production and distribution of power. The same reasons that justify higher rates make inevitable a lower valuation for purposes of sale. The hazard that properly increases its rate of earning pending obsolescence just as properly discounts its value for sale purposes. It might properly yield 10 per cent on its present physical value, yet not be worth 50 per cent as a sale price.

Appraisal and Valuation

The fact that must not be lost sight of is the fundamental difference between the appraisal of present physical value based upon cost, deterioration and appreciation, and valuation for the purposes of rate fixing or sale of the property. These two aspects of the problem are too often hopelessly entangled, while in fact they are impossible of logical consideration in the same terms.

Although they may with advantage be combined in one person, the functions of the appraiser and the valuer are very different. The engineer who makes the appraisal of present physical value may or may not be qualified by temperament, mental caliber and experience in large affairs to deal with the questions involved in the final valuation. The man who takes before him the data of appraisal, and weighs them with or against other factors in their nature incapable of precise determination, must be by temperament, training and propensity capable of dealing in a spirit of strict and judicial impartiality with problems quite impossible of methodical solution.

In the foregoing the writer has dealt with the so-called "intangible values" as elements to be considered aside from those of a purely physical character. Among these "intangible values" is often included a nebulous sort of asset called "going concern." If this is taken to represent the amount of the actual deficit during the early period of the development of the enterprise, or the difference between a fair rate of interest on a conservative investment and the lower rate actually realized during this early period, then this amount may properly be credited to capital account. But if this, in definite terms, can be done, this is no longer an "intangible value" at all. On the other hand, if it cannot be shown that such a deficit actually existed, but that, on the contrary the enterprise suffered no such period of preliminary expense, then the mere fact that such a condition *might* have had to be faced is no reason for any allowance on capital account.

Strictly speaking, no value can be "intangible" yet definite in its amount. In other words, so soon as a value takes on a character that may be definitely expressed in figures, it is no longer intangible at all. For instance, suppose that the present physical value of a water system is $100,000, yet, on account of the low cost of operation, large water sales and conditions of natural monopoly it yields profits of 50 per cent on present physical value. Here we have a value far in excess of its purely physical aspect based on cost. Yet the value is by no means intangible, as it means a large earning power, capable of being expressed in terms of capital on any assumed percentage basis. But if this company is operating under a franchise, this may be admitted to be of importance in its earning power without being tangible, in the sense of being determinable as representing a definite capital value. To be sure, if this franchise cost a certain amount of money, this amount simply can be credited to capital account, but its *value* may be, and quite generally is, a very different matter, and cannot be expressed in definite terms. Hence while its *cost* is tangible, its *value* is not.

A franchise may indeed be costly even though a necessary evil—a liability, instead of an asset. In a recent case coming under the writer's observation the appraiser was much inclined to place a high money value on the franchise under which the company operated, because this franchise paid a very heavy tax. Hence, he reasoned, if it was taxable property, its value must be proportional to the tax levied. Now as a matter of fact this franchise was a mere permit to do business, conferred no exclusive privileges, and to the extent of the franchise tax paid was a burden and a liability instead of a valuable asset.

Functions of Appraiser and Valuer

The man or commission upon whom the duty of valuation falls has to deal in many, if not most cases, far more with questions of equity and justice than with those questions of determinable fact dealt with by the appraiser of physical values. The functions of the appraiser of physical values are judicial only as related to the questions of deterioration, betterments or changed values of real property. The functions of the valuer as distinct from those of the appraiser are of a judicial, rather than a technical character; it is for him to see broadly the equities, and to weigh and adjust those equities to the ends of impartial justice. Both functions may, with advantage, be combined in one man, but even here the two phases of the work should be rigidly separated. The first phase is the collection of evidence and the determination of facts. The second phase involves the digestion of the facts, the weighing of the evidence and the formation of a mature judgment. The first phase calls for a man of technical knowledge, familiar with the business considered, and of a fair and judicial mind. The second calls for one possessing not alone technical knowledge and mental qualities of a high order, but a wide and impartial vision—a man of large affairs. It is only such a man who can say that it is or is not good business to buy a property at a certain price, or at what price it is good business to buy it. And it is only from such a source that a proper judgment can be expected when the fair return upon an investment is in question. In the large affairs of private business this is the type of man always demanded. In public affairs the ends of equity and justice demand quite as high if not higher qualifications, for here, through its legal powers, the community holds the whip hand.

Whatever the ultimate rearrangement of our economic system may be, we must keep in mind the fact that we are living under an established and conventional scheme of property rights, and individual fads and futurist ideas of universal justice can have no proper place in the mind of the valuer of public utilities. His is a function of business judgment, expressed in accordance with our present scheme of property rights. His decisions must balance with present standards of business practice and business morality—not with abstract ideals of what these standards should be.

Conclusion

It will be observed that in the foregoing the writer has touched not at all upon methods. Important, even vital to final accuracy as processes may be, they are not fundamentals. But the recognition of the fact that hazardous investments will not be made without the prospect of large returns is a fundamental. The fact that a high order of ability, courage and initiative not alone must, but should, be paid for, is a fundamental. And until the socialistic theory of economics is swallowed hide and hoofs, the fact that some people have the good fortune to acquire property of great value at small cost, must also be a fundamental consideration.

There is a tendency at the present time that leans to the penalization of large success. This is one of the most damaging and mischievous of the many manifestations of a certain careless socialistic trend of the public mind, and the results of this error are already evident in a sharp decline—in some States a total stagnation—in the development of new public-service projects. The public, which has countenanced by its indifference at least a policy which in many cases borders on oppression, will inevitably suffer serious inconvenience or even actual hardship through the enforcement of conditions which render investment in a public-service project palpably unwise.

Unfortunately neither excess of zeal nor incompetence can excuse abuse of the great powers that have been conferred upon officers or commissions entrusted with problems of valuation or rate-making. And it is safe to say that such abuse will discourage investment in the business affected to a degree that no reasonable natural hazard could. The prompt recognition of this fact by the public is hardly to be hoped for, yet until this is done, little further development of public-service projects by private capital can be expected.

Diagram Facilitates Estimating Weight of Steel in Concrete

By ALBERT M. WOLF
Melrose Park, Illinois

THE DIAGRAM shown herewith will be found useful in making approximate estimates of the amount of reinforcing steel required for reinforced-concrete work when the yardage of concrete has been estimated and the percentage of reinforcing steel is known.

Two different horizontal scales are used, and two lines are plotted on the diagram; the intersections of the horizontal percentage lines with the first give weight of steel in pounds per cubic foot, and intersections with the second give weight of steel in pounds per cubic yard for the percentage

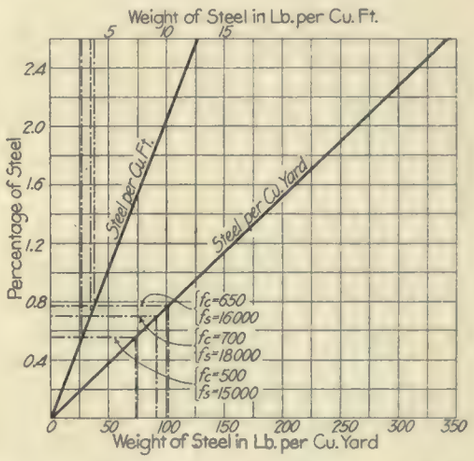


DIAGRAM FOR ESTIMATING WEIGHT OF STEEL IN CONCRETE

of steel in question. Thus, if 1 per cent of steel is to be used we find from the diagram that 4.9 lb. of steel will be required per cubic foot of concrete and 132 lb. per cubic yard.

Sometimes on preliminary plans very little or no reinforcing will be shown, but the unit stresses will be given. In this case an estimate of the reinforcing steel can be made by using the percentage of steel which corresponds to the given unit stresses in steel and concrete. The percentages for the most commonly used unit stresses have been plotted on the diagram in dotted lines. The vertical lines from the intersection of these lines with the curves give the weights of steel per cubic foot and per cubic yard on the upper and lower horizontal scales.

In this connection it is interesting to note the considerable difference in the amounts of steel required for different unit stresses. Thus we see that for f_c = compressive stress in concrete = 650 lb. per square inch, and f_s = tensile unit stress in steel = 16,000 lb. per square inch, 102 lb. of steel are required per cubic yard, while for f_c = 500 lb. and f_s = 15,000 lb., only 74 lb. of steel are required.

It should be borne in mind that this diagram is made up for rectangular beams and theoretical percentages of reinforcement on tension side only, and does not make any allowance for laps of bars at splices, spacing bars, stirrups, etc., which are necessary in the detailed design. Just how much should be allowed for these details depends largely

upon the class of work involved, and cannot be provided for on the diagram. An allowance of 10 per cent is, in general, enough to care for these details, but in any case the estimator should use his best judgment in this regard.

St. Paul Electrification Progressing Rapidly

First Locomotive Delivered for Main-Line Service Over Rockies—Overhead Construction Completed for 200 Miles

CONSTRUCTION work on the electrification of the Chicago, Milwaukee & St. Paul Railway over the Rocky Mountains has been actively prosecuted since the initial order for equipment was placed with the General Electric Company in September, 1914. The overhead construction, which will embrace 650 miles of single track, has been completed for 200 miles, and the 100,000-volt transmission line parallel to the tracks has been completed for a like distance, together with tie-in lines from the 100,000-volt system of the Montana Power Company. The trackage now ready for train operation includes extensive yards and sidings at Three Forks, Deer Lodge and Piedmont, and passing tracks at other points. The first of the forty-two electric locomotives has been delivered to the railway at Chicago.

One of the illustrations shows the general appearance of the new type of trolley construction and transmission lines. Wood-pole construction is used throughout both for cross-span and bracket construction. The twin 4/0 trolley wires are suspended individually and separately from the same steel catenary and the hangers of one trolley wire are located at points mid-span on the other. In the switching yards only one trolley wire is used.

SUBSTATIONS

Seven substations designed to supply power to the first half of the 440 miles of route have been completed and electrical equipment is being rapidly installed. Complete shipments of transformers, motor-generator sets, switchboards and other accessories have been made for the stations first erected, and the equipment of four substations is practically ready for operation. Construction crews are proceeding with the erection of the remaining seven substations between Deer Lodge, Mont., and Avery, Idaho.

Each of the motor-generator sets consists of a 60-cycle, three-phase, 2300-volt synchronous motor direct-connected to two 1500-volt direct-current generators. The generators are connected permanently in series to supply 3000 volts to the trolley. Each set is also provided with an exciter at each end, one providing excitation for the revolving field of the motor and the other supplying the separately excited fields of the direct-current machines.

These sets are in general similar to the five 1000-kw., 2400-volt units in operation on the Butte, Anaconda & Pacific Railway except as regards voltage and capacity. One new feature, however, has been added. This consists of a longitudinal ventilation of the core and field coils similar to that employed in the GE ventilated railway motor. The use of this method of cooling has effected a considerable reduction in the floor space required per kilowatt.

The motor-generator sets are designed to operate inverted in case the regenerated power exceeds that required by other trains operating near-by. For this reason there is no necessity for water boxes or other energy-consuming devices, since the excess energy is transmitted to the 100,000-volt system.

TRANSFORMERS

The transformers are under construction in the Pittsfield works of the General Electric Company. There are a total of thirty-two of these units, which are to be used for stepping down the power supply from the 100,000-volt transmission line to 2300 volts as required for the synchronous motor-generator sets. These transformers will be installed in fourteen substations, which will furnish power for the entire electrification from Harlowton, Mont., to Avery, Idaho. There are twenty-three 2500-kva. and nine 1900-kva. units.

In addition to the main transformer equipment, each substation will be furnished with a standard 10-kw., three-phase transformer stepping down from 2300 to 110 volts for lighting and auxiliary power circuits. For operating the railway signal circuits a standard 25-kw., single-phase transformer is being installed in each substation stepping up from 2300 to 4400 volts.



TYPICAL OVERHEAD CONSTRUCTION

LOCOMOTIVES

Work on the construction of the forty-two 282-ton locomotives is progressing rapidly at the Erie Works of the General Electric Company and in the Schenectady plant of the American Locomotive Company. The first complete locomotive was placed on the test tracks early in September and shipment was made Sept. 25 as scheduled. This locomotive has been taken in charge by the railway company at Chicago and is now being exhibited at various points on the Chicago, Milwaukee & St. Paul system under the direction of C. A. Goodnow, assistant to the president. A complete set of tests indicates that the locomotive will easily exceed the expectations of the designers.

FREIGHT LOCOMOTIVE FOR ST. PAUL ELECTRIFICATION—WEIGHT 282 TONS

The actual weights of the completed freight unit are as follows:

	Lb.
Total weight	564,000
Weight on drivers	448,000
Weight per driving axle	56,000
Weight per guiding axle	29,000

Twelve of the locomotives on order are geared for passenger service and the remaining thirty are geared for freight service. Both freight and passenger types are equipped for regenerative braking, this apparatus being under the control of the engineer. All of the passenger locomotives and several of the freight locomotives will be equipped with oil-fired steam boilers for heating the passenger trains. This equipment will include ample storage tanks for oil and water.

GROSS OPERATING REVENUES FOR JULY on the large steam railroads of the United States, according to a bulletin issued by the Bureau of Railway Economics, were $1,130 per mile, showing an increase of $3 or 0.3 per cent as compared with July, 1914. Operating expenses, were $750, a decrease of $36 or 4.6 per cent. Net operating revenue, therefore, was $380—an increase of $39 or 11.5 per cent, and operating income was $330—an increase of $39 or 13.3 per cent. The operating ratio was 66.3 per cent, as compared with 69.7 per cent in July, 1914, and 70.6 in July, 1913. Considering the three main districts, the respective ratios for July, 1915, and July, 1914, were as follows: Eastern, 65.5 and 70.8; Southern, 71.4 and 75.1; Western, 65.5 and 66.7.

Letters to the Editor

Comment on matters of interest to engineers and contractors will be welcomed

Micaceous Rock Requires Careful Watching

SIR: Under the caption, "Rock slide causes second collapse of subway decking," and the subhead, "Concealed cracks cause slide," in your issue of Oct. 2 it appears that the slipping or sliding of the layers of micaceous shift on each other was the primary cause of the recent accident in the New York subway. As some trying experiences have been had recently with rock structure of this kind in preparing the foundations for two large dams for the additional water supply of Hartford, Conn., it may not be out of place at this time to state some of the causes and remedies.

The material accounted for the most part was a thinly foliated mica schist impregnated to a slight extent with quartz and feldspar, and containing veins, dikes and irregularly-disposed masses of quartz and pegmatite. After some exposure to the air many seams showed that had not at first appeared, while others that seemed tight opened up, and the rock layer had to be removed to get a satisfactory foundation. Several well-defined joint planes crossed the formation through which water was given access to the depths of the rock. This water, acting on certain components of the rock, produced layers of hydrated mica having many of the characteristics of graphite. In other cases the joint planes and seams were tightly filled with very finely divided clay. When first uncovered, these materials were firm and the rock had every appearance of solidity, the seams being quite tight. After brief exposure to the air the characteristics were completely changed. Both the hydrated mica and clay became so unguentous that, had opportunity occurred, there would undoubtedly have been considerable rock sliding.

Such conditions are readily detected on the side of a cutting having the ends of the strata exposed, but on the other side the treacherous seams are hidden by apparently firm rock layers. The realization of the conditions and care and patience in searching out and applying remedies at length produced what were considered proper conditions for a foundation. In general, but tempered by experience previously acquired, very extensive use was made of air and water jets to try out the strata. By this same means seams too small to excavate were blown or washed out and the whole mass was tightened up by grouting. Without question the methods here used could also in many cases be applied for the prevention of disastrous rock slides. It is probable that considerable expense could be saved in the rock trenches by a careful study of rock conditions both for preventing unnecessary excavations and for rendering more stable the foundations of heavy buildings in the vicinty of rock cuts.

CALEB MILLS SAVILLE,
Chief Engineer, Board of Water Commissioners.
Hartford, Conn.

[It will be remembered by those who read the description referred to and noted the photographs of this slide reproduced therewith that the break was vertical, and the rock mass had dropped off rather than slid. It should be pointed out that the general practice in New York subway work is to underpin all buildings in advance of any excavation.—EDITOR.]

Signs for Road Detours

SIR: In compliance with a suggestion contained in an editorial in the Engineering Record of July 24 I wish to advise you that this department has ordered detour signs erected, as shown on the accompanying photograph. Whenever a road is to be closed for construction or for bridge repairs by the County Highways Department there has been ordered to be placed such signs,



DETOUR SIGN, COOK COUNTY, ILLINOIS

leading traffic from the point barricaded back to the same road beyond the barricade.

GEORGE A. QUINLAN,
Superintendent of Highways.
Chicago.

Can Sheet-Pile Cut-Off Be Driven in Core of Old Earth Dam?

SIR: Will any of your readers kindly inform me if they know of any case in which interlocking steel piling has been used for repairing a fracture in the puddle core of a high earthwork dam? Such a fracture, due to the erosion of leakage water, has occurred in a dam about 65 ft. high, and it is under consideration to drive a row of piling along the center line of the puddle core for a width of 50 ft., and to a depth of 90 ft. Under such circumstances the questions arise as to whether the piling might be expected to go down vertically, whether it would reach the required depth before becoming earthfast, and whether the shocks of the steam pile hammer would be likely to injure the puddle core.

E. P. HILL.
London.

[Whether the shocks of the pile hammer would be likely to injure the puddle core in question would probably depend on the size of the core and the material of which it is made. It does not seem likely, however, that a puddle core of any size would be injured in any way by driving piling into it. It has been found difficult to keep piling vertical in driving it to penetrations much less than 90 ft. unless a rigid driver and proper guide blocks are used. It is not likely that the cut-off would be a success if any boulders happened to be in the ground below the core. Round piling has been driven to as great or greater depths with the help of jets, and there does not seem to be any reason why sheet piling could not be so driven. If any of our readers have had experience in the use of sheet piling under similar conditions, the Engineering Record will gladly give space to their answers to the questions contained in the above letter. —EDITOR.]

What Is Ultimate Strength of Black Annealed Iron Wire?

SIR: The writer would like to know if you or any of your readers can cite him to references giving up-to-date and reliable data on the ultimate strength of black annealed iron wire, such as is generally used in concrete form work. I am especially interested in the probable ultimate strength of ties formed by twisting two or more strands of wire together as is customary on wall form work.

I have written one large manufacturer of wire, and also to the U. S. Bureau of Standards, but neither is able to give me any information along this line. What data I have been able to find vary considerably, and some of them have proved misleading in my own practice.

ENGINEER.

Inland Water Transportation

SIR: In an editorial in the Engineering Record of Sept. 11, you invite a discussion of an abstract of a paper by Capt. John H. Bernhard on inland water transportation, published on page 332 of that issue. The comments offered by the writer will be confined to the lower Mississippi River problem.

The author of the paper very properly places great emphasis upon the fatal handicap to river traffic imposed by the lack of terminal facilities, with the truly just observation that "with the present river terminals, the height of inefficiency seems to have been reached." He states, also, that "the excessive terminal cost often offsets the advantage of the low river rate."

The first and obvious remedy proposed by the author is to supply these lacking terminals; but that is easier said than done. The author's proposed device of providing floating terminals might in some measure meet the requirements, but can hardly be regarded as other than a makeshift, as permanent elevator structures on the banks of the river are what is needed. But here crops out a fundamental difficulty. You cannot have permanent structures on a river with unstable banks. It is not sufficient that the structure itself be on a permanent site; it is equally important that navigable water be maintained to give access to the structure.

Two notable cases may be cited showing the futility of building costly elevators on permanent sites and not maintaining means of access to them. In the early seventies of last century the Anchor Line Steamboat Company of St. Louis erected a large elevator in Memphis and a similar one in Vicksburg. These elevators very successfully handled a great volume of miscellaneous freight of all kinds. After a few years of such useful service both elevators were rendered wholly inaccessible to steamboats by channel changes created by caving banks several miles distant from their sites, by which the channel in front of the elevators

was in both cases completely filled by mud deposits, and the buildings fell into decay or were torn down.

If the problem of the lower Mississippi River had fallen into competent engineering hands when in its pristine state, before any attempt had been made by human agency to control its destructive flood effects, the problem presented would have been, on its positive side, how to get out of the Mississippi River the greatest possible uses for man's needs; and, on the other hand, to prevent the invasion of the adjacent territory by devastating floods.

In the contemplation of such a problem the first and obvious thing to be accomplished would have been to give permanence to the shore lines and fixation to the line of flood flow. This must have presented itself as the fundamental basis and condition precedent to any further developments. But when the first individual settlers located themselves along the lower river they obeyed the natural impulse to throw up small levees along the river banks to keep the overflow off their lands. Settlements multiplied and the levee lines were extended until, in the course of years, levee building developed into regular systems, and levees came to dominate all activities toward river control, the levee structures continually growing in magnitude, cost and importance.

For a century past a continual and costly warfare has been carried on between levee building on the one hand and levee destruction by caving banks on the other. Of the many millions of dollars that have been expended in this warfare it is probable that three-fourths at least of the money has been ingulfed by the river. Viewing the case solely from a levee standpoint, experience has abundantly shown that a system of flood protection, consisting of a conjunction of levee building and caving banks, is self-limiting and largely abortive.

Appropriations for the Mississippi River by the Federal Government have been made mainly in response to appeals for the building of levees made by riparian owners, to whose eyes the importance of bank protection has been obscured by the more imminent necessity to them of interposing levees between their property and the floods.

It is gratifying to note that during the past two or three years there has been a growing realization of the importance of bank protection, which, it is hoped, shall develop into a popular demand that specific provision shall be made in appropriation bills for this branch of river work, which provision has never been made heretofore. To those authorities who deprecate efforts to further improve the channel of the Mississippi River on the ground that it has now greater capacity for navigation than is being utilized, let the following picture be presented: Let us postulate a river channel from Cairo to the Gulf of Mexico with a least depth of low water of 25 ft., ranging up to 75 ft. at maximum flood stages. Let us assume stable shore lines upon which have been erected all proper facilities for handling freight, and permanent levee lines between which the whole flood flow is confined. Let us proceed down the river from Cairo to its mouth at midstage on a vessel drawing 30 ft., and its bow pointing to the head of the Panama Canal 1400 miles across the Gulf.

Can it be supposed that such a channel, reaching from the Gulf coast over a thousand miles northward into the heart of a region of high industrial development, would not be teeming with busy traffic? And supposing that such a channel has been created in the main trunk of the river up to Cairo; would such development halt there, or would not rather this main trunk become the stem from which would grow a similar full development of navigation in all its branching tributaries?

The remaining vital question is: Can this achievement be realized, and how? Given permanent shore lines and fixation of the line of flood flow, the necessary work would be practically accomplished and any auxiliary work needed would follow without doubt.

The writer has assumed a dogmatic tone that may seem to savor of ignorance or arrogance, or both, made necessary by the brevity of treatment of so large a subject; but these expressions are well matured convictions, based upon long study, reflection and observation upon the most important river problem that presents itself to American engineers.

T. G. DABNEY.

Clarksdale, Miss.

SIR: In your issue of Sept. 11, page 332, you devote considerable space to an abstract of a discussion by Captain Bernhard intended to show the desirability of larger expenditures by the National Government for the construction and development of waterways. This seems to be based on two fallacies which, in the writer's opinion, vitiate the whole argument—one, which was long ago exploded, that the cost of inland water transportation is only the cost of operating the vehicles (vessels, barges or whatever they may be), and the other, that because some commodities are transported by railroads at less than the average rate for the whole country, therefore, any lower rates represent a loss to the transportation company, which has to be made up out of higher rates between non-competitive points.

No theory of establishing "rates" can be entirely satisfactory to everyone, but a considerable experience with other systems based on zones, distance, etc., has shown to the satisfaction of the writer that they have at least as many objections, even though of a different kind, as the theory of basing them on "what the traffic can bear," or, as it is better expressed, "the rate which will move the traffic."

There can be no question of the cheapness of transportation on natural waterways, but even then the cost of trucking at each end may nullify the advantages when compared with railway transportation, which brings the freight directly to the factory siding. Water transportation might be cheaper for transfer between ocean-going steamers and inland points reached by natural waterways, but these are very few and a very small proportion when compared with the thousands of factories with railway sidings on the property which brings them in touch with every foot of the country and also with most docks and ocean terminals.

A very fair example of the arguments of those who favor the expenditure of Government money for artificial waterways is the complaint of the lack of care in keeping the Mississippi River channels marked. It is possible, of course, but highly improbable, that the cost of doing this is charged against the river traffic; if not, why not ask the National Government at the expense of the general public to install, operate and maintain efficient signaling systems on the railways and guarantee everybody immunity from accident?

It would seem to be of interest to ask Captain Bernhard to capitalize the expenditures to date on the Mississippi River and its tributaries, add the annual interest charges to the traffic, and then tell us what the cost of transportation might be, even making all allowances for protection of adjacent lands from floods and assuming a volume of traffic which might move at such rates as would be possible on this basis. This has been done for the Erie Canal and we know that is hopelessly outclassed as a transportation machine, though Captain Bernhard apparently does not consider the cost of construction as an item worth considering, or one which should be paid for by the traffic.

FRED LAVIS,
Consulting Engineer.

New York City.

Filing Engineering Clippings

SIR: Possibly the following method of filing clippings on engineering subjects may be of interest to young engineers who find that bound volumes require too much space.

Procure a box of envelopes and with each one upside down write in both (now upper) corners of the front side the same number, numbering the separate ones consecutively. Place the clippings one in each envelope. Turn the flaps in over the clippings, which will prevent their falling out.

For the file use twenty-six looseleaf notebook leaves, binding them together with paper fasteners. Devote one page to each letter in the alphabet.

The advantage in using the loose leaves is that as soon as a page is filled it can be removed and another substituted for it containing the same subjects rearranged in alphabetical order.

Read each article thoroughly and index the main subject and all minor subjects. By minor the writer means cost data on forms or labor, methods of erection, or special designs, etc. Each of these should be indexed under the proper letter, and on the right-hand side of the page write the number of the envelope in which the article may be found. Thus by referring to the index the number of the envelope containing the article that includes the desired information can be instantly obtained.

HENRY A. BURR,
Railway Draftsman and Designer, Nashville, Chattanooga & St. Louis Railway.

Nashville, Tenn.

THE EFFECT OF PRESERVATIVES on the strength of timber is reported by H. S. Betts and J. A. Newlin in Bulletin 286, U. S. Department of Agriculture, in which results of bending tests on bridge stringers, both untreated and treated by commercial creosoting methods, are given. Loblolly pine, longleaf pine and Douglas fir of ordinary stock sizes (8 x 16 in.) were used, and supplementary tests on small clear pieces cut from the specimens were made. The deductions are: That timber may be very materially weakened by preservation processes, although creosote in itself does not appear to weaken it; that a process which may seriously injure one timber may not affect another, and that the same treatment may have a different effect upon different pieces, depending on form, size and condition when treated.

HINTS FOR THE CONTRACTOR

Details Which Save Time and Labor on Construction Work

Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

[*Contributions to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

Backfilling Wagons, Truck and Shovel Make Record on Sewer Job

BY mounting triangular 3-yd. boxes on two ordinary wagon bodies and utilizing a 6-yd. motor truck, a Chicago contractor was able to complete 2½ blocks of 5½-ft. brick sewer in five days and to keep the street clean while the work was being done. The following notes are taken from the *Excavating Engineer:* The top of the box is 10 ft. above ground and the floor forms a chute starting at the top on the outside and extending at a 45-deg. angle past the side of the wagon for a distance of about 3 ft. This overhang is sufficient to permit discharging the material into the trench and still keep the wheels of the wagon from crumbling the edge of the trench. The discharge gate consists of a door, hinged at the top, controlled by a lever beside the driver's seat.

The sewer is part of the readjustment made necessary by reason of the new Union Station. It is a 5½-ft. circular brick sewer 2½ blocks long on Canal Street alongside the Chicago & North Western Railway station. The first half block was excavated in tunnel by hand on account of railroad tracks. The remainder was excavated by a revolving shovel with a ⅝-yd. dipper on a dipper handle 30 ft. long. The trench was from 14 to 20 ft. deep and 7½ ft. wide. The tough blue clay with occasional boulders required little bracing. The average advance was from 60 to 85 ft. per 10-hr. day. The shovel worked on a set of six 3 x 24-ft. platforms straddling the trench. The platforms consisted of two 12 x 12-in. timbers armored on the inside by a ¼-in. plate. These timbers were separated by a 14-ft. 12 x 12-in. stick with the center cut away for the insertion of steel straps, on which was hung a ring for handling.

In addition to the shovel crew, there were four men in the trench shaping the forms, handling braces and assisting in moving the platform forward. Two men tamped the backfill. The two brick layers were assisted by three passers and one man carrying mortar. With this crew the work was completed between Aug. 2 and 12, five days being lost on account of rain. The W. J. Newman Company was the contractor.

Machine Built at Panama Canal Shifts Track on Dumps

THE main dumps for disposing of excavated material on the Panama Canal were started from trestles constructed for the purpose, and when filled out as far as the spreader would reach the track was shifted to one of the edges of the dump. The track-shifter illustrated herewith was devised on the Isthmus for this work and was described in a paper presented to the International Engineering Congress in San Francisco last month by Maj.-Gen. George W. Goethals, governor of the Canal Zone.

The track-shifter consisted of a boom, with suitable tackle, extending from a flat-car out over the track in advance of the car, which lifted the track bodily, ties and all, from its bed. Another boom, lying in a practically horizontal position, and also equipped with tackle, extended out at an angle to the side of the car, and was used for pulling the track to one side or another. For operating the booms, the car was equipped with an engine similar to the ordinary hoisting engine. At first the track-shifter only moved a section of track 5 ft. sideways at a time, but it was later improved so that the track could be thrown over 9 ft. at one operation. On one occasion, at the Tabernilla dump, 1¼ miles of track were shifted 12 ft. from the original position in 1 hr. and 50 min. Ten of these machines were made on the Isthmus and used on the work. To facilitate this track shifting, the track had one free end and was made more flexible by an occasional switch-point in laying the rails.



SHIFTS TRACK 9 FEET AT A TIME

Railroad Mixing Plant Has Bins on Mixer Car Fed by Crane

By M. B. UHRICH

Assistant Engineer, Erie Railroad, Jamestown, N. Y.

THE UNUSUAL mixing plant illustrated herewith is proving itself very efficient and profitable in the construction of the heavy concrete retaining walls and bridge abutments necessary for the work of separating the grades of the Erie Railroad Company from those of three of the busiest streets in the city of Jamestown, N. Y.

This work, being done by Mahoney & Swanson, a local firm, has been in progress since the spring of 1913, and although the amount of concrete in place to date seems small, the actual time of mixing and placing is very little. Considerable trouble was met with in the beginning owing to the subsurface conditions. After the cofferdams were completed and the foundations prepared the mixing and placing went quite rapidly.

The whole plant consists of two Brownhoist locomotive cranes, two electric pumps and a Foote mixer placed on a flat car, which is equipped with an elevating tower and hoist and bins for the sand and broken stone. The locomotive cranes are mounted on standard-gage trucks, one having a 36-ft. and the other a 48-ft. boom. These machines, equipped with a steam-hammer and clam-shell buckets, drive and draw all the sheet piling and do all the excavating. The one with the longer boom forms the link between the loaded cars of material and the mixing plant.

This mixing plant was designed by Mr. Swanson of the firm and detailed and built by the Foote Manufacturing Company. An elevating tower is attached to the front end of the car, which allows the bucket to be lowered to the floor level. It is 38 ft. high from the rail and elevates the concrete 35 ft. Next to this and on the end of the car floor is a three-sack-batch mixer which discharges over the end of the car into the



PILING DIRT ON STREETS AND REHANDLING AVOIDED BY USING THESE WAGONS



TOWER BUILT BEYOND END OF CAR ALLOWS BUCKET TO DROP LEVEL WITH FLOOR

elevator bucket. The charging bucket on the other side of the mixer is partitioned, each of the two compartments having iron cleats riveted to the sides, by means of which the stone and sand are measured. On the other end of the car is a two-drum hoist, which operates the feed bucket and elevator. Both the mixer and the hoist are driven by electricity.

Between these two machines and supported on a heavy framework is a V-shaped bin which holds about a carload of material. This is equipped with an adjustable partition to meet the requirements of different mixtures. This bin discharges directly into the feed bucket, and is as low as possible to allow clearance enough for the bucket to be raised and lowered. Its top extends the full length of the car. The material is dropped into this bin by the crane. Deflectors placed on the top of the bin avoid spilling and waste.

The mixer is set in on a track opposite the foundations or forms to be filled by the locomotive crane, which operates directly behind it. In the rear and within reach of the crane is a car of sand. On an adjacent track and opposite the mixer is the box car containing the cement, and in the rear of this is a car of stone. The crane easily unloads the sand and stone into the bin faster than they are used, and does its own switching, removing the empty cars and bringing up full ones without delaying the work. This leaves only the cement to be moved by hand, which is easily done, using a platform from the mixing car to the cement car.

This scheme requires two tracks for operation, but it occasionally happens that only one is available. There is more switching to be done then, of course, as the crane has only one car of material within reach. The cement car is placed at the nearest convenient point and unloaded on platforms which are carried to the mixer by the crane as it switches the other materials. Little or no time is lost in this operation, depending on the distance to the switching tracks.

The usual force necessary to operate this plant is one engineer and one fireman on the crane, one man on the mixer, one man on the hoist, two men on the binds and three men handling the cement.

This mixing plant has a maximum capacity of 20 yd. an hour, and when two tracks are in use, reaches an efficiency of 98.6 per cent. When only one track is available the efficiency varies from 92 to 66 per cent, averaging 84 per cent for the past season.

How Powder Fuse May Be Lighted Without Splitting

BY HOLDING a safety match against the powder core at the end of the fuse and drawing the match box across the match, causing the match and powder core to inflame immediately, a black powder time fuse may be lighted more readily than by splitting, according to the United States Bureau of Mines. This way of lighting a fuse was originated by W. C. Cope, of the explosives chemical laboratory of the bureau in Pittsburgh, and is the result of considerable experience in blasting operations. It is obvious that this method may be used only when but one piece of fuse is to be lighted, as where several charges are to be fired at once the time interval between the ignitions would be too long. The method, however, would be applicable to mud-capping and block-holding on construction work.

In case safety matches are not at hand, the ordinary household match may be used by placing one match against the powder core and then lighting another and quickly touching it to the first one. Either way is said to produce better results than the old method of splitting the end of the fuse.

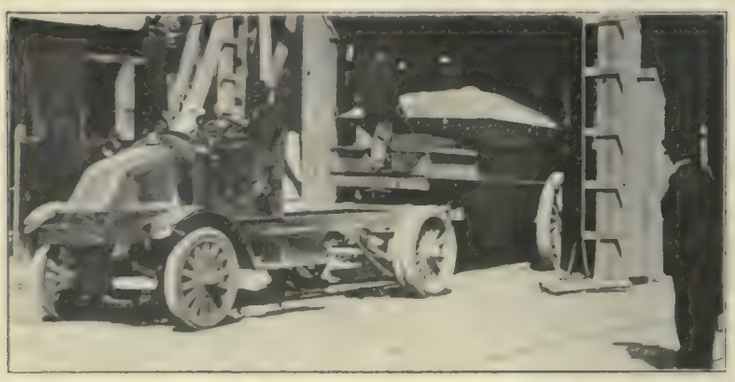
Standard Motor Truck and Trailer Operated as a Unit

THAT THE contractor is fast coming to realize, under certain conditions, the value of the motor truck as a method of haul and with his usual perspicacity is not slow in adapting it to his needs when aided by the manufacturer is evidenced in the accompanying photographs.

By removing the regular body of their motor truck and fastening a Martin fifth wheel to the rear frame of the chassis, a Kansas City company combined a 3½-ton Kelly-Springfield motor truck and a 5-cu. yd. Bulldog dump wagon as one unit without destroying the individuality of the motor truck. The dump wagon weighs 5000 lb. and with 5 cu. yd. of stone the total trailing load is about 12,500 lb.

At the conclusion of this particular use of the truck its regular body was replaced and the machine was ready for other service.

THIS AUTOMOBILE TRUCK AND WAGON WERE CONVERTED





INTO A TRAILER UNIT FOR SPECIAL SERVICE

The accompanying photographs show the combination which enabled the W. M. Spencer Crushed Rock Company to make four 20-mile trips, or 80 miles per day, delivering 20 cu. yd. of crushed rock. The 20-mile trips averaged 2½ hr., which included loading and unloading the trailer. About 20 gal. of gasoline and from ½ to ¾ qt. of oil was used per day. The roads over which the runs were made were in good condition and only a small fraction were of the ordinary dirt type. However, grades as high as 5 per cent had to be climbed.

A trip of approximately 50 miles was made from Kansas City to Independence, Mo., and return in 5 hr. 50 min., loading the wagon with 5¼ cu. yd. of crushed rock and ten 100-lb. sacks of cement, the latter being placed on top.

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

Seek to Compel Water Company to Install Filtration Plant

Efforts are being made to force a compromise between the East Chicago & Indiana Harbor Water Company, the cities involved and the Indiana State Board of Health in the controversy in which the board of health seeks to compel the company to install a filter system. The board allowed the question to go over until its next meeting, probably some time in November, pending an attempt of Mayor Frank Callahan of Indiana Harbor to arrive at an understanding with the officials of the water company on the filtration problem. Under the laws of Indiana the State Board of Health has power to order the installation of such a filtration system and officials of the board said that unless the Mayor and the company settled the matter it would probably enter an order in the case.

American Society Recommends Co-operative Plans for Investigtaions

At the regular meeting of the American Society of Civil Engineers Oct. 20, in New York City, F. zur Nedden presented a paper on "Induced Currents of Fluids." Secretary Hunt read written contributions from Dr. C. G. P. DeLaval and Clemens Herschel, and John C. Trautwine, Jr., discussed the paper. After the closing remarks by Mr. Nedden, suggesting the need of more co-operation in the conduct of experiments, Mr. Trautwine offered a resolution recommending that the Board of Directors take the necessary steps to promote, through the U. S. Bureau of Standards and the Engineering Foundation, a systematic plan of co-operative tests which would prevent duplication and waste.

A. S. M. I. Adopts Patented Paving Specifications After Strenuous Debate

Four-Day Convention at Dayton Enlivened by Discussion on Fifty Papers and Reports—Pioneer Activated Sludge Plant at Milwaukee Described

The adoption of standard specifications for bituminous pavements proved to be the storm center of the Dayton convention of the American Society of Municipal Improvements, Oct. 12, 13, 14 and 15. After battling with the convention the greater part of an afternoon session until 7 p. m. and holding fifty-one active members to a final vote of 32 to 19, the majority report of the sub-committee went down to defeat with colors still flying. As adopted the minority report sets forth as standards of the society specifications for Bitulithic pavement under the Warren Brothers patents and for a pavement similar to one laid under the so-called Topeka specifications which the Warren Brothers concede will not infringe. Opinions differed as to whether a pavement with the mixtures proposed will or will not be as good as the Topeka pavement. Among the fifty reports and papers there was important action taken in revising, defining and co-ordinating the duties of the standing committees. T. Chalkley Hatton's paper on "The Pioneer Plant for Treating Sewage by the Activated Sludge Process," abstract of which appeared on page 48 of the Engineering Record of Oct. 16, marked the first presentation of details of this installation.

Revise Wood Block Specifications

Numerous changes in the specifications on wood block proposed last year were made following four papers on various mooted questions on wood block by J. W. Howard, P. C. Reilly, Hermann von Schrenk and E. R. Dutton.

This specification, according to the predictions of those familiar with the general situation, was to have been the sensation of the convention, but because of the alleged "closed" preserving oil clauses it was finally put over to another year with the request that the incoming committee furnish for the printed proceedings additional clauses for oils not coming within the range of those specified. To the casual delegate Hermann von Schrenk's paper, containing numerous examples of old pavements in which various kinds of oil had been effective as a preservative for many years, largely removed the quality of the oil as the criterion of the success or failure of wood block paving and centered interest on the details of treatment and methods of laying. Another telling argument for internal harmony of the warring wood block interests was the statement of Eugene W. Stern, chief engineer of the Bureau of Highways, Borough of Manhattan, New York City, to the effect that no wood block paving was being laid in the Borough of Manhattan in 1915 because of strenuous objections by 250 representative street users to certain characteristics of wood block, which Mr. Stern believed could be much improved. Whether or not the closed specification advocates (if there are such) saw defeat awaiting them, the fact remains that the decision as to specifications for oil are now entrusted to the engineer and all producers

Latest Slide at Panama Which Has Closed Canal to Traffic for an Indefinite Period



Photo, Modern Photo Service

A LENGTH OF 1300 FEET IS INVOLVED, AND FOR PART OF THE DISTANCE, AS THIS VIEW SHOWS, THE CHANNEL IS PRACTICALLY CLOSED

Engineers Responsible for Construction of Panama-Pacific



Left to Right—L. F. Laurey, assistant electrical and mechanical engineer of the Exposition staff; H. D. Dewell, chief structural engineer; Shirley Baker, assistant director of works; Harris D. H. Connick, director of works; C. S. Scott; William H. Crocker, chairman of committee on buildings and grounds; Theodore tion; John A. Brashear; Prof. C. D. Marx; J. J. Carty; C. C. Vogelsang, commissioner of the Exposition; F. L. Hutchinson; Calvin W. Rice; Lieut.-Commander

have a competing chance. Some of the changes in the specification finally submitted as information widen the wood clauses to admit some of the Cuban pines, reduce the specific gravity of the oil at 38 deg. C. to a value of from 1.06 to 1.12, define the steaming and vacuum treatment more closely to insure penetration of the sapwood, insist on wetting before laying, advocate laying on a 1-in. 1:3 mortar bed or on sand containing 10 to 25 per cent of clay, laying closely instead of loosely and filling joints with sand or bitumen.

Other Paving Standards Little Changed

Brick paving specifications were not materially changed. They now permit the use of wire-cut lug brick. Suggestions were made to investigate vertical fibre brick. Before the sub-committee the National Paving Brick Manufacturers' Association strongly advocated the adoption of the standards recently adopted by the American Society for Testing Materials, but no action was taken.

Minor changes only were made in the asphalt specifications. The clauses in regard to contours after 5 years were considered too severe. Instead of requiring no deviation beyond ⅝ in. in 4-ft. distances, the new requirement is ½ in. in 3 ft.

A. H. Blanchard presented as a guide rather than as a standard a specification for a bituminous concrete pavement having but one product of a stone crushing plant.

Specifications for one and two-course concrete pavement followed closely those of the American Concrete Institute. However, clauses for joints and reinforcing were omitted and simply referred to in a footnote as items for the engineer to determine locally.

Crushing tests for stone block were omitted and the French test for wear inserted. Opinions differed as to the value of gravel in pinning the blocks together. It was contended that the difficulty in getting the filler to the bottom more than offset the pinning advantage.

Dr. Rudolph Hering presented two changes in the sewer pipe specification. The first omits the details of joints for reinforced concrete pipe and the second adds the words "without collapse" in the clause relating to tests on reinforced concrete pipe.

Garbage Disposal

J. E. Barlow, director of public service, Dayton, described conditions in his city since Jan. 1, when burying of the material began, using workhouse men. He also told of a new 50-ton plant in the course of construction.

Valuable data were presented on operation of the Atlanta high temperature destructor by E. R. Conant, chief engineer.

The report of the committee on garbage and street cleaning, John T. Fetherston, chairman, indicated a rapidly growing tendency toward the use of motor trucks for both purposes.

Introspective Investigation

The introspective report of the committee on committees, of which A. P. Folwell was chairman, recommended dividing the subject of streets—surface, sub-surface and super-surface—among additional committees, inasmuch as paving proper seems to have usurped the attention of the present committee. The six heads suggested and accepted by the convention are street paving, sidewalks and street design, city planning, parks and parkways, street lighting, traffic and transportation.

Society Affairs

Charles C. Brown, secretary, reported an active membership of 339, 100 having been lost during the year and 43 new members obtained. Receipts for the year total $2,972.45 and expenditures were $3,349.60, the deficit being drawn from the surplus funds.

The next convention will be held in Newark, N. J., under the following newly elected officers: President, A. F. Macallum; vice-presidents, N. S. Sprague, J. B. Hittell and E. R. Conant; secretary, C. C. Brown, Indianapolis; treasurer, W. B. Howe.

Indiana Ruling Frees Owner From Liability for Material Bills

Judge Rochford of the Marion County (Ind.) Superior Court held in a case recently decided that the owner of a building, which is erected, cannot be held responsible for the payment of material bills contracted for by the individual who is under contract with the owner to pay all material bills. The remedy of the seller of material for which a contractor does not pay is to sue the contractor, and not to file a lien against the building into which the material has been put, the Court held.

Judgments have been given often in Indiana in favor of the seller of materials against the owners of property in which materials used were not paid for by the contractor. Judge Rochford, however, held that when a building is being erected under contract and the contractor fails to pay his material bills, the only action that can lie is against the contractor. The decision was made in the case in which S. S. Rhodes & Son sued Grace Selvage, Joseph W. Selvage, C. C. Wynn, contractor, and others for a judgment of $700 for material put into two houses being built by Wynn for Selvage. Judge Rochford said the testimony disclosed that Wynn was under contract to build the houses and he held that the Selvages could not be held responsible. A judgment was given the plaintiff against Wynn. Judge Rochford contends that his ruling is supported by a decision from the Appellate Court of Indiana, handed down March 2, of this year. Mechanic lien suits for labor, however, Judge Rochford held, are good against the owner of a building on which the labor is put, when the contractor fails to pay such services.

Publicity Brings Enforcement of Chicago Building Code

That publicity pays is shown in the following notice sent all Chicago architects and builders by Charles Bostrom, city commissioner of buildings: "You are hereby notified that all buildings must comply with Section 520 (c) of the Revised Building Ordinances, which reads as follows: In buildings of every class where wood furring is used on brick walls, the brick between joists shall be projected from the bottom of the joist to the top of the joist for the full thickness of the furring and in no case shall such projection be less than 2 in.

"As such projection is intended for a fire stop, it must be solidly built to the full depth of the joist, with both vertical and horizontal joints properly filled with mortar. You are further notified that failure to comply with said ordinance will mean a loss of time and additional expense, for the reason that work on building will be stopped and cannot be resumed until satisfactory assurance is given that walls will be built as required."

To the *American Lumberman* full credit is due for bringing to light a flagrant violation of the Chicago Building Code. See editorial in the Engineering Record of Oct. 9, page 437.

Bloomington to Pay for New Water Supply by Installments

Hampered by the fact that it is very close to its bonded debt limit the city of Bloomington, Ind., has been unable to construct the pipe line necessary to connect its water distribution system to the dam recently built at Leonard Springs, about 7 miles distant from the city. To overcome this difficulty an arrangement has been entered into whereby four banks in the city are to furnish money for a holding company to let contracts for the necessary piping, which will amount to from $75,000 to $100,000. This plant will be rented to the city in such a manner that 10 per cent of the

Exposition and Success of International Engineering Congress



chief of construction; W. O. Waters, superintendent of building construction; Guy L. Bayley, chief electrical and mechanical engineer; A. H. Markwart, Hardee; Charles C. Moore, president of Exposition; John A. Britton, vice-president of Exposition; Carl S. Herman; Dr. F. J. V. Skiff, director in chief of Exposi- C. H. Woodward, U. S. N.; Charles Warren Hunt and Howard H. Holmes, consulting engineer of Exposition

total cost will be returned each year with interest at 6 per cent. At the expiration of 10 years the city will come into possession of the entire property. The details of agreement will have to be ratified by the State public service commission before becoming effective.

Governor Signs Contract for Boston's $3,000,000 Drydock

Construction of the $3,000,000 1200-ft. drydock at Boston has at last been made possible, Governor Walsh having on Oct. 13 signed the contract for the work. The low bid of the Holbrook, Cabot & Rollins Corporation was approved by the directors of the Port of Boston more than a year ago, but the matter has since been pending, owing to political and labor complications.

Development in California Under Commission Jurisdiction

The Railroad Commission of California has recently published a report outlining the public utility development work carried on in that State since the commission assumed jurisdiction over stocks and bonds, a period of approximately three and one-half years from March, 1912, to September, 1915. During this period stocks, bonds, notes and certificates have been authorized by the commission amounting to $466,000,000, the report states. Of this amount $175,000,000 has been authorized for the payment of maturing debts; $248,000,000 has been authorized for new construction, additional development of existing utilities and new ventures, and the balance has been used for miscellaneous purposes. The authority for new improvements has been distributed in the report as follows: Steam railroads (including $25,000,000 for expenditures outside of California), $102,800,000; electric railroads, $32,500,000; gas and electric companies, $80,000,000; water companies, $18,500,000; telephone and telegraph companies, $2,500,000; warehouses, $1,600,000; pipe lines, $10,000,000. Approximately $200,000,000 of the foregoing has already been expended or is in the process of expenditure. During the 3½-year period under review there have been launched 16 new railroad enterprises, 13 new gas and electric companies, 6 new telephone companies, a new $5,000,000 oil pipe line, an independent ferry line on San Francisco Bay and many new water companies. Seven hundred miles of new railway lines have been constructed or are now being constructed under authority of the commission and water power projects, involving the development of a total of 100,000 hp. have been initiated.

Miniature Sewage Plant Feature of Dayton's Budget Exhibit

A miniature sewage disposal plant on a scale of ¼ in. to 1 ft. with precise automatic siphons working at the correct cycle period, was one of the features of the municipal



THIS MINIATURE ACTUALLY WORKED ON CORRECT CYCLE PERIODS

budget exhibit at Dayton, Ohio, last week. Charles H. Kline, a member of the engineering staff, years ago, before he became an engineer, learned the tinners' trade and was therefore able to cut the model out of tin, working nights, in about two weeks' time. The Imhoff tanks with their suspended flowing-through chambers, involving conic sections, and all other parts went together without difficulty. The model, which is 3 ft. 2 in. wide by 7 ft. long, is a replica of the 800,000-gal. plant at Urbana, Ohio, except as to inner workings, such as valves, siphons, pipes and tiling, which had to be re-designed on account of their small size to overcome capillary attraction.

Other exhibits of interest to the engineer were a papier-maché model of the river improvements; waterworks apparatus, particularly meters and leaking fixtures; a full size sewage system with manholes, catch basins, inlets connected by a vitrified pipe system being cleaned and a 9-ft. segmental tile outfall sewer; clogged inlets, and a section of reinforced concrete pipe; tree roots taken from sewers; paving models of all kinds; laboratory testing outfits; garbage details; street cleaning apparatus and numerous charts. Although the exhibit is primarily one to educate Dayton's citizens and to assist in carrying a $1,000,000 bond issue, it was opportunely open to the delegates of the American Society of Municipal Improvements, who were also interested in the exhibit of the centralized purchasing department.

American Association of Engineers Prepares for Convention

Plans for the national convention of the American Association of Engineers to be held in Chicago, Dec. 10 and 11, are being rapidly completed. All engineering societies have been invited to send official representatives to the convention to join in the discussions and assist in attempts to solve a few of the welfare problems confronting the engineer.

During the latter half of September a gain of 55 members was made. A national membership committee has been selected to push the organization of local chapters in various parts of the United States. Those appointed on the committee are A. H. Krom, assistant engineer, Illinois State Public Utilities Commission; F. H. Newell, professor of civil engineering University of Illinois; S. Steenerson, engineer, Minnesota Highway Commission; Edwin R. Webster, civil engineer, Marion, Iowa; Daniel B. Luten, bridge engineer, Indianapolis; O. L. Dent, referee of drainage matters, Bemidji, Minn.; R. A. West, civil engineer, Tye River, Va.; Israel L. Beerman, engineer, New York State Highway Commission, Fillmore, N. Y.; Harold Almert, consulting engineer, Chicago; W. N. Winter, electrical engineer, Hood River, Ore.; H. L. Holderman, civil engineer, C., M. & St. P. Ry., Lewiston, Mont.; Hunter McDonald, chief engineer, N. C. & St. L. Ry., Nashville, Tenn.; George C. Keech, electrical engineer, Chicago, and A. T. North, contracting engineer, Chicago.

Owing to the increase in its activities, the association has taken larger quarters at 29 S. La Salle Street, Chicago.

Supervision of the work of the qualification committee has been undertaken by Ernest McCullough, consulting engineer, Chicago. The Service Clearing House is actively engaged in putting the engineer in touch with the employer and the employer in touch with the man without charge. One of the largest electrical manufacturing concerns in the United States has given the association the preference in filling all vacancies which require men of technical training.

News of Engineering Societies

The Municipal Engineers of the City of New York will hold a meeting at the Engineering Societies Building, Oct. 28. William Goldsmith will present a paper on "One Year's Operation — Manhattan Municipal Asphalt Plant."

The Albany Society of Civil Engineers will hear John H. Gregory of the firm of Hering & Gregory, consulting engineers, of New York City, speak on "Sewage Disposal with Special Reference to Present Day Practice," at a meeting to be held in that city Oct. 26.

Personal Notes

ARTHUR C. EVERHAM, formerly assistant chief engineer of the Kansas City Terminal Railway, has been appointed engineer of construction for the Kansas City Bridge Company, engineers and builders of bridges, viaducts, turntables, shuttles, buildings and substructures, of Kansas City. Mr. Everham was graduated from the University of Cincinnati in 1902 and was connected with the Cleveland, Chicago, Cincinnati & St. Louis Railway, on maintenance and construction, until 1903, when he entered the service of the Michigan Central Railroad as assistant engineer. In 1905 he was appointed assistant engineer in charge of all preliminary and location plans and surveys for the Detroit River tunnels for that company. As assistant tunnel engineer he had charge of the construction of the tunnels and of the general plans and specifications for the construction of the terminal facilities at both ends, from 1907 to 1909. He was appointed assistant chief engineer of the Kansas City Terminal Railway Company in 1910 and continued in that office until April of the present year. In his new connection he will have charge in the field of the construction work handled by the bridge company, devoting his time particularly to Government and railroad construction.

JOHN T. WHITNEY has been appointed to a position on the forces of the H. Koppers Company of Pittsburgh, on work in connection with the construction of the new coke ovens for the La Belle Iron Works at Steubenville, Ohio.

F. R. LYONS, formerly civil engineer student in the U. S. Office of Public Roads and Rural Engineering, has been promoted to the grade of U. S. junior highway engineer and transferred from the U. S. Post Road work in MacDowel County, North Carolina, to the Russel Experimental Road in Alexandria County, Virginia.

W. E. GUIGNON, formerly division engineer on the Pennsylvania Lines West of Pittsburgh, at Zanesville, Ohio, has been transferred to the position of division engineer at Logansport, Ind., succeeding A. C. Watson, whose transfer to another division is noted elsewhere in these columns.

G. PRESTON BRADY, formerly connected with Campbell & Lattimore, contractors on the foundation work for the High Level Bridge at St. Catharines, Ont., is now engaged in drafting work for the Pere Marquette Railroad in connection with valuation work.

J. K. SHERMAN, formerly assistant division engineer of the Pennsylvania Lines West of Pittsburgh, at Pittsburgh, has been appointed division engineer at Zanesville, Ohio, succeeding W. E. Guignon, whose transfer to another post is noted elsewhere in these columns.

J. B. RICHARDS, formerly general superintendent for P. M. Johnston & Company of St. Elmo, Ill., on the construction of concrete roads in Illinois, is now in charge of construction for the H. H. Hall Construction Company of East St. Louis, Ill., on concrete bridge work at French Village, Ill.

A. C. WATSON, division engineer of the Pennsylvania Lines West of Pittsburgh, at Logansport, Ind., has been transferred to a similar position at Cleveland, Ohio.

L. E. FAULKNER, formerly division engineer of the Mississippi Central Railroad, at Hattiesburg, Miss., has been appointed chief engineer of that road.

W. W. GREENLAND, formerly assistant engineer of the Wabash Railroad, at Moberly, Mo., has been appointed engineer maintenance-of-way of the Western division of that road.

R. L. CARLINGHOUSE, formerly connected with the Kern County (Cal.) Highway Commission, has been appointed to a position on the forces of the State highway department, in the office at Fresno.

LEROY N. REEVE, formerly office engineer for the U. S. Reclamation Service on the Grand Valley project in Colorado, has been transferred to the office at Denver as designing engineer.

H. E. CURTIS, formerly draftsman for the Southern Power Company on the design of its Eno steam plant and, previous to that, assistant superintendent with the Foundation Company of New York City, has been appointed assistant engineer on the forces of the Michigan Limestone & Chemical Company of Rogers City, Mich.

A. H. RINEY, U. S. junior engineer, has been transferred from the Osage River improvement work to the work on the Missouri River at Arrowrock, Mo. He has been succeeded in charge of the Osage River work by E. M. Levy, U. S. junior engineer.

ABERTHAW CONSTRUCTION COMPANY, specialist in reinforced concrete and industrial buildings, dams and water powers, of Boston, will move its main offices from 8 Beacon Street to the Niles Building at 27 School Street.

F. C. DRESSENDORFER, formerly assistant engineer on the forces of the Chicago & Northwestern Railway and, more recently, assistant superintendent for John Marsch, general contractor, has joined the organization of the Turner Construction Company of New York City. Mr. Dressendorfer first engaged in engineering work in 1904 on the forces of the Girard Construction Company of Cleveland and Chicago on railway location and construction. He entered the employ of the Chicago & Northwestern in 1905 and, in 1912, had charge of the Milwaukee improvements of that company, which included terminal construction, the erection of a reinforced concrete elevator and bridge and dock work. In 1914 he left the employ of the railway to accept a position as assistant superintendent in charge of bridge construction on the Grand Trunk extension in Massachusetts for John Marsch.

FRANK W. SKINNER, consulting engineer of New York City, has returned from a five months' business trip to London, Paris and Le Havre, where he secured from the Belgian Government orders for several hundred portable interlocking steel houses of his own design, to be manufactured in America. He also furnished the British Expeditionary Force with his "Slip-Joint" steel piles for protecting military trenches. Mr. Skinner was retained for important designing work, was consulting engineer in Paris to the Crown Prince of Serbia and was technical adviser to Gaston, Williams & Wigmore of New York, London, Paris, Rome and Petrograd.

GEORGE E. KING, JR., formerly draftsman for the Turners Falls Power & Electric Company of Turners Falls, Mass., has been appointed draftsman with the National Survey Company, maker and publisher of maps, of Chester, Vt.

S. V. KEELER, formerly draftsman with the Pennsylvania State Highway Department, has been appointed transitman on the forces of the Philadelphia & Reading Railway at Williamsport, Pa.

CLARENCE M. LAWSON has been appointed State engineer in charge of railroad and public utility work in Wisconsin by J. G. D. Mack, State engineer. This is, in effect, a reappointment, as Mr. Lawson has been in charge of substantially the same line of work for several years, the only difference being that his office is now placed under the authority of the State engineer, the creation of whose office was authorized under a recent act of the Legislature.

C. C. BROWN, editor of *Municipal Engineering*, has been appointed professor of sanitary engineering at Purdue University to succeed Professor Sackett, whose resignation was noted in these columns several months ago. Professor Brown was graduated from Cornell and Michigan Universities and has held the position of professor of civil engineering at Rose Polytechnic Institute and also at Union College. He has also held a number of important positions in the engineering field, including the posts of city engineer of Indianapolis and consulting engineer for the New York State Board of Health.

WALTER E. LEE, formerly assistant water engineer of Baltimore, has been appointed water engineer of that city. He was graduated from Cornell University in 1909 and was engaged in railroad work until 1911, when he joined the engineering forces of Baltimore's water department.

ROBERT L. CLEMMITT, who has been acting as water engineer of the city of Baltimore since the resignation of Ezra B. Whitman in 1914, returns to his former position as assistant water engineer, upon the appointment of Walter E. Lee as water engineer, which is noted elsewhere in these columns.

Obituary Notes

AUGUSTUS JAY DU BOIS, professor of civil engineering, Sheffield Scientific School, died suddenly of heart failure at New Haven, Conn., on Oct. 29, at the age of sixty-six. He was the author of some of the best-known treatises on structural design in the English language, a member of various engineering and scientific societies and a member of the governing board of Sheffield Scientific School. He was graduated from that school with the class of 1869.

WILLIAM BYRD KING, formerly second vice-president and general manager of the Fort Worth Belt Railway, died in Fort Worth, Tex., Oct. 11. He was born in 1850 and entered railway service in 1869, as rodman on the engineering forces of the Orange & Alexander. After serving as assistant engineer with the Texas & Pacific, the Missouri, Kansas & Texas, the Fort Worth & Denver City and the Fort Worth & Rio Grande, he attained the office of chief engineer of the Fort Worth & Denver City in 1889. Two years later he was appointed chief engineer of the Fort Worth & Rio Grande. From this position he was advanced to the office of vice-president and general manager. He became vice-president and general manager of the Fort Worth Belt Railway in 1902, and resigned from that office about a year ago on account of poor health.

Civil Service Examination

Illinois.—It is announced that an examination for an assistant sanitary engineer, salary from $100 to $250 a month, is to be held in the near future. This position is in conjunction with the recently established sanitary engineering bureau of the Board of Health. It requires a man of 25 years of age who, among other qualifications, has had an engineering training at least two years' experience in sanitary work. The duties are subordinate to those of the chief sanitary engineer, and include, besides, bacteriological analyses and inspection work.

Engineering Record

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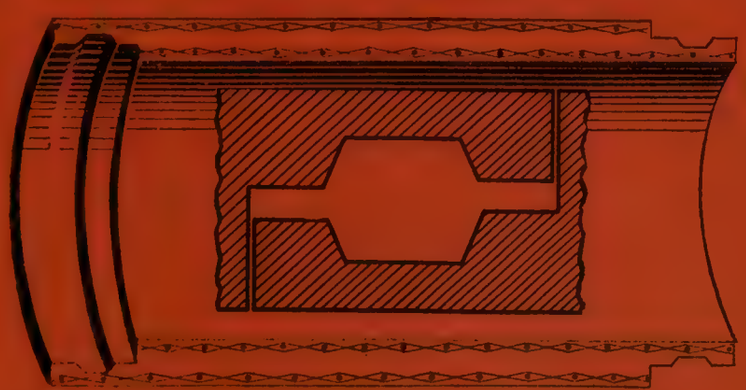


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Election Day and the Engineer

WITH Election Day close at hand the engineer must assume a certain responsibility in placing in offices which require technical knowledge on the part of the incumbent the men best qualified to administer the work. It is unfortunate that in many cities the practice of electing such officials as city engineers still obtains. These men should not be chosen by popular vote but should be appointed, with due regard to their fitness to perform the duties required of them. The average citizen with a ballot before him generally looks blankly at the names of candidates for engineering offices and then votes a straight ticket. He is in no position to make an intelligent selection. Yet his verdict decides the case of the city engineer. It is the clear duty of local engineering societies to investigate the qualifications of candidates for technical posts and indorse only those men who merit election. This can not be construed as electioneering. It is, on the contrary, a public service which can be easily rendered. It has as a precedent the action of bar associations in indorsing the candidates for elective judicial positions.

Speed Capitalized

IF SURFACE indications have been correctly interpreted developments in this country, due to the war in Europe, are opening up real opportunities to American concerns equipped to do work and supply materials quickly. Old plants are being remodeled and new ones built to handle the influx of war orders. All of this expansion, naturally, is rush work and it is the speed element which is the determining factor in the award of new contracts, provided, of course, construction or materials of satisfactory quality can be produced under conditions of forced draft. A number of concerns have been shrewd enough to capitalize this demand for speed by a campaign of publicity emphasizing in what ways their products can be utilized to cut down on the usual time required for construction work. The fact that new plants are needed, and needed quickly, is well illustrated by the case of a motor truck company which is assembling its machines under canvas circus tents. The munitions factories have, of course, been busy for months past putting up new buildings to increase their output, but it must not be inferred that new construction is being undertaken exclusively by concerns supplying ordnance, shells and other materials needed by the warring nations. A straw in the wind, indicating an awakening in other industries in the United States, is furnished by the statement, commented on editorially in this journal last week, in which the Government announced a policy of protecting, after peace shall have been declared, capital invested in American industries established to supply products, formerly foreign made, which the war has curtailed. The growth of a dye industry in the United States, with the consequent necessity for new building construction on a large scale, is only one of the promising opportunities which the future holds for engineer, contractor and material manufacturer. As matters now stand, however, it is the rapid worker who is getting the cream of the construction and engineering equipment business. Concerns in all lines which are affected by the industrial expansion will do well to make the most of their facilities for speedy construction.

Barge Canal Bond Issue

TUESDAY the voters of New York State will decide the fate of the proposed bond issue of $27,000,000 to complete the Barge Canal. Whatever one's views may be as to the wisdom of the original undertaking, the efficiency or honesty of the administration of the funds already provided, the benefit to come to the State from the finished canal, the question to be settled now is whether the State is willing to leave, longer than necessary, its great ditch unfinished and practically unserviceable. It is too late to decide not to build the canal. That might have been done ten years ago, but now the State has put more than $100,000,000 into the work. Engineers know that whether or not the money has gone as far as it might have there is much to show for it, and that legitimate additions to the original project and unforeseen contingencies have had much to do with the exceeding of the original estimate. The proposed bond issue, therefore, should be ratified and the canal should be finished as soon as possible and given a chance to justify itself.

Keep the Road Dry

WITH the advent of fall it is in order to sound the trite warning concerning the damage to roads by frost action unless adequate precautions are taken to insure thorough drainage. As the Office of Public Roads of the Department of Agriculture has pointed out in a timely bulletin, it is water, not cold, which is responsible for the deterioration of highways in winter. The familiar "heaving" of a road is the direct result of the pushing apart of its component materials by the expansion which follows the conversion into ice of the water retained in its interstices. The remedy is obvious—Keep the road dry. Now is the time to adopt preventive measures. Keep the ditches and drains open. Remove all accumulations of weeds and grass which retain moisture and obstruct drainage. Use the drag frequently on earth and gravel roads. Fill in and consolidate all raveled spots in macadam surfaces. Winter destruction of roads really begins in the fall. If this destruction is to be minimized road engineers should begin now to take the simple precautions which will safeguard the traffic routes over which they have supervision.

Standardizing Concrete Roads

ENGINEERS are fast adopting the common-sense view that the cheapest structure is that which costs least per unit of time that it is in service. The automobile has made the soft-surface road more expensive to maintain than hard roads of several times the soft-surface road's first cost. Concrete is gaining favor as a road building material because its first cost is being lowered and the quality of the concrete improved by efficient construction methods. Undesirable features in the finished road are being eliminated by increased engineering experience and skill in dealing with the design of the road slabs and in providing proper specifications. With the idea of furthering knowledge along both of these lines the construction of the experimental road, described on page 530 of this issue, has been undertaken by the engineers of the Pennsylvania State Highway Department with the co-operation of a number of cement manufacturers in the surrounding territory. While these men are not building the first or even the first good concrete road, they are, nevertheless, pioneers in the sense that they are crystallizing the best developments of concrete road practice in a way that will make it possible for any engineer to design and any contractor to build a good concrete road with economy. This is a service, performed years ago in the case of steel structures and only recently in the case of reinforced-concrete buildings, which should be welcomed by all highway engineers.

English for Engineering Students

IT CAN safely be predicted that the course in English for seniors, introduced for the first time this year in the engineering department at Princeton University, will be no uncertain factor in increasing the usefulness of that institution's graduates when they buckle down to real work after receiving their degrees. Engineers, as a class, are notably deficient in expressing their ideas on paper, and this has been the natural result of a short-sighted policy in technical schools where the aim has been merely to cram the students as full of "practical engineering" as is possible in the

four-year period of instruction. It should be remembered, however, that the man who can write well is not necessarily a good engineer, but the man who combines the abilities of good writing and good engineering possesses an asset of incalculable value. Men with these qualifications, reinforced with the necessary personal characteristics, reach the positions of high executive authority, while their less talented comrades must be content with the subordinate posts. To attain facility in writing requires hard work and much practice except in the case of the rare genius with an inborn aptitude for it. Writing is not a trick that can be learned over night, but it is well worth the effort expended on it. It is high time for all engineering colleges which have neglected their duty in insisting upon instruction in English to organize courses such as the one which has been inaugurated at Princeton.

City Guide Posts

THERE is no good excuse nowadays for not marking the names of city streets at intersections, and yet many cities are sadly deficient in this respect. Perhaps some city engineers consider it a matter of minor importance, but, in reality, it is a very essential feature in making a good impression on the stranger. Since it is the stranger that uses the street markings most, complaint about lack of attention to this matter unfortunately often fails to strike home with effect, and some communities boasting many municipal improvements overlook this detail, and the stranger, particularly the newcomer, is inconvenienced and vexed while he is getting his first impression of the city. City engineers the country over have developed schemes for posting the names of streets until there are probably almost as many methods as there are cities.

Schemes that can be applied in one city may not be at all suitable in another, but it would be well if every city engineer made it a point to study this question as he would any other engineering problem and not continue to renew old signs with duplicates simply because that particular style has been used before. A sidewalk name plate that has recently been received with much favor in western cities consists of an angle iron set horizontally in the curb, one face flush with the sidewalk surface and the other flush with the vertical face of the curb. The iron is painted black and on the vertical face the name of the street appears in raised letters painted white to make them stand out. This type is never hidden underfoot and lasts indefinitely.

Where lighting standards are available for elevating the signs their usefulness can be greatly increased, especially for residents if, under the street name, "600 Block" or a similar designation is used to locate the street numbers. Street names etched into electrolier globes have the advantage of being readily legible day or night, but renewing the breakages is costly. A commendable spirit was recently shown by the city engineer in a small western town who had available no funds for etched globes, but realizing the desirability of marking the streets had his draftsman cut stencils from cardboard and with these painted the street names on the electrolier globes. This simply illustrates the point that no matter what the conditions or lack of funds, there can be found some simple but effective means of marking all the streets and until this has been suitably done no city engineer should be content to let the matter rest.

Chicago Public Utility Galleries Become a Reality

STREET opening in the heart of our large cities is at best a most annoying and expensive operation, to say nothing of the irreparable injury done to pavements. New York had a chance, when its streets were first opened for subway construction, to build public utility galleries and William Barclay Parsons favored their construction, but the utility interests were unwilling to give up fancied or real rights enjoyed by having their conduits buried in common earth.

New York has a short stretch of gallery which has not been occupied. In Chicago there is now being constructed three and one-half blocks of model gallery in connection with the new Union Station. The Union Station Company is required to re-arrange at its own expense pipes and wires in the streets to be disturbed by its construction activities. According to agreement the company must maintain the pavements for many years to come, so it was not hard for the Commission on Downtown Municipal Improvements, the commissioner of public works, the city engineer and city council to arrange with the company to build the model gallery. Strange to say, the utility companies were not much interested, but some of them have been persuaded to enter the project. Many objections were raised. Gas explosions, broken water mains, and fuse blowouts were inimical to good service, the telephone and telegraph company contended. Decreasing the plant investment was also given as an excuse for staying out, and this is probably a perfectly valid one; for a corporation, which is a mere tenant of a municipally owned gallery, would not be able to claim in its appraisal values expensive pavements built on top of them. There would no doubt be a chance for tampering with the various mains, but probably the chances are not greater than those offered by numerous manholes now in service. The advantage of being able to inspect the lines daily and make immediate repairs is a very real one in many instances. In German and French cities no gas mains are included, but in London the gas mains have never caused an accident.

As to the practicability from a financial standpoint, Alvord & Burdick reported last year that foreign experience indicates that utility galleries, as applied to streets where the investments are already made, are not financially practicable, but where new streets are opened such galleries are warranted. They pointed out further in this report, which was abstracted in the Engineering Record of Jan. 9, page 53, that many streets in Chicago will be torn up, thus affording a chance to install galleries. The utilities should realize that the costly nuisance of digging up paved streets will have to be abated.

Highway Traffic Regulations Should Be Standardized

IN THE latter part of the eighteenth century there were what were described in England as the "new users" of the roads—the stage coaches. Parliament at that time passed many acts dealing with the building and regulation of highways. The beginning of the twentieth century sees another new user of the roads—the motor vehicle—which, in turn, has given rise to numerous statutory provisions relating to highways and the control of traffic. The control of modern road traffic is a problem which must receive concerted and scientific study if it is to be solved. The many and various regulations in force today make impossible either compliance with the laws or adequate provision for the safety of the traveling public.

In many localities danger signs have been posted, some by public officials, some through the enterprise of automobile associations. There has been, however, no uniformity, as might be expected under such circumstances. In most cases it is necessary to stop or greatly slow down a vehicle if the warning on the sign is to be read. Thus the signs become practically useless.

The traffic rules for cities are many, while the signals of the traffic police often are as complicated as those of a freight brakeman making up a train. In some cities two whistles mean east and west traffic open; in other cities two whistles are for north and south traffic. In any event one is supposed to distinguish the whistle above the chug and rattle of a street full of traffic. Sharp curves and steep hills are danger places whose proximity is variously indicated. It remains to have uniform markings so that, in any locality, one may know the road by standard warning signs.

A device used on some of the trolley lines in Massachusetts might offer a suggestion for highways. The poles are painted white to a height of 5 or 6 ft. on tangents. On approaching a curve the white band is raised on succeeding poles until it extends 10 or 12 ft. high near the tangent point of the curve, the rise of the bands being more or less gradual according to the sharpness of the curve. Such a device needs but a glance to understand its message. Whether such an arrangement would work satisfactorily on highways where poles are along side is problematical. But who to-day is to answer such a question? There should be some department or some bureau which should have charge of such matters.

At present what is done when similar suggestions are made is for some county or perhaps State official to try them out, and, finding some one satisfactory, install the method with the result that one does

one way and another a different way, both to accomplish the same purpose. But what of the road user who meets a dozen or more such devices in the course of a day's ride? How is he to know their significance?

The answer to the whole situation will be found as soon as some one is given the task of studying the situation and reporting on standard methods to be used under given conditions. Such a study could be logically undertaken by the U. S. Office of Public Roads, and it is to be hoped Congress will see the importance of such an undertaking and appropriate the comparatively small amount that would be necessary. Federal aid of this sort is both sane and practical.

Published Cost Data and the Contractor

COST data should not be published with the idea of benefiting the contracting business. They may be published for the benefit of engineers who are not in a position to obtain them directly, but persons seeking information on which to make estimates for bids should use any such published information with great caution. It must be borne in mind that while engineers' estimates should be, and are, most carefully made, the engineer does not lose money or have to go out of business because of slight mistakes in estimating doubtful factors. This possibility contractors must face, especially when competition is keen. An engineer's estimate should be as accurate as possible, but on a contractor's estimates depend his very business existence.

Cost data may be divided into three classes. First come those kept by public works engineers on operations conducted under the day-labor plan. This class of costs is frequently met with in print. Second, there are often published by engineers and others costs of work done under contract by another party. Last are the cost data kept by contractors for their own use and usually closely guarded.

The first class of costs is misleading in two ways to the intending bidder on similar work. A community is not a contractor. It does not have to make a profit out of doing a job by day labor in order to stay in business. If a public works engineer does with day labor for $47,000 what a contractor offered to undertake for $50,000 people look only at the fact that he has saved the city $3,000. In all probability, however, the contractor who bid $50,000 would have done all the work charged to the job by the city for $40,000, the rest of this bid covering overhead expense and his profit. For this reason the city engineer does not have to be as efficient a constructor as the contractor to make a favorable showing against contract prices. Such costs are apt to be too high by the amount of the lower efficiency of the construction organization, and too low by the amount of overhead that a contractor pays for and a city either avoids or charges to department expense.

Part of this overhead saving is in the fact that a community's construction organization is for the job only; it does not have to be held in dull times. Part of it is in the plant charge. Thus a community can only compete with contractors on work which does not require extensive plant, or on work of a kind that is continuous for the entire life of the city. The contractor, even if he does only simple work, must have efficient tools to meet the present strong competition, and must have enough plant to carry on several contracts at once. The conclusion is, then, that this class of costs may be relied on only as a basis, with due allowance made, for engineers' estimates, or for estimates where doing work by day labor is contemplated.

Published costs of the second class nearly always omit not only the main plant charge and overhead expense of the company, but also the same expenses of the very job on which the cost data are gathered. They are, therefore, more misleading than the first class. Such data include statements, seen in the engineering press, that such and such a plant turned out so many yards of concrete, at such a unit cost, or that so many feet of tunnel were driven by certain methods, with so many men paid such and such wages. Statements like this are made only with the idea of indicating that the layout or method employed is an advance in economy over previous systems. Nevertheless, men not familiar with a certain class of contracting have actually used data of this kind in bidding on work. Usually, too, the data are quoted in reference to a special performance under favoring conditions. In using them as a bidding basis the bidder assumes that he will have such favoring conditions all through his job. Consequently, he loses heavily. Further, it is not possible in the space available in the usual article to give all the conditions affecting the costs quoted. Without these conditions being thoroughly known estimates made from such data are apt to prove extremely unreliable.

Nothing can ultimately be hid in the contracting business. A new way of organizing work, a more economical plant layout, or money-saving methods in the overhead organization are all bound to be the property of everyone in a relatively short time. Either competitors originate similar methods, or employees or mutual friends, like material salesmen, carry the ideas about. No one organization can hope to monopolize all the construction brains in the country. There is, then, no valid objection to publishing organization and construction details in the technical press, though some men have been blind enough to blame that press for losses really traceable to other causes.

With cost data, gathered for the definite purpose of making a firm's living at considerable expense and for a certain line of work, the case is entirely different. Since no contractor has a monopoly on the construction brains of the country, securing work by bidding resolves itself into a question of which firm has the plant and organization available to do the job by the cheapest known methods. In hard times firms have sometimes taken work at a loss, because their organization was idle. To have it remain so would have been a greater burden than that deliberately assumed by bidding too low. Where competition is as keen as it has been during the current year, the most accurate and complete information on costs must be in the hands of every firm that is to keep its head above water. This condition shows that there are already more than enough competitors in the field. Therefore, the present economic situation in this field, especially in large centers and on large work, needs the closest study by any persons intending to venture into a construction field new to them.

It is, then, hardly fair to the firms already in business, especially at present, to publish information gained by these same firms at considerable expense to themselves. Such cost data would be used to increase competition even faster than it increases naturally.

Timber Branding Now Assured

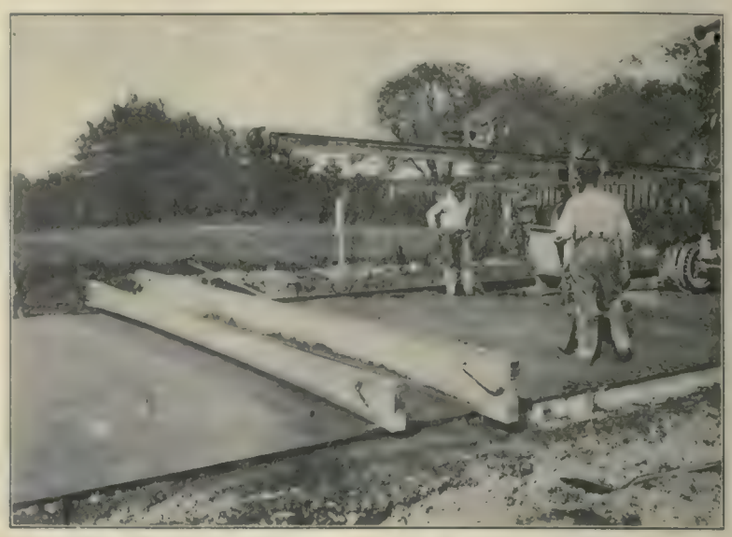
BRANDS for structural timber have been advocated by this journal for some time and from present indications much of the longleaf yellow pine timber in the future will receive a mark of some kind to identify it. One lumber company, which has practically nothing else but longleaf to sell, marks its product with the name of the town where it operates. Seven leading mills of the Calcasieu district of Louisiana have joined in the adoption of a common trademark and brand, in which the significant term "longleaf" is prominent. Another Louisiana concern is using its name as a brand under which is claimed "every desired factor in longleaf." Doubtless by this time other mills have adopted similar methods to insure the engineer and architect in getting longleaf yellow pine when he specifies it.

Another progressive step on the part of the lumber manufacturers is the adoption by the Southern Pine Association of the "density" rule originally formulated by the U. S. Forest Service, and in use for some time by the Isthmian Canal Commission in making purchases of structural timbers. This, together with the recent visual test methods for distinguishing longleaf yellow pine, puts the inspection of heavy timbers on a scientific basis so much desired by the structural timber user. In addition to adopting this rule the Southern Pine Association recommends to its subscribers that each piece of timber be branded at the mill according to grade.

While many merchandising difficulties between manufacturer, broker, wholesaler and retailer may arise from such a radical departure on the part of the manufacturers, they should not affect the ultimate consumer if he knows what he wants, specifies it, and sees that it is delivered. He has now a comparatively simple method of ascertaining what is good material with a guarantee back of it. To the complaints and strictures of many (not all) engineers and architects as to their inability to get suitable timber for structural use is no doubt due this revolution in the lumber industry. Now that the mills are meeting them more than half way they should inform themselves fully on the subject and take advantage of a much improved condition.



WOOD FLOATS AND RADIUS EDGERS USED IN FINISHING



TWO STRIKE BOARDS USED TO PREVENT WAVY SURFACE

Pennsylvania Builds Concrete Road as Object Lesson

Batches Mixed 90 Seconds Are Homogeneous and Easily Worked—Reinforcement Used—Materials Accurately Distributed by Nearby Trolley Line—Plant Selected with Care

TO SERVE as a model, both in quality of finished work and in construction methods, the Pennsylvania State Highway Department is building with its own forces a 16-ft. concrete road between Bethlehem and Easton, a distance of 8½ miles. In this work the cement companies of the Lehigh district are co-operating by supplying all cement free of charge and by sending engineering representatives to observe the methods used and offer suggestions based on a wide experience with concrete road construction in other States. Among the construction features of this object-lesson road are the thorough compacting and underdraining of the subgrade, and strict adherence to established grades. Every batch of concrete is mixed 90 sec., and sufficient water is used to make the concrete plastic, so that it does not quite level down in the discharge bucket. Since the dolomitic limestone used was proved by tests to have practically the same resistance to abrasion as the mortar, a 1:2:3 mix is used, thus insuring an easily-worked, homogeneous concrete.

On the theory that the cracks in concrete roads which are not reinforced are of surface origin, the slab length has been increased to 39 ft. 6 in., and Kahn road-mesh reinforcement, placed 2½ in. from the top, is used to eliminate longitudinal cracks caused by settlement of the shoulders. An extra-heavy strike board, followed by a lighter one, insures the thorough compacting of concrete and eliminates the formation of rolls in the surface. The broomed finish has been discarded in favor of the wood-float finish. At expansion joints a 3/16-in. radius edger is used, and at the sides a ¾-in. radius edger. This is expected to eliminate chipping. At present eight test cubes each week are taken from the regular batch of each mixer, and these cubes are tested after 7 days, 14 days, 28 days and 6 months.

MODERN CONSTRUCTION METHODS

Full use is being made of the resources of the territory in which the road lies to secure the cheapest acceptable road materials. Up-to-date road machinery in the most economical units is employed. The trolley line which parallels the road handles the distribution of stone, sand and cement. A small quarry available midway between Bethlehem and Easton has been opened. Two portable crushers are used, and the bins discharged into the cars on a spur from the trolley line. This quarry is supplementing the available supply of commercial stone, and cutting costs. The tailings and fine stone from these crushers are used in drainage ditches and on the shoulders of the finished road. The rock excavated in grading is crushed in a portable gasoline-driven "coffee-mill" crusher, and is used to cover the tile drains, which are laid in advance of concreting. The work was begun in the middle and is being carried in both directions toward Bethlehem and Easton by two completely equipped crews.

ORDER OF CONSTRUCTION

After the rough grading is done the subgrade is finished and rolled while the drains are being put in. The concrete crew, the finishing crew and the curing work follow in order, after which the earth used to cover the concrete is made use of by the "trimming-up" gang. Special attention is paid to the proper distribution of concrete materials, and rehandling has been practically eliminated. The sand and stone cars are spotted by the foreman at measured distances from the end of the last concrete. The men are distributed with care to insure uniform progress of each operation, from the rough grading to finishing the shoulders.

ROAD FOUNDATION

The present road-bed is of clay, mostly without heavy cuts or fills. All fills are made in 1-ft. layers and thoroughly rolled with a 10-ton roller, one of which is provided at each end of construction. Adequate longitudinal and transverse porous tile underdrains are being installed. Corrugated iron pipes are used to pass water under the road-bed where necessary, and concrete box culverts are built in advance of concreting to care for small streams and heavy watersheds. The side drains are of 4-in. porous tile, and are laid on ½ x 4-in. boards to maintain an even grade. They are set 18 to 24 in. below subgrade and laid with a covering of one-ply tar paper,



LOCAL QUARRY WORKED WITH PORTABLE CRUSHERS TO CHEAPEN STONE SUPPLY

wrapped around each joint, with the lap on the bottom. This paper contains little tar and will allow easy ingress for the water at joints. This method provides a joint which is thought to be considerably stronger and which is expected to last longer than the bagging joint generally used. The ditches are backfilled with tailings from the crusher plant and with stone from the grade cuts.

Grade stakes are set every 25 ft. and the subgrade is finished very accurately. It is rolled until thoroughly compacted. Although an effort has been made to spend no more money on this work than the saving of concrete justifies, a majority of the slabs have been laid with less than 4 per cent variation from the theoretical volume and several have run the exact computed yardage.

CONCRETE WORK ARRANGED ECONOMICALLY

Stone is loaded directly into the cars of the Easton Transit Company at Bethlehem and at the small quarry. Sand and cement, the former coming from a sand dredge at Succasunna, N. J., is transferred from the railway to trolley cars at Taylor Road, outside of Easton. The sand grades from fairly fine to pea gravel, and, being dredged, is very clean. Cement is stored in portable canvas sheds holding 90 sacks each, placed at measured distances along the road, and carried ahead as they are emptied. Accurate measuring of the sand and stone is accomplished by wood-box barrows of special design and of 3 cu. ft. capacity, shown in the photographs. They are struck off with a shovel. One No. 16 Koehring mixer of 3-bag batch capacity is used on each end of the concrete work. These machines have a boom delivery. The side forms are made of 6-in. channels in 12-ft. lengths, held in place by steel stakes. The finished concrete is 6 in. thick at the sides and 8 in. at the center, and is being laid on a level subgrade. The subgrade is sprinkled with a hose before placing concrete.

The reinforcing comes in sheets 5 ft. 2 in. wide, and in lengths of 6 and 10 ft. It is laid with lengthways joints staggered, and with a lap of 4 in. crosswise of and 12 in. parallel to the roadway. Expansion joints are made by tying two 9-in. x 16-ft. strips of ⅛-in. Elastite to a 9 x 16-ft. plate. This assembled form is securely placed with the Elastite next the slab being finished. Concrete is poured on both sides of joint, that on the back side is struck off, the strings are cut and the plate pulled out by handles, leaving the joint in place. After the concrete has set for 24 hr., the joint material is trimmed off ½ in. above the concrete surface.

The concrete crew is organized with three finishers, two men who handle both strike-boards, three men placing concrete and reinforcing, one mixer engineer, one fireman, one charging man, two men on forms, three men on cement, and from eight to twelve men on stone and sand. Although every batch is mixed 90 sec., this crew can place more than eight slabs in a 10-hr. day, making more than 100 cu. yd.; seven slabs can be run without crowding.



ROCK FROM CUTS USED BY CRUSHING IN PORTABLE "COFFEE MILL"

LET CONCRETE SET A DAY BEFORE COVERING

Under a very hot sun the fresh concrete is protected by canvas. On cool days it is simply wet occasionally with a hose. After 24 hours the forms are removed and the surface is covered with a few inches of dirt. This is wet night and morning for 10 days, and is removed after 14 days and placed on the side slopes or where needed. All traffic is kept off the subgrade, and as all materials are delivered by the trolley line, which parallels the road, there is no occasion for even construction wagons to use the subgrade after it has been finished. This permits keeping the rollers about a half a mile in advance of the concrete crews.



FLOAT FINISH GIVES SMOOTH ROADWAY

RAPID AND ECONOMICAL PROGRESS EXPECTED

Although the work has been in progress only three months, practically 4 miles of the 8½-mile stretch have been graded, 3 miles subgraded, and 2 miles concreted. This has been done although labor has been hard to get, and although stone deliveries were so slow at first as to keep one mixer idle a large part of the time. Steel mills in the vicinity are very busy, and men shipped from outside to recruit the camp of 150 laborers maintained are hard to hold.

The work is being done under the direction of William D. Uhler, chief engineer of the Pennsylvania State Highway Department, and George H. Biles, second deputy highway commissioner. J. T. Gephart, Jr., is acting engineer of the district in which the road lies, and J. E. Sampson has entire charge of the work as superintendent for the State Highway Department.



METHODS OF PLACING CONCRETE MATERIALS HAVE OBVIATED ALL RE-HANDLING

Two-Foot Water Head Straightens Distorted Soo Lock Gate

INJURY to the north leaf of the lower operating gate of the third lock at Sault Ste. Marie put the lock out of commission for 41 hr., from 3 a. m. to 8 p. m., Oct. 19.

When the leaf was being closed it was caught by the current running out of the lock and carried along to the sill, which it struck with such force as to spring the top of the gate, putting the toe post about a foot out of plumb. To make certain that no other damage had been done, the lock chamber was pumped out, permitting thorough examination. After attempts to straighten the leaf by the use of jacks and turnbuckles had proved unsuccessful, water was again let into the chamber, and after mitering the two leaves at the top the water was allowed to come up on the gate. Under about 2 ft. of head the distorted leaf straightened and mitered, so that there was practically no leak at the toe, though there was doubtless some along the sill. When not under pressure, the toe post is still 5 or 6 in. out of the vertical, but the gate is operating successfully. After the close of navigation such repairs will be made as seem necessary.

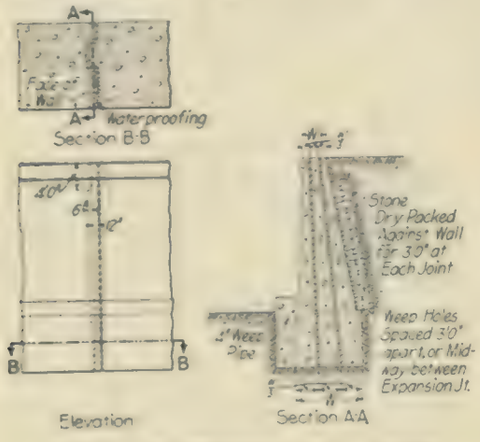
Discuss Expansion Joints for Concrete Structures

C. F. Bedwell and H. G. Throop Illustrate Typical Methods for Waterproofing and Providing for Temperature Changes

REPORTING to the committee on buildings and structures of the American Electrical Railway Engineering Association at the recent San Francisco convention, C. F. Bedwell and H. G. Throop described the methods to be used for proper provision for expansion and contraction in concrete structures and for waterproofing the joints. A few of the more typical forms of construction recommended are illustrated in the abstract which follows:

Reinforcement Needed for Restrained Structures

The stresses resulting from a drop in temperature of about 15 deg. Fahr. will stress the concrete in a restrained structure sufficiently in tension to cause excessive cracking unless properly reinforced with steel. To prevent these excessive cracks from being noticeable, although minute cracks will still remain, about 0.4 per cent of steel reinforcement should be placed near the exposed face of the wall. No amount of steel will entirely eliminate cracks, but the greater the percentage of steel the smaller will be the cracks. Small rods spaced close together, or a mesh, should be used rather than large rods spaced far apart.



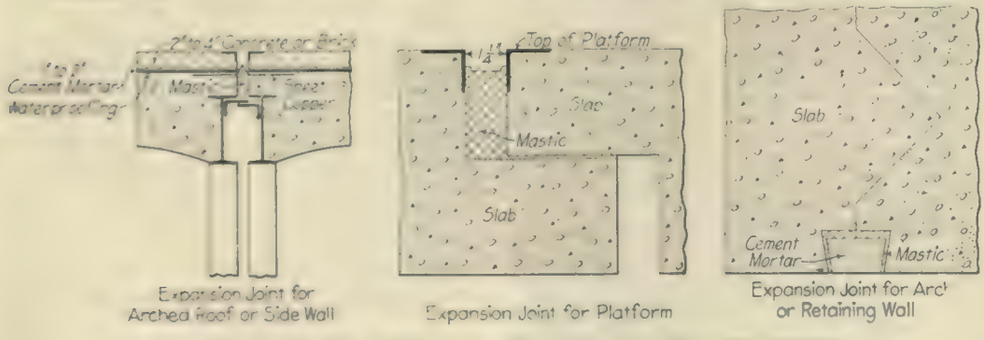
DETAILS OF RETAINING WALL JOINT

Reinforced-concrete slab bridges should be limited to spans of about 35 ft., because it is difficult to allow free expansion at one end of such bridges to prevent temperature stress.

When a fence, railing or coping wall is restrained or is part of a restrained structure, expansion joints should be provided about every 30 ft. The change in temperature is commonly taken to be 50 deg. Fahr. and the coefficient of expansion for both steel and concrete to be 0.0000065.

Two types of expansion joint for plain concrete retaining walls and for platforms or slabs are illustrated herewith. The proper use of waterproofing and mastic is indicated, and the necessity for drainage back of the retaining wall joints is recognized.

Expansion joints also serve as settlement joints and eliminate the danger of a retaining wall face being ruined by cracks caused by slight uneven settlement in the footing. In a reinforced wall the steel will reduce shrinkage and contraction cracks to a minimum and hold the wall true to line and grade where a plain wall might settle. It is possible to erect considerable lengths of reinforced wall without expansion joints.



TYPICAL FORMS OF EXPANSION JOINTS FOR VARIOUS STRUCTURES

Atlanta Burns Its Garbage for 91 Cents per Ton

E. R. Conant Gives Detailed Cost Data of 130-Ton Mixed Refuse Destructor—Clinker Successfully Used for Road Surfacing

DETAILS of unit cost for burning mixed garbage at Atlanta, Ga., for a 1-yr. period, during which 26,795 tons were cared for, were given in a paper at the Dayton convention of the American Society of Municipal Improvements by E. R. Conant, chief engineer. Operation cost 55.65 cents per ton and maintenance 4.52 cents. A credit for steam produced and sold amounted to 20.33 cents per ton, leaving a net cost of 39.84 cents. To this was added 2.16 cents for labor in the tipping room, and 3.24 cents for weighing. Clinker removal at 8.79 cents less 3.36 cents credit for its sale left a charge of 5.43 cents, making the total of 50.67 cents for all but interest and depreciation. Interest on $127,000 at 4 per cent amounts to 18.47 cents per ton, and depreciation was estimated at 22.18 cents, giving a total cost of 91.32 cents.

Mr. Conant stated that the plant had not been shut down in 1½ yr. but once or twice, and then for less than a day.

Contents of Refuse

The refuse delivered to the plant consists of 40 to 45 per cent of garbage, approximately 50 per cent of rubbish and 5 to 10 per cent of ashes. In the rubbish there is a great amount of tin cans and other indestructible matter. During the watermelon season in July and August the amount of garbage is largely increased. This year it averaged 15 tons per day and last year 20 tons per day. During these two months when there is an excess of garbage there is added to the refuse hopper about 10 per cent additional weight of ashes and cinders collected in a pile during the season when it is not necessary for consuming the garbage. The only labor cost involved is the wheeling of the cinder from the storage pile to the hopper. No other fuel is used.

The clinker from the plant varies from 20 to 30 per cent, according to the cinder. About half the clinker by weight is more or less vitrified. At first it was believed that this clinker would have no value, but after a trial in using it for a foundation for hardening streets it was found that it is well adapted for this purpose. Streets that have been hardened with the clinker have been in use for over a year. The streets so treated stand up under heavy traffic, and are found to be far more durable than those surfaced with gravel. A considerable quantity of the clinker is sold to property owners, who pay a nominal price for it. In one instance seventy-five cars have been filled and hauled by railroad 25 miles to be used as a foundation upon beach sand over which gravel was placed. This 2-mile roadway has stood up very well. The tin and sheet iron oxidizes and compacts with the ash and carbon, making a solid foundation strata.

Long 15-Ton Guy Derrick Folds Into Compact Form

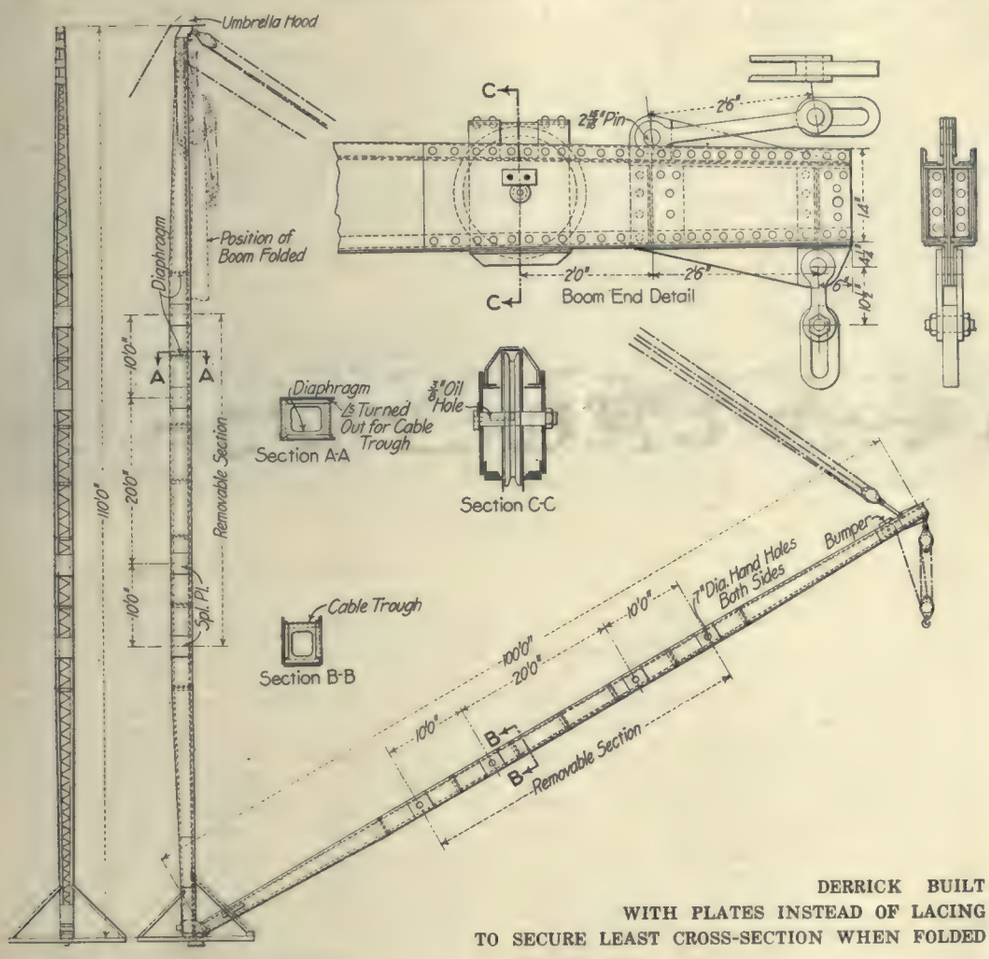
Ball and Socket Umbrella Hood Replaces Usual Gudgeon Pin at Top of Mast—Plates and Angles Reduce Mast and Boom Sections

IN CONSTRUCTING a skyscraper built recently in Chicago the contractor desired a compact 15-ton derrick to place floor framing to the base, which could be raised through a small opening after the floors were erected. For this purpose the mast and boom were made of angles and plates, thus reducing the combined thickness at the center of the two when folded to 56 in. Other features of the derrick are an umbrella ball-and-socket hood at the top of the mast instead of the usual gudgeon pin, a ball-and-socket base, a removable bull wheel and the attachment of the boom-fall line back from the end of the boom so as to give a reverse bending moment in the boom, tending to offset the moment due to the weight of the boom itself.

The derrick consists of an all-steel 110-ft. mast guyed by eight lines if desired, a 100-ft. boom and a bull wheel 14 ft. in diameter. The mast and boom each have one 20-ft. and two 10-ft. removable sections put together with bolted splice plates.

Ball-and-Socket Umbrella Hood

At the top of the mast a specially designed umbrella hood with a ball and socket provides for the attachment of eight guy lines. The ball and socket gives sufficient play to make the tension a direct pull during the ordinary working of the derrick when the mast is not quite plumb. The hood proper containing the socket is made up of upper and lower plates bolted to a cast-steel socket, a ring casting in two parts being placed below the lower set of plates to prevent jumping off when the collar begins to bear on the conical surface below the ball, and during erection or dismantling. In cross-section about 240 deg. of the ball is covered. The upper plate is cut from a single octagonal piece, but there are eight lower plates. In calculating the stresses it was found that the critical section is on the lower ring casting just within the bolt circle. The maximum load occurs when one of the guys is carrying all of the load and the phosphor-bronze ring is bear-



DERRICK BUILT WITH PLATES INSTEAD OF LACING TO SECURE LEAST CROSS-SECTION WHEN FOLDED

ball-and-socket joint. There is, however, another smaller horizontal bearing surface on which the mast rotates when turned by the bull wheel. The vertical surface of the phosphor-bronze bushing must take all horizontal thrusts and transmit them to the bowl casting, which is bolted to the floor or foundation. The lower part of the casting bolted to the mast is tapered so that the mast can tip considerably during erection and dismantling. Four clips hold the ball and bowl castings together and keep the surfaces clean and free from injury when the derrick is knocked down. The 3-in. hole through all three castings is sufficiently large to pass the two cables even when the mast is somewhat out of plumb.

Reverse Bending Moments Induced

To put a reverse moment in the boom to overcome the bending moment due to its dead weight, the boom fall is attached 2½ ft. back of the load fall pin. An additional reverse bending moment is produced at the foot of the boom by placing the pin below the center line. The attachment of the boom and load fall links at the end of the boom to a single central plate heavily reinforced is shown in the detailed drawing. Protection of the load-fall sheave carrying the line to the upper side of the boom is provided by a front plate which also acts as a bumper when the boom is folded against the mast.

This derrick and a duplicate were built for the Ketler-Elliott Erection Company and first used on the Marshall Field addition in Chicago.

ing on the conical surface below the ball.

The cast-steel ball, of 8-in. diameter, is finished all over and cored out to give a thickness of 1½ in. Below the ball portion of this casting are three heavy ribs to provide attachment for the top of the mast and the boom-fall links. The outer ribs are bolted to gusset plates extended from the sides of the mast, while the central rib carries most of the load of the links for the boom fall. As the center line of the hood is over the front face of the mast, an extra plate is used on the back to care for the large bending moment produced. This offset arrangement was necessary to keep the hood, which requires about 4½ ft. clearance, within the same plan area as the boom and mast when the latter are folded up.

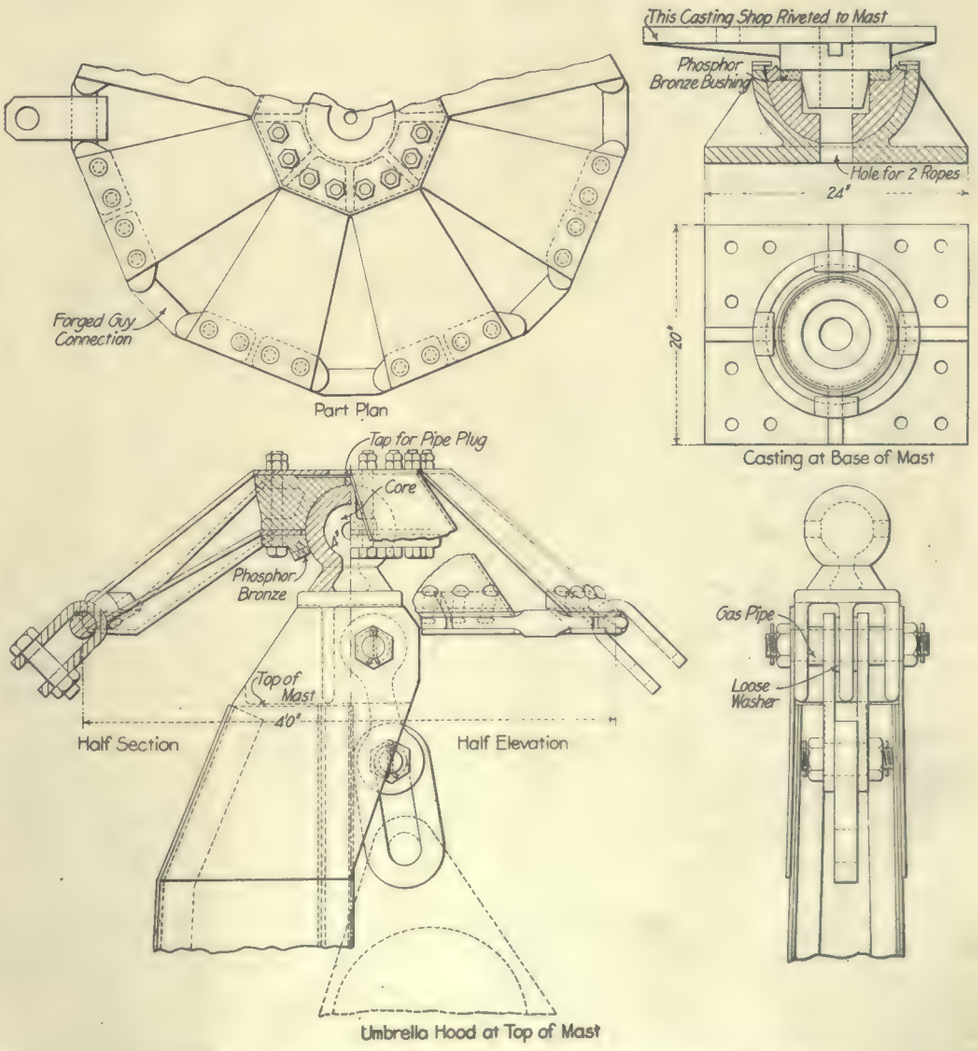
Mast and Boom of Plates and Angles

While a still more compact mast might have been made by covering all four sides with plates, the back side was laced and the section increased somewhat because accessibility is a feature that could not be overlooked. The lacing provides a ladder which could not be obtained so cheaply any other way. As the boom can be got at easily, plates were used on all four sides. To provide troughs for the ropes and make riveting of sections possible, the angles on the face of the mast and on the top of the boom are turned out.

The boom-fall line is brought out of the mast near the top at a point to clear the boom when the derrick is folded so as to be accessible and to clear the removable sections, which have several plate-steel stiffener diaphragms.

Two Base Bearings

As at the top, movement of the mast from plumb is cared for at the base by a



DETAILS WHICH INSURE CORRECT STRESSING AND EASY OPERATION

Engineer of Modern Sugar Plantation Has to Deal with Varied Problems

Plant of Niquero Company in Cuba a Good Example of the Various Classes of Construction Required for a Well-Balanced Plantation

By SAMUEL VICKESS
Consulting Engineer in Sugar Factories and Estates, New York City

MANY KINDS of construction of considerable magnitude enter into the development of the modern sugar plantation, and the engineer is a very great factor in its eventual success or failure. His work may include the surveying and mapping of great tracts of forest land, their subdivision into smaller parts for planting purposes, the location and planning of an adequate railway system and the design and construction of docks, bridges, roads, warehouses, dwelling-houses, one or more mills, water-supply and sewer systems, a lighting plant and telephone and transmission lines.

The plantation of the New Niquero Sugar Company at Niquero, Cuba, is an excellent example of the varied problems that are met with in the development of a modern estate. This might be very aptly termed an average plantation. It is neither exceptionally large nor so small as not to require skilled laying out and operation. Its equal in size and output may be found in many places elsewhere on the island of Cuba and in other sugar-growing countries.

More than a century ago there was a small wooden mill, which is still standing, near the present plant. The annual output of this mill was 83 tons of sugar. Ten years ago, when the company purchased the property, there was a more modern plant with 2000 acres of land under cultivation, all of which was within two miles of the factory. This plant had an annual output of 3250 tons. Last year's output of the new plant was 27,300 tons. To attain this greatly increased output required ten years of gradual extension and the expenditure of more than $2,000,000 for the purchase of new land, new installations and new construction.

LAND EXTENSION

Of the original 2000 acres under cultivation not one acre is still in use for cane-growing purposes. The percentage of yield from sugar cane decreases to a certain extent every year. In time, to make the continuance of the field profitable, it is necessary to fertilize and cultivate intensively or, on estates where virgin land is available at cheap prices, to plow it up and use it as pasture for the feeding of the large number of oxen that are required on the plantation for hauling cane from the fields to the railroad, and to open up new fields for cane-growing purposes. Such has been the practice adopted at Niquero, where 12,000 acres of forest land have been cleared and planted in cane up to last year. In addition to this the company has acquired control of 40,000 acres more which must be cleared and cultivated as needed.

In all there are 3000 acres of pasture land. These lands in themselves require more work to prepare than do pastures in the United States. There are no all-year-round running streams at Niquero, and the oxen have to be supplied. To this end numerous wells have been drilled, windmills or gasoline motors installed for pumping and pipes laid to distribute the water.

The land under cultivation for cane-growing had to be cleared, stumped, subdivided, plowed and planted. A system of roads had to be laid out and built, and bridges had to be constructed over stream beds and other depressions. These expenses have not been undertaken blindly, however, as experiments have been under way at Niquero for some time to determine the value and cost of fertilization and irrigation, and, in the future, these pasture lands will be cultivated intensively and used for cane-growing purposes again if the tests result satisfactorily.

RAILROAD SYSTEM

When the company took hold of the property there was not a foot of railway on the plantation. The cane had to be transported from the fields all the way to the mill by oxen, and the finished product hauled to the wharf by the same primitive method. With the exception of a short line down to the wharf the same methods were followed by the New Niquero Company until the exceptionally large output—for a mill without a railroad—of 13,000 tons was obtained. Then, to increase the output, and because the fields were reaching out to considerable distances, work was started on a railway system. This at present consists of about 22 miles of track. A 3-ft. gage is used, and 45-lb. rails. There is a main line, starting at the factory terminal yard and running to a country yard named Ceibabo, a distance of about 4½ miles; a north branch, which goes to another country station named Niquerito, about 10 miles from the factory, and a south branch, which goes to Coloraditas station, about 4 miles from the factory. Several minor extensions have been added to these lines in the last few years, and more will be added in the future. Each of the lines required several bridges over watercourses, three of them being of fair size and costing about $7,000 each, exclusive of lumber, which was to be had almost at the cost of cutting. Cuts were very largely avoided, but considerable filling and embankment was involved. Ties are of hardwood, cut on the property. The wharf line is about 0.6 mile long and of especially good construction.

COST AND EQUIPMENT

Concrete pipe culverts were used whereever practicable and, in many cases, open-top concrete structures. During the past year worn-out boilers have also been used for culvert purposes. The larger culverts had to be studied out very carefully and provision made to accommodate the variable flows that occur during the rainy season in the ordinarily dry stream beds.

The railroad grades, on almost all of the lines, are descending toward the factory, so that there is little work for the locomotives with loaded trains, and the fuel consumption is low. The branch from the factory to the wharf is so graded that by simply pushing the loaded car at the former point it will travel to its destination by gravity alone.



LAYOUT OF FACTORY YARD HAS MUCH TO DO WITH EFFICIENCY OF MILL



WATER SUPPLIED FROM TANK 68 FEET HIGH



ATTRACTIVE SURROUNDINGS A NECESSARY PART OF WORK

The railroads cost, on an average, about $10,000 per mile.

Each of the country receiving stations has an area of 33 acres. They are equipped with scales, cane transporters, wells, pumps, water tanks and loading sidings. The railroad equipment consists of 96 wooden cane cars, 79 steel cane cars, 6 flat cars, 2 box cars, a passenger car, 2 coaches, an electric car, hand cars, 3 tank cars and 4 locomotives.

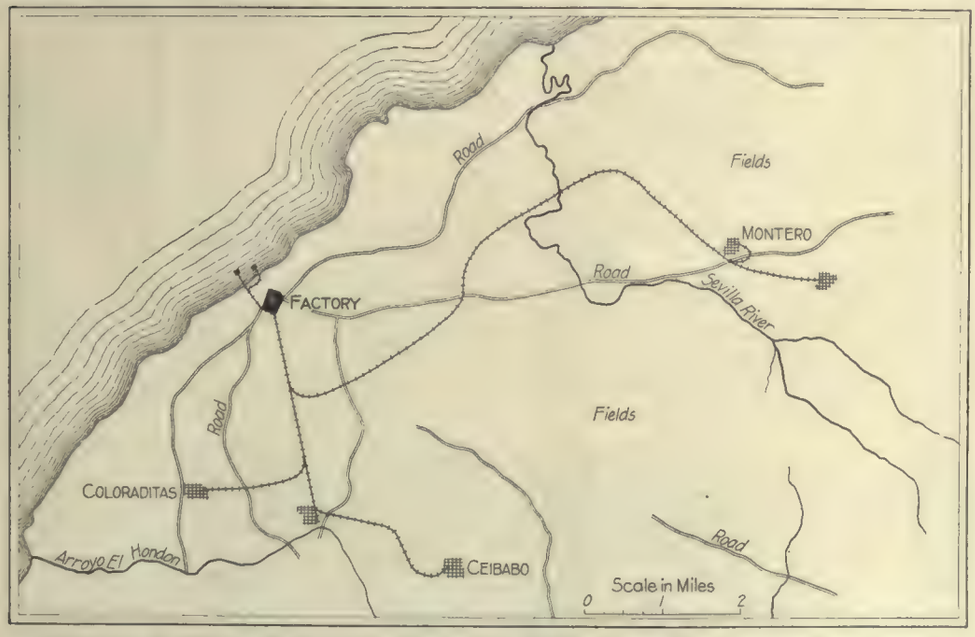
FACTORY TERMINAL YARD AND MILL

The main terminal yard is equipped with such sidings and appliances as are necessary to make the discharging of loads and handling of cars possible with the utmost dispatch and to provide for the storage of cane and empty cars sufficient for the night work. This yard is very important in sugar-mill design. A car congestion there would be very costly. The mill works 24 hours each day and the volume of the cane is large as compared with that of the sugar that is obtained from it. There are mechanical devices for unloading a whole car into the receiving pit at one time, and a chain-belt elevator to carry the cane up to the crushers and mills. The layout of the yard is shown in one of the accompanying drawings.

The tilting table for unloading at Niquero has proved to be an effective and economical device. It consists of a platform of sufficient width and length to accommodate one car. The loaded car is pushed on it, whereupon the outer side is elevated by hydraulic pressure until the cane slides off the car of its own weight and into the receiving pit.

The mill building is steel framed, and walled and roofed with galvanized iron sheets. It is equipped with all the necessary machinery for the manufacture of raw sugar. The warehouses are single storied and are also constructed of steel and iron.

The chimney at the mill is of steel, 180 ft. high by 16 ft. in inside diameter at the base, tapering to a 10-ft. diameter 40 ft. up. It is set on a concrete foundation.



RAILWAY SLOPES GENERALLY TOWARD MILL, MAKING WORK OF LOCOMOTIVES LIGHT

There are also several tanks for the storage of molasses, a by-product obtained in the process of sugar-making. This material weighs 90 lb. to the cubic foot, so the tanks required rather elaborate foundation work. Piles spaced to 4-ft. centers each way were driven to a 15-ft. penetration. They were then capped and a 3-ft. thickness of reinforced concrete was spread resting on them, which provided a foundation for the tank as well as a floor.

MUNICIPAL WORK

The water supply is pumped from wells to a tank 68 ft. high, with a capacity of 50,000 gal., from which it is distributed to the various buildings and yards.

The sewer problem at Niquero was very simple. Two lines of 18-in. vitrified pipe sewer, each 2000 ft. long, were laid to carry the sewage from the buildings down to the sea by gravity.

A sugar plantation is a small settlement in itself, apart and removed from the nearest habitation. Its operation requires the employment of skilled men who are accustomed to life in developed countries. To make it attractive to them it is necessary that the ornamental as well as the practical features be taken care of. To this end the New Niquero Company has laid out and established an attractive park on its property. The employees' houses are excellently constructed after the American style, modified to suit tropical conditions, and are equipped with running water, electric lights and all the sanitary fixtures, such as flush toilets, baths and other conveniences as are usual in the United States. The company has also encouraged every movement toward modern improvements in the village as well, such as clean streets and sanitary measures, the recent installation of an electric light plant and the building of a club house for recreative purposes.

WHARVES AND BRIDGES

There are two wharves at Niquero. The principal one is 1400 ft. long exclusive of the terreplane approach. It rests on hardwood piles driven down to rock. These are 15 in. in diameter at the butt, 8 in. at the toe and from 35 to 45 ft. long. They are spaced at 6-ft. centers each way. The stringers and caps are of cross-sectional area much greater than the highest possible load would require, as the lumber is so cheap that it is more economical to use it than to cut it down. The flooring is of yellow pine. The approach is of sufficient width to accommodate a single-track railway. The wharf proper is 54 ft. wide and accommodates two railway tracks as well as providing space to pile 12,000 bags of sugar. Boats drawing 13½ ft. of water may tie up directly alongside. The second wharf is 400 ft. long and is also constructed of hardwood with a yellow-pine flooring.

The bridges, as a rule, consist merely of concrete abutments and a timbered stringer under each track, but in places where the watercourses are swollen periodically out of all proportion to their usual state more elaborate structures had to be built. One of the latter, which is thoroughly typical of its kind at Niquero, is shown on an accom-

panying drawing. This is 121 ft. between abutments. Bents of hardwood rest on piles driven to approximately 12-ft. centers and capped. At the channel proper there is an 18-ft. span. This is of 12 x 12-in. hardwood strengthened by iron truss rods. The reason for this span is to avoid an obstructing bent that would collect floating débris and stop the flow so as to endanger the railway embankment.

Lighting and Telephone

The property at the mill is lighted by electricity developed in a private plant. The town is lighted from a municipal plant. Both of these plants have been installed within the last six years.

The company has installed a telephone system on its property that connects the factory office to all important offices, to all zone guard houses and to the different country freight-gathering stations. There is also an ice-manufacturing plant, a laboratory, machine shop, carpenter shop and sawmill. All these are completely equipped to serve their intended purposes.

Though working at nearly full capacity the Niquero plantation can by no means be said to be completed. In fact it may be aptly termed, "still under construction." More fields will have to be cleared from year to year, railroad extensions will have to be made and considerable additions to the factory buildings and warehouses are already projected.

The New Niquero Sugar Company is an American concern, with offices at 129 Front Street, New York City. J. H. Post, of B. H. Howell Sons & Company, of New York City, is president, and the writer is consulting engineer. All of the work was done under the personal direction of Ricardo Narganes, vice-president and general manager of the company, who has been affiliated with large engineering projects in Cuba for many years, having been general manager and representative in Cuba for Runkle, Smith & Company, contractors, on the construction of the Palatino Reservoir and the original distribution system of the Havana water supply, general manager of the Matanzas Gas & Electric Company, constructor of the Camaguey Electric Company and, for several years, general manager of the Havana Gas & Electric Company.

Formulate Rules for Society Programs

Introspective Investigation of A. S. M. I. Leads to Well-Defined and Co-Ordinated Duties for All Committees

UPON the program committee of a technical society so much of success or failure depends that the following notes are taken from an exhaustive introspective investigation and report of the committee work of the American Society of Municipal Improvements. The committee on committees, consisting of A. P. Folwell, chairman, E. S. Rankin and C. C. Brown, prepared a set of instructions to committees with the idea of having them handed down to each incoming chairman so that there would be a continuity of effort and no departure from the desired field of discussion.

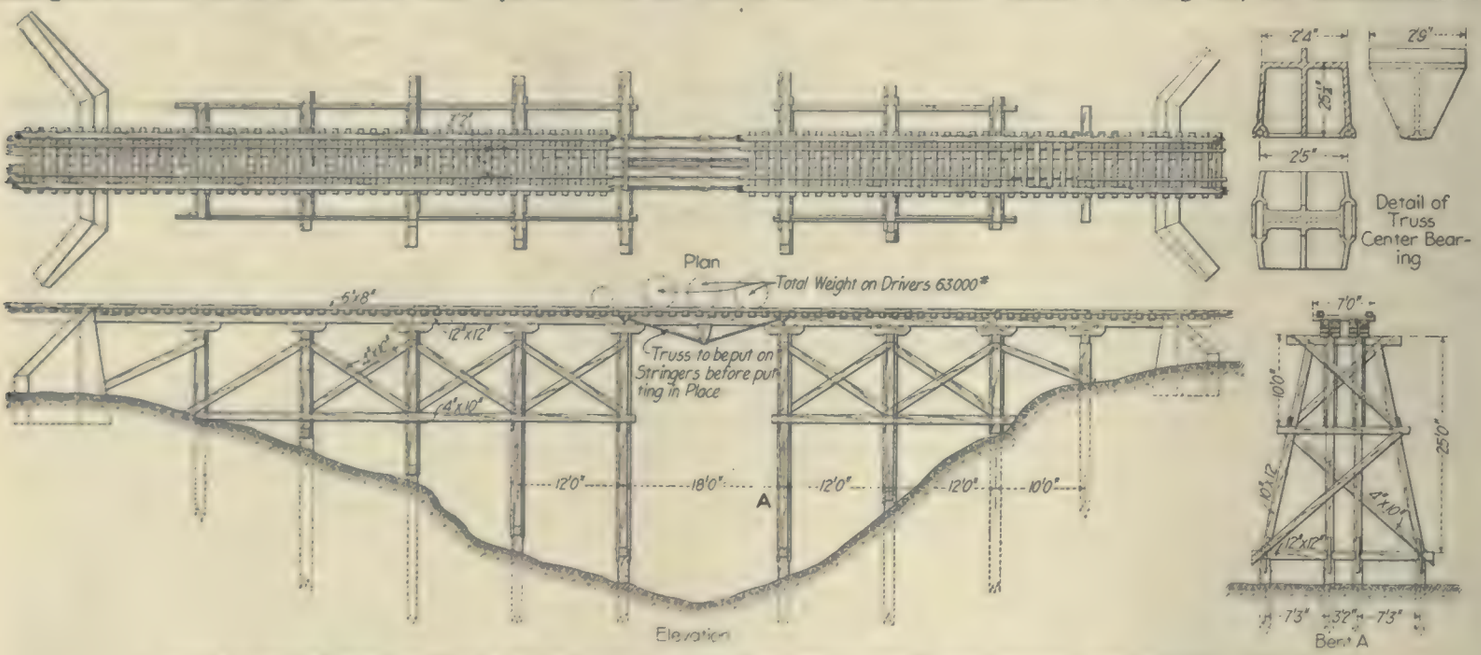
New chairmen begin their work in the dark as to the duties and aims of that committee. General duties consist in preparing a report and obtaining papers. The committee is urged to select some one feature to be given extended attention.

Papers on Selected Subjects Desirable

In obtaining papers for the annual meeting, instead of asking broadcast for papers on any subject, the society would be better served if each committee were to select subjects upon which it is desirable to have papers prepared, and endeavor to obtain discussions of these subjects from those best qualified to write them (whether members or not). The subjects chosen would ordinarily be those selected by the committee as the principal feature of its own report. At the same time the committee should make an effort to encourage the younger and newer members of the society to present any information which they may have on details of practice, with the idea of encouraging them to take an active part in the society so as to retain their interest. However, the committee should keep in mind the interests of the society as a whole, and eliminate as far as possible discussions of well-known ideas or descriptions of common-place work which would take up the time of the society with little resulting benefit.

The discussion in convention which is brought out by a paper is frequently more valuable than the paper itself from an informative point of view, and is especially so as giving an interesting and live convention. This idea should be kept in mind in selecting subjects and approving papers to be read before the society. In the case of some papers, such as those which contain tables and statements more or less burdened with statistics, it would be well for the committee to go carefully over the paper and note such matter as could not be readily apppreciated by an audience only when read from the printed page, and to request the author either to omit this in reading the paper before the society, or to prepare a brief statement for such oral presentation which will give the gist of the information contained therein.

A short paper full of meat is much preferable to a long one, and condensation of papers should be encouraged, but not to the point of lessening their intelligibility. There are exceptions, such as a comprehensive paper covering a wide field and endeavoring to sum up all available information on a subject; but generally speaking, 2500 to 5000 words is an excellent length for a paper, or at least for that part of it which is to be read aloud at the meeting.



TYPE OF BRIDGE USED AT LARGE WATER COURSES WHERE AN OBSTRUCTING BENT MIGHT STOP FLOATING DÉBRIS

Why the Traffic Census?

A TRAFFIC census is most valuable in determining the economic type of road in a large system of highways, said W. W. Marr, at the recent Northwestern Road Congress at Cedar Rapids, Iowa. "It is inconceivable that in any big system of roads the traffic will ever be the same on each road of the system. It is admitted that the traffic on a few of these roads will probably be so nearly the same that for practical purposes it may be considered identical, but some of the roads in the system will surely never carry more than a half, a quarter, a fifth, or a tenth the burden of the main roads, and if we have designed all the same, we must necessarily have wasted a great deal of money." It is necessary in an economic design of a system to consider the load burden, and this cannot be even approximated without some sort of estimate.

Pressure Test Shows Little Leakage from Huge Molded Concrete Pipe

Loss from 8000-Foot Conduit at Baltimore Only One-Third of Amount Fixed by City Water Department

PRESSURE tests recently made on long lines of 7 and 9-ft. precast reinforced pipe in Baltimore's waterworks improvements showed a total leakage rate of only 13,000 gal. in 24 hr. in an aggregate length of 8000 ft. under a pressure of 35 lb. per square inch. The maximum allowable rate of leakage under the contract was set by the city's engineers at 38,000 gal. as the result of preliminary tests on individual pieces of pipe. The 35-lb. test pressure called for in the specifications is to be the maximum actual working pressure. This is believed to be the largest pipe line of its kind to be required to stand so great a pressure.

The pipe line in question extends from the new filtration plant above Lake Montebello to the head of the distributing mains near Lake Clifton. For construction purposes, this line is divided into three sections. The first is an open trench line of 9-ft. pipe, extending 800 ft. from the filtration plant to the gate-house at Lake Montebello. The second is in tunnel between the Lake Montebello and Lake Clifton gate-houses, a distance of 5400 ft., of which 4125 ft. is of 9-ft. pipe and 1240 ft. of 7-ft. pipe. This pipe is laid inside of a 12-ft. brick tunnel formerly connecting these reservoirs. The third section is in open trench between a shaft near Lake Clifton and the head of the distributing system.

The construction of this pipe line and method of manufacture of the pipe were described in the Engineering Record of Oct. 31, 1914, page 474. All of the pipe is of the standard Lock Joint design, made on the work by the Lock Joint Pipe Company, of New York, the contractor for the entire pipe-line construction. Six-foot lengths were used throughout on both diameters of pipe, the joints being grouted in the trench or tunnel. The pipe walls are 8 in. thick in the 7-ft. size and 9 in. thick in the 9-ft. size.

Before the regular manufacture and laying of pipe was undertaken a preliminary test was made at 35 lb. water pressure on two standard pieces of pipe joined together and bulkheaded at both ends. Evidences of leakage were very slight, there being only one point where there was an appreciable amount of flow. The existence of this latter minute leak was considered to be an allowable imperfection in practical construction, and the leakage limit of 38,000 gal. for the entire pipe line was hence computed from the measurements in this test.

The principal tests were made on the completed pipe line prior to backfilling the trench and closing the tunnel. For convenience in securing leakage observations these tests were made in two sections, one embracing the tunnel and upper trench line near the filters, and the other embracing the lower trench line.

The test of the first-named section included 4925 ft. of 9-ft. concrete pipe, 1250 ft. of 7-ft. concrete pipe, 60 ft. of steel specials, a 72-in. and a 48-in. gate valve and a steel distributor at the end, having seven foot-bends and seven 30-in. valves. It was possible to measure any leakage past the valves for correcting the total loss of water from the pipe line.

How Leakage Was Measured

This section was shut off by bulkheading a Y-end at Lake Clifton with a steel dished head and closing all of the above-mentioned valves. The pipe line was filled through a gate at the filter plant and the head was gradually built up to the maximum service level in the gate chamber, which brought on the full test pressure. This level was then maintained to compensate leakage by means of a hose line, and the rate of inflow was determined by taking measurements of about 20 sec. flow from the hose in a barrel periodically throughout the 24 hr. of the test. At the end of 24 hr. the total inflow through the hose was computed and the observed leakage at the various valves was deducted. The remainder represented the leakage in the pipe itself. It amounted to about 9500 gal. per 24 hr., out of an allowance for this section of 34,000 gal.



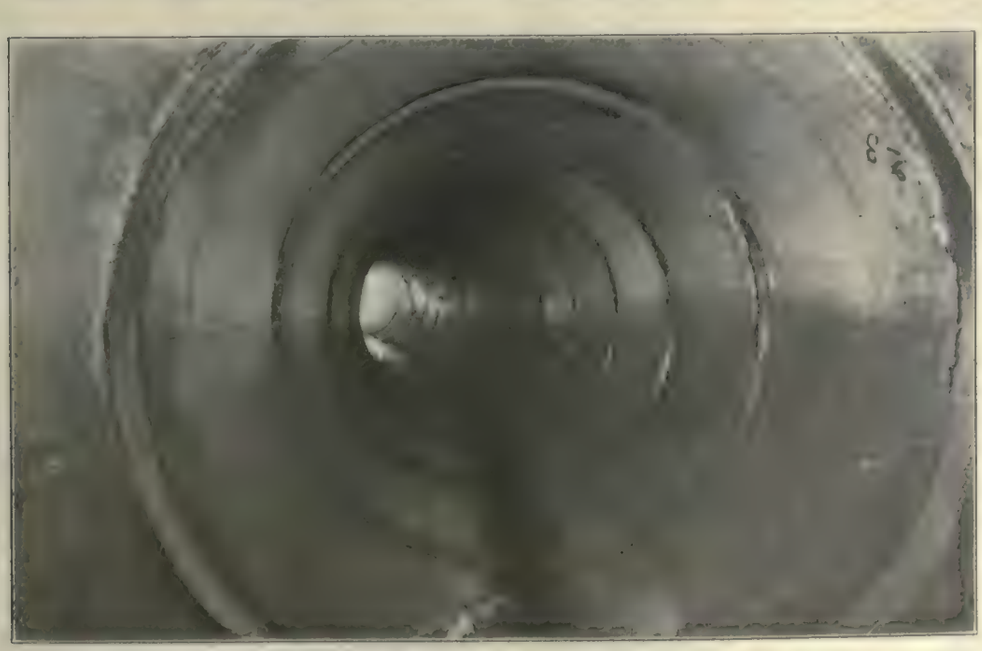
TRENCH WAS LEFT OPEN UNTIL HYDRAULIC TESTS WERE COMPLETED

Prior to the tests the contractors determined that when the tunnel was filled and then drained the water would leave the pipe bore quicker than it would flow out of the space between the outside of the pipe and the walls of the old 12-ft. brick tunnel. This would tend to produce a pressure from the outside of the pipe sufficient to cause an uplift 1700 lb. per linear foot. Since the tunnel is not backfilled, there would be nothing to prevent the rise of the pipe. To relieve this external pressure thirty-two 5 x 8-in. brass check valves were inserted in the 4000 ft. of 9-ft. pipe about 2 ft. below the center. These valves open inward upon the presence of external pressure and thus allow the water from between the walls to drain into the pipe. When the pipe is full and the pressure from the inside, the valves seat. In considering the leakage in the tunnel section above, it is very probable that a large amount passed through these valves, thus reducing to some extent the leakage attributable to the concrete.

Build Up Head from Tower

The lower section of pipe line, embracing 1750 ft. of 7-ft. pipe in open trench, was shut off for test by bulkheading its lower end and closing a 48-in. valve leading into it from the tunnel. In order to get the desired head here a timber tower 48 ft. high was erected on high land at its upper end, so that a platform stood 70 ft. above the pipe. An open barrel on this platform, with ¾-in. gravity line leading into the concrete pipe, was employed to apply the head. A fixed water level was maintained in this barrel by means of an inlet tapped from the city mains. The city mains could not be used directly for test purposes due to wide local pressure fluctuations.

When ready for the test this section was filled from the tunnel through the 48-in. valve and the pressure was very gradually built up from the barrel on the tower, the rise in the small gravity pipe being carefully controlled by a globe valve and pres-



THIS CONCRETE PIPE, UNDER 35 POUNDS PRESSURE, ALLOWED A LEAKAGE OF ONLY 13,000 GALLONS IN 24 HOURS FOR A LENGTH OF 8000 FEET



THE HUGE SECTIONS OF MOLDED PIPE MEASURED 9 FEET IN DIAMETER

sure gage. Measurement of leakage was made by taking frequent observations on the flow which was necessary to maintain the level in the barrel. These observations were made in a second barrel. The leakage in this section proved to be 3500 gal. out of an allowable leakage of 4000 gal.

A part of the above tests was continued over 48 hr., and it was observed that the leakage decreased from the original rate of flow. This was attributed to the fact that much of the water taken by the pipe line in the first 24 hr. was absorbed by the dry concrete walls.

CHARACTER OF LEAKAGE

Throughout the tests careful examination was made of all portions of the pipe line which could be reached. In only a few cases appreciable amounts of leakage were found. In one there was a light spray measuring 4½ gal. in 24 hr. Another consisted of a dripping of 75 drops per minute. In not over half a dozen other cases was the leakage such as to give an accumulation of water sufficient for a flow, though there were evidences of dampness in spots. The moisture which appeared seemed to be about equal only to the evaporation.

The tests seemed to indicate that the mere dripping or flow of water from any particular portions of the pipe in sufficient quantity to be measurable was not an index of the actual amount of leakage. Apparently there was considerable loss even when the number of spots showing appreciable amounts of water was exceedingly small. It also appeared that a very much greater leakage than actually occurred, or was allowed, would not have been detrimental either to the pipe line or to other structures.

The tests were conducted by the Lock Joint Pipe Company in conjunction with the Water Board of Baltimore.



TIMBER TOWER WITH WATER BARREL ON TOP TO FURNISH TEST PRESSURE

How the Federal Evaluation of the Boston & Maine Railroad Is Being Done

F. C. Shepherd, Valuation Engineer, Outlines to Boston Society of Civil Engineers Work and Problems of Both Railroad and Government

ONE OF THE FIRST large railroads to be taken up for evaluation by the Government in accordance with the Valuation Act of March 1, 1913, was the Boston & Maine Railroad. The Division of Valuation began work on the system April 29, 1914, and the railroad began its part of the work several months earlier. How both the railroad and the Government are carrying out the work, and some of the problems encountered, are described by F. C. Shepherd, valuation engineer of the Boston & Maine Railroad, in a paper published on page 291 of the October *Journal* of the Boston Society of Civil Engineers, to be presented before the society Nov. 17. An idea of how the Government is handling its larger field squads is given in an article in the Engineering Record of Dec. 26, 1914, page 696. How the Boston & Maine by means of wash borings proved that ordinary cross-sections missed a large amount of fill that had settled into soft ground was set forth in an article in the issue of June 19, page 776. Other matters touched upon by Mr. Shepherd that have already been discussed are eliminated from the following notes taken from his paper:

FIRST STEP TAKEN IN NOVEMBER, 1913

The first start toward valuation work on the Boston & Maine Railroad was made in November, 1913, when the president appointed a valuation committee. We first started a careful study of the history of the railroad. The present system is composed of some one hundred and seventy original corporations, the first of which was chartered in 1796. Under reorganizations, purchases and consolidations, there are now forty existing corporations, all of which are either owned, leased or controlled by the Boston & Maine.

Having the corporate ownerships as now existing we next made a study for a schedule of inventory or valuation sections. We were confronted with the fact that the valuations are to be made by State lines, and that, for our own records at least, we should make the valuation sections agree with existing corporations. We have therefore made the valuation sections as a whole by corporate ownerships, although there are some parts where the ownerships were so extensive or diversified that we have given more than one section to a corporation. At the present time we have sixty valuation sections, for each of which separate inventories and collections will be made. With all these corporations there are six common carriers under the act, for which valuations will be made by the commission.

Jan. 16, 1914, we were advised that the Boston & Maine was one of the first roads on which valuation work would start, and that actual field work would be commenced about May 1.

Feb. 1, 1914, Government Order 1, specifications for maps and profiles, was issued, following which our valuation department was organized. We first made a careful study of what plans were in existence on our entire system so as to determine which of them could be made acceptable to the commission. A careful study revealed the fact that on our system of some 2500 miles there were in existence maps, of various sizes, and mostly on a 100-ft. scale, for about 1000 miles, which it appeared could be brought up to date without complete field surveys. For the other 1500 miles we found that complete new surveys would have to be made.

We started in the office making tracings, in accordance with the Government regulations, from the existing maps, and to complete these maps started small parties of two men each over our lines, obtaining the data necessary to complete the plans; such as survey station points for turnouts, structures, etc., locations and dimensions of culverts, fences and buildings and other miscellaneous items, all of which would have to be placed on the maps before they could be filed with the Government. For this work four parties of two men each, under the charge of an assistant engineer, completed the 1000 miles in the field between Feb. 16 and Dec. 11. As fast as the field work was done, the information obtained was placed on the tracings in the office.

SURVEYS FOR NEW MAPS FOR 1500 MILES

For the new survey work, parties were started in the field in February, 1914. A gradual increase in the number of parties was made until nine parties were at work, and have been continuously to date. Up to Sept. 1, 1915, these parties had completed resurveys for 1250 miles of line and an entire resurvey of the Boston terminal, and it is anticipated that the entire work will be done by Dec. 1, 1915. These parties are composed of four field men and one draftsman, three parties being under the direct charge of an assistant engineer. The field draftsman travels continuously with the survey party, and completes and forwards to the main office a plan which shows all existing features, survey stations, offsets and other information, or a complete detailed resurvey of our line. These plans are inked in on mounted paper in rolls containing approximately seven miles on a 100-ft. scale.

The speed of these parties varies with the character of the line on which they are working, there being some locations where on account of congestion, number of tracks, etc., they will not cover more than ½ mile a week, while on other lines, where the conditions are much different, we have had some parties cover 7 or 8 miles a week. The average throughout is approximately 3 miles for each party.

All these parties find their own subsistence, using for the most part passenger or freight trains to go back and forth. We have, however, in some instances, used motor cars, which have increased our work at least 2 miles a week, this condition, of course, applying to lines where the railroad stations are few and far apart.

DUPLICATE NOTEBOOKS

On this work we are using duplicate field notebooks, by which a carbon copy is obtained of all the work. By doing this the draftsman always has a copy of the field notes the day after they are taken. By keeping the field plans in close touch with the field survey work we reduce corrections and the picking up of omissions to a minimum.

As fast as the field plans are received in the main office they are laid out for the Government sheets and the tracings made. A draftsman in the office can complete such tracings at the rate of two to three a day. For all the tracings we purchase the cloth cut to size, with the border lines printed thereon. For the title work we are using a Golding printing press. In the press, instead of type, we are using plates which are reproductions of the lettering of one of our draftsmen. With the press and the plates we are able to put titles on our maps at a cost of about 1½ cents each, and at the rate of about 200 in four hours.

Where we have made resurveys we are painting the rail at every 100-ft. station, and noting the station at 500 or 1000-ft. intervals, this being done to aid in the taking of profiles where necessary, and also for the assistance of the Government engineers in their chaining. Up to the present time we have made no start on profile work. It is hoped that instead of the profiles, as called for in Order 1, we can substitute our regular track charts, which, while on a much larger scale, give a more comprehensive idea of the rise and fall of the grades, and which we think would be much more suitable for use in working out valuation than that called for by the map order.

LAND LINES THE MOST DIFFICULT PROBLEM

Our next step is the working up of the land lines and land records called for in Order 1, and it is this work which we find is the most difficult and takes the most time. At the start we found that there was practically no part of our system on which the land records were complete, and that there was a large proportion of our system on which no land maps were in existence. We have therefore found it necessary to reproduce on our plans all the land lines for the entire system. It can readily be seen what it means when it is realized that the purchase of the lands covers a period from about 1830 to date, and that there are about 25,000 land parcels to be located. Many of the original corporations are non-existent and have passed through so many hands during the different reorganizations that many records have been lost.

While our men in the office use the deeds which are in the possession of the railroad, many deeds are missing, and our land commissioner has for over a year had his assistants going to every registry point in New England and part of New York State obtaining the record of every deed in the name of any railroad which has ever been a part of our system. After checking this record against the deeds we have, abstracts are then made of the missing ones. Beyond this the commissioner is obtaining copies of all county commissioners' awards and all locations as filed for all the railroads. We find, even with all this information, that there are many places where we can get no records of ownership of parts of our right of way. At these points, of course, we will be obliged to fall back on the fact that the railroad is there and in possession. Such records will undoubtedly be accepted by the commission.

After making up the plans in accordance with Order 1 we are starting on Order 7, pertaining to schedules of land. For this order we are obliged to show on the form called for, besides the information above shown in the plan, the areas and the considerations shown in the deed for all the land parcels. These forms are then handed to the valuation accountant, who will work up the information regarding the original cost of every parcel. This means a tremendous amount of work, as it will entail going over all the original records which can be found and obtaining from these records information regarding every voucher by which payment was made for every parcel of land. Further than this, we are to find, and of course it is to our advantage also, any information possible regarding expense incurred in each acquisition. It will, of course, be absolutely impossible for us to find such information in many instances. Many of the old records are gone, or lost by fire.

FINDING HIDDEN ITEMS

The physical inventory is obtained from an actual survey of conditions as of to-day. It is perfectly obvious that many conditions which existed at the time the railroads were built cannot be shown or found to-day and that in such an inventory the railroads therefore would lose many items which should be used in the reproduction cost. This question has faced the railroads since they first started on this work. In order to reduce such a loss as much as possible we first issued a circular letter, asking for information regarding records not on file, or any specific data regarding difficulties met with during the construction of the various parts of the road, or any conditions which required unusual expense. The responses from this circular were gratifying. From it we have located many old records, plans and notebooks not known to be in existence. We have also received a great deal of information by letter.

To handle this feature of the work we organized a small squad for hidden research. It was the duty of some of the members of this squad to interview those from whom letters had been received, and finally we started some of them walking the line, interviewing everybody who had any knowledge of any part of the railroad. All the information which was obtained was placed on index cards. Moreover, all the notebooks and plans that we could find were collected. In addition to this the valuation accountant has had a squad of men at work getting for us all information regarding quantities on the many large improvements and grade-crossing separations made since the railroad was originally constructed. All the information so obtained is furnished to the pilots for their use as they go over the various parts of our system.

To assist in describing the inventory features, I have divided them into three departments: Engineering, lands and accounts.

HOW THE GOVERNMENT PARTIES PROCEED

The first Government track and roadway party started on the Boston & Maine Railroad April 29, 1914. Other parties were added, so that during the year 1914 there were five such parties at work. The work here was suspended during the winter months and these parties transferred to the South. They returned here again in April, and during this year six parties have been at work. Up to the present time, 1900 miles have been covered by these parties, and it is anticipated that all the track and roadway inventory work will be completed on the Boston & Maine by Dec. 15.

All these parties are under the charge of a senior field engineer, with headquarters in Boston. Each party is under the charge of an assistant engineer. These parties usually comprise nine men: the assistant engineer, three cross-sectionmen, three recorders and two computers.

The cross-sections are plotted directly into notebooks in the field, and usually on a 10-ft. scale. On each section is shown the distance out and the distance down, with the center of the track and the base of the rail being assumed as zero; for all changes in the section the original ground surface at the base of fills or edge of cuts is noted. The original surface where removed is plotted by judgment. No elevations are taken. When the sections are being made, the classification is shown on them.

THE MASS PROFILE

Each day the cross-section notes are turned over to a computer, who works up the area of each section by use of a planimeter, and transfers the areas to a quantity diagram. This, in reality, is a mass profile, from which the quantities of each cut and fill can be obtained directly by planimeter. The diagrams when finished are sent to Washington, where they will be used in connection with the necessary computations for overhaul. Ballast depths and sections are taken for each cut or fill and deducted or added to the cross-sections, depending on whether the cross-section is an embankment or a cut. Ballast depths are found by digging, and for this the railroad furnishes the labor.

The recording party chains the line and makes a complete inventory of features other than grading and ballast. The weights of the rails are noted; the ties, rail braces, tieplates and anti-creepers are counted in two 600-ft. blocks for each mile, from which an average is obtained for the entire mile; all culverts are measured and dimensions noted; all information at turnouts is obtained, with a notation for each part, such as the switch, frog, guard rail, etc.; a record is made of all signs and fences; bridges up to 16-ft. span are inventoried; the result being a complete inventory of all the parts which go to make up the track and roadway, outside of ballast and grading. All computations and collections of this information are made in the office by a computer, and for each mile or track plan as made by us. The computers in the office collect all this by accounts and work up all quantities.

When the work was first started the ordinary type of notebook was used, with a complete running sketch being made of the entire road, and from this the computations were made. As the work proceeded, how-

ever, developments were made of a type system, by which the various items are typed by letter or number. With the aid of these and special field forms, much better progress is made and a much better inventory obtained. At the present time these field parties average about 2½ miles a week.

INVENTORYING BRIDGES AND BUILDINGS

The work in connection with inventory of bridges and buildings was started in October, 1914. For these parties both the Government and the railroad furnish one engineer and one computer. Our representative is furnished with copies of all the bridge or building plans which we can find in our files and also information regarding the construction, weights of superstructures and specifications if necessary. The bridge party visit in turn every bridge of over 16-ft. span as they travel along the line, and take sufficient measurements to identify the plans or records, which they may have or to compute all quantities in case no plans or quantities are in existence.

The building party performs the same work in connection with buildings. For the buildings sufficient measurements are taken so that the cubical contents of each building can be figured, and sufficient notations are made as to the kind of construction of the building as will be necessary in making an appraisal of the building. In the buildings, records are taken of all furniture and fittings other than stationery. The line between the building and the track and roadway party is usually drawn at the building wall, although the building party do take the platforms and awnings, drains directly connected with the building, and in some instances have taken the features outside the building, such as driveways, shrubbery, etc. For our own records we are also taking photographs of each building. Up to the present time these parties have covered some 800 miles, and hope to finish our line some time during the winter. In order to make more speed, we have furnished a motor car for the use of the bridge and building party as it travels over the line. We have recently, also, put on an additional building party which is taking the buildings at the large junction points or terminals.

SIGNALS AND INTERLOCKING

The signal and interlocking party started late in October, 1914. In the party there are two representatives from the Division of Valuation and a pilot from the railroad. This party is taking all measurements necessary for the working up of the various quantities for all automatic signals, crossing and warning signs and interlocking towers. This party has completed some 700 miles to date, and will undoubtedly finish during the winter.

In all this work no attempt has been made toward fixing the depreciation, although this has been done in some of the other districts. The Government engineers are, however, making careful notations regarding the condition of the various parts as they find them, and on the bridges and buildings have made some attempt toward fixing the service life which can be expected from the various parts of the structures. It is anticipated that the depreciation, or the condition percentage, will only be obtained after a careful study of all maintenance records and operating conditions, and by traveling over the lines with a special train with the proper representatives of the railroad and the Division of Valuation.

LANDS

The land work for this district is under the direct charge of the valuation attorney. For the actual field work he is being aided by assistant attorneys and by senior and junior appraisers.

As fast as we finish the land maps for a valuation section, prints are turned over to the valuation attorney. In June, 1914, actual field work was started on the land valuation. The first work in the field is the establishment of zones, each zone depending on the character of the adjacent and adjoining lands. In some places the zones are continuous, where the character of the land is similar on both sides of the right-of-way, but where there is a distinct difference on either side, the zones are sometimes carried along the center of our right-of-way. These zones are established by actual inspection of the line.

The appraiser next visits the assessors' offices in the district where the railroad is located, and obtains from their records the assessed values of all the adjoining or adjacent lands, noting the comparison between the assessed and the actual values. He then obtains records of all bona fide sales in the locality which can be substantiated, and finally visits representative men, usually real-estate men, in the various localities, and obtains from them their opinions of the actual value of these adjoining and adjacent lands.

TREATMENT OF LAND INVENTORY YET TO BE DETERMINED

From all these data the appraiser makes his estimate of the normal market value of the adjacent and adjoining lands, which is the so-called basic value to be used in the valuation of our right-of-way lands. What the next procedure will be has not yet been determined by the Division of Valuation.

The railroad land committees have had this question under consideration for a long while. They have asked from all the roads any information which can be given on recent acquisitions, divided so that it would show what the railroads have to pay above the normal market value for consequential or sequence damages, and also the acquisition costs. This information will be compiled and filed with the Division of Valuation so as to give to them a record of what might be expected in the acquisition of new railroad lines, and information which the railroads think should be used in the fixing of the values of the rights-of-way as now owned.

It is ordinarily estimated that the land values of a railroad represent about 30 per cent of its value. This would mean approximately a $5,000,000,000 investment for lands by the railroads of the United States.

The Boston & Maine, through its land commissioner, has its own representatives at work compiling basic values for use in checking the Government figures. Up to the present time there has been no real co-operation between the Division of Valuation and the railroads on land values. Various schemes have been proposed by the railroads for such co-operation, and the director himself has expressed himself very strongly in favor of some method of co-operation, but has stated that it is his opinion that the opinions obtained from local parties should be found separately.

The accounting work for this district is under the direct charge of a district accountant. The work here is being handled by an accountant, who has under him a number of assistants. The first accounting work in connection with valuation of the Boston & Maine was started by the Government in May, 1914. An attempt was first made to work out the original cost to date of the original Boston & Maine corporation. This corporation was chartered and construction work started in 1835. The accountants were given all books or records which we had in our possession and started to make up the original cost to date, using the present classification and accounting system. After considerable time had been spent on this work the accountants came to the conclusion that from the records available they would not be able to make up in any way such an original cost. This work was then dropped.

Since that time they have been at work on the financial history of the Boston & Maine Railroad. They have attempted to work up full details of all stock and bond issues, and also to show where all the moneys coming from such issues have been used. They have also made a careful investigation of all operating accounts, endeavoring here to work up a complete statement of all the operating earnings and where all these earnings have been used, as, for instance, operating expenses, additions and betterments, retirements, dividends, etc. It is estimated that up to the present time they have completed perhaps one-half of the work which they are to do.

This briefly represents the present condition of the valuation work on the Boston & Maine Railroad, and is fairly typical of the work which has been started on various other roads in the United States. On some of these roads the inventory of the physical property has been completed, and in one or two instances preliminary reports have been made on these roads, showing the cost of reproduction new and the cost of reproduction less depreciation. In these reports, however, no values were placed on the lands or on any of the contingent items, but just the mere inventory of physical property.

COST AND ACCURACY OF WORK

The cost of this work, both to the Government and to the railroads themselves, has been widely discussed. The work on the Boston & Maine will consume over two years, possibly three, during which time a maximum organization of 130 will have been actively at work. We estimate that the cost to the railroad will be at least $100 per mile and probably more, and that the cost to the Government will be at least an equal sum. The cost on other roads will vary, depending upon the conditions, some more and some less, but it is anticipated that at least $100 per mile will be expended by all the railroads in the country, and that the Government will probably spend a similar amount. This will make the total cost of valuation approximately $50,000,000.

Many questions have been asked as to the accuracy of the inventory of the physical property. We have always found that the Government engineers are anxious to arrive at as correct results as can be obtained, and it is probable that the errors in the parts that can be readily seen will be small. In the grading and masonry, however, there are many chances for loss. No one knows how thick or how deep many of the masonry walls or abutments are, or what may be under them. For the grading,

the original surface of the ground is always a matter of guess. A comparative test was made last year by the Delaware & Hudson Company, on the cross-sectioning of a part of their line. One party made cross-sections, using first the Lock level, second the "Y" level, and third using a transit and level. It was found that the same party doing the cross-section work by these various methods obtained practically uniform results, but that when a second party did the work, using the same methods, their results were uniformly alike, but differed from the results obtained by the first party. In other words, the mere personal element shows much variation in results obtained. It is then evident that with all the care that can be taken, there is liable to be a considerable loss to the railroads on some items, such as grading and masonry.

Test Plant Operated to Deodorize Oil Refinery Wastes

Aeration, Coagulation, Sedimentation and Storage Tried at Installation in Neodesha, Kansas, to Prevent Stream Pollution

By F. R. HESSER
Assistant Engineer, Kansas State Board of Health

AERATION, coagulation, sedimentation and storage were the methods tried in an experimental plant to deodorize the wastes from the Standard Oil Company's refinery at Neodesha, Kan. The wastes, amounting to 1,000,000 gal. daily, were discharged into the Fall River near its junction with the Verdigris River. Cherryvale, Independence and Coffeyville each supplied with an up-to-date mechanical filtration plant, take their water from the Verdigris at distances of 8, 11 and 30 miles respectively from Neodesha. After a very dry fall these towns in January, 1915, began to complain of odors and tastes in their water, and the State Board of Health was requested to seek a remedy.

Investigation led to the belief that, due to the unusual condition of the streams, the refinery waste was the source of a large part of the offensive odors. In order to avoid the recurrence of such conditions it was desirable to find a practicable method of deodorizing the waste before discharging it into the streams. While the Standard Oil Company had nothing to offer in the way of solution, it agreed to construct an experimental plant, to be designed and operated by a representative of the State Board of Health.

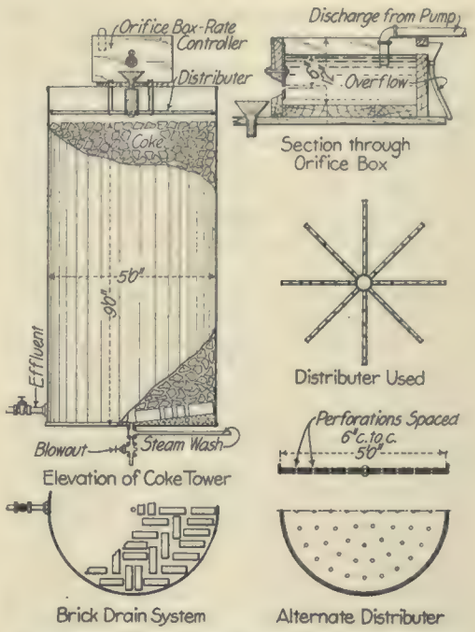
Odors Due to Acids

Preliminary experimental work led us to believe that the odors were due to compounds of naphthalenic and sulphonic acids, partially in solution and partially suspended as an emulsion, in the wash water from the agitators. The writer, therefore, designed a plant which, it was thought, would break up the emulsion and remove odors by aeration. The original plan included a rate regulator, coke aerator and steam wash for regenerating the coke, and contemplated pumping waste water from some point in the outfall sewer. Since the odor complained of is characteristic of the agitator wash water it was found advisable to place the plant near the agitators and thus avoid pumping. Chemical dosing devices and a settling basin were added later during the three weeks' operation, concluded April 10, 1915.

Details of Plant

The coke tower, 10 ft. in height and 5 ft. in diameter, was made of two sheets of ⅜-in. steel, lapped and riveted along the horizontal and vertical seams. A flat circular bottom of the same material was placed in the cylinder and tapped at the center to receive a 1-in. bushing. The cylinder was then erected vertically upon timber supports so that its base was about 6 in. above the ground. A 1-in. steam line, tapped into the steam main between agitators 1 and 2, was connected to the bottom bushed tap by a tee and nipple and a valve placed on the open or down end of the tee to serve as a drain or cleanout valve. Valves were placed in the steam line at the main and just outside the cylinder. The main valve was closed at night during cold weather to prevent excessive condensation and ultimate freezing in the 1-in. line.

A layer of concrete 3 in. thick at the outside and sloping to 1 in. thick at center was then placed on the cylinder bottom and



AERATION AND COKE STRAINING DEVICE FOR DEODORIZING OIL REFINERY WASTES

a 1½-in. effluent line was tapped into the north side of the cylinder just above the concrete floor. A hand-operated valve just outside the cylinder controlled the flow of effluent through this pipe, which extended about 8 ft. and dropped through an elbow and 6 in. of nipple into the sewer catch-basin serving agitator 3. Brick were then placed on edge and staggered to form a gridiron collecting system and support for the coke.

Hard coke was placed in the tower to a depth of about 9 ft. above the bottom, with no attempt made to grade it by size. The pieces ranged in size from 1 or 2 cu. in. to 50 cu. in., with at least 80 per cent between 10 and 30 cu. in. It later became apparent that a small section on the southwest side of the tower had been packed too hard, for when steam was passed through the tower the whole exterior became evenly heated with the exception of a section about 2 ft. wide extending from the top to about 5 ft. above the bottom.

Rate Regulator

The rate regulator consisted of a 2 by 2-ft. wooden box, 1 ft. deep, having pivoted inside one face a steel orifice plate 10 in. in diameter and ¼ in. thick. Six orifices of different sizes were so spaced about the center of the plate that any one could be made to discharge through a beveled opening near the bottom of the box. A constant head of 6 in. was maintained over the discharging orifice by means of influent valves and a 1½-in. overflow in the back face of the box.

The orifice diameters and corresponding rates are as follows:

Diameter of orifice, in.	Discharge gal. per hr.	Rate mil. gal. per acre per day
¼	0.57	1.82
½	2.19	7.00
¾	4.9	15.70
1	8.8	28.0
1¼	13.6	43.6
1½	19.6	62.7

The orifice box, for plain aeration, is supported upon two 2-in. planks laid across the top of the tower. One of these planks, crossing the middle of the tower, is perforated by a 4-in. hole directly over the center of the tower and supports the distributer.

The distribution system consists of a sec-



ARRANGEMENT OF EXPERIMENTAL DEODORIZING APPARATUS AT NEODESHA, KANSAS

tion of 6-in. steel pipe, 10 in. long, plugged at the lower end and having eight ¾-in. taps spaced equidistantly around the circumference and about 1 in. above the bottom. Into these taps are screwed eight ¾-in. pipes, 26 in. long, capped at the outer end and perforated with six 3/16-in. holes along the upper side. This sprinkler is wired directly under the hole in the plank previously mentioned, so that the discharge from the orifice box falls into the 6-in. pipe and is discharged into the air above the coke surface.

During the first two days raw water was obtained from a 1½-in. pipe tapped into the wash-water discharge line from agitator 3. The waste varies, however, from strongly acid at the beginning of wash to an alkalinity approaching that of raw river water at the end of wash. The odor also decreases and the period of operation was limited to that of washing (about 4½ hr. maximum per batch of oil).

To obtain a uniform wash for treatment agitator 1 was connected to agitator 3 and used as an equalizing basin, proportional quantities from various washes being mixed and stored there. A 1½-in. supply pipe connected, as in the case of agitator 3, conveyed the raw waste to the orifice box.

CHEMICAL DOSING

After one week's run on plain aeration a sedimentation basin was erected between the coke tower and agitator 3. It was a covered, steel tank, 8 ft. in diameter and 5 ft. deep, placed on wooden bents so that an outlet pipe 7 in. below the top would discharge into the distributer.

The orifice box was made to discharge into a mixing trough of white pine 3 in. x 3 in. by 5 ft. long, having baffles and bottom cleats to cause agitation. Solutions of lime, iron sulphate, alum or colloidal clay were mixed to known strength in 16-gal. kegs provided with brass spigots. These discharged into tin cans in which a 6-in. head was maintained above a 1/16-in. orifice near the bottom, which, in turn, discharged into the orifice box or the mixing trough. The basin was provided with underflow baffle at the inlet end and skimming weir at the outlet end.

RESULTS OF OPERATION

Samples were collected and diluted until the characteristic odor was masked. The results were then recorded by the dilution strength. Raw waste was usually detected in 1 to 1000 or 1 to 4000 dilutions. By aeration, at rates of 28,000,000 gal. per acre per day or less, an effluent masked in 1 to 256 dilutions could be obtained. By coagulation with lime and iron and subsequent aeration equal or better results were obtained, and plain storage for periods of 24 hr. or more effected a reduction of 25 per cent in some cases. Dilutions of 1 to 256 represent a reduction of odor of 75 per cent or more. This will be masked by the minimum mean flow of the Verdigris River, when the agitator waste is at its maximum of about 400,000 gal. per day. Further experimental work will be carried out soon to obtain data upon which to design a plant and base its operation.

THIRTY-MILLION PASSENGERS were carried on ferry boats in San Francisco bay without injury through accident during the year ending June 30, 1915. In the last 25 years, it is stated, only two deaths have resulted from ferry mishaps.

Further Means Suggested for Interpretation of Water-Turbine Test Data

Diagrams Recently Explained in Engineering Record Should Be Supplemented by Other Features, and Computations Simplified by Special Computer

By L. F. HARZA
Consulting Engineer, Portland, Ore.

THE TWO recent contributions of Prof. S. J. Zowski upon "Some Recent Tests of High-Power High-Speed Water Turbines" in the issues of the Engineering Record of Nov. 28, 1914, page 585, and Dec. 26, 1914, page 689, are devoted to a discussion of the latest phenomenal developments in the design of high-characteristic turbines. The methods there used for the analysis of test data and for representing graphically the operating characteristics of the turbines were described by a subsequent article in the issue of Jan. 9, 1915, page 45, by George H. Bancroft. It is with regard to these methods that I desire to offer a word of comment and some additional material without which in my judgment the series of articles is incomplete. The writer has used for several years the method of turbine analysis advocated by Mr. Bancroft with some modifications and additions, part of which he described in a discussion of a paper by O. B. Coldwell upon "Principles to Be Considered in Selecting a Waterwheel Unit," published in the *Proceedings* of the American Institute of Electrical Engineers of December, 1912. This paper with its discussions was not published in the *Transactions* and is for this reason not conveniently available, which fact I offer as an excuse for again mentioning some of the methods there presented.

Graphical representation of the test data of a turbine by "equal-efficiency curves" is chiefly useful in presenting to the mind's eye its characteristics in the form of a picture, from which by practice can be judged its relative suitability for different classes of service as compared with some other turbine. To study a turbine without these curves is comparable in difficulty and laboriousness to the task of reading a book if each letter of each word were on a different page so that neither the letters of a word nor the words of a sentence could be viewed collectively; it is worse than trying to picture in the mind the topography of an area by viewing a map showing the elevations of isolated points but without contours.

FIVE NEW FEATURES TO HELP VISUALIZE TURBINE CHARACTERISTICS

The writer adds to the system of platting as used and described in the previous articles five additional features believed to add to the clearness of the mental picture, namely: (a) The reduction of the test data of turbines of all sizes to some uniform size; (b) the use of a uniform size of platting sheet with identical scales, at least for all turbines of the same general class, such as those described by Professor Zowski; (c) the provision upon this platting paper of permanent background curves of equal values of the "specific speed" or "type characteristic" in addition to the vertical and horizontal platting lines; (d) the platting of an additional form of diagram not previously described; (e) the use of special mechanical means to reduce the data to form for platting.

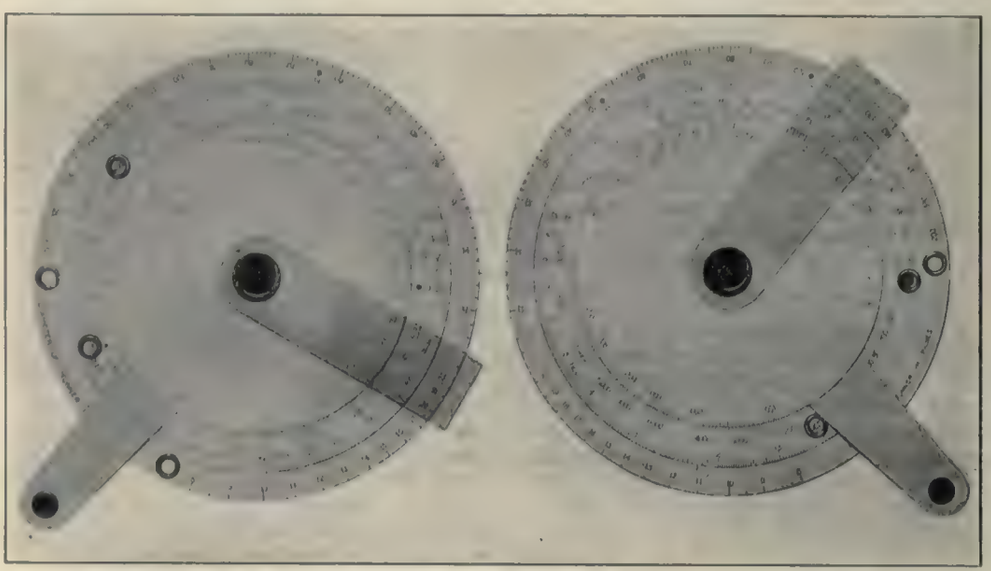


FIG. 1—THIS SPECIAL COMPUTER HAS PROVED TO BE A GREAT TIME SAVER

In Professor Zowski's first contribution he shows characteristic curves of seven turbines, one of 28-in., one of 35-in. and five of 30-in. size, and in his second contribution he discusses one of 35-in. and one of 30-in. size. The advantage of reduction to a standard size for platting should be obvious if it can be done without too much work, except in cases where it is proposed to use the same size as tested. The uniform size of platting sheet with its uniform scales is of importance, as it permits the making up of a Van Dyke negative from which these sheets, containing also the curves of "specific speed," can be readily duplicated; and comparison of turbines is made more apparent to the eye.

SPECIAL COMPUTER

The reason why the reduction to uniform size of runner is not more generally practised is probably the necessary additional work of computation. About four years

ago the writer constructed a circular computer (shown in Fig. 1) for facilitating these computations, and this has proved a great time saver in his own work. The size of turbine to which this computer was intended to reduce all data is 10 in., and the standard head is 1 ft., the latter being the same standard head as used by the previous writers. The calculator could, of course, be made straight as well as circular.

The formulas solved by the computer are

$$N_1 = DN/10\sqrt{H} \qquad (1)$$

and

$$P_1 = 100P/D^2H^{3/2} \qquad (2)$$

in which D = turbine diameter in inches; H, head in feet during test; P, brake horsepower under head H; N, revolutions per minute under head H; P_1, power of a 10-in. runner under 1-ft. head corresponding to a power of P under head H, and turbine diameter D; N_1, revolutions per minute of a 10-in. runner under 1-ft. head corresponding to a speed of N under head H, and turbine diameter D.

These formulas are the same as given by Bancroft, with the additional factors for reduction to a 10-in. diameter. This size was chosen as a convenient one mathematically. Since that time the manufacturers have been gradually approaching 30 in. as a standard size of runner for experimental test purposes. The addition of another scale on the baseboard (not shown) would permit the reduction of data from any tested size to any other desired size, such as 30 in., equally well. Another scale might also be easily provided such that the computation would not need to be reduced to a 1-ft. head, but could be applied directly to the proposed operating head if desired. The formulas solved would then be

$$P_1 = \frac{d^2h^{3/2}}{D^2H^{3/2}}P \qquad (3)$$

and

$$N_1 = \frac{D\sqrt{h}}{d\sqrt{H}}N \qquad (4)$$

in which d is the desired size and h the desired head.

Description of Computer

It will be seen from Fig. 1 that each set consists of three disks. The upper one is fixed by means of an extension arm to the baseboard, and is provided with the scale of P_1 in the left set and of N_1 in the right set. The largest disk has an outer scale of turbine diameter D for each set. The intermediate disk has an outer scale of head H for each set, with inner scales of power P for the left set and speed N for the right set.

By way of illustrating the use of the computer assume the data as given by Professor Zowski for No. 1796, in the test of which it was found that a 28-in. wheel under a head of 17.11 ft. and running at a speed of 153 r.p.m. gave 125.2 hp. with an efficiency of 66.52 per cent. To reduce to a 10-in. runner, the diameter of the tested runner, 28 in., on the largest disk of each set is placed opposite the graduation between the two sets (on the line joining their centers) on the baseboard. The head at time of test, 17.11 ft., on the outer scale of the middle disk of each set, is then placed opposite the graduation H on the largest disk. From the left set the value of P_1 is then read on the upper disk opposite the tested value of P, 125.2 hp., on the inner scale of the middle disk; and the value of N_1 on the right set of disks is read on the uppermost disk opposite the tested speed, 153 r.p.m., on the inner scale of the middle disk.

It will be noted that after the largest disk is set no further computation is involved with reference to the tested or desired size of turbines; it is as easy to reduce all test data to the same size as not to do so. If the head during test were constant the middle disks also would not need to be moved; in reality they must be shifted slightly for each observation to involve the fluctuations in the test head at Holyoke. The computations thus consist principally in reading P_1 and N_1 opposite P and N for each observation of the test, a very simple and rapid process comparable to multiplying each of a series of numbers on the slide rule with the same multiplier. The process would be equally simple if additional scales were added to reduce to any desired size other than 10 in. and to any desired head other than 1 ft.

Value of Uniform Scales

The value of uniform size of turbine and scale of platting is illustrated by the three accompanying figures, representing three successive types in point of their power output for a given speed. Fig. 3 is test No. 1796, the same as Fig. 1 of Professor Zow-

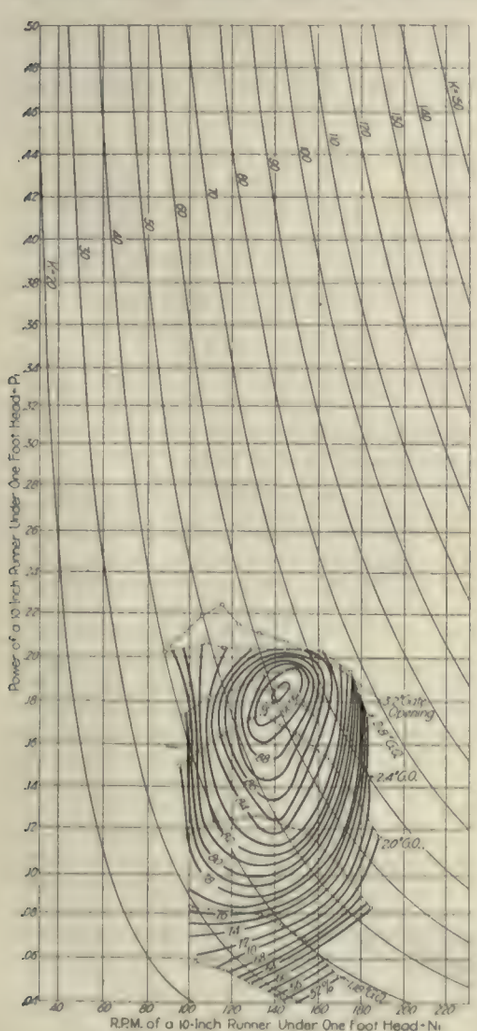


Fig. 2—Test 2321

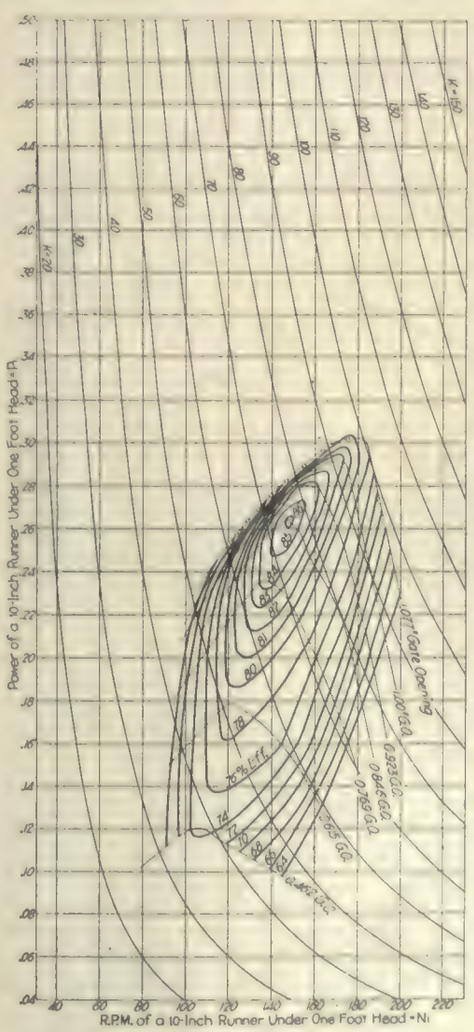


Fig. 3—Test 1796

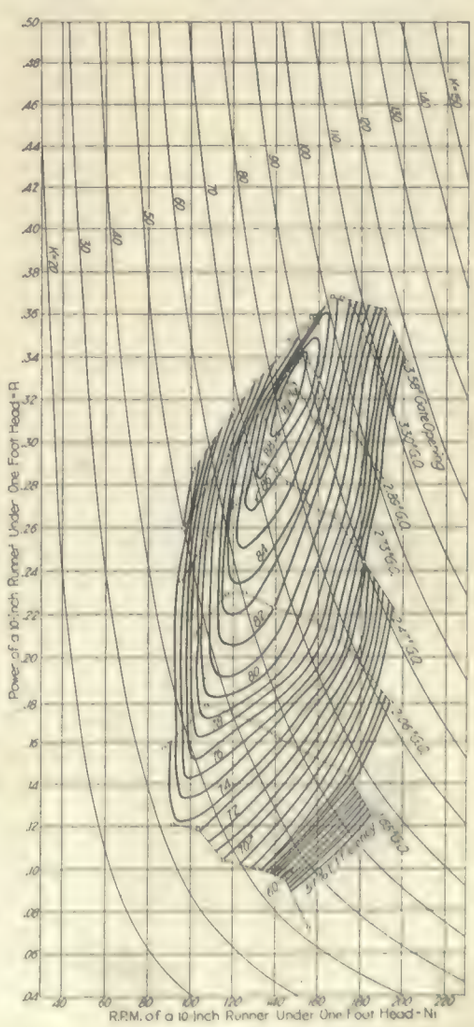


Fig. 4—Test 2270

THE VALUE OF UNIFORM SIZE OF TURBINE AND SCALE OF PLATTING IS SHOWN BY THESE THREE FIGURES, REPRESENTING THREE SUCCESSIVE TYPES IN POINT OF THEIR POWER OUTPUT FOR A GIVEN SPEED

ski; Figs. 2 and 4 are Nos. 2321 and 2270 respectively, which are mentioned by him at the close of his first article. The height of diagram here shown is just a trifle more than sufficient to permit the platting of Zowski's runner No. 2363, which indicates its remarkable increase of power above that of test No. 2270, which represented approximately the existing limit prior to the recent Zowski runners.

There are added to the usual background lines, in all of these diagrams, lines of equal values of "specific speed" or "turbine characteristic" K or

$$K = (N\sqrt{P})/H^{5/4} \qquad (5)$$

The relation between K, P_1 and N_1 for platting these curved background lines, and using the general size of reduced turbine of d instead of 10 in. and the general head of h instead of 1 ft., is derived as follows: From equations 3 and 4

$$P_1 N_1^2 = \frac{PN^2h^{5/2}}{H^{5/2}} = K^2h^{5/2} \qquad (6)$$

from which

$$K = N_1\sqrt{P_1} \div h^{5/4} \qquad (7)$$

If h is 1 ft., as is usual, then

$$K = N_1\sqrt{P_1} \qquad (8)$$

Also, $h^{5/4}$ will be constant for any head to which the test is reduced and will therefore permit the platting of curves of equal values of K, which are hyperbolas between N_1 and P_1. These curves are permanently inked upon the negatives from which the platting sheets are printed so that no extra work is thereby added to the work of platting. Thus it will be seen by interpolation that the three turbines at their points of best efficiency have specific speeds of about 63, 76 and 85 respectively.

New Form of Diagram

In Fig. 5 is shown another and very useful form of diagram, used by the writer for several years but not heretofore published. Its chief use is in the operation of the station after the generating units have been installed, although it also constitutes a valuable guide to the selection of a unit, as in the case of the other diagrams. After installation the speed of any unit is fixed by the generator, whereas the head may vary. The horizontal scale, therefore, shows a varying head with a fixed speed and is obtained from the horizontal scale N_1 of the preceding type of diagram, which shows a varying speed with fixed head, by means of equation 4 after substituting $h = 1$ ft., $d = 10$ in., N = chosen constant speed of unit, and D = chosen size of runner, thereby obtaining

$$N_1 = DN/d\sqrt{H} = \text{constant}/\sqrt{H} \qquad (9)$$

Thus, if it is required to plat the operating curves of a No. 1796 runner of 60-in. size to operate at a speed of 120 r.p.m., we have

$$N_1 = 60 \times 120/10\sqrt{H} = 720/\sqrt{H}$$

from which the values of N_1 for the distorted horizontal scale of H shown at the top of test No. 1796, (Fig. 3) were computed. Now draw vertical lines through these values of H intersecting the equal-efficiency curves below; tabulate the values of P_1 at which these lines intersect the various curves; and then in an adjoining column compute and tabulate the products of these values of P_1 by the value of $D^2H^{3/2}/100$ for the vertical line in question. These products will be the ordinates, and the values of H the abscissas, for platting the curves of Fig. 5. This diagram may also be platted from the curves of Bancroft's Fig. 1 by drawing vertical lines for each value of H and proceeding as above.

Best Way to Plat

The most accurate way, however, to plat this diagram is to proceed independently of any other forms of diagrams which may have been platted, by computing from the original test data the abscissa and ordinate of each observation included in the test. To derive the formulas for this computation, solve equation 4 for h, the abscissa, obtaining

$$h = \frac{N_1^2d^2}{D^2} \cdot \frac{H}{N^2} \qquad (10)$$

Now N_1 is the constant speed at which it is proposed to run the desired turbine, while d is its diameter, and D the diameter of the tested turbine. Hence the first factor is constant throughout the test; the test head H and the test speed N alone vary for each observation, and the former but slightly. After first computing and tabulating the values of the abscissa h from equation 10 for each observation of the test, substitute this with the other elements, all of which are known, in equation 3 to obtain the ordinate p for platting.

As an alternative a formula can be derived such that the ordinate p can also be obtained directly from the test data without first computing h; thus by substituting h from equation 10 in equation 3 we have

$$P_1 = p = \frac{d^5}{D^5} \cdot \frac{N_1^5}{N^5} P \qquad (11)$$

It is doubtless more convenient, however, to compute h first for each observation and then use these values in equation 3 for obtaining p as explained above.

The points may then be platted directly in Fig. 5, using the co-ordinates h and p, and writing the efficiency beside each point, then interpolating lines of equal efficiency between them; or, preferably, a diagram very similar to Bancroft's Fig. 1 may first be platted, except having h and p for co-ordinates instead of N_1 and P_1 for the lower set of curves. This diagram may then be used to plat Fig. 5, as explained by Bancroft for his very similar problem, thus insuring greater accuracy than by interpolating the equal-efficiency lines.

Possible Applications of Diagram

This diagram, Fig. 5, now visualizes the operation of the turbine by showing the efficiency resulting from operation at any actual specified power and head. It is equally easy to adjust the vertical scale to kilowatts at the switchboard and to place such a diagram where it will be at all times before the operator, so that he will know the economy with which his units are working and whether to increase or decrease the number of units in service to improve his economy. It is also very useful in converting switchboard and head readings to river discharge in the frequent instances where a record of stream flow is derived from the station operating data.

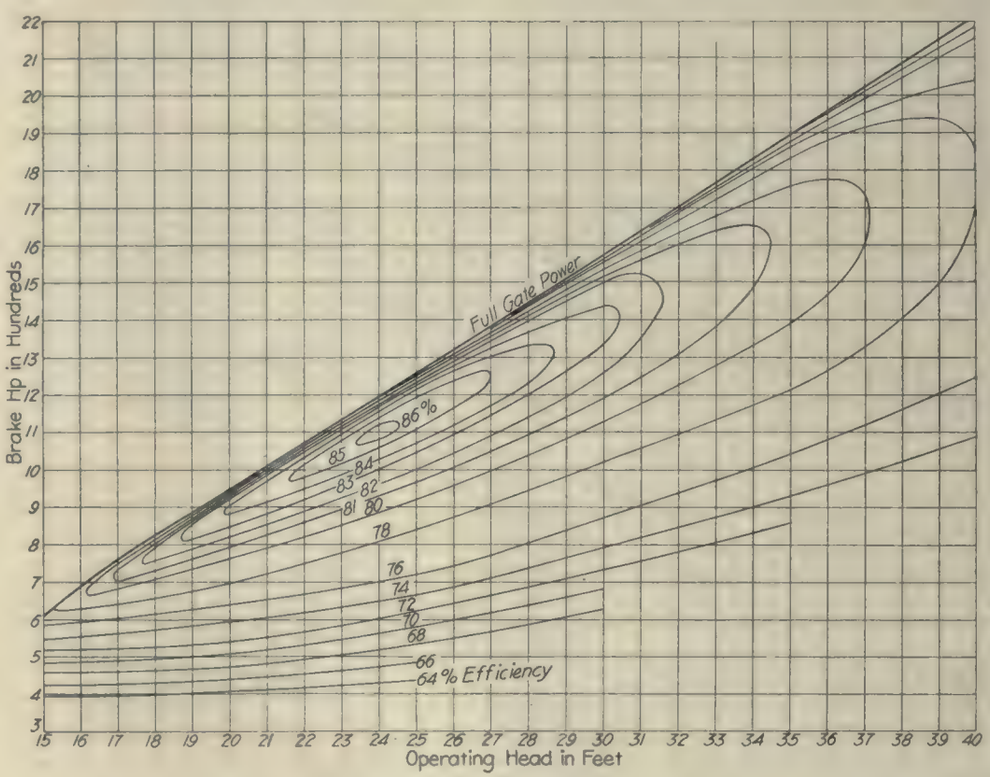


FIG. 5—THIS NEW FORM OF DIAGRAM IS USEFUL IN OPERATION OF STATION

All computations in connection with the reduction of test data for platting any of these forms of characteristic curves, as well as for applying these curves to the selection of turbines for any given conditions, can be made by means of the "computer" in a very simple and rapid manner. But few hydraulic engineers are accustomed to making such graphical studies in selecting equipment, the excuse usually being that such detailed studies are properly confined only to the manufacturer of turbines. On the contrary, these characteristic curves are only the pictures of the results accomplished by the far more elaborate study of the designer, and are chiefly of use to the prospective purchaser, just as an architect's sketch indicates to the client in a general way what type of building he is to get and whether it will be acceptable in appearance.

TWO MILLION MILES OF DIRT ROADS, the Department of Public Roads estimates, have been built in the United States. The total length of public roads of all kinds in this country is estimated at 2,250,000 miles.



FOREST PARK ENTRANCE HAS 40-FOOT CONCRETE ROADWAYS AND 25-FOOT PARK SPACES

Test Results Will Form Basis for Selecting Pavements in St. Louis

Nelson Cunliff, Commissioner of Parks, Tells Missouri Highway Engineers of His Experiments with Many Types of Surfacing

REINFORCED and plain concrete with various mixes and materials and a number of bituminous macadam types using Rocmac, Stanolind, Tarvia and Texaco are used in the experimental stretches of road laid by the Department of Parks of St. Louis, Mo., in an effort to obtain a satisfactory pavement. The following information has been abstracted from a paper presented at the recent convention of the Missouri Highway Engineers' Association by Nelson Cunliff, commissioner of parks:

Until 1910 St. Louis park drives paved with 6 to 8 in. of gravel proved satisfactory. With the increase in the use of the automobile these drives produced a great deal of dust and started to deteriorate. In order to overcome this the gravel was given a treatment of oil primarily as a dust preventive, and with the additional hope that the oil might have some binding quality that would maintain the road surface. The oil performed its function well for a few years; then the surface of the road began to show a great number of bumps, which proved a great inconvenience to fast-moving traffic and required constant attention from the road maintenance gangs. At times there were employed in one park as many as twenty-five men, whose sole duty it was to chop off the bumps.

Experiments with Concrete Mixes of Different Proportions

Four years ago experiments with asphalt macadam pavement were started. These investigations were followed by tests of concrete pavements, and during this year with a number of experimental stretches of penetration work. During 1914 a concrete roadway was laid at one of the main entrances through Forest Park, this work being about the first concrete roadway laid in St. Louis. In order that the department might have the greatest information possible regarding this kind of pavement the entire stretch was divided into sections, in which various mixes and materials were used. The first slab consisted of a 1:2:3 mix, using a 3-in. gravel and Meramec sand. This was followed by a slab using a 1:2:3 mix with 3-in. limestone. The next slab had a 1:2:3 mix using 1½-in. gravel and Meramec sand, while in the fourth one, 1½-in. limestone was used instead of gravel. This same change of material was repeated through the mixtures of 1:2:4, 1:2½:5 and 1:3:6. Single roadways were made 40 ft. wide with armored joints and ½-in. fillers spaced every 35 ft. All slabs were reinforced with American Steel & Wire Company's style 27 fabric. The reason for having the comparison between stone and gravel was that the engineer-in-charge was of the opinion there was a higher coefficient of expansion and contraction in gravel than there was in limestone.

Crushing Tests

As each of the slabs was poured a sample of the concrete as it came out of the mixer was taken and put into a testing laboratory cylinder. The samples were crushed at periods of 4, 8 and 16 weeks after being poured. The crushing tests indicated that the 1:2:4 mix using 1½-in. gravel gave the highest compression unit stresses, and the 3-in. gravel gave a low breaking stress. The 1½-in. limestone ranked second and the 3-in. limestone third.

In a section adjoining the one described hydrated lime was used in varying proportions. The proportions of the cement, sand and coarse aggregate, also varied. There is no doubt, stated Mr. Cunliff, that the introduction of hydrated lime makes a better pavement for concrete roadways than those in which no lime is used. It is easier to trowel the surface of the roadway, and that section in which hydrated lime is used seldom develops any map cracks such as are sometimes found in pavements made with ordinary Portland cement.

Place Strain Gage Plugs

A few months after this pavement was in place steel plugs 1 in. in diameter and about 4 in. long were placed in the pavement about 10 in. on each side of the armored joint in each slab. These plugs were so placed that a longitudinal and a transverse reading on the slab might be taken, and that two readings across the joint might also be obtained. These readings were taken by means of a 20-in. strain gage. The accompanying photographs illustrate the arrangement of the plugs and the methods of recording temperature or moisture content movement in the slab and across the joints. Along with the strain gage readings the temperature and humidity of the day on which readings were made are recorded. Inasmuch as this pavement has not been down a year no attempt to draw any conclusions at the present time from these readings has been made, but it is felt that they will prove valuable in showing the results obtained in the way of decreasing movement in the slab through increasing the density of the concrete by a richer mix, or by the addition of hydrated lime.

Nine Types Tried in 1915

This year the department set aside a 1650-ft. strip of traffic roadway through Fairground Park for experimental purposes. This is the only traffic roadway crossing the park, and is subjected to a great deal of heavy hauling together with



EXPERIMENTAL SECTIONS OF ROAD IN FAIRGROUND PARK

1—Penetration 2—Concrete 3—Rocmac

a moderate amount of pleasure vehicles. About 700 ft. of this experimental strip is set aside for a Rocmac pavement, 50 ft. for a 1:2:4 gravel concrete reinforced, 50 ft. 1:2:4 gravel without reinforcement, 50 ft. of 1:2:4 limestone reinforced and 50 ft. of 1:2:4 limestone without reinforcement. These sections all have armored joints with a felt filler set at an angle of 22 deg. with the center line of the pavement, which is 33 ft. wide. Next is a 200-ft. strip of Tarvia X penetration. The wearing course is composed of a 4-in. course of stone that passes a 3-in. ring and is retained on a 2-in. ring, compacted to 3 in. For the first coat 1½ gal. of Tarvia X per square yard is used, and ¾-in. limestone is used to fill the voids in the 3-in. stone. Then a seal coat of ½ gal. to the square yard is applied. Pea gravel is used as a finish or wearing course.

The next two stretches of pavement are made in a way similar to the last one described. In the first one Stanolind C is used and in the second Texaco 96 is used. The last stretch is made along the same lines, using 1½ gal. of Tarvia X for the first coat of penetration work and ½ gal. to the square yard of Texaco 96 as a seal coat. It is realized that the dealers in the various types of bituminous materials do not approve of this latter type of construction, but it has been carried out with the idea of following a theory based on the following ideas: When tar is applied to a stone it seems to penetrate into the pores of the stone no matter how thick the layer of dust there may be on the surface of the stone. One is never able entirely to peel back the tar or to obtain a line of cleavage between the tar and the surface of the stone. It is not possible to obtain this result with asphalt. The asphalt may thoroughly coat the stone, but the asphalt may be peeled away from the stone, leaving no discoloration. Since the oils in the tar attack the asphalt an asphalt having a greater consistency than the tar is used. In Mr. Cunliff's opinion the asphalt will produce a better wearing course than will the tar.

The cost data records of this department for large areas of the types of pavements are given in the table.



LEFT—SIX PLUGS PERMIT TWO LONGITUDINAL READINGS, TWO TRANSVERSE READINGS AND TWO OVER JOINT



RIGHT — READING STRAIN GAGE ACROSS JOINT — NOTE STANDARD STEEL BAR FOR CHECKING STRAIN GAGE

UNIT COSTS AND QUANTITIES OF MATERIAL FOR EXPERIMENTAL PAVEMENTS IN ST. LOUIS

	Stanolind	Tarvia	Texaco, 96
Binder per square yard, gallons	1.9	2.1	2.0
Depth of material in feet	0.45	0.55	0.42
Cost of binder per gallon, cents	5	6.5	6.5
Labor cost per square yard, cents	17.5	20	17.5
Material cost per square yard, cents	22.0	32	25.0
Total cost per square yard, cents	39.5	52	42.5

	Tarvia bottom, Texaco top	Concrete	Rocmac
Amount road binder to square yard	1.5 gal. 0.5 gal.	1.1 sacks cement 1.9 cu. ft. sand	1.53 gal.
Depth of material in feet	0.33	0.50	0.44
Cost of binder per gallon, cents	6.5	38.75	20
Labor cost per square yard, cents	18	32	17
Material cost per square yard, cents	25	93	43
Total cost per square yard, cents	43	125	60

How Shall Patented Materials or Processes on Public Works Be Handled?

Daniel B. Luten Discusses S. Whinery's Recent Article from the Viewpoint of the Bridge Patentee—Mr. Whinery Replies

AFTER pointing out certain undesirable features of present practice in the use of patented materials or processes in public work, S. Whinery, consulting engineer, of New York City, in an article on page 73 of the Engineering Record of July 17, advocated the payment of all royalties directly by the city or State. Last week there was published (page 511) a communication from George C. Warren of Boston disagreeing with Mr. Whinery's recommendation in the field of road construction. Daniel B. Luten of Indianapolis, who controls certain patents for concrete arch bridges, has sent to the Engineering Record the following letter, to which Mr. Whinery has replied.—EDITOR.

Daniel B. Luten's Letter

The full text of Mr. Luten's letter is given below:

"The article by S. Whinery in your issue of July 17, page 73, entitled "State Should Deal Directly with Patentees of Processes and Materials in Public Work," presents an interesting viewpoint of some of the difficulties popularly supposed to confront the use of patents in public lettings. Mr. Whinery has presented the matter in the way in which it no doubt appeals to the average contractor and engineer, but engineers and contractors are often misinformed as to patents, and frequently believe that things are as they wish them to be rather than as they really are. Their wish is father to their thoughts. I believe it is this lack of proper information and correct thought as to patents that is responsible for the difficulties of using patents in public work, rather than the reasons given by Mr. Whinery.

"I have no objections to Mr. Whinery's solution of having the State or city pay the royalty provided this will give the results desired; that is, the use of patented devices where meritorious. But it does not. One reason why it does not is shown by the following illustration: My plans were filed by the city of Topeka, Kan., for a bridge with the usual 10-per cent royalty clause. The following item appeared in a Topeka daily:

TEN PER CENT RAKE-OFF
City Must Pay Royalty to Luten for New Bridge

The city of Topeka will pay tribute to Daniel B. Luten of Luten bridge-patents fame. Ten per cent of the contract price of the bridge to be built over the Shunganunga Creek on Kansas Avenue will go to Luten. "It is cheaper to pay the royalty than to try to build a bridge not infringing on the Luten patents," said W. G. Tandy, city commissioner of streets. "We tried to adopt a plan for the bridge which would not infringe on Luten's rights, but to do so would cost more. As to whether or not Luten should have been granted his patents by the Government is not for us to consider. The point we must consider is that he has these patents."

Luten holds forty-one patents on the construction of bridges. If a bridge is desired with an arch of a certain degree of curve, Luten has a monopoly on that kind of an arch. There are 360 deg. in a circle, but Luten was satisfied to secure only forty-one patents.

"The above was of course inspired by some contractor who happened to meet the reporter and suggest such a story. He doubtless had been impressed by such argu-

ments as those advanced by Mr. Whinery. His object, however, was to gain an advantage for himself by placing obstacles in the way of the introduction of new devices in concrete bridges. Contractors and engineers frequently oppose such innovations for the same reason that union labor opposes new machinery, because they believe that it limits their individual opportunities. The benefit to the public, or to the profession, receives scant consideration.

Difficult to Introduce Inventions

"Mr. Whinery by his proposed reforms would make it more difficult for the patentee to introduce his invention. This is already difficult and must be done in the face of serious opposition by those who always favor the old and tried methods. The above newspaper clipping shows how embarrassing it may become for a public official to specify meritorious patented improvements in the face of possible newspaper criticism inspired by prejudiced bidders.

"In that particular instance the use of the patents saved the city upward of 25 per cent and the royalty charge was but 10 per cent of contract price. Nevertheless the reporter made a false statement as to what the patents covered and became quite facetious in his criticism of what was really beneficial to the taxpayers.

"In fifteen years' experience in the promotion of my own patented devices on public work I have come to believe that the prejudice against patented devices does not exist at all in the public mind, but comes primarily from contractors and civil engineers. The only prejudice on the part of the public is against the possibility of eliminating competition on public work by their use. And this prejudice, slight as it is, is sedulously cultivated by contractors and engineers who imagine that their own opportunities will be limited. Mr. Whinery's article will have this same effect.

Engineering Prejudice Against Patents

"As an example of the prejudice shown by members of the engineering profession, I beg to quote the following from a letter written by an engineer in Iowa in public office:

" 'Personally I am opposed to patents on any kind of reinforced-concrete work. As an engineer I feel that any member of the profession who fosters such patents that tend to burden the public with patent royalties is doing the present age a great injustice and is a disgrace to the profession. If occasion should arise, I will freely give my time and money to fight them to the last ditch.'

"This official is sworn to uphold the constitution of the United States, which contains the following:

" 'The Congress shall have power to promote the progress of science and useful arts, by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries.'

"Note the contrast between the engineer who believes that patents burden the public, and the constitution, in which it is held that patents promote the progress of science. It was in Iowa that the anti-Cameron patent association was organized; Iowa is the State that has an engineering college that has frequently shown its antagonism to patents; Iowa has a law providing that the Attorney-General may defend suits for infringement of road and bridge patents, and it was an Iowa engineer that advocated at a road convention that the United States Government should at its own expense defend infringers and thus encourage violation of its own patent grants! This engineer above quoted might well be an exception, but I have numerous other similar opinions from other States.

Only Successful Patents Are Opposed

"Opposition does not arise against a patent until it becomes a success. This shows again that the prejudice of engineers and contractors grows out of selfish motives. But strangest of all the engineer's and contractor's prejudice is rather against payment of royalty as such than against the purchase of a patented device. Engineers will specify and contractors will purchase deformed bars for reinforcement at a price that pays a handsome royalty, when they hesitate to recommend or use a patented device that the contractor can make himself, provided he purchases the right from the patentee. Thus, strange as it may seem, a monopoly due to special machinery or heavy investment of capital receives more encouragement than the reward for an intellectual achievement such as an invention.

"An established royalty is nearly parallel to an engineer's fee, and an established royalty of 10 per cent ought to go far to meet the criticisms that have lately been launched against low fees by engineers. If 10 per cent can become a popular charge for royalties on engineering patents, it will be at least one step toward the payment of higher fees for engineering alone.

Two Flaws in Mr. Whinery's Argument

"I find two serious flaws in Mr. Whinery's argument, and they are at the root of all the criticism directed at patents on public work. Mr. Whinery assumes that a patent can be extended to create a monopoly on unpatented materials. He also assumes that a patentee may not fairly compete with other bidders on his own patented device, even when the patent is thrown open to all bidders by naming a specific royalty. Neither assumption is sound.

"Taking up the last first, because the illustration is more striking, let us assume that a patented pavement is to be let, to cost, say, $10,000 to construct; that there are to be several bidders, including the patentee, and that they will all arrive at exactly this same cost of $10,000 in their estimates. In order to make the contrast more striking let us assume that the royalty is specified at an excessive amount, say $10,000, or 100 per cent of the cost. And let us assume the profit figured by each bidder to be small, say 1 per cent, or $100. Now surely if the patentee has any advantage over the other bidders by reason of his $10,000 royalty, it will be greater because of this excessive royalty and diminished profit than if each were reasonable.

"But suppose the patentee endeavors to take advantage of his excessive royalty to reduce his bid in order to secure the award, and he cuts $200 off his bid. He would bid $19,900 as against $20,100 by each of his competitors. But when he computes his profits, he will find that he has but $9,900, whereas if he had refrained from bidding at all he would have received $10,000 in royalty. And if he reduces his bid by more than the $100 profit figured by each bidder he is a loser. In short, the patentee cannot take advantage of his royalty to secure the work.

"As another illustration suppose Smith loses a $20 gold piece under a sidewalk. The owner of the walk calls for bids to remove the walk and restore Smith his $20. Smith concludes to bid against the others. Can Smith bid lower than his competitors by reason of having a claim for the $20 which the others must restore to him? Of course not.

Underbidding Must Sacrifice Profits

"Then if a patented improvement is to be let, and Smith by reason of a patent has a claim for $20 from each of the other bidders, it must be obvious that the only reduction Smith can make is in his profits, and each of the other bidders can equally afford to make a similar reduction except for the inequalities of skill and capital and equipment that always exist. If this applies to the patentee it also applies to his agent, the only condition being that any commission paid to agents must be paid regardless of who receives the award. And this is the same condition that makes an agent valuable to a patentee; that is, that he shall give services toward promotion for a commission.

"It has been the finding of the courts that a public letting is fair to all when the patentee bids against other competitors, provided a royalty is specified so that bidders may have access to the patent. Nevertheless Mr. Whinery advances as one reason for his proposed plan that it would prevent direct dealings with the possibility of collusion or corrupt arrangements between contractor and patentee, but he gives no example of what would constitute such an arrangement.

The Patentee's Agent

"If a special price is quoted to one contractor conditioned only on his getting the work, then possibly favoritism might result. But what possible object would it be for the patentee to make such an arrangement, and has it ever been done? If the special price is a concession made to him regardless of who gets the contract, there can be no favoritism. It is doubtless failure to appreciate this view that has led Mr. Whinery into his criticisms. If a patentee is debarred from employing agents, who in many cases will be forced to bid themselves in order to gain introduction of the patented devices, then the introduction of patented devices will become a tedious process indeed.

"Mr. Whinery, however, argues that if the commission which the agent receives for promoting had been allotted instead to the other bidders by reducing the royalty by that amount, the city would have been benefited by correspondingly lower prices. As a matter of fact the city would never have heard of the patented improvement under those conditions. Mr. Whinery's suggestion recalls the hunter's excuse, 'We would have killed the rabbit if we hadn't missed him.' Furthermore, even if there were any unfairness in the patentee or his agent bidding, the taxpayer would have been the beneficiary by the amount of the advantage gained. And courts and legislatures will hesitate long before finding in favor of the contractor as against the taxpayer.

Extending Monopoly to Unpatented Materials

"On the other false assumption, that a patent can be extended to create a monopoly on unpatented materials, Mr. Whinery, of course, refers to the practice of offering for sale by the patentee, not only the right to

use but combined therewith some more tangible property as paving material. It is refreshing to find Mr. Whinery saying that 'an invention protected by patent is as much the private property of the patentee as his real estate or his chattels.' Mr. Whinery will hardly deny that it is entirely proper for the owner of a lot to sell it with the proviso that building materials shall be purchased from him. The only harm done is to the patentee himself in case he makes his conditions so onerous that it embarrasses the sale of his products.

"The purpose of the patentee in including materials with his royalty is often to avojd the prejudice of engineers who are willing to pay a higher price for a patented article but will not pay royalty alone for 'blue sky,' as they sometimes express it. Another reason is that the essential elements required for good construction and satisfactory service of the patented improvement can thus be assured by the patentee himself, the party usually most interested, and not left to the haphazard efforts of incompetent contractor or lax inspector.

"Mr. Whinery attempts to make of this feature an objectionable monopoly under which the patentee can supply inferior goods. As such it can accomplish no purpose. The patentee has the right to charge anything he may elect for his royalty. Suppose he charge a high rate and make a free gift of the paving pitch to the contractor, is anyone injured? The Supreme Court has ruled in the Dick case that the patentee has the same right that an owner of real estate has to name the terms under which his property may be used. If I choose to specify that the right to use my patents in a bridge, together with the reinforcing steel and the cement, will be furnished for a given sum, in order that no skinning in cement or steel may result, I fail to see how I have extended a monopoly. For the assumed excessive profits on the materials that must constitute the alleged monopoly could have been secured to me any way by specifying a higher royalty.

OBJECTIONABLE PRACTICES RARE

"All of this Mr. Whinery dismisses as objectionable by saying, 'The practices resorted to for this purpose are too well known to need description here.' I beg to differ. I have never heard of any such objectionable practices except the highly imaginary newspaper editorials following the Dick decision by the Supreme Court, and I doubt not that Mr. Whinery has drawn his inspiration from those sources rather than from actual abuses. If such is not the case, will not Mr. Whinery illustrate a few of the abuses by actual examples to facilitate discussion?

"Mr. Whinery argues that few patented devices are useful and that great conservatism should be shown before adopting them. But the patented device has at least one advantage in this respect over all competitors, for the law permits the issue of a patent only for useful improvements, and the issue of a patent is proof that at least the trained experts of the patent office hold it to be useful. As much could never have been said for some unpatented monopolies, as, for example, certain brands of asphalt pavements. The patent office never grants a patent for an alleged perpetual-motion machine but calls for a working model.

"If the above arguments are sound, Mr. Whinery's seven distinct advantages disappear. But if the article written by Mr. Whinery shall have resulted in a thorough discussion of these greatly misunderstood features of patent promotion, a great good will have been done the engineering and contracting professions, and I sincerely hope, therefore, that the whole subject may be given a thorough airing in your journal."

S. Whinery's Reply

Mr. Whinery's reply is as follows:

"The communication from Mr. Luten that you have kindly submitted to me for comment may be summarized as a plea for the more favorable treatment of the patentee and his inventions, a contention that the prejudice against patented articles and processes is wrong and without adequate foundation, and a criticism of my article in your issue of July 17, on the ground that, in common with engineers and public officials, I am prejudiced against patentees, and that my suggested plan for the State to pay definite royalties to patentees is impracticable and unfair to the patentee.

"Either Mr. Luten did not read my article with care, or I fail to understand some of his statements. I thought I made it clear that I am not only not prejudiced against or opposed to patents, but strongly advocate fair and just treatment of patentees and meritorious inventions. What I am opposed to, in common with officials, engineers and honest people generally, is the employment by patentees and their associates of questionable, underhand and crooked practices to hoodwink and defraud the public for the purpose of making illegitimate profits.

"As was made clear in my article, I confined my attention mostly to the use of patents in connection with pavement and road work. I cannot say with confidence from personal knowledge and experience to what extent my remarks apply to other fields of public work. There is undoubtedly a well-defined public belief, based upon much circumstantial and not a little direct evidence, that some pavement and road patents have been used by the patentees, or by contractors favored by them, to extort unreasonable and excessive profits over and above a fair and liberal royalty. Mr. Luten seems to question the existence of such practices except in rare cases, and challenges me to name specific cases. To do so here would be of doubtful propriety, even if the space necessary to state the facts in such fullness and detail as would satisfy a doubter were available. But if Mr. Luten wishes to pursue the matter further I will be glad to refer him personally to facts and court records that will justify all the statements made by me.

THE TWO FLAWS MR. LUTEN CITED

"Mr. Luten says he finds two serious flaws in the argument of my article, and that they are at the root of all the criticism directed at patents on public work. One of these is the assumption that a patent can be used to create a monopoly on unpatented articles. I did not say exactly this, but no matter. He refers to the Dick case, and I am willing to rest my statements on the evidence offered in that case and the argument presented by Chief Justice White in his dissenting opinion. Besides, as Mr. Luten knows, the position of the court on the questions involved has been greatly modified in a subsequent case.

"The other flaw found by Mr. Luten is stated thus: 'He also assumes that a patentee may not fairly compete with other bidders on his own patented device, even when the patent is thrown open to all bidders by naming a specified royalty.' If he will read the article more carefully he will find I said exactly the contrary. The question of a proper royalty having been agreed upon between the State and the patentee, the latter should be free, as stated in the article, to bid for the work upon exactly the same footing as other contractors. If he should think it wise to be satisfied with a smaller profit, and to underbid other contractors in order that he might insure the proper doing of the work and maintain the good reputation of his patented product, the public would certainly not object. The question of a fair and just royalty for the use of the patent is one thing; that of the cost of the work independent of the royalty would be quite another, determined by fair and open competition, except that the patentee would still have some advantage over other bidders if he were willing to encroach upon his royalty for a part of his reasonable profit on the work.

"Under such a fixed-royalty arrangement the patentee would not be estopped, as Mr. Luten asserts, from promoting the adoption and use of his patent by every legitimate means, such as advertising, agencies or personal efforts, but expenses thus incurred would be chargeable to the royalty account and might properly be considered and allowed for in fixing the royalty.

GROUND FOR PREJUDICE

"There must, of course, be some ground for the distrust and prejudice that exist against patents and patentees, particularly when it is found to be quite prevalent among so able, open-minded and disinterested a class as the professional engineers of the country. What personal or professional interest could they have in opposing meritorious inventions and improvements? The truth doubtless is that so many practically useless patents have been issued (Mr. Luten's ratiocination that all patents issued must be useful because the fundamental patent law stipulates that patents may be issued for useful inventions is, in the face of facts, amusing), and so many of those having merit have been exploited by questionable and crooked methods, that people have come to distrust patents generally, and to be suspicious of the motives and methods of patentees. The situation is most unfortunate for both the public and for the patentee who has something of value to offer and desires to introduce and promote it by legitimate and honest methods only. This class of patentees can best help to improve the situation by denouncing and fighting the other class, instead of by seeming to defend them by contending that abuses exist only in rare cases.

"The agreement by competent and responsible officials upon a fair and reasonable royalty, and its payment directly by the State, would clear the way for fair and reasonable competition in contract work involving patent rights, and would do more than any other one thing to improve the present conditions.

"It does not appear to me that Mr. Luten presents any valid or weighty arguments against this plan. It is clear that he does not think it would enlarge the present opportunities or profits of the patentee. That, however, is not the crux of the matter. The problem is to devise a method of dealing with patented articles and processes in connection with public work that will be

just and fair to the patentee, will protect the public from imposition, and will place the introduction and use of patented articles and processes upon a sound and equitable business basis. If this can be done meritorious inventions will come to be welcomed, and the present prejudice against patents and patentees will tend to disappear."

Paving Crown Best Distributed by Hyperbolic Curve

New Formula Has Been Developed in Kansas City Where Parabolic Sections for Streets Have Been Abandoned

By CLARK R. MANDIGO
Assistant City Engineer, Kansas City, Missouri

WHY the parabolic form of paving crown receives so much attention has always been a mystery to the writer. In spite of the fact that few engineers follow the true parabola in laying out crowns the parabolic crown continues to get columns of space in periodicals and pages in text books. Highway engineers have recognized the necessity for some sort of a curved cross-sectional surface for pavements, but have not been satisfied with the distribution of the cross fall when either the parabolic or circular form is used.

On high-crowned pavements the cross fall near the sides is too great and on flat-crowned roadways the fall near the center is too little. There are also obvious objections to plane sides or to two tangents connected by a circular arc, although both of these have been used for lack of something better. Many engineers have followed the practice of specifying the total crown and the amount of drop to the quarter point, with instructions to round the pavement between points so that it "looks good." With men of experience and inspectors whose eyes can be depended upon, such a distribution has worked out fairly well on narrow pavements, but on wide pavements and flat crowns on city streets, where close and careful design is necessary or templates have to be cut, such a method is not satisfactory.

R. S. Beard's Formula

In order to get a curved cross-sectional surface which would answer all requirements, Robert S. Beard, office engineer in the city engineer's office of Kansas City, Mo., has worked out the street crown formula given below. Taking the surface of the pavement at the center as the origin, the general equation for a street crown of any conic section is found to be

$$x^2 = \frac{cw^2y(m^2-4) - mw^2y^2(m-4)}{16c^2(m-1)}$$

where

x = the horizontal distance from the center,

y = the vertical distance below the top of the crown,

c = total crown of the street,

w = total width of the street between curbs,

c/m = the value of y at the quarter points.

When $m = 2$, $x^2 = w^2/4c^2y^2$, the equation of two straight lines; that is, when one-half of the crown is the drop given at the quarter points the crown becomes two planes intersecting at the center of the street. When $m = 4$, $x^2 = w^2/4cy$, the equation of the parabola. If one-quarter of the crown is the drop given at the quarter points the pavement takes the parabolic form.

When m has a value between 2 and 4, the crown curve is a hyperbola lying between the straight line and the parabola, and for values greater than 4 it is an ellipse.

For use on roadways with no car tracks Mr. Beard has worked out a hyperbolic section in which $m = 8/3$, that is, three-eighths of the total crown is the drop given at the quarter point. The general equation of this hyperbolic section is

$$x^2 = (w^2y/60c^2)(8y + 7c)$$

or

$$y = c/16(-7 + \sqrt{49 + 1920x^2/w^2})$$

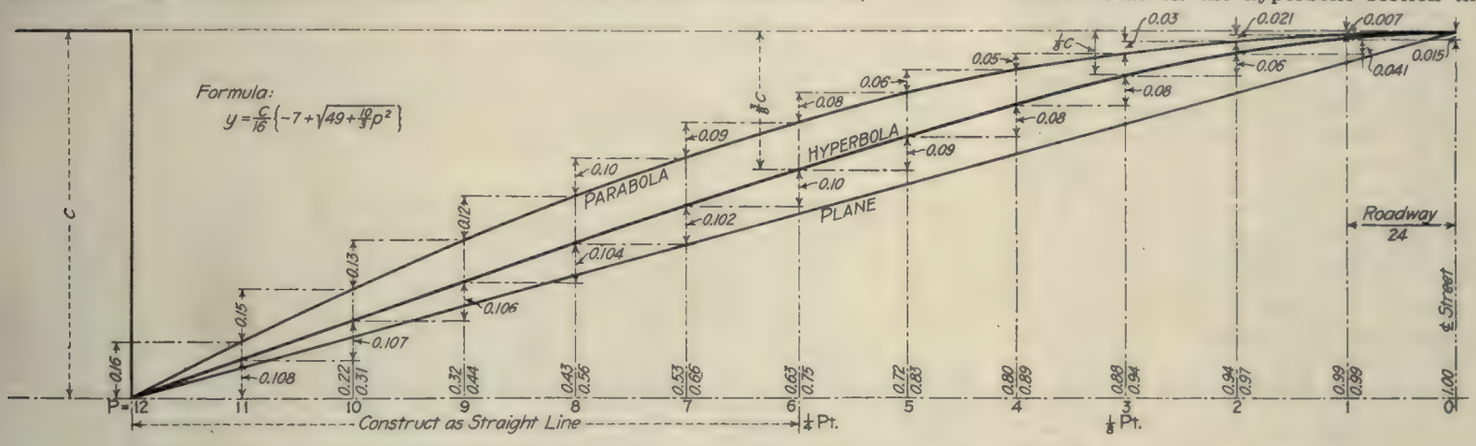
If x is expressed in units of 1/24 of the width of the pavement, w, and p is the number of these units from the center of the roadway, the last equation becomes

$$y = c/16(-7 + \sqrt{49 + 10p^2/3})$$

This equation is of special form for determining the total vertical drop at any twenty-fourth point of the roadway width.

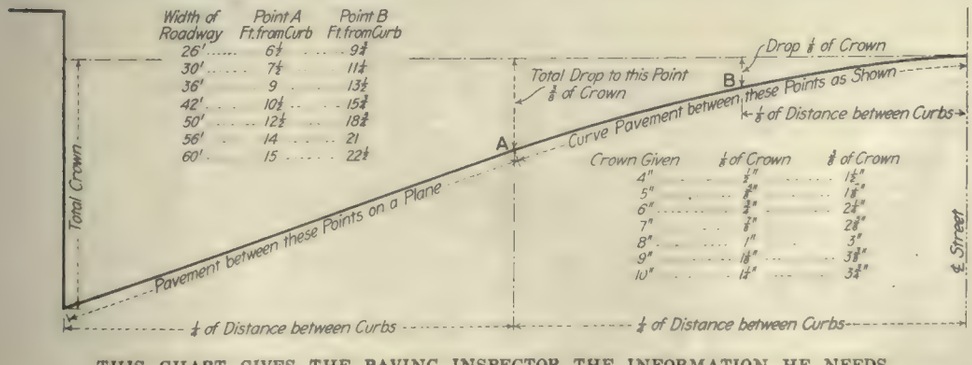
The Diagram Below

The diagram compares this curve with the parabolic form of cross-section. It gives the portion of the total crown rise in each one-twelfth unit of distance from the gutter to the center of the roadway by figures along each of the curves, and the total accumulated proportion of the total crown rise above the gutter for each curve by twelfths along the base line. It will be noticed that on the hyperbolic section the rise from the gutter to the point half-way to the center is almost exactly a straight line, the variation at the extreme ends being less than 1 per cent of the total crown. This portion of the pavement would, therefore, in practice be constructed as a straight line. From the quarter point to the eighth point the rise is almost exactly two-eighths of the crown, the remaining one-eighth rise being distributed in the center eighth section.



COMPARISON OF HYPERBOLIC SECTION ADOPTED AND PARABOLIC SECTION ABANDONED FOR KANSAS CITY STREETS

In actual construction of pavements less than 50 ft. wide the special hyperbolic section could be assured by the following rule: The total crown being given, let the surface of the pavement fall one-eighth of the crown in the first one-quarter of the distance from the center to the gutter, three-eighths of the total crown from the center to the point half way to the gutter, and from this point make a plane surface to the gutter. It will be seen that such a curve provides twice the fall that the parabola does from the center to the eighth point, and 50 per cent more fall from center to quarter point, and that the rise in the first quarter next to the gutter is one-eighth of the crown less than that called for by the parabola and is uniformly distributed. This proposed section, therefore, very materially modifies the chief criticism against the parabolic form.



THIS CHART GIVES THE PAVING INSPECTOR THE INFORMATION HE NEEDS

Parabolic Curve Abandoned

No attempt has been made for the past five years to follow the parabolic form of paving crown in Kansas City. The distribution of the crown has not followed any fixed curve, but has been whatever experi-

ence has shown gives the best riding and best drained pavement. With the gradual decrease in the amount of crown incident to greater care in construction and better riding qualities, and with the increased use of the template for the mortar cushion of block pavements, and for the testing of the finished surface of concrete and asphalt pavements, the necessity for a satisfactory rule for determining the distribution of the crown became increasingly apparent. It was found that the best proportioned crowns followed very closely the hyperbolic section, where m equaled 8/3.

The hyperbolic section shown on the diagram has, therefore, been adopted recently for the surface of all pavements not on car line streets with excellent results. On streets with car tracks, where the distance from the rail to the gutter is 12 ft. or less, the block pavements are laid as a plane surface with a uniform cross fall from track to curb varying from less than ¼ to nearly ⅜ in. to the foot, according to the kind of pavement used and the grade of the street. On asphalt streets where there is less than 22 ft. between the curb and car track, and on other pavements where the distance is between 12 and 22 ft., the plane is varied slightly by using 7/3 for the value of m in the formula, deducting, of course, the space occupied by the rails from the width between curbs for w. (It is difficult to roll properly sheet asphalt laid without some curve in the cross-section.) The formula gives then a drop of practically 1/6 of the crown at the eighth point and 3/7 at the quarter point. For greater widths of pavement on car line streets the regular ⅜ quarter-point formula should be used.

Flexibility of Hyperbolic Formula

These examples should be sufficient to show the flexibility of the hyperbolic formula. Although more complicated in appearance than the parabola, it is more simple in operation, as the quarter point drop is always assumed and on all except the widest streets it is only necessary to calculate the drop at the center eighth point since the quarter point next the curb is constructed as a straight line. A formula for the value of y at the eighth point in terms of m and c can be easily worked out if needed.

It should be remembered that the nearer the value assumed for m is to 2 the more nearly the cross-section becomes two planes, and the nearer m is to 4 the more nearly it approaches our old enemy, the parabola. The writer believes the special section in the diagram proposed by Mr. Beard will give the best results on city streets, m being 2 2/3. It is suggested that this cross-sectional pavement curve be tried in other cities and the results as to general appearance, drainage and riding qualities be reported.

A SAVING OF $3,296 ON SEWER WORK completed this year by the city of Victoria, B. C., is indicated in a report to the streets committee made recently by City Engineer C. H. Rust. The work included the construction of the outfall for the northwest sewer system at Macauley Point, for which bids were asked last fall. The lowest tender, $6,230, was considered excessive, and upon recommendation of the city engineer it was decided to build the outfall under the direction of the city's engineering department instead of by contract. This was done at a cost of $2,934.

Literature

For the Civil Engineer and Contractor

New Publications

YEAR BOOK OF NEW YORK SOCIETY OF ARCHITECTS, 1915. Limp leather; 6 x 9 in.; 241 pages, tables and diagrams. New York, United Engineering Society Building.

Contains building laws of all the boroughs of New York City, provisions from State laws, and rules and regulations of a number of State and municipal departments. Much of this information is of value to the builder as well as the architect. Building statistics covering several years in New York City and a chapter on the history of Greater New York are given.

LOOKING SQUARELY AT THE WATER POWER PROBLEM. By Henry J. Pierce. Cloth, 6 x 9 in.; 66 pages; illustrated; 7 appendices. Seattle, Wash., published by the author.

STRENGTH TESTS OF STRUCTURAL TIMBERS TREATED BY COMMERCIAL WOOD-PRESERVING PROCESSES. By H. S. Betts and J. A. Newlin, engineers, Forest Products Laboratory. Bulletin 286, U. S. Department of Agriculture. Paper; 6 x 9 in.; 15 pages, diagrams. Washington, D. C., Superintendent of Documents.

LOAD DISTRIBUTION TESTS OF REINFORCED-CONCRETE SLAB FLOORS UNDER CONCENTRATED LOADS. Bulletin 28, Ohio State Highway Department, Clinton Cowen, State Highway Commissioner. Paper, 6 x 9 in.; 97 pages; illustrated, tables and diagrams. Columbus, Ohio, State Highway Department.

ELEMENTS OF RAILROAD TRACK AND CONSTRUCTION. Second Edition. By Winter L. Wilson, professor of railroad engineering, Lehigh University. Cloth, 4¾ x 7½ in.; 396 pages; 210 figures. New York, John Wiley & Sons, Inc.; London, Chapman & Hall, Ltd. $2.50 net.

STATISTICS OF RAILWAYS OF THE UNITED STATES, 1904-1914. Bulletin 81 of the Bureau of Railway Economics. Paper, 6 x 9 in.; 67 pages; 76 tables. Washington, Bureau of Railway Economics.

This is the third annual edition of this report, the second, for 1903-1913, appearing last March. It is made up entirely of tables, on population and area; railway mileage; capital securities and dividends; revenues, expenses and taxes; employees and compensation; equipment; freight-traffic statistics; passenger-traffic statistics, and accidents.

THE TOXICITY TO FUNGI OF VARIOUS OILS AND SALTS, PARTICULARLY THOSE USED IN WOOD PRESERVATION. By C. J. Humphrey, assistant pathologist, and Ruth M. Fleming, scientific assistant, Office of Investigations in Forest Pathology. Bulletin 227, U. S. Department of Agriculture. Paper, 6 x 9 in.; 38 pages; 4 plates. Washington, Government Printing Office. 10 cents.

COTTON WAREHOUSE CONSTRUCTION. By Robert L. Nixon, assistant in cotton marketing. Bulletin 277, U. S. Department of Agriculture; contribution from Office of Markets and Rural Organization. Paper, 38 pages; 13 figures. Washington, Government Printing Office. 10 cents.

INVESTIGATION OF THE CONCRETE ROAD-MAKING PROPERTIES OF MINNESOTA STONE AND GRAVEL. By Charles F. Shoop, assistant professor of experimental engineering, University of Minnesota. Bulletin 2, University of Minnesota. Paper, 7 x 10 in.; 55 pages: illustrated.

An advance report on this Bulletin was published in the Engineering Record of March 27, 1915, page 390.

APPLICATION OF THE THEORY OF LEAST SQUARES TO THE ADJUSTMENT OF TRIANGULATION. By Oscar S. Adams, computer, U. S. Coast and Geodetic Survey. Special Publication 28, U. S. Coast and Geodetic Survey. Paper 6 x 9 in.; 220 pages; tables and diagrams. Washington, D. C., Government Printing Office.

THE TORONTO HYDROELECTRIC SYSTEM. Fourth Annual Report, 1914. Paper, 8 x 11 in.; 26 pages; illustrated. Toronto, Can., Toronto Electric Commissioners.

Books Reviewed

Steam-Boiler Economy

Second edition. Author, William Kent, Sc.D. Cloth, 5½ x 9 in.; 717 pages; 287 illustrations. New York, John Wiley & Sons, Inc. $4.50 net.

Since the first edition was published in 1901, such important changes have taken place in boiler design and operation that the author has made extensive changes to make the book conform to present practice. Among the changes and their results that are discussed are size of boilers and their better construction and increased rate of running, coal and ash-handling machinery, mechanical stokers, gas analysis, superheaters, draft and temperature-measuring apparatus, purchase of coal under specification, treatment of feed water, bonus and premium systems of paying wages. Chapters on boiler design and construction and on boiler attachments and boiler-room appliances have been added. That the book has really been revised is shown by the late heating values of coal quoted and by the new A. S. M. E. code for boiler construction and operation, as well as reference to forms of apparatus and methods of operation that have been developed since the first edition was published.

With its many changes this well-known book should find an increased field of usefulness among owners and managers of power plants as well as among operating engineers and students.

Practical Surveying

Author, Ernest McCullough, consulting engineer. Cloth, 5 x 7½ in.; 401 pages; 229 illustrations. New York, D. Van Nostrand Company. $2 net.

Reviewed by A. F. Comstock

Associate in Railway Engineering University of Illinois, Urbana, Ill.

It is not often, as in this case, that a successful practising engineer of 30 years' experience finds time to write a book dedicated to the education of mere beginners. Most of the numerous texts on surveying assume the student to possess a working knowledge of geometry, algebra, and trigonometry; but the author has elected the part of writing for self-tutored students whose mathematical preparation includes only arithmetic. That there is a real need for a book of this kind seems manifest to one who has attempted to teach students having such limited preparation. That a man of the author's attainments has written such a book with evident care should insure for it a cordial reception.

To picture clearly in words to the untutored mind the essentials of a technical subject is indeed difficult. This the author has done skillfully, both as regards development of the subject and style of writing. Eight chapters constitute the main text divisions and are as follows: Introductory, chain surveying, leveling, compass surveying, trigonometry, transit surveying, surveying law and practice, and engineering surveying. An appendix on "The Essentials of Algebra" concludes the book. Naturally the subject matter has been restricted to plane surveying, and the aim has been also to emphasize land surveying methods. Instruction in elementary mathematics is given as necessity for it arises.

A pleasing effect is produced in the book through a combination of clearness in exposition and description, a practical logic, a conviction born of long experience, and a historical touch running through the description of various methods and instruments of surveying. Throughout there is a fine understanding of the beginner's needs, in serving which adequately the author has produced a book that should interest also surveyors of more mature years.

HINTS FOR THE CONTRACTOR

Details Which Save Time and Labor on Construction Work

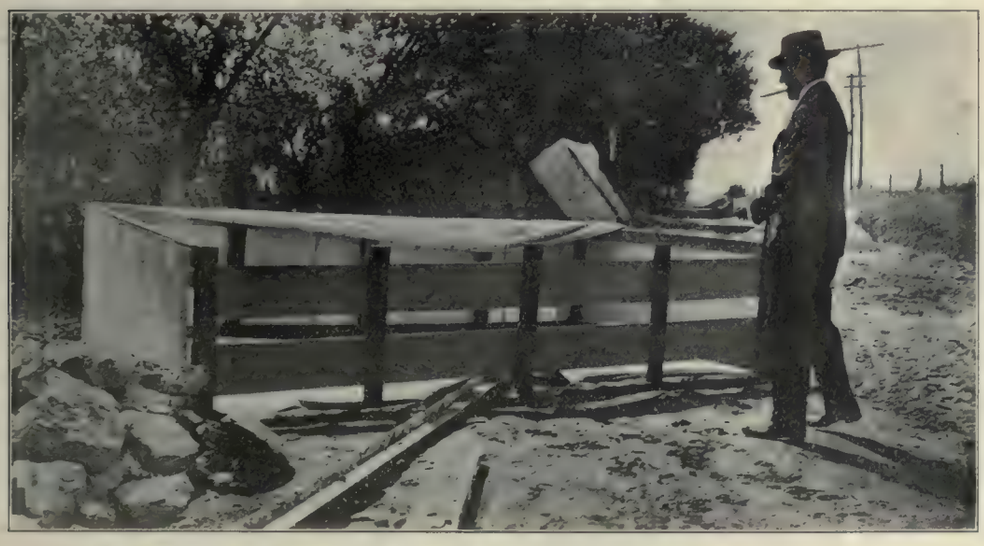
Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

[*Contributions to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

Portable Unit Sheds Solve Cement Storage Problem on Road Work

EIGHTEEN-OUNCE canvas stretched tight and tacked with roofing nails over a frame of 2 x 4-in. studs and 1-in. plank makes a waterproof portable cement house which has solved the cement storage problem and eliminated rehandling on concrete roadwork. The front of the house is made by a full-sized flap of canvas, secured by cords around the edge tied to nails in the frame when the house is full.

Twenty or thirty of these sheds have been built. They are distributed at measured distances along the road ahead of the mixers and are filled with 90 bags of cement each. As the cement is used, the sheds are thrown on a cart or on a couple of wheelbarrows and moved ahead.



IN THESE SHEDS CEMENT IS STORED ALONG ROAD AHEAD OF CONCRETE CREW

Instead of using 2 x 4-in. pieces underneath, 4 x 4's should be used to raise the cement higher, if the houses have to be set on wet ground, or to make the floor stronger if the sheds are to be set over a ditch. Some green laborers did this with one of the sheds shown and the floor broke when the shed was filled with cement and several sacks were spoiled. This is the largest loss of cement that has occurred through the use of these sheds, though there have been several heavy rains.

Electric Dragline Makes Record on Reclamation Project

DIRT WAS moved at the rate of two ¼-yd. buckets per minute straight time from noon on Aug. 14 to the end of the month on the drainage excavation for the Boise irrigation project, according to J. L. Burkholder, assistant engineer in the October *Reclamation Record.* For approximately three-fourths of the length of the ditch excavated the hard material had to be blasted, 600 lb. of dynamite being used during the above period. Counting the time actually spent in digging the rate was 3 yd. per minute.

In the 49¼ shifts 58,590 cu. yd. were excavated from a ditch 7910 ft. long. The highest run per shift was 1583 cu. yd. Machine efficiency was as follows: Digging, 77.2 per cent of the total time, 424 hours; mechanical repairs, 13.8 per cent; electrical repairs, 5.8 per cent; moving, 3 per cent; blasting, 0.2 per cent.

Pavements Grouted at One Application Without Separation of Sand

By D. MOOMAW

Road Engineer, Cuyahoga County, Cleveland, Ohio

BY MIXING fairly coarse sand and cement in equal parts with twice the volume of water required to make a mixture of normal consistency, spreading the grout with shovels and pushing it along the pavement with brooms till it fills the joints ahead of the broom, segregation of the sand has been practically eliminated and a perfect filling of the joints secured in building a granite block pavement on the new Brooklyn-Brighton viaduct in Cuyahoga County, Ohio. This method was devised and used under the direction of the county's engineers, and, according to the contractor who put it in practice, proved quicker than the usual way of applying the grout rapidly in three coats.

The sand used for grouting was required to be of such size as would pass an 8-mesh screen and not more than 40 per cent pass a 60-mesh screen. Sand and cement were used in equal parts and the water was specified as double the amount necessary to bring the mixture to normal consistency. The sand and cement were mixed dry in the mixing box until a uniform color was obtained. One-half the required amount of water was then added and thoroughly mixed to form a thick mortar, the remainder of the water being then added. The mixture was constantly agitated until the entire batch was removed to the pavement with scoop shovels.

By the use of water in the quantity specified, the amount of water is determined in the laboratory and a more uniform character of grout is obtained. In this particular case determinations were made in our own laboratory on cement and sand after delivery for use. Three determinations were made, one with the sand perfectly dry, one with the sand somewhat damp, and one with the sand quite wet, so that a modification could be made to suit the condition of the sand. Grout mixed in this manner and allowed to set showed by careful analysis a difference in sand content between top and bottom of a 4-in. depth of only 0.9 per cent. From this it is apparent that the viscosity of the mixture is sufficiently high to sustain the sand until setting takes place. Actual experience has shown that it is sufficiently liquid to flow freely into place.

Filling was accomplished in a single application, and the joints were kept full for a period of 45 min. to take care of any settlement, after which time the surface was finished with brooms and left to set. In applying the grout to the pavement with shovels, it was deposited on the last few courses already filled and broomed slowly forward to allow it to run into the joints rather than be swept over them. The joints were not swept over until they had been filled from the bottom up. By this method, few of the joints became air-bound and those few were opened with a small pinch bar and allowed to fill. The pavement was laid on a cement-sand cushion, and it was found that after a period of 45 min. no settlement of the filler was observed.

The advantages claimed for this method are the elimination of the trouble arising from the segregation of the sand and cement, the complete filling of the voids between the paving blocks and a more complete bond between block and filler. This method of application allows the filler to displace the air from the pavement, forming no air pockets, and covering all bonding surfaces complete with no interval for drying out. It absolutely prevents the occurrence of such a condition as the writer recently observed in building a Medina block pavement where the job was stopped for the night after one application of grout had been made. It assures the fullest efficiency of the filler, as no partial filler or intermittent coating of the bonding surface can occur.

Specifications for grouting brick and stone pavements have remained practically unchanged for years. Many engineers having expressed their dissatisfaction with the present methods, and then proceeded to specify them unchanged for their new work If we specify that the grout shall be mixe to a consistency of thin cream, we should b consistent and specify that the coarse aggregate for concrete should be the size of green apples. If we require that sand shall not separate from the ceme should not specify a method that will ct. such separation. If we demand that t grout filler shall rigidly bond the brick o

stone together, we should not leave its accomplishment entirely to the judgment of an inspector. It is as a remedy for some of the shortcomings of the present practice that the writer wishes to submit for the criticism of others the methods outlined above.

Long Reach Given Mixer Boat by Trussed Boom Supporting Chutes

By C. R. ANDREW
Junior Engineer, U. S. Engineer Office, Ohio River Dam No. 16

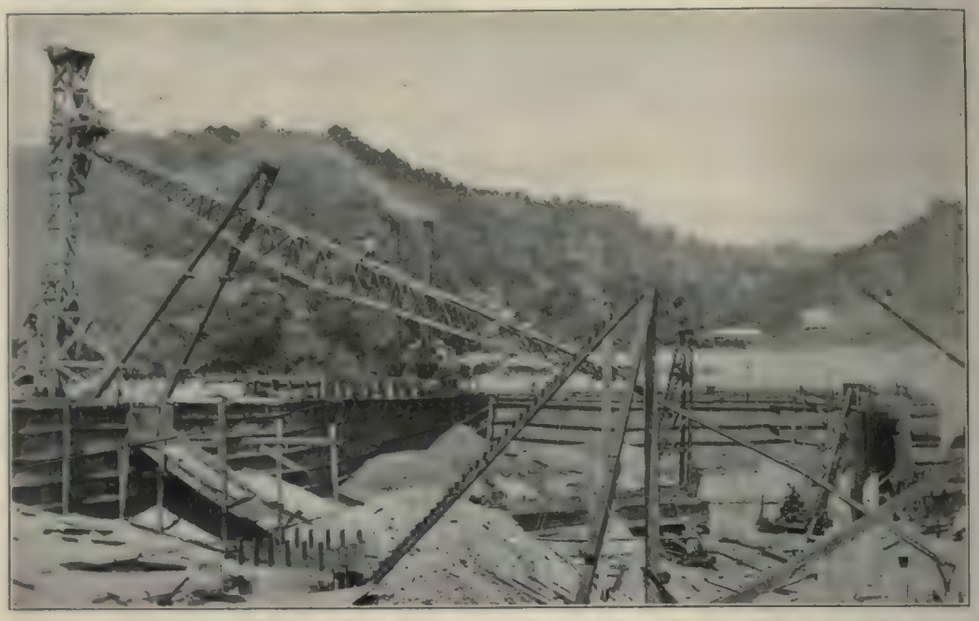
THE MIXER boat shown in the accompanying photographs was used to great advantage in constructing lock and dam No. 16 on the Ohio River near Bens Run, W. Va. The essential new features of the boat, as may be seen from the illustrations, are the 80-ft. wooden A-frame and the 156-ft. steel boom to support the chutes, which arrangement allowed the boat to be set in place ready to concrete with little rigging and in a short time. The boat carried a mixer, receiving bins and a 96-ft. wooden tower. Sand and gravel were placed in the receiving bins by a derrick boat. From the bins the aggregate ran by gravity into measuring hoppers and thence into the 1-yd. mixer placed at the base of the tower. The mixed concrete was hoisted to the top of the tower by a mine hoist using a single line, dumped into a receiving hopper and spouted into the forms.

The departure from common practice in using the A-frame and steel-boom arrangement for supporting the chutes greatly facilitated moving from one form to another. During the early part of the season the mixer boat was used without the boom, the chutes being supported from a cable running over the top of the tower and attached to a deadman on the bank or on the cofferdam. To move and hang chutes in this way costs about $50.00 per move and required from three to four hours time. After installing the boom, moves were made in from 45 min. to 2 hr., depending upon the amount of chute required to reach the form from the end of the boom, and the cost of the moves was cut in even greater proportion.

Another advantage of the boom over the cable is that the concrete will flow on a much flatter slope. Using the cable it was found that the chutes must be hung on a slope of not less than 3 on 1, and even this slope often gave trouble on account of clogging and overflowing. Using the boom it was found that the concrete would flow freely with a 1 on 4 slope, and if necessary even on a less slope. It is believed that this is due to the rigid support given the chutes by the boom. During the period from Sept. 16 to Oct. 15 this boat placed 14,660 batches of concrete, no work being done on Sundays or holidays.

The contract for lock and dam No. 16 was signed on Aug. 6, 1913, with a specified time limit of four years. At present practically all the permanent work is complete and there only remains cleaning up and removal of cofferdam and plant. The total amount of the contract is about $970,000.

This work is being done by the T. A. Gillespie Company of New York and Pittsburgh, under the direction of the Corps of Engineers, U. S. A., Major T. H. Jackson, district officer. N. J. Beisel is superintendent for the contractor, and the writer is assistant in charge for the Government. The mixer boat was designed by H. B. Mish, engineer for the contractor, under the direction of T. S. Shepperd, vice-president, and was built by the contractor's forces at the site.



TRUSSED BOOM CUT IN TWO TIME REQUIRED FOR RIGGING CHUTES AT EACH MOVE



GUYS AND BRACES OF 96-FT. TOWER ALLOW FREE OPERATION OF DERRICK BOAT

Acid Water Decomposes Dynamite Charges with Serious Results

THE MOST serious blasting accident in building the Panama Canal, which killed twenty-three men and injured forty others near Bas Obispo, was finally traced to decomposition by acid water of the 22 tons of 45-per cent dynamite loaded in the 52 holes which exploded prematurely, according to a statement by Maj.-Gen. George W. Goethals, in a paper presented last month to the International Engineering Congress.

The charges had been tamped and the fuses set in all. The last hole was being loaded at the time of the accident. The entire charge was to be set off by electric current from the Empire power plant after 5 o'clock on the day of the accident. The wires were not strung and the fuses of no two of the holes were joined. Furthermore the dynamos at Empire were not in service at the time the explosion occurred. It was a clear day and there was no lightning to which the explosion could be ascribed. It developed later, when the water in the bottom of the holes was examined chemically, that the water was acid and that it would attack the cartridges, liberating the nitroglycerin. It was known that a "dobe" blast had been fired just across the cut from where the explosion occurred, and it was assumed that the accident was due to the detonation of a quantity of free nitroglycerin by the jar of the "dobe" blast. Further investigation showed that the action due to the acidity of the water required approximately 24 hours for the release of the nitroglycerin, and the holes had been loading for several days. As a consequence, no loading operations were undertaken thereafter in any area that could not be completed and fired on the same day.

MUD REMOVED FROM ST. LOUIS WATER in 1915 amounted to 358,000 tons. To accomplish it required 13,660 tons of lime and 6770 tons of sulphate of iron. The sterilization process utilized 28 tons of liquid chlorine.

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

Preparations for Hetch Hetchy Work Being Rushed to Completion

Before the snows of the coming winter render difficult work in the Hetch Hetchy Valley, the contract for clearing timber and brush from the 808-acre reservoir area, which is to be used for storing the new San Francisco water supply, will be nearing completion.

The city engineer's force is working overtime in the preparation of specifications for 67 miles of railroad between Rosasco and the dam site. Every effort is to be made to rush the completion of this line, which is expected to afford a great saving in transportation costs. Delivery of material at the dam site by teams and motors is now costing $24 per ton, which is to be reduced, it is expected, to $9 per ton when the railroad is in operation. On the 300,000 tons of freight to be transported this will be a saving of $4,500,000. The estimated cost of the road will be about $1,700,000.

A diversion tunnel 500 ft. long and 20 ft. in diameter has been started through which the Tuolumne River will be carried past the site of the main concrete dam. This tunnel is now one-tenth completed and will make it possible to unwater the dam foundations which are now submerged to a depth of 20 ft. The tunnel is being driven from two headings, each of which is being advanced at the rate of 2½ ft. per day. It is expected that this tunnel will be completed by the end of 1915 and that the diversion dam under simultaneous construction will be completed about March 1, 1916.

Four miles from the site of the Hetch Hetchy dam a sawmill has been erected, which is now turning out lumber at the rate of about 18,000 ft. b.m. per day at a cost of $8 per thousand.

Longest Stretch of Concrete Road in Illinois Dedicated

The new State-aid concrete pavement on Milwaukee Avenue, Cook County, Illinois, declared by one of the speakers to be the longest stretch of concrete road in the State, was formally dedicated Oct. 16.

Milwaukee Avenue is one of the most important thoroughfares in Illinois. It is the artery of a large system of county roads and an outlet from the extensive truck gardening district tributary to Chicago. When several of the contemplated pavements from Evanston, Wilmette and other North Shore suburbs of Chicago are completed, and when the concrete section on Milwaukee Avenue has been extended to the county line, as is now planned, there will be a direct good roads route from Chicago and the North Shore suburbs to the attractive lake region of Northern Illinois and Southern Wisconsin.

Sixth Concrete Crib for Victoria Harbor Under Construction

The sixth concrete crib used in the construction of the piers in the Victoria harbor improvement scheme is now under construction and will be launched from the marine ways in the near future. Since the first two cribs were constructed on a floating drydock marine ways were built to accommodate four cribs simultaneously and three have been successfully launched by the new method.

Since the commencement of the work the following items have been completed: Earth excavation, 31,940 cu. yd.; rock excavation, 20,183 cu. yd.; rubble foundation, 365,699 tons.



FIRST FINISHED TOWER OF NEW TECHNOLOGY BUILDINGS IN CAMBRIDGE

Coroner's Jury Would Keep Traffic Away from Subway Blasts

The coroner's jury investigating the subway accident which occurred on Seventh Avenue, in New York City, on Sept. 22, returned a verdict on Oct. 26 in which it was recommended "that at the time of blasting in the subways of greater New York no traffic of any kind be allowed over any part of the temporary structure."

The verdict concludes that the deaths which occurred were "due primarily to an excessive blast at the northeast heading of the excavation. That while due care was not exercised in estimating the amount of explosive to be used in this particular blast, the evidence submitted does not show criminal negligence." It was further recommended that "the Public Service Commission shall designate the maximum to which temporary work shall precede the permanent structure. The jury, in deploring this accident, expresses the hope that it will serve to impress on all contractors and the Public Service Commission the necessity for the utmost caution and care, both in operation and inspection of all subway work."

The jury also censured the Bureau of Combustibles of the Fire Department, which has control of all blasting operations, for not carrying out through its inspectors the powers assigned to it by the code of ordinances. The jury failed to state in its findings just what ordinances the Bureau of Combustibles was blamed for not carrying out. From the testimony at the inquest, however, J. O. Hammitt, head of the Fire Prevention Bureau, is reported to have considered that the jury referred to the use of blasting mats made of timber and rope to cover the blast and prevent fragments of rock from flying. Mr. Hammitt is further quoted in the press as saying that such a covering of the blast would have introduced a very serious hazard by providing missiles in the form of logs used in the covering, which would have been a great danger to the timbering. He is also quoted as saying that there was no evidence of any of the holes having been overloaded and that whether there were too many holes, whether they were improperly located or whether there was too heavy a charge in any one of them were matters over which the fire department had no control. The verdict cleared the contractors and the Public Service Commission of the charge of criminal negligence.



MAIN BUILDINGS FOR NEW TECHNOLOGY WILL SOON BE READY FOR OCCUPANCY BY ENGINEERING STUDENTS

Dr. Corthell Nominated for Presidency of Am. Soc. C. E.

Dr. Elmer L. Corthell, consulting engineer of New York City, has been nominated for the presidency of the American Society of Civil Engineers. The other candidates for offices to be filled at the annual meeting to be held Jan. 19, 1916, are: For vice-presidents, Palmer C. Ricketts, of Troy, N. Y., and Alfred Craven, of New York; for treasurer, Lincoln Bush, of New York; for directors, Virgil G. Bogue and Alexander C. Humphreys, both of New York, district 1; Otis F. Clapp, of Providence, R. I., district 2; Richard Khuen, of Pittsburgh, district 4; F. G. Jonah, of St. Louis, district 5; Edwin Duryea, Jr., of San Francisco, district 7.

Illinois Waterworks Officials Meet in Chicago

Seventy-five waterworks officials, engineers, superintendents and their friends met in Chicago, Oct. 19, at the annual fall meeting of the Illinois section of the American Waterworks Association. John Ericson and his assistants piloted the visitors over the route of the new Wilson Avenue tunnel, the municipal pier, which is nearing completion, and the municipal shops. He talked about the tunnel and the new type of intake in the evening (see Engineering Record, Jan. 16 and 23, pages 73 and 103). S. A. Greeley also delivered an illustrated paper on "Water Softening for Municipalities."

An invitation from the American Association of Engineers to name a committee to cooperate with the new association was accepted, after it was explained that the Jovians, an order represented by 26,000 electrical men, had also named such a committee.

Start Work on $2,000,000 Power Project in Wisconsin

Work was started by the Wisconsin-Minnesota Light & Power Company, Oct. 20, on the construction of the power dam on the Chippewa River, two miles east of Chippewa Falls, Wis., at what is known as the Paint Creek site. The dam, which will be over three-fourths of a mile long and sixty feet high will generate about 50,000 hp. The entire work, including the cost of the flowage rights, the closing of several highways and bridge erection, will bring the construction cost to about $2,000,000 and, it is expected, will take about two years to complete.

Rock Island Proposes to Lease Track to Gas-Electric Line

Negotiations are now in progress between the recently organized Muscatine-Iowa City Railway Company, Muscatine, Iowa, and the Chicago, Rock Island & Pacific Railway, whereby the latter railway will lease to the former its Montezuma branch, a line approximately 100 miles long, running through twenty-two Iowa towns. The new company proposes to operate gas-electric cars for both passenger and freight traffic over the Montezuma branch. It is expected that details of the agreement will be settled shortly, and that by Jan. 1, 1916, the line will be taken over by the new corporation.

Consents Obtained for Queensboro Tunnel, New York City

The necessary number of consents of property owners has been obtained to legalize Route [illegible] the so-called Sixtieth Street-East River [illegible] of the New York dual transit system. [illegible] embraces the tunnel under East River [illegible] ch it has been decided to build instead of [illegible] ng the Queensboro Bridge, as first proposed [illegible] Public Service Commission. The line is decid[illegible] a two-track underground railroad, beti[illegible]g at Fifty-ninth Street, west of Fifth in[illegible]ue. It will curve diagonally under Cen[illegible] Park and Fifth Avenue into Sixtieth Street, and run along Sixtieth Street to and under the East River to North Jane Street, Long Island City, where it will emerge from the ground and connect with the new elevated lines in Queens Borough.

Yale Professor Who Died Last Week Was Noted Structural Authority

Augustus Jay DuBois, whose death on Oct. 19 was noted in this journal last week, was the author of some of the best known treatises on mechanics and stresses in the English language. His "Strains in Framed Structures," first published in 1883, has long been a standard engineering work, and is now in its eleventh edition. His book on "Graphic Statics," published in 1876, was largely instrumental in introducing to American engineers the graphic method now so widely used for determining stresses in framed structures. He translated and edited several important German works on mechanics, including Weisbach's "Mechanics of Engineering." A series of books on mechanics culminated in his "Mechanics of Engineering," published in 1901. In addition, Professor DuBois contributed numerous articles to technical journals and many essays to current periodicals.

Noted Authority on Structural Design Who Recently Died at New Haven



AUGUSTUS JAY DUBOIS

Professor DuBois was born April 25, 1849, was graduated from the Sheffield Scientific School in 1869, was awarded the degree of Civil Engineer in 1870 and received the degree of Doctor of Philosophy in 1873. Later he studied mechanics for two years at the Mining Academy in Freiburg, Saxony. From 1875 to 1877 he was professor of civil engineering and mechanical engineering at Lehigh University. In 1877 he was appointed professor of mechanical engineering in the Sheffield Scientific School, from which chair he was transferred to that of civil engineering in 1884. He remained in the school both as a member of its faculty and as a member of its governing board until his death. He was also for many years one of the representatives of the Scientific School on the University Council. In 1883 Professor DuBois was married to Adeline Blakeslee of New Haven, who survives him.

Professor DuBois' direct influence on the profession of civil engineering is well known. His indirect influence, through the large number of engineers who received personal instruction from him during his thirty-eight years at the university, is probably much greater.

Good Roads Campaign Being Organized in the Argentine

Realizing the importance of a system of good roads for bringing products to the railways, a strong effort is being made in the Argentine Republic to organize a good roads compaign. According to *The Americas*, published by the City National Bank of New York, the National Congress now has before it a project of law for the reorganization of the Federal bureau of good roads into a Federal commission on bridges and roads, which shall take up the whole subject comprehensively, employ engineers and make surveys, prepare a plan for interior communications with existing and projected railways, unify the efforts of minor governing bodies and hold conferences of officials, publicists and organizations interested in good roads to discuss roadway problems.

Ask Bids for Jersey City Pipe Line

Jersey City has advertised for bids on the eleven-mile 72-in. pipe line that has been under discussion for several years. The work will include a single line of steel pipe of the diameter already stated and a double line of 48-in. cast-iron pipe under the Passaic River.

New Mannheimer Building in St. Paul to Be Abandoned

The steel skeleton of the Mannheimer Building in St. Paul, Minn., is to be dismantled and removed. Owing to financial reasons the project for a large seven-story department store on this site is to be abandoned, although the steel frame had been completely erected about a year ago. Special features of this building and the design were described in the Engineering Record of Aug. 7, page 159, and of Sept. 25, page 392.

Illinois Utility Commission Suggests Chicago Dig Subways

The Chicago Surface Lines were ordered on Sept. 30 by the State Public Utility Commission to better their service within 60 days. Rerouting to increase track capacity and the use of trailers were the main points. In an opinion accompanying the formal order was the recommendation that subways be constructed, that the surface and elevated lines be consolidated, that the city prohibit the use of car tracks by vehicles during rush hours, and that additional bridges over and tunnels under the river be built.

Illinois Highway Department Makes Offer of Shop Inspection

The Illinois Highway Department in a circular letter addressed to all fabricators of structural steel offers to make shop inspection of all steel bridges the plans for which are prepared by the department, as covered by Section 348 of the General Specifications for Bridge Work in the edition of July, 1915. William W. Marr is chief State highway engineer. A notification of two or three days before the structural material is ready for inspection, to be sent to the department, is requested.

Massachusetts Reservoir Finished Six Months Ahead of Time

The Ashby reservoir for the city of Fitchburg, Mass., is now practically completed, six months in advance of the time specified in the contract. Work was started April 15 of this year, since when two dams, 1200 ft. long, each consisting of concrete core walls, spillway and rolled earth embankment, with other work incidental to flooding a reservoir basin of 700,000,000 gal. capacity, have been finished. Ernest E. Lothrop is city engineer of Fitchburg, and Metcalf & Eddy of Boston are consulting engineers for the work. The reservoir was built by the E. W. Foley Contracting Corporation of New York City.

News of Engineering Societies

The Public Utilities Association of West Virginia will hold a convention at White Sulphur Springs, W. Va., Nov. 18 and 19. This association is composed of electric railways, electric light and power companies, and water and telephone companies. W. C. Davisson of Charleston, W. Va., is secretary.

The Western Society of Engineers will hold a meeting Nov. 2, at which time L. E. Johnson, president of the Norfolk & Western Railway, will speak on "The Relations Between the Railroads and the Public." The discussion will embrace the railway situation, with especial reference to regulation as it is and as it ought to be.

Personal Notes

NICHOLAS S. HILL, JR., consulting engineer of New York City, has been awarded the 1914 prize of the Municipal Engineers of the City of New York for his paper, "Valuation of Public Utilities."

ALFRED D. FLINN, deputy chief engineer of the Board of Water Supply, has been delegated to represent the Municipal Engineers of the City of New York at the Pan-American Scientific Congress to be held in Washington, D. C., Dec. 27 to Jan. 8.

DON L. TEAL, formerly assistant county engineer of Jefferson County, Iowa, has been appointed county engineer of Lucas County, Iowa, succeeding Leo Hollingshead, resigned.

EDWARD H. SARGENT, formerly assistant civil engineer on the forces of the New York State Conservation Commission, has been appointed assistant engineer of water power, storage and drainage, by George D. Pratt, State conservation commissioner, at an annual salary of $3,000. Mr. Sargent was selected from the Civil Service list resulting from a recent examination for the position, his name being second on the list. He was graduated from the Massachusetts Institute of Technology in 1907, and, for six months thereafter, served as rodman for the Board of Water Supply of New York City on surveys, designs and estimates of structures on the Catskill Aqueduct. He was appointed instrumentman and draftsman on the forces of the State water supply commission in 1907 and attained the grade of assistant civil engineer in 1910. In connection with this work he made rainfall and stream flow studies and preliminary designs and estimates for water power and water supply projects. When the water supply commission was consolidated with the State Conservation Commission he retained his position and continued in it up to the present appointment.

RAY E. KOON of the firm of J. B. & R. E. Koon, civil, hydraulic and sanitary engineers, of Portland, Ore., will have charge of the surveys for the Sultan River water supply for the city of Everett, Wash., representing Burns & McDonnell, consulting engineers, of Kansas City. The citizens of Everett recently voted a bond issue of $600,000 for the Sultan River work.

E. SHELAH, formerly engineer maintenance-of-way of the Decatur division of the Wabash Railroad, has been appointed engineer maintenance-of-way of the Springfield division, with headquarters at Springfield, Ill.

G. P. MACLAREN has been appointed division engineer of the Toronto district of the Canadian Northern Railway, with headquarters at Rosedale, Toronto, Ontario.

ROBIN A. BOWMAN, formerly engineer and contractor for the Maceio Electric Tramways, Maceio, Brazil, has been appointed engineer in charge of maintenance and construction on railroad work for Bartram Brothers at San Pedro de Macoris, Republic of Santo Domingo.

F. C. FRENCH, formerly designing engineer for the Anaconda Copper Mining Company, whose return to Salt Lake City, where he intended to open offices for the purpose of resuming consulting practice, was noted in these columns, Oct. 9, has been engaged as construction engineer on the remodeling and enlargement of the plant of the Beatson Copper Company at Latouche, Alaska.

A. J. GAYFER has been appointed division engineer of the Lake Superior district of the Canadian Northern Railway, with office at Capreol, Ontario.

WILLIAM C. HATTAN, formerly division engineer on the Carolina, Clinchfield & Ohio Railroad, at Dante, Va., is now engaged in preparing plans for a water system and street improvements for the town of Kingsport, Tenn. Mr. Hattan was graduated from Washington & Lee University in 1899 and entered railway service as rodman on the West Virginia Shore Line Railroad in July of that year. He left the road in 1901 and served for a few months as masonry inspector on the Western New York & Pennsylvania and, later, as chief of party for James H. Nichols, civil and mining engineer, of Sharon, Pa. In 1902 he was appointed resident engineer on the Ozark & Cherokee Central, in charge of work in the Indian Territory. From 1903 to 1904, he was assistant engineer for Vandevanter & Hood, civil engineers, of Baltimore, in charge of the location and construction of the Baltimore and Belair Electric Railway. In 1904 he was appointed resident engineer of the Cumberland extension of the Western Maryland at Hancock, Md. He left that work in 1905 to accept a similar appointment on the Potomac Valley. Later he was resident engineer on the South & Western. He was appointed division engineer on the Carolina, Clinchfield & Ohio, in which capacity he had charge of the construction of that company's Elkhorn extension, in 1913.

J. D. EVANS, formerly division engineer for the Canadian Northern Railway at Trenton, Ontario, has been appointed supervisor of bridges and buildings.

W. V. CRUSE, formerly resident engineer on the forces of the Illinois State Highway Department, has joined the staff of Edwards & Chamberlain, consulting engineers, of Eldora, Iowa.

MARSHALL K. WHITE has resigned from the engineering department of the Spring Valley Water Company, San Francisco, to become assistant city engineer of Jackson, Tenn.

J. V. SNYDER has been appointed engineer of location and construction on 10 miles of railway extension for the Meadow River Lumber Company at Rainelle, W. Va.

CHESTER B. LEWIS, superintendent for Albert Kahn, architect, of Detroit, has changed his address from Ann Arbor, Mich., where he was in charge of the construction of the Science Building for the University of Michigan, to St. Louis, where he will have charge of the construction of an addition to the assembling plant and service station of the Ford Motor Company.

PERCIVAL H. EVERETT has resigned from the office of chief engineer for the Kern County (Cal.) Highway Commission. He was appointed to the office in 1913, after having served for two years as assistant chief engineer of the Los Angeles County Highway Commission.

J. H. SHEDD, consulting engineer, of Providence, R. I., has been appointed consulting engineer for the water department of East Hartford, Conn., to act with C. H. Olmsted, city engineer, in the matter of increasing that city's water supply.

THOMAS L. HINES, JR., has resigned from the engineering forces of the Baltimore paving commission to accept an appointment as efficiency engineer for E. I. du Pont de Nemours & Company, manufacturer of explosives, of Wilmington, Del.

W. G. KIEKHOFFER has been appointed consulting engineer for the department of the State engineer of Wisconsin.

EDMUND PENNINGTON was re-elected president of the Wisconsin Central Railway at a meeting of the board of directors, held at Minneapolis, Oct. 18.

WILLIAM F. PERKINS has resigned from the engineering forces of the Paving Commission of Baltimore to accept a position with the Bartlett-Hayward Company, engineers, of New York City.

L. M. ROTH has resigned as engineering salesman for the Illinois Steel Company and the Carnegie Steel Company at St. Paul to open offices in the Security Bank Building, Minneapolis, for the purpose of engaging in business as dealer and broker in engineering specialties. Mr. Roth is a graduate of the University of Minnesota in civil engineering.

C. W. FINDLEY has been appointed levee district engineer of Ellis County Levee District No. 2 by Capt. A. A. Stiles, State reclamation engineer of Texas.

FREDERIC W. DARLINGTON has become associated with J. B. Berry, S. S. Roberts and A. G. Shaver for the purpose of engaging in practice as consulting engineer, with offices in the Transportation Building, Chicago, Ill., and in Los Angeles, Cal.

G. M. HARBERT has been appointed county road engineer of Harrison County, W. Va., with headquarters at Clarksburg.

R. R. MARSDEN has severed his connection with H. S. Ferguson, consulting engineer of New York City, by whom he has been employed for the past five years, to join the engineering department of the Laurentide Company, Ltd., at Grand Mère, Province of Quebec, Canada.

Obituary Notes

H. M. MCCARTNEY, who was identified with early construction on the Union Pacific Railroad and the San Pedro, Los Angeles & Salt Lake Railroad, and later became assistant engineer of the Western Pacific Railroad at San Francisco, died recently in Los Angeles at the age of sixty-seven years. Mr. McCartney retired from active railroad life about four years ago, since which time he has been connected with the land department of the Southern Pacific Railroad in Los Angeles.

OLAF R. PIHL of the firm of Pihl & Miller, contracting engineers, of Pittsburgh, died in that city, Oct. 14. He was born in Norway and came to this country in 1880. About fifteen years ago he served for a period in the U. S. Engineer's Office and later was constructing and supervising engineer with the Pan-American Exposition. He was also associated at one time with the Dravo Contracting Company.

Civil Service Examinations

Examinations Previously Announced

Date		See Eng. Record
Nov. 6	Chief sanitary engineer, sanitary engineering bureau, Board of Health, Illinois	Oct. 9
Nov. 10	Assistant sanitary engineer, Board of Health, New Jersey	Oct. 16
Nov. 13	Civil engineer, Grade 4, highway department, California	Oct. 16
Nov. 20	Engineering draftsman, Grade 2, California	Oct. 16
Dec. 4	Mechanical engineering draftsman, California	Oct. 16
Dec. 6	Sanitary engineer, Massachusetts	Oct. 16
Dec. 8-9	Surveyors and transitmen; General Land Office, United States	Oct. 16

Combine Road Scarifier, Planer, and Roller in One Machine

A machine which combines the properties of a road scarifier, a planer and a roller has been placed on the market. It is designed to re-surface in one trip over a road its entire roadway from ditch to ditch, and leave a uniformly crowned grade with a rolled, compact and well finished center.

The main frame of the machine is made of 10-in. I-beams of heavy section braced and tied together. Each scraper bar or blade is made up in three sections, and is fitted with a detachable cutting edge, in the same manner as the ordinary road machine blade. The roller frame is made of structural steel and the rollers, which are 42 in. in diameter, are carried on a 3-in. steel axle. The rear axle of the machine and the roller axle are set in parallel, longitudinal positions, in order to avoid bending of the rolls when making short turns. The toggle principle is employed for opening and closing the blades and also for holding them at their various working angles. The front center and rear of each blade can be raised or depressed independently. The extreme width of cut that can be made is 30 ft., but it can be decreased to 15 ft. by the turning of two hand wheels. The blades when folded for transportation rest on supports located above the front wheels of the machine so that there is nothing to prevent short turning. The weight of the rear end of the machine can be transferred to the face of the rolls as the machine passes along, thus increasing the roller pressure at will. The machine, which requires between 25 and 40 hp. to operate, is manufactured by the Western Wheeled Scraper Company, Chicago.



MACHINE SCARIFIES, PLANES AND ROLLS ROAD IN ONE OPERATION

Condron Company Issues Bulletin on Flat Slab Patents

The recent court decision sustaining the Norcross patent for flat-slab floor construction and the general interest in this subject led the Condron Company to discuss in detail the different systems in their September bulletin, with the title "Regarding Flat Slab Patents and the Akme System." Photographs and drawings clearly illustrate the difference between the various systems, and of the Norcross and of the Sinks patents histories are given, together with a copy of the latter, in full. Copies of the bulletin will be sent free, on request, by the Condron Company, 1215 Monadnock Building, Chicago.

Standards Set by Testing Material Society Adopted by Brick Men

Paving brick specifications recently adopted by the American Society for Testing Materials by letter ballot were accepted as standard by the National Paving Brick Manufacturers' Association at Dayton, Ohio, Oct. 12. The association urged the American Society of Municipal Improvements also to change their specifications to conform, but the effort was not successful.

It was announced that work started by J. E. Howard of the Bureau of Standards on brick road tests will be resumed this fall in Cleveland and other cities.

The following officers were elected for the ensuing year: President, C. C. Blair; vice-president, J. W. Robb; treasurer, C. C. Barr; secretary, Will P. Blair, Cleveland, and H. H. Macdonald, assistant secretary

Rules Issued to Help Prevent Winter Concrete Failures

The following condensed statement of the precautions to be observed in placing concrete in freezing winter weather now approaching is taken from a printed circular headed in red ink "Caution" and circulated by the Trussed Concrete Steel Company of Youngstown, Ohio, to be used by superintendents and foremen on concrete and form work and posted in conspicuous places on the work.

1. During cool weather, even though not freezing, the setting of cement is delayed. The only sure way of knowing when the cement is fully set and the concrete properly handled is to actually test it with a hammer for hardness.

2. Be careful to avoid freezing of the concrete. Protect all freshly-laid concrete by covering it with some material that will prevent freezing. Be especially careful to protect this concrete during the night. If absolutely necessary to place concrete during freezing weather, the materials should be heated and the placing of the concrete so protected as to keep the temperature above freezing.

3. Workmen are apt to become careless during cold weather. Therefore, the superintendent in charge should take particular care to see that the forms are properly braced, that the bottoms of beam and column boxes are clean, that the steel is accurately placed, and the concrete thoroughly mixed. Special vigilance is required at this season of the year.

4. The most important point, one whose importance cannot be overestimated, is caution in the removal of the form work. Forms must not be removed until absolutely certain that the concrete is thoroughly hardened and that no portion is either soft or frozen. Remove forms carefully and without shock to the structure and always leave in place a few posts to avoid placing the entire dead weight too suddenly on beams and columns.

To Have Alternate Periods of Quiet at Cement Show

In accordance with the wishes of the majority of exhibitors, each alternate half hour at the Cement Show, to be held in Chicago in February, 1916, will be a period of quiet. Beginning every hour, machinery will be permitted to run for thirty minutes. Periods of quiet will follow in the second half. The beginning and end of each period will be announced by the sounding of gongs.

Mixer Manufacturers Association Adopt Standard Rating Method

A resolution providing for the uniform rating of concrete mixers was adopted at the August meeting of the National Association of Mixer Manufacturers. Up to the present time there has not been a standard method for such rating. Some manufacturers give capacities in mixed concrete, while others give them in loose material. According to the resolution adopted, the capacity of a mixer will be specified according to the "size of wet, mixed batch." The dry capacity may be approximated as one and one-half times the wet mixed batch, assuming the use of cement, sand and 1½-in. stone, with 1¾ gal. of water per cubic foot.

Another Pamphlet Out on Trade Activities of European Nations

Swiss commerce is the subject of the latest booklet of the Bureau of Foreign and Domestic Commerce, Department of Commerce, on the home trade campaigns and organizations of the leading European nations. It is entitled "Commercial Organizations in Switzerland." The economic history of trade organizations in Switzerland and the types evolved are included in the text, besides a discussion of the Swiss Federal Department of Commerce and general information concerning industrial localizations, principal products and commercial publications of the country. The publication can be had by sending five cents to the Superintendent of Documents, Washington, D. C., asking for booklet 101 of the Special Agents series.

Business Notes

The Garford Motor Truck Company of Lima, Ohio, has opened a branch office at Twenty-third Street and Indiana Avenue, Chicago, to handle its sales and service business, which was formerly handled by the Overland Motor Company. C. A. Crane will have charge of the new office, assisted by C. E. Golder, Fred Liser and J. C. Philpott.

The Detroit Steel Products Company of Detroit attained the largest monthly output in its history in September. Previous high monthly records have been made in the spring and early summer.

Industrial Works, manufacturer of locomotive cranes, pile drivers, grab buckets and similar equipment, of Bay City, Mich., has established a branch office in the Widener Building, Philadelphia.

Trade Publications

The following companies have recently issued trade literature:

Magor Car Company, 30 Church Street, New York. General catalog G, 11 x 8½ in., 64 pages, illustrated. Railroad cars, box, gondola, hopper, tank, flat, cane and logging types. Catalog written in English and Spanish, one the translation of the other.

American Bitumastic Enamels Company, New York City. "Recent Achievements in the Prevention of Corrosion." Paper, 8 x 10 in., 47 pages, illustrated. This booklet is unusually well written and illustrated and covers many of the various fields of application of protective points to the protection of steel structures. After discussing the electrolytic theory of corrosion and a short early history of the bitumastic products, a detailed description is given of their use on the Panama Canal lock gates, on marine work, on drydocks and on pontoons, on the Catskill aqueduct, the Narrows siphon and other waterworks systems, on standpipes and water tanks, on sewage plants, and on other structural work. Comparative costs are stated, and reports of scientific tests are detailed. Directions for applying and specifications for steamers are also included.

Engineering Record

Circulation 20,000 Copies
McGraw Publishing Company, Inc.

November 6, 1915

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Tunkhannock Viaduct in Service

THE Delaware, Lackawanna & Western Railroad plans to shift its trains to-morrow to the Tunkhannock viaduct. The progress of the work on this mammoth structure has been followed by a series of articles in this journal, the last appearing July 10, on page 42, when a number of views of the nearly completed bridge were shown. The 2375-ft. viaduct, 240 ft. high, is only one feature of the Nicholson cut-off, the purposes of which were set forth in the Engineering Record of April 26, 1913, page 461, by G. J. Ray, chief engineer of the Lackawanna. The new line, located in northeastern Pennsylvania between Clarks Summit and Hallstead, is 39.6 miles long. Besides shortening the road 3.6 miles, it elimnates 2440 deg. of curvature and reduces the ruling grades from 1.23 and 0.52 per cent, uncompensated, eastbound and westbound, respectively, to 0.68 and 0.237 per cent. The economic value of the reduction in grades is the greater because the remainder of the 115-mile operating division between Scranton and Elmira, N. Y., with the exception of a pusher grade out of Scranton to Clarks Summit, has limiting grades each way of about 12 ft. per mile. The new line eliminates westbound pushers west of Clarks Summit, and fits the eastbound grades to the lighter ones west of Hallstead so that a train brought to Hallstead by any class of engine can be moved on to Scranton with the aid of a pusher of the same class. Coming so closely after that other great and perhaps more spectacular cut-off of the Lackawanna—the Hopatcong—this latest improvement testifies again to a progressive management blessed with funds to build for the future.

A Rate Revision Upward

IN the rate case of the Peoples Natural Gas Company of West Seneca, N. Y., decided last week by the State Public Service Commission, the unusual feature was that the town authorities waived the provisions of a franchise which limited the price the company could charge for gas to 25 cents per 1000 cu. ft., thus allowing the commission to sanction an increase of rates to 32 cents. It is an easy matter for any public utility commission to receive the public's solid backing in any program involving a revision of rates downward, but a proposal for higher charges is never received with much enthusiasm. It must be realized, however, that State commissions have a double duty to perform. They are, as Commissioner D. P. Hodson stated in his opinion, under obligations to conserve the interests of the company as to income and benefits quite as much as to protect the rights of the public as to rates and service. Justice can not permit, much less require, a corporation to conduct its business at a loss. Earnings, in order to be reasonable, must be large enough to provide sufficient funds to pay all operating expenses and fixed charges and to cover also such proper amounts for interest, profit and depreciation as can be regarded fair under the circumstances of the case. In the end this principle must govern if the mutual interests of the public and the utilities are to be served.

Architectural Features in Design

ENGINEERS in this country should exert more influence in the development of architecturally pleasing effects in the design of structures than they have done in the past. Frequently the pressure brought to bear upon them by owners or officials of corporations and municipalities who control the design of engineering construction and insist upon mere utility and, sometimes, upon lowest first cost, is hard to resist. It is encouraging to note cases in which this pressure has been successfully resisted and overcome. In the case of the Glens Falls bridge, described on page 574, it is seen that the expenditure of a little thought on effective details requiring the addition of a small percentage of the cost has resulted in a structure of striking appearance. Engineering work should not be wholly utilitarian. In all cases where natural surroundings require it, where the consistent development of a great architectural plan is possible, or where the presence of appreciative observers is probable, the element of general architectural appearance should be given consideration. We are still far behind European engineers in this respect. Surely the great natural wealth of this country can be better applied in this direction than we have yet succeeded in applying it.

Cuban Sugar Plantations

PROSPERITY such as they have not known in many years has befallen the Cuban sugar plantations. The good crop and high prices of last year and the prospect of even greater returns during the coming season have caused a marked revival of construction activity in the sugar-growing industry. New plantations to a value of several million dollars are projected or actually under construction, established mills are contemplating additions and extensions, and numerous promoters are seeking capital to develop hitherto untouched territory. That the American engineer could find in this activity a profitable field cannot be gainsaid. A consideration of the kinds and magnitude of construction that enter into the establishment of a modern plantation, such as the one described on page 534 of last week's issue, will demonstrate that the field is well worthy of attention. Cuba has need of technically trained men. Even in dull times it has not been able to find a sufficient number of such men among the natives to supply the demand. There is work for the American engineer to do in Cuba and the terms of renumeration are generally liberal. In return he can do much for the island. Very few of its plantations have been compelled to cultivate intensively, to increase the cane-growing life of the individual acre and to get the maximum return from it. New land has hitherto been too cheap and near at hand. Agriculture has been destructive rather than conservative. But, in time, such conditions must change. The virgin lands of the island are being encroached upon more and more each year. The man who devises a cheap way of restoring the vitality of the old lands and demonstrates to the cane planters the profit that lies in such restoration will render a very great service.

Appreciation of the Engineer

IN large public works the daily press is always on the lookout for a scandal. Padded estimates, top-heavy payrolls, inferior construction at high prices, and extra work are fair game for reporter and editorial writer. This sort of material makes a "good story," and on some of the yellow journals the standard of practice seems to be never to allow the facts to spoil a good story. For this condition of affairs engineers are in part responsible. They are, or think they are, "too busy" to let the public know about the work under way, and this attitude has been responsible for the all too general belief that there must be some graft connected with every city or State contract. To claim that all public work is clean would indicate an amazing degree of unsophistication, but the stigma of crookedness should not be all-inclusive. In pleasing contrast to the muckraking story is the commendation of the Winnipeg Aqueduct work in a recent issue of the *Manitoba Free Press*, following a public inspection of the work. In an editorial that journal pays high tribute to the civil engineer's part in the project for delivering a new water supply to the Winnipeg district through a 100-mile conduit. This work, to which James H. Fuertes has devoted his energies as consulting engineer, has involved also the building of a standard-gage railroad line, primarily for construction purposes, and the Canadian paper sees in the undertaking not merely a means of securing a better

water supply but an opportunity of "opening up a magnificent farming territory, until recently supposed to be nothing better than swamp, muskeg and scrub brush. The road was built as a necessary step toward the aqueduct but now promises to justify itself as an economic venture." With public opinion behind it, the course of the Winnipeg Aqueduct work should be fairly smooth.

Coroner's Jury and Engineer

THE verdict of the coroner's jury which investigated the collapse of subway decking after a blast at Seventh Avenue and Twenty-fourth Street in New York City was at once contradictory and consistent. The findings, which were given in the Engineering Record last week, were consistent in following the expert testimony presented to the jury, and contradictory in their recommendations for future public safety, since contradictory testimony on this point was heard by the jury. The entire circumstance emphasizes again the work the engineer must do to make the laymen understand engineering construction better. When this has been done by proper publicity, public clamor will be directed toward real improvement in methods, where faulty work has attracted public attention through an accident, and will not blindly attack everyone connected with the work on which the accident happened, as is now the case.

The recommendation of the jury that the public be kept off temporary street supports over subway work while blasts are being fired is right in line with the weight of the best engineering testimony presented to it. As has been pointed out by this journal before, the burden of carrying out this suggestion lies with public officials and the general public. The engineers and contractors are already doing all that is in their power.

The paragraph of the finding which censures the Fire Department for not supervising the blasting operations more closely is a good example of what may be expected of a body of average jurymen to whom a misleading instance of work with which they are not familiar is presented. The jury was told of an experimental blast that had been masked with timber mats, which prevented rock fragments from flying, and appears at once to have jumped to the conclusion that such mats would have prevented the accident on Seventh Avenue, and to have blamed the Fire Department for not having compelled the contractors to use them in all cases. The efficacy of such mats in subway work is very doubtful. Successive blasts tear apart the fastenings, and the slightest neglect in inspecting and renewing these would result in hurling down the subway cut where the mat was used a volley of timber missiles much more dangerous than the rock fragments the mat was supposed to confine.

For blasts too large to be covered with woven-rope mats, timber mats have been used on open construction, but the benefit from them is at least doubtful. That an average jury was misled by the presentation of a successful instance, uncontradicted in the general testimony, is, however, not to be wondered at. Those handling the case would have done better to have gone more thoroughly into the subject of covering blasts with such mats, and shown the jury the exact uses and limitations of this practice.

Full-Size Tests to Duplicate Service Conditions

THE importance of tests of full-size members of bridges, buildings, machinery and other structures, the necessity for conducting the experiments so as to subject the member to such stresses as it will sustain in actual use, the need for systematic and well-planned tests, and suggestions of the kinds of tests most needed are vital points in the paper on this subject by Gaetano Lanza of Philadelphia presented before the International Engineering Congress at San Francisco, in September. There should be further co-operation and systematic organization in the making of such tests, the necessity for which is emphasized by Mr. Lanza. Such co-operation as is conspicuously in evidence in the comprehensive series of full-size column tests now being made by the U. S. Bureau of Standards under the auspices of the committees of the American Society of Civil Engineers and the American Railway Engineering Association is of the utmost value. This co-operation should take place among university laboratories, experiment stations, industrial works and government bureaus, and should insure comprehensive series so arranged as to determine experimentally the effect of the alteration of each of the variable factors in the given problem.

In the issue of May 8, 1915, page 574, the point made by Mr. Lanza, that experimental tests should duplicate actual conditions as nearly as possible, has already been emphasized by this journal in connection with the series of column tests above mentioned. Too wide a departure from usual working materials and practice in the fabrication of test pieces is to be deplored, even though the arguments for scientific exactness and control be strong.

Mr. Lanza divides the tests most needed into two general classes, those on members employed in bridges and buildings and those on pressure vessels and parts of various kinds of machinery. The civil engineer is directly interested only in the first class, and among the more important recommendations for tests are: Built-up columns for buildings and bridges, with especial reference to effect of details, eccentric loading and ratio of yield point to crushing strength of the material; tests of full-size columns of heat-treated and alloy steels; I-beam tests for variation in both yield point and ultimate strength with form of section; repeated and alternate stresses, which need to be investigated much more thoroughly than in the past, and impact tests, which should be placed upon a more scientific basis, with study of the effect of the nature of the impact machine, its foundations and the supporting ground.

The recent developments in the use of alloy steels, as presented by J. A. L. Waddell in his paper before the International Congress, abstracted on page 386 of the issue of Sept. 26, strongly emphasize the necessity for full-size tests of these materials, as is also recommended by Mr. Lanza. This necessity is particularly evident in the case of vanadium steel and Mayari steel to determine the actual strength values of fabricated members of full size to prove whether or not such high-strength material is, at the same time, ductile and tough enough to withstand practical shop fabrication without injury.

Exploitation's Reaction and Its Moral in Latin America

NORTH AMERICAN capital has at last awakened to the possibilities of South America, Central America and the West Indies. Large banks in this country are establishing branches there and our manufacturers are planning to adapt the patterns of their products to the standards of the countries wherein they expect to sell them, and to go after their trade aggressively. A painstaking effort is being made to gain an understanding of the attitude and susceptibilities of the Latin-American peoples so that we may work in harmony with them to mutual advantage, instead of merely insulting them as we have done in the past. With American money and American products will go the American engineer, and, later, the American contractor. Such was the program in Cuba after the Spanish-American War and there is little doubt that it will be followed in this new and greater field. It is to be hoped, however, that this latest expansion of American influence will not, after a very few years, result in the same loss of reputation and distrust of everything American that resulted from the exploitation of Cuba.

We hear much of the necessity of establishing branch banks, of giving long credits, of adapting ourselves to Latin-American ways and of being able to speak and correspond with those with whom we deal in their own language. But one essential is apparently overlooked, and, unless we wish to stand in the broader field in the near future as we stand in Cuba to-day, that essential must be considered above all others. The American reputation for honesty must be rigidly maintained. The dishonest few who would sully it must be entirely eliminated. This was not done in Cuba, with the result that those few—and their number was very small indeed—undid much of the good work that had been accomplished, and went a long way toward ruining American prestige for many years to come. Our works in Cuba, in total, entitle us to appreciation and respect instead of distrust.

Even so late as seven years ago the American engineer who went to Cuba was a fortunate individual. In the first place, engineering in that country is on a par with, if not actually held in higher esteem than, any other profession. In addition to

this the work of American engineers and contractors on the construction of the Palatino reservoir and the water distribution system of Havana, in Spanish times, and their services immediately after the Spanish-American War, including the planning of the Havana sewer system, the cleaning up of that city, the elimination of yellow fever, and the transforming of an ugly, dog-tooth coral shore, on which the seas at high tide deposited a good part of the city's refuse, into a widely known Malecon which is now the show place of the city, made the word American a highly regarded prefix.

American contractors, too, were esteemed for their honesty and admired for their efficiency. Small firms were organized in the early days of American influence and grew large and opulent, but not through dishonesty. Construction was on a boom, and they took advantage of the opportunity. Profits were proportionately large, but no one begrudged their size so long as the work was well done.

The dishonest ones were undoubtedly at work even in those days, but they did not come prominently to the fore until the Intervention, some four years later. When they had finished their work little was left of the reputation of the American engineer, promoter and contractor.

There are still opportunities in Cuba for American engineers and contractors. The country's sugar plantations and other works demand a large number of men of professional education and training. There is a marked deficiency of such men among the natives, so that the American is still welcomed. But his honesty and efficiency are no longer taken for granted. He must prove himself. So it will be in the new field that seems about to be opened up. Its full value will never be realized unless the carpet-baggers are mercilessly weeded out.

National Parks as an Asset

NATIONAL PARKS may be an asset or a liability, just as the policy of management may be sane and business-like or shortsighted and indifferent. It has taken a long time and a good deal of agitation to induce the Federal Government to change its policy in handling national park affairs, but now that this has come about, as outlined on page 568, it is fair to expect that the proposed plan will be backed up adequately and pushed through to completion without unnecessary delay.

The profits which it is estimated this country will enjoy when the chain of national parks is adequately equipped and advertised are rather staggering, and the first thought is a question as to whether the figures have not been placed too high. However, no reason is apparent for discounting figures which the new general superintendent of national parks bases on a detailed study of the entire problem, and the new policy of constructive management has much in its favor. Under the proposed plan of financing no government appropriations for what might be classed as business ventures will be required; such funds as the department will need to spend on the parks will be chiefly for substantial improvements, such as roads and trails. The plan for chalet construction requires the concessionaire to furnish the capital, but offers him the safety of government backing in his investment, at the same time he is left free to use his initiative and business ability in operating his property.

Under the terms of the grant the concessionaire will become virtually a co-partner with the government and in this point is the secret of success which the scheme promises. When financial or operating difficulties arise it will be mutually desirable for concessionaire and government agent to study the matter together, thus putting at the disposal of any concessionaire the benefit of experience in each of the other parks. From the standpoint of the government it will be less expensive and in many ways more satisfactory to help the concessionaire over his difficulties than to insist that he either conform strictly to the letter of the contract or suffer eviction. The new policy will be heartily approved by engineers the country over, and it would be well indeed if there were assurance that equally sane and business-like views would be applied consistently in all government problems with which the engineer is closely identified.

Making the Contractor the Scapegoat for Engineering Inefficiency

THIS JOURNAL has received a copy of specifications of the sort that should have gone out of fashion long ago. They will deter any responsible parties from bidding on the work, and will cause trouble for the owner, the engineer who was ignorant enough to prepare them and any contractor foolish enough to sign a contract which includes them. It seems that repeated condemnation on the part of those interested in good work and fair dealing has no effect on certain persons with a quasi standing as members of the engineering profession. Cannot contractors solve the matter by refusing to bid on specifications of this sort, and forcing their authors to deal with irresponsible bidders until these men or their clients have learned this lesson so that it will not be forgotten?

The phrase "to the satisfaction of the engineer" occurs constantly in the document, and is used as a lazy substitute for stating in plain English what the engineer wants and how he proposes to get it. The specifications provide that the engineer may take charge of the job with his own crew and mix and place concrete at the contractor's expense, at the engineer's discretion. If the engineer doubts the ability of a contractor to do concrete work when the contractor understands what is wanted, he is betraying the trust of his client to enter into an agreement with that contractor. Or does the engineer doubt his own ability to get any contractor to do what he wishes?

These specifications contain the outgrown provision that bids by other contractors may be invited for any extra work in connection with the contract, in case the contractor and the owner cannot speedily agree on the payment for such extra work. A definite provision for payment for extra work at cost plus per cent, or according to some other approved method, is always preferable to this clause. Furthermore, interpreted in accord with the general tone of the specifications, any contractor would be justified in assuming that this clause would be held over his head as a club in making prices for extra work.

The person who fathered this document further requires that reinforced wall concrete shall be placed in layers 6 in. thick, each thoroughly tamped before another layer is placed. This stamps him as either ignorant of concrete construction, or as seeking to carry out in the field experiments that should be made in the laboratory. The specifications further state that the reservoir walls—the main concrete item, containing about 900 cu. yd.—must be poured continuously, and provides cash penalties for delays due to breakdowns which are so severe as to require duplicate mixing plants. This is an unnecessary expense on such a small yardage, and entirely unwarranted in view of the fact that such a breakdown could have no serious effect on the finished wall if any of several methods for bonding the old and new concrete were used. These methods would be much cheaper than the extra expense necessary to insure continuous pouring, and probably would not even need to be used. This penalty feature for a one and one-half to three-hour breakdown is apparently due to inexcusable ignorance.

The all too usual clause throwing responsibility on the contractor for errors made by the engineer in gathering the data on which bids are asked, is, of course, inserted at the end. The engineer says in effect that he thinks he wants certain things done—certain quantities of certain materials moved, or furnished and placed—but that if the contractor finds that the engineer wants something else the contractor must pay the difference. In normal times an extra and unnecessary sum, added to the bid, comes out of the owner's pocket to pay for this deficiency of his engineer. Either the engineer is not paid enough to make proper investigations of the site, which may be either his fault or that of the owner, or the engineer says, in effect, that he does not know his business and cannot determine the ordinary conditions of the work with enough certainty to predict its approximate cost. The engineer should have the sense and backbone to stand on his design and estimate. If extraordinary conditions, such as could not possibly be predetermined at a reasonable expense, are found, no one can blame the engineer, while the contractor is entitled to be protected against loss. Usually the insertion of this clause merely means that the contractor has to assume the cost of any mistake, however gross, in the engineer's work, although he is seldom given time, and should not be put to the expense of thoroughly checking the engineer's explorations and estimates.

Such specifications as these hurt the engineering profession, municipalities and other owners as well as contractors. All should join to educate the specification writers to a proper conception of what specifications are for.



KINGAN'S COOPER SHOP MOVED IN SECTIONS FROM LEVEE LINE



DRAGLINE FINISHING SLOPE WITH 1½-YARD BUCKET

High Levees Will Protect Indianapolis from Floods

Construction of Earth and Wall Barriers Along White River Involves Rapid Concrete Methods, Large Excavating Units and Riprap Laid on Paper "Shingles"—Channel Velocity Reduced to 10 Feet per Second

THREE OUTFITS, each consisting of an A-frame derrick, a ½-yd. concrete mixer fed by aggregate excavated and screened on the ground, and seven men, are completing each week three 40-ft. base sections for the 2300 ft. of gravity wall on a portion of the West Side White River flood protection at Indianapolis. The contractor receives about $1,100 for the 170 cu. yd. of concrete placed over the forty 21-ft. piles driven into the extremely porous gravel in the bottom of the trench of each section, which is 14 ft. wide and 30.5 ft. deep, measuring down from the natural surface.

The West Side White River flood protection work, when completed, will present an unbroken barrier against future floods 4 ft. higher than that encountered in 1913, on the west side of the river from high ground near Belmont Avenue above Fall Creek, through the heart of the manufacturing and business portion of the city downstream to the Belt Railroad, a total distance of 4½ miles along the new and straightened channel. Surveys of the watershed and flooded areas and subsequent studies following the 1913 disaster, when $7,000,000 damage was sustained, indicated a channel 650 ft. wide and 29 ft. deep must be provided to care for the same intensity of runoff, 120,000 sec. ft. To provide this cross-sectional area some 400 properties had to be acquired on the west side of the river, all bridges lengthened and curves in the present channel straightened out. Wherever feasible a riprapped earth levee with a traffic way on the top, 60 to 75 ft. wide, was planned, but at certain points where unusually valuable improvements encroached on the desired area gravity concrete walls replaced the levee. To withstand the erosion opposite the mouth of Fall Creek a wall was deemed necessary. To have moved the car barns and power plant north of Washington Street was considered prohibitive in cost. The wall alignment cuts close to the power house, the foundation of which was carefully shored up. Subways for the traffic way under the railroads near Kingan & Company's packing plant (see drawing) support the back of the levee and form abutments for the bridges.

South of Oliver Avenue the levee consists of Drover Street elevated to a height of from 12 to 16 ft. above its former elevation. The industries between Drover Street and the river and from Morris Street to Oliver Avenue are being removed to other locations, and the ground upon which they stand will become park lands and river channel. South of Morris Street, the Indianapolis Abbatoir Company feeling that it was able to withstand the onslaught of a flood such as the one of 1913, the levee is continued in Drover Street to the company's south line, then bent east and south to the river bank and again continued south to the Belt Railway embankment.

The special district benefited and assessed for the work on the west side, amounting to $1,300,000, covers an area of 1400 acres valued at from $1,000 to $5,000 per acre. In practically all of this area damages were sustained in 1913. Under the flood law passed last winter this benefit district pays one-tenth the cost of all construction and land acquisition, the city of Indianapolis under a general tax pays 45 per cent and Marion County pays 45 per cent, the benefit district sharing in this 90 per cent according to its assessed valuation in the general taxes.

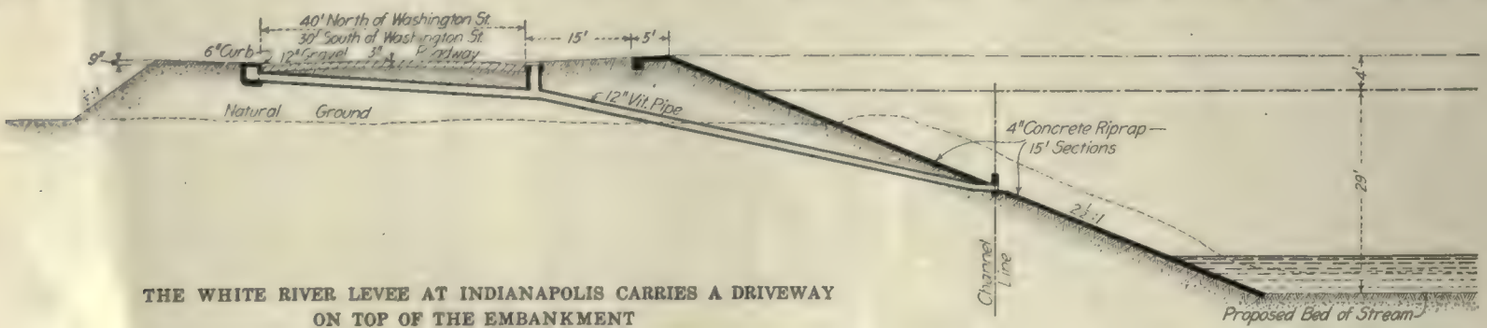
REDUCE FLOOD VELOCITY TO 10 FEET

In connection with lengthening the bridges it is proposed to construct regulating weirs and dams so as to reduce the velocity of the stream and to prevent any scouring at bridges. The velocity of the stream as estimated by the city engineer and verified by the United States Army engineers would be practically 10 ft. per second during extreme floods. This velocity is considered excessive, and some means must be provided to check the current and to prevent the destruction of river structures.

The plan on the east side is to provide a levee and street from Tenth Street south practically parallel with the harbor lines on the west side. The city engineer is of the opinion that this work can be done without much cost to the city by granting to gravel companies the privilege of removing and selling the gravel on condition that the gravel companies will construct the levee and street with the earth stripping. According to the plan, it is proposed to construct subways under the Belt Railroad north of Tenth Street and on the Crawfordsville Road or Park Drive on the east side of the river, and eventually to build a subway under the Belt Railroad near Raymond Street.

EXCAVATION AND LEVEES

Material in the bends cut off by the realignment of the channel provides more than enough material for the levee, but in



THE WHITE RIVER LEVEE AT INDIANAPOLIS CARRIES A DRIVEWAY ON TOP OF THE EMBANKMENT

some cases it has to be hauled up to two miles, as in the sub-contract work of the T. A. Kearns Company of Chicago, which is building the 350,000-cu. yd. embankment from the northwest end of the wall near Lansing Street and the street from Washington Street north to Belmont Avenue. Four narrow-gage nine-car trains of 4-yd. Western dump cars are loaded by a 70-ton Bucyrus shovel and handle about 35,000 cu. yd. per month. A Lidgerwood dragline with a 70-ft. boom handling a 1½-yd. bucket travels along the bank and slopes up the levee to the required line for the riprap. Ahead of the dump made by the dirt trains all excess excavation on these slopes is thrown back into the levee prism, the dirt trains completing the fill to the required heights and widths.

Above the Belt Railroad, the above company has been moving 5000 cu. yd. per day directly into the levee with an electric dragline operating a 4½-yd. bucket at the end of a 100-ft. boom.

The Marsch-Cleary-White Company is doing all the work south of Washington Street, including the masonry retaining walls and excavation for the depressed roadway under the railroads at Kingan & Company's plant.

The fill from Washington Street to Morris Street, about 100,000 cu. yd., is being made from the widening at the bend south of Washington Street (see drawing) and that below Morris Street is obtained from the borrow pit in the channel change at the extreme south end of the work. Here a Monigan No. 2 dragline handling a 1½-yd. bucket is throwing dirt from the borrow pit directly into that part of the levee which lies adjacent to it. About one-fourth of the Kingan plant west of the river lay within the channel lines and had to be wrecked and moved to the west of the flood walls and levee. All streets intersecting the levee had to be raised and the dwellings fronting these streets have been raised to the new grades, and the lots are being filled to the new elevations under this contract. This work affects some ninety-five resident properties adjoining the levee but not condemned.

Hickey Brothers of St. Louis are subcontractors for building the 950 ft. of 40-ft. wall opposite Fall Creek by methods similar to those to be described below.

WALL AT WASHINGTON STREET

In the 260,000-yd. wall at Washington Street noted in the opening paragraph the methods used by the contractor, the Kuert Contracting Company of Indianapolis are as follows: The A-frame derricks are mounted on a platform straddling the completed sub-base and their booms are long enough to command the whole of the 40-ft. section opened. Three-inch oak sheeting is driven by a Vulcan steam hammer and braced with three sets of 10 x 10-in. wales and 12 x 12-in. cross-braces, one at each end and one at the center, thus giving plenty of room for excavating with the 1-yd. Hayward grab bucket.



WEST SIDE WHITE RIVER FLOOD PROTECTION AT INDIANAPOLIS

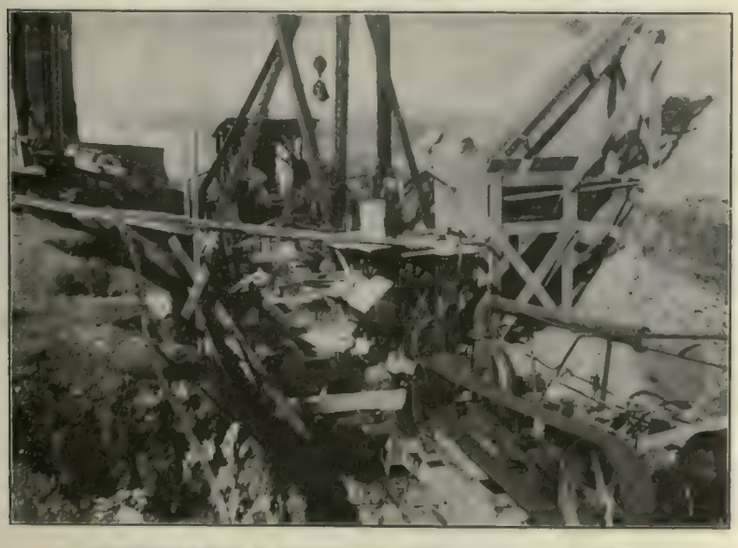
Portion of plant moved from point A back of levee.

On account of the large amount of water a 10-in. Potts centrifugal pump, belt driven from a straight line Atlas engine, is started shortly after the excavation is begun. The discharge is through old sewers or new ones built through the bank to the river. The piles are imbedded in 18 in. of concrete and the spacing is such as to put only 2½ tons pressure on each one. Their principal function is to furnish stability should erosion ever endanger the foundations.

The material as excavated contains an excess of fine sand, otherwise it is considered proper for concrete and is delivered by bucket through a screen into a hopper feeding directly into a mixer placed high enough to discharge by chute into the trench. The mixture obtained is about 1:2 ½:5.

FILL STEEL FORMS RAPIDLY

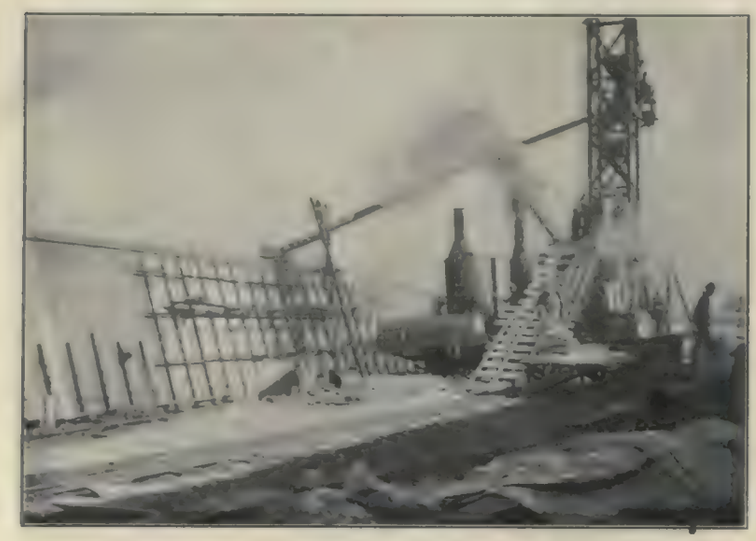
For the high wall Hydraulic pressed steel forms are used in sections 26 ft. 8 in. long. As the total height of from 28 to 31 ft. is usually poured in 5½ hr., some interesting developments in the way of horizontal pressures have developed. When first set up the forms tended to tip toward the river, the side with the least batter. To overcome this ⅝-in. cables were attached to a deadman to prevent an additional thrust expected in the same direction during the deposition of concrete. Contrary to expectations the first forms filled started to move toward the bank. For a week speculation was rife among the engineers and contractors. Finally it was noted that the eight rods for each set of ribs tying the two sides together were not all exactly horizontal, on account of the fact that the holes punched in the ribs for them were all equally spaced, the side with the least batter gaining elevation the faster. It was therefore concluded that the uplifting component on the bank side was practically all cared for at the base, but that the slight horizontal component toward the bank due to the wet concrete at the top, which was transferred by the rods to a higher point on the forms on the river side permitted a movement toward the shore. Thereafter three ⅝-in. cables were placed on the river side to anchor each section during the period of concreting.



STIFFLEG FEEDS GRAVEL TO MIXER THROUGH SCREEN



TAR PAPER STRIPS OVERLAPPED TO EXCLUDE GROUND WATER



MATERIAL CARS COAST TO FOOT OF INCLINE



BRINGING AHEAD SMALL FORM PLATES FOR WALL

In carrying on this work the following régime is usually in force: To-day concrete is poured in a section. To-morrow morning the plates, of which there are sufficient for 1½ sections, are removed, carried ahead and placed on ribs erected the previous day. The ribs, of which there are enough for three sections, on concrete poured yesterday, are left until the second day before removing and re-erecting. The rods, which are held by Universal form clamps, are removed by a Universal puller and used again after passing through a small field straightener. The mixer is moved forward and a new material track laid on the day following concrete deposition. Every other day concrete is poured.

Six timbers hold the wood bulkheads in place. Two at the bottom are braced from 4 x 4-ft. upward keys left in the concrete base. The remainder are held by ¾-in. rods run through at least five vertical form ribs.

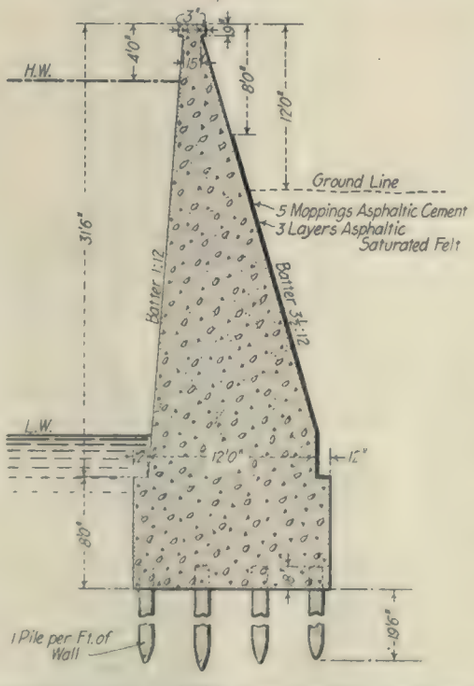
USE AGGREGATE DIRECT FROM RIVER

The concrete plant, consisting of a ½-yd. Smith mixer and Insley tower, is mounted on a movable platform with a raised platform 15 ft. above the mixer platform, to which aggregate cars are hauled up an incline by means of a single drum hoist operated from the mixer engine. These cars are loaded some distance back on the bank of the river by a clamshell which digs the material from the river bed as needed and discharges it over a screen, whence it flows to a hopper feeding the cars. These cars are of a home-made bottom dump type holding ¾ cu. yd. From the bin the cars coast 100 ft. to the foot of a 20-ft. incline and are pulled up this incline by a hoisting engine and coast to the foot of the mixer platform, where cement is added. Double tracks are laid between the temporary pit and the mixer. Sixteen men plus an engineer and foreman form the crew in pouring the 200 cu. yd. in each section of form.

RIPRAP LAID ON PAPER "SHINGLES"

The Marsch-Cleary-White Company, general contractors, are carrying on the remainder of the work, including 95,000 sq. yd. of riprapping of all the earth levee sections. This involves laying up and down the slope a 15-ft. strip of 1:2:4 concrete, 4 in. thick, reinforced with No. 27 Triangle mesh. The toe of the paving ends at a point 6 to 10 ft. below the river low-water line. Concrete prepared in a ¼-yd. Milwaukee mixer on the top of the levee is led down the slope in open steel chutes.

To prevent washing out the green concrete by the ground water, which seeps in rapidly from the bank side, the contractor is using successive layers of tar paper laid like shingles, only in the reverse order; i.e., the top one is placed first with a lap of 4 in. This tends to lead the ground water down the slope to a point below the toe of the riprap, where it is easily pumped out. The excavation around the toe of this slope paving is protected on the river side by 15-ft. Lackawanna steel sheet piles driven by a 2000-lb. drop hammer into the gravel to a depth of about 10 ft. below the surface. Trenches 60 ft. long are dewatered at one time and are allowed to fill immediately after all the slabs have been placed.



GRAVITY WALL, 2300 FEET LONG, OBVIATES MOVING CAR BARNS AND POWER STATION

The flood protection work is being carried out under the direction of B. J. T. Jeup, city engineer, with D. C. Hayne, assistant city engineer, directly in charge of the design and construction. H. B. Mitchell is resident engineer for the Marsch-Cleary-White Construction Company. P. E. Hickey, of Hickey Brothers, Thomas Kearns Company, of T. A. Kearns Company, and John Kuert of the Kuert Contracting Company are personally in charge of their respective sub-contracts.

New Orleans Record for Succession of Storms Broken

Over 19 Inches of Rainfall in 15 Days—Drainage System Temporarily Crippled by Hurricane of September 29

NEW ORLEANS has just been through an extraordinary experience due to a rapid succession of heavy storms, the first accompanying the hurricane of Sept. 29, which left hardly a single roof in the city undamaged. Heavy rains are a matter of greater concern to New Orleans than to other cities, because a goodly portion of the city is at or below the level of Lake Pontchartrain, bounding the city on the north, and a still larger area is below the



ROADWAY ALONG LEVEE IS CONTINUED IN SUBWAY UNDER RAILROADS

mean level of the Mississippi River, forming the southern boundary of the city. Consequently, all of the storm water, as well as the sewage, must be pumped. The hurricane crippled the transmission system between the power and the pumping stations during the first storm, delaying the handling of the storm water, but the subsequent storms, unaccompanied by destructive winds, were handled with little or no difficulty. A detailed account of the experience of the system has been prepared by George G. Earl, general superintendent of the Sewage and Water Board of New Orleans, as a report to the board and certain facts therefrom are here presented.

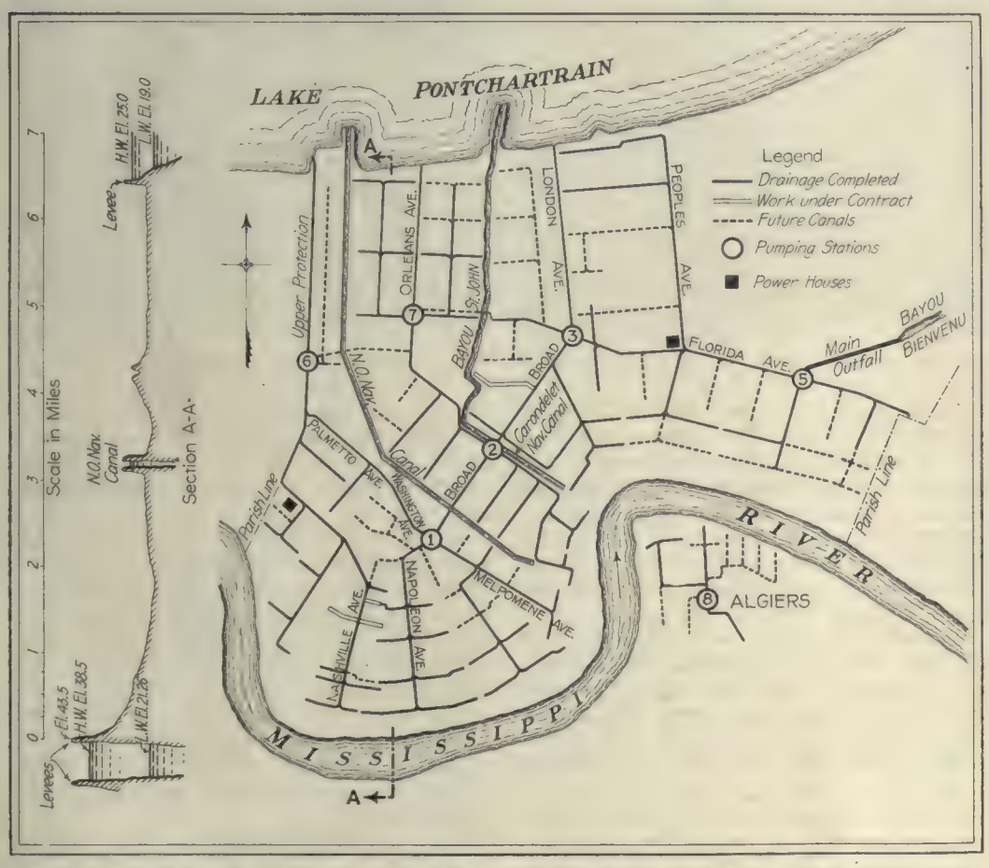
RECORD OF THREE STORMS

From the records of the board prior to Sept. 29, this year, it would appear that a rainfall of 7 in. or over in 24 hr. was to be expected on an average of about once in 11 years, and that the average year would show a maximum rainfall in 24 hr. of about 4½ in. Six recording gages have been maintained by the board, or its predecessor, the Drainage Commission, since 1894. Prior to the recent storms there were only two which recorded as much as 7 in. in 24 hr. on any of these gages. One of these, in 1903, recorded 9.21 in. in 15½ hr., and the other, in 1907, showed 8.12 in. in 26 hr. Nevertheless, in the period from Sept. 29 to Oct. 13, inclusive, this year, there were two storms which recorded over 7 in. in 24 hr., and between them was a storm which exceeded the maximum storm of many of the years in this period.

Specifically, the storm of Sept. 29, 1915, gave a maximum record of 8.36 in. in 21 hr.; that of Oct. 12-13 showed 7.96 in. in 21¾ hr., while in between, on Oct. 3, 4, 5 and 6, 5.92 in. fell in 60 hr., making a total for the 15-day period of 22.24 in. These are maximum recorded falls. The average record of all the six gages maintained by the board for the period was 19.24 in., while the record of the United States Weather Bureau office at New Orleans was 19.91 in. for the same period.

Compared with this record it is interesting to note that the heaviest recorded rainfall for any previous consecutive period of 15 days was in April and May, 1907, when the gages showed 14.1 in. Moreover for any one calendar month previously the maximum was 16.1 in., recorded in September, 1898.

If the above described rainfall had been spread uniformly over the 15-day period, it would have amounted to 1⅓ in. per day and would have given the city drainage system no trouble at all, because the present capacity of pumps discharging into the various high level outfall canals is sufficient to discharge into said canals each day as much water as a 3½-in. rainfall precipitates upon the 25,000 acres of drained area of the city. When the additional pumps now under contract are installed the discharge capacity will be equal to all of the precipitation which a 7½-in. rainfall in 24 hr. can pour upon the same area.



SINCE GROUND LEVEL OF NEW ORLEANS IS BELOW RIVER ALL DRAINAGE AND SEWAGE MUST BE PUMPED

Present pumping capacity can handle 3½-in. rainfall on area of 25,000 acres in 24 hours. Dry weather flow is normally pumped through stations 1, 2, 3 and 5 to Bayou Bienvenu and thence to Lake Borne. In heavy storms, when dilution is great, stations deliver to Lake Pontchartrain.

HURRICANE OF SEPTEMBER 29

The hurricane of Sept. 29 began on the night of Sept. 28 with rain and a gradually increasing northeast wind. By 7 o'clock on the morning of the 29th the wind had reached a velocity of 40 miles an hour and increased gradually until the maximum steady blow of 80 miles was reached between 5 and 5.30 in the afternoon. At 7 o'clock that morning the drainage system was operating normally. The first indication of trouble was at 10.50 a. m. when heavy short-circuits occurred. These continued with increasing frequency during the day until at 5 o'clock in the evening, when the storm was at its height, the short-circuiting and destruction of transmission lines caused the shutting down of the pumping stations. When final shutdown came the water on the suction side of the stations stood at various levels from 19.2 to 22.0 C.D., indicating the flooding of large portions of the city, since much of it is at elevation 20. While linemen were kept on duty all night, little could be done until Thursday morning. By extraordinary efforts, Station 3 was put in operation by noon and Stations 6 and 7 by 7 o'clock of the evening of Sept. 30. At 8.40 on Oct. 1 Station 7 was in operation and the remainder were thrown into service shortly thereafter.

Drainage water to be handled, however, came not only from the rainfall but from the lake, the levees being overtopped by several inches at several places. For this reason Mr. Earl joins with the chief engineer of the Orleans Levee Board in urging that the levees be raised in order to protect the city beyond question from lake tides. The Sewage and Water Board is constructing its own outfall pumping stations with a view to being able to maintain them in operation with a maximum water elevation of 30 C.D. on the discharge side. The maximum attained in this storm was 26.2.

By Friday night the area between the two navigation canals was practically free of water, and by Saturday night, Oct. 2, most of the water had been removed from the large low area above the New Basin Navigation Canal and back of Clara Street. A portion of the city, however, which is very sparsely settled, was not relieved of water until Wednesday, Oct. 6, despite the fact that the pumping stations were operated continuously from the afternoon of the day following the storm. This was due to the crevasses and overtopping of the levees.

REMEDIES PROPOSED FOR TRANSMISSION LINE TROUBLES

As a cure for the transmission line interruptions, it has been proposed that the lines be put underground. This proposal Mr. Earl considers and dismisses as being prohibitive from the standpoint of cost. Moreover, such systems are subject to trouble no less than overhead lines, particularly where heavy rainfalls, as is the case in New Orleans, completely saturate the ground. Stations operated independently by steam power have also been urged, but taking into consideration all of the facts, Mr. Earl believes the present system is more certain to give satisfactory results than any proposed.

Reviewing these storms, in conjunction with the fact that there was a sustained wind velocity of over 80 miles an hour, and velocities up to 120 and 130 miles in gusts, with a lake level of 26.2 C.D. (Cairo datum), whereas previous wind velocities have not exceeded 70 miles an hour and lake elevations have not been above 25.7, the report concludes that a repetition of these conditions in the near future is improbable. Mr. Earl, therefore, believes that the citizens of New Orleans ought to feel confident that they can proceed with the rapid development now in progress without any question as to the probability of properly handling the drainage.

Ten and Three-Quarters Miles of 36-Inch Riveted-Steel Pressure Line Built on Sooke Work

Efficient Workshop Fabricated Sections from the Plate for the Pipe Line of Victoria's New Water Supply System

By BOYD EHLE, M. Am. Soc. C. E.
Of the Sanderson & Porter Engineering Staff—Resident Engineer, Sooke Lake Water Supply System

THE NEW Sooke Lake water supply system for Victoria, B. C., has been described in a number of articles in the Engineering Record. In two articles by the writer, in the issues of Oct. 2, page 406, and Oct. 23, page 507, the general features of the system were described, some costs were stated and special attention was given to the method of building the 27-mile, 42-in. concrete flow line. The lower end of the line, as described in the first of the articles just referred to, is composed of riveted-steel pipe, 10¾ miles long, 36 in. in diameter, made from both 5/16-in. and ⅜-in. plate. Of the total length of 56,677 ft. 20,137 are of the thinner and the remainder of the thicker plate. This article will be devoted to a description of the fabricating plant and of the construction of the steel line. Some data will also be given as to the cost of the work.

BEGINNING OF WORK

Only 2685 ft. of the ⅜-in. pipe had been laid by the original contractors prior to closing their work. They had erected a shop at Thetis Cove, Esquimalt Harbor, and started to make pipe. About 3000 ft. in various stages of completion was worked on, none of which was accepted by the engineers. This pipe was later made over by the succeeding contractor at greater cost than using the plain plate. The plate came from Pittsburgh around South America in tramp steamers to Esquimalt Harbor and was lightered to the shop wharf, where it was unloaded by derrick onto tram cars and stored in a plate shed at the end of the shop.

Upon the failure of the original contractor, the city relet the fabrication and laying of the riveted pipe to the Burrard Engineering Company, Ltd., of Vancouver. This company was associated with Angus McDonald, an experienced pipe maker, who brought over his plant and trained organization from Barnet to the shops purchased from the receiver for the former contractor, and personally supervised the fabrication of the pipe with excellent results.

Trenching and backfilling the pipe was done by day labor under the engineer's supervision. The minimum depth of cover for the pipe was 1½ ft., but in the streets and roads it was necessary to go deep enough through the hills to conform to the projected regrading. Jackhammer drills, using air from gasoline compressors, were used in the rock trenching.

PIPE

The plate for the pipe was of open-hearth flange steel and the rivets of open-hearth extra-soft steel, according to the standards of the American Society for Testing Materials. Pioneer mineral-rubber pipe coating was used at first and later Geneseo,—about 6 lb. per foot of pipe.

The 5/16-in. plates were 68 x 117¾ in. and 68 x 119¾ in.; the ⅜-in. plates 68 x 118 in. and 68 x 120½ in. for inside and outside courses. The pipe was fabricated in four courses—about 22 foot lengths—for straight pipe. The rivet holds were punched and then reamed to size. Longitudinal seams were lap-joint double-riveted and girth seams single-riveted.

Split calking was done inside and out at all seams with air hammers. The plate in all cases was tightly bolted up and the contractor used an air hammer on the longitudinal seams to lay up tight the edge of the plate. There were two templates for the 5/16 and for the ⅜-in. straight pipe, and three special templates for each size plate to give ½, 1 and 1½-deg. cuts for the curve pipe. These special templates were prick punched on the plate, while the standard templates were clamped to the plate for punching. Filler pipe were cut to length at the shops and rushed out to the pipe laying as soon as the closure distance to the curve points could be closely measured.

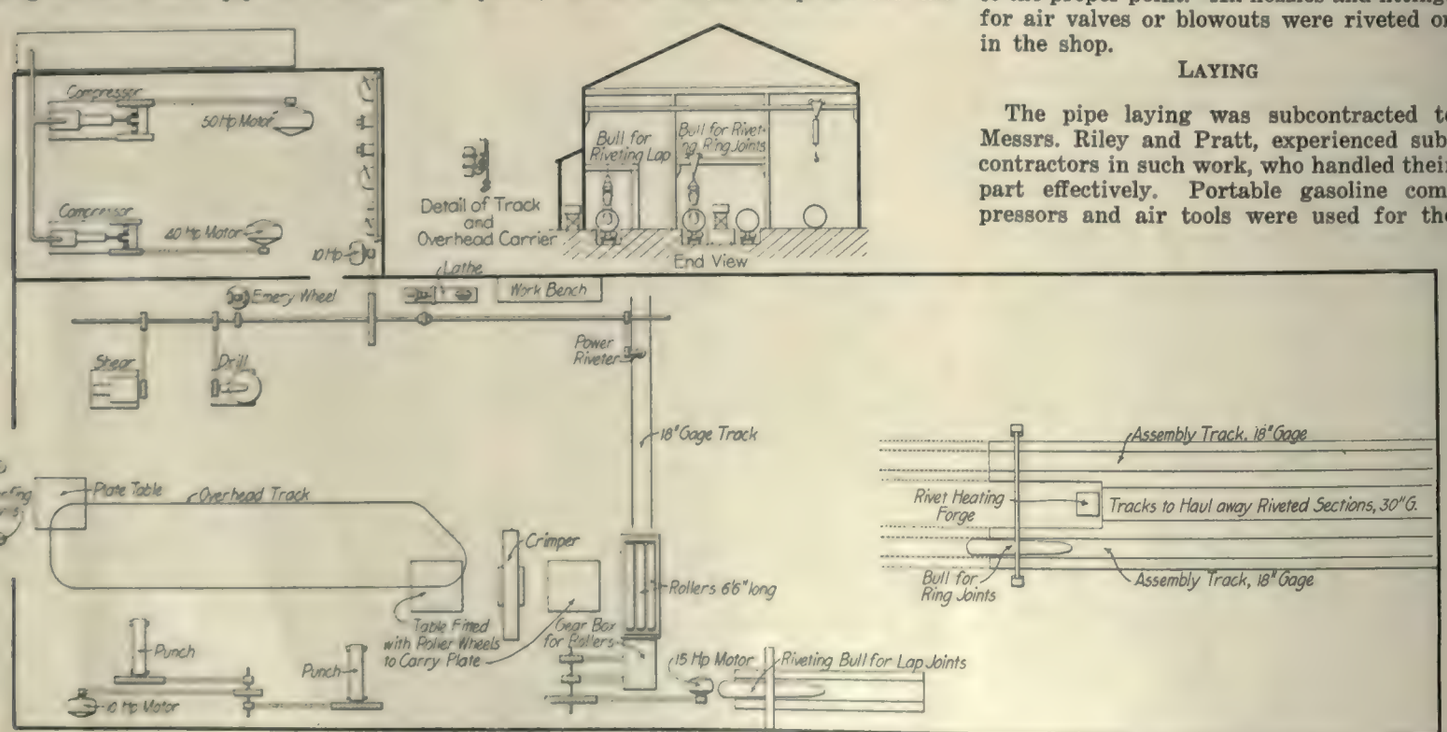
SHOP

Electric motor drive was used in the shop. Plate was taken from the storage piles on either side of a tram track by an overhead traveling crane with an air hoist, attached to a trolley on the lower flange of the crane girder, and loaded to a flat car for delivery to the shop. At the entrance of the shop, the plate passed to the scarfing anvils. It was then lifted and passed to the punches by an overhead hanging track, after the template was clamped to it. These punches were offset so that the nearer one worked on the narrow side of the plate and next on the wider without any shifting sidewise. From the punches the plate was sent directly ahead on rollers to the bending rolls. The rivet holes were reamed and the ring course sent to the first riveting bull, riveting the longitudinal seams. The edges of the longitudinal seam were hammered tight and the course passed ahead to the assembling bull, which was hung from an overhead trolley to serve two depressed assembling tracks. The pipe was hoisted by an air lift to a truck with a swivel mounting, for turning the pipe at right angles, after which it was pushed out to the calking shed at the end of the shop. The method of assembling the curve pipe is shown in a drawing.

At the end of the calking shed, the pipe was immersed in the horizontal dipping tank for about one-half hour. It was then hoisted to an inclined position for draining and rolled out on the storage trestle to dry. The pipe was loaded at the end of this trestle on trucks hauled by horses for delivery to the line. Each special was marked with the station number to insure delivery to the proper point. All nozzles and fittings for air valves or blowouts were riveted on in the shop.

LAYING

The pipe laying was subcontracted to Messrs. Riley and Pratt, experienced subcontractors in such work, who handled their part effectively. Portable gasoline compressors and air tools were used for the



THE MAKING OF THE STEEL PIPE FOR THE PRESSURE LINE WAS HANDLED EFFICIENTLY IN THIS PLANT

TABLE 1—COST OF 36-INCH STEEL PRESSURE LINE 36,540 FT. OF ⅝-IN. PLATE; 20,137 FT. OF 5/16-IN. PLATE

(From engineers' cost accounts)

	⅝-In.	5/16-In.
Plate	$3.35	$2.74
Rivets	0.28	0.18
Hauling	0.205	0.165
Fabrication	0.668	0.668
Laying	0.366	0.366
Miscellaneous	0.407	0.407
	$5.276	$4.526

field riveting and calking. The pipe was rolled to the trench, and lifted and jointed by means of a tripod derrick having hand winch power. Rivets were driven from the inside, using a hammer "hold up" on the outside of the pipe held by a chain. Drop holes for delivering the rivets inside the pipe were cut with a field hand-punch and threaded for screw plugs. All bell hole excavation and unwatering was done by the city and the contractor was never delayed by such work.



CONCRETE SADDLES ON I-BEAMS CARRY STEEL PIPE ACROSS DRAWS

The costs are given in Table 1, while Table 2 gives the wage scale.

The work was done under the direction of C. H. Rust, Mem. Am. Soc. C. E., city engineer and water commissioner of Victoria, B. C. Wynn Meredith, Mem. Am. Soc. C. E., a member of the firm of Sanderson & Porter, New York and San Francisco, was consulting engineer, and the writer resident engineer.

TABLE 2—WAGE SCALE, RIVETED PIPE WORK

	Per 9 hr.
Foreman	$7.00
Layer out	5.00
Punchman	3.50
Punch helper	3.00
Scarfer	4.00
Rollman	3.50
Riveter	4.00
Rivet heater	3.25
Holder on and bolting up	3.00 to 3.50
Bucker up	3.00 to 3.50
Calker	4.50
Dipping tankman	3.00 to 3.50
Machinist	5.00
General helper	3.00
Rounder up	3.50
Watchman	3.00
Field Work	
Foreman	7.00
Bull gang foreman, $5.50; two at $3.25; two at $3.50	
Riveting gun man	4.75
Rivet heater	3.75
Calker	5.00
Bucker up	4.00
Compressor engineer	4.75

LAND BORINGS IN CHICAGO with a drilling machine cost $1.94 per foot for five holes aggregating 151 ft. The holes were made through brick paving, concrete slabs and frozen ground in February. In two cases wells from 6 to 13 ft. deep had to be dug to cut through lower concrete slabs and to remove boulders. One shallow boring of 56 ft. and six deep borings for bridge foundations, all three totaling 795 ft., cost $2.46 per foot.

Terminals the Need of Inland Water Transportation

Ford, Bacon & Davis in New Orleans Report Tell What Must Be Done to Revive Mississippi River Traffic

THE NECESSITY for radical improvements in inland water terminals in order to realize the possibilities of inland water transportation has been repeatedly emphasized by proponents of such transportation. It was one of the points made by Capt. John H. Bernhard in his extensive discussion, abstracted in the Engineering Record of Sept. 11, page 332. Ford, Bacon & Davis, engineers, in a section of their report to the Board of Commissioners of the Port of New Orleans on the New Orleans Ship Canal and Terminal, go into the subject in more detail, setting forth the essentials of all-efficient water terminals. They deplore the fact that while the Government improves waterways it does little to supply terminal facilities. They urge public ownership of the waterfronts, and better development of them. They hold that to bring back river navigation in the Mississippi Valley every port town, large and small, must build suitable terminal facilities. These notes are taken from the report.

CHEAP TRANSSHIPMENT IMPERATIVE

The realization of cheap transportation lies in the facilities for loading and unloading and the transshipping of freight from one carrier to another; the ability to transfer a commodity from a water carrier to a railroad, or vice versa, and the quick and cheap delivery of this commodity to the consignee. A study of this subject clears up the mystery supposed to surround the decline of the inland water transportation in the United States, especially that on the Mississippi River, as a more effective method of competition than the cutting of rates has been the refusal of the railroads to co-operate with water lines in the handling of freight. Inasmuch as a great proportion of traffic does not originate or find its destination immediately along the river banks, it is imperative that they should have the co-operation of the railroads. This the railroads have refused and the public has been slow to furnish by necessary legislation and by publicly owned terminals. At the terminals on the Mississippi system especially, there is a conspicuous lack of co-ordination between the railroads and water lines.

It is possible at several Lake Erie ports for a vessel to discharge 10,000 tons of iron ore into cars, load 10,000 tons of coal from cars and clear within twenty-four hours of its entrance. The cost of coaling a boat from Memphis, Tenn., under ordinary conditions equals the cost of loading coal at Conneaut, delivering this at Duluth, a distance of 889 miles, and unloading it. For moving this coal in port about 60 ft. there is a terminal charge approximately equal to the cost per ton of transporting the coal from Pittsburgh to Memphis, a distance of about 1200 miles. The neglect of harbor facilities renders necessary the large crew of the river packet, and enormously increases the current expenses and fixed charges per ton-mile of freight carried on account of the length of time the boat is delayed in port.

FEDERAL AID LACKING

The Federal Government constructs or improves waterways, deepening channels and building revetments and breakwaters, but does not, in general, supply terminal facilities. These are usually provided, if they are to be had at all, by various agencies or by State or local authorities. In the past the public has left this important development largely to the railroads and certain private interests, but a complete co-ordination of all means of transportation centering in a city cannot be had between a large number of such private interests.

The ideal plan for a modern port would undoubtedly be to stop all railroads at a certain line or zone outside the city and then turn the freight over to a publicly owned belt railroad for delivery to consignees or co-ordination with the other carriers for further shipment. Under this plan the belt line and all necessary warehouses and docking facilities would be publicly owned and operated on a basis of actual cost of service, giving shipper and carrier absolutely the same treatment. So ideal a system would save millions of dollars of duplication of service and plant—the most wasteful phase of the present-day commercial operations.

INDUSTRIAL TERMINALS

There is another and more important consideration for the public ownership of port facilities, and that is that such facilities are no longer desired simply for the transshipment of freight passing through a port, but are needed in the service of a manufacturing and industrial terminal as well. The former type of port is especially useful to a great section of the country served, while the latter means a direct and permanent gain to the city or community owning the port. Through the industrial type of terminal raw goods pass into the city to be manufactured, and the finished articles pass out. In its highest form such a terminal is really an industrial area fed by railroads at the rear and vessels on the waterfront.

Essentials of such industrial terminals are (1) cheap land for manufacturing and storage sites, (2) cheap rentals, (3) cheap power, (4) cheap food supplies, (5) satisfactory banking facilities, (6) street and industrial railroad services and connections, (7) satisfactory health conditions, (8) schools and churches, and (9) satisfactory labor market.

WHAT IS NEEDED

The harbor of New Orleans in general meets all the requirements of an industrial terminal and a river, rail and ocean port. New Orleans is only one, however, in a chain of river terminals from St. Paul and

Minneapolis on the Mississippi River, Pittsburgh on the Ohio River and Omaha on the Missouri River to the Gulf of Mexico. As a step in bringing back river navigation every port town, large and small, must build facilities to handle freight between water and rail so that the water-borne traffic can be delivered to the warehouse of the buyer or picked up at the factory the same as rail traffic. There should be developed certain river terminals 300 or 400 miles apart for the long hauls which the river is particularly adapted to make, and these should be publicly owned and operated, their equipment consisting of (1) floating and stationary wharves with unloading, loading and conveying machinery; (2) terminal industrial basins where required; (3) terminal railroad yards; (4) belt railroads; (5) spur railroads extending back from the wharf front at right angles to the river and longitudinal belt trackage—these spurs to be of such length as to connect with the main trunk-line railroad and in such position as to serve existing and proposed industries; (6) car-lighterage or car-ferry equipment for loading direct from car to barge simultaneously with the loading from wharves; (7) freight lighterage equipment consisting of small barges used in the collection of freight; (8) warehouses, elevators and storage yards; (9) manufacturing lofts; (10) drydocks, and (11) paved motor roadways behind the wharves and over the entire wharf front to supplement the belt-railroad service.

How Quantity Competition Can Be Eliminated

H. M. Saumenig Tells Engineers of Chicago Association of Commerce About Americanization of English Quantity Methods

LITTLE DOUBT exists in the minds of many contractors that our present method of duplicating quantities by each contractor in preparing estimates on competitive building work is so wasteful that it will have to be revised at no distant time, according to H. M. Saumenig, who presented recently his solution before the engineers' division of the Chicago Association of Commerce. It is an Americanization of the English quantity methods. Mr. Saumenig would apportion the division of the work on a building between architect, quantity surveyor and contractor as follows:

The architect should prepare the plans and specifications, and the quality of the work contemplated should be absolutely determined by him. The quantity of work should be determined by a go-between —the quantity surveyor—whose function it should be accurately to prepare the quantities; to see that the architect's conception as to quality and quantity is correctly conveyed to the bidders; and to adjust, with the co-operation of the architect, any possible contradictions or obscurities in the plans and specifications which present-day speed and high-pressure methods make liable. Finally, the determining of unit prices and the execution of the actual construction should be by the general contractors and subcontractors under the architect's supervision.

The adoption of the English quantity system in its entirety, stated Mr. Saumenig, under which the owner pays direct for the cost of the quantities, is impractical in this country, for the present at least. You can all picture to yourselves the wail of anguish which the average owner would give if it were even suggested to him that we have quantities prepared on, say, an office building to cost $1,000,000, the quantities for which might cost at least 1½ per cent.

Deal with Contractor

The only manner, in Mr. Saumenig's opinion, in which the quantity system can be inaugurated here is by dealing directly with the subcontractors. This plan would involve the least number of difficulties, as the subcontractor now pays for the cost of the quantities any way, either in preparing them himself, personally, or by employing one or more estimators. Where he does it himself he is taking time away from the direct supervision of work actually in construction, and slighting generally other features of his business which are of equal importance. Where he employs estimators their salaries represent very tangible and substantial overhead. Representative concerns engaged in building construction are quick to realize that such a system as that proposed would ultimately tend to reduce this overhead, stabilize their profits, curb wildcat bidding and unreasonable competition, enable them to bid on more work at less cost, and eliminate losses due to errors in quantities.

Competition in prices is legitimate. Competition in quantities—our present system—is absurd and never can and never will, in any way, change the fact that a certain definitely fixed quantity of labor and material is necessary to complete any contract. There can be no legitimate competition in taking off quantities, except that unfortunate kind which bidders make for themselves when they take off too much or too little.

Any credit man or surety company would vouch for the statement that subcontractors generally are considered among the worst credit risks. The percentage of failures are due not so much to mismanagement as to incorrect estimating. Of the failures due to mismanagement most of these can be directly traced to the excessive amount of time spent in preparing quantities and the consequent neglect of supervision of actual work in progress.

The Owner Pays

It is entirely obvious that, in the long run, the economic debt which is being rolled up by present wasteful estimating methods is inevitably paid by the ultimate consumer, the owner. General losses in any one line of business endeavor cannot fail to affect the final selling prices in that particular trade. These losses in building construction represent the gross of all the quantities left out of all sub-bids, plus the bad debts of material men, plus general contractors' and subcontractors' failures. A great proportion of all these wastes is directly traceable to faulty quantities and needless duplication of estimating.

An owner only deceives himself when he believes that he is getting something for nothing. No amount of inspection or bonding will make a cheap building good or induce a subcontractor, who is endeavoring to save money at the expense of the job, to put in all that is called for.

The adoption of the quantity system would reduce the cost of building construction in three ways: First, a large part of the present excessive and unproductive overhead expense caused by wasteful estimating methods would certainly be saved; second, the subcontractors, who now spend much of their time in preparing quantities, would be more free to devote themselves to effecting economies in the conduct of their building operations and the actual supervision of construction; third, the system would obviate the necessity of adding to bids a sum for contingencies in order to cover possible errors in estimating. Mr. Saumenig is of the opinion that a very good definition of the word "contingencies," as used by subcontractors generally in their estimates, would be "Cost of estimating the jobs I didn't get."

Eliminate "Guesstimating"

When real estimating shall have superseded "guesstimating" general contractors and subcontractors as a body will have made a substantial step forward toward stable and legitimate profits, the architect will have obtained a better finished job that will more nearly represent his original conception, and the owner will have received what he paid for.

It is unfortunate indeed that the building industry, handling as it does such a large proportion of the output of the steel, glass, paint, lumber and slate trades, and practically all of the output of the cement, burnt-clay and cut-stone trades, should be thus handicapped. On the authority of a number of the surety companies, who are at present underwriting contractors' bonds, it may be stated that the successful inauguration of such a system as the one under discussion could not fail to stabilize the building business generally, and should tend largely to reduce the item which bidders now feel called upon to add in order to cover contingencies.

The objection may be advanced by some subcontractors that their smaller and perhaps less capable competitors, under such circumstances, would be placed, as far as the quantities are concerned, on the same basis as themselves. This is true. It is also true, however, that no subcontractor ever made money by under-estimating his quantities, and the contracts that responsible subcontractors now lose, other things being equal, usually go to some one who has left out something. This could not occur under the quantity system. We hear of many instances, these days, of work being let for less than cost. What is the result? The sub-bidders, whose quantities were assumably correct, are stigmatized as highwaymen and robbers, and the job is completed, perhaps, by the surety company which furnished the bond. As a possible consequence there is a new bankrupt added to the already long list. This situation does not help the responsible bidder who rightfully deserved the contract and who would probably have secured it had it not been for his competitor's errors in quantities.

Mr. Saumenig is of the opinion that the majority of financially responsible and competent general contractors and subcontractors in Chicago would much rather see more competition, with all bidders figuring on the same quantities, than to be "up against" the haphazard methods now in vogue, where the successful bidder is frequently the one who has succeeded in leaving out the most items.

Japan's Railway Mileage amounted to 5944 miles on March 31, according to a recent consular report. There was a gain of 265 miles during the fiscal year 1914-15.

Wire Cables of Various Types and Materials Tested by U. S. Bureau of Standards

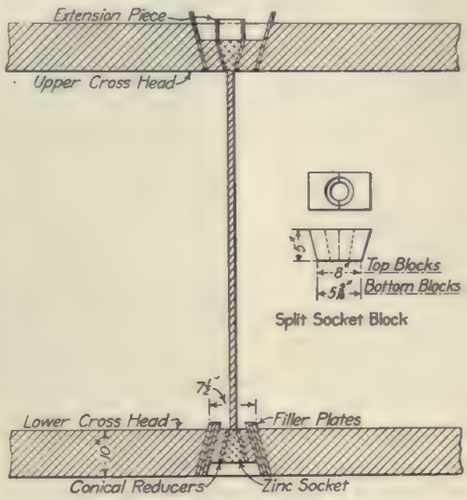
Methods of Preparing Specimens for Test Described—Results of Different Groups Show Wide Variations of Strength

TESTS of wire cables in three extensive series have been completed by the U. S. Bureau of Standards in a practical investigation carried on mainly for the Isthmian Canal Commission. The following description of the preparation of the test specimens and tables giving the results of tensile tests of 165 cables in series 3, ranging in diameter from ¼ in. to 1½ in., is taken from data furnished by the bureau.

PREPARATION OF SPECIMENS

In making a tensile test it is essential to insure unity of action of the strands and component wires, that the cable be free from bends, that the pulling force be truly axial and that the strands and wire be firmly held at the ends. A number of grips and end sockets have been devised to attain as high an efficiency for the combined strength of the individual wires as practicable and the simultaneous rupture of as many of the strands as possible. The length of specimen is important, many engineers advising 25 ft. or longer, but practical considerations fixed the length of specimens used at about 6 ft. 6 in.

Zinc sockets were used throughout in making the tests. The cables were prepared for making these sockets by first wrapping lightly for an inch or two with soft wire, both at the ends and at points varying from 5½ to 9 in. or more from the ends according to the length of the socket. After winding, the cable was inserted in the molds, the ends were unraveled, the rope core was removed and the separate wires were wiped clean with waste and gasoline. In the larger sizes unusual care is required in the cleaning, as even a slight amount of grease or rope lubricant causes slipping at high stresses. The cable may be dipped in a strong solution of caustic soda, or for a few minutes in a solution of hydrochloric acid.



SOCKET BLOCKS AND INSERTION IN TESTING MACHINE

Split socket blocks of drop forged steel with finished surfaces are held by filler plates. Conical reducers used for smaller cables, and extension pieces for the longer sockets on the 1¼-in. and 1½-in. cables.

Commercial spelter melted to a temperature of 400 to 500 deg. C, is then poured around these wires in the mold or socket, which is held in a vertical frame that keeps the cable concentric with the axis. These sockets fit into wedge-shaped recesses in the machine heads, as shown in the accompanying drawing. In the tests of the ¼-in. cables more than 50 per cent failed at or near the sockets. In the majority of cases this was due to the overheating of the small wires, and care should be taken to have the spelter no warmer than is necessary. A number of experiments showed that better breaks can be obtained for small-diameter ropes by simply unwinding the strands and bending each strand back upon itself without further bushing.

DESCRIPTION OF SPECIMENS—RESULTS OF TESTS

The 165 cables, for which results are here given, varied in diameter from ¼ in. to 1½ in., and in nature of construction from the more usual six-strand, nineteen-wire type to the eight-strand, nineteen and six-wire type. The results for tensile strength are averaged in groups in Table 1. The original tables include the reduction in diameter and percentage of elongation under loads below the ultimate, but space limitations preclude their inclusion here. The average lay and average size of the hemp core for the various sizes of cable are as follows:

Size of cable, in.	Lay, in.	Hemp core, in.
¼	2	1/16
5/16	2¾	1/8
⅜	3¾	5/16
½	4½	¼ to ⅜
5/8	5½	5/16
¾	6½	7/16
⅞	6 to 8	½
1	7¼ to 9	5/8
1¼	7 to 10	¾
1½	11 to 12½	¾

The tests of individual wires for some of the ⅝-in., 1¼-in. and 1½-in. cables have been averaged and are given in Table 2,

TABLE 1—RESULTS OF TEST OF WIRE ROPES AND CABLES

Description	Number tested	Total load, lb. Min.	Aver.	Max.	Net section, average, sq. in.	Unit stress, lb. per sq. in. Min.	Aver.	Max.	Strands and wire
Twelve ¼-Inch Wire Ropes									
Swedish iron	1	...	2,920	.....	0.017	.....	167,800	.....	6-19
Tiller ropes	3	2,238	2,340	2,440	0.017	130,700	141,000	152,500	6-42
Crucible cast steel	8	4,200	4,800	5,610	0.024	183,400	198,200	216,000	6-19
Eleven ⅜-Inch Wire Ropes									
Swedish iron	1	.....	4,585	.....	0 060	.....	75,900	.....	6-19
Tiller ropes	1	.....	4,460	.....	0.039	.....	115,000	.....	6-42
Crucible cast steel	2	10,270	10,300	10,320	0.0565	182,000	182,200	182,400	6-19
Galvanized steel	7	3,780	3,940	4,020	0.054	70,500	73,000	76,400	6-7
Eleven ½-Inch Wire Ropes									
Crucible cast steel	3	16,280	17,840	18,960	0.103	157,300	175,600	195,300	6-19
Galvanized steel	3	6,930	7,620	8,000	0.093	77,700	82,000	89,700	6-7
Tiller ropes	5	5,850	6,370	6,780	0.068	81,900	92,700	108,100	6-42
Ten ⅝-Inch Cables									
Galvanized steel	2	12,950	13,190	13,430	0.162	80,700	81,600	82,500	6-7
Galvanized plow steel	1	.....	32,920	.....	0.159	.....	207,000	.....	6-19
Crucible cast steel	3	26,220	26,750	27,170	0.153	169,000	175,400	186,100	6-19
Extra flexible steel	4	24,980	28,060	30,900	Varies	126,700	198,200	249,700	8-19
Eleven ⅝-Inch Cables									
Galvanized plow steel	3	30,480	34,500	36,700	0.148	212,900	232,100	243,100	6-19
Plow steel	1	...	31,200	.....	0.1505	.....	207,300	.....	6-19
Crucible cast steel	3	26,830	27,750	29,150	0.164	162,800	169,200	179,300	6-19
No record	4	28,410	30,670	33,510	0.149	183,500	206,500	233,800	6-19
Eleven ⅝-Inch Cables									
Special hoisting	4	32,250	33,870	35,990	0.157	192,300	217,200	245,000	6-19-6
Extra flexible	4	29,710	30,200	30,680	0.145	203,500	208,400	221,600	8-19
No record	3	29,940	32,400	34,000	0.148	196,900	205,500	210,600	6-19
Eleven ⅝-Inch Cables									
Plow steel	1	...	33,970	.....	0.143	.....	237,100	.....	6-19
Galvanized steel guy rope	1	...	12,426	.....	0.162	.....	76,900	.....	6-7
Extra flexible	2	24,660	24,980	25,300	0.122	198,900	204,100	209,400	8-19
Crucible cast steel	2	30,930	31,480	32,020	0.165	187,400	190,700	194,000	6-19-6
No record	5	30,350	31,510	32,280	0.158	192,200	199,600	204,400	6-19
Eleven ⅝-Inch Cables									
Flat strands	5	34,220	35,540	36,610	0.187	183,300	190,400	196,100	6-25
Plow-steel "digging" rope	1	...	30,200	.....	0.159	...	189,700	.....	6-19
"Digging" rope	2	30,200	30,730	31,260	0.140	210,500	220,800	231,100	....
Hoisting rope	3	25,890	28,380	29,700	0.139	188,400	204,900	227,200	....
Nine ¾-Inch Cables									
Galvanized steel	1	.....	14,190	.....	0.1905	...	74,500	.....	6-7
Plow steel	1	.....	48,030	.....	0.235	.....	204,400	.....	8-19
No record	3	43,500	47,240	49,780	0.214	199,400	221,100	232,900	....
Crucible cast steel	4	36,610	39,210	44,020	0.223	171,900	175,800	179,500	6-19
Twelve ¾-Inch Cables									
Extra flexible	4	36,900	38,930	42,730	0.198	180,300	196,800	216,500	8-19
Tiller rope	1	.....	42,050	.....	0 207	.....	202,900	.....	6-19
Special steel	1	.....	46,210	.....	0.218	.....	212,400	.....	6-19-6
No record	2	40,260	43,040	45,820	0.216	178,000	199,600	222,100	6-19
Crucible cast steel	4	41,680	42,300	43,040	0.240	173,700	176,600	179,300	6-19-6
Eleven ¾-Inch Cables									
Plow steel	1	.....	52,620	.....	0.233	.....	225,900	.....	6-19
Crucible cast steel	2	40,560	41,500	42,450	0.235	172,500	176,500	180,600	6-19-6
Special hoisting	2	33,290	39,970	46,640	0.203	195,400	197,000	198,500	6-19-6
No record	2	44,210	45,330	46,440	0.225	200,600	202,000	203,400	6-19
Extra flexible	4	36,330	41,970	45,300	0.216	182,800	193,600	203,500	8-19-6
Ten ⅞-Inch Cables									
Crucible cast steel	6	48,150	51,620	56,000	0.288	175,100	179,400	186,700	6-19-6
Galvanized steel	1	.....	22,410	.....	...	.....	84,900	.....	6-7
Special	2	64,090	69,550	75,010	0.308	220,500	225,300	230,100	....
Extra flexible plow steel	1	.....	52,560	....	0 256	.....	205,100	.....	8-19
Twelve 1-Inch Cables									
Plow steel	1	.....	62,150	.....	0.328	.....	189,500	.....	8-19
Tiller ropes	2	17,230	17,340	17,450	0.252	67,900	69,350	75,100	6-42
Galvanized steel	2	24,800	26,320	26,850	0.386	61,200	69,700	78,200	6-7
Crucible cast steel	3	66,640	69,050	70,750	0.383	179,100	180,300	182,900	6-19-6
Extra flexible	4	59,110	.....	80,580	0.400	137,200	175,600	211,500	8-19
Nine 1⅛-Inch Cables									
Galvanized iron	2	34,010	34,210	34,410	0 500	65,800	68,500	71,200	6-7
Galvanized steel	2	36,650	44,500	52,350	0.479	79,700	92,300	104,900	6-7
Crucible cast steel	5	78,100	84,220	93,000	0.460	159,600	183,600	206,200	6-19-6
Seven 1¼-Inch Cables									
Extra flexible	1	.....	112,950	.....	0 905	...	124,800	.....	8-19-6
Galvanized steel	2	117,700	120,750	123,800	0.595	182,500	204,450	226,400	6-37
Crucible cast steel	4	96,140	103,560	109,030	0.625	158,800	165,750	178,500	6-19-6
Seven 1⅜-Inch Cables									
Plow steel	1	.....	163,770	.....	0 856	.....	191,300	.....	8-19
Galvanized steel	1	.....	154,550	.....	0.844	.....	183,100	.....	6-37
Extra flexible	1	.....	166,450	.....	1.132	.....	147,000	.....	8-19-6
No record	1	.....	211,700	.....	0 980	.....	216,000	.....	6-19-6
Special steel	3	183,180	185,500	189,900	0.943	194,300	196,700	201,400	6-19-6



FRACTURES OF CABLES OF VARIOUS SIZES

together with the ratio of the average strength of the individual wires to the strength of the cable as a whole. For the ⅝-in. cables these ratios average 1.23, which is a somewhat lower average efficiency than the 85 per cent often assumed by engineers. The larger cables, however, are seen to have very much larger efficiency.

The above data has been furnished through the authorization of S. W. Stratton, director of the U. S. Bureau of Standards, by J. H. Griffith, associate engineer-physicist and J. G. Bragg, assistant physicist. A number of these tests were made, data compiled and computations carried out by N. DeW. Betts, W. C. Campbell, L. H. Losse and H. Kaplan, assistant engineers, and J. G. Bragg and T. H. Holmes, junior engineers in the Technologic Branch of the U. S. Geological Survey.

TABLE 2—RESULTS OF TESTS OF INDIVIDUAL WIRES

Description	Average strength, lb. per sq. in.	Average elongation, per cent in 80 cm.	Ratio to Average strength of rope
⅝-in. special digging rope	253,100	2.0	1.20
⅝-in. hoisting rope	252,300	2.0	1.27
⅝-in. plow-steel digging rope	245,600	4.5	1.28
¾-in. digging rope	270,000	2.3	1.17
¾-in. hoisting rope	272,500	2.4	1.20
1¼-in. plow-steel cable	192,900	..	1.06
1½-in. plow-steel cable	189,500	..	1.04

RED-CROSS ROAD REPAIR SIGNS are one of the "stunts" employed by Jasper County, Missouri, in its good-roads movement, stated J. P. Clarkson at the recent Northwestern Road Congress at Cedar Rapids, Iowa. On his inspection trips the foreman employed by the county for road maintenance and repair work carries a supply of these signs to which are attached two repair form sheets. When the foreman discovers a bad spot in the road he fills out on one sheet instructions to the repair man and keeps the other for the office file. He then tacks the red-cross notice with its instruction sheet up on the fence or tree nearest the part of road to be repaired. These signs serve a two-fold purpose; they show the repair men where work must be done and they tell the traveler that the county officials are aware of the road condition and are going to repair it.

United States Will Capitalize Its Scenery

Newly Adopted Policy of Opening Up Our National Parks in the West Should Bring the Country $50,000,000 Annually

THE ASSETS which this country holds latent in National parks are to be developed and utilized if plans now being considered at Washington are carried to completion. Among those who have really seen something of the National parks, it is generally admitted that if their attractions were more generally known and more readily accessible the custom of visiting them would become much more popular than at present. This belief has at last brought about action on the part of authorities at Washington; plans are being considered for opening up the parks on a large scale, and meanwhile construction is being begun in Yosemite Park on the first of the chain of improvements.

NATIONAL PARKS OF THE UNITED STATES

Name	Location	Area, Sq. Miles	Roads and Trails	Hotel Accommodations
Sequoia Park	California	2,525		
General Grant Park	California	40		Several hotels
Yosemite Park	California	1,124	75 miles roads; 700 miles trails	For 3500 guests
Crater Lake Park	Oregon	159,360		
Mount Rainier Park	Washington	324	84 miles roads	Several hotels
Glacier Park	Montana	1400		
Yellowstone Park	Wyoming	33,480	Sufficient roads and trails	72 hotels
Nesaverde Park	Colorado	640		
Hot Springs Park	Arkansas	14		Sufficient
Platt Park	Oklahoma	47		
Wind Cave Park	South Dakota	312		

SWITZERLAND'S EXAMPLE

Those who urged action on the part of the United States Government pointed out that Swiss scenery has been so advertised that in 1913 it attracted tourist trade amounting to $250,000,000. In that same year the passenger-traffic department of one of the large railroads in this country estimated that the sum of $500,000,000 was annually spent abroad by American tourists.

American scenery is not inferior to that found in Europe, it is asserted, and with proper equipment, management and advertisement, our scenic attractions could turn a large part of the tourist tide from Europe to our Western States. The superintendent of National parks has estimated that an annual saving of at least $50,000,000 would accrue to the United States within a few years under a policy of development which would open up the parks and advertise them adequately.

In contrast to other countries our National parks have never been supported by appropriations calculated to adequately develop and maintain them. On the contrary, when the question of appropriations for this purpose has come up before Congress, the parks have been looked upon as a liability and treated almost as a necessary evil. The money allotted to them, advocates of the new policy affirm, has too often been in proportion to the influence of those who represented the district—or perhaps of those who represented the voting power of the district.

All this is attributed largely to the fact that in such reasonable requests for funds as have occasionally been made, there has been no explanation of the value that such expenditure adds to the country's resources, and no statement of what return on the investment is to be expected.

THE NEW POLICY

This situation is now entirely changed, and although no large appropriations are



NEW ROAD UNFOLDS RUGGED SCENERY OF THE YOSEMITE



YOSEMITE VALLEY AS VIEWED FROM GLACIER POINT



LIBERTY CAP IN YOSEMITE NATIONAL PARK

immediately available for improvements, it can at least be said that officials at Washington are alive to the potentialities of the National parks as a feature in the development of the country. Plans for park development are being worked out on certain fundamental lines; there must be transportation facilities, suitable hotel accommodations inside the reservations, sufficient roads and trails to make the points of interest accessible, and, finally, these improvements must be exploited in a way that will attract tourist travel to them.

It has been shown that those who are allotted concessions in the parks for operating hotels and other tourist accommodations will neither make nor maintain suitable improvements on short-term leases. It was therefore decided that the best scheme is for the concessionaire to build chalets and hotels according to designs prepared under the superintendent of National parks, and then to operate these as concessions under long-term contracts.

Under the new scheme of leasing such concessions twenty-year permits will be granted and the permittees will pay the Government 50 per cent of their net revenues. At the end of the twenty years the buildings are to become the property of the Government. During the term of the lease the concessionaires are to keep their books open to inspectors, who are to see to it that the Government's proportion of profits is fairly represented. This plan insures the construction of only such buildings as will conform to the general scheme of development and will be adequate for the service it is desired to provide.

Relation Between Concessionaires and Government Officials

A most important factor in managing hotel concessions is to be the relation between concessionaires and Government officials with whom they deal. It has been shown that difficulties of operation are certain to arise, and that if concessionaires find themselves in trouble the park officials can do far better by advising with them as to the best solution rather than by considering only the terms of the lease and leaving the lessee to make good in his own way or be ejected. It is planned to arrange the supervision in such a way that the benefits of experience in all of the reservations will be available to each concessionaire. It is thought that this will be greatly to the benefit of each, as well as for the permanent good of the parks.

As to the advertising campaign, it has been decided that the average tourist cannot be expected to read Government reports and bulletins on the geographical formation of the flora and fauna of any particular area, especially if these are in scientific language. To attract the public there must be announcements that in the National reservations are to be seen the deepest canyons in the world, the highest waterfalls, the greatest trees on earth and the oldest living thing known to man. The tourist must be told about transportation facilities, how long it will take to go, how much can be seen in a certain time and how much it will cost.



GOVERNMENT ROAD THROUGH TIMBER LAND OF RAINIER NATIONAL PARK

Work Now in Hand

The general scheme for constructing a sufficient number of chalets in the several parks will be begun in Yosemite Valley in California. Here one large structure on the floor of the valley to cost $150,000 is just being undertaken, while a smaller hotel on Glacier Point will be begun next month. Other mountain inns throughout this reservation are then to be built at the rate of three per year until the chain of twenty-three is complete. About 75 miles of road are to be constructed to bring the park up to the standard of accessibility.

Glacier Park will require about forty-three inns and 60 miles of road, but actual construction will not be undertaken there until the plan as it is being carried out in California has progressed somewhat. A plan has been proposed for the enlargement of Sequoia National Park to take in Mount Whitney and the Kings River canyon. If this is carried through, forty-seven mountain inns will be required to equip that area adequately. Mount Rainier Park will require several inns and about 75 miles of road.

In handling the entire matter of inaugurating a radically new National-park policy the study of what can best be done and how to do it has devolved largely upon the office of general superintendent of National parks, recently created for this purpose by Mr. Lane, Secretary of the Interior. The first appointee to this position is Mark

Daniels, a civil engineer experienced in landscape and highway engineering, who has taken up headquarters in San Francisco and is working out detailed plans for extensions in addition to supervising the work already under way.

Road Oil Test for Loss on Heating Needs Revision

Wide Variations in Evaporation Due to Convection Currents in Heating Ovens Now Used

By NORMAN CHIVVIS
Chief Chemist, Municipal Testing Laboratory, St. Louis, Missouri

IN practically every specification for road oil appears a clause stating that the oil shall not show more than a certain percentage loss when heated a given period at a given temperature. Sometimes the amount of oil to be used is stated and the dimensions of the receptacle specified. The difficulty of obtaining consistent results in evaporation tests has led to the advancement of many methods of performing this test, none of which at the present time seems perfectly satisfactory. It is practically impossible to obtain concordant results in the same laboratory with the present methods. Naturally, results from various laboratories are very hard to compare.

One great difficulty, that of holding a constant temperature throughout the period of the experiment, has been practically eliminated by the introduction of the electric constant-temperature oven with thermostatic control. The Freas constant-temperature oven is one of the best known and is capable of holding a temperature constant to within a few degrees Centigrade for an indefinite period. The dimensions of the receptacle for the oil and the amount of oil used in the test affect greatly the result, as they determine not only the surface exposed to evaporation but also the accessibility of air to this surface. Oil in a very shallow vessel would obviously show a greater loss than the same oil in a relatively tall vessel of similar capacity. This is generally ascribed to the ease with which air currents may pass across the shallow vessel, thus accelerating evaporation.

Effect of Convection Currents

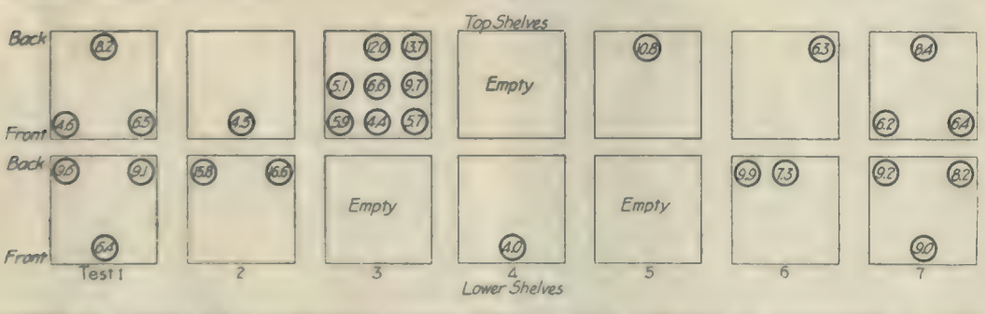
This brings up the point which is generally known, but which has never been given the proper amount of attention—the presence of convection currents set up inside the oven and their effect upon evaporation tests. The standardization of these air currents was the underlying principle of the cylindrical oven, provided with a fan, which appeared on the market some years ago. The fan was intended to produce a constant current of air through the oven. The currents varied, however, from test to test, and results were obtained as confusing as when the box type of oven was used.

An exhaustive series of tests has been made in the Municipal Testing Laboratory at St. Louis, and from the data compiled it is evident that a decided variation in result may be obtained, depending upon the position occupied by the sample in the oven. The possibility of there being any difference of temperature between various points in the oven was considered, but readings taken in all parts of the interior agreed within 2 or 3 deg. C., which is too small a variation to account for the difference in the losses. The oil used in the tests was a light road oil suitable for cold application. This class of oil usually shows a loss of 5 to 10 per cent when heated at 325 deg. Fahr. for 5 hr. Twenty grams were used in each instance. The container was of brass, 1¾ in. high and 2½ in. in diameter; its approximate weight was 40 grams. From the accompanying table and diagram it may be seen that losses varying from 4 to 16 per cent were obtained, depending upon the position occupied in the oven:

VARIATIONS IN EVAPORATION LOSS DEPENDING ON POSITION OF SAMPLE IN OVEN

	Top Shelf	Lower Shelf	Back of Oven	Middle of Oven	Front of Oven
	8.2	9.0	8.2	5.1	4.6
	4.6	8.2	9.6	6.6	6.5
	6.5	9.2	9.1	9.7	6.4
	4.5	9.9	15.8	..	4.5
	12.0	7.2	16.6	..	5.9
	5.1	4.0	12.0	..	4.4
	6.6	9.6	13.7	..	5.7
	13.7	9.1	10.8	..	4.0
	9.7	6.4	6.3	..	6.2
	5.9	15.8	9.9	..	6.4
	4.4	16.6	7.3	..	9.0
	5.7	..	8.4	..	..
	10.8	..	9.2	..	..
	6.3	..	8.2	..	..
	8.4	..	..	..	..
	6.2	..	..	..	..
	6.4	..	..	..	..
Average	7.4	9.5	10.4	7.1	5.8

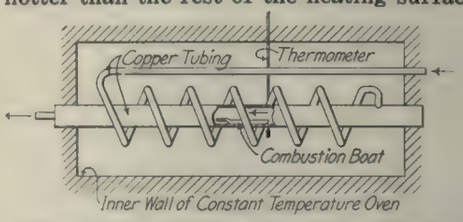
The tests were repeated and the samples placed in approximately the same positions with practically the same results. The positions showing the highest and lowest losses were the same in each case. The table summarizes the results and shows that the highest losses were shown by the samples in the rear of the oven, while the samples toward the front consistently showed the lowest losses. Although no such a decided difference is noticed between the top and bottom shelves, the lower shelf seems to represent higher losses. This condition can be explained if we assume that convection currents were rising in the rear of the oven and descending in the front. In the center was a space of slight motion. This condition would cause high losses to samples placed in the rear of the oven, due to the fact that this upward draft exerts an ejecting action, drawing from the surface of the oil the volatilized fumes and thus increasing the loss.



LOSSES OF WEIGHT ON EVAPORATION VARIED GREATLY WITH POSITION OF CONTAINER IN OVEN
Figures in circles, which indicate positions, show per cent loss.

Naturally, just the opposite effect is experienced in the front position of the oven. The descending current tends to produce a blanketing effect which would retard the carrying off of the volatilized oil, with low loss as a result. At the top of the oven there would probably be a dead air space with little or no motion. What air convection there was would pass across the top of the cans on the top shelf. This condition would tend to produce an intermediate result.

Endeavoring to confirm this view, a small section of the heating coil was replaced by a section of wire of smaller diameter, thus producing a small area which was decidedly hotter than the rest of the heating surface.



COPPER TUBE HEATER WHICH ELIMINATES OBJECTIONS OF ORDINARY APPARATUS

This set up a decided upward draft above the overheated section. Samples placed in this position of the oven showed a loss as high as 26 per cent. This might have been partly explained by the fact that the temperature was higher over this very hot section of the coil, but thermometer readings showed that in all parts of the oven except a few inches over this spot, the temperature was still uniform to within 3 or 4 deg. C., too small a difference, it would seem, to make such a large difference in volatilization.

Copper Tube Heater

The only device which the writer could find described in the literature on this subject which would seem to eliminate the objectionable features of the ordinary apparatus, is that described by Archbutt & Deeley in their "Lubrication and Lubricants." It consists of a straight copper tube 2 ft. long, the shape of an ordinary combustion tube. Near one end a piece of copper tubing ⅜ in. in diameter and 10 ft. long, is brazed into it and coiled as shown in the sketch. The whole is inclosed in any constant temperature oven. A definite amount of oil, 0.5 gram, is weighed into a platinum combustion boat and shoved to the center of the tube. Air is then aspirated through the apparatus at a constant speed of 2 liters per minute during the experiment. It is preheated as it passes through the coil and is the same temperature as the oil as it passes over the boat. Remarkably close checks are claimed for this method; tests of oil showing losses as high as 15 to 20 per cent agree within 0.5 per cent in all cases. This apparatus undoubtedly eliminates the difficulty arising from ununiform air currents, but unfortunately is too elaborate and presents too many difficulties of application to warrant its extended use. Something might be evolved which would obviate the complexity of this apparatus and still secure the benefit of its principle, and place before testing engineers a method which will be free from the objections existing under the present specifications.

A Factor in Asphalt Testing

For heavy oils and asphalts this volatility clause in the specification may not

seem to be so important, but although, in the case of asphaltic cements, the actual losses usually check rather closely, the penetration and ductility on the residue vary within wide limits. This is an important factor in asphalt testing. That it is the presence of convection currents that causes this error is shown by the fact that if baffle plates are placed in the oven and solid shelves fitting closely to the side of the oven are installed, the losses are greatly reduced, and the results are in close agreement. It can plainly be seen, however, that this method results in merely a distillation and not an evaporation. A distillation test could possibly be substituted for the evaporation tests. Certainly it would be much easier to perform accurately.

At present, the two valuable factors for light road oil are volatility and viscosity, and the volatility of light oils is unfortunately the most difficult of the evaporation tests to perform. Of course, the specification for this type of oil can be changed, calling for a lower temperature at which to perform this test. This would reduce the actual error, but the percentage error would remain about the same. However, the value of this test, performed at the higher temperatures, not only on road oils but on all classes of lubricating oils, will justify a great deal of work being done to perfect it and bring it to a point where results obtained by various laboratories will be in close enough accordance to be of more use in evaluating oils than it is at the present time.

Dummies Play Important Part in Fender Tests

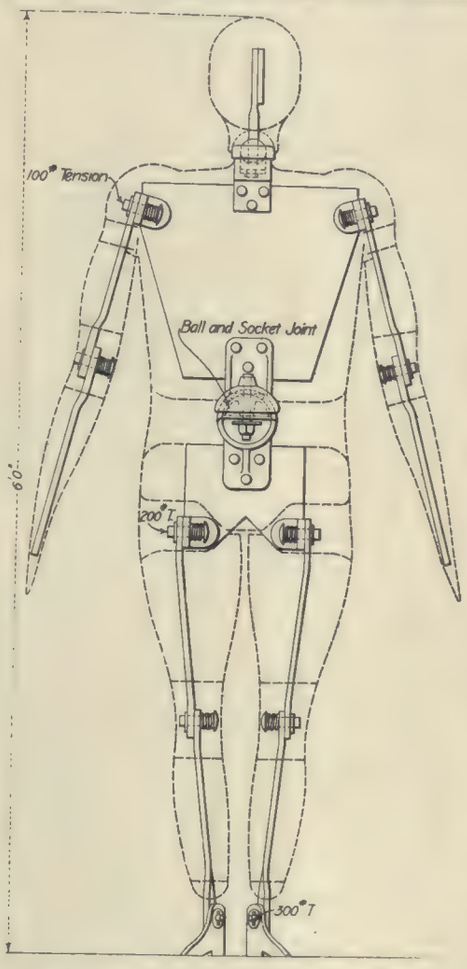
Col. Henry A. Allen, C. E. Fitch and Hugh Borland, Three Chicago Engineers, Draw Up Specifications for Motor-Truck Fenders

THREE Chicago engineers, one from the civil and two from the mechanical field, have recently completed one of the oddest engineering jobs that the city of Chicago has ever called upon its technical men to perform. This work consisted in designing several practical dummies for auto-truck fender tests, conducting the tests and then drawing up specifications for fenders that have real life-saving properties. As a result of the tests the engineers have recommended that the police reports of accidents to pedestrians by automobiles and trucks contain data on forty-six points, ranging from the type of vehicles in the street at the time of the accident to the color of the injured person's eyes. They also suggest that public speed tables be posted in various parts of the city, the tables to give the equivalents of miles per hour in feet per second so that a practical conception of speed may be obtained by the public.

In making its investigation the committee gave attention to the following points: Length of projection in front of truck, protective width, factor of traffic interference, protective height, resiliency, protective efficiency, adaptability to varying road conditions, material and workmanship, strength, durability, reliability of operation, weight, method of attachment, manner of operation, efficiency of mechanism, inconvenience to car operation, appearance, cost. The specifications were then drawn up based on the data obtained on each of these subjects.

Three sizes of specially designed and constructed dummies were used in the tests, one representing a child four years of age, weighing 35 lb., one a boy of twelve years, weighing 80 lb., and another a man, weighing 180 lb. Each fender during the dummy tests was subjected to 168 hits at speeds varying from 3 to 15 miles per hour. The dummies were subjected to more than 2500 hits.

A summary of results show that two fenders allowed no run-overs, three fenders allowed one run-over, three allowed two run-overs, one allowed three run-overs, and two allowed nine and fourteen run-overs respectively. Eliminating the last two fenders, the remaining nine give a protective efficiency against run-overs of 98.2 per cent or better. Of these nine fenders



ANATOMY OF THE FATHER OF THE FAMILY

one was manually tripped all times, two were not adapted to picking up, and a fourth was unsatisfactory in general performance. This left five fenders to be considered as to their compliance with other factors of protection, as well as to the character of results of hits which were not run-overs and not liable to cause grave injury. Each fender, as previously stated, made 168 hits on the dummies, the percentage of pick-ups being more than 85 per cent for all five, one fender attaining an efficiency of 100 per cent. Forty-two of the 168 hits were made at a speed of 15 miles per hour, and the concussion the person run down would receive, regardless of any other results, was certain to be serious.

What the Tests Indicated

The committee drew the following conclusions from the tests.

1. With increased speed the protective efficiency of any fender decreases owing to the effect of concussion.

2. The efficiency of a fender greatly diminishes with increase in speed above 12 miles per hour.

3. A limit in speed can be positively, automatically controlled by various tried types of speed governors.

4. Automatic speed-control devices will not only be advantageous to the safety of the public but also to the trucks.

5. Broad, resilient surfaces of fenders tend to minimize the number of fatal accidents at all speeds, even at high speeds, because of landing a body on a large area instead of on some projecting point of the track.

6. In non-fatal accidents the liability of serious injury to a person struck is greatly reduced.

7. All fenders specially referred to are designed for and were tested under head-on collisions.

8. No fender was presented for test to prevent running in from side accidents.

9. It is doubtful whether any fender can be designed to afford complete protection at a speed of 15 miles per hour or above.

10. Designs of fenders embodying points of merit, other than those herein specially referred to, have been presented to the board, but owing either to lack of mechanical skill or other causes they have not been presented for practical tests.

11. All fenders tested have been designed for and were tested on trucks of 2 tons' capacity or over.

12. No fender has been presented for test suitable for trucks of a capacity less than 2 tons.

13. Various types and designs of fenders have been presented of high protective efficiencies.

14. The probable run-overs may be reduced to 2 per cent and serious injuries to 25 per cent by the use of proper fenders.

The committee, consisting of Col. Henry A. Allen, chairman, Claude E. Fitch and Hugh Borland, recommended that a permanent board under the supervision of the police department be appointed to conduct tests of fender devices believed by such board to warrant the conduct of tests in accordance with the recommendation of this committee and the terms of the city's ordinances and specifications. It is interesting to note that the aid of the engineers was invoked by the request of Chief Healy and Major Funkhouser of the police department.

GROSS OPERATING REVENUES FOR AUGUST on the large steam railroads of the United States, according to a bulletin issued by the Bureau of Railway Economics, were $1,191 per mile, showing an increase of $17, or 1.3 per cent, as compared with August, 1914. Operating expenses were $765, a decrease of $23, or 3 per cent. Net operating revenue, therefore, was $426—an increase of $40, or 10.2 per cent, and operating income was $375—an increase of $39, or 11.4 per cent. The gain was, however, to a large extent confined to the Eastern and Southern districts, the Western gaining only 3.9 per cent per mile. The operating ration for the whole country was 64.2 per cent, as compared with 67.1 per cent in August, 1914, and 68.8 in August, 1913. Considering the three main districts, the respective ratios for August, 1915, and August, 1914, were as follows: Eastern district, 63.6 and 67.3; Southern, 67.6 and 74.1; Western, 63.1 and 64.5.

Development of New York's Rapid Transit System Resulting in Dual Contracts

New Lines Now Being Completed After Much Legislation, Continued Litigation and Agreements Between City and Companies

THAT New York City will soon enjoy the benefits of one of the finest rapid-transit systems in the world, judged from the standpoint of efficiency in service through well-chosen routes combined with speed and capacity for handling the hundreds of thousands of passengers per day that have to be transported, is promised by the rapidly approaching completion of the comprehensive dual system planned by the Public Service Commission of the First District, New York. A history of the development of this system, its ultimate facilities and value, and the difficulties encountered in the long struggle to obtain for the Greater City adequate transportation at fair cost is of immediate interest in connection with the current descriptions of the engineering construction now appearing in this journal. The following facts have been abstracted chiefly from a paper by Daniel L. Turner, deputy engineer of subway construction, printed in the June issue of the *Public Service Board.*

RAPID TRANSIT COMMISSION

The first elevated railroad in New York City, and in the world, was constructed in 1868. Not until the Rapid Transit Act of 1891, however, was a self-perpetuating permanent commission empowered to lay down routes, make plans and offer fully developed perpetual transit franchises for sale at public auction established. The effective feature of the next act, passed in 1894, was the provision for municipal construction and ownership. Alexander E. Orr was the chairman of the Rapid Transit Board then created, and it was under his direction and that of his chief engineer, William Barclay Parsons, that the routes were fixed upon, the plans were prepared and contract No. 1 for the first city-owned subway was awarded to J. B. McDonald on Feb. 21, 1900.

As noted in the Engineering Record of Nov. 29, 1902, page 505, this first subway was the work of about 118 engineers. A total of about forty-six miles of underground track and about eleven miles of elevated track were completed in 1902. The shop drawings, based upon working drawings prepared in the office of the chairman of the board, were made by the steel contractor, the American Bridge Company.

EXTENSIONS TO SERVE GREATER NEW YORK

As soon as contract 1 was under way, the board sought authority from the New York Legislature to extend its functions to all parts of Greater New York. The necessary law was enacted April 23, 1900. The board immediately prepared the plans and entered into contract 2 on July 21, 1902, providing for the extension of the subway to Brooklyn. The cost of this extension was estimated at from $8,000,000 to $10,000,000. The Rapid Transit Subway Construction Company bid $2,000,000 for construction and $1,000,000 for real estate and terminals. This led the board to believe that the great value of the operating rights was being appreciated at last, and therefore that the solution of the transit problems was at hand. Consequently it laid out a comprehensive system of routes intended to serve the whole city and endeavored to construct some of them.

The Elsberg amendments to the Rapid Transit Act, passed in 1906, although not generally recognized as having done so because construction was halted, really marked another advance step. They provided that the Board of Estimate and Apportionment should approve transit matters. Heretofore it had been possible only to construct transit lines with city money, while the new amendment made it possible also to equip and operate with city money. On the other hand, the Elsberg amendments limited the lease to twenty years with one twenty-year renewal. This was disastrous to transit progress, as capital could not recoup itself in this short time. For although city money was being used to build the subways, the carrying charges were immediately transferred to the operator, who, therefore, had to assume the cost burden practically to the same extent as if he had furnished the money in the first instance. The operator's own contribution to the project came in last. For this reason additional transit facilities were again blocked, and all further efforts of the Rapid Transit Board were in vain.

PUBLIC SERVICE COMMISSION

The law creating the Public Service Commission was passed in 1907. This law brought a new era. The commission for the First District, comprising New York City, was given sweeping powers of regulation and control over existing public utilities, as well as those which it brought into being. The Rapid Transit Board disappeared, and the new commission, with William R. Willcox as chairman, immediately took up the transit problems. In spite of its great powers innumerable obstacles interfered with rapid progress and it was found necessary to obtain more amendments to the Rapid Transit Act.

The defect in the Elsberg amendment was overcome in the Rapid Transit Act of 1909, which was finally passed, by recognizing that the contractor was entitled to be recouped for his expenditures before the city could exercise its short-lease privileges. Therefore it was provided, in case the city should recapture after a minimum period of ten years, that the contractor's expenditures should be returned to him with 15 per cent additional.

Another stumbling block which was disclosed by the negotiations with existing companies which were carried on by the commission and the Board of Estimate during 1910, 1911 and 1912, was the inability to amalgamate the old and the new lines into one continuous system. Consequently, in 1912, other amendments to the Rapid Transit Act were obtained, making it possible to add to the existing facilities. This was the last legislative step necessary.

NEGOTIATIONS AND FINAL CONTRACTS

In June, 1910, the Interborough Rapid Transit Company and the Manhattan Elevated Company submitted the so-called triborough system proposition, described in the Engineering Record of Sept. 10, 1910, page 289. In 1911 a joint committee of the Public Service Commission and the Board of Estimate took up with the Interborough Company's officials the proposition for joint construction of new subways and equipment and operation by the company made in December, 1910. In March, 1911, the Brooklyn Rapid Transit Company made a proposition for operation over new city-built lines, and a supplementary offer in April conceded all the points demanded by the committee and previously refused by the Interborough officials. These main points included: (1) Estimating of operating expenses on cost per passenger, not on car mileage, (2) inclusion in the construction accounts of cost of real estate and easements, (3) exclusion of banking discounts from cost of construction, and (4) right of the city to transfer lines recapturable after ten years to a second operator. The Interborough Company then finally conceded the necessary points to the city, and on March 19, 1913, Edward E. McCall, the newly appointed chairman of the Public Service Commission, Theodore P. Shonts, president of the Interborough Rapid Transit Company, and Timothy S. Williams, president of the New York Municipal Railway Corporation (the Brooklyn company), signed the dual system contracts.

DUAL SYSTEM CONSTRUCTION

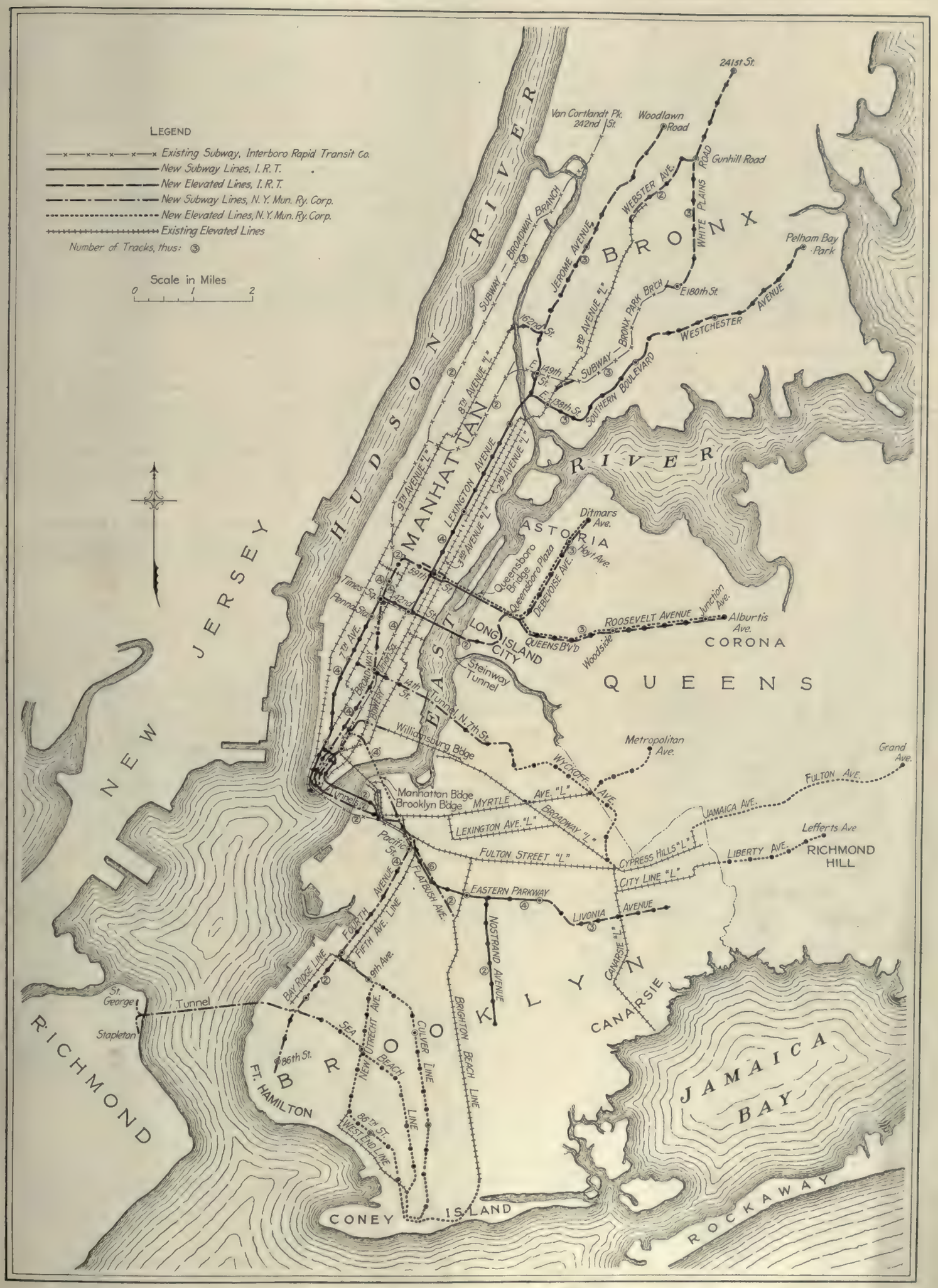
The five boroughs which constitute the Greater City, combined on Jan. 1, 1898, are Manhattan, the Bronx, Brooklyn, Queens, and Richmond on Staten Island. They form a city approximately included in a semi-circle of 18 miles radius. The real community center of the Greater City lies south of Fifty-ninth Street, between the Hudson and East Rivers in the borough of Manhattan. The active life of the Greater City, which spreads over 327 square miles, is concentrated here into an area of about 8 square miles. A comprehensive municipal transit system must join all the boroughs together and make them equally accessible to this community center. These are the chief functions of such a system from the city-plan standpoint. The dual system aims to accomplish this ultimately.

The existing Manhattan Elevated system below the Harlem River was constructed between 1868 and 1880; the Bronx portion of the Manhattan system between 1885 and 1891, and the existing Interborough subway between 1900 and 1904. These systems were designed to serve only Manhattan and the Bronx, which then constituted New York City. Similarly, the Brooklyn elevated lines, which were built between 1885 and 1894, were intended to serve Brooklyn alone.

Upon these existing lines as a foundation, the new plan has been formulated, with the primary purpose of furnishing all sections with direct service through the community center. As shown on the acompanying map, the Interborough company's system will furnish rapid transit for Brooklyn, Manhattan, the Bronx and Queens. The Brooklyn Company's system will do the same thing for Brooklyn, Manhattan and Queens, and ultimately will also serve Richmond. In this way a dual system serving the whole city has been created.

MILEAGE, INCREASED SERVICE AND COST

The enlarged system to be operated by each company will thus consist of its existing systems extended (1) by adding



MAP OF GREATER NEW YORK, SHOWING EXISTING SUBWAY AND ELEVATED LINES AND NEW LINES OF THE DUAL SYSTEM

tracks to its existing lines, (2) by extending its existing lines farther out into new territory, and (3) by constructing new city-built subways and elevated structures. The existing subway and elevated single-track mileage is: Interborough Company, 191 miles; Brooklyn Company, 105 miles; total, 296 miles. The added single-track mileage as extensions to existing lines is: Interborough Company, 21 miles; Brooklyn Company, 45 miles; total, 66 miles. The single-track mileage of the new subway and elevated systems is: Interborough Company, 149 miles; Brooklyn Company, 110 miles; total, 259 miles. The total new single-track mileage, including additions, extensions and new lines is, therefore, 325 miles, and the grand total of single-track mileage is, for the old and new lines incorporated under the dual system, 621 miles.

ROUTING

The method of routing a system has a most important bearing on its territory-serving qualities. At present there is one four-track trunk subway traversing Manhattan, as noted on the map. With the new subways completed there will be three such four-track trunk lines, with collecting and distributing branches in Brooklyn, the Bronx and Queens. All these four-track lines through Manhattan have been designed to develop a two-way traffic movement. For example, now there is a total of twelve tracks through the community center, five used by empty and seven by full trains. The dual system adds a total of nineteen tracks through the community center, five used by empty and fourteen by full trains. Thus 75 per cent of the additional tracks will be utilized for the movement of full trains.

By this means the dual system subway service alone will be nearly five times as great as the present subway service. This enormous increase in subway capacity, together with the increase in the old lines, produces a capacity for the dual system, old and new lines combined, three times as great as on the existing lines. The Greater City will be served by 332 more stations than at present; the total number of such stations will be increased from 179 to 511, or nearly trebled. Simultaneously, therefore, the dual system will practically double the single-track mileage, will treble the capacity, and will treble the territory-serving ability of the existing facilities.

To complete this project will cost the Interborough Company for construction and equipment, $105,000,000; the New York Municipal Railway Corporation for construction and equipment, $61,000,000, and the city for construction, $164,000,000; a total of $330,000,000.

The dual system not only meets the immediate requirements, but also provides for the future. Whenever new lines are needed the city can construct them, and the companies are required by their contract to operate them. The city, however, assumes any operating deficit.

Architectural Effects Secured in Glens Falls Arch Bridge Over Hudson River

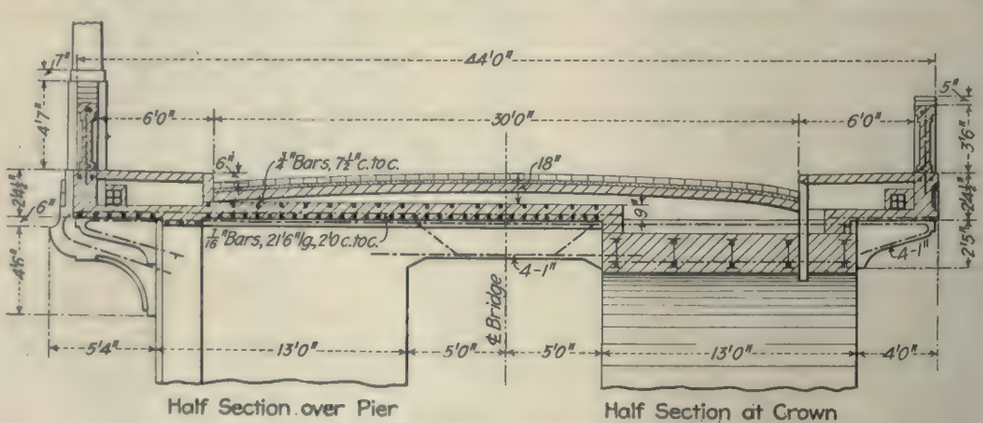
Effective Railings, Curved Brackets and a Special Spiral Stairway Feature Reinforced-Concrete Arch Bridge of Striking Appearance

THE new Hudson River bridge at Glens Falls, N. Y., combines excellent architectural appearance with comparatively low cost. Simple and effective design of the railing or balustrade and the supporting sidewalk brackets, and the use of heavy pylons at each end and graceful concrete poles to support the trolley wires, make a structure of unusual appearance. The reinforced-concrete spiral stairway on one side leading to Cooper's cave near the center of the structure is unique, and seems to merit a rather detailed description. When completed this stairway will have a bronze railing to insure safety in use and add further to the appearance.

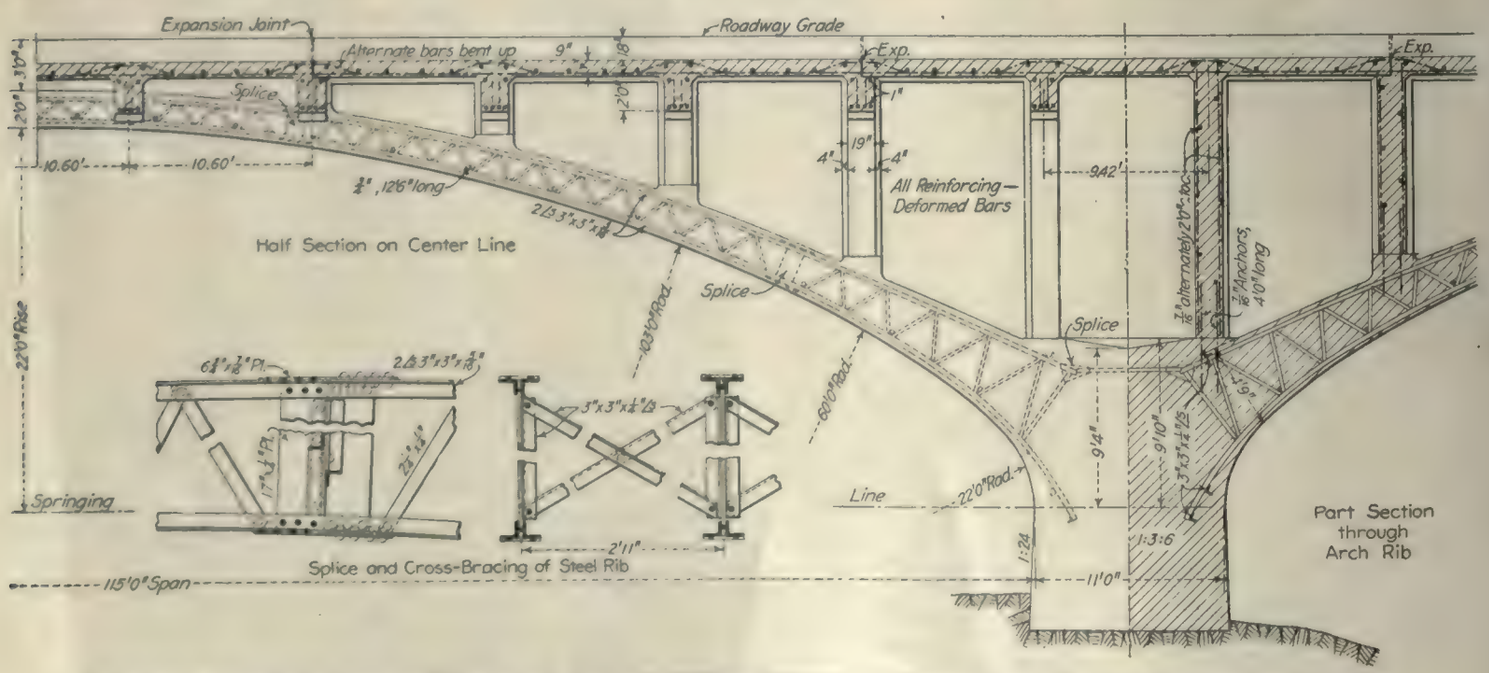
The bridge is on a main highway to Lake George and carries a single-track trolley line. It is much frequented by tourist travel, and hence the slight added expense for architectural effects is considered wholly justifiable. In order to provide continuous traffic over the old bridge at the same site, one-half of the new bridge was erected first, the roadway beams being designed to act as cantilevers until the second half was finally completed after traffic had been diverted to the half first constructed. The easterly rib was built first, and each rib constructed in three sections—the section at the crown first, then the two end sections simultaneously.

LOADS AND ALLOWABLE STRESSES

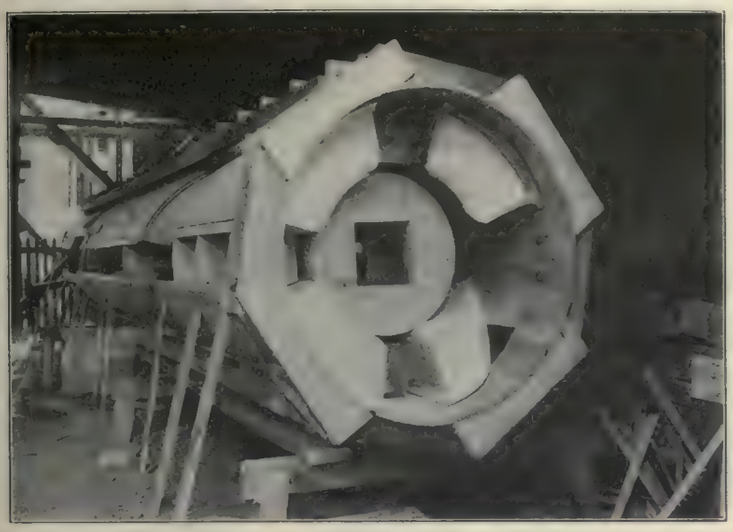
The design of each 13-ft. rib and the floor shown in the accompanying drawings was



HALF-SECTIONS SHOW DETAILS OF ROADWAY AND SIDEWALK SUPPORTS



SECTIONAL ELEVATION AND DETAILS OF BRACING FOR REINFORCEMENT OF RIBS—SPANDREL WALLS FULL WIDTH OF RIBS



SPIRAL STAIR FORMS ASSEMBLED TO CHECK FABRICATION



GRACEFUL APPEARANCE OF ARCHES—STAIRWAY TO ISLAND

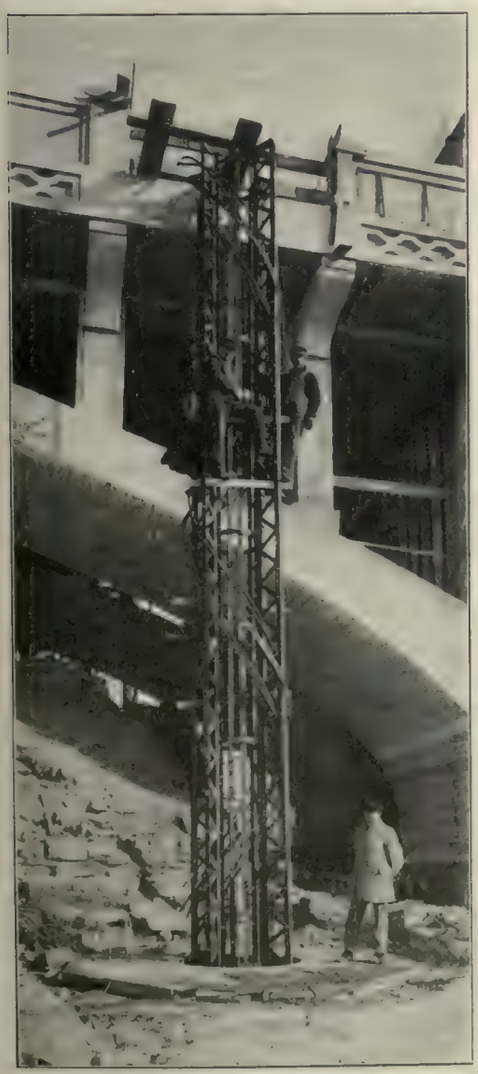
made to provide for a single 40-ton electric car on the track at the center, for 150 lb. per square foot on the balance of the roadway and for 100 lb. per square foot on the sidewalks. Three conditions of loading, as usual, were considered—dead load, half-span live load, and full live load. Each rib is assumed to carry its load uniformly distributed over the width.

The allowable stresses in the concrete are 500 lb. per square inch when temperature effects are neglected, and 650 lb. when temperature effects are included. The elastic ratio between steel and concrete was assumed at 20, and the unit stress in steel therefore does not exceed 10,000 lb. and 13,000 lb. respectively. The outline of the arch ribs was fixed after many trials, applying the elastic theory of analysis, in order to give a center line conforming as closely as possible to the lines of pressure for the three given conditions.

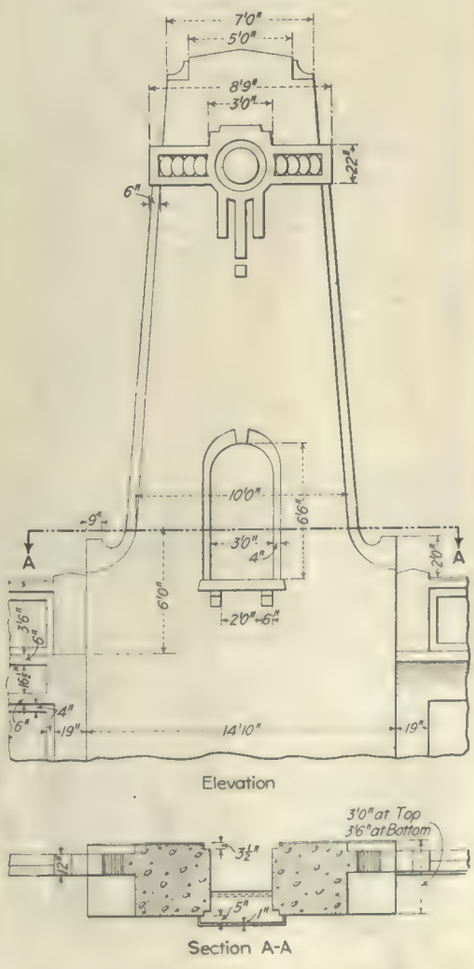
MATERIAL AND PROPORTIONS

The concrete used in the structure was of three grades: (a) 1:2:4 mixture, with broken stone passing a 1½-in. ring, used for the arch ribs between skewbacks, for floor slabs, girders and brackets, for the upper 4 ft. of the transverse walls cast as a monolith with the girders, and for copings, cornices, parapet walls, railings and lamp posts, sidewalks and curbs; (b) 1:3:6 mixture, with broken stone passing a 2-in. ring, used for spandrel walls, transverse walls that do not carry brackets, and for the lower parts of transverse walls which do carry brackets; (c) 1:3:6 mixture, with broken stone passing a 3-in. ring, used for foundation courses and retaining walls, and for abutments, piers and pylons.

Expansion joints located as shown on the accompanying drawings marked the points for discontinuity in placing the concrete, and the walls were carried up to the bottom of the floor slabs. A single layer of two-ply tarred felt was used in the hori-



STEEL REINFORCEMENT FOR MAIN SHAFT OF SPIRAL STAIRWAY



DETAILS OF ORNAMENTAL PYLON



ORNAMENTAL SPIRAL STAIRWAY
Handrail of bronze to be added

zontal expansion joints, and vertical expansion joints ½ in. wide were filled with tar paper and pitch.

Details of Arch Construction

The bridge extends in a north-and-south direction and consists of six arch spans, one with a clear span of 90 ft., four with clear spans of 115 ft., and one with a clear span of 60 ft. The retaining walls at the north end are 84½ ft. long, and at the south end one retaining wall is 110 ft. long and the other 41½ ft. long. The total length of the reinforced-concrete structure is 679 ft.

The arches are of the Melan type, the accompanying elevations and sections of the 115-ft. span showing the typical details used. The method of supporting the 30-ft. brick roadway is on concrete slabs by spandrel walls over the two 13-ft. ribs and by reinforced-concrete beams between them, and the cantilever brackets for the two sidewalks are used throughout the bridge except for the arched approach span at one end. One photograph shows the general appearance of the structure; the solid spandrel approach span just mentioned and the large ornamental pylons are at the far end.

Spiral Stair to Island

The island seen in the center of the picture is largely composed of solid rock, and contains a cave called Cooper's Cave, which is somewhat of a curiosity. Access to this island was furnished by the ornamental reinforced-concrete stairway which is shown by the photographs. Some idea of the complicated nature of the form construction is given by the view of the assembled form boxes, which were built in separate units and erected around the steel frame, seen in the other photographs, inside the shell shown partly completed in the trial assembly on the ground.

The four main ribs of the vertical central column of this stair, which makes exactly two complete turns, were each reinforced by two angles laced together and held in place by the five circular hoops shown in the photographs. Five spiral rods and a spiral band reinforce the inside of the steps, and four horizontal rods to each step, not shown in the picture, were cast with the main column, and designed to support the loads by cantilever action. Special attention is called to the smooth finish of these steps, and the beading on the forms, which gave excellent results. The total cost of this stairway, including the bronze handrail not shown, was about $4,000. This is only 2.7 per cent of the total cost of the structure, which was about $150,000.

The bridge was designed by the Concrete-Steel Engineering Company of New York, and its construction supervised by E. H. Harder, resident engineer of that company, It was constructed by Callanan & Prescott, contractors, of Albany.

Dayton's New Garbage-Reduction Plant will have a novel dryer with the feed end maintained at a cooler temperature than usual. The idea is to save an additional amount of grease, according to a statement by J. E. Barlow, director of public service, in a paper presented to the American Society of Municipal Improvements. No attempt will be made to recover the "stick" liquor, which will be run out over gravel. The plant will have a capacity of 50 tons per eight-hour shift.



THIS DESTRUCTION IS ATTRIBUTABLE TO FAILURE TO PROTECT THE SAND BEYOND PAVEMENT WITH SODDING

Galveston Adopts Plan to Strengthen Its Waterfront Defense Against Future Storms

Fill Back of Sea Wall to Be Retained by Fourteen-Foot Concrete Bulkhead at Edge of Brick Pavement

FOLLOWING the severe storm of Aug. 16-17, this year (see Engineering Record, Aug. 28, 1915, page 271), Galveston County, Texas, called in Brig.-Gen. H. M. Robert, U. S. A. (retired), to advise on the measures necessary to prevent again the destruction of the boulevard pavement back of the sea wall. General Robert reported, under date of Oct. 11, advising that the present brick pavement be widened 30 ft.; that is, extended to a distance 100 ft. back from the back of the wall, and that at its edge there be built a reinforced-concrete sheet-pile bulkhead, 14 ft. deep, to prevent undermining. This plan has been adopted by the county. The recommendation that 20,000 tons of rock be placed at the toe of the sea wall to protect it from undermining, and from exposing the first row of piles and the wood sheeting to the ravages of the teredo, has also been adopted.

As noted in the Engineering Record of Aug. 28, the sea wall itself suffered no damage, other than the washing away of sand beneath the toe. However, the water blown across the top churned away the sand beyond the pavement wherever it had not been protected by sodding and planting to Bermuda grass. For a length of 6000 ft. it undermined and destroyed not only the full width of pavement, 54 ft., but also the 16-ft. sidewalk, leaving at some places a sheer drop of 6 ft. to the sand at the back of the sea wall. In other places only part of the pavement was destroyed.

Plan Adopted

The plan adopted provides for paving the full width of the county's right-of-way, 100 ft., for its entire length of 14,000 ft., and placing along the outer edge a reinforced-concrete sheet-pile bulkhead, 14 ft. deep and 6 in. thick. This will have a concrete cap, 12 to 15 in. thick and 30 in. wide. Tie rods, 10 ft. apart, will run to a continuous 8 x 12-in. reinforced-concrete deadman buried beneath the pavement 20 ft. back from the bulkhead. Since the greatest depth of scour was 6 ft., General Robert considers a 14-ft. bulkhead ample. By this construction the sand back



AS THIS PICTURE CLEARLY SHOWS, THE BOULEVARD PAVEMENT BACK OF THE SEA WALL WAS DESTROYED BY UNDERMINING STARTING THE BACK EDGE



ANOTHER VIEW SHOWING UNDERMINING FROM REAR—IN PLACES THE BRICK PAVEMENT, CEMENT GROUTED, CANTILEVERED 12 FEET

of the sea wall is fully inclosed, the sea wall and bulkhead protecting front and back and the pavement the top. The pavement will be of the same type as that now used—vitrified brick laid on a hydraulically placed sand, and using cement-grout filler. This construction has given very satisfactory results, part of the pavement laid by this method in 1903 being still in place and in excellent condition. In fact, the only sections of original pavement not now in place are those where grade changes were necessary or where the storm undermined and destroyed them.

It will be noted from the drawings that the pavement grade is made 2 per cent toward the Gulf, thus giving an elevation of 19 ft. at the back edge. This uniform grade will continue down to the top of the sea wall, thus allowing prompt escape of the water. For 75 per cent of the length, however, the sidewalk edge will be raised 4 in. to prevent vehicles from running onto the walk.

The new construction, so far as grades are concerned, is to be applied only where the boulevard has been washed out.

In his report General Robert emphasizes the necessity of planting with Bermuda grass the space beyond the 100-ft. boulevard. This recommendation has been made before, but was generally disregarded. Where this protection was provided there was no undermining, and had it been general there would have been little damage to the boulevard. This matter, however, is beyond the control of the county, and is under the city's authority. The protective power of the Bermuda sod was plainly shown wherever the lawns were cut by shell or sand drives or walks. These were points of weakness. Undercutting started at them, spread under the pavement and to both sides. At the sides, however, the resistance of the sod was so great that the destruction did not go far.

The sodding is accomplished by putting over the sand a 4 or 5-in. layer of loam and planting tufts of Bermuda grass at the corners of 4-ft. squares.

While so far as the county's right-of-way is concerned the recommendations have been adopted, the report points out that the sod protection should be carried back, if possible, to a distance 300 ft. from the sea wall. Further, it has been suggested that at the back edge of the pavement, there be placed a clay mound 2 ft. high and 5 ft. wide at the base and that back of it and from its top there be carried for 100 ft. a 2 per cent grade, the slope to be planted to Bermuda. This would give a ground elevation 200 ft. back from the wall of 23 ft., 6 ft. higher than the wall, thus effectively protecting the city from water from the Gulf. Some water did come over from this direction in the August storm. General Robert heartily indorses the suggestion. Its execution would depend on the city, but sentiment in Galveston is hardly such as to insure the carrying out of the work.

The new work will be carried out under the direction of R. M. Sias, county engineer.

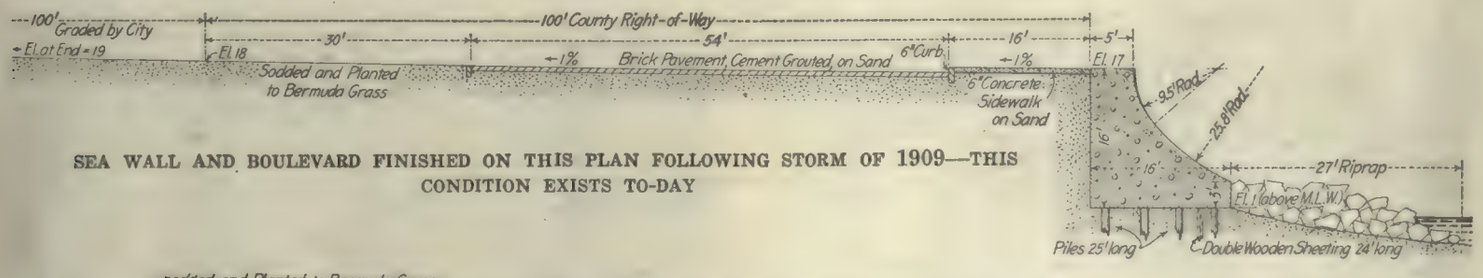
Urge Construction of Pacific Coast Military Road

AS AN ECHO of the resolutions recently passed by the Pan-American Road Congress in Oakland, Cal., a San Francisco newspaper prints the following communication, received from a local engineer, urging the construction of a Pacific Coast military road:

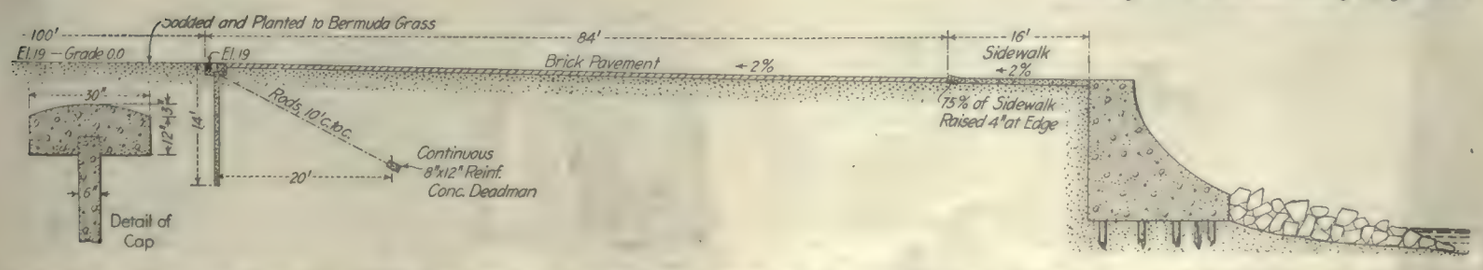
"One of the most important elements in a comprehensive scheme of defense of an extended coast line is the existence of an adequate system of lines of communication. While the value of railways for this purpose will always be great, the relative importance of good highways has been vastly increased by the introduction and general use of the many forms of motor-propelled vehicles.

"During our Civil War campaigns were planned only for those seasons of the year when normal weather conditions promised passable roads. Even then operations of vast import often were aborted or impeded by untimely rains. Now that the consumption of munitions is on such an enormous scale the problem of transport, always a difficult one, is far more serious than formerly. Clearly the army mule—our main reliance in the past—will be wholly inadequate in the future. Moreover, although the mule team could be utilized to some extent even on the worst of muddy roads, the use of motor vehicles makes good roads absolutely indispensable. These, of course, must be constructed before the outbreak of hostilities.

"Without doubt any attempt at actual invasion of our western mainland would be aimed at San Francisco, at once the commercial and financial metropolis of the Pacific Coast and the point of greatest strategic value upon our entire coast line. It is a matter of simple prudence, therefore, that every possible landing place within practicable distance both north and south of San Francisco should be made readily accessible to our defending army by means of easy and permanent roads. The trunk line of this system should be located out of range of observation and of gun fire from the ocean, with branches leading to all positions commanding the landings that would be occupied by our forces. It would, therefore, seem highly desirable to invite the co-operation of the National Government in this matter. A recommendation to Congress on the subject would be timely and quite in order."



SEA WALL AND BOULEVARD FINISHED ON THIS PLAN FOLLOWING STORM OF 1909—THIS CONDITION EXISTS TO-DAY



PLAN RECOMMENDED OCT. 11, 1915, AND ADOPTED INCREASES WIDTH OF PAVEMENT AND PLACES CONCRETE BULKHEAD AT REAR EDGE

Tests Show How Loads Are Distributed on Reinforced-Concrete Slab Floors

Percentages of Concentrated Loads Above Joists Carried by Adjacent Joists and Effective Width of Slab Determined

OWING to the indeterminate nature of the distribution of the actual concentrated loads on highway bridge floors, and in order to obtain test data upon which rational design of reinforced-concrete slab floors can be made, three series of tests have been conducted by the highway department of the State of Ohio. The results are published in Bulletin 28 of the department, recently issued. Both laboratory and field tests are included—one laboratory series and one field series to investigate the distribution of concentrated loads to the joists, and one laboratory series to determine the load distribution across the slab and the effective width. The abstract which follows includes the principal results and the final general conclusions which seem to be justified by the tests.

With the exception of the dead loads, practically all heavy loads, such as the wheels of a road roller or heavy motor truck, on highway bridge floor are concentrated on small areas. In the design of reinforced-concrete floors, therefore, there are two assumptions which must be made: (1) In designing the supporting joists or stringers, the proportion of a concentrated load on the slabs carried by the joist immediately below it; (2) in designing the floor slab itself, the width of the slab which may be considered as carrying a concentrated load resting upon it. A satisfactory theoretical solution of these questions is impossible, as it involves the elastic properties of concrete and steel in flat slabs and beams with multiple supports, and requires so many assumptions that any results thus obtained would be little better than assuming the distribution at once.

TESTS FOR LOAD DISTRIBUTION TO JOISTS

The laboratory tests for determining the distribution of concentrated loads to supporting joists were made on 5 x 8-ft. slabs. Two 6-in. slabs, one 7-in. slab and one 8-in. slab with ¾ per cent reinforcing, and the same series with 1 per cent reinforcing, were made. All but two were also reinforced with a layer of wire netting of 6-in. mesh, made of No. 9 and No. 11 wire. The main reinforcing rods were placed parallel to the 8-ft. dimension of the slabs, which were cast on three lines of 10-in., 25-lb. I-beams as joists, spaced 3 ft. 6 in. center to center. These beams were supported on end I-beams 12 ft. apart corresponding to floorbeams in a bridge, as shown in one of the accompanying photographs. The I-beam joists were supported on ¼-in. rods as knife edges on the top of the cross beams.

The load was applied to a paving brick bedded in mortar at the center of the slab over the middle joist, by means of a simple beam acting as a lever. An upward pressure was exerted on the lever on one end through a screw jack resting on the weighing table of the testing machine, which produced a downward pressure at the other end on the brick. The lever was held down between the slab and the testing machine by two 1¾-in. rods anchored into the floor.

During the tests, both the elongations of the extreme fibers of the I-beam joists and the deflections at the middle were taken. Calibration runs were made on each beam without the slab with a single concentrated load in the middle, for the purpose of determining the value of the coefficient of elasticity for each beam. The slabs were centered on the 12-ft. span and bedded in cement mortar spread on the tops of the I-beam joists in order to secure an even bearing on all the beams. The test loads were applied in increments of 2000 lb. until a total of 20,000 lb. was reached.

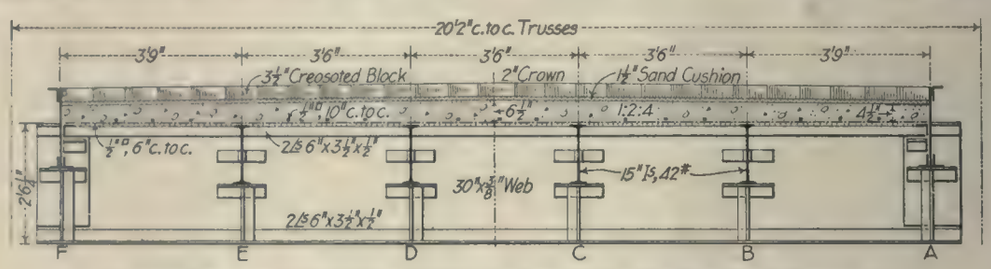
RESULTS OF LABORATORY TESTS

The results of these tests, in terms of equivalent uniform load (assumed distributed over the 5-ft. length of bearing of the slab) computed from the elongations of the lower fibers of the I-beams, and the percentages carried by each beam, are given in Table 1. The percentages carried by the middle beam are shown in the accompanying diagram. The results given are based upon the 20,000-lb. load, as the curves between load and deformation and load and deflection both very closely approximate straight lines, and therefore the equivalent loads will be fixed percentages of the total load for each test and the percentages will not vary with the amount of the load.

It is worthy of note that in Table 1 the sums of the three percentages given for each test are less than 100 per cent, or in other words, that less than the whole of the load is accounted for by the assumption of the 5-ft. uniform distribution along the joists.

FIELD TESTS

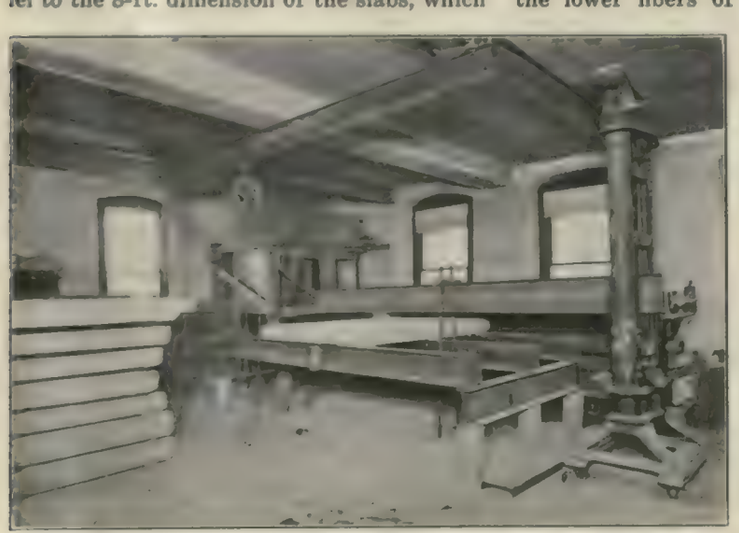
A series of tests were made on the floor of a ten-panel Warren truss bridge, 205 ft. long, center to center of end pins. The roadway is 18 ft. wide between curbs. The floor is a reinforced-concrete slab supported on I-beam joists, shown in the accompanying cross-section, with a floor surface of creosoted wood block laid on a sand cushion. Since the thickness of the slab varies from 4½ in. at the curb to 6½ in. at the middle, the reinforcing rods shown give 1.19 per cent reinforcing at the curb and 0.76 per cent at the middle.



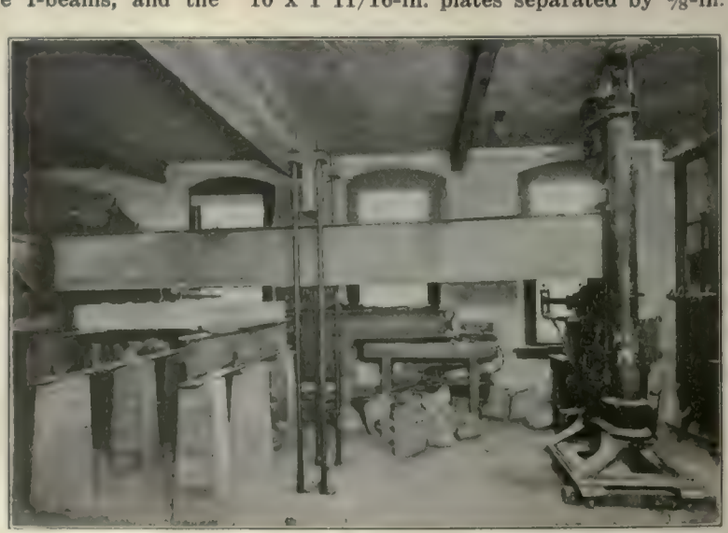
CROSS-SECTION OF THE HIGHWAY BRIDGE FLOOR WHICH WAS TESTED

To determine the load distribution to the joists, the load was applied through a paving brick directly over the middle of the I-beams at points *D* and *E* in each of the two panels adjacent to the center of the bridge, by means of a 25-ton screw jack acting on the foot of a V-frame, which was hung from the adjacent top struts of the upper lateral bracing. The arrangement is shown in one of the photographs.

The amount of load applied was determined by inserting a spring device between the jack and the bridge, as shown in the photograph. This spring was made of two 10 x 1 11/16-in. plates separated by ⅝-in.



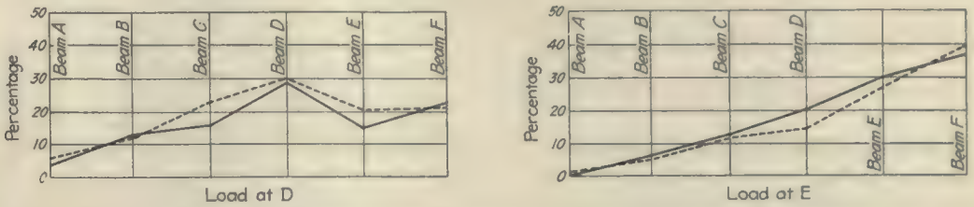
ARRANGEMENT FOR TESTING LOAD DISTRIBUTION TO JOISTS



APPLYING A CENTRAL LOAD TO A CONCRETE SLAB



APPARATUS FOR LOADING BRIDGE FLOOR



AVERAGE COMPUTED PERCENTAGES CARRIED BY EACH BEAM OF BRIDGE FLOOR

fillers at the ends. On each side was fastened a deflectometer which magnified the deflection of the plates 100 times and was read directly on a scale attached to the instrument. It was calibrated up to a load of 20,000 lb. and was sensitive enough to indicate increments of 200 lb. The loads were applied in 5000-lb. increments up to a total of 20,000 lb. at each point. The elongation of the lower fiber of each joist at the middle of the panel was measured with a strain gage.

Equivalent Uniform Loads

Assuming the coefficient of elasticity to be 30,000,000 and reducing the readings to equivalent uniform loads, the values given in Table 2 for the 20,000-lb. load are found. The sums of these equivalent loads given in the last row indicate that the applied loads are nearly uniformly distributed to the beams, as the totals check well with the total load applied.

The equivalent uniform loads are reduced to percentages of the applied loads, the weighted average is computed for each point and plotted in the accompanying diagram.

Special Conditions in This Test

While it has been shown that the deformation in the joists accounts for the total load applied if considered uniform, it is well to inquire whether some unusual conditions conspired to make the concentrated load develop only as much stress as would have been expected had the load been applied uniformly along the joists. It should be noted that in the case of this bridge the floor joists are made fast to the web of the floorbeams, a condition which, together with the continuity of the concrete over the top of the floorbeams, tends to restrain the ends.

For perfect fixed-end conditions a concentrated load at the center will produce a bending moment equal to that produced by the same weight uniformly distributed over a beam without fixed ends. Since the concrete slab is cast partly around the top flange of the I-beam, it may act as a composite beam, depending on whether or not the bond between the concrete slab and the steel flange has ever been broken. These conditions offer an explanation why an actual concentrated load stressed the bottom fiber of the I-beam an amount that would ordinarily have been calculated for the same load uniformly applied. The designer should compare his conditions with those herein described before assuming a longitudinal distribution equivalent to that indicated by the test.

TABLE 2—EQUIVALENT UNIFORM LOADS FOR JOISTS UNDER 20,000-POUND LOAD IN FIELD TEST

Joist	Panel east of center: Load at D	Panel east of center: Load at E	Panel west of center: Load at D	Panel west of center: Load at E
A....	1,180	0	1,480	500
B....	2,340	1,090	2,200	1,460
C....	3,140	2,550	4,240	2,200
D....	5,780	4,020	5,860	2,920
E....	3,580	5,860	3,880	5,640
F....	4,620	7,160	4,520	7,860
Sum..	20,640	20,680	22,180	20,580

TABLE 1—EQUIVALENT UNIFORM LOADS AT 20,000-POUND LABORATORY TEST LOAD BASED ON ELONGATION OF LOWER FIBERS—PERCENTAGES TO EACH JOIST

Thickness, in.	Reinforcement, per cent	Age in days	Load uniformly distributed over 5 ft. for beam: A	B	C	Sum	Percentages for beam: A	B	C	Sum
6	¾	497	4,480	9,990	4,800	19,270	22.4	50.0	24.0	96.4
6	¾	491	4,360	10,350	4,490	19,200	21.8	51.7	22.5	96.0
7	¾	498	4,430	6,220	4,540	15,190	22.2	31.1	22.7	76.0
8	¾	495	4,480	4,970	4,440	13,890	22.4	24.9	22.2	69.5
6	1	327	4,480	9,030	4,890	18,400	22.4	45.2	24.5	92.1
6	1	187	3,960	10,350	4,020	18,330	19.8	51.8	20.1	91.7
7	1	325	4,790	7,050	4,540	16,380	24.0	35.3	22.7	82.0
8	1	607	4,530	7,290	4,510	16,330	22.7	36.4	22.6	81.7
8	1	142	5,000	6,520	4,020	15,540	25.0	32.6	20.1	77.7

Conclusions Regarding Distribution to Joists

The following conclusions regarding the distribution of the concentrated loads on a reinforced-concrete slab to the floor joists seem to be warranted by these tests.

1. The percentage of reinforcement has little or no effect upon the load distribution to the joists, so long as safe loads on the slab are not exceeded.

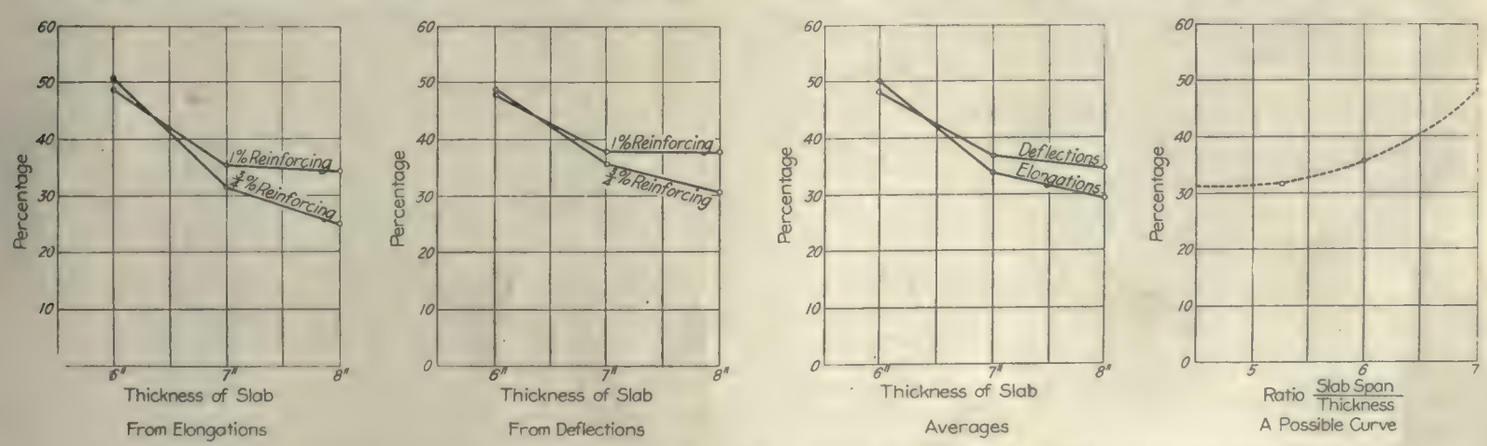
2. The amount of load distributed by the slab to other joists than the one immediately under the load increases with the thickness of the slab.

3. The outside joists should be designed for the same total live load as the intermediate joists.

4. The axle load of a truck may be considered as distributed uniformly over 12 ft. in width of the roadway.

5. If the slab has ample grip on the upper flange of the I-beam and is continuous over the floorbeams, and if the joists are riveted to the webs of the floorbeams, the live-load stress in the joist may be but one-half as great as for a similar load on a plain I-beam supported at its ends.

6. Under these favorable conditions the axle load in a panel of not more than 20 ft. may be assumed as uniformly distributed over two-thirds of the length of the joists to be considered as simple I-beams sup-



PERCENTAGES CARRIED BY MIDDLE BEAM B COMPUTED FROM EQUIVALENT UNIFORM LOADS BASED ON SLAB TESTS

ported at the ends. Without these conditions, the load may be assumed as uniformly distributed over a length of at least 5 ft.

DISTRIBUTION OF CONCENTRATED LOAD OVER SLAB

To determine what width of a reinforced-concrete slab may be considered in designing for concentrated loads, and how far from the point of concentration the load causes stresses in the slab, a series of laboratory tests on three spans, 3½ ft., 5 ft. and 7 ft. were made. Twenty slabs were made and tested, of which fourteen were 7 in. thick and six were 4 in. thick. Various percentages of transverse reinforcement were used. The main reinforcing of all slabs was 1.04 per cent, placed with the center 1 in. above the bottom of the slab.

The concentrated load was applied through a brick at the center of the slab in the same manner as previously described. A photograph of the apparatus is shown. Observations were made of the deflections and of the deformations in the concrete and the steel.

TO DETERMINE EFFECTIVE WIDTH

Defining "effective width" as that width used in designing over which a single concentrated load may be considered uniformly distributed on a line down the middle of the slab parallel to the support, two methods of obtaining this width may be used:

1. The loads causing known deformations in a 1-ft. slab may be used as units for comparison with loads causing equal maximum deformations in the other slabs.

2. The deformations on a transverse section (parallel to supports) may be plotted for any load, and the area under this curve divided by the maximum ordinate to the curve (maximum deformation) will give the effective width.

A material like concrete, with many variations in hand mixing, is so variable that it is thought that the results obtained by the first method are not entirely reliable.

EFFECTIVE WIDTHS FROM DEFORMATION CURVES

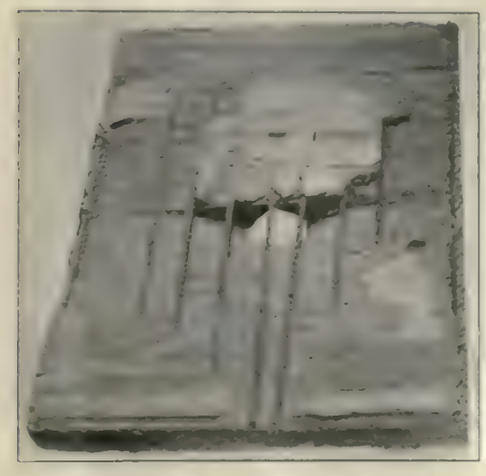
The deformations of the steel and the concrete and the deflections of the slab, on a transverse line down the middle of the slab, were plotted for each load and slab. The area under any one of these curves divided by the maximum ordinate to the curve will give a value of the effective width of that slab for that load. Thus three values of the effective width, one from the deflection, one from the deformation of the concrete and one from the deformation of the steel, are obtained. In nearly all cases the concrete deformation gives a less effective width than either of the others, and the greatest effective width is given by the deflections.

It was found that, in testing, the slabs left the outer edges of the I-beams, due to deflection, showing that the effective span was about equal to the clear span. Table 3 gives a summary of the effective widths in percentages of the clear span, based on unit deformation in the concrete.

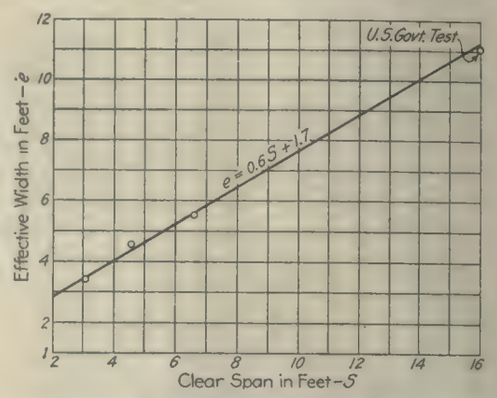
All of the slabs failed by shear—that is, by the brick punching through the slab. Views of the failure of one of the slabs are shown herewith.



TOP OF SLAB AFTER FAILURE



BOTTOM OF SLAB AFTER FAILURE



EFFECTIVE WIDTH OF SLAB UNDER CONCENTRATED LOAD

Table 3—EFFECTIVE WIDTH IN PERCENTAGE OF CLEAR SPAN BASED ON UNIT DEFORMATION IN CONCRETE

Number tested	Thickness, in.	Clear span	Width, ft.	Transv. reinf., per cent	Aver. age, days	Percentage effective width at a unit deformation of 0.0006	0.001	0.0016	0.002	Average up to 0.001 per cent	Average up to 0.001 in.
1	7	3 ft. 1 in.	3.5	Varies	104	98.5	96.0	91.4	91.3	98.1	36.3
3	7	3 ft. 1 in.	7.0	Varies	135	119.6	125.1	113.3	109.2	121.7	45.0
3	7	4 ft. 7 in.	5.0	Varies	146	88.7	83.9	79.3	78.3	87.6	48.2
1	7	4 ft. 7 in.	10.0	0.2	146	107.0	101.6	89.7	85.0	105.8	58.2
1	7	6 ft. 7 in.	7.0	0.2	147	78.3	70.5	65.7	64.0	76.2	60.2
1	4	3 ft. 1 in.	5.25	0.4	42	108.1	108.0	109.0	105.8	107.1	39.6
1	4	3 ft. 1 in.	7.0	0.4	126	113.9	103.6	95.2	92.7	111.7	41.3
1	4	4 ft. 7 in.	7.5	0.4	43	95.2	95.1	86.8	84.0	95.6	52.7
1	4	4 ft. 7 in.	10.0	0.4	80	98.1	96.1	90.9	85.3	98.1	54.0

RESULTS AND EMPIRICAL FORMULA

The results shown in the table indicate a decrease in effective width as the load increases, but this is not marked until after safe loads are exceeded. The effective widths in inches given in the last column are the averages for seven values for deformations up to 0.001 per inch, which corresponds to a unit stress of about 1500 lb. per square inch in the concrete. This is well beyond the safe working values.

The accompanying diagram shows the values of the effective width plotted with the clear span. It is seen that a straight line fits these points fairly well, and until further data are available the following equation may be used with safety:

$$e = 0.6\,S + 1.7$$

where e is the effective width in feet of a slab of greater width than length, and S is the clear span in feet.

This equation is independent of the thickness of the slab. It is worthy of note that the results for the 7-in. and 4-in. slabs indicate that the thickness has some effect on the effective widths, but the effect is small and further experiments would be necessary to determine its value.

Tests on the floor slabs of the 205-ft. highway bridge used for the field tests were made, and the effective width was found to average about 4.5 ft. The equation gives about 3.9 ft. and therefore errs on the safe side.

CONCLUSIONS REGARDING EFFECTIVE WIDTH

These tests of slabs seem to warrant the following conclusions:

1. The effective width is affected very little by the percentage of transverse reinforcement parallel to the supports.

2. It decreases somewhat as the load increases.

3. In percentage of the span it decreases as the span increases.

4. The foregoing formula will give a safe value of effective width where the total width of the slab is greater than 1 1/3 S + 4 ft.

The first series of tests cited was made by G. R. Logue and R. H. H. Spidel, in the testing laboratory of the Ohio State University. Acknowledgment is made of the valuable services rendered by Prof. C. T. Morris and Prof. W. S. Hindman in conducting the tests, which were made under the supervision of Clinton Cowen, State highway commissioner of Ohio, and J. R. Chamberlain, deputy of bridges.

COAGULANT REQUIRED AT ERIE, PA., for the first six-month period of operation of the new rapid filters varied from 0.15 to 0.6 grain per gallon, averaging 0.37 grain. The variations, according to J. S. Dunwoody, superintendent of filtration, were more for experimental reasons than a necessity. The chemical is controlled automatically within 0.006 grain per gallon. Bacteria in the supply average 749 per cubic centimeter, and in the effluent 9. Complete sterilization was effected by using 4.85 lb. of bleach per million gallons. Turbidity of the supply averaged 18 parts per million, varying from 3 in July to 48 in November. Wash-water averaged 3.22 per cent of the net amount filtered.

HINTS FOR THE CONTRACTOR

Details Which Save Time and Labor on Construction Work

Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

[*Contributions to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

Handling Collapsed Sewer Adjacent to New Trunk Line

PARALLEL to the open-cut section of the 16½ x 16½-ft. Mill Creek sewer in St. Louis is an old 4 x 5-ft. brick sewer in poor condition, which has collapsed at several points during construction. Although the two sewers are but 8 ft. apart, it was decided to retain the existing conduit as a sanitary sewer because it carries particularly offensive gas wastes. The photograph shows a typical break. The repair is made by pulling up the steel sheet piling far enough to drain the old sewer into the new one. The ground over the break is then excavated and the old sewer repaired. In order to provide for handling a possible future break in that part of the old sewer already passed, a "Y" has always been built into the new sewer at each break.

C. L. French is resident engineer of the first section along which the brick conduit occurs.



EXCAVATING BEHIND STEEL SHEET PILING TO REPAIR COLLAPSED BRICK SEWER

Improvements in Use of Unloader Plows Developed at Panama

THE UNLOADER plows, used to clear continuous trains of flat-cars of dirt in disposing of material excavated in the dry at the Panama Canal, were covered top and bottom with sheet steel. To save digging the dirt off of aprons accidentally thrown back and covered in loading the cars, a short chain with a hook and a cable grip was used to attach the aprons to the moving unloader line and throw them in advance of the plow. A stretcher frame was erected over the track at the inner end of each dump to overhaul the unloader cable. The cable was attached to this frame by a chain having a soft link and a slip link. These features, which saved much time and trouble in using unloader plows in the Canal Zone, were brought out by Maj.-Gen. George W. Goethals in a paper presented recently to the International Engineering Congress.

When first used on the canal work, the unloader plow was a skeleton with a plate wing. It was weighted down with from 7 to 10 tons of ballast in order to keep it on the bottom of the cars and to prevent it from riding over the spoil. Pieces of rock were continually working under the bottom and over the top of the plow, and as there was no way for the débris to escape except by being ground out, constant damage was done to the car floors and trouble was also caused by the débris catching in the aprons. The plow was covered with sheet steel on the top and bottom and thus the small rock was excluded, while, by an adjustment of ballasts along the share of the plow, 3½ tons of weight were found sufficient to hold the plow on the floor, entirely overcoming its tendency to rise. At first it was necessary to spend several minutes in digging out the end of the cable attached to the plow from the spoil along the face. This waste of time was eliminated by forming grommets of old cable and attaching them to the plows, where they were always in plain sight, so that the unloading cable could be coupled to the grommet without any additional labor. Times was also wasted at first in attaching the cable to and releasing it from the stretching frame, which consisted of two uprights held together and braced spanning the track. A slip link was placed in the chain which held the cable to the stretching frame, and a blow from an iron rod opened this link, allowing the cable to fall upon the car without the train stopping. In this chain there was placed a soft link with a breaking strain of 1½ tons, so that if anything checked the cable in the process of stretching this link would give way and save the cable-stretcher from being wrecked.

In handling material in slides or at other points where it was necessary to uncouple the cars from a train and back them alongside the shovels, the steel aprons that bridged the intervals between the cars were thrown back, in order that the couplings might be parted. In loading, these aprons were frequently covered with a ton or so of soil, and when it became necessary to throw them back in position so that the plow could pass over them, considerable labor was required to take off the spoil. This extra work was obviated by an apron-thrower, which consisted of a short chain with a hook on one end and a cable grip on the other. The hook was placed under the apron and the grip fixed to the moving unloader cable, and thus the apron was returned to its correct position in advance of the plow.

Economy in Use of Fuel Results in Elimination of Dense Smoke

By F. M. LOGAN
Smoke Inspector, Pennsylvania Railroad, Pittsburgh, Pa.

A NEW FIRE may be built under a stationary boiler without the emission of smoke of a greater density than 20 per cent for a period not exceeding two minutes by placing a layer of coal 10 to 14 in. thick over the grates, sealing the fire-box tight and placing on top of the coal a layer of dry shavings or small pieces of wood, being careful to see that the latter is heaviest along the side sheets of the fire-box. After this has been done a quart of oil should be sprinkled over the wood and a piece of old, greasy waste, about the size of the fist, placed in the center of the fire-box to ignite the fire. After doing this the fire door should be left partly open until the fire is burning, when the door should be closed gradually. The hook or scraper should not be used, but the fire should be allowed to take its own course. On lighting the fire, judgment should be used to prevent too much draft, which might draw the shavings away from the top of the coal. If a damper is being used it should be so regulated that a slight draft is created at the beginning, later increasing as the fire begins to burn. If it becomes necessary to apply more coal this should be dampened and placed over the places that have become bright. This method of building a fire produces considerably less smoke than is allowed by the city smoke-prevention ordinance of Pittsburgh, where the writer's work in increasing the efficiency of firing on locomotive and stationary boilers for the Pennsylvania Railroad has largely been done.

To continue smokeless operation after the fire is built, the coal should be dampened before throwing it on the fire. This prevents any fine coal from passing over the fire, through the flues and out of the stack as unburned carbon. Many are of the opinion that wet coal does not give satis-

factory results, but as I have obtained excellent results from the above methods, I do not agree with them. Coal should be fed to the fire frequently and in small amounts, being placed over the bright spots. The hook or scraper should be used as little as possible. Frequent raking of the fire spoils it and wastes a large amount of fuel, at the same time causing clinkers to form on the grates, which condition results in shutting off the air, produces imperfect combustion and makes excessive smoke.

In cleaning fires I have found the best results are obtained by burning down one side of the fire, removing the dirt and clinkers and placing a layer of green coal over the grates. Hot coals should then be thrown over the green coal. The other side of the fire should then be treated in the same manner. If there is no particular haste in building the fire up after cleaning, hot coals should not be thrown on top of the green coal, but the fire should be allowed to burn gradually. If haste is required, the live coals should be thrown so as to cover the green coal on the side that has just been cleaned, during which operation the fire door should be slightly open, in order to admit air and thus aid combustion.

Some years ago, before the adoption of scientific methods in firing, it was a common expression of firemen to say: "If she doesn't make smoke, she doesn't make steam." This era has passed, however, and it has been demonstrated that it is not only unnecessary to make smoke to produce steam, but that better results are obtained when the stacks are free from smoke. Nevertheless, comparatively few owners of stationary boiler plants have as yet carefully studied the details of their boiler operation, although it is no exaggeration to state that those who have are enthusiastic over the results obtained.

[The efficiency obtained by Mr. Logan in firing is as superior to that found in the operation of many contractor's power plants as his methods are different from those of the old-school fireman, still largely represented on construction work. Contractors and master mechanics who have never looked into their boiler operation will do well to follow Mr. Logan's suggestions, proved effective under conditions closely similar to those on construction work.—EDITOR.]

Large-Sized Drums and Sheaves Give Wire Rope Economy

THE best wire rope results are always obtained with large size sheaves and drums. The experience of the A. Leschen & Sons Rope Company indicates that it is important for the grooves to be smooth and of sufficient size so that the rope fits easily



TWO CAUSES OF WIRE ROPE WEAR

without wedging or bending on the side. The accompanying diagram shows the effect of using a rope too large for the groove. When a groove becomes scored it should be turned to eliminate the corrugations. If this is not done shortened rope service will be the result, because of excessive wear done to the uneven surface. Another important point, attention to which prevents undue wear on the rope as well as on the sides of sheaves and drums, is to keep both drums and sheaves in alignment.

Canvas Cover for Concrete Roads Unrolled on Frame from Pipe

THE FRAME shown in the accompanying photograph is used in covering fresh concrete placed on road work. A strip of canvas 19 ft. wide and 50 ft. long is rolled around a length of 2-in. pipe. The frames are then stuck in the shoulder of the road on each side, being supported by the strap-steel stakes shown in the photograph, which are bent around the 2 x 3-in. wood runners of the frame at intervals. Across the road 12 to 14 ft. apart are laid 2 x 3-in. pieces, 17 ft. long, resting on the frames on each side. The canvas around the pipe is then laid across the road and unrolled over the frame.

This device enables the covering to be taken up and reset in a short time, and is especially useful during rainy weather. It keeps the canvas in good condition and prevents its being dragged over the ground or over the green concrete.



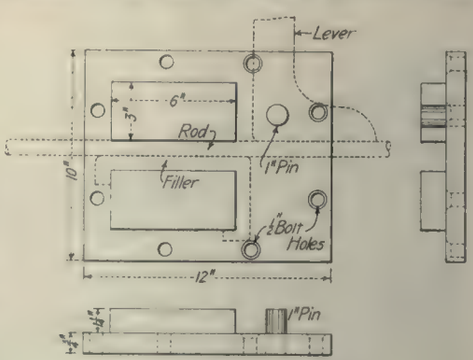
CANVAS PROTECTION UNROLLED FROM PIPE OVER EASILY-SET FRAME

Home-Made Tool Bends Reinforcing Bars of Several Sizes

By R. C. HARDMAN
Colorado Springs, Colo.

A SMALL "home-made" bar bender has been used successfully by the writer for bending cold bars up to 1¼ in. diameter, where not greater than 90 deg. bends were required. The apparatus consists essentially of a cast-iron plate containing two lugs between which the bar is placed, a steel lever fastened to the plate by means of a steel pin about which it acts and a set of fillers, as shown in the accompanying sketch.

The cast-iron plate can be cast of coarse metal in any foundry, the top of the plate with which the lever comes in contact being machined. The bolt holes, certain ones of which must be countersunk to allow free action of the lever, may be either cored or drilled. The space between the two lugs



INEXPENSIVE BAR BENDER

should be slightly larger than the largest size bar to be bent. The filler is a device made of strap iron by any blacksmith, which fits around the lug opposite the lever, to insure a tight fit for bars smaller than the maximum. A set of these to accommodate the various commercial sizes of steel bars can be made at small cost. To insure a good fit the edges of the lug around which the "filler" is placed should be machined. The lever is made of 1 x 2-in. flat steel forged to shape, with the face engaging the bar slightly upset on the upper side. Its length is about four feet.

The operation of the apparatus can be readily seen in the sketch, in which the lever, bar to be bent and a filler are shown dotted. The apparatus is fastened to a bench by means of bolts, and countersunk so that the top of the plate is flush with the top of the bench.

Two men can make cold bends under one inch in diameter. On larger sizes three men are required unless recourse is had to a pipe extension to the lever.

The cost of the apparatus should not exceed $12 to $15, and it will readily pay for itself on a small job which will not admit of a more versatile bender.

PAGE COUNTY, IOWA, has had thirty of its highway bridges washed out this season. The expense of making repairs and replacing destroyed structures will total $100,000, according to I. H. Taggart, county engineer.

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

To Start Work on $400,000 Waterworks in Cuba

Construction will be started in the near future on the new waterworks system to supply the cities of Caibarien and Remedios in Cuba, the cost of which will be between $400,000 and $450,000.

The supply will be obtained from a series of springs and carried by a gravity line through Remedios to Caibarien. In all there will be about 37 miles of pipe line. The J. G. White Engineering Corporation, as engineers for the Caibarien-Remedios Waterworks Company, will have charge of the work, which will probably be completed within a year.

Caibarien is a city of about 12,000 inhabitants, located on the north shore of the island and is one of the largest shipping ports in the country.

Propose Chicago Branch of American Society of Civil Engineers

Chicago members of the American Society of Civil Engineers met Oct. 28 at the rooms of the Western Society of Engineers to consider and to express a preference for a member of the nominating committee. E. M. Layfield, acting secretary of the Western Society, was unanimously chosen a candidate to represent District No. 5.

A committee was also chosen to look into the desirability of effecting the organization of a Chicago branch of the society. Onward Bates, who presided over the meeting, explained that the Chicago members, although greater in number than in any other city next to New York, because of the absence of any concerted action might have no representation on the board of direction after January, 1916, when C. F. Loweth's term expires.

Tunkhannock Viaduct to Be Put Into Service To-Morrow

Train service over the Tunkhannock viaduct of the Delaware, Lackawanna & Western Railroad, and over the entire 40-mile cut-off of which it is a feature, is to be inaugurated tomorrow, Nov. 7. As stated in the editorial note on page 557, the viaduct is on the Nicholson cut-off in northeastern Pennsylvania, a $12,000,000 change of alignment shortening the road 3.6 miles, eliminating 2440 deg. of curvature and effecting a great reduction in the ruling grades.

There are two monumental reinforced-concrete arch viaducts on the cut-off—the Martin's Creek and the Tunkhannock. The former is 1611 ft. long and 150 ft. high. The Tunkhannock dwarfs even the Martin's Creek, however, and is the largest structure of its kind in the world; it is 2375 ft. long and 240 ft. high, consisting of ten arch spans. The accompanying view of the finished structure, with men and a locomotive on top, gives an idea of its magnitude.

The entire cut-off was built under the general direction of G. J. Ray, chief engineer of the railroad, F. L. Wheaton, engineer of construction, being in immediate charge. A. B. Cohen, concrete engineer, handled the design of the two viaducts. The contractors for the Tunkhannock viaduct were Flickwir & Bush of New York City, F. M. Talbot being general manager.

Conference on Valuation to Be Held in Philadelphia Next Week

A conference on valuation will be held at the Hotel Adelphia in Philadelphia, Nov. 10-12, under the auspices of the Utilities Bureau. According to the tentative program the arrangement of sessions is as follows:

Wednesday, Nov. 10
8.00 p. m.—The Reproduction Theory.
Thursday, Nov. 11
10.00 a. m.—Original Cost.
2.15 p. m.—Franchise Values.
8.15 p. m.—Valuing Land.
Friday, Nov. 12
10.00 a. m.—Depreciation.
2.15 p. m.—Going Value.
6.30 p. m.—Valuation and the Future in Public Utilities.

The program for each session involves formal papers, formal discussion and open discussion. The last session is a dinner, the price being $2 per plate.

Among those scheduled to take part in the addresses or discussions are John M. Eshleman, former president of the California Railroad Commission; Morris Knowles, director of the course in valuation of Public Utilities, University of Pittsburgh; H. P. Gillette, consulting engineer, New York City; Robert H. Whitten, secretary, Board of Estimate and Apportionment, Committee on the City Plan, New York City; Morris L. Cooke, director of public works, Philadelphia; John R. Freeman, president of Manufacturers' Mutual Fire Insurance Company, Providence, R. I.; Hammond V. Hayes, consulting engineer, Boston; Halford Erickson, member of the Wisconsin Rail-



TUNKHANNOCK VIADUCT, THE WORLD'S LARGEST OF REINFORCED CONCRETE, WILL GO INTO SERVICE TO-MORROW

road Commission; Leonard Metcalf, consulting engineer, Boston; Clifford Thorne, chairman, Iowa Board of Railroad Commissioners; Charles A. Prouty, director of valuation, Interstate Commerce Commission, and Edward W. Bemis and Milo R. Maltbie, members of the advisory board to the Division of Valuation.

The nine announced purposes of the Utilities Bureau indicate that its mission is to collect, collate and disseminate information relative to municipal utilities. The presence of the word municipal may explain why there is only one scheduled speaker with the railroads' point of view—F. W. Stevens, general valuation counsel, New York Central Lines, New York City. There are three or four representatives of other utility interests listed in a total of thirty scheduled speakers. The program suggests that the conference will have a highly theoretical flavor.

The eight trustees of the Utilities Bureau are as follows: Louis B. Brandeis, counsel for the Interstate Commerce Commission in the Five Per Cent Rate Case; Frederick A. Cleveland, director of the New York Bureau of Municipal Research; S. S. Fels, manufacturer, Philadelphia; Felix Frankfurter, professor of law, Harvard University; Charles F. Jenkins, proprietor of *Farm Journal*, Philadelphia; L. S. Rowe, president of the American Academy of Political and Social Science; Chester H. Rowell, proprietor of the Fresno (Cal.) *Republican*, and Charles R. Van Hise, president of the University of Wisconsin. Dr. Van Hise is president of the board. Morris L. Cooke is acting director.

Germans Awarded Prize in Swedish Harbor Plan Competition

The first prize in the International competition for plans to enlarge its harbor, details of which were given on page 32 of the Jan. 17, 1914, issue of the Engineering Record, was awarded by the city of Helsingborg, Sweden, to the firm of Ludwig Lange, Hanover, together with Marine-Hafenbaudirektor Behrendt, Wilhelmshaven, Germany. Albert Lilienberg and Lieut. N. A. Svenson, Gothenborg, Sweden, were awarded the second prize. The third prize went to Thuresson & Company, Stockholm, Sweden. The judges also recommended the purchase of the following, at $270.00 each: Plans of Prof. R. W. Otto Schulze, assisted by Walter Rouff, Danzig, Germany; those of Ivar Tybjerg, Aalborg, Denmark, and those by Carl Semler and the Contractor Construction Company, Stockholm, Sweden. The harbor department itself decided to buy at the above mentioned figures the projects submitted by Lieutenant Plomann, Stockholm, and S. Ewald, city engineer of Helsingborg, assisted by the architectural firm of Lewerentz & Stubelius.

The time limit of the competition was set for July 15, 1914. The judges met for the first time Aug. 1, 1914, but the work was interrupted the following day by the outbreak of the European war. It was not resumed until Aug. 12, 1915, and it was completed Aug. 24. Because of the unexpected length of time required before results were announced it was decided to increase the prizes and the sums of purchase to the extent of interest for one year at 5 per cent.

American Society National Water Law Committee Meets in Chicago

The special committee of the American Society of Civil Engineers on "A National Water Law" began a meeting in Chicago on Nov. 4, which will terminate to-day, at the rooms of the Western Society of Engineers. The committee consists of the following: F. H. Newell, chairman, professor of civil engineering, Urbana, Ill.; Charles W. Comstock, formerly State engineer of Colorado, Denver; George G. Anderson, consulting engineer, Hollywood, Cal.; Clemens Herschel, New York City; W. C. Hoad, professor of sanitary engineering, Ann Arbor, Mich.; Robert E. Horton, consulting hydraulic engineer, Albany, N. Y.; John H. Lewis, State engineer, Salem, Ore.; Charles D. Marx, president American Society of Civil Engineers, Stanford University; Gardner S. Williams, vice-president American Society of Civil Engineers, Ann Arbor, Mich.

The subject under consideration has to do with the future development and best use of the water resources of the country in municipal and domestic supply, power, irrigation, drainage and stream pollution.

To Hold Pennsylvania Welfare and Engineering Conference Nov. 16-18

The third Pennsylvania Industrial and Public Welfare and Engineering Conference will be held in Harrisburg, Nov. 16-18, under the auspices of the Engineers' Society of Pennsylvania. The industrial exhibit will run most of the week. Governor Brumbaugh of Pennsylvania has instructed all State departments that employ engineers, architects, chemists and inspectors to co-operate with the engineers' society to make the conference a success, and has requested the heads of all such departments to bring in their field men to attend the convention. The committee of arrangements consists of John P. Jackson, State commissioner of labor and industry; F. Herbert Snow, chief engineer of the State Public Service Commission, and Farley Gannet, consulting engineer, of Harrisburg, and president of the Engineers' Society of Pennsylvania. Paul Gendell is director of exhibits. The exhibits will include safety and sanitary appliances, engineering and contractors' equipment and electrical devices.

Defines Violation of New York's Building Code

A new section in the revision of the various articles in New York City's building code, still in progress, has been proposed to define the nature of the violation of the building laws which will constitute a misdemeanor. In article 32, on enforcement, it is to be provided in section 655 that "any person who shall receive and fail to comply with any written peremptory order of the superintendent of buildings issued only when in his judgment an immediate compliance with such order is essential to the public peace or safety, within the time specified in such order, shall be guilty of a misdemeanor."

The amount of the penalty for violation has also been changed from the present $50 to "not less than $10 nor more than $50 as may be fixed by the superintendent of buildings." Similarly, for continued violation after notice the penalty has been changed from $250 to "not less than $50 nor more than $250 as may be fixed by the superintendent of buildings." A hearing was held on these proposed changes on Nov. 4. If they pass the Board of Aldermen, they go into effect immediately.

Los Angeles Water Supply Damage Suit Settled

In the Superior Court of California judgment for the city of Los Angeles was recently entered in the $3,500,000 damage suit by the Natural Soda Products Company. The action involved damages for the alleged diversion of waters of the Owens River. A long and bitter contest was impending until an unexpected offer of compromise was made by the plaintiff, who offered to settle, it is reported, for the sum of about $15,000.

New York Board of Estimate Abolishes Bureau and Committees

In the interests of economy and because their work for the most part has been practically completed, the New York City Board of Estimate, by a vote taken Oct. 27, abolished the bureau of sewer plans and four committees, including that on port and terminal facilities.

Plans for Second Link in Toronto Hydroelectric Radial Indorsed

Plans for the second link in the Toronto (Canada) Hydroelectric Radial System, which will link Toronto with Sarnia and take in all municipalities along the line from Toronto, by way of Guelph and London, were emphatically approved at a gathering of representatives of the municipalities interested in the section from Guelph to London, held in Toronto, Oct. 28. A resolution of approval was moved by the Mayor of London and seconded by the representative from Berlin.

Sir Adam Beck, chairman of the hydroelectric commission, in presenting the plan, pointed out that while the present contract supply of power was about exhausted, the commission had plans before the Government that would allow for the immediate development of 200,000 hp. He further declared that the radials would mean a great saving to the people of Ontario, as they would free them from excessive railway charges. Not only would they give lower rates to those who used them, but, by competition, would compel the railways to reduce their fares.

Utah's State Road Commission Moves Into New Offices

The State road engineer and the State Road Commission of Utah moved into offices arranged for them in the recently completed State Capitol at Salt Lake City on Oct. 30. It is expected that the State engineer will move into the new building very shortly.

Concrete Road Building Sub-Committees Appointed

The sub-committee organization for the Second National Conference on Concrete Road Building, to be held in Chicago, Feb. 15 to 18, 1916, has been completed, and those who accepted appointments on the committees are engaged in preparing their reports. Seventeen general subjects will be covered including: Drainage and preparation of sub-grade; economical width of paving, length and shoulders; problems of design; thickness, crown and grade; aggregates; handling and hauling materials and water supplies; organization of concreting crew; proportions of material and consistency of concrete; mixing and placing; reinforcement; joint location and construction; expansion and contraction; finishing and curing; construction of shoulders and curves; methods and form of maintenance; form of specifications; house construction and estimating, and bridge inspection problems. The chairmen of the committees are: Hector J. Hughes, chairman of the school of engineering, Harvard University and Massachusetts Institute of Technology; J. J. Cox, instructor in civil engineering, University of Michigan; Ira O. Baker, professor of civil engineering, University of Illinois; D. A. Abrams, instructor in charge, structural materials research laboratory, Lewis Institute, Chicago; T. R. Agg, professor in charge of highway engineering, Iowa State College; H. P. Gillette, editor-in-chief *Engineering and Contracting;* W. S. Gearhart, State engineer of Kansas; Ernest McCullough, civil engineer, Chicago; Richard L. Humphrey, consulting engineer, Philadelphia; George A. Ricker, formerly first deputy commissioner, New York State Highway Commission; F. E. Turneaure, dean of the college of mechanical engineering, University of Wisconsin; Charles W. Baker, editor-in-chief, *Engineering News;* A. N. Johnson, highway engineer, Bureau of Municipal Research, New York City; A. H. Hinkle, deputy highway commissioner, Ohio State Highway Department; A. R. Hirst, State highway engineer, Wisconsin Highway Commission; C. J. Bennett, State highway commissioner of Connecticut, and A. Marston, dean and director, division of engineering, Iowa State College.

Rhode Island Board of Public Roads Issues First Bulletin

With the purpose of describing the work done upon State highways during 1915 and of outlining in brief the ideas it entertains for work in the future, the Rhode Island State Board of Roads has commenced the publication of the *Rhode Island Highway News*, a bulletin designed to acquaint the public with the work of the department in a way that would be impossible in the regular annual report.

The first issue contains fifteen pages of text, profusely illustrated and written up in interesting style. The pictures are well selected and instructive. Methods of construction are described and the problems before the board are frankly discussed.

Calgary Entertains Engineers Returning from San Francisco

About fifty engineers, returning from the International Engineering Congress in San Francisco by the Canadian route, were entertained at Calgary, Alberta, by the Calgary branch of the Canadian Society of Civil Engineers and the city authorities. Points of engineering interest were visited and a luncheon was given in the visitors' honor. The engineers of the city, aided by the Canadian Pacific Railway Company and the citizens of Bassano, provided a dinner and a visit to the Bassano dam, a part of the big irrigation project of the Canadian Pacific Railway. An attractive booklet describing some of the features of engineering interest in the vicinity was issued.

If You Want a License Without Examination Apply Now

To obtain a structural engineer's license in Illinois without examination application must be made before Jan. 5, 1916, according to a notice being sent out by the Western Society of Engineers. Requests for application blanks and copy of the laws should be addressed to the Illinois Board of Examiners of Structural Engineers, 1735 Monadnock Block, Chicago.

San Francisco-Oakland Terminal Consolidates Departments

The departments of Maintenance-of-Way and Structures and of Docks and Wharves of the San Francisco-Oakland Terminal Railways have been consolidated under the name of Department of Way and Structures. The Docks and Wharves department was created early in 1914 to facilitate the extensive works undertaken by the company in San Francisco Bay, which are now nearing completion.

Scientific Congress Outlines Work of Engineering Section

The engineering section of the Pan-American Scientific Congress to be held at Washington, D. C., from Dec. 27, 1915, to Jan. 8, 1916, will treat of such subjects as relate to water and land transportation and various other problems of interest to the engineering sciences, such as a common Pan-American body of engineering nomenclature and laws regulating the use of water. The chairman of the section is Brig.-Gen. W. H. Bixby, U. S. A., retired. Dr. E. L. Corthell is secretary. Among others included in the membership of the section are: Capt. C. A. McAllister, engineer in chief, U. S. Coast Guard; Lieut. Col. E. E. Winslow, corps of engineers, U. S. A.; Col. W. W. Harts, U. S. A., in charge of the Office of Public Buildings and Grounds, Washington, D. C.; A. P. Davis, director and chief engineer, U. S. Reclamation Service; R. B. Marshall, chief geographer, U. S. Geological Survey; L. W. Page, director, U. S. Office of Public Roads; S. W. Stratton, director, Bureau of Standards, Department of Commerce; E. Lester Jones, superintendent, U. S. Coast and Geodetic Survey; Major C. W. Kutz, Corps of Engineers, U. S. A.; Charles Warren Hunt, secretary, American Society of Civil Engineers, and Col. L. H. Beach, Corps of Engineers, U. S. A. General William C. Gorgas has been appointed chairman of the Public Health and Medical Science section of the Congress.

First Through Train Over Canadian Northern Pacific

The first through train over the line of the Canadian Northern Pacific Railway left Montreal, Que., on Oct. 12 at 5 p. m., and arrived in Vancouver, B. C., early on the morning of Oct. 19. The trip was made as an inspection of the line preliminary to the inauguration of regular service on Nov. 1, which commenced with a through passenger train service of three times a week. On the special train were twenty members of the Canadian Senate, fifty members of the House of Commons and thirty newspapermen.

The last spike in the new transcontinental line was driven at Basque, B. C., 182 miles east of Port Mann on Jan. 23, 1915. The system opened its first line in central Manitoba in 1896, and now has in operation approximately 10,000 miles of single track.

News of Engineering Societies

The Southwestern Waterworks Association will hold its annual convention at Waco, Texas, May 8-10, 1916. These dates were decided upon at a meeting of the executive committee, held in Dallas, Oct. 25. E. L. Fulkerson of Waco is secretary of the association.

The Engineers' Club of St. Louis heard F. G. Jonah, chief engineer of the St. Louis & San Francisco Railway Company, speak on "Suggested improvements in the Terminal Situation in St. Louis," at a meeting held in that city Nov. 3.

The Municipal Engineers of the City of New York will make an inspection of the Newark meadows land reclamation and harbor improvement work to-day.

The Western Society of Engineers has arranged the following program of meetings for November: Nov. 2, "The Railroads and the Public," by L. E. Johnson, president Norfolk & Western Railroad; Nov. 8, "Design of a Railroad Pontoon Bridge," H. J. Hansen, Chicago, Milwaukee & St. Paul Railway; Nov. 22, "Street Railways," Leonard A. Busby, president Chicago Surface Lines; Nov. 29, "The Use of Influence Lines" and "The Deflection of Trusses," by R. W. Flowers and E. H. Casper, both of the American Bridge Company.

The Association of Urban Universities will hold a conference on co-operation between cities and universities in training for public service at Cincinnati, Nov. 15-17.

Personal Notes

FORD KURTZ has been appointed resident engineer for the J. G. White Engineering Corporation, engineers for the Caibarien-Remedios Waterworks Company of Caibarien, Cuba, on the construction of that company's water supply system at Caibarien.

P. W. HAVERSTICK, formerly transitman in the office of the engineer of maintenance-of-way of the Pennsylvania Railroad System, has been appointed assistant supervisor of the Conemaugh division, at Verona, Pa. He was graduated from Pennsylvania State College in 1907 and entered the service of the Pennsylvania in 1908. He was appointed transitman in 1914.

LOUIS K. ROURKE, formerly assistant division engineer of the Central division of the Panama Canal and recently commissioner of public works of the city of Boston, and Edward C. Sherman, formerly division engineer on the Charles River dam and lock at Boston, later designing engineer on the Panama Canal, and, for the past four years, in private consulting practice, have associated themselves under the firm name of Rourke & Sherman to conduct a general consulting engineering practice, occupying offices at 6 Beacon Street, Boston. They will give special attention to organization, to the design, construction and operation of public works, including river and harbor improvements, refuse disposal, water supply, sewerage and pavements, railroad work and to Spanish-American projects.

EDWARD M. BOGGS, formerly chief engineer of docks and wharves of the San Francisco-Oakland Railways, has been appointed chief engineer of the recently created department of way and structures of that road. He entered railway service in 1881 as chairman in the engineering department of the Columbus, Hocking Valley & Toledo. In 1886 he was appointed resident engineer in charge of the construction of 11 miles of railway in the Rocky Mountains for the Colorado Midland. As engineer for the town of Cascade, Cal., in 1881, he laid out the original town site and planned a water system. From that year until 1892 he engaged in private practice in San Bernardino, Cal., and Redlands. From 1892 to 1897 he was professor in civil and hydraulic engineering at the University of Arizona. He received the degree of civil engineer from that university in the latter year. He left this work to become chief engineer of the Southern California Power Company of Redlands, Cal., in which capacity he designed and constructed the hydraulic works in Santa Ana cañon. In 1899 he returned to private practice. In 1902 he was appointed chief engineer of maintenance-of-way and structures of the San Francisco-Oakland Terminal, which office he occupied until 1914, when the department of docks and wharves was created in order that he might devote his attention exclusively to the extensive works the company had under construction in San Francisco bay.

I. B. FUNK has resigned from the office of city engineer of San Fernando, Cal.

FRANK P. KEMON, formerly general superintendent for the Duquense Contracting Company of Pittsburgh, has been appointed general superintendent for the Sutton & Corson Company of Ocean City, N. J., in charge of the construction of a sewage disposal plant and 8 miles of intercepting and outfall sewers for the town of Avalon, N. J. As superintendent of construction for the Millard & McGraw Company of Philadelphia, Mr. Kemon had charge of the construction of the Waverly transfer for the Pennsylvania Railroad at Waverly, N. J., and a 5-mile section of the New York Short Line, including the four-track concrete bridge across Neschaminy Falls, besides other construction for the same railroad. As superintendent of concrete masonry for the Carter Construction Company of Chicago, he had charge of the construction of concrete structures on the Lake Erie & Pittsburgh, including a bridge across the Chauyoga River, and an 11-mile section of grade revision on the Cincinnati, Hamilton & Dayton, which included a reinforced-concrete arch bridge across the Great Miami River. From the Carter Company he went to the Duquense Contracting Company, where he had charge of the construction of an addition to the Pittsburgh waterworks filtration plant at Aspinwall, Pa., as well as a considerable amount of railroad construction.

GEORGE H. BINKLEY, has resigned from the office of chief engineer of maintenance-of-way and structures of the San Francisco-Oakland Terminal Railways. He was appointed to office in the early part of 1914.

HENRY GOLDMARK, consulting engineer, of New York City, has been retained to take charge of the fabrication, in the United States, of the lock gates, sluice valves, operating machinery and electrical equipment for the large tidal lock which will give access to the new harbor at Chemulpo, Korea. The work is to be done in accordance with competitive plans prepared by Mr. Goldmark for the McClintic-Marshall Company of Pittsburgh, successful bidders on the entire equipment, which were adopted by the harbor authorities.

S. E. STEWART, formerly transitman in the office of the engineer, maintenance-of-way of the Pennsylvania Railroad System, has been appointed assistant supervisor on the Tyrone division. He was graduated from Ohio Northern University in 1909 and entered the service of the Pennsylvania as rodman on the Elmira division in 1910.

HORATIO V. NYE, at one time U. S. examiner of surveys and, until recently, engineer and assistant superintendent of the Northwestern Consolidated Milling Company of Minneapolis, Minn., has been appointed assistant secretary and sales manager of the Southwestern Milling Company of Kansas City.

H. D. STOWE, formerly supervisor for the Pennsylvania Railroad System at Dunkirk, N. Y., has been appointed pilot engineer in the office of the valuation engineer. He was graduated from Yale University in 1902, and took a position as rodman in the office of the principal assistant engineer of the Pennsylvania System at Buffalo, N. Y. In 1905 he was transferred to Altoona, Pa., as transitman and, in 1906, was appointed assistant supervisor at Bordentown, N. J. He attained the grade of supervisor in 1911 and was transferred, in that capacity, to Dunkirk in 1913.

G. W. CURTIS, formerly supervisor for the Pennsylvania Railroad System at Shamokin, Pa., has been appointed pilot engineer in the office of the valuation engineer. He was graduated from Princeton University in 1902 and entered the service of the Pennsylvania System, in July of that year, as rodman in the office of the assistant engineer of the Pittsburgh division. In 1905 he was transferred to Altoona and promoted to the grade of transitman. In 1906 he was advanced to the grade of assistant supervisor of the Amboy division. He was appointed supervisor at Shamokin in 1912.

JAMES COLE ROBERTS of the U. S. Bureau of Mines has been appointed to the Joseph Austin Holmes Professorship of Safety and Efficiency Engineering at the Colorado State School of Mines.

RALPH H. STEARNS, formerly designing engineer for the Board of Water Commissioners of the City of Hartford on the Nepaug water supply project, has been appointed assistant engineer on the forces of the Water Supply Board of Providence, R. I. Mr. Stearns was graduated from Massachusetts Institute of Technology in 1901 and served as rodman for the Metropolitan Sewerage Commission of Massachusetts until 1902, when he was appointed transitman for the Boston Transit Commission on the construction of the East Boston tunnel and on the studies of the Washington Street tunnel. In 1904 he was promoted to the position of assistant engineer on the latter work. From this position he went to the New York City Board of Water Supply, where he served as assistant engineer designer on the Catskill Aqueduct work. With the Hartford board of water commissioners he had charge of the design of all structures included in the Nepaug supply system, including a 9,000,000,000-gal. reservoir, a 42-in. cast-iron pipe line, 36,660 ft. long, 3667 ft. of concrete conduit and 2333 ft. of tunnel. He completed his work on this project in 1914, since when he has been engaged in consulting practice in Boston.

A. W. MACPHERSON has been appointed assistant chief engineer of the department of way and structures of the San Francisco-Oakland Terminal Railways, with headquarters at Oakland.

EDMUND S. HIGGINS has been appointed maintenance engineer for E. I. du-Pont de Nemours & Company, manufacturer of high explosives, of Wilmington, Del., at City Point, Va.

HENRY L. COLLIER, formerly consulting engineer of the Yellow Pine Manufacturers' Association of St. Louis and, previous to that, for many years commissioner of public works at Atlanta, Ga., has opened offices in the Candler Building, Atlanta, to engage in practice as consulting engineer, specializing in pavements, concrete construction and land lines and boundaries. Mr. Collier was graduated from the University of Georgia in 1872 and first engaged in engineering work as assistant resident engineer for the Georgia Western Railway. In 1874 he was appointed instrumentman on the U. S. Government survey of a double-track railroad from Gunter's Landing, on the Tennessee River, to Brunswick, Ga. In 1876 he served as engineer in charge of the location of the Toccoa & Elberton Railroad, which is now a part of the Southern Railway System. From 1878 to 1879 he was again in the Government service and from 1880 to 1881 he was division engineer with the Georgia Pacific. In 1882 he was appointed chief engineer in charge of location and construction of the Gainesville, Jefferson & Southern. From 1887 to 1889, as chief engineer of location and construction of the Atlanta & Florida, he located that line from Atlanta to Madison, Fla., and constructed it from Atlanta to Fort Valley, Ga. In 1890 he was engaged in contracting and, from 1891 to 1892, he was general manager of the granite quarries at Lithonia, Ga. He became examiner of surveys for the U. S. Government in Wyoming, Idaho, Oregon, Washington, Utah, Nevada and California in 1893 and served in that capacity until 1898, when he was appointed chief engineer of the Tifton & Moultrie Railroad in Georgia. In 1900 he was appointed chief engineer in charge of location and construction of the Georgia & Florida Railroad a second time. He was appointed commissioner of public works of Atlanta in 1901 and consulting engineer for the Yellow Pine Manufacturers' Association about four years ago.

WILLIAM GOLDSMITH has resigned from the position of superintendent of the Borough of Manhattan, New York City, municipal asphalt plant to accept a position as engineer in charge of construction of the New Hampton Farms Reformatory for the Department of Correction, New York City. The work will involve an expenditure of about $800,000 and will include a railway line, a water supply and sewerage system, a power plant and various buildings.

G. W. SMITH, formerly assistant superintendent for J. G. Cordner, architect, of Lincoln, Neb., on the foundation work for the new Ford automobile assembly plant at Omaha, Neb., has been appointed architectural engineer for the Hodgin Construction Company, general contractors, of St. Paul, Minn., who have the contract for the building and also for the new plant for the same company at Oklahoma City.

H. W. ECKEL, formerly borough engineer of Washington, N. J., and, previous to that, resident engineer on the Coquahalla division of the Kettle Valley Railway in British Columbia, has joined the engineering staff of the Taylor-Wharton Steel Company and is located at High Bridge, N. J. Previous to his work at Washington, Mr. Eckel spent a year in the Nome district, Alaska, engaged in prospecting and mineral surveys, and three years in British Columbia on railroad construction, his last work in that line being the Kettle Valley work.

LOUIS C. BROWN, formerly resident engineer for the L. A. Boulay Engineering Company of Toledo, Ohio, on paving work at Mount Victory, Ohio, has been appointed resident engineer for W. J. Sherman, consulting engineer of Toledo, on the Sylvania (Ohio) waterworks improvements, construction of which will be started in the near future.

G. W. BASS, formerly water purification superintendent for the Central Illinois Public Service Company, at Lawrenceville, Ill., has been appointed deputy health commissioner in charge of the Porter County Health Laboratory at Valparaiso, Ind.

R. H. PINKHAM, formerly assistant supervisor for the Pennsylvania Railroad System at Derry, Pa., has been appointed division engineer of the Renovo division. He was graduated from Massachusetts Institute of Technology in 1899 and entered the service of the Pennsylvania in 1901 as levelman in the office of the engineer of maintenance-of-way. About two months later he was promoted to the grade of transitman in the office of the principal assistant engineer at Altoona, and, in 1902, he was appointed assistant supervisor at St. Mary's, Pa. He was transferred to Derry in the same capacity in 1912.

J. F. REHN, formerly chief engineer and general superintendent of Cementos Hildago, at Hildago, Mexico, has been appointed engineer in charge and superintendent of the Nebraska Portland Cement Company, with offices at Superior, Neb.

ALFRED P. BOSWORTH, formerly connected with the engineering forces of the California State Highway Commission, in the San Francisco and Fresno offices and on construction, has been appointed city engineer of Tulare, Cal. This is a new office combining the offices of superintendent of streets, superintendent of sewers and superintendent of waterworks. Mr. Bosworth was with the State highway commission for four and a half years. Previous to that he was, for two years, with the department of revaluation of the Southern Pacific Railroad.

T. K. MINSKER, formerly assistant supervisor for the Pennsylvania Railroad System at Bowie, Md., has been appointed supervisor of the Buffalo division at Dunkirk, N. Y., succeeding H. D. Stowe, whose appointment to another office is noted elsewhere in these columns. Mr. Minsker was graduated from Lehigh University in 1903 and entered the service of the Pennsylvania in July of that year as rodman on the Chautauqua division. He attained the grade of transitman in 1906 and that of assistant supervisor later in the same year.

F. X. BRADLEY, formerly assistant supervisor for the Pennsylvania Railroad System at Derry, Pa., has been appointed supervisor of the Allegheny division, at Salamanca, N. Y. He entered the service of the Pennsylvania in 1903, as rodman in the office of the principal assistant engineer at Williamsport. He was promoted to transitman in 1906 and became assistant supervisor in 1909.

H. P. THOMAS, formerly assistant supervisor for the Pennsylvania Railroad System, at Tacony, Pa., has been appointed supervisor of the Middle division, at Hollidaysburg, Pa. He was graduated from Haverford College in 1905 and entered the service of the Pennsylvania as rodman on the Belvidere division in the same year. He was promoted to the grade of transitman in 1908 and to that of assistant supervisor in 1909.

HARVEY W. HINCKS of Los Angeles, under whose supervision the Modoc Point Irrigation project and the Sprague River dam were recently completed, has been promoted from assistant engineer in the U. S. Indian Irrigation Service to engineer in charge of the irrigation work on the Klamath Indian Reservation, with headquarters at Chiloquin, Ore.

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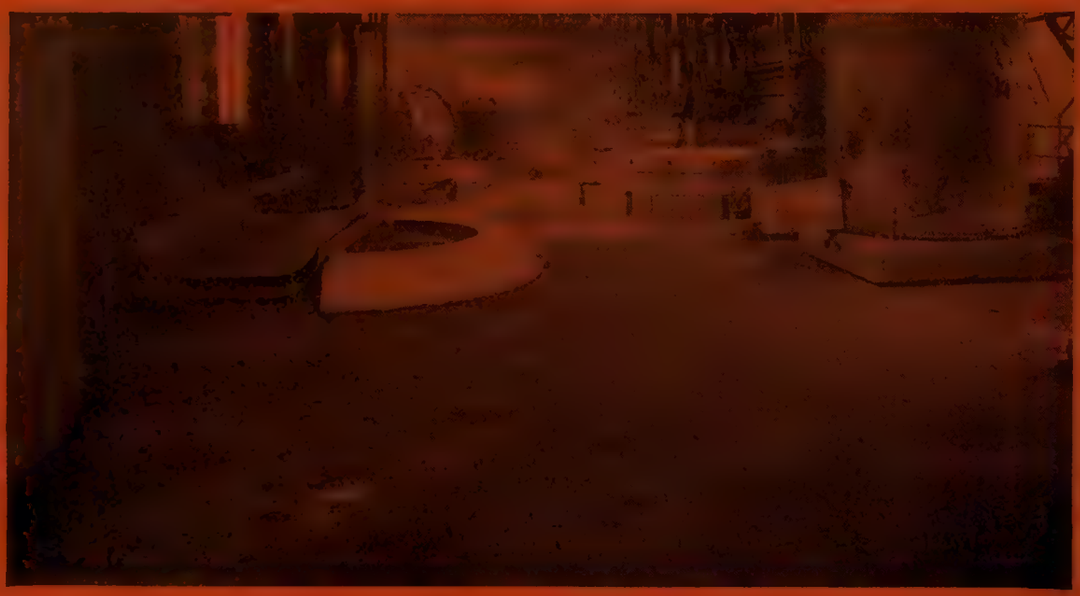
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Engineers and National Defense

THAT the services for which the country should look to the engineer and the construction man, if the peace of this nation should ever be threatened by a foreign military power, are services for which such men are already trained and available for duty if an intelligent plan of organization is adopted is forcibly brought out in the article by George Perrine on another page of this issue. The suggestion that the construction work necessary for properly insuring our safety, in the light of the present upheaval in Europe, may be begun at once and carried to completion at a low cost by periodic voluntary service on the part of those with experience in engineering construction, is here advanced, as this journal believes, for the first time. It is worth the serious consideration both of those in a position to respond to such a call and of those military and Government officials charged with protecting this country from aggression. Is it too much to ask of contractors and engineers and of the Government that a definite movement shall grow out of this suggestion whereby this country may be made safe at a minimum economic outlay?

New York's Constitution

LAST WEEK'S election carried down to defeat the proposed revision of the New York State constitution. Readers of the Engineering Record are in a general way familiar with New York's efforts during the last six months to revise its basic document, for in connection with the work of the Constitutional Convention a committee of engineers made recommendations as to the proper treatment of departments having to do with engineering work. Much time and effort was spent by the committee of engineers in formulating recommendations for the benefit of the convention. With the exception of one point—the consolidation of several of the engineering departments—the recommendations were not incorporated in the proposed constitution by the convention. So far as the proposed revision itself was concerned, therefore, the work of the committee had already been pretty well lost. Now all of it goes down to temporary defeat. Nevertheless, the committee wrote some documents which should be of very great value in connection with legislative work not only in New York State but in other commonwealths. The principles are generally applicable. Engineering societies should have legislative committees to watch for legislation effecting engineering work and even to initiate it. Such committees will find the conclusions reached by the committee of engineers of help.

Engineers Recognized

IN CONNECTION with the publicity which the Lackawanna Railroad is now giving its new cut-off, it is gratifying to note that the engineers responsible for the work are given due credit. While one would have expected that their names would be mentioned in the general descriptions sent out by the railroad to the newspapers on the day of the opening of the new line, it is contrary to railroad practice to give credit in the company's descriptive circulars. Nevertheless, this is what the Lackawanna has done. In descriptions of the cut-off included in the new timetable Mr. Ray, as chief engineer, and Mr. Wheaton, as engineer of construction, are given credit for the gigantic work. It is a move in the right direction. Railroad practice is to keep the engineer in the background, to look on him entirely as a subordinate, and to put the financial and traffic departments in the limelight. A shift of the light now and then to the engineering department would give deserved credit and much encouragement.

Danger!

NOW that the fall and winter months are upon us, with the possibility of concrete failures due to negligence or criminal ignorance of the effects of cold weather on strength, both words of caution and test conclusions are timely. The words of caution will be found on page 556 of the Engineering Record of Oct. 30, abstracted from a poster printed by a prominent concrete company. They contain good rules for preventing failures, particularly with reference to the removal of forms. Results of laboratory tests showing variations in strength of concrete with curing temperature are given on page 600 of this issue. They show conclusively and with convincing uniformity that the strength varies directly with the increase in curing temperature, and that the loads which comparatively green concrete can support when the curing temperatures are near the freezing point may be only one-half as great as the normal allowable values. The weakness of low-temperature concrete must be realized by all contractors. Engineers and building departments have an obligation to spread this knowledge and to insist, where they have authority, upon extra precautions, such as the heating of materials and the protection of the work after pouring, wherever winter concreting is allowed. The facts regarding cold-weather concreting are too well known to allow any plea to set aside a charge of criminal negligence if life is lost or serious injury sustained, due to neglect of the necessary precautions. Fortunately the number of failures last winter was smaller than those of previous seasons—an indication that warnings are not going unheeded. If engineers and building departments will do their part in helping to educate the contractor, there will be still fewer failures this year.

Preparedness for Ice-Fighting

REPETITION of the usual warning against the dangers of winter concreting is a reminder that now is the time for drawing up instructions as to the procedure in ice-fighting at hydroelectric plants exposed to ice difficulties. As in military matters, or any occupation where forces must be marshalled quickly and used instantly with maximum effectiveness, careful detailing at leisure is the only way to insure success. There is time yet, before severe weather conditions come, to pore over the ice-run records, to discuss with station operators the peculiarities of ice conditions at the plant in question, to learn what other stations have done and then lay out, definitely and step by step, the procedure for keeping the plant in operation no matter how vigorous the ice assault. As a basis for the directions, plants which have no instructions at the present time would do well to study carefully the two articles by F. A. Allner, general superintendent of the Pennsylvania Water & Power Company in the Engineering Record of July 17, and July 24, 1915, pages 66 and 113. The procedure adopted at the Holtwood plant proved its efficiency last winter, and, with the additional precautions included in the instructions as a result of last year's experience, should keep the plant in service without serious danger of interruption under the most adverse conditions to be expected.

Casting Bread on the Waters

OPPORTUNITY knocks at the doors of the four agricultural schools and the State University of Arkansas. Its State highway engineer, H. R. Carter, has appealed to the Legislature in his recent biennial report to provide means whereby students at the State colleges may come to a better understanding of modern road construction, and the benefits to be derived therefrom. In order that this may be accomplished, he suggests that rock for experimental roads be furnished free by the State. The counties in which the schools are located are to do the grading and the handling of the rock, assisted by the labor of the students of each school. The State highway engineers will be sent free on request and plans and specifications furnished gratis. Perhaps it is too much to expect the students to spend time as laborers on

the road, but it might well be made compulsory for every student to include in his studies the subject of modern road construction. In a State which has only 3 per cent of its 36,000 miles of road improved, where education on the subject of better roads is sorely needed, the colleges have an excellent opportunity to send broadcast into the State each year hundreds of young graduates who, by actual experience and study on the subject, can awaken the dormant conscience of its rural population and stimulate a desire for road improvement. The colleges will not be casting their bread on the waters in vain, for a gratified rural legislature will surely reward their efforts with increased appropriations.

Good and Bad Regulation

THERE is a widespread idea that because railroad men are opposed to some regulation they are opposed to all. Members of the Western Society of Engineers had an opportunity Nov. 2 to hear otherwise from L. E. Johnson, president of the Norfolk & Western Railway. Mr. Johnson not only favors regulation, but considers it the only alternative to government ownership—but it must be "wise and fair." He holds that the regulation should be centralized in the Interstate Commerce Commission, which should have higher-salaried members appointed for life and empowered to do much of the regulating now done by Congress and by State commissions and legislatures.

The State commissions would confine their activities to purely local matters. To Mr. Johnson "there cannot be any good reason for applying widely different and wholly inconsistent requirements in States adjacent to each other, such as Nebraska and Kansas, or Massachusetts and Connecticut; and there certainly cannot be any good reason why a State government should apply one rule in a State and the Federal Government should apply an entirely different rule in the same State. . . . There can be no good reason why a State passenger should be allowed to travel for 2 cents a mile in a State when the Interstate Commerce Commission has held that 2½ cents is a reasonable rate for interstate travel in that same State. . . . There can be no good reason why a State law in Texas, for example, should prescribe certain hours of work for railway employees engaged in State commerce when a Federal law prescribes different hours for all railway employees engaged in interstate commerce. . . . There can be no good reason why the Interstate Commerce Commission should hold that the earnings of the railways in Eastern territory are not as large as they should be in the interest of the public, and that at the same time the States should be allowed to prevent the increases in earnings which the Interstate Commerce Commission holds should be permitted in the interests of the public."

Mr. Johnson pointed out that the country ought to regard railroad securities as safe and advisable investments for people of small means, but that the protection of the investor had been largely overlooked in the protection of the traveler, the shipper and the employee. Regulators need to be equally zealous in guarding the welfare of all of these interests. Such impartiality was hardly typified, however, as Mr. Johnson suggested, by the appearance of sixteen State commissions against the railroads in the recent Western rate case. This journal has already commented on the arraying of the State commissions against the railroads at the Federal conference on valuation in Washington last May.

The most enlightened railroad men do not oppose all regulation. They oppose only unfair regulation. They believe that the same body that fixes maximum rates should be authorized to fix minimum rates. They do not think it fair for the Government to establish a maximum fair return on the investment without giving some sort of assurance of a minimum return; to deny rate increases and then wash its hands of wage increases obtained by the unions at the pistol point. They think State regulation should not be such as to subject them to suit under Federal laws for discrimination. In short, what they ask is a competent centralized authority that, to quote Mr. Johnson again, "will confer the maximum benefits on each class that is directly interested and on the public as a whole" and "will equally consider the rights and interests of the traveler, the shipper, the employee and the investor."

The Draft Tube—A Neglected Feature of Hydraulic Design

PRACTICE in the design of hydroelectric plants has become very refined in recent years. With the steady and phenomenal climb in turbine efficiencies has come searching examination of all details which might rob the installation of even a fraction of 1 per cent efficiency. This searching examination has extended practically to every feature of the plant, but it may well be questioned whether the same scientific examination has been given to draft-tube design as has been accorded other features. For that reason the Engineering Record directs attention to the series of two articles by A. G. Hillberg, which begins in this issue, page 604.

Mr. Hillberg advances one theory which, if his observation and reasoning be correct, should answer a very baffling question in hydroelectric station practice. As is well known, vibrations in such stations have long been the subject of investigation. Many engineers believe that they are due to certain defects in mechanical details of the wheels, as for instance the location of the bearings. In large, vertical, well-designed, single-runner units, however, operating under comparatively low heads, it is unlikely that the shaft is responsible. The runner itself is well-balanced, so well, in fact, that a few years ago a large runner, weighing 130,000 lb., when supported on a horizontal shaft was set in motion by a 5-lb. weight on the periphery. The generator rotor is equally well balanced. The shaft connecting them is generally short, from 20 to 30 ft., and from 20 to 23 in. in diameter. On this shaft there are at least three steady bearings, one directly above the crown plate of the runner and the other two located below and above the generator rotor. In addition there is a thrust bearing, which can be located either above the generator or between it and the runner.

Some engineers, while conceding that the location of the steady bearings on these short shafts cannot be held accountable for the vibration, contend that the design in which the thrust bearing is placed on top of the generator is a contributing factor. As to this there is probably still room for argument, but the very general acceptance of this type of design, even for large units, seems to indicate that engineers generally would not charge this feature of design with the difficulty in question.

It is Mr. Hillberg's contention that the vibrations originate in the draft tube. The water discharged from low-head turbines sometimes measures as much as 3500 sec.-ft. If this stream, flowing at a velocity of 15 to 20 ft. per second, does not fill the draft tube, vibrations are to be expected. The fact that in certain installations it has been observed that vibrations increase with the gate opening would tend to support Mr. Hillberg's theory.

The method, therefore, based on the theory that the change in velocity head should be less than the corresponding change in elevation has much to commend it. If Mr. Hillberg's views as to the source of the vibration are correct a design based on this theory would obviously tend to prevent the trouble. There is one apparent objection to a tube designed in this manner; the rapid increase in area of the lower part would make the center to center spacing of wheels rather large.

It is apparent that the desideratum in hydroelectric design is not merely to secure a high-efficiency wheel, but to set it in such a fashion that the over-all hydraulic efficiency of the unit will be high. The draft tube is therefore an important factor. How serious its influence may be was shown in a Middle Western installation in which two different designs of draft tube were used. One was designed by the consulting engineer, the other by the turbine manufacturer. The over-all hydraulic efficiency of the unit installed with the draft tube designed by the former was about 5 per cent higher than the wheel set in the manufacturer's tube.

In another case the designer of the draft tube calculated the sizes required for the top and end areas, and then figured each intermediate area on the basis that the draft tube, when developed along its center line, should be a frustum of a cone. In other words, the developed tube would have a straight flare. In this plant it has been found dangerous to overspeed the wheels because of the excessive vibration.

Mr. Hillberg's articles should direct closer attention to draft-tube design. Already careful and able hydraulic designers are giving the matter close consideration, but the importance of handling the discharge water with least loss of efficiency is one that should be more generally appreciated.

Organizing Industry for National Defense

TO ORGANIZE the industries of the nation and to standardize all the equipment needed for 1,000,000 troops in such a way that manufacturers upon receipt of a telegram from the Secretary of War would within one day start to turn out and deliver material almost as fast as it could be taken from storage—that is the Gillen plan for an industrial general staff. Careful study of the plan fails to reveal any reason why such an organization is not entirely feasible in principle.

The details of the plan are entirely too long to repeat here. In effect it provides for a civilian general advisory board of experts selected from the industries which would supply the different materials needed by the Government. The board would be under the direct control of the Secretaries of War and the Navy. Representatives from the war, navy, quartermasters and justice departments would be members of the board. Other members would be elected by a group of at least five representatives from each industry, these representatives to be appointed by the President. The purpose of the group is to have a definite entity with which the Government can confer. The groups would co-ordinate and standardize specifications in accordance with factory equipment and raw materials available. Dies for irons used in the manufacture of the wagons, for example, would be made by the Government and sample wagons by the manufacturers. Data as to names of companies, capacity and delivery possibilities are to be collected with a view to preventing confusion and to getting competitive prices and quick delivery. To keep the plan alive the Government would call for bids from each group every six months on war needs for from 500,000 to 1,000,000 troops. Contracts would be made immediately but fulfillment would wait upon the word of the Secretary of War.

Of special interest to the engineer is the inclusion of waterworks and sewerage as "industries." The work of the group in this case, according to the plan, would be quite largely to educate its members in army regulations, camp-site selection and sanitation. Control of the railroads would be effected by a group of railroad presidents. An ingenious method of mobilizing motor trucks and of converting 50,000 pleasure cars into trucks without any prior investment of money are details well worked out. No mention is made of road builders or the advantage of co-ordinating present road construction with military requirements. For instance, the very great desirability and necessity of completing the many short links now separating large cities before building further isolated stretches of road could well receive the attention of a civilian "group" co-operating with army officials.

To Martin J. Gillen, president of the Mitchell Wagon Company, Racine, a large amount of credit is due for putting in concrete form a subject which after-dinner speakers are beginning to wear threadbare with repetitions of generalities. Among the 15,000 recipients of copies of the plan are practically all the interested corporation officials in the country. Of the 600 replies, only three considered the idea of no value. The others believed it meritorious, and many of the suggestions offered have been incorporated in a revised draft of the plan.

Mr. Gillen sums up the question squarely in the following words: "Either this nation is strong enough to fearlessly plan with suppliers and regulate them for its own protection during times of peace, or cowardly repose in the full realization that in event of war pull, graft, confusion, lack of supplies and improper preparedness will cost this nation many lives, hundreds of millions of dollars and may be national honor."

Relation Between City Planning and Municipal Research

SHOULD city planning commissions have executive or merely advisory functions? This is a question which is coming to the front and one which has already begun to create discussion. It was made prominent by two papers presented at the Seventh City Planning Conference held at Detroit in June. Dr. Robert H. Whitten, of New York City, emphatically favored advisory commissions, while Mr. Thomas Adams, Town Planning Adviser of the Canadian Commission of Conservation, urged for commissions with more power.

It may be admitted at the outset that the idea of having a plan for a city or town is fundamentally sound. Those cities have developed best which were laid out on broad and expansive lines by men who, while they could not foresee the future, could appreciate growth. But there is something else that is just as important as having a plan, and that is, adhering to the plan after it has been made. In fact, there are three steps—making the plan, adopting the plan and carrying out the plan. The first is a matter of expert thought, the second is a matter of legislation, the third is a problem of administration. The question therefore presents itself in this form: Should a planning commission confine itself to the first phase of the subject, namely that of studying the local community from all points of view and developing a plan to be accepted or rejected by the people, or should the commission be made an integral part of the machinery of government and be given the broader powers of enforcement? There are no doubt sound arguments in behalf of both ideas, but it is certain that the latter course is not likely to be popular with either the legislative or the administrative officers. Even where planning commissions confine their activities to the formative stage they are met with coldness and adverse prejudice. If city planning is to make sure progress the causes for this unsympathetic attitude must be removed.

A planning commission in order to pursue its work needs to have before it all sorts of information in regard to the city or town and its people. Data must be obtained from the various departments and right here comes the first rub. Often the facts are not at hand, or, if existing, cannot be put together in the form desired without extra labor on the part of the various departments. The planning commission then becomes a sort of bureau of municipal research and comes to be regarded as an inquisitional body. Weak spots in administration may be discovered in this way, but the benefits are beside the issue. Again there is a tendency for permanent planning commissions to desire to become repositories for the data collected, thus supplanting or duplicating the work of the regular administrative departments. This in the end is bound to be destructive of the main work. There is indeed grave danger lest the whole movement run on the rocks through the arousal of petty jealousies toward over-zealous planners, and that the plan itself become obscured in the minds of the public by a maze of detail.

How may this be prevented? One way would be to have the planning board include in its membership some of the heads of the administrative departments. This would not only forestall the jealousies resulting from outside interference, but would incite enthusiasm for municipal work as a whole. After all, are not the city engineers as a class the most competent of city planners for their communities, and is not a planning commission without its official engineer member a case of Hamlet with Hamlet left out? But with the city officials should be associated other persons, able citizens, representatives of industries, business, capital and labor if a plan acceptable to all the people is to be secured. This might mean a large membership, with a working committee, or a small commission with a large advisory board. The questions raised are so important to the success of the movement that in these days when legislation is beginning to crystallize it is important to study the trend of events to make sure that they are leading toward the desired goal.

Planning commissions should not become bureaus of research. Their mission is broader, and although the results of surveys are desirable and even necessary to city planning, the greater issue should not be obscured by the less. Better policy would be to put the collection of the necessary data in the hands of one expert who would know the facts needed in any particular case.

Finally, just what is meant to-day by a city plan? Is it the arrangement of streets, a division of the area into channels for transportation, parcels of land for private uses and other parcels for parks and public uses, or is it something broader? Does it include all of the physical city—houses, sewers and water pipes, and so on? There seems to be a tendency to the adoption of the broader view. But there is a great danger of over-reaching, and in attempting to do too much nothing may be accomplished. We are coming to regard city planning as something desirable and worth while. We have had comprehensive definitions of city planning, but who will define what is meant by a city plan? Is it like the system of harbor lines set by the government, or something more?



TYPICAL ALL-STEEL PASSENGER TRAIN—EACH COACH HAS ITS OWN MOTOR EQUIPMENT AND PANTAGRAPH

Pennsylvania Inaugurates Electric Service in Philadelphia

Running of Electric Suburban Trains Between Broad Street Station and Paoli First Step in Electrification of District—To Increase Rush-Hour Capacity of Terminal 8 Per Cent

ELECTRIC TRAINS are now being operated by the Pennsylvania Railroad in Philadelphia. The substitution of electric for steam power for the suburban train service between Broad Street Station and Paoli marks the completion of the first step in the electrification of the Philadelphia district. The electrification of another suburban line has already been started. The main purpose of the change in power is to increase the capacity of the Broad Street Station and relieve the congestion at the terminal. The Paoli service is operated by the overhead system at 11,000 volts, single-phase, 25 cycles, the railroad company buying the power. The trains are multiple unit, each car being a motor.

PURPOSE OF IMPROVEMENT

Broad Street Station is of the stub type, with sixteen station tracks approached by six main-line and three yard tracks on an elevated railroad which crosses the Schuylkill River from West Philadelphia, at which point the routes divide for New York to the north, Washington to the south, and Pittsburgh to the west. In addition to the through passenger service there is an extension suburban service extending over six different routes. The growth of all business in recent years has been such that the limit in capacity of the station has been reached, and many plans have been formulated and discussed for relief by physical enlargement of the station and its approaches, or by re-routing movements. All of these plans involve extensive reconstruction, and would require much time for their accomplishment, so that some more expeditious method of obtaining relief was desirable. The possibilities of electric traction as a means to this end were examined into by committees of operating officials of the road, and their analysis and estimate indicated that during rush hour the relief which would be secured by the electrification of the suburban Paoli service alone would be equivalent to increasing the station capacity by an amount equivalent to 17 or 19 per cent of the Paoli service, and for the station as a whole to that accomplished by reducing the total number of trains about 8 per cent. A similar increase in capacity would result for the electrification of other suburban lines, and work in connection with one of these, namely, the Chestnut Hill service, has already been started.

CAPACITY INCREASE

This increase in capacity is effected by the elimination of switching and movements of empty power, and also by the quicker acceleration of trains and shorter length of track occupied when the steam locomotive is omitted. The relief thus afforded by the electrification of the Paoli and Chestnut Hill lines is estimated to be sufficient to take care of the normal growth of business for the next seven or eight years.

It is estimated that under electric operation there will be sufficient saving in operating costs as compared with steam to pay interest on the investment, which in this case includes the entire Broad Street ter-



TUBULAR POLES USED WHERE ROOM FOR BRACING WAS AVAILABLE—NOTE WARPING OF CATENARY SYSTEM ON CURVE



SEMAPHORES REPLACED BY LIGHTS OUTLINING SIGNALS IN THREE POSITIONS—BOOSTER TRANSFORMERS ON BRIDGE

minal. This means that the increased capacity will in part, at least, be self-sustaining, whereas increased capacity by physical enlargement would give no direct return upon the investment. In addition there are the other advantages of electrification, such as higher speed of trains, more comfortable service, especially in bad weather, and cleanlier and more attractive conditions for the traveling public.

CHOICE OF SYSTEM

Analysis of service conditions and cost estimates covering all available electric systems led to the conclusion that one using a very high voltage, overhead contact wire and one eliminating moving machinery in substations would be the most suitable and economical as to both first and operating costs. Primary importance was attached to the feature of possible long-distance operation over the entire division affected, rather than to the requirements for present short suburban electric service. The system adopted is 11,000-volt, single-phase, 25-cycle power supplied direct to the trains from the overhead catenary trolley system.

The present installation covers the suburban passenger service only and involves about forty-three trains each way per day from Philadelphia westerly to Paoli on the main line of the Philadelphia division. The main tracks are electrified for 20 miles, and the improvement includes a coach yard at West Philadelphia and a coach and repair yard at Paoli. In all 93 miles of track are embraced in the present electrification.

Power is purchased from the Philadelphia Electric Company and is generated in their main station on the easterly bank of the Schuylkill River about a mile south of the West Philadelphia passenger station. The power is delivered to the railroad company at 13,200 volts, whence it is stepped up to 44,000 volts and transmitted to the step-down substations, of which there are three. The step-up substation is on the west bank of the Schuylkill River opposite the electric company's power house. The step-down stations are at West Philadelphia; Bryn Mawr, about midway on the improvement; and Paoli. Along the right-of-way the transmission lines are carried on the catenary system.

CATENARY SYSTEM

The power system is similar to that used on the Norfolk & Western electrification, described in the Engineering Record of June 5, page 704, and in its main features the catenary system is like that of the Norfolk & Western. In order to try out the various types of structures and details considered for the work, an experimental four-track section about one mile long was completely equipped in the fall of 1913. Study of this led to the adoption of what is known as the tubular cross-catenary bridge for carrying the catenary trolley wires. On either side of the track a tubular steel pole is set and grounded into a concrete foundation. Each pole has a double guy anchor-



OVERHEAD WORK FOR TANGENTS AND FOR CROSSOVERS—STRUCTURAL STEEL POLE AT RIGHT OF PICTURE

ing the pole away from the tracks, and spanning the track between the poles are the two cross wires forming the cross-catenary bridge which carries the longitudinal wires. This type of structure has been used throughout wherever the property or arrangement of tracks would permit. Where there was no room or guying, self-supporting structural steel poles have been used. (The tubular poles were also used on the Norfolk & Western work, but the smaller number of tracks made it possible to use cross girders for the most part instead of the cross catenaries.)

TUBULAR POLES

The tubular poles are built up of various lengths, sizes and weights of steel pipe welded together, different heights and lengths being required to suit the varying conditions at the different locations. The guys are solid steel rods with a heavy turnbuckle near the ground end to permit of adjustment. Numerous experiments and tests of different forms of guy anchors were made to determine the holding power and economy, and the anchor adopted is of the dead-weight type, consisting of a concrete slab reinforced with old rails held in place by the weight of the soil above. Where the guy rods pass up through the soil they are protected against corrosion by means of a steel pipe, the space between pipes and rods being filled with grout. Each catenary structure is grounded by means of a copper plate buried in coke.

WIRES

The cross wires are of extra-high-tension galvanized-steel strand, the upper strand usually being ¾ in. and the lower one ½ in. in diameter. Both are socketed at each end and at one side a turnbuckle is installed. The top and bottom cross wires are joined together by means of a vertical ¾-in. rod and suitable malleable iron clamps, etc., at the point where insulators carrying the longitudinal wires are located.

As in the Norfolk & Western work the cross wire bridges are located about 300 ft. apart on tangents, but are closer together on curves, the exact spacing depending on the degree of curvature. After the bridges are erected insulators are suspended approximately over the center of each track, these being precisely over the center of the track on tangents, but offset toward the outside of the curve on curved track. After the insulators are erected the main messenger wire is strung out and suspended from them. This is a ½-in. extra-high tension, seven strand, double-galvanized steel cable, having a sag of 5 ft. in a span of 300 ft. Every mile or two this messenger is socketed and dead-ended on one of the heavy structural signal bridges, which are spaced about ½ mile apart.

HANGERS

Every 15 ft. on curved track and 30 ft. on tangent track a hanger supports the lower two wires from the messenger wire. The upper of the two wires, called the auxiliary messenger, gives suitable current capacity to the system. The lower one is the contact or trolley wire. Both are carried in a vertical plane generally about 22 ft. above top of rail.

In the Terminal division, which includes the first 5 miles from Broad Street Station, where the steam locomotive traffic is very dense, resulting in much smoke and corrosive gases, a non-corrodible tube hanger is used. Some of the tube is Monel metal, while the balance is a bronze mixture containing 90 per cent copper. The tube has an outer diameter of 9/16 of an inch. On the Philadelphia division, where there is relatively less traffic, wrought-iron strap hangers 1 x 3/16 in. are used.

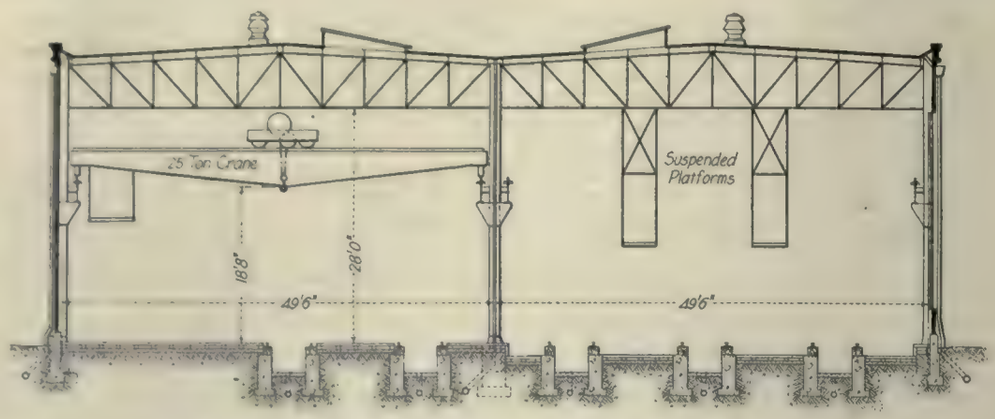
On tangents the casting at the bottom of the hangers holds the auxiliary messenger only, and the trolley wire is, in turn, supported from the auxiliary messenger every 15 ft. at points equally distanced from the hanger. This insures a very flexible trolley wire.

On curves the two lower wires do not hang directly beneath the messenger, but the whole system swings into a curved plane until a balance is reached between its weight and the tension in the wires. The tensions in both the auxiliary messenger and trolley wires are selected, so that in extreme hot weather there will be enough tension to prevent sagging, and yet in extreme cold weather the contraction will not cause stresses beyond the elastic limit.

SECTIONALIZING

The catenary system over each of the four main tracks is separated electrically from those over the other track, and trolley sectionalizing points with switches are provided at all crossovers so that sections of the line may be temporarily cut out of service for repairs. On the main running tracks sectionalizing is of the "air-break" type, the trolley wire being divided into two wires which are spread apart, and each wire being lifted up at a different point. Insulators are placed in each wire where it hangs above contact with the pantagraph; that is, while the pantagraph is making contact with one wire the other is lifted up and sectionalized. At crossovers and in yards the trolley wires are sectionalized by means of wood stick insulators, having runners or gliders on each side so arranged that while the pantagraph always makes contact with at least one of these levers they are separated electrically.

Several of the accompanying illustrations, as well as that on the front cover, show the different forms the catenary system takes on tangents, over curved tracks and in yards.



CROSS-SECTION OF CAR INSPECTION BUILDING IN PAOLI YARD

ERECTION CARS

The cars used in the erection of this catenary work had top platforms which could be readily raised or lowered by means of chain hoists. They were also equipped with removable outriggers, so that in the four-track section the work could be completely erected over one of a pair of tracks without in any way interfering with the regular steam traffic on this track.

The electrified route is crossed in many places by overhead highway bridges, some of which are not high enough above the tracks to permit the trolley being carried at the normal height of 22 ft. At such points the trolley wires gradually dip and go under the bridges at a lesser height. The catenary bridges are so located that these highway bridges come in the center of a span where, due to the sag in the messenger, the vertical height necessary to clear the system is a minimum. At such bridges the system is steadied by being held with post-type insulators supported by brackets on the bridge structure.



CARS FOR OVERHEAD WORK HAD ADJUSTABLE PLATFORMS AND OUTRIGGERS

In order to minimize the inductive effect of the traction currents on adjacent telephone and telegraph wires, a special system has been installed. This consists of series or booster transformers located about a mile apart. These transformers are mounted on signal bridges, and the current in each of the trolleys is constrained to pass through a primary coil of the transformer, thus inducing an equal current in the secondary coil, the ratio of the transformers being approximately unity. The secondary coils of these transformers are connected across insulated joints in the track, and consequently, as all trolley current must flow through the primary coil, the secondary coil insures that all the returning traction current, at this particular point of the circuit, at least, must flow through the rail. In this manner the traction current is prevented from taking earth returns in parallel with the track, or if there be a tendency between these booster transformers for the traction current to seek an earth return, this is corrected at the next booster transformer, which constrains or picks up all the traction current and again starts it through the rail.

ROLLING STOCK

Standard suburban steel coaches of the type used in the regular steam service have been used for the electric service without structural changes. This was made possible by the fact that the requirements for mounting electric apparatus on the cars had been thoroughly considered at the time when the steel car was introduced upon the railroad. The rolling stock consists of ninety-three standard all-steel cars, of which eighty-two are passenger, nine combination passenger and baggage, and two combination baggage and mail. All cars are motor cars, as no trailers will be operated in this service. The equipment of each car consists of two 225-hp. motors and automatic multiple-unit electric air-brake equipment. All the main fixtures of the electrical apparatus are mounted on one end of the car, and the air-brake equipment on the other, giving a slightly uneven weight distribution on the two trucks. The cars are designed for double-end operation.

The pantagraph is of especially light construction. The springs which raise it are designed to give flexibility to the framework, so that in operation a slight dragging of the trolley takes place, resulting in its following the wire much closer than with a rigid framework. In addition the shoe is spring mounted on the framework. The trolley is provided with four insulators suitable for 11,000-volt service, and the whole mechanism is mounted on a case provided with insulators similar to those of the trol-

ley, which gives it a double insulation.

In connection with the pantagraph the safety-first principle has been carried out in the provision of a grounding device of novel design. Steps for mounting to the roof are provided at one corner of the car only, and a lever is placed on the roof at this corner. When one climbs to the roof of the car this lever is thrown up, thus locking the trolley in the down position and grounding the entire framework.

The air-brake equipment is designed so that it may be used either in steam or electric service, and differs from the ordinary pneumatic brake in that the brake pipe reduction is made on each car by means of electric control instead of being made entirely with the engineer's brake valve. The addition of electric control to the pneumatic brake does not change its function in any way, but shortens the time required to get the brakes applied on all cars.

Trains of from two to seven cars are operated in regular service, the average acceleration on a straight level track being approximately 1 mile per hour per second up to 30 miles per hour, with a balancing speed of 60 miles per hour.

A substantial and completely equipped car inspection building has been constructed at Paoli yard. A cross-section of this building is shown. It is planned to serve not only the cars required for the present electrification but also those required by certain other divisions when electrified.

Changes in Signal System

Throughout the electrified zone it was necessary to change the existing direct-current track circuits to alternating-current track circuits and to provide impedance bonds, which permit the return of the 25-cycle traction current, but sectionalize the various track circuits so far as the 60-cycle current is concerned. In the electrified part of the Philadelphia division about 15 route miles, all four-track, the old form of semaphore signals has been replaced by those of the electric light type in which different rows of lights, each with suitable lenses, indicate the various positions of clear, caution and danger. A view of one of the typical signal bridges with the new type of signals is shown.

Wire Conduit

Following the heavy sleet storm of March, 1914, which caused so much damage to the overhead wires in the Eastern States, the railroad company decided to put certain parts of their telephone and telegraph wires under ground, and this has now been done throughout the electrified zone. The absence of the usual overhead telephone and telegraph wires along the right-of-way will be noticed in several of the photographs.

Along the main line this underground conduit consists of six single ducts, 3-in. bore, part of clay conduits, and part of bituminized fiber. The conduit bank is protected with concrete on all sides. There are concrete manholes every 400 ft. or less. In order to minimize inductive disturbances from the traction circuits the conduit is located as near the edge of the right-of-way and as far from the track as practicable, although in some cases it is just beyond the ends of the ties on the outside track.

Personnel

The design and construction of the electric installation was carried out by Gibbs & Hill, consulting electrical engineers for the company, in co-operation with the engineering department and the officials of the railroad. All construction except that of substation buildings and inspection building, which were covered by outside contracts, was carried out by a specially organized force. The mounting of the multiple-unit car equipment on the cars was carried out by the railroad forces at the Altoona shops, under the direction of the motive-power department. The signal equipment and changes in telegraph and telephone lines were designed and installed under the direction of the signal and telegraph departments respectively.

No less than twenty-four manufacturing companies supplied important items on plant or equipment for the installation. The Westinghouse Electric & Manufacturing Company furnished the motor car equipment and transformers; the National Tube Company supplied the tubular poles; the structural poles and bridges were furnished by the McClintic-Marshall Company, while the J. A. Roebling's Sons Company, the Waclark Wire Company and the Bridgeport Brass Company supplied the transmission, messenger and trolley wires.

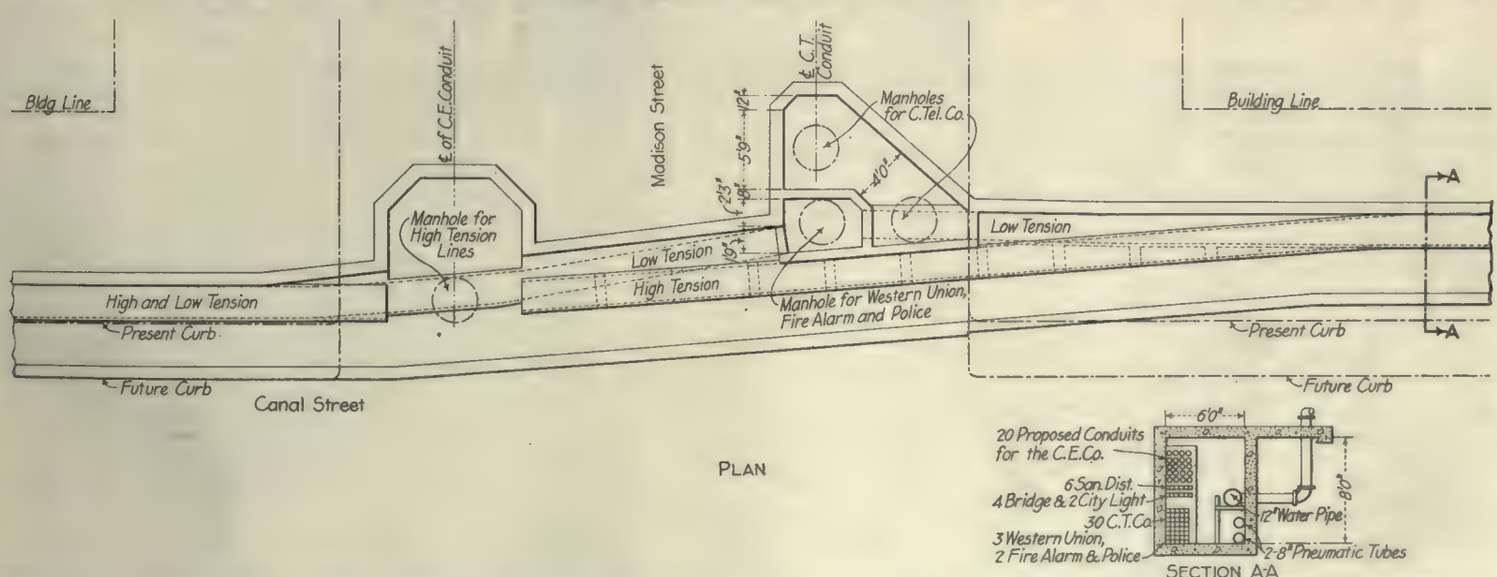
Chicago Builds Its First Utility Gallery

Construction of New Union Station Aids in Bringing Co-operation Between City, Public Utilities and the Station Company, Making the Project Feasible

CHICAGO is to have a model public-utility gallery. Co-operation between the city authorities, the new Union Station Company and the public utility companies has made this possible. This will be the only gallery of its kind in operation in this country, it is believed; New York built one in connection with the Bridge Loop Subway, but its use has been insignificant.

Erection of New Station Aids

The erection of the new Union Station furnished the opening wedge for the city officials to urge the new type of construction, as the station company is required to rearrange at its own expense the underground service pipes and wires of the city, as well as those of other public utilities. At the request of the city officials the Union Station Company agreed to build a utility gallery in Canal Street from Madison Street to Monroe Street, with a spur extending 80 ft. farther south in Canal Street to connect with possible future galleries in that thoroughfare, and in Monroe Street from Canal Street to Clinton Street. The City Council then appropriated $12,000 to carry the gallery one block farther north in Canal Street from Madison Street to Washington Street. The station company, by the terms



PLAN, LONGITUDINAL SECTION AND TRANSVERSE SECTION OF CHICAGO'S NEW UTILITY GALLERY IN CANAL STREET

of its grant from the city, is obliged to maintain for ten years the pavements about the structures it is to erect. For further details as to the preliminaries see the editorial in the Engineering Record of Oct. 30, page 528.

CONCRETING AMID CONGESTED TRAFFIC

As the north end of the gallery on Canal Street parallels the east side of the Chicago & North Western station, with its enormous suburban traffic, an arrangement for furnishing concrete without blocking traffic had to be devised. A small triangular vacant lot lies to the east of the street. Alongside of it are the depressed tracks of the Chicago, Milwaukee & St. Paul Railway, over whose lines gravel, sand and bulk cement are furnished to the contractor.

The above factors led the contractor to erect a tower, and to chute the concrete directly across the street to a small bin, from which it is spouted to two-wheel buggies. A clamshell bucket lifts sand and gravel from the railroad cars to near-by storage piles, whence the same bucket delivers the material to the bins over the mixer. Bulk cement is delivered by a worm conveyor direct from the railroad cars to a cement bin also over the mixer. As the contractor also has a contract to build a large concrete retaining wall and a reinforced-concrete sewer on Canal Street, he will use the same concrete outfit for doing all three jobs.

FIND WOODEN STREET BURIED 8 FEET

In the excavation for the gallery an old gravel road was unearthed 6 ft. below grade, 2 ft. below that a 2-in. plank pavement in excellent condition was found, and about 11 ft. down the floor of an old-sub-sidewalk was revealed. In addition the brick foundation walls of former buildings, curb walls and the conduits and cables for water, gas, sewer, electric light, telephone and telegraph were found running in every direction. Under the sidewalk at the east entrance of the North Western station a concrete wall 2 ft. thick, inclosing a lavatory, was encountered and had to be torn out.

The gallery, a reinforced-concrete box of 6 x 8-ft. interior dimensions, with sides 10 in. thick, is being placed under the sidewalks. The top conforms to the slope of the present sidewalk, provision being made for a 4-ft. extension of the present sidewalk. The floor is sloped 1 in. to the center for drainage purposes.

CHANGE ORIGINAL PLANS

As the Chicago Telephone Company wanted separate manholes at Madison Street for its wires, the original plans were changed. As may be noted in the accompanying plan, the telephone company can pull their cables from either Madison or Canal Street as necessity demands. There are 19,000 telephone wires going through the gallery. Separate manholes are provided for the high and low tension wires.

Tunneling under the street railway tracks on Madison Street is now under way, the usual shoring methods and box heading being employed. Owing to the hazards and unforeseen difficulties to be encountered, the contractor, the W. J. Newman Company, Chicago, has been awarded the contract on a percentage basis for the portion of the gallery between curb lines on Madison Street.

C. C. Saner is the assistant engineer for the city in charge of construction, reporting to H. S. Baker, assistant city engineer, under whose direction the project was designed and fostered. John Ericson is city engineer, in charge of all work of the Bureau of Engineering.

Specialized Experience of Engineers and Contractors Vital to Country's Defense

Can Be Made Available for Present Work and Future Need by Military Camps to Construct Defenses and Transportation Lines—Large Firms Should Take Lead

By GEORGE PERRINE

First Lieutenant First Regiment U. S. Volunteer Engineers, Spanish-American War; Assistant Tunnel Engineer, Rapid Transit Subway Construction Company, New York

THE PROFESSION of engineering and the business of contracting train men in the very essentials needed to carry on the modern operations of war. While the country is talking of preparedness, and while all realize that the immunity from attack by a powerful enemy which we have enjoyed so long may end at any time, what have engineers and those who have had experience in contracting done to place their organized services at the disposal of the country for emergencies, and what can they do?



PORTO RICAN BRIDGE BUILT BY VOLUNTEER ENGINEERS IN SPANISH WAR

In the first place, modern war is made possible largely by the engineer. It is impossible without adequate transportation, without adequate earthworks, without tools and materials of the latest design. In the second place, the maintenance of an army in the field is the same problem, on a scale commensurate with the size of the army, as that faced every day on every contract job in getting the men, the materials and the work together to produce results. The services which the engineer and the contracting man can render in defense of their country are thus performed behind the firing line and largely before the country is attacked. Therefore, there is immediate need of co-operation in this direction. No one need hang back from distaste of life in the trenches, as the services for which we are fitted are not performed with a rifle. No one need hang back waiting to enlist in the fighting branches of the army, as the service he can perform along the lines of his life training are as essential as those of the soldier, while there will be ten volunteers for the daredevil work to one who can capably handle the equally important business along the lines of communication.

PREPARATION FOR DEFENSE

The first consideration for the defense of our extensive coast, it seems to the writer, is adequate coastal railroads and highways, out of reach of interference from a hostile fleet. Back of these, at suitable distances inland and apart, must be concentration depots for men and supplies, from which, over radial lines to the coastal roads, a threatened invasion could be opposed in force on short notice. These should have lines connecting with the interior supply centers of the country. The elements of such a system exist already. It could be perfected, and the missing links supplied most economically at Government expense, if large numbers of engineers and construction men would join military camps for a short period each year, where the time of the men would be devoted largely to surveying, grading and possibly completing the necessary stretches of railroads and highways. In the case of the railroads, if there were no prospects of immediate use for commercial purposes, the ties and rails would never have to be laid until the emergency called for it. This work could be done under pressure in a few days, if war were to be declared. The highways would be immediately available, and the Federal help in building them would be most valuable to the local population.

Modern steel and concrete forts have hopelessly failed in the present great war. Massive defensive earthworks, which in future will take their place, could be economically designed and constructed without elaborate outlay for working plants, by volunteer service of the sort outlined here. Guns to equip these works could be held in reserve at concentration centers. An early example of citizen service of this kind was afforded in Revolutionary times, when students of Columbia College turned out in force and helped build a fort still standing on Governor's Island in New York Harbor.

RESERVE READY IN PRACTICE

Under this plan men who have made, in the course of their daily business, a life study of maintaining and providing camps, of mobilizing and transporting men and equipment—men whose living has been made by having things "at the front" when they were needed—would be at the instant disposal of the War Department in emergencies. Equally important, men who could design and build emergency defensive works, bridges and lines of transportation



MINE DEFENDING TRENCH SPRUNG DURING MANEUVERS AT FISHKILL, N. Y.—CONTRACTORS' MEN COULD DO SUCH WORK WELL

would be available. Also, and by no means least important, an army of mechanics, carpenters, foremen, experts in handling explosives, riggers, stationary engineers, blacksmiths, cooks, teamsters and specialized workmen of all kinds, without whom no defense of any sort could be made against an invasion, would be available.

The great consideration is that no expensive training for these men is needed. It is not even essential that all should be able to drill or shoot. All that is required is for the Government to know who and where they are, and for them to know what they are to do and where they should report.

EXAMPLE IN PORTO RICO

An evidence of this sort of service was brought out on a small scale in the American occupation of Porto Rico, where a volunteer engineer regimert of which the writer was a member supplied men on short notice to the regular army officers for erecting the hospital encampment, building a garbage incinerator, erecting an ice machine, rebuilding bridges and roads destroyed by the Spanish, handling supplies and doing other work of the thousand varieties that requires a specialist.

WORK FOR INDUSTRIAL ENGINEERS

The value of the services of engineers and others engaged in factories and industrial lines would also be great in a crisis. These men should know what their plants will be expected to supply in case of war, and plans should be made ready for converting them to the necessary use. The mechanics and workmen of each plant could be trained to make the changes, and the engineers and owners of the plant could be prepared to do their part in directing the work and arranging to have ready the extra equipment and supplies needed.

IMPORTANCE OF FOREMAN

Good foremen are needed in large military operations for a countless variety of services in constructing defenses and communications and in handling supplies. It would be folly in an emergency to take up the time of our few thousand army officers, who are the only men in the country with real military training, with such work. Good foremen, all the way from "pushers" to men who handle million-dollar construction contracts, have been trained to this work and could be made available by thousands. The men who served short periods each year in semi-military, semi-construction camps of the type proposed would have ready what simple personal equipment they needed, and could come to the aid of their



A JOB FOR THE ENGINEER AND TIMBER BRIDGE MAN—BUILDING A PONTOON BRIDGE AT FISHKILL MANEUVERS

country in a crisis at a moment's notice and without confusion—a thing now impossible.

Big Firms Should Help

Contractors and engineers are at least as vitally interested in defending this country from imposition and attack which would cut their business short as is the Pennsylvania Railroad, which has announced that it will give vacations of sufficient length to all its employees who will take military training. Cannot the large contracting and engineering firms take the lead in offering vacations to all of their employees who will volunteer for a short period of military construction service of the kind outlined? Many of them would be in a position to lend the Government idle



NO ONE IS BETTER FITTED TO HANDLE SUPPLIES THAN THE MAN WITH CONSTRUCTION TRAINING

equipment at times for the use of such encampments, the Government to pay transportation and upkeep. It is high time that the engineers and contractors of this country did something definite to make possible a vital service in emergency to their country for which it can look to no other class of citizens.



MEN WHO BUILT THIS BRIDGE IN ROCKIES TO CARRY MACHINERY COULD BUILD OTHERS TO CARRY BIG GUNS

New System of Filing Building Plans Saves Time

New York City Department Indexes Plans According to Lot Location—Colored Labels and Charge Cards Used

THE IMPROVED system of filing plans now used by the New York City Bureau of Buildings not only saves time and avoids confusion and delay for reference purposes, but minimizes the probability of errors by the use of colored labels, and insures an exact record of the location of plans by the method of numbering and the use of charge cards which indicate date taken out, person to whom charged and date returned. The number of filing clerks can be reduced as a result of the greater simplicity and rapidity of use of the new system, according to the last report of the bureau, from which the following abstract is taken.

Old System Caused Delay

The bureau has in its files at the present time more than a quarter of a million plans and applications for new buildings and alterations. The system of filing these in use since 1868 had become obsolete and absolutely inadequate for present needs, because of the length of time lost locating plans in the confused and congested plan room. The method of filing in the past had been to give each plan a serial number, together with the year number, and file it away in bins containing from 25 to 100 plans of all sizes. To locate any plan it was necessary to take out all the plans in any one compartment and turn each one to read the number on the side.

The borough of Manhattan is divided into eight tax sections. The blocks in each section have been given definite numbers, and likewise the lots in each block have also been given definite numbers. These block and lot numbers remain constant, thus furnishing an ideal basis for a system of numbering and filing plans. The new system consists in indexing the plans according to the location of the premises on which the building is to be or has been built, that is, giving the plans the numbers of the lot and block, and filing them away in geographical order according to locations of the lots and blocks upon which the buildings stand.

Labels with Location Numbers

All the plans are to be rolled on sticks of uniform length and stored in cases of uniform depth, thus preventing any small plans from being lost or two plans being rolled together and lost, as frequently happened under the old system. On the end of each stick is a label containing the number of the plan, so that the plan numbers can be read without removing them from the compartments.

To insure the filing of the plans in their proper location, the plans for each block are given a separate and distinct color from those in adjacent blocks. The color appears in the label at the end of each stick holding a plan. Further, in order to show the general position of the plan, the plans in each tax section are given a distinctive color on the neck of the stick back of the label. It can be readily seen from this color scheme that it will be impossible for a plan to be lost in the files, for a casual inspection of the plan files will detect any misplaced plans by means of the fact that the color in the label does not correspond with the others in the same compartment.

Constant applications are being received from other departments to consult these old plans; for instance, along the lines of the projected subway all the plans for buildings are desired in order to determine the nature of the foundations of the buildings that are to be preserved during the subway excavation. All these plans under the new system of filing will be in adjacent compartments and can be instantly found when wanted. Likewise, architects and owners are continually calling for these plans whenever they desire to make alterations to existing buildings. This new system will be a great help to them, because of the fact that all the plans covering building operations in any one site can be instantly found.

At the present time the plan files contain thousands of plans for buildings that have been demolished to make place for new buildings erected upon their sites. The new system of filing will automatically remove these from the plan files, for when a new building plan is filed upon any lot, the new plan will take the geographical position which the former plan occupied in the plan room.

Charging and Checking

A new charging and checking system for keeping track of the plans and applications in the bureau has been instituted during the past year. This consists in adapting the system in use in the loan department of the New York Public Library, namely, a charge card is placed in each application and when an application leaves the plan desk it is noted on this card to whom it is charged, with the date, and when the application is returned the date is also noted. The plan clerk under this arrangement will have either the application in the files or a card at the charging desk whereby he can tell instantly the location of the plan.

Every property owner in the borough will know the building-bureau plan number of his property, for this number will be the lot and block number which always appear on his tax bill, thus placing the records of the bureau immediately at his disposal.

Removing 258,000 Tons of Sediment from the water of St. Louis in 1914 cost 22½ cents per inhabitant. In the classification process, which was used prior to the construction of the filters, 13,660 tons of lime and 6770 tons of sulphate of iron were applied to 34,656 million gallons of water. E. E. Wall in his annual report pictures it for the layman as follows: "Had it been loaded on ordinary coal cars, they would have made a train 112 miles long."

Building-Area, Height and Other Limitations to Use of Private City Property Compiled

Data Presented by Nelson P. Lewis in Engineering Congress Paper on City Planning Show Practices in American and European Cities

MUCH of the paper on city planning presented by Nelson P. Lewis, chief engineer of the Board of Estimate and Apportionment, New York City, at the recent International Engineering Congress was published in the Engineering Record of Sept. 25, page 382, and that of Oct. 2, page 415. The paper discussed other phases of the general subject than those published in the issues referred to, however. There was, for example, considerable statistical information relative to building-area and height and other limitations to private property. These statistics are abstracted as follows:

AREA LIMITATIONS—EUROPEAN CITIES

The following are area limitations in various foreign and American cities:

Berlin, Germany.—The lot is divided into three theoretical zones, the first being 6 m. wide from the building line, the second 26 m. wide and the third embracing all the remaining land. All of the first zone may be occupied, 7/10 of the second, and 6/10 or 5/10 of the third, depending on whether it is inside or outside the former city walls. When the allowable building area is computed by this means, however, the building may occupy that area in the whole lot irrespective of the zones.

Düsseldorf.—The city is divided into five zones for which the heights of buildings are fixed, and in each zone there are from two to five classes prescribing the proportion of a lot which may be built upon. The proportions vary from 3/10 to ¾.

Leipzig.—The rear courtyard must be as wide as the height of the rear wall of the building.

Birmingham, England.—Behind all new dwellings there must be an aggregate unoccupied area of not less than 300 sq. ft.

Sheffield.—Behind all dwellings there must be unoccupied areas aggregating not less than 150 sq. ft. for buildings 15 ft. high, 200 sq. ft. for those 25 ft. high, 250 sq. ft. for those 35 ft. high, and 300 sq. ft. for those more than 35 ft. high, the height in all cases being measured to a point halfway up the main roof.

AMERICAN CITIES

New York.—Dwelling houses accommodating not more than two families may cover 90 per cent of the lot; hotels may occupy 90 per cent of interior and 95 per cent of corner lots above the second floor, but for each and every story above five an additional 2½ per cent of the lot area must be left free. In the case of lodging houses 35 per cent of interior and 8 per cent of corner lots must be left open. Office buildings on interior lots may cover 90 per cent of the lot at and above the second floor, while those occupying corner lots having an area of 3000 sq. ft. or less may cover the entire lot. Tenement houses, or those accommodating three or more families, may cover 90 per cent of corner lots having areas not more than 3000 sq. ft., but if located on interior lots more than 90 ft. but not exceeding 105 ft. in depth, 30 per cent of the lot area must remain uncovered.

Chicago.—Tenement houses must not be built nearer than 10 ft. to the rear lot line, except that when the lot abuts on a public alley the rear line of the building may be within 16 ft. of the opposite side of the alley. Rear buildings may be erected on a lot only on condition that the minimum distance between front and rear buildings is 10 ft., to which 5 ft. must be added for each story more than one of the higher building on the lot; provided that a one-story building without basement and not used for habitation may be placed on the rear of a lot containing a tenement house if a minimum distance of 10 ft. between buildings is maintained at every point.

Philadelphia.—No building for dwelling purposes shall have a frontage of less than 14 ft. At least 144 sq. ft. of the lot must be left open.

Boston.—Where tenement houses have no open space on either side they must have a yard the full width of the building at least 12 ft. deep in the rear, and the building must not exceed 1800 sq. ft. in area.

HEIGHTS OF BUILDINGS—EUROPEAN CITIES

The following are limiting heights of buildings in various cities:

Berlin.—Building heights are limited to the width of the streets upon which they front, measured between building lines. The fronts of no buildings for habitation may exceed five stories in height, although the roof may be carried to a greater height, provided no part of it projects beyond a line drawn at an angle of 45 deg. back from the top of the front wall. In the case of rear buildings or buildings fronting upon inside courts the limits of height are governed by the dimensions of the court, but their height may not exceed by more than 6 m. the width of the court on which they front, and in no case may it exceed 22 m.

Düsseldorf.—Of the five zones already referred to, the limiting heights are respectively 20 m.; 16 m., or, where four stories are allowed, 20 m.; the same; 16 m.; and 13 m., or, where three stories are allowed, 16 m. In none of the zones, however, may the height of the buildings exceed the width of the street upon which they abut. The classes of buildings which govern the proportion of the lot area which may be built upon varies in each zone.

Leipzig.—The height of buildings to the top of the main cornice may not exceed the width of the street, while in the central part of the city this height may not in any case exceed 22 m.

Birmingham.—No building shall exceed 100 ft. in height.

Sheffield.—New buildings are limited in height to the width of the street upon which they front, although provision appears to be made for carrying them to a greater height by special permission.

Liverpool.—Dwelling houses erected in new streets are limited in height to the width between opposite buildings, but there is no limit to the height to which business buildings may be carried.

AMERICAN CITIES

New York.—The labor, tenement house and other special laws impose a virtual limit upon the height of certain classes of buildings, but there is no direct limit prescribed by statute or ordinance, except that which restricts buildings used as dwellings to a height of 1½ times the width of widest abutting street. Office buildings may be carried to any height.

Chicago.—Tenements or dwelling houses may not exceed by more than one-half the width of the widest street on which they front—buildings set back from the street line being allowed to add the amount of such set back to the street width in computing the allowable height. Fireproof buildings for office and business purposes may be carried to a height of 200 ft. above the sidewalk level, but prior to Sept. 1, 1911, the maximum height for such buildings was 260 ft.

Philadelphia.—No law or ordinance limiting building heights.

Boston.—Buildings in the business section may not exceed 2½ times the street width, and in no case may be more than 125 ft. high. In other parts of the city the limit of height is 80 ft., except that where but one side of the street is built upon or where its street is 80 ft. or more in width, the height may be 100 ft. Wooden dwellings are limited to three stories above the basements, but may in no case be more than 45 ft. above the street level.

Washington.—On Pennsylvania Avenue 160 ft. is the limiting height; on other business streets 20 ft. more than the street widths, with a flat limit of 130 ft.; on residential streets, 85 ft., provided that on streets over 70 ft. wide the height may not exceed the street width minus 10 ft.; on streets from 60 to 70 ft. wide, 60 ft., and on streets less than 60 ft. wide, the street width.

Charleston, New Orleans, Cleveland and Fort Wayne.—Building heights are restricted to 2½ times the width of the widest street, with absolute limits in the four cities of 125, 160, 200 and 200 ft. respectively.

Buffalo and Rochester.—Height is limited to four times the average least dimension of the building, without specific limit in feet.

Toronto.—Height of five times the least dimension, with an absolute limit of 130 ft.

RESTRICTIONS AS TO USE

A further and more radical step in the direction of restricting the use of property outside the street line is the attempt to specify the uses to which the property may be put. While for many years the conduct of noxious trades or occupations has been quite generally prohibited within city limits or restricted to certain districts, the division of the entire city into districts, in each of which is prescribed the use to which private property may be put, is now claimed to be a reasonable exercise in the authority of the municipality. This plan of districting has been most fully developed in the German cities. The factory districts are naturally located along the lines of rail or water transportation, but their position with respect to the remainder of the city is often determined by the direction of prevailing wind.

Following are regulations of this character adopted in America:

Los Angeles.—The entire city, except two suburbs, is divided into industrial and residential districts, there being twenty-five of the former and only one of the latter. The former are widely scattered and the latter includes the remaining area, so that it en-

tirely surrounds many of the industrial districts and really covers the entire city. Within the residential district are fifty-eight districts designated as "residential exceptions," in which business is permitted subject to certain conditions. One of these is about ½ sq. mile; the others are small, covering not more than two city blocks. The restrictions are not sweeping. The largest industrial district has an area of several square miles; the smallest consists of a single lot. Their combined area is only about 1/10 that of the residential district. In most of them all kinds of business and manufacturing are unrestricted, while certain specific kinds of business are excluded from the residential district, but those not specially excluded are permitted in the "residential exceptions," although the owners of 60 per cent of the neighboring property fronting must consent to the establishment of any "residential exception."

Seattle.—Use to which property may be put is restricted.

Baltimore.—Use of property in certain sections is regulated.

New York State.—The municipal legislative body in any city of the second class, on petition of two-thirds of the property owners affected, may establish residential districts within which no building other than single or two-family dwellings may be erected, such restrictions to continue until a similar petition shall have been presented to and approved by the same body.

Massachusetts.—Any city or town in the State except Boston, which is governed by special act, may regulate the height, area, location and use of buildings and other structures for the prevention of fire and the preservation of life, health and morals, except, however, bridges, quays, wharves and structures owned and occupied by the National or State Government.

Minnesota.—Minneapolis, St. Paul and Duluth may by two-thirds vote of the municipal legislative bodies when petitioned to by a majority of property owners in any proposed district establish residential and industrial districts. Authority is given to classify the various industries and restrict each class to a definite limited area, while upon a similar majority petition the original restriction may be set aside. Minneapolis has created certain industrial and residential districts.

Wisconsin.—Similar powers have been conferred on eight of the principal cities of the State.

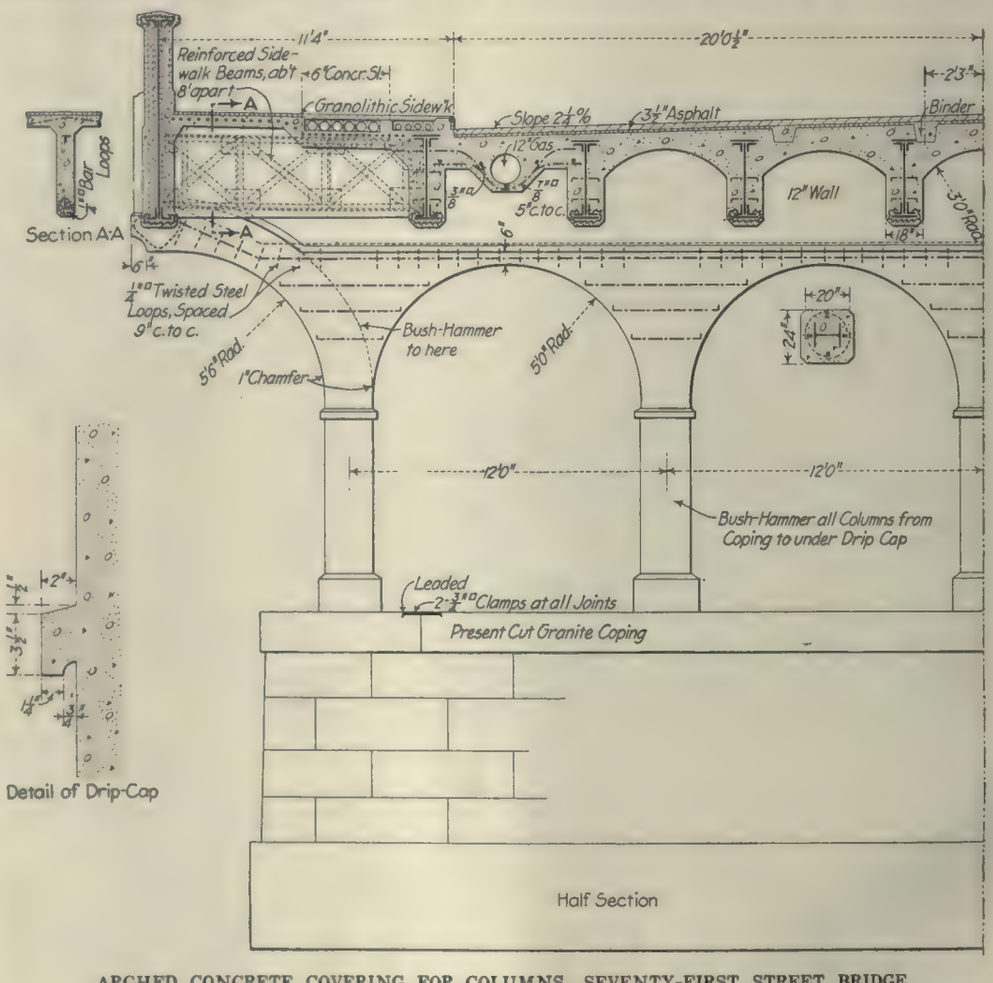
Ontario, Canada.—The Provincial Legislature has authorized the councils of cities of more than 100,000 inhabitants to restrict the erection of buildings of certain classes to designated parts of the city. Toronto has acted under the provisions of this law, and apartment houses and garages are excluded from most of the residential streets.

IN REPAIRING STREETS where trenches have been cut in concrete foundations the city of Detroit requires that all concrete used in repairing shall be at least 8 in. thick and shall extend in every direction beyond the edge of the excavation a distance of 6 in. at the bottom of the concrete and 8 in. at the top. The object of this provision, states the commissioner of public works, is to secure a shoulder of solid earth for the new concrete to rest upon, with the object of preventing settlements which have heretofore invariably occurred.

Street Bridges in Philadelphia Designed for Permanent Artistic Effects

Highway Crossings Over Railroads Kept Clear of Obstructing Girders —Steel Protected by Concrete with Effective Surface Treatment

RECENT BRIDGES just completed or in process of design or construction under the supervision of the Bureau of Surveys of the City of Philadelphia contain certain basic features of artistic and effective treatment which are worthy of record. The principal features of several small spans of various types will be described—a 28-ft. arch span on weak foundations in which the arch thrust is resisted by reinforced-concrete ties below the springing line, a street crossing over a railroad, showing typical steel and concrete construction for unobstructed roadway and sidewalks, including arched concrete column incasement to improve the appearance from the car windows, and the architectural treatment of steel undergrade bridges by the use of concrete pylons, artistic railings and abutments, sodded slopes, and the painting of steel to harmonize with the substructure.



ARCHED CONCRETE COVERING FOR COLUMNS, SEVENTY-FIRST STREET BRIDGE

GENERAL SPECIFICATIONS AND LOADING

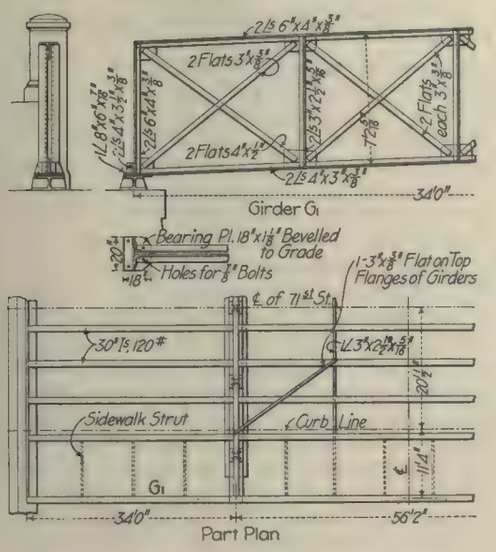
Street bridges in Philadelphia are subject to the specifications and approval of the Bureau of Surveys. The specifications drawn up by the Bridge Division contain the following requirements and recommendations regarding general design:

"When conditions such as span, headroom, foundations and facility of erection permit, a concrete-arch type of bridge is preferred, and if sufficient rise can be obtained the arch shall be of rubble concrete without steel reinforcement. The limit of flatness permissible without reinforcement is the curvature of a radius equal to the span. Steelwork over railroads shall be incased in concrete with a minimum thickness of covering of 3 in. For highways deck bridges are always preferred, no girders or trusses being permitted to project above the floor surface of either driveway or sidewalks except as parapets, unless limited depth of floor or other circumstances make the preferred construction impracticable or unreasonably expensive. Columns in sidewalks and recesses in abutments are objectionable and to be avoided whenever practicable."

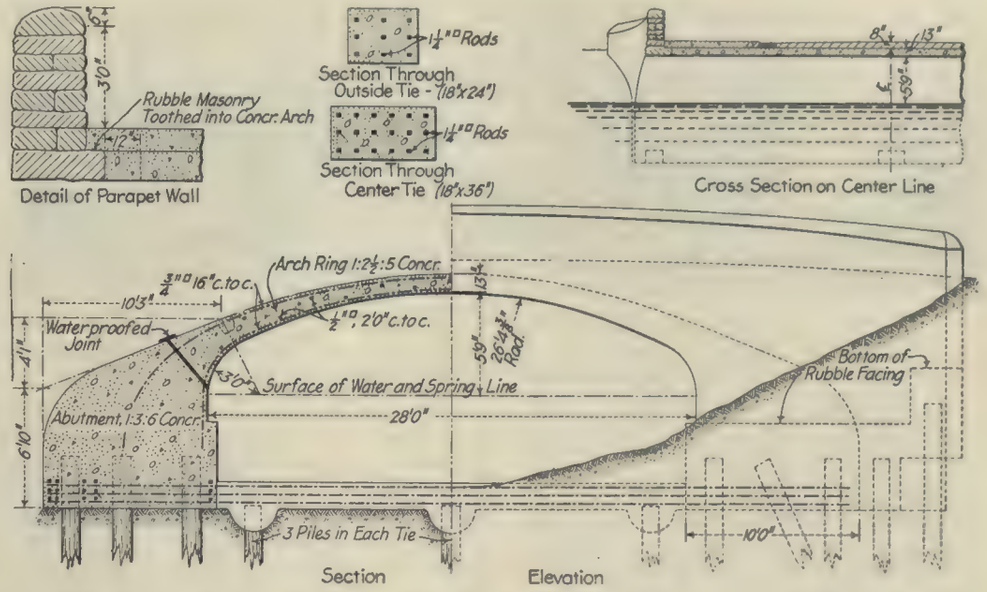
The specified live load is as follows:

(a) A uniformly distributed load over the entire surface, including driveway and sidewalk (or the entire surface of footbridges) of 100 lb. per square foot for spans up to 75 ft. Sidewalk brackets, joists and floor to be proportioned for a local loading of 110 lb. per square foot. For main girders or trusses of bridges with cartway less than 34 ft., add 600 lb. per linear foot of bridge for additional general load on one street-railway track, and for bridges with cartway 34 ft. or over add 1200 lb. per linear foot of bridge for additional general load on two street railway tracks.

(b) A concentrated moving load of 20 tons on one axle with wheels 5 ft. apart on any part of the driveway; or 27 tons on



SEVENTY-FIRST STREET BRIDGE DETAILS



TYPICAL SMALL ARCH BRIDGE DETAILS—28-FOOT SPAN IN LEAGUE ISLAND PARK

two axles 7 ft. apart on each street-railway track; or 40 tons on two trucks 20 ft. center to center, with axles 5 ft. center to center on each street-railway track. Stresses produced by the street-railway concentrated loads are to be increased for impact by the formula

$$P = 5/(L + 5)$$

where P is the added percentage and L is the loaded length of the bridge producing the maximum stress in the member.

The unit stresses for steel and concrete are in accordance with usual standard practice. Of the concrete protection for girders the part in compression is considered to carry its proportion of the stress.

Arches with Ties Below the Stream

A series of five small arches varying in span from 24 to 40 ft. carrying park drives over lagoons in League Island Park are now being constructed. The foundations are soft and require the use of piles, but rather than depend on the thrust resistance of battered piles, it was decided to use reinforced-concrete ties below the stream and design the abutments as horizontal beams. One of the accompanying drawings gives typical details and shows the three ties used and the manner of bending the rods to act as shear bars in the abutments.

Although not drawn in detail on the elevation, the facing and parapet walls are being built of rubble stone from Conshohocken, of the general dimensions shown on the section. This parapet wall is used as the facing form for the concrete of the main arch, and gives the appearance of stone arch construction. The sweeping curves of the design work out better in rubble than would be possible in concrete except at very much increased expense for forms and workmanship.

Typical Street Crossing Over Railroad

The recently completed overhead crossing at Seventy-first Street over the Philadelphia, Baltimore & Washington Railroad is a fair example of the construction used to preserve an unobstructed roadway and sidewalk, and also furnish a structure of satisfactory appearance by covering and preserving the steel with concrete. The accompanying drawings and photographs show the typical details and appearance of this structure. Shallow intermediate plate girders with cover plates are used in the longitudinal direction spanning four tracks with plain concrete jack arches between them. The deep outside (railing) trusses are composed of four angles laced with double flats for diagonals in both directions and vertical posts, as shown by the detail of the end of the 34-ft. truss shown. The sidewalk struts are built up of two angles double-laced with 3 x 5/16-in. flats and single angles vertical. Concrete covers the steel as required to a minimum depth of at least 3 in.

The intermediate columns are of 12 in. H-section with standard details. They support the main cross girders, which are 3 ft. 9¾ in. out to out, masked and protected by the concrete in arched form as shown by the half cross-section. The old masonry piers, built fifteen years ago with a view to supporting a steel bridge with wood floor were used, the existing coping stones being anchored together by clamps, as noted, in order to resist any possible spreading from the fact that the outside columns are the most heavily loaded.

Other details of the floor construction are noted on the section. Attention is called to the method of providing for the 12-in. gas main and reinforcing the concrete for the panel in which it occurs, also the provision for future trolley rails. The facing concrete on exposed surfaces was finished by bush-hammering. The columns up to the drip cap were so finished because easily visible from the windows of passenger trains. This drip cap is shown in detail, and makes an effective springing line for the arched concrete in addition to the protection for the finished surface below. The use of drip caps under the bridge deck is justified by the amount of dirty con-



LUZERNE STREET ARCH BRIDGE WITH EFFECTIVE RAILING



SEVENTY-FIRST STREET BRIDGE OVER P. B. & W. RAILROAD

Steel columns shown in right-hand picture are masked in arched concrete.



DOUBLE-TRACK RAILROAD BRIDGE OVER FIFTY-FIFTH STREET

Ornamental pylons and curved wing walls with bush-hammered facing—steel painted to harmonize in color—slopes of embankments sodded

densed steam which accumulates on the concrete overhead.

ARCHITECTURAL EFFECTS

Other examples of the results being obtained in the effort to apply simple but effective modifications in outlines for ornamentation are indicated by the photographs of the Fifty-fifth Street Bridge under the Philadelphia & Baltimore Central Railroad and the Luzerne Street crossing over the Pennsylvania Railroad, Oxford Road Branch. The Fifty-fifth Street Bridge is a double-track structure on a curve and spans an 80-ft. street. It was, therefore, necessary to allow the use of curb columns in order to reduce the girder depth. The striking features in the ornamental treatment of this structure are secured by the heavy pylons hiding the ends of the girders, the curved wing walls with effective cylindrical ends, the bush-hammered facing of Port Deposit granite chips, the painting of the steelwork to harmonize with the concrete, and the sodded slopes which furnish a contrasting green outline for the wing walls.

The 37-ft. arch bridge carrying Luzerne Street over the Oxford Road Branch of the Pennsylvania Railroad is improved in appearance by the panel outline of the arch, the circular panel ornamentation, the false horizontal joints (also used in the Fifty-fifth Street bridge) and the effective design of the concrete railing. This form of railing is one of the best used in these city bridges, and was described in detail in the Engineering Record of Oct. 11, 1913, page 401, in an article describing other ornamental bridges in Philadelphia. It was cast on the ground in units one panel in length instead of being poured in place, and expansion joints were provided in its erection.

SURFACE TREATMENT

It so happens that the concrete structures above mentioned have been surface-finished with the "bush-hammer"—the customary name for what is properly called the "patent," or parallel-bladed hammer. This is an alternative for the method of scrubbing the green concrete with brushes and water to reveal the aggregate. One method or the other is used on the exposed surfaces of all concrete built by or under the supervision of the Bureau of Surveys. The scrubbing method is found to require special framing of forms and extreme care in their removal; the bush-hammering method permits the forms to remain in place as may be desired and the finishing to be postponed until a convenient time. On the other hand, the hammering is apt to damage a design which contains many small features with sharp edges. The two methods are alternated as the nature of the design, situation and material seem to require, and the choice makes a negligible difference in the contract price.

This work is being done under the direction of George S. Webster, chief engineer of the Bureau of Surveys, Philadelphia. The details of design and construction are directly under the supervision of Jonathan Jones, assistant engineer, who kindly furnished the data here given.

How Curing at Low Temperatures Affects Concrete

A. B. McDaniel Reports Results of Tests—Compressive Strength of Concrete Cured at 60-70 Deg. Double That at 32-40 Deg.

OF SPECIAL economic importance to the contractor or the builder is a knowledge of the strength of concrete at early ages under different temperature conditions. Exact information will then replace guesswork as to when forms may be removed and what loads may be safely applied to the different parts of a concrete structure. Tests, therefore, were made at the laboratories of the University of Illinois during 1913 and 1914 and were recently reported by A. B. McDaniel, assistant professor of civil engineering at that institution, in Bulletin 81 of the Engineering Experiment Station.

Three groups of tests were made—group 1, forty-five 6 x 6-in. cylinders; group 2, fifty-one 6-in. cubes, and group 3, sixty 8 x 16-in. cylinders, subjected to various molding and storage temperatures. All test specimens were made with Universal Portland cement, clean, well graded Attica sand, and crushed limestone in the proportions of 1:2:4 by weight, or 1:2.2:3.6 by volume. The materials for each specimen were weighed out separately and then mixed. The temperature of the storage room was determined by daily readings of maximum and minimum thermometers. All the specimens while in storage were covered with several layers of moist sacking, which was sprinkled daily.

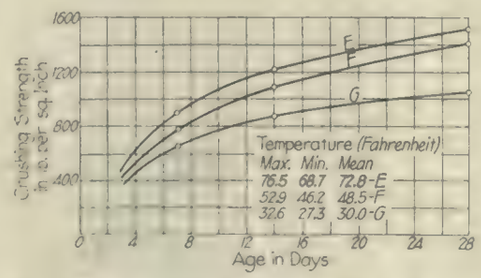


FIG. 1—STANDARDIZED VALUES FOR 6 X 6-IN. CYLINDERS OF GROUP 1

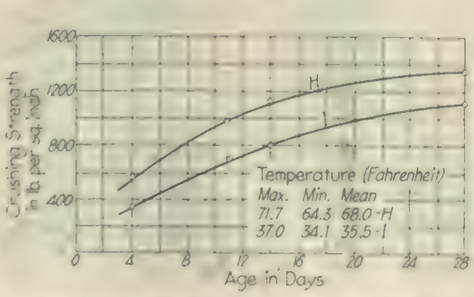


FIG. 2—STANDARDIZED VALUES FOR 6-IN. CUBES OF GROUP 2

The specimens of group 1 were tested in about 20 hr. after removal from storage at the given temperature. The specimens of groups 2 and 3 were brought to the laboratory and tested within 1 hr., with the exception of two specimens which were stored in a room varying in temperature, as mentioned below, and kept in the laboratory at 70 deg. Fahr. for 7 days and 21 days respectively before testing.

STANDARDIZED STRENGTH—EFFECT OF NON-UNIFORM TEMPERATURE

The observed values for the cubes and short cylinders of groups 1 and 2 have been

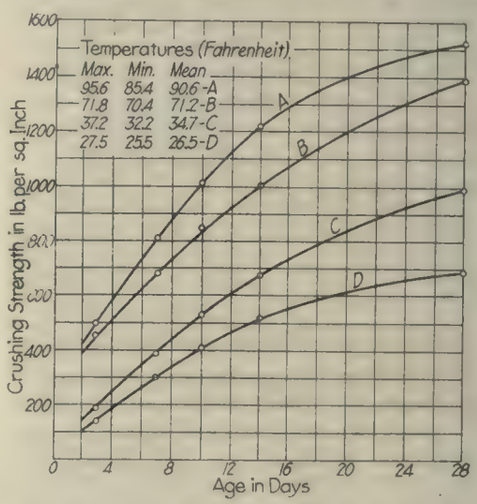


FIG. 3—AVERAGE VALUE FOR 8 X 16-IN. CYLINDERS OF GROUP 3

reduced to the equivalent strength which would be obtained for standard cylinders of height equal to twice their diameter by multiplying by 0.73, the ratio determined by the committee on specifications of the American Concrete Institute. These equivalent average values are given in Figs. 1 and 2 for the temperatures indicated on the diagrams.

The specimens of one set were stored in a room where it was known that the temperature would not be uniform. The mean temperature varied from 22 to 35 deg., with an average of 27 deg. for 42 days. All of these specimens tested at 11 days were slightly disintegrated on the surface, and those tested at 28 days were badly disintegrated. Of those reserved to be tested at 42 days only one could be tested, the other two being very badly disintegrated. These two specimens were then kept in the laboratory, as described above, for 7 and 21 days respectively. The 42-day specimen failed at 420 lb. per square inch, while the 49-day specimen (5 x 5 x 6 in.) failed at 1270 lb. per square inch and the 63-day specimen (4 x 5 x 6 in.) at only 400 lb. per square inch. These results indicate that the low temperature retarded the hardening action of the concrete, and that the alternations above and below freezing caused a softening and crumbling of the material.

The average results for the standard 8 x 16-in. cylinders at the mean temperatures shown are given in Fig. 3. It is noteworthy that under a temperature slightly below freezing the concrete gained strength continuously. It is also interesting to note that the curve for a mean temperature of 26.5 deg. is substantially of the same character as that for a mean temperature of 71.2 deg.

The tests are summarized in Figs. 4 and 5. Fig. 4 shows the relation between strength and temperature for the several ages of the tests, and Fig. 5, drawn from the values in Fig. 4, shows in a general way the relation in per cent between the strength at 28 days for a temperature of 70 deg. and the strength attained at various ages under varying temperatures. These values are sufficiently accurate to furnish suggestive information which may be useful in determining the time when forms may be removed and loads applied.

GENERAL CONCLUSIONS

It is believed the following general conclusions are justifiable:

1. Under uniform temperature conditions, there is an increase of strength with age within the limits of the tests. For any temperature the rate of increase decreases with the age of the specimen, and this rate of increase is less correspondingly at the lower temperature conditions. For the specimens tested, under normal hardening temperature conditions of from 60 to 70 deg. Fahr., the compressive strength of the concrete subjected to a uniform temperature at the ages of 7, 14 and 21 days may be taken as approximately 50, 75 and 90 per cent of the strength at 28 days, respectively. For lower temperatures the percentage values are less, and for higher temperatures the percentages are higher. The relation between the percentage values at the ages of 7, 14, 21 and 28 days is nearly the same for temperature conditions from 30 to 70 deg. However, the values for the lower temperatures should be used with caution.

2. Concrete which is maintained at a temperature of from 60 to 70 deg. will, at the age of one week, have practically double the strength of the same material which is kept at a temperature of from 32 to 40 deg.

3. Figs. 4 and 5 may be used to determine the representative strength of concrete similar to that used in these tests, for various temperature conditions and for ages up to 28 days. These diagrams may be used with a fair degree of approximation to ascertain the relative strengths which concrete of ordinary practice may be expected to attain at the different temperatures.

It should be noted that generally in this investigation the specimens were stored under temperatures which were nearly uniform during the whole storage period. In one set the variations in temperature include a number of alternations above and below the freezing point, and the specimens were seriously injured. The results accord with the well known effect of freezing and thawing upon green concrete.

The tests were made under the supervision of Professor McDaniel—those of groups 1 and 2 by J. A. Anderson and W. J. Bublitz, and those of group 3 by J. A. Anderson.

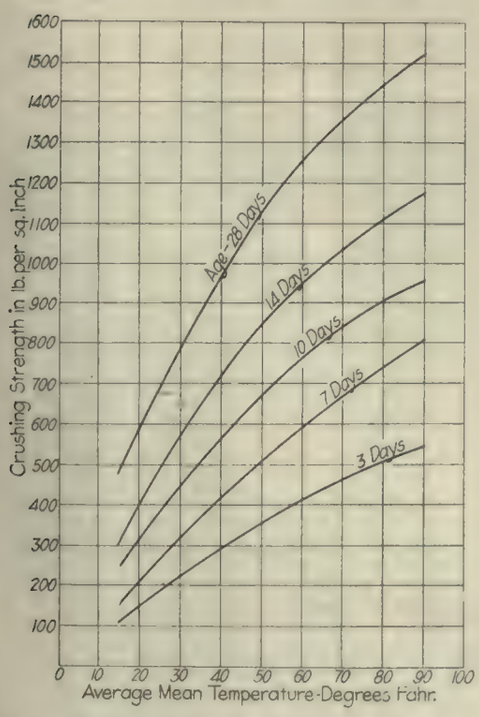


FIG. 4—RELATION OF STRENGTH TO TEMPERATURE AT DIFFERENT AGES

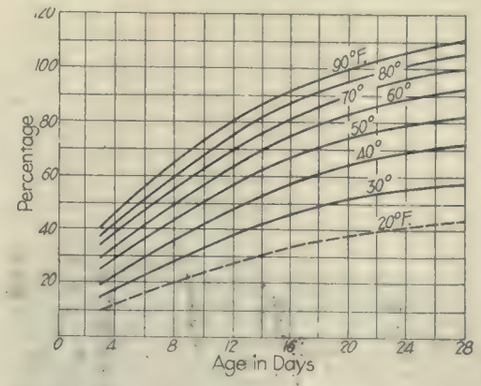


FIG. 5—STRENGTH PERCENTAGES FOR VARIOUS MEAN TEMPERATURES

Percentages are based upon strength at 70 deg. for 28 days.

Mileage of Government Valuation Inventory Tabulated

THE MILEAGES covered up to Sept. 30, 1915, by the Government in connection with the field work of evaluating the railroads is given in the accompanying table, taken from a progress bulletin issued by Thomas W. Hulme, general secretary of the Presidents' Conference Committee. It will be noted that on three good-sized roads—the Kansas City Southern, the San Pedro, Los Angeles & Salt Lake and the Western Pacific—as well as on ten smaller lines the parties inventorying roadway and track have completed their tasks, while on larger systems, such as the Boston & Maine, the Chicago & Eastern Illinois, the Big Four, the Great Northern, the Rock Island and the Central of Georgia, the work is well advanced.

PROGRESS OF FIELD INSPECTION, SEPTEMBER 30, 1915, FOR GOVERNMENT VALUATION OF RAILROADS

Road	Date Division of Valuation forces began work	Miles of road	Total miles inspected and inventoried to date: Road and track	Bridges	Buildings	Signals	Telegraph and telephone	Total miles "Adjacent Similar Land" inspected
Eastern Group								
Boston & Maine	4-29-14	2,434	2,246	798	798	835	2,326	1,235
Chicago & Eastern Illinois	5-2-14	1,140	1,104	1,102	1,102	989	1,123	989
Cleveland, Cincinnati, Chicago & St. Louis	8-24-14	2,381	1,960	1,441	820	1,952	2,218	....
Pennsylvania	1-1-15	5,919	1,248	1,030	1,039	890	1,058	210
New York, New Haven & Hartford	3-31-15	2,046	553	....	....	....	....	108
Boston & Albany	4-21-15	392	159	106	....	....	....	....
Chicago, Indianapolis & Louisville	5-25-15	610	424	610	....	....	386	....
Ann Arbor	6-1-15	292	* 292	292	292	292	292	....
Maine Central	8-14-15	1,057	102	....	....	....	63	....
Bangor & Aroostook	8-16-15	626	106	....	....	....	....	....
Total	.....	16,897	8,194	5,388	4,051	4,958	7,466	2,542
Western Group								
Texas Midland	.....	111	* 111	111	111	111	111	111
New Orleans, Texas & Mexico	.....	173	* 173	173	173	173	173	173
Kansas City Southern	.....	878	* 878	878	878	878	878	878
San Pedro, Los Angeles & Salt Lake	.....	994	* 994	994	994	994	994	994
Elgin, Joliet & Eastern	.....	211	* 211	211	211	211	211	211
Western Pacific	.....	981	* 981	981	981	981	981	981
Quincy Western	.....	6	* 6	....	....	....	....	....
Missouri Southern	.....	54	* 54	54	54	54	54	54
Mississippi River & Bonne Terre	.....	54	* 54	54	54	54	54	54
Arizona & Swansea	.....	21	* 21	....	....	....	....	....
United Verde & Pacific	.....	26	* 26	....	....	....	....	....
Cape Girardeau Northern	.....	106	* 106	106	106	106	106	....
Minneapolis, St. Paul & Sault Ste. Marie	5-1-14	4,125	2,109	404	404	404	....	500
Great Northern	5-3-14	7,321	4,597	1,927	1,927	3,504	6,495	592
Rock Island lines	8-1-14	7,680	5,711	1,667	1,667	720	7,210	....
Chicago & North Western	9-2-14	8,346	91	91	91	91	91	91
St. Louis Southwestern	11-12-14	1,568	747	747	747	....	747	747
Illinois Central	11-18-14	5,960	1,673	1,726	1,726	1,166	4,077	1,506
Santa Fe	12-4-14	11,117	1,109	1,109	1,109	....	2,107	....
Southern Pacific	1-3-15	6,906	248	....	....	561	705	....
Chicago, Milwaukee & St. Paul	5-22-15	9,611	1,271	....	....	....	....	498
Total	.....	66,249	21,171	11,233	11,233	10,008	24,994	7,390
Southern Group								
Norfolk Southern	2-27-14	903	903	903	903	903	903	....
Atlanta, Birmingham & Atlantic	2-19-14	658	658	658	658	658	658	650
Central of Georgia	7-8-14	1,972	1,972	1,959	1,902	1,972	1,972	1,972
Savannah & Northwestern	2-18-15	109	109	109	109	....	109	....
Charleston & Western Carolina	5-29-15	341	341	None	None	None	297	....
Georgia Southern & Florida	1-2-15	605	605	605	605	605	605	....
Mobile & Ohio	6-15-15	1,114	600	None	None	None	None	....
Southern	7-14-15	7,000	275	None	None	None	None	....
Total	.....	12,702	5,463	4,234	4,177	4,138	4,544	2,622
Grand total	.....	95,848	34,828	20,855	19,461	19,104	37,004	12,554

*Field work of roadway and track parties completed.



TOWER AND CHUTES KEEP CONCRETE AHEAD OF REST OF WORK

Well-Designed Concrete Plant Aids Construction of Waterworks Dam

Spouting System Places Good Concrete on Development of Bridgeport Hydraulic Company—Aggregate Is Washed a Batch at a Time in Measuring Hopper

A WELL-DESIGNED concrete plant of greater capacity than would ordinarily be considered necessary for the job is materially aiding the economical construction of a small dam being built by the Bridgeport Hydraulic Company on the Means Brook watershed near Bridgeport, Conn.

This company supplies the city of Bridgeport with about three times the quantity of water consumed by other cities of its size, on account of the large manufacturing interests located there. This business is growing very rapidly, and makes profitable the development of the smaller watersheds in the vicinity, of which the Means Brook watershed is one. A 36-in. pipe line will conduct water from the dam to the main storage basin, whose level is to be raised 10 ft. to accommodate the supply from this and other developments. The Hemlocks dam, another unit of this company's system, which was described in the Engineering Record of Sept. 14, 1912, page 392, has recently been put in service.

CONSTRUCTION PROBLEMS

The dam is of concrete, on a foundation of gneiss, and extends across the creek valley from east to west. Only 12,000 cu. yd. of concrete are required, and the greater part of the time necessary to complete the job is taken up in excavating the rock to secure a sound foundation. As the job is several miles from the nearest railroad or town, necessitating a camp for the men, and as the supply of good labor was not found plentiful, only so large a force as can be employed to best advantage on the foundation excavation is maintained at the job. It is here that the large capacity and labor-saving layout of the concrete plant has proved its value. It is possible to concrete a section in a few runs as soon as the foundation has been prepared. At the same time, as the concrete plant is able to keep up by running only a short part of the time, this method of organizing the work does not appreciably delay the excavation.

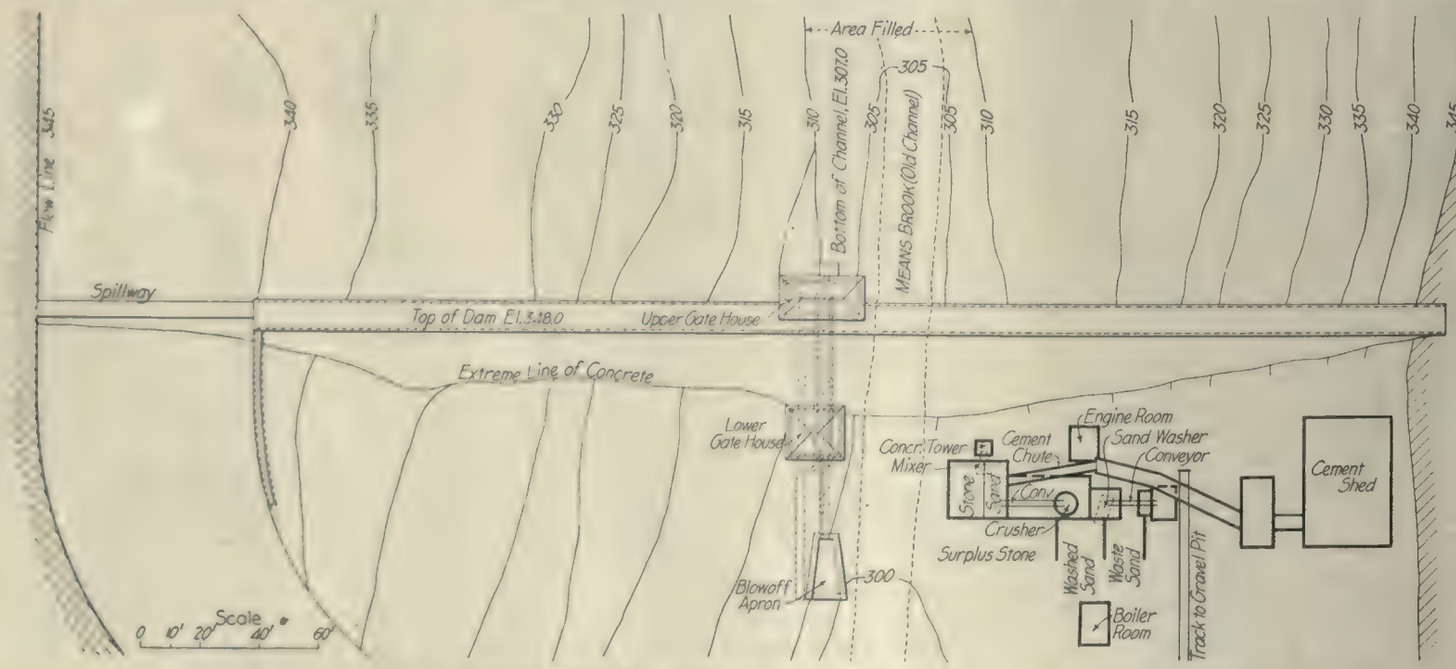
GRAVEL PIT DEVELOPED

On account of the long haul over indifferent roads, it has paid to develop a gravel deposit found in the east side of the valley a few hundred feet below the dam, although this deposit was at a low elevation and contained a large excess of sand, and although the material from it had to be washed. Cement for the work is hauled in automobile trucks from Shelton, a distance of 4 miles.

The pit is worked with a revolving steam shovel, and the 4-yd. side-dump cars used are handled on the pit floor and at the mixing plant by a dinky. A hoisting engine set at the top of the incline to the pit floor hauls the dinky and two cars at a time from the pit to the upper level. This deposit is a pocket of glacial drift, in which are many large boulders. These are blockholed and shot up for the crusher, as this is considered the cheapest method of getting them out of the way.

ECONOMICAL CONCRETE LAYOUT

A 150-ft. tower, designed to spout a distance of 250 ft., is used for placing all the concrete. The company expects to build a larger dam soon, and it was decided to try out the spouting method of placing concrete on the present job with a view to laying out the larger one more intelligently. Over the 1-yd. mixer at the base of this tower, which is located just east of the creek on the valley floor below the dam, are the stone and sand bins. Downstream from these on the valley floor are storage piles for both sand and stone, which are reached by a clamshell guy derrick. This derrick handles washed sand from the pile to the bins, while normally the stone drops directly into the bins from a revolving screen mounted above it. Crushed boulders and gravel are elevated by a bucket



LAYOUT MADE POSSIBLE LOW-COST CONCRETE WORK WITHOUT REQUIRING THAT A LARGE CREW BE HELD ON THE JOB

conveyor to this bin from a No. 5 McCully gyratory crusher, set east of the bins. This crusher is fed by a chute from a grizzly screen, set above and east of it. The sand from this screen is washed down a trough directly into the sand washer, or can be run out on the ground below the storage pile for washed sand. As this surplus sand piles up, the derrick loads it back into the dump cars, and it is wasted on a dump between the plant and the pit.

The grizzly screen is fed by a bucket conveyor from a pit east of the sand washer into which the side-dump cars from the gravel pit discharge. The plant is supplied with steam by one 100-hp. and one 30-hp. boiler. The crusher is run by a belt from a horizontal engine.

The cement house is located on the hillside east of the tracks on which the dump cars operate. A runway extends from it across the tracks to a point over the crusher, whence the cement is dropped down an inclined chute to the charging platform. It has been found that keeping this chute full to the top saves the cement sacks, by reducing the speed with which the bags slide down the chute.



LEFT — LOCAL GRAVEL PIT DEVELOPED WITH INCLINED TRACK

STONE IS WASHED WHEN MEASURED

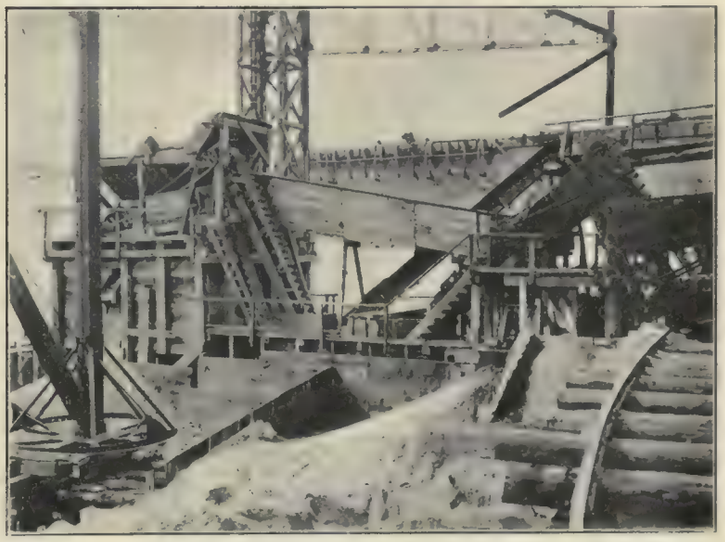
The stone is washed in the measuring hopper, a batch at a time. A sill at the discharge gate prevents the wash water from reaching the charging hopper. This water runs out through a screen in the bottom of the measuring hopper and is carried back to the creek in a small flume. This is done on the theory that when the stone is freshly washed and still wet it not only is cleaner, but is more easily filmed and makes a better bond with the mortar.

SPOUTING SYSTEM WORKS WELL

The dam is concreted in 60-ft. sections, keyed to each other, and poured in 4-ft. lifts. The wooden forms are made in panels, handled by the derricks and built up in 8-ft. sections, as concreting proceeds. The rock is washed off with a high-pressure water jet and covered with 1 or 2 in. of rich mortar before concreting the base of each section. The mass concrete is mixed in the proportion of 1:2½:4½. The end of the last section of chute is handled on top of the form by a derrick, and the concrete is spouted to place without rehandling in the form.



TYPICAL SECTION OF DAM



RIGHT — MATERIALS HANDLED BY MACHINERY FROM CARS TO FORMS



ROCK FORMATION IN FOUNDATION

Little difficulty has been experienced in making a mixture of the proper consistency flow freely through the chutes used. It is said that spouting has proved much faster than handling the concrete with derricks, as was done at the Hemlocks dam. The concrete placed appears uniformly dense, has good horizontal joints, and leaves a surface against the form which has required no plastering. Exposed surfaces are finished by wetting and rubbing them with cement bricks.

The top of the dam is surfaced with mortar. As the finish mortar has to be mixed stiff, it has, of course, to be shoveled down the chutes. This mortar is given a rough-surface sidewalk finish.

LARGE CAPACITY AN ADVANTAGE

The sand washer and crusher have a capacity of several hundred yards a day, while the concrete plant never has to place more than 180 yd. a day. This in turn is considerably in excess of the rate required to keep up with the excavation. All of this equipment, however, was on hand, and would otherwise have been idle. The expense of transporting it and setting it up was not much more than the same expense for lighter equipment. It has been more than justified by the fact that it has enabled a small force to keep up good progress with the work.

EXCAVATION HANDLED BY DERRICKS

One stiffleg and two guy derricks handle the earth and rock excavation. The stiffleg derrick and one guy derrick have had to be moved twice as the worked progressed. The excavated material is to be spread along the base of the dam on the upstream and the downstream sides. Several tripod drills are used on the rock excavation, and these are supplied with steam from the hoist boilers.

The strike of the gneiss formation is nearly parallel to the dam, and the dip is very sharp and toward the north. The rock, therefore, breaks out in deep, natural keyways, triangular in section, and no other key or bond between the rock and the masonry is required. The rock contains fissures near the surface, and excavation is carried down until these are entirely cut out. The upstream side of the excavation is made several feet deeper than the downstream side.

No great trouble was experienced with

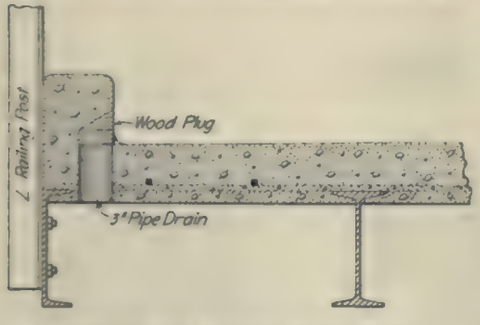
the stream during construction. It was at first diverted through a wooden flume and is now passed through pipes embedded in a finished section of the dam.

A feature of the design of the dam is a riser pipe through which all water from the reservoir flows, and the discharge of which is located 4 ft. below the spillway, so that the reservoir cannot be drawn down below that level. This was done to insure a constant stored supply for the water system of a small village in the neighborhood, which is to be supplied direct with water from this basin.

The entire work is under the direction of Samuel P. Senior, vice-president of the Bridgeport Hydraulic Company. A. B. Hill, consulting engineer for the company, made the general design for the dam, which is being built by forces of the company under Dick Hughes, superintendent. W. B. Pollitt is resident engineer.

Wisconsin Concrete Bridge Floor Drains Placed Under Curb

SIDE DRAINS under the curb, instead of vertical drains at the side of the curb, are the latest devices employed by the Wisconsin Highway Commission to avoid the



SIDE DRAINS PLACED UNDER CURB

danger from openings in its reinforced-concrete bridge floors, causing injury to the feet of small domestic animals, such as sheep and colts.

The reinforced-concrete bridge floors in use in the Middle Western States are ordinarily 6 in. thick, with a curb at the outside of the roadway. The common way of providing drainage is by vertical openings through the floor at the curb. In order to remain unobstructed these openings should be at least 3 in. in diameter.

The detail designed by M. W. Torkelson, bridge engineer for the Wisconsin Highway Commission, is not easily obstructed, and consists of a 3-in. pipe, as shown in the drawing, set under the inside of the curb with the top covered with a tapering wooden plug, which is withdrawn after the concrete has set. The same result could be obtained by using an elbow in connection with the pipe, but there is not sufficient room between the edge of the channel and the inside of the 6-in. curb commonly in use, and the elbow would be more expensive than the use of the temporary plug.

PUBLIC IMPROVEMENTS AT VANCOUVER, B. C., according to a report recently issued by that city, are valued at $25,803,151. The items making up this total include the investments in streets, sewers, waterworks, schools, buildings and other improvements. In addition to the total named, there is $8,252,562 in street improvements, the greater part of which is a debt against adjacent property.

Design of Turbine Draft Tubes Analyzed

Part I—Assumptions Have to Be Made—New Formula Derived for Reduction of Velocity of Water Leaving Turbine—Shape and Size of Tube

By A. G. HILLBERG
Hydraulic Engineer, New York City

THE OVER-ALL hydraulic efficiency of a hydroelectric installation depends on the efficiencies of the various parts through which the water passes. The design of the turbine itself, naturally, is of great importance, but even the most efficient waterwheel, when mounted in a poorly designed scroll case with an inefficient draft tube, will not show a high over-all hydraulic efficiency for the plant. Vibrations in powerhouse substructures are often due to poorly designed draft tubes, in which the discharge does not fill the tube. In the upper part, where the change in elevation is more rapid than in the lower, a vacuum is formed between the stream and the walls of the draft tube, resulting, naturally, in vibration of the stream. The greater the discharge and the higher its velocity the less the vapor pressure in the vacuum and the greater these vibrations. In an article published in the Engineering Record in the issues of Oct. 2, page 413, and Oct. 9, page 442, the writer discussed the various phases of the design of large scroll cases. In this article the design of draft tubes will be treated.

Referring to the previous article, the maximum draft head of a turbine was discussed in connection with the location of the vertical center plane of the scroll case. The total draft head was referred to the difference in elevation between the top of the runner band and the lowest tail-water level. The formula arrived at read

$$E = 33.9 - (M - L) - (v^2/2g) \quad (1)$$

where E = difference in elevation, or maximum permissible draft head; v, velocity through the runner band at full load; g, 32.16; M, margin allowed for governing and vapor tension, and L, allowance for all losses due to friction and curvature in the draft tube and the outflow loss at its end.

It was shown that the value of $(M - L)$ should be selected at from 3 to 6 ft., depending on the physical conditions of the plant in question—M depending on the load variations and L upon the length of the draft tube.

ASSUMPTIONS MUST BE MADE

In dealing with the flow in curved and expanding tubes several factors develop which prevent an absolutely correct mathematical solution of the problem. If two succeeding sections be considered, and it be assumed that the flow is normal to the first one, the expansion and the consequent reduction in thickness of the film of water, when passing through the following section, will have upset this direction of flow. The result may be an increase or a reduction of the pressure on the walls, or it may be the formation of eddies. In order to permit any kind of a mathematical solution, it is, therefore, necessary to make certain assumptions.

In this case the following assumptions have been made:

(a) The flow in the tube, because of the slight increase in areas from one section to the other, is normal to the plane under consideration.

(b) The change in velocity head should not at any time be greater than the change in elevation. (This is, of course, in order to get a certain amount of back pressure, so that the stream will expand and fill the vessel.)

In order to anaylze the problem as completely as possible, the following factors should be investigated: Shape of center line and its length; velocities and change in velocity heads; shape of areas, volume of draft tube, and time required for a particle of water to travel through the draft tube.

SHAPE OF CENTER LINE

The velocity, v_1, of the flow through the band of the runner is always known as soon as the turbine has been designed, and the desired outflow velocity v_n at the end of the draft tube can be determined from the physical conditions of the tailrace (see further under velocities). As the discharge, Q, at full load (that is, 0.8 gate opening, wider openings being considered as overloads) is known, the areas A_1 and A_n at the top and end of the tube can be calculated. $A_1 = Q/v_1$ and $A_n = Q/v_n$. As A_1 is horizontal and A_n generally vertical (and if not vertical the plane in which it is to be placed is known) the center line of the draft tube can be located.

It should be borne in mind, however, that the draft tube must be placed deep enough to permit its being sealed at all stages of the tail water. This seal refers to the lowest point of the roof of the draft tube and not necessarily to the upper edge of the end area. As the required seal only needs to be from 2 to 3 ft. it is generally sufficient to locate the upper edge of the end area about 8 to 15 in. below the lowest tailrace level. Although the benefits of bigger seals than these are not denied, every additional inch means, generally, a lot of additional excavation for the bottom of the draft tube.

When determining the shape of the curvature of the center line, several known curves lend themselves admirably for the purpose. As the single-runner turbine is of the mixed-flow type, that is, the flow is deflected from radial to axial, the center line of the draft tube should be vertical immediately below the runner. This vertical part is a direct extension of the center line of the turbine shaft, and its location is therefore known. The center point of the end area is also known, as this area has been determined as to its size and location (see "Shapes of Areas").

The center line must go through the center point of the end area and be of such shape that the extended center line of the shaft is a tangent to it. It is also desirable that the tangent to the center line at the point of its intersection with the plane of the end area is horizontal or nearly so.

SUITABLE CURVES

Curves that fill these requirements are the parabola, the ellipse, arcs of circles with short tangents at each end, and such higher-plane curves as the cubical parabola, the cissoid, logarithmic and exponential curves.

Although the parabola, the ellipse and the higher-plane curves have their advantages from a standpoint of calculation and design, they are never used because of difficulties met with in laying out the form work in the

field. The curve most generally used is the arc of a circle with tangents at both ends. In laying out a center line of a draft tube in this way the radius of the arc should be as long as possible in order to minimize the losses due to the curvature.

One disadvantage of this curve, however, is that the change of curvature is small in the upper end of the draft tube, and that consequently, in order to make the stream of water fill the tube, a considerable back pressure is required. Part of an ellipse or a parabola would be better in this respect, as shown in Fig. 1.

As the drawing shows, the change in elevation is more gradual and better distributed throughout the length of a center line of parabolic shape than of one elliptical or circular. If the draft tube is short, however, the tangent at the lower end of the curve will not be horizontal, and, as it is desirable to have a horizontal or nearly horizontal discharge of the water, it is sometimes necessary to insert at this end a short arc of a circle with a long radius.

Length of Center Line

The length of the center line depends on its shape, as, generally, its top and bottom

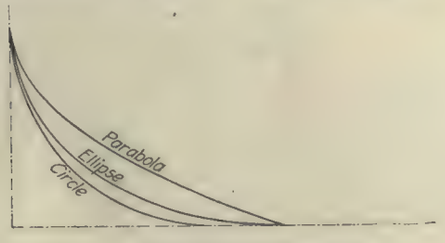


FIG. 1—CURVES FOR CENTER LINE

co-ordinates are given. The shortest curve connecting these points is a straight line, which will be the chord of the segment formed by the curve.

Should the center line be composed of short tangents connected by an arc of a circle its length can be determined by trigonometry, but if it be of elliptical, parabolic or other shape, calculus offers the most convenient way of obtaining the length. If, therefore, S is the length of the curve from the point A to B,

$$S = \int_A^B \left[\sqrt{1+\left(\frac{dy}{dx}\right)^2}\right] dx \qquad (2)$$

the proof of which can be found in any textbook on higher mathematics.

Shapes of Cross-Sections

As the runner band is circular, the upper end of the draft tube, in order to fit the distributor, must also be circular. The flow of the discharge below the turbine, although axial in its general direction, follows along lines of approximately helical shape, and the areas of the draft tube should, therefore, be circular until the curvature of the tube has broken up the helical flow lines and forced the flow to become perpendicular, or approximately so, to the cross-sectional areas.

The shape of the end area can be varied within a wide range, whose limits in the vertical direction are the depth of excavation and the water seal required, and in a horizontal direction the thickness of masonry between the draft tubes necessary to carry safely the weight of the power house. The least amount of excavation is required if this area is a rectangle and the intervening pier is as thin as permissible in order to carry the load. From a hydraulic point of view, on the other hand, it is better to have an area of circular cross-section. As this area, however, generally requires too much excavation in the tailrace and too much concrete in the power house, a compromise between the structurally and hydraulically best conditions is made, and the area takes an elliptical shape.

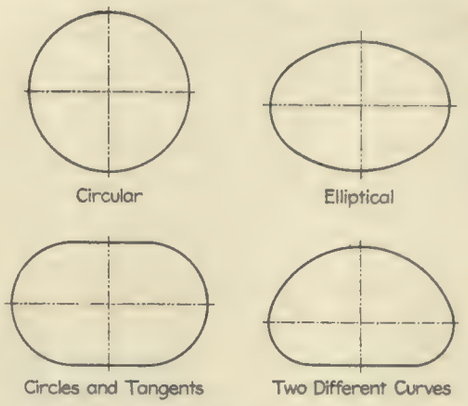


FIG. 2—FOUR POSSIBLE CROSS-SECTIONS

As elliptical forms are difficult to build the designer generally uses an area composed of two semicircles with tangents in between the major axis horizontal. In one case the end area was composed of two different curves with the same horizontal axis. (See Fig. 2.)

All intermediate cross-sectional areas must be larger than the top area and smaller than the end area. Their shape can also be varied within the limits of the shapes of the two given areas. It is, however, customary to keep the areas circular until the diameter of the circle becomes equal to the minor axis of the end area. After that point has been reached the circular shape is abandoned and the horizontal axis increased until it equals the major axis of the end area. Different designers have their own opinions about the best way of changing the shapes of the areas, and no definite rule, therefore, can be established.

Velocities

The velocity of the flow at any point in a draft tube must be related, in a certain way, to the velocities at other points. The velocities at two points, however, are known at the outset; these are v_1 and v_n, the velocities at the top and end of the tube. For the former,

$$v_1 = 0.3 \text{ to } 0.4\ \sqrt{2gh_o} \qquad (3)$$

where

$$h_o = h_a - (\sqrt{h_a}/3) \qquad (4)$$

For the deduction of the formula for h_o see the previous article in the Engineering Record of Oct. 2, page 414. In the formula for v_1 the operating head of the plant is h_o.

The turbine builder will give the velocity of flow as soon as the runner of the wheel has been designed. If it be required to design a draft tube for estimating purposes before the turbine has been designed finally, it is better to assume too high than too low a value.

The outflow velocity v_n should be kept as small as possible in order to waste a minimum of the head. Usually

$$v_n = 0.05 \text{ to } 0.1\ \sqrt{2gh_o} \qquad (5)$$

but a few cases have been recorded in which v_n has been even less than $0.05\ \sqrt{2gh_o}$. It is not always advantageous to use a small value of v_n, as the flow in the tailrace must be rapid enough to carry away the water. A low value of v_n might, therefore, result in an unnecessarily expensive excavation for the tailrace. As a low velocity requires a bigger area for the outflow, too low a velocity might also result in a longer spacing of the wheel centers, thus increasing materially the cost of the power house.

By means of these velocities the corresponding cross-sectional areas A_1 and A_n can be calculated, as the discharge Q is known. The intermediate areas can be calculated only after the velocities through the planes in which these areas are located have been determined. The problem, therefore, is to find the velocity change per length unit in the draft tube measured along the center line.

Change in Velocity Head Less Than Change in Static Head

It must be remembered, however, that this change in velocity must be such that the change in velocity head becomes somewhat smaller than the change in static head. The idea is that on one side the film of water is subjected to a pressure corresponding to the change in velocity head, and, on the other, to a pressure corresponding to the change in static elevation. If the difference in pressures be such that the film is subjected to a back pressure, the film will obviously expand sideways and thus fill the cross-sectional area of the tube. Applying the theorem of Bernouilli to this case,

$$(v_a^2/2g) + P_a + h_a = (v_{a+1}^2/2g) + P_{a+1} + h_{a+1}$$

but in accordance with assumption b,

$$(v_a^2/2g) - (v_{a+1}^2/2g) = h_{a+1} - h_a \qquad (6)$$

so that $P_a = P_{a+1}$, or, in other words, the pressure remains constant.

If equation 6 is satisfied for the full-load discharge through the draft tube, it is true that for smaller discharges

$$(v_a^2/2g) - (v_{a+1}^2/2g) < h_{a+1} - h_a$$

Consequently there will be a back pressure

$$P = (h_{a+1} - h_a) - [(v_a^2/2g) - (v_{a+1}^2/2g)]$$

In this formula h_a and h_{a+1} are the static elevations at the points a and $a+1$ on the center line, while v_a and v_{a+1} are the corresponding velocities.

In any two succeeding sections

$$v_a A_a = v_{a+1} A_{a+1} = Q$$

Therefore

$$v_a = \frac{A_{a+1}}{A_a} v_{a+1}$$

and

$$v_a^2 = \left(\frac{A_{a+1}}{A_a}\right)^2 v_{a+1}^2$$

Substituting v_a in equation 6,

$$(v_{a+1}^2/2g)\left(\frac{A_{a+1}}{A_a}\right)^2 - \frac{v_{a+1}^2}{2g} = h_{a+1} - h_a$$

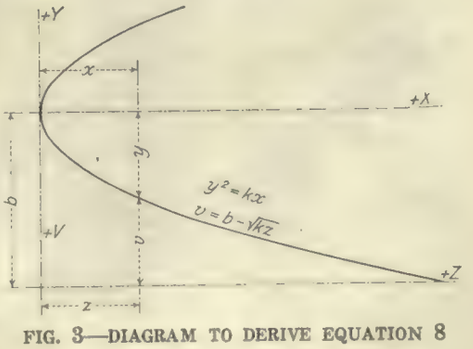


FIG. 3—DIAGRAM TO DERIVE EQUATION 8

so that

$$v_{a-1}^2 = \frac{2g}{\left(\frac{A_{a-1}}{A_a}\right)^2 - 1}(h_{a-1} - h_a)$$

This equation represents a parabola, and it proves that the velocity should be retarded in accordance with a curve cut from one of the branches of a parabola. The equation can be written

$$y^2 = kx \qquad (7)$$

CO-ORDINATES MUST BE SHIFTED

This equation is very convenient, but, unfortunately, it is not directly applicable to the problem. In order to make it applicable it is necessary to shift the X-axis so that the apex of the curve will be located on the Y-axis at a point with the co-ordinates 0 and b (Fig. 3).

Calling the new system of axes V and Z, any points on the curve that formerly had the co-ordinates x and y will now have the co-ordinates z and v. Of these co-ordinates $z = x$ and $y + v = b$, or $y = (b - v)$, so that $(b - v)^2 = kx$, or

$$v = b \mp \sqrt{kz}$$

As in this case the lower branch of the curve only is used, equation 7 finally becomes

$$v = b - \sqrt{kz} \qquad (8)$$

Referring to Fig. 4, v_1 is the velocity at the top of the draft tube; v_n, the velocity of the outflow; l, the length of the tube measured along its center line; z_1 and z_n, the abscissas of the ordinates v_1 and v_n.

ONLY ONE OF THREE POSSIBILITIES DESIRABLE

Three different possibilities now obtain

(1) $v_1 + v_n > y_1 + y_n$

(2) $v_1 + v_n = y_1 + y_n$

(3) $v_1 + v_n < y_1 + y_n$

In case 1 there is obvious danger that the change in velocity may become too great in

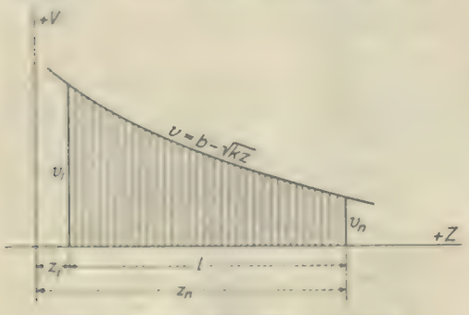


FIG. 4—FOR VELOCITY ANALYSIS

the beginning of the tube, provided the difference is considerable. In case 3 it is apparent that if the difference is considerable the velocity curve becomes practically a straight line, which is not desirable. Consequently only case 2 needs further examination.

Since $y + v = b$ in this case, $y_1 + v_1 = b$ and $y_n + v_n = b$, or

$$y_1 + v_1 = y_n + v_n$$

But

$$v_1 + v_n = y_1 + y_n$$

so that

$$v_1 + y_1 = v_n + y_n$$

and

$$v_1 - y_1 = -v_n + y_n$$

or

$$2v_1 = 2y_n$$

Thus $v_1 = y_n$ and $v_n = y_1$, so that

$$b = v_1 + v_n \qquad (9)$$

Substituting the co-ordinates z_1 and v_1, and z_n and v_n, in equation 8, it becomes

$$v_1 = b - \sqrt{kz_1}$$

and

$$v_n = b - \sqrt{kz_n}$$

Or

$$b - v_1 = \sqrt{kz_1}$$

and

$$z_1 = \frac{(b - v_1)^2}{k}$$

In the same way it is proved that

$$z_n = \frac{(b - v_n)^2}{k}$$

But

$$b = v_1 + v_n$$

so that

$$z_1 = v_n^2/k \text{ and } z_n = v_1^2/k$$

From Fig. 4 it is obvious that $l = z_n - z_1$, so that

$$l = \frac{v_1^2}{k} - \frac{v_n^2}{k} = \frac{1}{k}(v_1^2 - v_n^2)$$

which gives

$$k = (v_1^2 - v_n^2)/l \qquad (10)$$

Introducing the values found in equations 9 and 10, in equation 8 it becomes

$$v = (v_1 + v_n) - \sqrt{\frac{v_1^2 - v_n^2}{l}}\,z \qquad (11)$$

This is a convenient expression giving directly the velocity at any point z on the center line. As mentioned previously, v_1, v_n and l have already been determined and can be considered constant quantities at this stage of the calculation.

It is now required to locate the ordinates v_1 and v_n on the Z-axis. Substituting in equation 11 the co-ordinates z_1 and v_1 it becomes

$$v_1 = (v_1 + v_n) - \sqrt{\frac{v_1^2 - v_n^2}{l}}\,z_1$$

so that

$$v_n = \sqrt{\frac{v_1^2 - v_n^2}{l}}\,z_1$$

or, solving for z_1,

$$z_1 = \frac{l}{\left(\frac{v_1}{v_n}\right)^2 - 1} \qquad (12)$$

and

$$z_2 = l + z_1 \qquad (13)$$

Equations 12 and 13 locate the ordinates v_1 and v_n on the Z-axis. As v_1 always is larger than v_n, the term $(v_1/v_n)^2$ is greater than one, and, consequently, z_1 always positive.

A table is now established giving the number of points on the center line, their distance from the upper end; z, the abscissas on the axis; v, the velocities; $v^2/2g$, the velocity heads; the difference in velocity heads; the static elevations of the points; the differences in elevation; the areas of the cross-sections, and the shapes of the areas. (For such a table see the problem.)

TIME

When a particle of water is passing through the tube its motion is assumed to be curvilinear. Therefore $v = dz/dt$. As in this case the abscissas x equal the abscissas z and the ordinates y equal $(b - v)$, it is obvious that for calculating the time required it is just as correct to use the parabola $y^2 = kx$ as it is to use $v = b - \sqrt{kz}$. But in this case $y_1 = v_n$ and $v_1 = y_n$, so that

$$k = \frac{y_n^2 - y_1^2}{l} = \frac{v_1^2 - v_n^2}{l}$$

As $x = z$ it is obvious that

$$v = dz/dt = dx/dt$$

and

$$v^2 = \left(\frac{dx}{dt}\right)^2$$

Hence

$$\left(\frac{dx}{dt}\right)^2 = kx$$

and

$$dt = dx/\sqrt{kx}$$

Integrating this equation between the limits x_1 and x_n, we have

$$t = \frac{1}{\sqrt{k}}\int_{x_1}^{x_n}\frac{dx}{\sqrt{x}} = \frac{2}{\sqrt{k}}\Big|_{x_1}^{x_n}\sqrt{x}$$

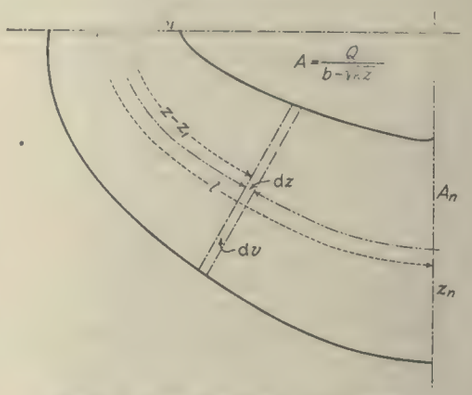


FIG. 5—FOR VOLUME ANALYSIS

Hence

$$t = \frac{2(\sqrt{x_n} - \sqrt{x_1})}{\sqrt{k}}$$

But $x_n = z_n$ and $x_1 = z_1$. Therefore

$$t = \frac{2(\sqrt{z_n} - \sqrt{z_1})}{\sqrt{k}} \qquad (14)$$

VOLUME

When it is desired to estimate the yardage of concrete in the power-house substructure it is necessary to know the volume of the draft tube. This volume is generally estimated by dividing up the draft tube in sections and assuming each one to be a frustum of a cone. A more accurate method is to divide the tube into horizontal layers from 1 to 2 ft. thick, and estimate the volume of each layer. Both methods require considerable work and the final total is only approximate. The number of operations is also considerable, thus increasing the danger of error.

The equation of the velocity curve for the draft tube read

$$v = b - \sqrt{kz}$$

where $b = (v_1 + v_n)$ and $k = (v_1^2 - v_n^2)/l$. In any cross-section $Q = Av$, where Q is the discharge, A the area and v the velocity. Hence $v = Q/A$. Introducing this in the equation for v,

$$Q/A = b - \sqrt{kz}$$

or

$$A = \frac{Q}{b - \sqrt{kz}} \qquad (15)$$

The infinitesimally small volume of a film of water in the draft tube (Fig. 5), therefore, is

$$dv = Adz = \frac{Q dz}{b - \sqrt{kz}}$$

or

$$V = Q\int_{z=z_1}^{z=z_n}\frac{dz}{b - \sqrt{kz}} = \frac{Q}{b}\int_{z=z_1}^{z=z_n}\frac{dz}{1 - \frac{\sqrt{k}}{b}\sqrt{z}}$$

Differentiating,

$$\sqrt{z}\,\mathrm{d}(\sqrt{z}) = \frac{\mathrm{d}z}{2\sqrt{z}}$$

or

$$\mathrm{d}z = 2\sqrt{z}\,\mathrm{d}(\sqrt{z})$$

If now $\sqrt{z} = y$; $\mathrm{d}(\sqrt{z}) = \mathrm{d}y$, so that $\mathrm{d}z = 2y\mathrm{d}y$. Introducing this in the equation for V,

$$V = \frac{2Q}{b}\int_{z_1}^{z_n} \frac{y\mathrm{d}y}{1 - \frac{\sqrt{k}}{b}y}$$

Integrating,

$$V = \frac{2Qb}{k}\left|\left\{\left[1 - \frac{\sqrt{k}}{b}y\right] - \ln\left[1 - \frac{\sqrt{k}}{b}y\right]\right\}\right.$$

But $y = \sqrt{z}$, so that, when the limits are introduced,

$$V = \frac{2Qb}{k}\left\{\left[1 - \frac{\sqrt{k}}{b}(\sqrt{z_n} - \sqrt{z_1})\right] - \ln\left[1 - \frac{\sqrt{k}}{b}(\sqrt{z_n} - \sqrt{z_1})\right]\right\} \quad (16)$$

Equation 16 gives directly the exact volume of the draft tube between any limits z_1 and z_n. The total volume is obtained by introducing the abscissas, z, corresponding to the entrance and outflow velocities. In order not to complicate the equation the expressions for b and $\sqrt{k}$ have not been introduced.

The equation can be made somewhat shorter by introducing

$$m = \left[1 - \frac{\sqrt{k}}{b}(\sqrt{z_n} - \sqrt{z_1})\right]$$

in which case it reads

$$V = \frac{2Qb}{k}(m - \ln m) \quad (17)$$

(To be concluded)

BRICK HIGHWAYS TOTALING 37 MILES in length have been built in the State of Washington. These pavements are from 16 to 18 ft. wide, and cost, with reinforced-concrete base, from $28,000 to $32,000 per mile.

Letters to the Editor

Comment on matters of interest to engineers and contractors will be welcomed

Information Wanted as to Society Employment Bureaus

SIR: It is possible that the Western Society of Engineers, 1745 Monadnock Block, Chicago, may attempt seriously the establishment of an employment bureau for the benefit of technical men and the employers of technical men.

Your active co-operation is desired. We wish to receive from officers and past officers of societies that have made similar attempts the reasons why the attempts failed, if they failed, and what degree of success was encountered. We would like to hear from every man who has any ideas on the subject, and the undersigned will not be appalled if the mails are filled with letters of advice or information. The task if properly attempted is a big one, we know, hence the desire to receive the benefit of experience and information which is certainly available.

ERNEST MCCULLOUGH,
First Vice-President, Western Society of Engineers.
Chicago.

Cast-Iron Pipe Makes Good Record in Galveston Storm

SIR: The following information regarding the storm damage at Galveston, Aug. 16 and 17, will supplement the information contained in the Engineering Record of Aug. 28, page 271, Oct. 23, page 500, and Nov. 6, page 576.

The portion of the water supply main crossing Galveston Bay is 10,800 ft. in length, and was built under the pavement of the causeway. The picture shows the condition of the pipe line after the storm. The protected roadway from the arch bridge to the mainland, and from the arch bridge to Galveston Island was almost completely destroyed for a total distance of 8500 ft.

The water main, 30 in. in diameter, was laid at an elevation of 10 to 14 ft. above mean low tide, and after the storm was found from 8 to 18 ft. lower than its original grade. In the 8500 ft. of pipe washed down only seven breaks were found, including the two breaks at the ends of the arch bridge.

This line is class B pipe made and carefully tested according to the American Waterworks Association specifications, and very carefully laid, all joints being poured and finished 2 in. deep. In many places where settlement caused abrupt angles the lead was pulled out of the joints from 1 to 1½ in. Air pressure of 30 lb. per square inch failed to show any serious leaks except at the seven breaks mentioned above, and no pipe was broken. This seems remarkable when one considers the stress sustained during the storm. The wind reached a velocity of 100 miles per hour, producing a tide elevation of 17.4 ft. at the causeway, and a current of very high velocity at right angle to the pipe line.

Repairs to this line were made with considerable difficulty on account of the pipe having settled several feet below water where serious breaks occurred, being covered with concrete slabs and other debris and in many places having several feet of water under the pipe. Where the line was submerged divers were used to place sleeves and fill joints, and in other places a derrick barge was used to raise the line sufficiently to permit repairs.

During the progress of this work, about 18 days, Galveston secured water through a temporary 8-in. line and through a dupli-



STORM CAUSED ONLY SEVEN BREAKS IN GALVESTON'S 30-IN. CAST-IRON WATER SUPPLY LINE

cate 30-in. submerged line which had been repaired.

A. T. DICKEY,
City Engineer.

Galveston, Texas.

Tests Prove Lug Angles Valueless

SIR: I wish to thank you for the abstract in the issue of Oct. 23, page 512, of my paper on "The Effect of the End Connections on the Distribution of Stress in Certain Tension Members," and also for your remarks on page 497 of that issue. It is gratifying that a wide publicity should be given to these tests, which appear to me to have a somewhat important practical bearing. At the same time I fear that I do not find myself in entire agreement with all that you write in your editorial. You state that "in many cases joint detailing is simplified by avoiding long, single lines of rivets in the connection plates and the advantage in smaller gussets tends to offset the cost of using lug angles." My objection to this will be best stated by quoting a paragraph from the original paper (page 168), omitted in the abstract which you publish:

"To sum up, it may be said that in neither the single nor double angles does the lug angle cause a displacement of more than 0.1 in. in the line of pull either parallel or perpendicular to the end plate, and that this produces only small changes in the maximum stress, insignificant in comparison with those arising from the stiffness of the gusset plate in its own plane. The effect of the lug angle is thus so small as to be practically negligible. It is also uncertain, since, depending upon the stiffness of the gusset plate, which is difficult to predict, it may increase or diminish the maximum stress. The contention that the lug angle increases the virtual length of attachment of the main angle to the gusset plate, allowing more rivets to be used, is also seen to be incorrect, since practically none of the stress is transmitted into the angle through the rivets in the lug angle, at any rate until the member is near to the breaking load, when it is of no importance."

This applies, of course, only to members such as are dealt with in the paper. There may be special cases in which lug angles are of value.

Montreal. CYRIL BATHO.

[Although tests may not justify the practice, it is customary to design these connections by counting the rivets in the lug angles for their full value. The shortening of the connection mentioned in the editorial results from this practice, which these tests evidently discredit.—EDITOR.]

Comparing Sewer Sections

SIR:—The paper by Prof. R. DeL. French of McGill University, which appears in your issue of Aug. 21, page 222, has interested me very much. One thought which runs through the article seems to be that, except for very small percentages of total capacities, the various shaped sewers now in general use are not so good as, or at any rate not better than, the circular sewer which, for a given area, of course, has the least material in it. The advantages of the egg-shaped sewer, for instance, are clearly shown by his curves to be evident to an appreciable degree only when the sewer is flowing about one-tenth full. This greater velocity at a lower percentage of capacity is supposed to be desirable in eliminating sediment during the low water stages.

All this pro and con is on the supposition that the sewer is clean, but a glance at Mr. French's diagrams "a" and "b" will immediately show that the angle of two lines tangent to the periphery at the water surface during the low stages is very much greater in the circle than in the egg shape. If we should set up two pairs of smooth boards in the shape of troughs, each trough at an angle corresponding to these two sections, and endeavor to draw an ordinary brickbat through them, the friction would be much greater in pulling through the narrow trough than through the flat wide one. From this fact we might advance the theory that the narrow invert of the egg-shaped sewer offered more resistance to sliding obstacles than the round sewer.

I had an opportunity last spring to observe whether there was anything in this theory during an investigation of the old sewers of Milwaukee, which, however, was not carried on with this particular feature in mind. I inspected the Milwaukee sewers in more than fifty places and, although Milwaukee is not by any means a flat city, I found that in every case the egg-shaped sewers were very much more clogged up with sediment than the round ones of approximately the same capacity; in fact, the sediment had reached such a depth in the egg-shaped sewers that they were practically round sewers with an invert offering considerably more resistance than that of the round sewers. This sediment not only acted as an impediment and a reducer of the cross-section, but seemed to offer a means of retaining sewage at a low-stage season until it had become very septic; and as a consequence the inverts of these egg-shaped sewers were noticeably softer on the surface and blackened throughout the section by the sulphurous products of sewage decomposition. This was true, of course, in a measure of both the round and the egg-shaped sewers, but more noticeable in the egg-shaped; and the cases of complete disintegration which I noticed were all in egg-shaped sewers.

If these observations could be duplicated in other places so as to make sure there was no special reason for the collection of sediment under the conditions which I observed, they would form a very strong reason for abandoning the egg-shaped sewer altogether because they would take away the only excuse it has for existence.

BENJAMIN BROOKS,
Engineer.

Kansas City, Mo.

SIR:—R. DeL. French makes a hydraulic comparison of different sewer sections in the Engineering Record of Aug. 21, page 222, which interests the writer very much. I believe that a proper selection of a sewer section cannot be made without such a study of the hydraulic value of different sections. I notice that Mr. French makes his comparison of velocities on the basis of the depth of flow in the circular section. The same quantity of water which flows at a certain depth in the circle will flow at widely different depths in the other sections. It was for this reason that O. L. Eltinge and the writer made such a comparison on the basis of decimal parts of the common capacity of all the filled sections in the Engineering Record of July 26, 1913, page 112. It might be worth while to make a comparison of the relative depths of flow on the same basis.

The calculations for our diagram were very similar to those of Mr. French, but we differed from him in finding that the relative velocity of the egg-shaped section as compared with the circular section when both are loaded to their capacity was 97.8 per cent of the velocity of the sewage in the circular section instead of 95.7 per cent. In reducing the proportionate velocities of the egg-shaped to their proper proportions of the filled circular sections, Mr. French divides them by 95.7 per cent, when they should be multiplied by 95.7 per cent. By Mr. French's argument a certain percentage of 95.7 per cent is more than that percentage of 100 per cent.

The thirty sewer sections shown herewith are considered by Mr. Eltinge and the writer to be the typical sections of American and European practice. The dimensions, area, perimeter and hydraulic radius of each section are expressed in terms of one of the main dimensions of the section. The constants x and y shown with each section are exact factors by which the capacity and velocity of each section can be determined from any diagram giving the capacity and velocity of circular sewers. These factors are absolutely independent of any particular flow formula, friction factor or slope.

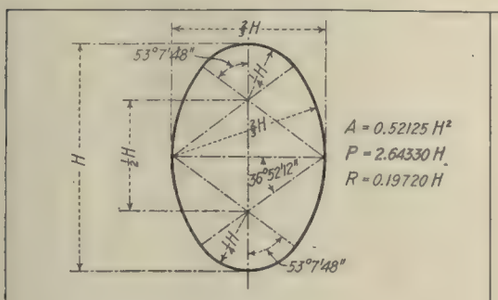
If it is desired to find the dimensions of a standard egg-shaped sewer with a friction factor of $n = 0.013$, which will have a capacity of 83.42 sec.-ft. on a 0.1-per cent grade, multiply 83.42 by its x factor, 0.91808. The result is 76.59 sec.-ft. It is found from any circular sewer diagram that a circle of 4.83-ft. diameter has this second capacity under the same conditions. Its velocity of flow is 4.18 ft. per second. The required egg-shaped sewer has this same velocity and the height of the section is found by multiplying the diameter 4.83 ft. by the egg-shape y factor 1.2946. The result is 6.25 ft. or 75 in.

The derivation of these factors is very simple. In all of the accepted hydraulic formulas the area and hydraulic radius are the only functions of the shape of any section which determine its capacity and the velocity of flow. Any two sections with equal hydraulic radii have the same velocity of flow, regardless of their relative shapes or areas. The hydraulic radius of any section is its area divided by its wetted perimeter, or expressed algebraically, $r = A/P$, or $A = pr$. For the circle $r = \frac{1}{4}\pi D^2/\pi D = D/4$.

Sub-zeros are used to designate functions of the circular section which has the same hydraulic radius as the section under investigation. Since the hydraulic radius of every circular section is $D/4$, the diameter of the circle which has the same velocity of flow as any other particular section is equal to four times the hydraulic radius of that section.

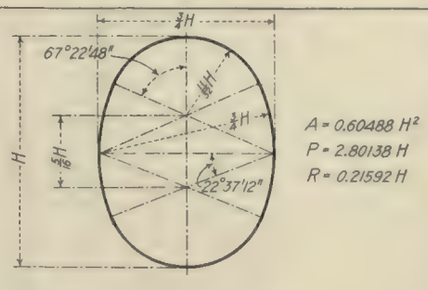
Q for the section $= AV = prV$ and $Q_o = A_oV = P_orV$. From this $Q_o/Q = P_orV/PrV = P_o/P$, or $Q_o = QP_o/P$. The factor x shown with each section is P_o/P; it is the factor by which to multiply the capacity of the required section to find the capacity of the circular sewer having the same velocity of flow. The factor y is the height of the section divided by the height of the circular section having the same hydraulic radius.

ROBERT S. BEARD,
Assistant Engineer, City Engineer's Office.
Kansas City, Mo.



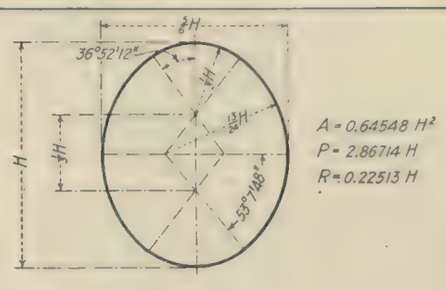
1 x ⅔ OVAL

x = 0.93748 y = 1.26778



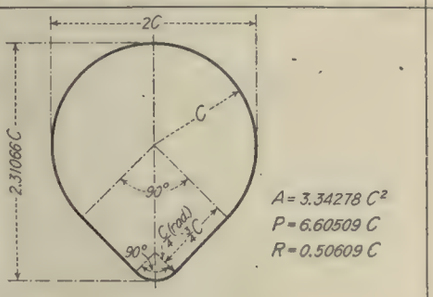
1 x ¾ OVAL

x = 0.96857 y = 1.15783



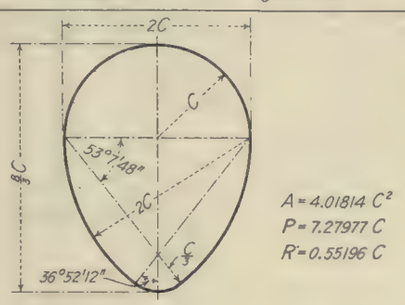
1 x ⅚ OVAL

x = 0.98671 y = 1.11048



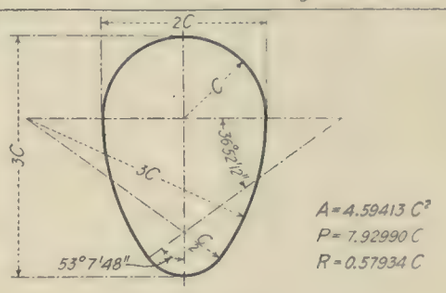
SWEDISH EGG

x = 0.96286 y = 1.14143



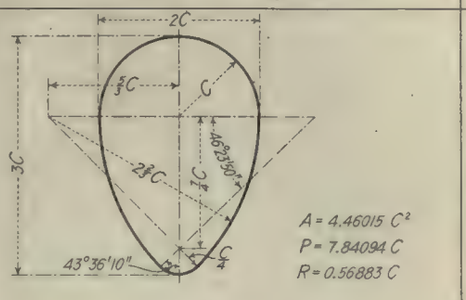
OVOID

x = 0.95280 y = 1.20782



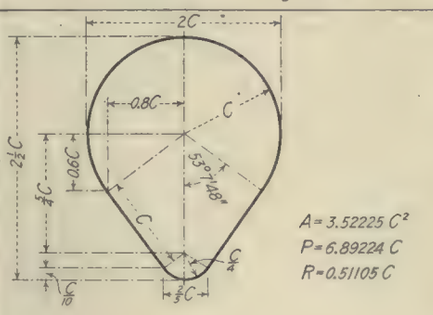
STANDARD EGG

x = 0.91808 y = 1.29456

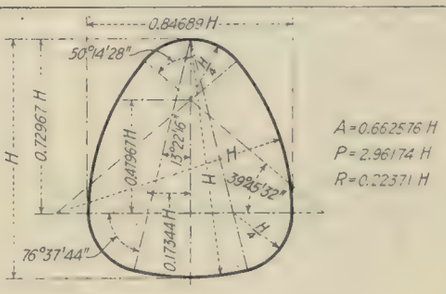


SHARP EGG

x = 0.91164 y = 1.31850

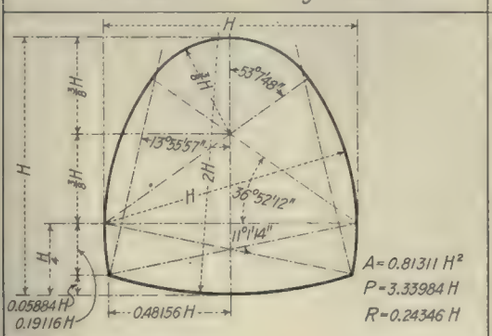


x = 0.93177 y = 1.22298

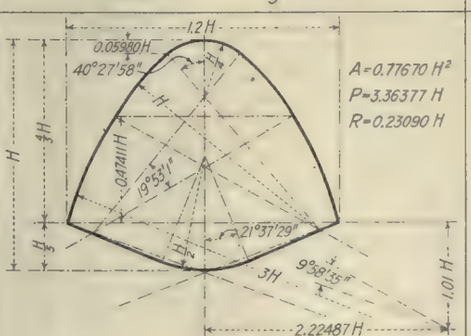


CATENARY

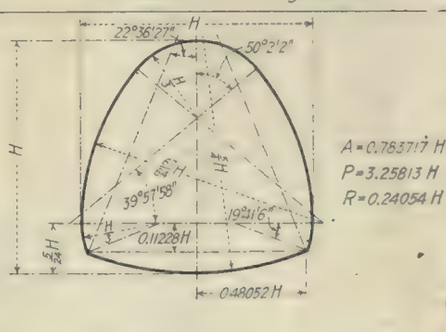
x = 0.94919 y = 1.11751



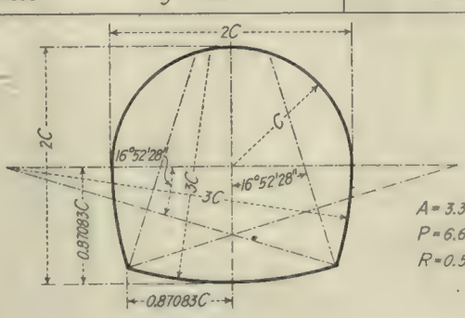
x = 0.91603 y = 1.02687



x = 0.86260 y = 1.08271

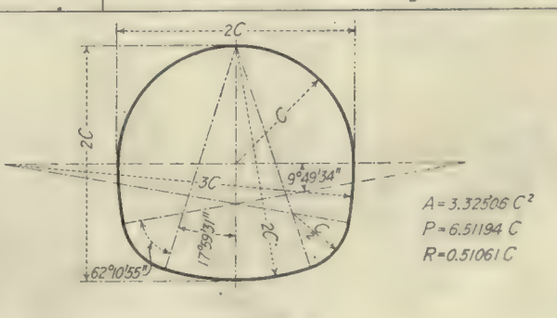


x = 0.92775 y = 1.03932



HORSESHOE

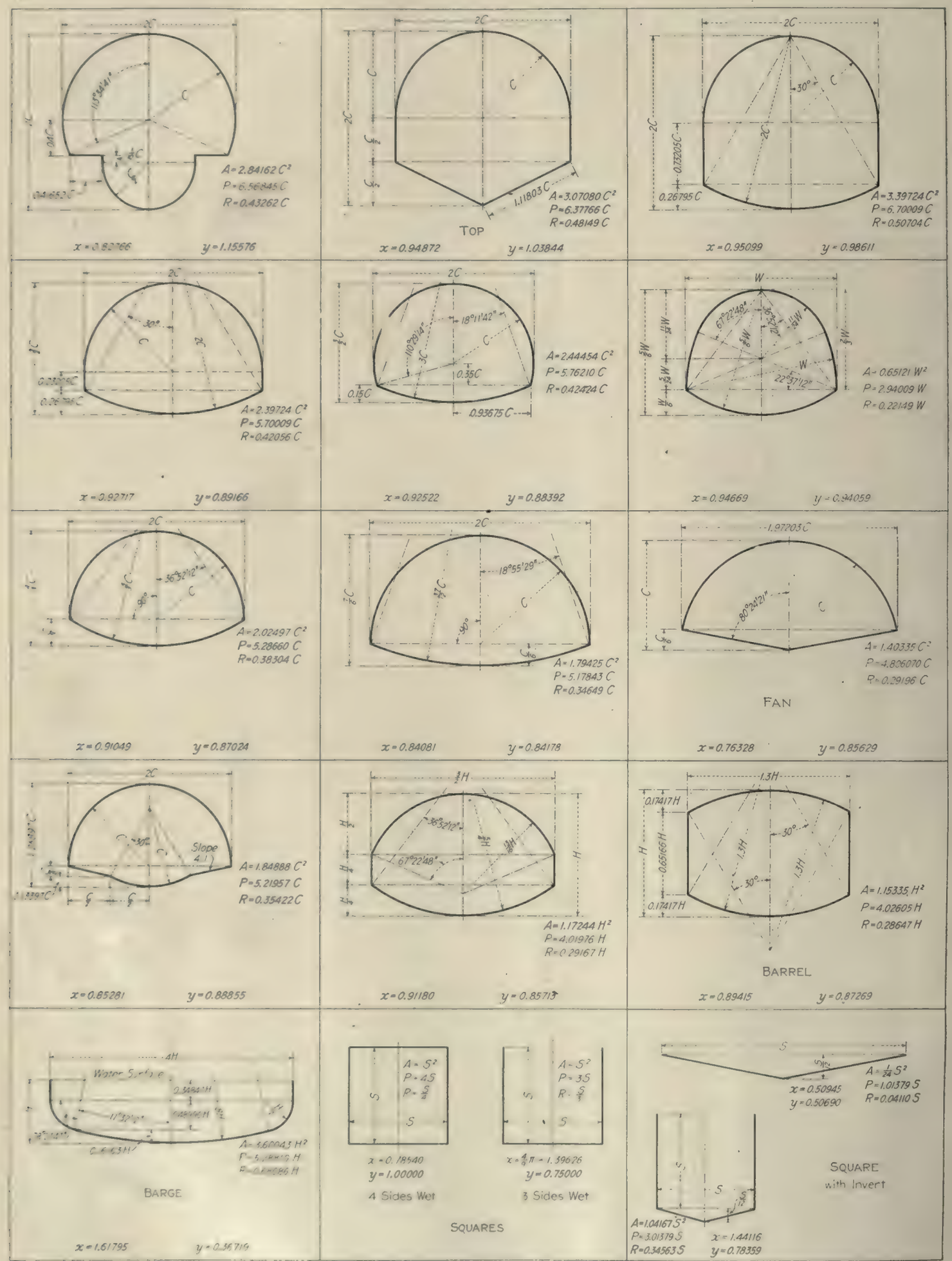
x = 0.95554 y = 0.98499



BASKETHANDLE

x = 0.98535 y = 0.97922

TYPICAL AMERICAN AND EUROPEAN SEWER SHAPES COMPARED WITH CIRCLES ON BASIS OF CAPACITY AND VELOCITY



TYPICAL AMERICAN AND EUROPEAN SEWER SHAPES COMPARED WITH CIRCLES ON BASIS OF CAPACITY AND VELOCITY

HINTS FOR THE CONTRACTOR

Details Which Save Time and Labor on Construction Work

Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

[*Contributions to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

Barge with Skidway Lays 300-Ft. Line of 12-In. Pipe in Five Hours

By A. G. ELLIOT
Mullins, S. C.

THREE HUNDRED feet of 12-in. cast-iron pipe were laid by the rig shown in the accompanying illustrations from the shore out to a depth of 15 ft. in five hours at Washington, N. C., recently. Only one small leak, which was easily fixed, developed in the twenty-five joints.



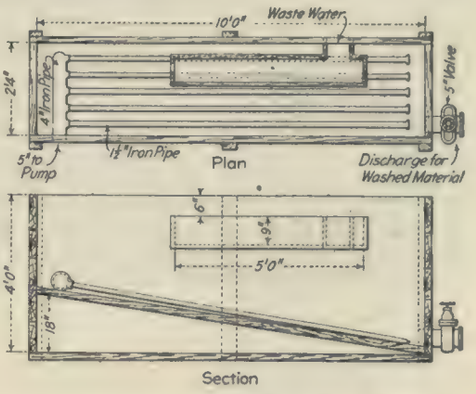
SIMPLE BUT EFFECTIVE SKIDWAY

The rig consisted of an inclined skidway, made of old rails spiked to heavy timbers, and suspended between two barges with its upper end resting on the outer barge. Over this end was erected an A-frame for handling the pipe. The 12-ft. lengths were carried on the outer barge, set on the skidway with tackle and calked above water. The outer end of the skidway was supported from a cable hung from a second barge, and kept far enough from the bottom to give the pipe line a long, easy curve. The barges were withdrawn from the outer end as the lengths were laid. As the joints of ordinary cast-iron pipe are not flexible, this part of the work required great care to prevent breaking the pipe. The work was done without a diver, and at a cost of less than 75 cents a foot, exclusive of the pipe, which was furnished by the city. The writer was the representative on the work of Gilbert C. White, consulting engineer, of Charlotte, N. C.

Continuous Washer Cleans 250 Yards of Sand a Day

IN THE sand washer illustrated herewith water comes up through the sand from the bottom. The washer was inexpensive to build, and thoroughly cleans 250 cu. yd. of dirty sand in a 10-hr. day. It was built for the concrete plant at the Means Brook dam of the Bridgeport Hydraulic Company, described elsewhere in this issue. The idea was not original with the Bridgeport Hydraulic Company, but has been improved by their engineers on successive jobs until what is thought to be a most efficient sand washer has been developed.

The rapid action of the washer is due to the mechanical stirring and washing of the sand by the water, which escapes under about 50-lb. pressure through perforations in several coils of pipe laid in the bottom of the box. The washer operates continuously, the sand being drawn out at the bottom at the same rate as it is taken in at the top. If the dirty sand comes too rapidly, it is diverted momentarily to a waste sand pile. The sand is washed down a flat trough with baffle-plates into the box, through which the water is already running. The dirt is washed out and carried, suspended in the water, into the overflow trough along one side of the box. Clean sand is drawn out through a 5-in. gate valve on a short nipple built into the lower end of the box near the bottom. The head of water in the box washes the sand out through this pipe at a rapid rate and deposits it on the storage pile, at the head of which the washer is located. The sand used on this work contains considerable fine clay, yet it is thoroughly cleaned by one trip through the washer.



WATER BOILS UP THROUGH SAND FROM PIPE COIL ON BOTTOM



BARGE DURING OPERATION SHOWN LAID 500 FT. OF PIPE IN 5 HOURS

Gasoline Pump Kept from Losing Prime with Water Low in Sump

By WILLIAM G. BROADHURST
President, F. R. Long-W. G. Broadhurst Company, Hackensack, N. J.

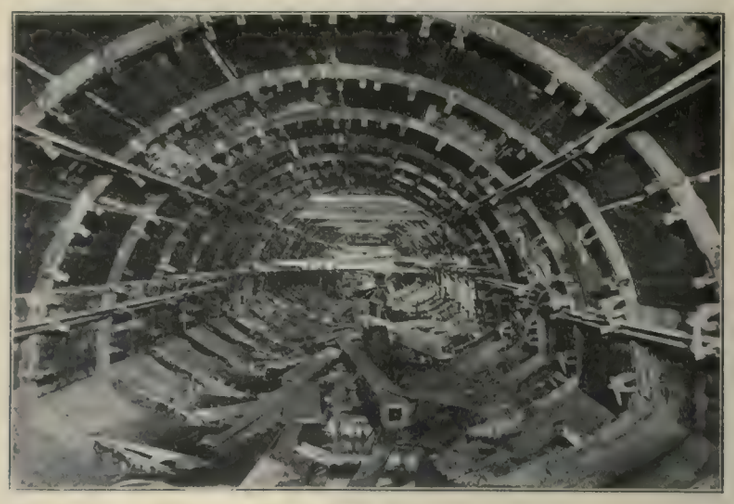
IN PUMPING out a cofferdam with a 4-in. centrifugal pump driven by a gasoline engine, it was found difficult to get out the last of the water. When the water was low, the pump took water out of the sump faster than it ran in, emptying the sump and causing the pump to suck air which necessitated shutting down the engine and priming the pump. While this was being done, the water would rise again.

The difficulty was overcome by opening the switch controlling the ignition of the engine for a few seconds just as the pump was about to suck air. This caused the engine and the pump to slow down so that the pump would not lift the water, which then accumulated in the sump. Before the engine stopped entirely, the switch was closed and the pump started again and run a few seconds. By repeating this operation several times the cofferdam was pumped practically dry without once having to prime the pump.

Extra Detonators in Long Blast Useless Unless Connected

EXTRA DETONATORS for hastening the explosion of a long charge of dynamite or powder are worthless unless connected to the firing circuit, according to experts of the U. S. Bureau of Mines. Experiments made by the Bureau and described by Charles Munroe and Clarence Hall in *Bulletin* 80 indicated that the explosive wave caused by the first detonation exploded the dynamite surrounding the other detonators





REINFORCING HUNG FROM TRENCH BRACES TILL SIDE-WALL CONCRETE SETS—INTERIOR VIEW SHOWS HOW FORMS ARE HANDLED

before these detonators themselves went off, unless they were placed 5 in. apart or less. One test with this very close spacing indicated a slight acceleration of the explosion with an insensitive dynamite. The experiments were made by putting up 1¼-in. sticks of dynamite in cartridges made of 1½ and 1¾-in. pipe 42 to 80 in. long, with only the end blasting cap connected to the firing battery. A long charge can, of course, be detonated much more quickly by putting a blasting cap in each end and connecting both to the battery.

Boom Conveyor Builds Concrete Cottages in 3½ Hours Each

BY THE SIMPLE boom concrete conveyor shown in the accompanying photograph a contractor at Euclid Beach near Cleveland exceeded Edison's dream of building a house a day and built the one-story cottage in 3½ hr. On the conveyor chain, which runs at quite a high speed, are sheet-metal paddles cut to the same diameter as the steel-lined trough in which the paddles run. The chain is driven by a sprocket wheel on a gasoline engine at such a speed that the concrete is shot into a head or baffle plate at the top with considerable force. It then drops into a chute conveying it into the Pressed Steel wall forms. The small continuous mixer shown in the picture feeds into the boot of the elevator a mortar consisting of cement and coarse lake sand devoid of large aggregate. The walls of the one-story house are 4 in. thick and 9 ft. high. The plan dimensions are 20 x 34 ft.

D. S. Humphrey, contractor and the inventor of the conveyor, has erected a two-story office building 25 ft. high with the outfit.

Reinforced-Concrete Work Well Handled on Chicago Sewer

IN A LARGE trunk sewer now being constructed in connection with the new Union Station in Chicago, the invert and side walls are concreted first to hold the reinforcing and the sides of the trench, so that the trench bracing which supports both may be removed to allow concreting the arch. Interior form braces are also eliminated by the use of a special design of Hydraulic pressed steel forms. The sewer, which is 9 x 12 ft. inside and 12 x 18 ft. outside, is of reinforced concrete and runs from Monroe and Clinton Streets east to Canal Street, and thence north on Canal to Washington Street and east on that street to the Chicago River.

The major portion of the bottom of the 12-in. invert, about 10 ft. wide, is laid directly on the soil without the use of forms. This section, which is laid first, furnishes a support for the ribs of the steel forms. Then the steel forms and reinforcing are placed and concrete poured to complete the invert. The sides and a section of the arch to the springing line are poured monolithic. This section of the concrete work is then allowed to set for a day. The outside steel forms for the arch are next braced against the bank. Then the 6 x 6-in. 12-ft. trench braces, seen in the accompanying photograph, are removed, and the work of setting forms and concreting the arch completed.

The small inside form sheets are removed by knocking out keys which hold them to the ribs. The ribs, which act as a brace to the new arch, are allowed to stand for 72 hr. before being removed. Four men put up and take down in a day a section of form work 20 ft. long. Of course, only a few minutes are required in taking the forms down. The rate of progress is measured by the rapidity of concreting. The W. J. Newman Company of Chicago is the contractor for the work.



NOVEL CONVEYOR OUTDOES EDISON IN BUILDING CONCRETE COTTAGES

Channel Blasted in Coral Rock Under Water by "Dobying"

A CHANNEL between Clearwater and St. Petersburg, Fla., 100 ft. wide and 8 ft. deep at low tide was recently blasted without drilling any holes in which to place the charges, according to the *DuPont Magazine*. The charges of dynamite were simply placed on the bottom, relying on the tamping effect of water over them to break up the rock. These shots did great execution on the fairly soft coral, and the cost of the extra dynamite used is said to have been more than balanced by the saving of labor in not drilling any holes, leaving the time saved in completing the channel a clear gain.

TWENTY MILES OF ELECTRIC RAILWAY have been completely constructed during the past year by the city of San Francisco. The city has acquired, constructed and equipped 43.6 miles of single track and has under consideration the immediate construction of an additional 5 miles.

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

Worcester Plans Road Congress

The Chamber of Commerce of Worcester, Mass., announces that an "International Road Congress" will be held in that city Dec. 14 to 17 inclusive. The convention hall will be in the Hotel Bancroft and an exhibit of road-building materials and equipment will be held in an adjoining auditorium. The Massachusetts Highway Association and the Federal Government will co-operate with the local authorities in conducting the meeting.

The first day, Dec. 14, at 2 p. m., will be Governors' Day and there will be addresses by the Governors of several New England States. Road Builders' Day is scheduled for Dec. 15 at 9 a. m. The sessions on Dec. 16 will be featured by addresses by the Mayors of Boston, Providence, and Montreal. The final day, Dec. 17, will be Automobile Day.

Among the engineers on the program for the congress are Logan Waller Page, Clifford Richardson, W. W. Crosby, Dr. Ira N. Hollis, George W. Tillson, H. L. Sherman, J. R. Worcester, W. A. McLean, Dr. Joseph H. Pratt, Nelson P. Lewis, W. H. Connell, George C. Diehl and William D. Sohier.

New York Authorizes Bond Issue to Complete Barge Canal

The final count of the votes at the election of Nov. 2 on the referendum authorizing a bond issue to complete the New York State barge canal shows a majority of about 25,000 in favor of the issue, according to results tabulated in the office of the State engineer. The plans for the uncompleted sections will be finished at once in order that it may be possible to award contracts just as soon as the money is available.

To Study Advantages of Use of Hydrated Lime in Concrete

To determine if the claims that the addition of hydrated lime to concrete increases its plasticity, decreases segregation and improves its waterproofing qualities are justified, the U. S. Bureau of Standards will make tests on such concrete. Before entering into the work an advisory committee, composed of representatives of the four interests involved—the cement industry, the lime industry, the engineer and the contractor—was asked to participate in outlining plans for the work. This committee, which was selected by P. H. Bates and W. E. Emley (of the Bureau of Standards), who will have active charge of the work, met in Pittsburgh, Nov. 4, and offered criticisms of the plan of work prepared by the Federal bureau. As a result the program was modified to meet such criticisms insofar as was advantageous, and it is expected that the research will be started during the present month.

As outlined, the work is extensive in scope. The tests will include: Determination of compressive strength, expansion, reinforcement, permeability, action of sea water, the hydration of cement, absorption, segregation, abrasion and adhesion of cement to reinforcement. Specimens to which varying proportions of hydrated lime have been added up to five years of age will be tested.

The advisory committee consists of Nathan C. Johnson of New York, Alfred H. White of the University of Michigan, S. C. Potts of the Pennsylvania Railroad System at Altoona and Dr. J. N. Mackall of the Maryland State Highway Commission, Baltimore, engineers; W. A. McIntyre of the American Association of Portland Cement Manufacturers, Ernest Ashton of the Lehigh Portland Cement Company, E. D. Beyer of the Atlas Portland Cement Company and W. M. Kinney of the Universal Portland Cement Company, representing the cement interests; W. E. Carson, president of the Lime Manufacturers' Association, Laurence Hitchcock, chairman of the executive committee of the Hydrated Lime Bureau, and N. G. Hough, manager of the Hydrated Lime Bureau, representing the lime interests; and the James L. Stewart Construction Company of Pittsburgh, W. L. Prettyman, president of the Concrete Construction Company of Philadelphia, and H. L. Smith, general manager of the Turner Construction Company of New York City, contractors.

New England Waterworks Officers for Ensuing Year Nominated

In a report submitted to the secretary of the association the committee of the New England Waterworks Association appointed for that purpose states that it has nominated the following officers for the ensuing year: For president, William F. Sullivan of Nashua, N. H.; vice-presidents, C. M. Saville of Hartford, C. E. Davis of Philadelphia, S. E. Killam of Boston, R. S. Lea of Montreal, Canada, D. A. Heffernan of Milton, Mass., and W. W. Brush of New York City; executive committee, R. C. P. Coggeshall of New Bedford, R. J. Thomas of Lowell and F. J. Gifford of Dedham, Mass.; secretary, William Kent of Narragansett Pier; treasurer, L. M. Bancroft of Reading, Mass.; finance committee, George H. Finneran of Boston, D. N. Tower of Cohassett, Mass., and John Mayo of Bridgewater, Mass.; editor, R. K. Hale of Boston, and advertising manager, G. A. King of Taunton, Mass.

Form Chicago Chapter of the American Association of Engineers

By-laws for the Chicago chapter of the American Association of Engineers which starts with a membership of 160 were adopted at a meeting held Nov. 5. In order properly to place the responsibility for the work to be accomplished by the chapter, fourteen standing committees are provided for. An idea of the scope of the work is given in the following committee titles: By-laws, meetings, program, entertainment, initiation, finance, inspection trips, publicity, articles for publication, membership, visiting, grievances, local legislation and employment and information. Chapters are being formed at Springfield, Ill., Minneapolis, Indianapolis and several other points.

In order to compensate for the effort required on the part of the pioneers in the association to establish "going value" a provision is to be made in the constitution providing that there be no fees other than annual dues until 500 members have been obtained, after which an initiation fee of $2 additional to the annual dues will be charged. The initiation fee is to increase with each 500 new members.

City Managers to Meet in Dayton

The City Managers' Association and two other municipal organizations, the National Municipal League and the Ohio Municipal League will meet in Dayton, Ohio, during the week of Nov. 15 to 19. On the program of the city managers on Nov. 15 and 16 are Fowler S. Smith on "Purchasing Methods," Karl Mitchel on "Municipal Cost Data," Charles E. Ashburner on "The Citizen and the New Form of Government," G. C. Cummin on "Budget Making," Winton Miller on "Publicity Work Necessary Under the New Plan" and Henry M. Waite on "Powers and Duties of the City Manager."

Eight Killed and Many Injured in New York Factory Fire

Horrors of Triangle Fire Repeated on Smaller Scale in Building with Unprotected Stairways and Only One Fire Escape

Unprotected stairways, despite an order issued as far back as January, an inadequate provision of fire escapes and a bolted door were responsible for the loss of life and the large number of injured in a fire that occurred, Nov. 6, in a factory building at 281-283 North Sixth Street, Williamsburg, New York City, in which there was a total absence of any provision such as a sprinkler system, fire drills or interior signal system that might have tended to lessen the effects of the disaster. That the casualities were not greater was due to the fact that, being a half-holiday, the usual number of workers were not in the building.

An inspector of the State Industrial Commission visited the building in January and discovered that the law was being violated inasmuch as the stairways, walls and ceilings of the exits were not fireproofed. An order to remedy the defects was served on the owner. In February it was not complied with. Several months passed and for some reason no notice of the violation was given the counsel of the State Industrial Commission until September. Legal steps were then taken to inforce the order, with the result that only three days before the fire the owner started to work on building fireproof partitions.

At the time the flames were first discovered there were about 200 persons in the buildings. In the first two floors, which were occupied by a candy manufacturing establishment conducted by Mr. and Mrs. Edward L. Diamond, the owners of the building, a very small percentage of the working force was on hand. On the third floor there were about 60 persons, on the fourth between 40 and 50 and on the top floor about 40. The first sign of fire came from the bottom of an unused elevator shaft. Almost simultaneously flames burst out on every floor.

At first the occupants made for an unprotected stairway that ran along the elevator shaft. Escape by this route was soon cut off by the stairway catching fire between the first and second floor. A locked trap door on the fourth floor prevented the escape of many by a side stairway.

The spread of the flames drove the workers back toward the windows, where a jam occurred, and, in consequence, a panic. Some made their way down the one fire escape. But even here the flames followed and enveloped them. Several were found dead on its iron platforms.

The known dead as a result of the disaster number eight and 36 were injured. Besides there are a number of missing, so the casualties may run higher. The owners of the building were arrested and later released on bail. Investigations are in progress to determine the responsibility.

There was no sprinkler system in the building, nor was there an interior fire alarm system. The testimony and findings to date indicate a total absence of any of the customary precautions generally recommended for such buildings.

Ohio River Dam Near Steubenville Completed and Put in Operation

Dam 10 in the Ohio River, about a mile above Steubenville, Ohio, was completed and put in operation Nov. 4. The total cost of the construction was somewhat over a million dollars.

Work in 46th Street Cofferdam, New York City, Well Along

The excavation for the two slips flanking New York City's new pier at Forty-sixth Street and the North River will soon be finished. The foundation for the portion of the pier within the cofferdam is more than half concreted, and the space between the outside concrete walls of the pier foundation is largely backfilled with excavated rock. The work of concreting the south wall of the south slip at the lower end of the cofferdam is also well along. As soon as the excavation is complete, the back walls of the two slips will be concreted, completing the work which requires pumping the cofferdam.

The rock to be excavated sloped upward toward the shore, and as soon as a face high enough to permit their use was reached, six well drills were installed. These drill holes to the bottom of the cut, and the face is blown down into the excavation in full-depth sections, as in quarry work. The holes are not sprung, however. The drills are shown in the accompanying photographs.

The large sound stone broken out are used in great numbers as plum stone in the heavier concrete sections. They are washed off with a hose one at a time as they are raised by the cranes to be swung into place.

The pile portion of the pier is nearing completion, less than 100 ft. on the outer end remaining to be driven. This part of the work has been delayed by the difficulty of obtaining the 85-ft. piles needed for the river end of the pier. The pier is being built for the Department of Docks and Ferries of New York City, of which R. A. C. Smith is commissioner and C. W. Staniford chief engineer, by the Holbrook, Cabot & Rollins Corporation, for whom Daniel Hughes is in charge as superintendent under Thomas B. Bryson. A description of the design being carried out under this contract will be found on page 120 of the Engineering Record for Aug. 1, 1914.

The Bacon's the Thing

The frankest—and rawest—expression of pork-barrel sentiment we have heard in a long time is this from the Key West (Fla.) *Journal:*

"If you employed a man at a salary of $7,500 a year and allowed him an expense account in addition, you'd expect that man to produce results, wouldn't you? Florida is going to employ a man to represent her in the United States Senate next year. Let's employ a man that can 'produce.'"

A patriotic citizen of Florida whose indigna-



FACE OF ROCK EXCAVATION SHORTLY AFTER A BLAST AND SOUTH SLIP WALL IN LOWER CORNER OF COFFERDAM



CRANES AT WORK BACKFILLING FOUNDATION FOR SHORE END OF NEW YORK CITY'S NEW FORTY-SIXTH STREET PIER

tion was aroused by the paragraph asks this pointed question:

"With a constituency that openly and shamelessly gives notice that he is to be employed to 'produce' what do you think will be the character of the services performed by a Senator elected with this understanding?"

He will do exactly what such people as the editor of the *Journal* want him to do. He will bring home all the "bacon" he can. With his eyes closed and his nose clasped tightly between two fingers he will vote for the off-color projects of other members of Congress in order to get all the cash he can for dams in Florida creeks and post-office buildings in Florida villages.—*Collier's.*

Aluminum Company Takes Over French Holdings in Plant

It is reported that the Aluminum Company of America has taken over the entire French holdings in the hydro-aluminum plant near Whitney, N. C., which, when completed, was, according to the original plan, to have cost $10,000,000. Formal transfer of its property is said to have taken place last week. It is understood that the new company will carry the construction to completion at once, expending for the purpose several millions of dollars. Work on the plant was originally started early in 1914, but ceased shortly after the European war broke out.

Unassembled Examination for Illinois Waterways Engineer

Because of the large number of competent applicants for the examination for waterways engineer recently announced in Illinois, who found it impossible to attend the examination in the State, the Civil Service Commission has postponed the examination and has issued a letter reannouncing it under different conditions. The substance of the letter is as follows:

It has been decided to make this examination an unassembled one as far as the written portion is concerned. This means that a set of questions concerning education, training and experience will be mailed to each applicant, which is to be filled out by him and returned to the commission at Springfield before some date, to be fixed later. This information, or examination, will be subject to correction by a board of examiners.

Those whose education and experience indicate that they would be able to handle the duties of the waterways engineer will be directed to assemble at some convenient point in Illinois for a personal interview with the board of examiners.

By this arrangement persons in distant parts of the country will be enabled to take the preliminary portion of the examination without going to any expense, while those who succeed in this preliminary portion may make the trip with a reasonable chance of being placed on the eligible list.

The questions will be mailed to applicants Dec. 1.

It has been announced by the new waterways commission of Illinois that action will be started early next spring on the deep waterway through the State.

News of Engineering Societies

The Washington Society of Engineers will hold a banquet Nov. 23 at Rauscher's, in Washington, D. C.

The Montana Institute of Municipal Engineers will hold its annual meeting at Billings Jan. 17-19, 1916. Carl C. Widener of Bozeman is secretary.

The Hydrated Lime Bureau will hold its first annual meeting at the Oliver Building, Pittsburgh, Dec. 1. It will be decided upon at the meeting whether or not the bureau will be continued. In case it is decided in the affirmative a definite program will be determined upon for the ensuing year.

The Engineers' Society of Western Pennsylvania will hear Thomas Fleming, Jr., of the firm of Chester & Fleming, consulting engineers of Pittsburgh, speak on "Improvements in the Art of Mechanical Filtration" at a meeting to be held in Pittsburgh Nov. 16.

The Cleveland Engineering Society will hold a special meeting Nov. 23 to hear W. H. Alexander, local forecaster of the U. S. Weather Bureau, speak on "What the United States Weather Bureau in California Is Doing for the Benefit of the Engineer."

The American Society of Agricultural Engineers will hold its annual meeting in Chicago Dec. 28-30. The papers to be presented cover, among other subjects, such matters as farm conveniences, including water and sewerage systems, drainage, irrigation and farm structures. F. M. White of Madison, Wis., is secretary of the society.

The Colorado Association of Members of the American Society of Civil Engineers will be addressed this evening by F. C. Steinhaur, superintendent of Denver mountain parks, on "The Construction of Automobile Highways in the Mountain Parks." L. R. Hinman, secretary, announces that hereafter the weekly noonday lunches are to be held at Clarke's restaurant.

The Yale Engineering Association held its first annual meeting in New Haven, Conn., on Nov. 5. The meeting was addressed by E. M. Herr, president of the association; Russell H. Chittenden, director of the Sheffield Scientific School; Arthur T. Hadley, president of Yale University, and by the heads of the engineering faculties of the school. The 160 members present visited the new Mason laboratory of mechanical engineering, the Hammond laboratory and other recent additions to the equipment of the School. Lunch was served in Memorial Hall. The purpose of holding the meeting in New Haven was to interest the members of the society in the advancement of engineering education.

The Carnegie Institute of Technology of Pittsburgh will celebrate Carnegie Day Nov. 23 and 24.

Personal Notes

H. W. MUDGE, formerly president of the Rock Island System has been elected president of the Denver & Rio Grande Railroad succeeding B. F. Bush.

EDWARD S. AULT, formerly connected with the Marion Steam Shovel Company of Marion, Ohio, has been appointed city engineer of that city.

WALTER N. POLAKOV has resigned as superintendent of power of the New York, New Haven & Hartford Railroad to engage in consulting practice. In the eighteen months he had charge of the operation of the power plants of the New Haven he effected a saving of 25 per cent in the cost of electric power. His address is Revonnah Manor, Stamford, Conn.

LEWIS W. BALDWIN, formerly general superintendent of all lines of the Illinois Central Railroad south of the Ohio River, has been appointed general manager of the Central of Georgia Railway, with headquarters at Savannah. He was graduated from Lehigh University in 1896 and entered railway service in the engineering department of the Illinois Central. He was appointed track supervisor in 1900 and, in the following year, became roadmaster of the Yazoo & Mississippi Valley Railroad. In 1902 he returned to the Illinois Central in a similar capacity and, in 1904, was promoted to the grade of trainmaster. Subsequently he served as superintendent on subsidiary lines. He attained the grade of engineer, maintenance-of-way in 1910 and that of general superintendent in the early part of the present year.

WILLIAM S. DOWNS, formerly resident engineer in charge of reservoir construction for the Hydroelectric Company of West Virginia, has been appointed county road engineer for Monongalia County, West Virginia, to have charge of the special road improvements in Morgan district, for which there is a $300,000 bond issue available.

HORACE M. BRINGHURST, formerly supervising draftsman for the Port of Seattle Commission, has been appointed draftsman for the McClintic-Marshall Company of Pittsburgh, Pa.

HUGH M. WILSON, first vice-president of the McGraw Publishing Company, was struck by an automobile while returning from the city to his home in Scarsdale on the evening of Nov. 5. The machine did not have its headlights burning. The first reports of the accident indicated that Mr. Wilson was seriously hurt. To allay the anxiety of the many friends who have inquired about him it can be said that while his injuries are painful they will not incapacitate him for any great length of time.

PAUL M. LINCOLN has resigned from his position in the engineering department of the Westinghouse Electric & Manufacturing Company to devote his time to the manufacture of a meter which he has recently invented. Up to July of this year Mr. Lincoln was president of the American Institute of Electrical Engineers.

LAWRENCE A. DOWNS, formerly superintendent of the Kentucky division of the Illinois Central Railroad, has been appointed general superintendent of all lines south of the Ohio River, with headquarters at New Orleans. He was graduated from Purdue University in 1894 and entered railway service in 1895 on the engineering forces of the Vandalia Railroad. He went to the Illinois Central in 1896 as assistant engineer in maintenance and construction. In 1898 he was appointed roadmaster on the Amboy division and, in 1907, he became assistant chief engineer of maintenance-of-way. He attained the grade of superintendent in 1910.

A. F. LOHR, formerly connected with the Buckeye Steel Castings Company, has been appointed deputy county engineer of Madison County, Ohio.

W. G. KIRCHOFFER, sanitary and hydraulic engineer of Madison, Wis., and consulting sanitary engineer to the State Board of Health has been appointed consulting engineer for the department of the State engineer of Wisconsin. This appointment was noted in the Oct. 30 issue of this journal but Mr. Kirchoffer's name was erroneously spelled.

A. S. MILLER, formerly city engineer of Lake City and county surveyor of Columbia County, Florida, has been appointed assistant engineer for the State Highway Commission of Iowa.

R. L. BALDWIN has resigned from the office of appraisal engineer for the State Utility Commission of Missouri to become associated with Burns & McDonnell, consulting engineers, of Kansas City. Mr. Baldwin, who is a graduate of Missouri State University, was associated with the same firm before becoming appraisal engineer for the utility commission. He held the latter office for two years. In his new connection he will have charge of the firm's electrical work and of appraisals of electrical and other utilities.

WILLIAM M. RUMSEY, formerly city engineer of San Diego, Cal., has opened offices in the Granger Building, San Diego to engage in private practice. He began his engineering work in 1887 in the building and contracting field and has since been engaged principally in irrigation and municipal work. He was in the service of the city of San Diego, as assistant city engineer and as city engineer for nine years.

C. F. LOWETH, chief engineer of the Chicago, Milwaukee & St. Paul Railway, has been elected a member of the engineering committee for the Western group, Presidents' Conference Committee, Federal Valuation of the Railroads in the United States.

F. P. GILBERT, formerly assistant sanitary engineer on the forces of the Maryland State Department of Health, has been appointed assistant superintendent of the water and sewerage systems of Freehold, N. J.

E. H. MAY, formerly assistant on the engineering corps of the Indianapolis division of the Pennsylvania Railroad Lines West of Pittsburgh, has been appointed assistant division engineer of the Michigan division of the Vandalia Railroad, with office at Logansport, Ind.

Obituary Notes

T. W. M. DRAPER, civil and mining engineer, of New York City, died Nov. 8, at the age of sixty-one years. He was born in New York and was educated in Germany and Switzerland. After serving as a volunteer in the Franco-Prussian War, he returned to the United States, where he engaged in work in Colorado. Later he was engaged on the construction of the Atlantic & Danville Railroad and, during the Spanish-American War, served as captain of engineers.

WILLIAM F. ALLEN, who devised the present method of computing standard railway time, died in South Orange, N. J., Nov. 9, at the age of sixty-nine years. He entered railway service in 1862, as rodman on the Camden & Amboy Railroad and rose to the grade of assistant engineer in its service. In 1868 he became resident engineer on the West Jersey Railroad and, in 1872, he was appointed assistant editor of the *Official Railway Guide*. Six months later he was appointed editor of the guide and, in 1914, he became president of the National Railway Publication Company which publishes it. He began working on standard time reckoning for railroads in 1881 and to-day the plan he devised is in use throughout the continent. In 1875 he assisted in the founding of the American Railway Association and, at the time of his death, he was its general secretary and treasurer.

EBEN R. DYER, superintendent for the last fifty years of the Portland (Maine) Water Company and the Portland Water District, died Nov. 8.

Civil Service Examinations

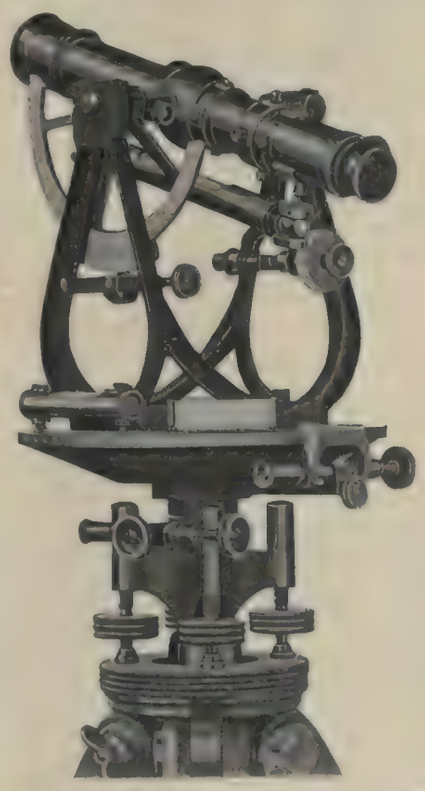
New York.—In the open-competitive examinations to be held within the State Dec. 11 it is announced that application forms must be duly executed and filed with the Civil Service Commission, Albany, by Dec. 1, and that no form will be sent from the office after Nov. 29. Furthermore, it is stated that in writing for forms the position for which the form is desired should be particularly specified.

Among the positions for which examinations are to be held are those for junior engineer, grade 7, salary from $1,201 to $1,500 a year; junior assistant, engineering department, salary from $901 to $1,200; structural draftsman, salary same as junior engineer, and junior draftsman, salary same as junior assistant.

Each of these positions requires technical training, the two superior ones especially. Experience up to two years gives any candidate for the lower positions who has met the other requirements preference, and is required of those candidates who take the examinations for the higher positions, unless they have had a certain definite college or university technical education. The age limit for the smaller jobs is 20 years, that for the other two being 21 years. Non-residents are permitted to take examinations for any of these positions, but will be subject to the civil service regulation, giving residents of the State preference.

New Type of Transit Has Beveled Limb and One Piece Standard

A transit that includes a new type of one piece trussed standard and a beveled, or "dished," limb has recently been put on the market by W. & L. E. Gurley of Troy, N. Y. The standard consists of a solid bronze casting, said to be of perfectly balanced symmetry. The limb is hollow and ribbed, increasing in depth from the outer edge toward the spindle and socket. The plate is heavily ribbed.



BEVELED LIMB A FEATURE OF THIS TRANSIT

Water Softening Zeolite Found in Black Hills

Following the discovery of a water softening zeolite in the Black Hills, North Dakota, and a year of experiments, a company has been formed in Des Moines, Iowa, to place it on the market under the name of Refinite. The material is reduced to particles about the size of rice grains and then put through a bake oven. It is used as a filtering media in a simple mechanical filter. After a definite quantity of lime and magnesia has been stored up a solution of common salt is passed through the filter to restore the water softening properties of the zeolite.

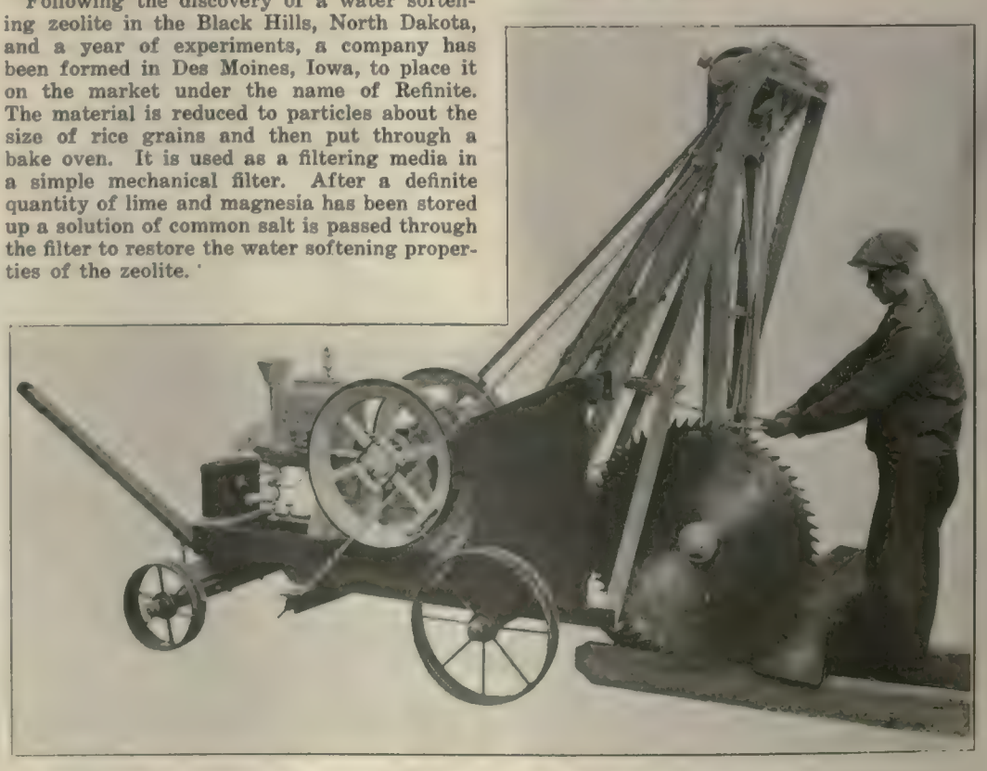
An installment has been operating for more than two months in the home of Charles S. Denman, manager of the Des Moines Water Company. R. N. Kinniard, chief engineer of the water company, is chief engineer and manager of the Des Moines Refining Company, which will handle the zeolite. He states that it is entirely feasible to soften the entire water supply of Des Moines but that probably the consumers would not stand for the additional cost, 75 cents to $1 annually. Plants for residences can be installed, however, for from $150 to $500.

How England's Export Trade Is Fostered and Directed

In the recent publication of the Bureau of Foreign and Domestic Commerce, Department of Commerce, describing the system constituting the commercial activity of the United Kingdom and the methods and manner in which the Government fosters and directs trade expansion, Archibald J. Wolfe, the author, who personally investigated the work, has included lists of British chambers of commerce, discussions of their organizations and functions and accounts of State-aid methods to trade and manufacturers' and employers' associations. The booklet, which is entitled "Commercial Organization in the United Kingdom," and contains 53 pages, may be obtained by applying to the Superintendent of Documents, Washington, D. C., sending five cents and asking for pamphlet 102, Special Agents' series.

Saw for Cutting Heavy Timbers Can Be Moved on the Job

For cutting heavy timbers to be used in the construction of trestles, cofferdams, mill buildings and work of like character requiring a large size power saw, a 30-in. portable swing cut-off saw has been placed on the market. The saw can be easily moved around the job—the entire apparatus weighing 1800 lb. Power is furnished by a 6-hp. engine. The saw which is hung on a swinging steel frame is pulled by the operator through the timber to be cut. In the accompanying photograph the guard which is furnished for the saw has been removed so that the method of operation can be more easily illustrated. The new machine is manufactured by the C. H. & E. Manufacturing Company, Milwaukee.



SAW BEING SWUNG INTO POSITION BY OPERATOR—SAW GUARD REMOVED TO SHOW OPERATION

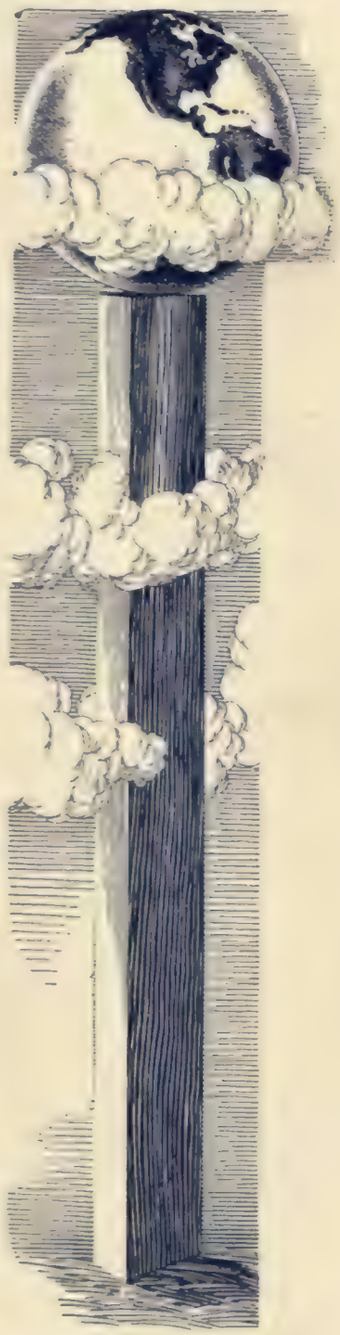
Engineering Record

Circulation 20,000 Copies. McGraw Publishing Company, Inc.

November 20, 1915



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The Pennsylvania Electrification

IT is to be expected that any innovation will be tried first either under compulsion or where its advantages are most manifest. Railway electrification came in the United States first as a solution of difficult terminal problems where smokeless operation was essential. Then came the application to trunk-line divisions with heavy gradients. Following the same rule, the determination to electrify certain branches of the Pennsylvania Railroad in the Philadelphia territory rested upon a special advantage, and not upon the economy under entirely normal conditions. As was well set forth in the last issue of the Engineering Record, page 590, increased capacity in the Broad Street Station was imperative. The alternatives were electrification and costly alteration of the terminal. The latter would mean a large addition to capital cost, and represent an investment necessarily unproductive. The adoption of electrification, on the other hand, on account of saving in operating costs, is in part, at least, self-sustaining. The saving will be sufficient, when compared with the cost of operation under steam, to pay interest on the additional investment. One is tempted to speculate upon the period which will intervene before the entire Philadelphia district of the Pennsylvania is electrified, and then, letting loose a bit on one's imagination, to ask whether, when this electrification is accomplished, electrical operation between Philadelphia and New York is not a logical and quite an immediate step.

Artistic City Bridges

ENCOURAGING are the signs that city departments are giving more consideration than formerly to the architectural treatment of bridges and other civic structures. Some cities, fortunately, have long given adequate study to their bridges, and an account of some recent work in Philadelphia, on page 598 of the last issue, not only gives typical features of several bridges but shows that the Bureau of Surveys of that city is still improving on the practice which as many as 10 years ago made its concrete bridges notable for general appearance and finish. It is significant that there is employed in the bridge division an "architectural bridge draftsman" who devotes his whole time to making comparative studies of possible architectural treatments of structures. Not only are the structures themselves designed to be pleasing, but the surroundings whenever possible are given consideration. A small expenditure for the sodding of embankments, and the planting of trees and shrubs, gives a finishing touch that sets off the structural work. It has been found in Philadelphia that the public appreciation of these structures is keen. It would not be possible to impose on any group of Philadelphians an ugly bridge of the old type, because they have, during some 10 years, been educated to higher standards by actual examples. The appreciation of the working classes is just as keen, too, as that found in wealthier sections. The thought that "anything" will do for a mill district and that handsome bridges are only for boulevards has, therefore, been rejected. Pleasing treatment adds but little to the cost of a structure. What it adds to the tone of a neighborhood—as an inspiration for better-kept yards and homes—cannot be computed, but the result unquestionably is very large.

Realizing on Engineering Assets

IT WOULD seem that the best advertising a railroad company can do is to exploit those of its engineering achievements and precautions which make for the safety and comfort of its passengers. Railroad publicity, however, has been in the hands of those who love florid language, suitable only for lavishing upon the road's scenic wonders and on the elaborate equipment of its limited trains. With the "safety first" movement vigorous, progressive roads can make much capital out of their engineering and management policies and achievements. The Southern Pacific is vigorously advertising its success in winning the Harriman safety medal, while the Pennsylvania is using the menu cards in its diners for little preachments on its practice for insuring safe drinking water on trains, its policy with regard to steel cars, and the construction and maintenance standards which produce its wonderful roadbed and track. Just now the Lackawanna is telling the East about the wonders of its new cut-off and of the giant Tunkhannock viaduct. With pardonable enthusiasm it characterizes the structure as the "Ninth Wonder of the World," thus catching the fleeting attention of a busy public. Moreover its revised time-tables, made necessary by the shortened schedule over the new line, devotes three pages to pictures and a description of the engineering marvels of the new route. Even the most careless reader cannot but feel that here, with massive structure, wide cuts and no grade-crossings, there must be a safer, better railroad. Without doubt engineers are partly responsible for the lack of appreciation on the part of railroad publicity departments of the engineering advantages of their lines. The publicity man is not able to grasp engineering facts in engineering language; they must be translated for him, and their importance made striking by means of comparison with common objects and experiences. A little effort on the part of engineers in this direction would undoubtedly redound to the benefit of their systems in an advertising way and would also help to emphasize the importance of the engineer's work.

Coroner's Jury Exonerated

THE jury which investigated the collapse of subway decking on Seventh Avenue in New York City should not be confused with the average coroner's jury. The Engineering Record has been reliably informed that its editorial comment of Nov. 6 on the findings of this jury was at fault in suggesting something of the kind. As a matter of fact, hastily as the jury was assembled, it was drawn from a panel including many of the best-known engineers in the city, more than one of whom served (with contractors, architects, and professional men) on the jury. It is interesting to note that the strong impression was made on the jury by the evidence, according to one of these engineers, that the street-railway car which fell into the cut, causing most of the deaths, had no business where it was at the time of the blast. The impression created by the evidence was that this car had overrun a red flag in an attempt to get by before the blast was fired, and had been traveling at too high a speed in approaching the block. Rather than indict the motorman or the blasting foreman for what the jurymen felt to be a public fault, allowed constantly to pass unchallenged by the city administration, the verdict recommended that in future traffic be barred from temporary street decking when blasts are fired. It should be said in justice to the jury that it did not censure the fire department for failing to enforce the use of blasting mats, but for failure of its inspectors to specify, as is provided by ordinance, the maximum quantity of dynamite per ton of rock which would be safe in the rock being excavated at the scene of the accident. The view in which the jurors finally concurred held that had such a maximum limit been set, it would have been proper to indict the blasting foreman. This man testified that each hole was loaded with two and one-half times the quantity of dynamite that he had used in firing previous rounds in the same heading. Even this testimony failed to account for all of the twenty-five sticks which were taken from the powder house on the morning of Sept. 22. Why the holes in this particular round were loaded so heavily the evidence did not clearly disclose. The jury concluded, however, that the law empowered the inspectors of the fire department to fix a safe upper limit for the proportion of dynamite to rock in the various subway

cuts. Therefore, since, according to the evidence, the inspectors had not done this, it was held that they were at fault and they were censured accordingly.

Two Road Meetings or One

DISCUSSION of the decision of the American Road Builders' Association to hold a convention next January or February, which appears elsewhere in these columns, naturally prompts the inquiry whether one or two road congresses will be held in future. As those interested in highway matters know, the Engineering Record has consistently urged that there be only one national road congress each year. That policy, if adopted, would mean a considerable saving for engineers, highway departments and manufacturers. Moreover, with the rapid increase of local highway meetings the educational work is being well handled, and more than one national meeting is not called for. Then, too, one large meeting would be sufficient for the exchange of views between experts. From every angle a single national meeting is desirable and sufficient.

Practically, however, the attainment of any permanent agreement between the American Highway Association and the American Road Builders' Association seems to be impossible. Their joint effort at Oakland was discouraging.. The meeting was only a shadow of what a national highway congress should be. Antagonistic personalities in the two associations, the desire of those in the management of both to wield an influence in the highway movement, and the lack of "backbone" on the part of both engineers and manufacturers, who time and again have declared that they would only attend one meeting, make any effective and lasting unification impossible.

While the Engineering Record still holds, and will maintain, that a single national meeting (with many local meetings by State and county organizations) is ample for all needs, it will cease for the practical reasons cited to advocate the policy. Contemplating, however, the reasons for abandoning the policy one cannot suppress a cynical and critical feeling toward those whose narrowness has prevented, and still prevents, the adoption of the better plan.

The Spirit of the Agreement

ANNOUNCEMENT has been made that the American Road Builders' Association will hold a convention in January or February next, either at Cleveland or Pittsburgh. This action, it seems to the Engineering Record, is a violation of the spirit of the agreement made between the Road Builders' Association and the American Highway Association when the Pan-American Road Congress was organized. The agreement was that the individual conventions of these two associations were to be abandoned. It appears that there was no written agreement as to just which conventions should not be held. Apparently, therefore, there will be wide diversity of opinion regarding the action of the Road Builders' Association. Certainly, however, it was the belief of this journal that the conventions of what might be called the 1915-16 convention season were to be abandoned. It is inconceivable that the American Highway Association would have agreed to the Oakland congress plan had it suspected that the abandonment of the Road Builders' December convention was to be followed by a January or February meeting.

The Road Builders contend that for some years they have been considering the advisability of transferring their convention from December to January or February, arguing that in the dead of winter engineers and contractors are sure to be free from field duties and will thus be able to attend the meeting. Had they determined not to make the change until the season of 1916-17, an interval of 17 months would have elapsed between the Pan-American Road Congress at Oakland and their 1917 convention. Such an interval, manifestly, was undesirable, and the directors of the association therefore determined to take advantage of this prospective long interval to hold a meeting in February of next year. Without a doubt the directors are sincere in their belief that their action is not a violation of the agreement between the two associations.

In this view, however, the Engineering Record cannot share. While it appreciates the advantages to the Road Builders' Association of the January or February meeting, it holds that it was unfortunate to make the change at the present time when the association was bound by relations with the American Highway Association. To say the least, the move has been an unfortunate one. Technically the Road Builders (in the absence of written documents) may be entirely within their rights. It is hard, however, to square the abandonment of a December convention and the holding of a February meeting with the spirit of the agreement with the Highway Association.

Philadelphia Engineers Know How

SIXTEEN HUNDRED new members in 4½ days—such is the record that the Engineers' Club of Philadelphia has set up for the emulation and inspiration of engineering clubs and societies throughout the country. Starting on Monday morning, Nov. 8, with 551 members, the membership rose by noon of Friday, Nov. 12, to 2127, making the Philadelphia organization the largest local body of engineers in the United States, exceeding even the New York Engineers' Club. Since the close of the campaign over 200 additional applications have been secured, bringing the total to nearly 2350 members.

The story of organization, team-work and enthusiasm is partially told in the news pages of this issue. Little is said, though, about the sacrifices that must have been made by team captains and their men, for only individual recital of methods could convey an adequate idea of the energy required to attain and surpass the predetermined mark—1000 new members. The imagination and experience of the reader must be left to visualize the work that was done in those 4½ strenuous days.

One cannot suppress a feeling of pride that an engineering organization has had the vision, the courage and the ability to attempt such a campaign. Engineering associations are accustomed to proceed along conservative lines. Campaigns and advertising are taboo. They are believed to be out of harmony with the dignity of the organization. The profession at large, therefore, owes a debt of gratitude to the Philadelphia club for daring to depart from the beaten path and take the chance of inviting censure and criticism. Be it recorded, though, that despite the whirlwind character of the campaign, it did not clash with the dignity and standing of the club. No adverse criticism has been deserved and none has come. Instead, there is a quiet pride of accomplishment, a new sense of the possibilities of the organization, a closer fellowship on account of the intimate contact—and contest—between the campaigners. The club has demonstrated that publicity methods can be used without detriment—aye, with great gain—to the organization.

The club members are not unmindful, too, of the obligations which the larger membership entails. The club, fortunately, is not content, as are some engineers' clubs, to be merely a social organization, furnishing a place for the members to entertain their guests and to be entertained. It believes it has a mission to further the interests of the profession and such civic interests as are of an engineering character. Its participation last year in the discussion on the desirability of licensing engineers in Pennsylvania is an example of the work it aims to do. With the ability and energy displayed in the campaign and with the large addition to membership, one may confidently expect the club to initiate and successfully carry through plans in every way worthy of its position as the largest engineering club in the country. It was apparent at the closing luncheon that while there was pride in the total membership resulting from the campaign, numbers were considered not as an end but as a means for increasing the club's ability to serve the profession and the community.

One of the very noticeable features of the campaign, and one that deserves emulation generally, was the effort made to secure the applications of the most prominent engineers in Philadelphia, particularly of those who have been graduated into executive work and on this account have largely lost their touch with engineers and with things engineering. In this effort the campaigners were singularly successful. One can safely predict that if the club is able to secure the active work of these men, whose advancement is an assurance of their broader vision and great ability, its possibilities for accomplishment will be immeasurably increased.

Without doubt the Philadelphia club's campaign methods will be closely studied by engineering societies throughout the country. Much can be learned from its efforts. Aside from the very apparent advantage of

larger membership, no small value should be placed upon the greater confidence which the result has given the members and the closer fellowship resulting from the work. The publicity in the daily press, too, has undoubtedly given the club a wider influence.

Other organizations may feel that the time for a similar effort is not ripe. In one particular, however, local clubs generally can at once follow the lead of the Philadelphia organization—in bringing about an affiliation between the local branches of the various national engineering societies. In fact, it was this affiliation between the local associations of members of the national bodies which led logically to this greater step of an enlarged and more powerful Engineers' Club. Some other cities have been working on the affiliation plan. St. Louis has progressed far, and without a doubt the possibilities elsewhere, while necessarily smaller than in the third city of the country, are still very large.

The Engineers' Club of Philadelphia is to be heartily congratulated on the success of its campaign, and even more so on the possession of a membership undaunted by a big idea.

Freedom to Choose Customers

THERE is a lot of comfort for many manufacturers in the decision of the United States Court of Appeals for the Second Circuit in the cream of wheat case. This is the first case of its kind that has been decided since the enactment of the Clayton law, and those who assumed that that law would operate to destroy all liberty in the choosing of customers, although purporting to grant this right, may now take heart. The case of the Great Atlantic & Pacific Tea Company vs. the Cream of Wheat Company was dismissed by Judge Hough of the United States District Court for the Southern District of New York last July. The tea company complained that the refusal to supply it with cream of wheat was an illegal discrimination, based upon objection to the act of the tea company in selling cream of wheat below the advertised price. Judge Hough's decision was so sweepingly and emphatically adverse to this contention that cautious counsel advised their clients not to assume that it would be upheld on appeal. Judge Hough's decision from the manufacturer's point of view was apparently too good to be true.

Judge Hough has now not only been upheld, but the Court of Appeals seems to have been infected with some of the spirit that characterized the decision below. Judge Lacombe, for example, remarks in his opinion: "We had supposed that it was elementary law that a trader could buy from whom he pleased and that his selection of seller and buyer was wholly his own concern. It is part of a man's civil rights that he is at liberty to refuse business relations with any person whomsoever, whether the refusal rests upon reason or is the result of whim, caprice, prejudice or malice."

That seems plain enough, and after reading it the layman may wonder what has been bothering the manufacturer with respect to his liberty to sell or to refuse to sell his products as he might see fit. Whim, caprice, prejudice and malice, collectively, seem to be fairly inclusive of the motives—now legally approved—that might induce a producer to refuse to sell to a given customer. But it must not be forgotten that the court has not said that a refusal to sell is justified if the purpose or result of such refusal is to create unreasonable monopoly and restraint of trade. The two decisions are so worded that this important fact may be overlooked. We may act on caprice or malice, but restraint of trade is still forbidden.

It is an unavoidable consequence of the rulings in the cream of wheat case that the burden of proof to show an improper motive in the choosing of customers will hereafter lie heavily upon the plaintiff or prosecution. Under a reasonable application of Judge Hough's and Judge Lacombe's decisions, it would seem that every assumption is in favor of the defendant and that it will devolve on complainants to prove that objectionable actions are not due to caprice but are plainly dictated by a desire to restrain trade. For some years we have had—with the notable exception of the announcement of the rule-of-reason doctrine—a long line of decisions the effect of which was to sharpen the teeth of our anti-trust laws and almost to create panic among those who wanted to obey the law, whatever it was, and at the same time conduct their business successfully. The cream of wheat decision represents a decided reaction from strict construction of anti-monopoly laws, at least so far as the important matter of choosing customers is concerned.

Engineering Problems of the Submarine

THE European war has directed upon the submarine, owing to a few sensational exploits, a degree of attention which is perhaps not altogether its due. It is not known accurately how large a number of submarines Germany had at the beginning of the war, nor indeed how many have been added, but neither number is a very great one, and there are evidences that the total has been greatly reduced by an active campaign of trapping and sniping.

To secure the merit of invisibility when prowling about, the submarine sacrifices speed to a degree which is a very serious handicap. The two weak points in general design are, therefore, the power plant for operating on the surface and the electrical equipment now necessary when working submerged. The ordinary storage battery in almost universal use is put at a disadvantage by its weight, its fuming and the added unpleasant results of even a very small leak if sea water reaches the battery solution. When working on the surface it seems to be difficult to extract from oil engines of practicable size the requisite amount of power for high speed. In at least one of the early French submarines the lead battery was replaced by an alkaline storage battery, and the substitution of the Edison battery in some of our own submarines now building may tend to lessen risks and greater possibility of prolonged submersion.

As to primary motive power, there have been many recent suggestions of using steam engines with flash boilers or their like, fired by oil, in the hope of getting greater effective power. The gasoline engine which could be made so enormously effective seems barred by the extreme danger of leak in gasoline tanks when the boat is running submerged.

The tendency seems to be toward the building of bigger and bigger submarines with more speed and greater cruising radius, with the possible differentiation of a coast-defense type of relatively small size and power. Whether this last stands much chance of practical usefulness may be considered somewhat doubtful. Experience seems to show that purely defensive methods must be considered of dubious utility. The offensive-defensive seems to have the advantage both on sea and land. And in fact one of the greatest dangers of the submarine, so far as our own country is concerned, is that the somewhat sensational German operations may lead us to put unjustified confidence in submarine craft, not as auxiliaries for special purposes, but as a general defense, leading to the development of a shipless navy which would fail even as a defense in case proper means of dealing with the submarine are developed during the present war.

All the indications point to the probability of an effective reply to submarine warfare, thorough enough to destroy the value of the submarine for coast defense. In spite of the destruction of numerous trawlers and freighters, with now and then a liner, the precautions taken by Great Britain against submarine operations have been sufficient to avoid even a single casualty among the great fleets of transports carrying men and war materials to the coast of France. It is questionable whether when the war ends the new weapon will be regarded as practically more efficient than some of the old ones.

If the United States chooses to build a considerable fleet of submarines they will unquestionably not be without their use, but if it builds them at the expense of an efficient sea-going navy this is likely to prove money wasted. The ingenuity of the engineer is being more actively applied to means of destroying submarines than to improvements in them, and at present apparently with greater results. The underwater telephone, for example, by which one can hear the machinery of the submarine at a distance of several miles and locate its approximate direction and distance, is likely to be a formidable weapon in hunting these unseen prowlers, and very likely has already been of material assistance. Not less important is the giant aeroplane with ample bomb-carrying capacity and power to keep the seas for long voyages. Between these and the fast-scouting boats and nets, the work of the submarine is already beset with great difficulties, so that while recognizing to the fullest the value of such craft under certain circumstances it behooves one to go very cautiously before putting great faith in the submarine defense alone as a security against invaders from the sea.

Philadelphia Valuation Conference—Some Editorial Views

A Far-Reaching Conference

A MOMENTOUS conference on valuation was held by the Utilities Bureau in Philadelphia last week. An account of it will be found in the news section of this issue. Commissioners, lawyers, economists and engineers were drawn from all parts of the United States, and doctrines were propounded which, if they could be proved to be correct, would have a tremendous effect on public utilities of all sorts. The Engineering Record is obliged to disagree with many of these doctrines. It feels that the presentation of the many problems involved was one-sided and may have done great harm. It feels further that the radical views revealed are an indication that we have not yet got down to fundamentals; that these fundamentals are not, as many hold, matters of law and its interpretation, but are questions of pure ethics and public morality.

A Belated Announcement

IT SEEMS unfortunate that the opening remarks of Mr. Cooke, acting director of the bureau, setting forth the purpose of the conference, did not appear in the advance program. A conference suggests opportunity for equal presentation of all sides of the subject, and the great preponderance of announced speakers from the consumers' viewpoint was the only intimation to be derived from the program that one side only was to be featured. In his opening remarks Mr. Cooke in a few words made it plain that the bureau thought the utilities amply able to handle their side of the case, and that this conference was called to develop the consumers' side. Such being the case the program could well have so stated.

Who Are the Public?

THIS JOURNAL uses the term consumers advisedly. In the conference they were habitually referred to as the public. It is here submitted that the users of utilities are only part of the public, or rather, that the public includes other classes than users. The Pennsylvania Railroad has 90,000 stockholders—a public much smaller than that of its users, but larger than the consuming public of many a gas or water utility. Besides the individuals, banks and insurance companies have vast sums invested in utility securities. The commissions and bureaus are not representing the whole public so long as they segregate the investing public and treat it, through the managers of the utilities, as a foe of the whole people, to be opposed as a public menace at every turn.

What Is Rate Making?

RATE MAKING was a favorite phrase at the meeting. Always it was given the same significance—rate cutting. Distress was more than once voiced that the rate-makers would have to remain idle for a period of years because conditions would not warrant any further reductions. Not once was it suggested that they might busy themselves raising rates as conditions might require. The Engineering Record repeats that if the commissions are fairly to represent the whole public, including the investing public, it must regard the rate as something capable of movement either up or down.

The Agency Theory

JUDGE HELM of Kansas, Professor Bauer of Cornell and others pictured the agency theory in bold relief. The utilities, they say, are public property entirely; the book owners are but the managers, or, to be more accurate, the foremen, the real management being vested in the public. Government ownership, according to that view, must already be here, but the Government is saved from putting up the purchase price by forcing the stockholders to loan it on doubtful security. The stockholders are limited to a "fair return," the public taking the rest—but the earning of this fair return is put squarely up to the management. If the theory could be sustained, there would be no further argument for reproduction cost; neither unearned increment, nor donated land, nor franchise values, nor anything else not actually paid for, would be entitled to any income. The Engineering Record does not believe that the theory is correct.

Law and Justice

INSTANTLY comes a chorus of exclamations that this is not a matter of opinion, but of law, established long ago in the Munn case in 1876. The Engineering Record is not a law analyst. It does not believe, however, that all of the points claimed have been positively settled. It has perceived, as Mr. Burch has, that whatever the question on the general subject, plenty of decisions are cited to support either side. It has noted with Mr. Knowles that court decisions change with the times. Beyond all that, if the agency theory is in accord with law the Engineering Record believes the law itself must ultimately be changed in the interests of real justice.

What Is Regulation?

LET IT NOT be supposed from the foregoing that this journal opposes regulation. Its views on this subject were set forth in these columns last week, on page 588. But there are degrees of regulation. Without any regulation the utility gets all of the profit on what the traffic will bear. With regulation on the agency basis the consumers get all of the profit except a little more than the bare cost of production. Somewhere between these extremes lies fair regulation. The owners of the utility should be allowed the major part of the extra profit due to efficiency in management, and to a good part of that chargeable to good luck and the general prosperity of the public served. And certainly if the public shares in the profits it must share as well in the losses—applying itself as assiduously to the regulation of operating expenses, such as wages, as to the regulation of rates, and shouldering its share of what it and the utility cannot regulate, such as unprecedented floods.

"Threat Value"

IT IS GRATIFYING that at least one State commissioner—or rather former State commissioner—John M. Eshleman, does not approve of the agency theory. His more liberal views are suggested in the abstract, on page 625, of his address on the reproduction theory. In opposing this theory he develops the idea that the reproduction cost includes, besides the actual sacrifice of the investor, a goodly amount of what he terms "threat value," based on the monopolistic protection afforded by the public itself. But is not the characterization unfair in some respects? This journal's views of franchise values and other intangibles not paid for will be touched upon later. Is it quite just, however, to include unearned increment on land as part of "threat value?" Is not the desire of the utility to recognition of this increment as an element of fair value, when such recognition does not mean burdensome rate increases, a perfectly normal and reasonable desire to share in the general prosperity to which this increment testifies, and to which the utility has contributed in no small measure, rather than to a mean attempt to take advantage of a helpless public?

Interdependence of Railroad Rates

AND DOES NOT Mr. Eshleman, in classing the railroads with the local gas plant, commit the same error of which he accuses the reproductionists, that of thinking monopoly and competition at the same time? Some railroads are monopolies over large territories; all, perhaps, enjoy local monopolies to a certain extent. Even at best, or worst, however, the interdependence of rates plays an important part. If one road can make a profit hauling goods from A to B at a certain rate, and sees fit to establish that rate, all other roads from A to B must make the same rate, profit or no profit. Not alone is direct competition affected. The railroads running to C, which town competes with B, may not ignore the rates made to B by an entirely different set of roads, lest they be charged with discriminating against C. Within certain limits the Government allows the railroads to even up for low long-haul competitive rates by high short-haul monopolistic rates, but those who trace the actual operating movement and see the relative costs of switching and transit perceive

that this system is not wholly inequitable. Seemingly the interdependence of railroad rates destroys a large part of the railroad's "threat value."

Which Would Shift First?

MR. ESHLEMAN and others called the reproduction method an engineer's invention devised solely to produce the highest figure. It was suggested that the utilities would promptly recede from their position if it were shown that reproduction cost would be less than original cost. Let us look at the other side of the picture. Suppose prices, including land values, had steadily fallen since the building of the plant. Would the so-called public care to allow a return on $1,000,000 because the plant cost that much, although it could be replaced for $500,000; or would not the company, rather, be charged with extravagance in construction, or lack of foresight, and allowed a return on present value only? This journal suspects that if reproduction cost should suddenly prove to be less than original cost there would be danger of a collision in the mad scramble of the two parties at interest to exchange positions.

Depreciation

THIS JOURNAL has repeatedly expressed its views on depreciation. In general it agrees with the railroads that in a properly maintained utility of unlimited life, spending about the same amount each year for renewals, such renewals are virtually operating expenses; that the public must pay such operating expenses; that it is not necessary to maintain a separate depreciation reserve as such, and that there should be no deduction of depreciation to obtain fair value. Special attention is called, however, to the point made by Mr. Allison, that it is utterly impossible to determine the service life of many of the units of the utility plant, and that the engineers should be more active in pointing this out. Those who doubt the significance of this should figure a sinking fund, compounding at 4 per cent, to renew a $1,000,000 bridge with an assumed life of twenty-five years, and then another fund, compounding at 4½ per cent, to renew the same bridge with the length of life estimated at fifty years. For such reinforced concrete structures as the Tunkhannock viaduct, put in service last week, reasonable guesses could vary between much wider limits.

Going Value

WHILE there was little agreement at the conference as to the definition of going value, there was fairly general agreement as to what part of it should be included in fair value. They would allow actual development costs in the early years, but disallow franchise values, enhancement from continued operation, and the other intangibles attaching to the going plant. The Engineering Record inclines to the same view, and believes the railroads can afford to allow such "other elements of value" as those of connected use or advantageous location to prove their existence automatically by heavy traffic, or low operating expenses, or both. But the method of measuring these development costs proposed by Mr. Thorne does not seem satisfactory. He would require proof of early losses, uncompensated by later excessive profits. One might suspect the father of this thought to be the knowledge that seldom if ever do the books show the full development costs. In any event measuring these costs by existing deficits or lack of them rewards poor management at the start and penalizes early effectiveness, as has frequently been pointed out. Mr. Thorne recognizes this, and so would exclude from consideration all but the early experimental years; but surely Mr. Hagenah's plea for allowing the continuous development expenses of the municipal utility in the rapidly growing city is pertinent. It would seem that in this question of going value the fairest results will be obtained by the co-operation of the parties at interest in estimating what the development ought to have cost. In such an event the public's representatives should see that every legitimate item is admitted, even down to the present time, while the utility should recognize that the development cost of plant enlargement, such as the four-tracking of an established double-track railroad, is less proportionally than that of plant newly created, such as the original single track built into pioneer territory.

Drawing the Curtain on the Past

MUCH was said in favor of drawing the curtain on the past—not, however, when going value was being discussed. Thus is human nature portrayed. The past is pertinent in going value, they say, evidently because the utilities usually cannot substantiate in figures their claims for development expenses that must have been incurred. On the other hand, evidence of subsequent large dividends can be found; hence the utility loses both ways when the past is explored. With depreciation the advantage is reversed. The public demands that the utilities produce depreciation reserves. The utilities cannot. Clearly, therefore, these reserves, which do not exist, have no value. The utilities claim they were never allowed to earn these reserves. Let us draw a curtain on the past, and begin anew.

Keeping the Engineer in His Place

AS IS USUAL in these mixed gatherings, the engineer was kicked around considerably by the lawyer and the economist. According to Professor Gray, the engineer is in no way fitted to discuss questions of value and wealth, and his testimony on these matters is never regarded seriously by the economist. In general, neither the economist nor the lawyer hesitates in these discussions to put the engineer in *his* place, but both are shocked when the engineer attempts to define *their* functions. Under these circumstances, is the engineer going to stay "put," or is he going to assert himself? Is he going to admit that the *hours* he spends on the valuation details of plant with which he is familiar are worth less than the *minutes* spent by lawyers and economists on details of plant with which they have no acquaintance?

Degrees of Worthlessness

IT is true that Professor Gray, after delivering the engineer his staggering blow, applied the smelling salts himself. In other words, after proving that none of the expert testimony of engineers in valuation cases was of any account, he uttered the sad plaint that the railroads, by pooling their interests, can afford to get all of the best of these engineers. Furthermore, reputable engineers, it seems, are unwilling to tell the truth for the Government, for fear of damage to their future business. Consequently the public is at an unfair disadvantage, and the railroads win by sheer numbers of witnesses. Reverting to the original theorem, that none of these engineers are worth anything as witnesses, the equation may be expressed thus:

$$10 \times 0 > 5 \times 0$$

As the Engineer Sees the Conference

CONSIDERING the conference as a whole, there seems to have been much abstract theory presented, but not so much practical suggestion. The criticism was destructive rather than constructive. So many times the speaker seemed to fall just short of a definite conclusion. Usually one learned what he did not favor; often one was left in doubt as to just what he did advocate. At present the valuation question seems to divide into two parts: How to make present valuations, particularly the Federal valuation of the carriers, in accordance with existing law; and how to work out a definite and just basis for the future. As to the first part, the conference did not get down to this level and grapple with the actual problems being encountered. As to the second, the theories propounded seemed, as already stated, to be based on concepts of what existing law means and not on fundamental ethics.

Rays of Light

HAVING objected to most of the theory developed at the conference, the Engineering Record is glad to commend a few detail suggestions. The method of obtaining reproduction cost of land explained by Mr. Hayes (see page 626) is worthy of careful consideration. It appears to be all that Mr. Hayes claims for it, a means of getting in evidence what railroads probably would have to pay to reproduce their right-of-way, and at the same time avoiding rejection by the courts because of conjectural items. The importance of maintaining as well as making inventories was well set forth by Mr. Pillsbury. Valuation by approximation as used by Mr. Morse in insurance valuations would probably not be acceptable to the courts in their present attitude, but the idea is excellent and it would certainly be desirable to get away from hair-splitting in inventorying small items when estimates must serve for much larger ones.



EIGHT MECHANICAL FILTERS MUST SUPPLY PURE FEED WATER FOR 40,000 BOILER HORSE-POWER PLANT

Softening Plant Converts Hard, Impure River Water Into Boiler Feed Supply

Chemical Treatment by Intermittent System and Rapid Filtration Reduce Steam Generating Costs at Youngstown Sheet and Tube Mill

BY THE INSTALLATION of a water softening and purification plant, comprising eight steel reaction and settling tanks, 30 ft. in diameter and 26 ft. high, two sets of three reagent mixing tanks and eight mechanical filters with a combined capacity of 4,000,000 gal. daily, it has been possible for the Youngstown Sheet & Tube Company to convert the hard, contaminated flow of the Mahoning River into a satisfactory boiler feed water and to make an appreciable saving in the cost of steam generation and boiler maintenance. The treated water, it has been found, does not contain any permanent hardness and the remaining lime and magnesia salts are reduced to less than their solubilities in distilled water. Such a water, experience has shown, does not form boiler scale or cause corrosion, for the small amount of lime and magnesia salts left in the water are of such a character that when precipitated as a result of concentration in the boilers only a slight quantity of sludge is formed. The following data regarding the new works were supplied by J. C. W. Greth, who, until his death last August, was manager of the water purifying department of the William B. Scaife & Sons Company of Pittsburgh, which supplied the equipment for the Youngstown plant.

At the mill 30,000 boiler horse-power are in service, operated at an average load of 125 per cent of rating or at the rate of approximately 40,000 hp., requiring the evaporation of 4,000,000 gal. of water.

STREAM FLOW VARIABLE

The stream flow of the Mahoning River varies considerably. The average minimum flow per 24 hr. is 15,000,000 gal. The average maximum daily flow is 13,000,000,000 gal. The mean average daily flow is 776,000,000 gal. The minimum daily flow has often been as low as 10,000,000 gal. The maximum flow of water is hardly equal to all of the demands of various plants along its banks in Youngstown at all seasons of the year. The daily use of water from the Mahoning River, in passing through Youngstown, is approximately as follows: City of Youngstown, 12,000,000 gal.; Carnegie Steel Company, Ohio works, 70,000,000 gal.; Brier Hill Steel Company, 50,000,000 gal.; Republic Iron & Steel Company, 110,000,000 gal.; Youngstown Sheet & Tube Company, 150,000,000 gal.; total, 392,000,000 gal.

This list, of course, does not include the smaller users. It is only possible to obtain sufficient water from the river by means of dams, forming pools, which become merely circulating basins for each plant. Were it not for the fact that the city and the manufacturing concerns along its banks return their sewage and waste into it there would be very little water in the river except at flood stages. The water supply is badly contaminated in addition to the hardness which it contains. On Aug. 8, 1914, the river water had a temperature of 127 deg. Fahr. at the intake of the plant of the Youngstown Sheet & Tube Company.

The analyses in Table 1 will illustrate the range of the mineral impurities in this supply that are of interest in connection with boiler feed water, and which vitally affect the cost of steam generation and boiler maintenance.

TABLE 1—RAW WATER, MAHONING RIVER

	Grains per U. S. gallon				
Volatile and organic matter	1 05	1 30	25	1 65	1 90
Silica	85	45	35	45	55
Iron and alumina oxides	15	05	trace	05	25
Calcium carbonate	66	2 54	6 27	5 75	8 48
Calcium sulphate	2 99	6 26	4 59	9 18	61
Magnesium carbonate	94	1 66	.. ..	.. ..	.. ..
Magnesium sulphate	..	..	5 40	4 56	5 07
Magnesium chloride	27	68	.. ..	.. ..	.. ..
Magnesium nitrate	14	27	.. ..	.. ..	.. ..
Sodium sulphate	..	..	96	7 60	4 37
Sodium chloride	16	48	4 12	10 55	3 46
Sodium nitrate	..	..	31	..	..
Total solids	7 21	13 69	22 25	39 79	24 69
Suspended matter	8 75	45	35	75	29 10
Free carbonic acid	33	33	22	10	33
Incrusting solids	6 00	11 91	16 61	19 99	14 96
Non-incrusting solids	16	48	5 39	18 15	7 83

It will be readily noted from the analyses that while rainfall reduces the hardness of the water there seems to be no regular rule that can be followed, since there is neither a regular reduction in the various impurities nor any regular increase. The principal impurities are the different lime and magnesia salts; a variation in any one of these substances involves a change in the treatment. While, as a rule, only two reagents, lime and soda ash, are employed in softening water, some of the impurities,



CHEMICALS FROM OVERHEAD BINS ARE WEIGHED AUTOMATICALLY BEFORE REACHING THE REAGENT MIXING TANKS

such as magnesium sulphate, affect the quantities of both lime and soda ash required. On the other hand, any variation in the carbonic acid contained in the water affects only the lime treatment.

SOFTENING SYSTEM INTERMITTENT TYPE

The We-Fu-Go water softening and purifying system, built by William B. Scaife & Sons Company of Pittsburgh, was the system installed to effect the purification of this water. It is a system of the intermittent type in which definite quantities of water are treated all the time with predetermined weights of reagents.

The water to be purified is pumped from the river to a barometric condenser by an



THE EIGHT STEEL REACTION AND SETTLING TANKS ARE FITTED WITH MECHANICALLY OPERATED STIRRING PADDLES

18-in. DeLaval centrifugal pump, having a capacity of 13,600 gal. per minute against a head of 36 ft. The condenser has a capacity of 240,000 lb. of steam per hour. From the hot well of this condenser the water flows by gravity to the raw water well of the water purifying system, whence it is pumped to the reaction and settling tanks of the water purifying system. The advantage of using this condensed steam is, first, in its temperature; second, in the dilution of the water by condensed steam; and, third, in the saving of water. The objection to its use is the lubricating oil which must be removed in the treatment to make it fit for boiler feed use. This is effectively taken care of in the apparatus installed.

The system consists essentially of eight steel reaction and settling tanks, 30 ft. in diameter and 26 ft. high, each holding 120,000 gal. of water. About 2 ft. in the bottom of each tank is allowed for sludge storage. Each tank is equipped with mechanical stirring devices operated by an electric motor. There are two sets of three reagent mixing tanks, with power-operated stirring devices; three centrifugal pumps for introducing the reagents into the reaction and settling tanks; and eight mechanical gravity filters of steel, each 15 ft. in diameter and having a capacity of 500,000 gal. of water per 24 hr. The piping connecting the treating tanks to the filter headers are so cross-connected that any one or all of the treating tanks can be connected with any or all of the filters. It is also possible to use the water directly from the settling tanks without the use of the filters. Means are provided for supplying the settled water for filter washing, doing away with the necessity of wash pumps for this purpose. All the main valves in connection with the treating tanks are hydraulically operated from an operating board, located in the building in which the filters are located. All other valves are operated by means of extension stems and stands through a universal coupling.

CHEMICALS AUTOMATICALLY WEIGHED

The chemical reagents are stored in hopper-bottom bins in the floor above the reagent mixing tanks. The reagents are taken directly from the cars to the storage room by means of an elevator. The storage bins discharge into movable reagent hoppers, one for each set of reagent mixing tanks. The reagent hoppers are fitted with Fairbanks, Morse & Company's automatic scale, which enables the operator to deliver the proper quota of reagents to the various reagent mixing tanks. Three American centrifugal pumps are used for delivering the reagents from the reagent mixing tanks to the reaction and settling tanks. These pumps are cross-connected so that they can operate with any reagent tank or tanks to deliver to any one of the eight reaction and settling tanks. The reagent mixing tanks are fitted with mechanically operated stirring devices to facilitate the dissolving of the reagents.

FILTER STRAINERS UNIQUE

The filters are of the mechanical gravity type fitted with the usual pipe manifold, into which Scaife strainers are screwed. These strainers are of unique design, consisting essentially of an outer and an inner cone of sheet brass and a cast-brass base. The base is spun onto the outer cone, the inner cone being free to move up and down. The outer cone is slotted parallel to the base of the strainer; the inner cone has openings at right angles to the slots of the outer cone. During the regular operation of the filters the full area of the openings in the outer cone is available for carrying the water from the filter. During the washing process the inner cone moves up and closes off a number of the openings in the outer cone so that the total of the openings equals the discharge of wash water through the wash main into the filter bed. This insures a uniform distribution of the wash water to all parts of the filter bed, using a minimum of wash water, and, since the water enters the filter at high velocity, effects an efficient wash.

The filters are provided with an air wash system, air being supplied by a positive air blower operated from the line shaft, driven by the motor which operates the stirring devices in the reagent mixing tanks. The filtering material consists of graded crushed quartz supported by a layer of gravel. The flow of the water to the filters from the reaction and settling tanks and from the filters to the clear well is controlled by means of balanced valves and copper floats.

The stirring devices in reaction and settling tanks are operated by electric motors, one for each row of tanks, and consist of slow-moving paddles set at an angle to give the water the much-desired rolling motion so essential for thorough mixing and aiding the completion of the reactions, as well as to prevent the breaking up of the precipitate into fine, slow-settling particles. The paddles are located in the bottom of the tanks and mix the sludge of previous purification with the incoming water; about 24 in. are allowed in the bottom of each tank for the storage of this sludge, which is a factor in the treatment of the water.

HOW SYSTEM OPERATES

The operation of this system is briefly as follows: One or two reaction and settling tanks may be treated at a time, depending upon conditions; usually, however, only one tank is treated at a time. While a tank is filling the reagents are introduced and thoroughly mixed with the water, by means of the stirring device, which not only mixes the water and reagents, but the sludge of preceding purification. This sludge floats in the water, hastens the chemical reaction and causes the new, finely divided precipitate to form large, woolly flakes, heavy enough to settle quickly as soon as the water stops moving. After a tank is filled the stirring device is stopped and the water permitted to stand in order to allow the precipitate to settle to the bottom of the tank. The softened water is taken out of the tank by means of a hinged floating outlet pipe, arranged to rise and fall with the level of the water, so that the water is always drawn from the top. The water at the top being the clearest, carries the least amount of floating sludge through the floating outlet pipe to the filter, thus reducing the filter cleaning to a minimum.

The washing of the settling tanks needs only to be done about once a week. This is accomplished by opening the valves to the sewer and starting the stirring devices to mix up the sludge, which is soft enough to

TABLE 2—TREATED WATER, MAHONING RIVER

	Grains per U. S. gallon				
Volatile and organic matter	1 25	1 15	65	65	75
Silica	80	45	45	75	65
Iron and alumina oxides	05	trace	trace	trace	trace
Calcium carbonate	1 25	75	75	88	1 14
Magnesium carbonate	..	.. ..	.. ..	.. ..	29
Magnesium hydrate	12	20	67	48	44
Sodium carbonate	1 42	1 50	1 44	1 78	1 08
Sodium sulphate	3 91	15 76	23 43	18 46	7 35
Sodium chloride	99	7 42	11 37	10 22	2 31
Sodium nitrate	08	.. ..	.. ..	.. ..	16
Sodium hydrate	64	52	08	94	.. ..
Total solids	10 51	27 75	38 84	34 16	14 17
Suspended matter	..	trace	05	trace	trace
Free carbonic acid	none	none	none	none	none
Incrusting solids	2 22	1 40	1 87	2 11	2 52
Non-incrusting solids	7 04	25 20	36 32	31 40	10 90

flow. When the filters require washing the settled water from one of the reaction tanks is used for this purpose.

RESULTS OF TREATMENT

The softening results obtained from this installation are shown by the analyses of the softened and purified water in Table 2.

It will be noted that the softened water does not contain any permanent hardness and that the remaining lime and magnesia salts are reduced to less than their solubilities in distilled water. Such a water, it has been found, will not form scale or cause corrosion, for the small amount of lime and magnesia salts left in the water are of such a character that when precipitated as a result of concentration in the boilers only a slight sludge is formed. By washing out with a good pressure or by rubbing with the finger the metal of the boiler can be exposed. Corrosion can not occur, it is claimed, because the purified water contains neither corrosive acids nor substances which, in the boiler, can produce such acids. These analyses also show a uniform quality of the purified water from this variable supply so that the improvement in boiler operation and maintenance charges is believed to justify the installation.

SEATTLE HARBOR IMPROVEMENTS made during the past three years have cost approximately $6,100,000, and include wharves, transit freight sheds and warehouses. All of the units are now completed and in operation except a seven-story concrete fruit warehouse, of which five floors are up; a two-story wharf, and a public cold storage plant.

Mass Concrete Retains Setting Heat Several Years

Records During 1915 from Thermometers in Arrowrock Dam Confirm First Conclusions Reported by C. H. Paul and A. B. Mayhew

FURTHER CONCLUSIONS are reached regarding the temperature variations in mass concrete as the result of nearly a year's additional records in the testing of temperature variations being made at the Arrowrock dam. In the closing discussion of their paper on this subject, which was abstracted in the Engineering Record of June 5, page 710, Charles H. Paul and A. B. Mayhew, in the *Proceedings* of the American Society of Civil Engineers for October, page 2009, state that none of the new results tends to contradict any of their original conclusions. The following abstract includes the new conclusions and the principal points of interest brought out by the later records, which are shown in the accompanying diagram for the thermometers 3, 5 and 9.

EFFECT OF WATER IN RESERVOIR

The record of thermometer 5 compared to that of thermometer 9 shows the effect of the water in the reservoir on the temperature of the concrete close to the upstream face. The water was above the elevation of thermometer 5 after Feb. 26, and the temperature of the water at that elevation was between 32 and 52 deg. during the remainder of the period shown on the diagram. At the elevation of thermometer 9, covered from May 11 to Aug. 24, the water was considerably warmer, especially after the early part of August, when the surface was not far above that elevation.

With records of nearly 2½ years for some of these thermometers, and after having the reservoir filled within 28 ft. of the top of the dam during the season of 1915, all of the thermometers, with the exception of No. 2, continue to give readings that indicate perfect condition of the apparatus. This is gratifying to the engineers in view of the difficulties experienced heretofore in obtaining satisfactory results for any length of time with similar apparatus.

By taking advantage of the inspection galleries it has been possible to measure the movement of fifteen of the expansion joints, spaced 50 ft. apart, not only at the upstream face of the dam, but also at the upstream and downstream walls of the inspection gallery, 16 ft. and 22 ft. respectively in from the upstream face of the dam. The accompanying table gives the average maximum opening, and the average subsequent minimum opening of these fifteen joints.

These records are for one season only,

AVERAGE MAXIMUM AND MINIMUM OPENINGS OF FIFTEEN EXPANSION JOINTS IN ARROWROCK DAM

Location of joints	Maximum in.	Minimum in.
At upstream face	0.0708	0.0064
In 16 ft. from upstream face	0.0444	0.0300
In 22 ft. from upstream face	0.0324	0.0240

and undoubtedly the heat in the concrete due to setting was still being felt.

NEW CONCLUSIONS

The following conclusions can be added to those given in the original paper:

6. (Superseding 6 in the paper.) The seasonal variation in the temperature of concrete 10 ft. from an exposed face is about 12 deg., when the seasonal variations of the mean daily temperature of the air is about 72 deg.

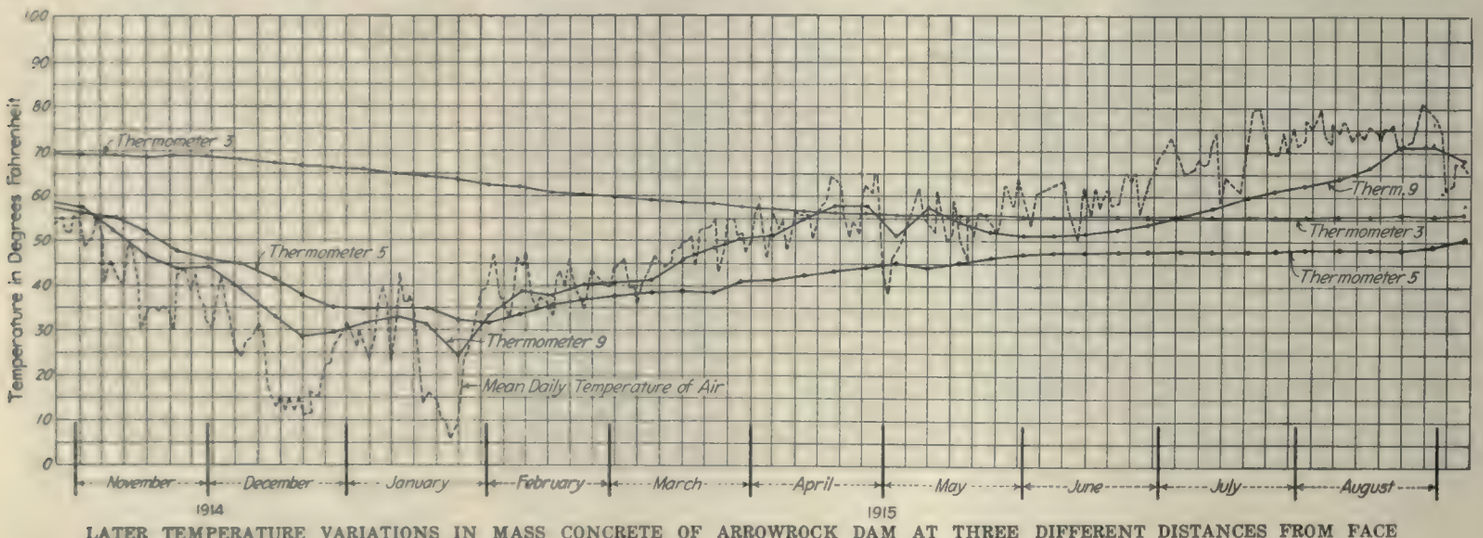
7. The seasonal variation in the temperature of concrete 20 ft. from an exposed space is very little, and after the effect of "setting heat" has once been overcome, the change in temperature of concrete at that distance from an exposed face is so slight as to be negligible under ordinary conditions.

8. The effect of the "setting heat" in concrete 20 ft. or more from an exposed space is felt for several years after the concrete is placed. Concrete near the center of the mass of a large dam probably retains some of its "setting heat" for five years or more after placing.

9. Contraction joints are desirable in all large concrete structures, whether or not they are to be exposed to wide variations in outside temperature, except possibly when all construction may be carried on during cold weather and when the variation of outside temperatures, after completion, would be slight.

10. Changes in volume due to setting, hardening, and seasoning of concrete are more important ordinarily, excepting at points very close to exposed faces, than changes in volume due to the influence of daily or seasonal variations in outside temperatures.

Similar investigations at the Kensico dam of the Catskill aqueduct tend to confirm these conclusions.



LATER TEMPERATURE VARIATIONS IN MASS CONCRETE OF ARROWROCK DAM AT THREE DIFFERENT DISTANCES FROM FACE

Thermometer 9 is 1 ft. and thermometer 5 is 3½ ft. from the east or upstream face. Thermometer 3 is 20 ft. from the west face.

Reproduction Basis of Valuation Criticised

John M. Eshleman Calls Railroads Shortsighted in Trying to Realize on "Threat Value" Far Above Cost—Warns Against Government Competition

THE REPRODUCTION theory of valuation was sharply criticised at the valuation conference in Philadelphia last week. The agency theory of regulating utilities was advocated by many, and if this theory be correct there is little room for argument for value based on reproduction cost. John M. Eshleman, Lieutenant-Governor of California, and formerly president of the State railroad commission, found objection to the reproduction method by a different line of reasoning, as he does not support the agency theory. He developed the idea that much of the value of the protected monopoly is "threat value," based upon the consumer's necessity for the monopoly's product; that the public may, if the threat price becomes too high, make a counter threat of ruining the utility by entering into direct competition with it; that reproduction cost as interpreted by the utilities, particularly by the railroads under the Federal Valuation Act, includes absurd and intolerably extravagant claims for hidden and intangible items that would make for a total far in excess of the investors' real sacrifice, and that if such a sacrifice be allowed the public will be forced to compete with the utilities "until they shall be of a reasonable mind." He does not specify absolute rules for valuing existing utility property, but urges the co-operation of all concerned in attempting to reach the just and fair result.

Mr. Eshleman's address was in part as follows:

It is unfortunate from the standpoint of clearness that the term "value" has ever entered into the discussion of the regulation of utilities. It has no place there and can not, in the nature of things, be an element to be considered in solving the problems that must be solved either in fixing rates or in determining a price which shall be paid for a utility property.

"Threat Price"

Let us assume, for the sake of argument, that the desire to preserve actual physical life in an extremity will ordinarily cause the surrender by the person involved of more possessions not directly useful for the prolongation of life than will any other motive. Assuming this to be true, the one in possession of the only supply of food can always take from a person in dire need of such food all of his other possessions. Thus we see that value, viewed subjectively as it ought to be, is always determined comparatively and personally—comparatively because the sacrifice that will be made by the one in whose mind the value is fixed is determined by the sacrifice that must be made to secure a substitute for the thing valued; and personally because the ultimate sacrifice that will be made to secure the object is determined by the estimate the one valuing puts upon the desirability of his condition in possession of the object and not in possession of it.

Price, therefore, when determined independent of cost is merely the money or barter equivalent of the value thus determined. Its maximum is limited solely under certain conditions by the resources of the buyer; its minimum under certain other conditions may even be nothing. In the case just referred to, the one in possession of the sole supply of food, if so minded, might take all the one in need possessed, but plainly the amount that could be taken as the price would be determined and limited absolutely by the amount possessed by the purchaser and would have no relation whatsoever to the cost to produce the article sold; it might be many times more, or much less, than the cost price. The price thus determined for lack of a better name I shall call "threat price."

From the standpoint of society, however, it is always desirable that prices charged shall have a reasonable relation to cost price. Mankind as a whole is interested in any plan which tends to determine rewards in relation to efforts. As a part of organic society we each admit the justice and desirability of this as an abstract proposition; as an individual we also each admit both its justice and its desirability as concerns the other fellow when dealing with us; but we always instinctively shrink from accepting it and applying this rule to ourselves and the concrete enterprise we have in hand. Mankind is so constituted that if left free to work upon the necessities of others it has uniformly taken good measure for its service, and a study of the activities of those in control of necessities and possessed of the power to impose a threat price demonstrates that they do so when permitted.

Protected Monopolies

But in the realm of a public utility we have a situation that is peculiar. We have here an agency that to many of its patrons always is a monopoly, and if properly controlled it should be permitted to continue as a monopoly.

But so soon as we admit that public utilities or natural monopolies should not be destroyed as such monopolies, then do we present the necessity of devising a method of preventing them from imposing a threat value and securing a threat price. In short, we say to these agencies, "You may not be permitted to take all you can get. Government will only allow you what you ought to take."

When we are left to determine the earning an agency ought to take, we always will have primarily before us what the agency has done; what effort it has put forth; what sacrifice it has made. And when, having marshalled all the facts that may be secured bearing upon this main question, we have fixed an earning or have determined a basis upon which an earning should be permitted, then this basis is the "fair value" of the property. Does the reproduction theory of valuation meet these requirements?

Reproduction value is based upon what it would cost another or the governmental agency itself to build a similar plant entirely independent of the need of such duplicate plant. The owners of these properties have brought themselves to that state of mind that they feel that the price to which they are entitled is determined not by what they have sacrificed, but by what they can force the prospective buyer to pay. And their theory grows up from the analogy of prices fixed under competition when their prices can not be fixed under competition. Are the utility owners any more justified in contending that the just price is determined by the answer to the question, "How much can we force them to pay rather than go elsewhere?" when there is nowhere else to go, than the public would be in asking, "How little can we force them to take rather than be ruined?" One is certainly no more devoid of equity and justice than the other. They are both threats alike.

Two Bars to Reproduction Theory

There are two absolute bars to the application of the reproduction theory of valuation to utilities. The one is the impossibility of imagining the monopoly never to have existed and the conditions which such monopoly has produced still there; of thinking of the effect of a certain known cause and at the same time conceiving such cause never to have operated. The other is the impossibility of thinking monopoly and competition at the same time; the impossibility of having the condition of the property of a monopoly affected by a duplicate competing agency and still remain unchanged.

Justice Hughes discusses the first difficulty in the Minnesota Rate Case. He there says:

"Moreover, it is manifest that an attempt to estimate what would be the actual cost of acquiring the right-of-way if the railroad were not there, is to indulge in mere speculation. The railroad has long been established; to it have been linked all activities of agriculture, industry and trade. Communities have long been dependent upon its service, and their growth and development have been conditioned upon the facilities it has provided. The uses of property in the communities which it serves are to a large degree determined by it. The values of property along its line largely depend upon its existence. It is an integral part of the communal life. The assumption of its non-existence and at the same time that the values that rest upon it remain unchanged is impossible and cannot be entertained. The conditions of ownership of the property and the amounts which would have to be paid in acquiring the right-of-way supposing the railroad to be removed are wholly beyond reach of any process of rational determination. The cost-of-reproduction method is of service in ascertaining the present value of the plant when it is reasonably applied and when the cost of reproducing the property may be ascertained with a proper degree of certainty."

Those urging the reproduction theory to determine the price upon which an earning shall be allowed are confronted with a very interesting dilemma. If their theory is to deal with the very property in question as a monopoly, they cannot, as Justice Hughes points out, think it away and at the same time have the results that come from its presence. On the other hand, if it is an alternative proposition which they urge and the thing which they have a right to exact is that which the public or a competitor would have to pay to put in a second plant identical with their own, they have to be confronted with the results of such duplication and they come face to face with the thing I have had in mind from the beginning, namely, the threat power of the public.

Owners of public-utility property would never for a moment contend for the reproduction theory if they thought the public

would take them at their word. For as far as price is concerned under this theory it is utterly immaterial to the public whether they buy the existing utility property or leave it there and proceed to duplicate it. For do not the proponents of this theory seek to capitalize not only the physical property but every known disadvantage to the public, such as paving over mains, for example, and every known or imagined advantage to themselves, such even as having consumers attached to the system? And they place their reliance on one thing alone and that is that the public, if they should build a competing utility in this field, would lose money because of the dividing up of the business. On this they pin their hope when they pile Ossa on Pelion in piling up the items with which the public shall be taxed. By what license do they forget that the loss of business by duplication will fall on them too?

RAILROAD POLICY SHORTSIGHTED

It is not by way of criticism that I call attention to the program of the utilities to-day. They are merely following a natural business course, shortsighted, however, in my opinion, if the public is awake. To-day the Interstate Commerce Commission is engaged under an act of Congress in collecting data concerning the railroads of the United States. The railroads quite naturally are attempting to determine the lines upon which the inqury shall be prosecuted, and the results that shall be obtained. I have confidence in those directing this valuation, and I have no fear that they will not do all in their power to secure the information fairly and make their determination intelligently and fearlessly. But the fact that tremendous sums are being expended by the representatives of the railroads in hunting for hidden quantities and the like, and in seeking in every way in their power to affect the determination of this question in a way favorable to themselves, should put the public on guard lest their side be not properly presented. It is my belief that if the Interstate Commerce Commission should adopt the reproduction theory of valuation as the proper price upon which the railroads should be permitted an earning—which would ultimately determine the price which the public would be required to pay for these roads if public ownership should prevail—a result will be produced which will make it necessary for the public to resort to its threat power and compete with these agencies until they shall be of a reasonable mind.

I recognize the very general character of the rule I suggest, but of necessity it must be general. For the future always the cost of doing the business should be the aim. Of course in this will be included every legitimate element of cost. Always such cost must stand the comparison with costs under publicly owned utilities. For the past we should allow such a basis for earning as equitable considerations warrant, never enhanced because the agency is a monopoly and determined in view of all the facts that can be ascertained. In marshalling these facts the work of the engineer in determining quantities and unit costs as bearing upon what the property should have cost under ascertained conditions and the work of the accountant in analyzing actually located expenditures are but complements to each other. Each is extremely important, but neither alone under the conditions under which utilities have been conducted in the past suffices finally to solve our problem.

I conclude that as far as the past is concerned it is impossible to know in any case that we have done absolute justice involving utility property, but I contend we may be assured within reasonable limits in any given case provided there is co-operation by all concerned in attempting to reach the just and fair result. But I am quite sure that the cost-of-reproduction method as now being used, or rather abused, is getting us farther from the solution of the problem rather than nearer to it.

Land Reproduction Cost Figured by a Definite Method

Applying to Present Normal Prices Basic Ratio at Time of Original Purchase Is Claimed to Eliminate Conjecture

WHAT has been called an engineer's method of determining the reproduction cost of railroad land for valuation purposes—a method that aims to eliminate the conjectural, speculative features objected to in the Minnesota rate decision, and one that has, the Engineering Record understands, been applied on the Kansas City Southern Railway—was described by Hammond V. Hayes, consulting engineer, of Boston, at the valuation conference last week in Philadelphia. It consists simply in finding the normal basic value of adjoining land at the time of purchase of the railroad right-of-way, as well as the price actually paid for each parcel. With these two a ratio or multiplier is obtained representing what the company was originally obliged to pay as compared with the prices prevailing in ordinary voluntary sales. This ratio, then, applied to the present normal basic value, will, Mr. Hayes contends, give the amount the company would now be obliged to pay for its right-of-way, including all claims for damages, severance or suitability.

Following is an abstract of the part of Mr. Hayes' paper describing the method:

An analysis of both the original cost and the cost of reproduction of land shows that each may be divided into two parts, (1) the figure which would be assigned in condemnation proceedings as the price which a company should pay for the land acquired by it, and (2) the costs of condemnation, of damages, and of purchase.

BASIC RATIO

The method which should be employed in ascertaining the first portion of both the original and the reproduction cost is that in which the normal market value is ascertained of adjacent similar lands as revealed by the prices paid in voluntary private sales, both at the time of the original acquisition of the lands by the company and at the time of the appraisal. This method has been extensively used as a normal basis for the ascertainment of the reproduction cost. There are two features of the recommended method, however, which need particular emphasis: That the normal sales value of adjacent similar property should be found, not for the time of the appraisal alone but as of the date of the original acquisition of the land under valuation, and that each parcel of land—a parcel being defined as a separate and distinct purchase—be associated with similar adjacent lands of which the past and present market value can be ascertained. In addition to the two normal basic figures thus found, the amount paid to the original owner of each particular parcel should be found and entered against that parcel.

By this method the price paid by the company and the normal market value at the time of purchase are shown for each particular parcel, and there is revealed, by the ratio between these two figures, the difference between the cost to a company of its land and the amount which was paid at that time in voluntary normal sales of similar land. Moreover, as the date of acquisition is given, it will be possible, in many instances, to determine, for land similar in character, the trend of this ratio from early days to the date of the appraisal. The ratio of the price the company has actually paid for its land to the normal market value of adjoining similar lands is thus established in a distinct and convincing manner, and a ratio is established by the use of which the reproduction cost may be found from the normal market value of similar and adjacent land at the time of the appraisal.

Difficulties will be found with this method, and the research will be laborious and expensive in many cases. On the other hand, the courts and the rate-making tribunals must have facts, represented by figures which can be supported, to show that a public-utility company did not and does not pay the normal market price when it acquires land, that it has always paid, and would be liable to have to pay at the time of valuation, the normal price increased by a definitely established multiplier.

ASSUMPTION ELIMINATED

The figures obtained through the use of the method above advocated give the original cost, and, for the reproduction cost, the price which a company has paid and in all reasonable probability would have to pay at the present time for the land now used for the benefit of the public. It eliminates the necessity of any assumptions as to what a company has paid or would have to pay for encumbrances upon the property, or for severance, for damages, for suitability or similar claims which in the past have been made in many claims for land values. The actual cost to the company of the land which it owns includes all such elements of value. They are shown as far as they need be by the difference between the market value of adjacent similar lands and the prices actually paid. There is introduced no element of personal opinion or judgment, however honest and wise.

An objection may be raised to these groups of figures on the ground that the company may have paid originally more than it should. This objection cannot be well taken in such cases, as the land had been acquired through condemnation proceedings. Such evidence is definite and convincing. On the other hand, where land has been acquired by private purchase, the company should be given the benefit of the doubt.

All conjectural figures based on claims for recognition of special value arising from the fact that a company owns and uses a continuous strip of land for its right-of-way, or a large area of land for its terminal purposes, or that its rights-of-way and terminals are peculiarly well suited to railway purposes, or that that land was not acquired free from encumbrances nor could be reproduced free from probably more expensive encumbrances, or similar claims for a larger reproduction value, are entirely eliminated.



INTERSECTION OF OAK HILL AND FRISCO CUTS—TEMPORARY BRIDGES IN FOREGROUND, SECTIONS OF PERMANENT BRIDGE BEYOND

Elimination of Tower Grove Grade Crossings at St. Louis Completed

Two Intersecting Streets Crossing Two Non-Parallel Railroads Make Complex Problem—Streets Carried Over Tracks on Reinforced Concrete

VIRTUAL completion of the elimination of the grade crossings at Tower Grove, St. Louis, was signalized July 31 by the opening of all streets involved. The matter was first brought up in 1905. The fact of two avenues, Tower Grove and Vandeventer, crossing on fairly level ground two railroads, the Missouri Pacific, and the St. Louis & San Francisco (Frisco), non-parallel and only 300 ft. apart, and the avenues themselves intersecting between the railroads, afforded an ample field for study; and in the seven or eight years between the first agitation and the adoption of the final plan three distinct methods of treatment were broadly discussed—depressing the street the full depth, depressing the tracks the full depth, and combining track depression with street elevation. The last plan was adopted, and the streets were carried across on their original alignments by reinforced-concrete structures. Problems in the design included cantilevering part of a parallel street over the depression. Problems in the construction included five temporary bridges to maintain traffic. These notes and illustrations are taken from a paper presented before the St. Louis Engineers' Club by S. L. Wonson, bridge engineer of the Missouri Pacific Railway, who described the work in detail from inception to completion.

THE CROSSINGS

The general location of the railways and streets is shown on the general plan. The two railroads cross Vandeventer Avenue on a large skew and Tower Grove Avenue approximately at right angles. Just west of the crossing the Oak Hill Branch of the Missouri Pacific branches off to the south and crosses the Frisco. An industrial spur from the Oak Hill line backs in across the two avenues south of the Frisco, and this spur is in turn crossed by two industrial spurs from the Frisco.

The crossings, which are near the western city limit, are typical as to development, in that the section was built up and the streets were opened up across the tracks long after the building of the railways. As the section developed the street traffic grew, until in 1909 it amounted to approximately 400 street cars, 2400 vehicles and 600 pedestrians in twenty-four hours. Passenger stations on both roads, at which practically all passenger trains stop, contributed largely to freedom from serious accidents, but at the same time increased the inconvenience and delay to street traffic by the necessity of trains occupying the crossings during stops.

EARLY ELIMINATION STUDIES

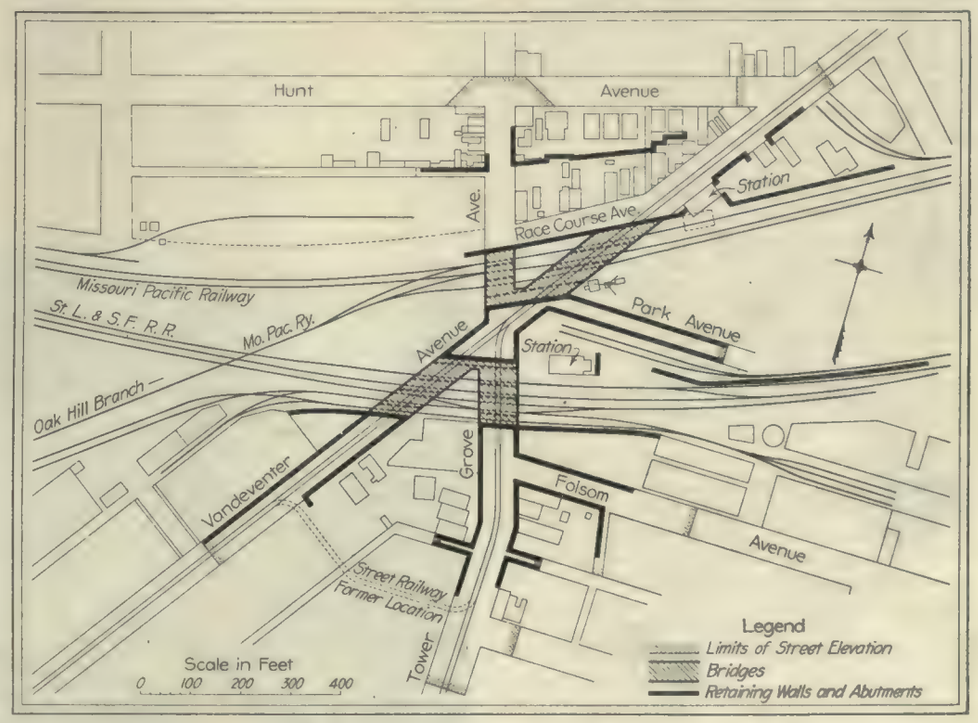
In 1905 the question of eliminating these crossings was first taken up on a basis of street depression, and in 1907 a plan was agreed upon providing for a long subway on the line of Tower Grove Avenue, parts of Vandeventer Avenue being closed. The estimated cost of this scheme was about $500,000.

Popular opposition to this scheme caused its final rejection, and in 1909 an ordinance was passed requiring the railroads to depress their tracks and leave the streets on their existing grades. This would have cost $3,000,000 and was successfully defeated by the railroads when carried to the State Supreme Court in 1912. In 1913 the cheaper plan was adopted of depressing the railroads 13 ft. and raising the streets a like amount.

PLAN ADOPTED

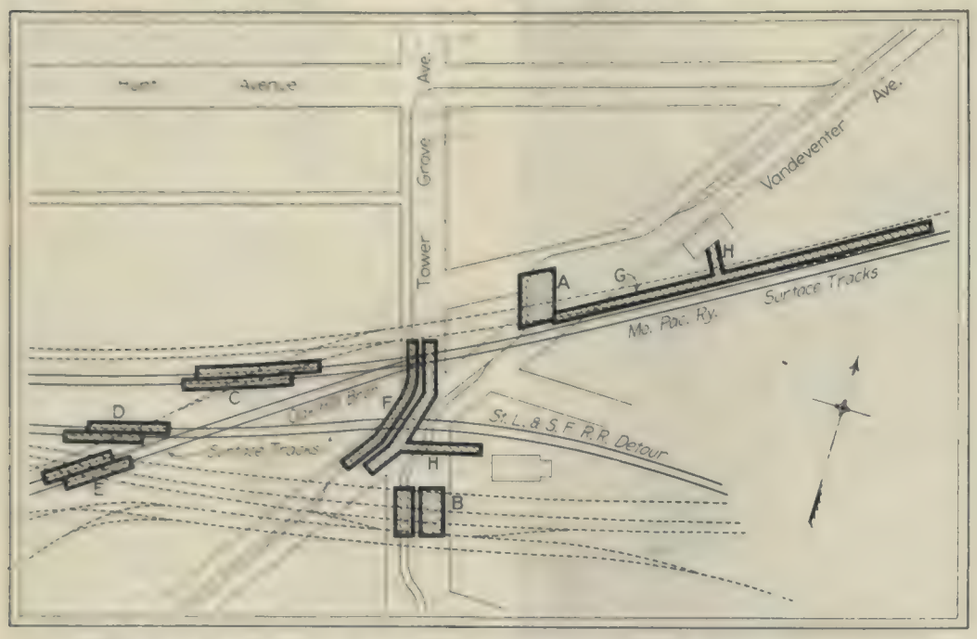
The general plan shows the scheme adopted. The bridge structures are of reinforced concrete, the bents being spaced to accommodate both present tracks and future proposed tracks. The approaches and the space between bridges are solid fill, held by retaining walls on the street line except at points where the properties themselves have been filled to the new level. The street grades are 3½ per cent.

Realizing that the service level of many lots and buildings would in the future be at the new street grade, and as the construction of retaining walls in such cases was an economic waste, the railways induced several of the property owners to raise their buildings and allow the railways to fill their property in. In general, however, the property owners preferred to



GENERAL PLAN OF IMPROVEMENTS—BRIDGES SHOWN CROSS-HATCHED

Note that the properties on Race Course Avenue have been raised and the retaining walls built behind the buildings.



VARIOUS TEMPORARY BRIDGES WERE REQUIRED DURING CONSTRUCTION

A. Vandeventer Avenue Bridge over Missouri-Pacific Cut. B. Tower Grove Avenue over Frisco Cut. C. Missouri-Pacific Bridge over Oak Hill Cut. D. Frisco Bridge over Oak Hill Cut. E. Oak Hill Bridge over Frisco Cut. F. Temporary High Level Bridge, Tower Grove Avenue. G. Temporary Platform. H. Temporary Footbridge. Temporary location of tracks, solid lines; ultimate, dotted.

await a definite adjustment with the city, which under the ordinance assumed the damages.

The new railroad profiles lower summits on both lines. The most unsatisfactory feature as to gradient was the necessity of introducing 2½ and 3-per cent grades to reach the industries south of the crossings. There is also a sharp but short dip in the profile of the Oak Hill branch to cross the Frisco at grade.

BRIDGES AND WALLS

The bridges are of concrete beam and slab deck construction. The bents have rectangular columns and footings spaced about 12 ft. on centers. The columns are joined at the tops by cross girders supporting the deck beams and at the feet by continuous diaphragms extending to 4 ft. above top of rail, these serving primarily as guards against damage to the bridge from derailed equipment. The footings of bents and abutments are designed for a maximum pressure of 2½ tons per square foot on the firm yellow clay found at this point, this figure having been adopted after a series of loading tests. On account of the skew of Vandeventer Avenue the deck beams there are built normal to the bents, and, with the deck slabs, are supported at the street lines by fascia girders from 26 to 72 ft. long, those more than 35 ft. being steel plate girders incased in concrete.

Gravity sections were used for the abutments of the Frisco bridges, while those and the connecting retaining walls of the Missouri Pacific bridges are of a reinforced counterfort type on the north side and a bent-and-slab design on the south side.

At Race Course Avenue requirements of street widths at the elevated level and track room at the depressed grade necessitated the use of cantilever brackets for supporting the sidewalk and concrete rail along the retaining wall between the two bridges. One of the drawings shows the construction. In order to avoid possible cracking of the sidewalk due to slight settlement of the street fill the portion of the sidewalk slab inside the wall was also designed as a cantilever. As the retaining wall and street line are not parallel the overhang of the sidewalk slab is variable throughout—a feature typifying a considerable absence in uniformity of construction imposed by local conditions throughout the entire work.

SUPPORTING A 20-INCH WATER MAIN

A 20-in. water main was supported under the west sidewalk of the Tower Grove Avenue bridges by ⅞-in. round U hangers 6 ft. apart, as shown in one of the illustrations. The ends of the hangers embedded in the sidewalk slab are of bronze to insure permanence, and sleeve nuts under the slab permit installation as well as adjustment and replacement of the main. Removable sections of the sidewalk slab provide access to the joints of the main for calking and repairs by breaking through the 2½-in. sidewalk finish.

Material changes were required in the Missouri Pacific station, which was raised and swung around parallel to the new street at the new grade. The Frisco station was underpinned and maintained without change in level or position.

The elimination ordinance provided that the construction cost, including the relocation of municipal sewers and water mains, should be assumed by the railways, and the damages to abutting property by the city. The expense of rearranging other utilities, such as street-car tracks, gas mains, conduits and wires, was assumed by the proprietary interests. No attempt was made by the ordinance to prescribe the division of cost between the railways. As they adjusted it between themselves, each assumed the rearrangement of its own facilities and there was a distinct division of the work on the basis of location except as to part of the work on the Missouri Pacific spur on the south side. Almost all of the Missouri Pacific work was done with its own forces. The Frisco performed its track depression and rearrangement with its own forces and the remainder of its work by contract.

MAINTAINING STREET TRAFFIC

Owing to the considerable volume of street traffic and the absence of other crossings in the vicinity, it was necessary to provide for maintenance of street traffic throughout the construction. To avoid the expense of a temporary viaduct at one side the city permitted closing the two west legs of the X, the plan being to complete the elevation of these sections and turn street traffic over them, after which the remaining legs would be completed. This plan with minor changes was followed.

One of the illustrations illustrates the successive steps in making the Missouri Pacific track depression. The two main tracks were first thrown over to the south side of the right-of-way and a steam-shovel cut as wide as practicable along the north side was started from the west end of the depression, the shovel being carried on blocking through the deeper portion of the cut to permit loading on cars on a surface track. In the vicinity of the streets the cut was widened to include excavation for the bridge abutments and retaining walls along the north side of the tracks in order that the concrete work might be started.

When the cut had been carried up to the

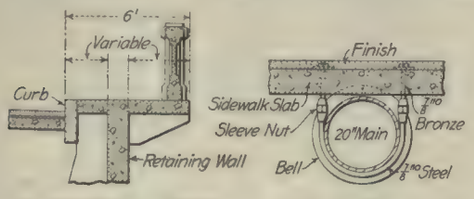


LOOKING NORTH PRIOR TO IMPROVEMENTS—FRISCO IN FOREGROUND



INTERSECTION OF AVENUES AS IT NOW APPEARS—NOTE OVERHANG OF RACE COURSE AVENUE IN BACKGROUND

street-car tracks in Vandeventer Avenue a wooden bridge was built behind the shovel to carry the street traffic over the excavation by a slight detour. The cut was then continued through the street and to the east end of the depression. East of the streets sufficient width could not be left between the operated surface tracks and the edge of the excavation for the proper accommodation of passengers and handling of baggage, and a temporary platform 500 ft. long was built along the track for this



CANTILEVER SIDEWALK, AND METHOD OF HANGING 20-INCH MAIN

purpose, connecting with the station by a temporary footbridge.

A permanent track was then laid in the excavation and westbound traffic was transferred to it, the temporary bridge at Vandeventer Avenue being raised about 4 ft. to provide overhead clearance. This permitted removal of one of the two surface tracks, widening the excavation and construction of the second permanent track at the depressed level. The depression of the Oak Hill branch was performed in a similar manner. Most of the material for raising streets and private property was dumped from the dirt trains brought on a temporary track from the west end of the depression into Tower Grove, Race Course and Vandeventer Avenues.

The Frisco excavation was also made by steam shovels, but under somewhat less difficult operating conditions, as it was here possible to divert traffic on two temporary tracks largely clear of the excavated area. Part of the cutting beneath and between the bridges was handled very successfully by a Thew shovel loading on cars or into teams as conditions dictated.

One of the drawings shows the stage of the viaduct construction Dec. 1, 1914, when street traffic was transferred from the surface over the two east legs of the X to the high level over the two west legs, the gaps in the permanent work being closed by temporary wooden bridges. Prior to this change, as shown in another illustration, temporary bridges were in service for Vandeventer Avenue traffic over the Missouri Pacific cut, Tower Grove Avenue traffic over the Frisco cut, Missouri Pacific traffic over the Oak Hill cut, Frisco traffic over the Oak Hill cut and Oak Hill traffic over the Frisco cut.

It had been intended to change all traffic to the depressed level and all highway traffic to the elevated level on the same day, but unforeseen delays and complications made it impossible to abandon all the surface tracks at this time. A temporary bridge, *F* on the drawing last mentioned, was therefore built to carry street traffic over the incomplete portion of Tower Grove Avenue north, and Vandeventer Avenue south, of the street intersection. To provide for clearance over the surface tracks used by the Oak Hill trains and the Frisco detour tracks this bridge was raised about 4 ft. above the permanent street grade with run-off on the completed concrete viaduct. After this change in street traffic a comparatively free opportunity was afforded for the remaining steps of the work. All railway traffic was removed from the surface in February, 1915, and on July 31 all streets were opened for travel.

The total cost of the improvement to the railways, city and public-utilities companies was $830,000. Owing to the conditions imposed upon both design and construction, the work required attention out of proportion to its magnitude. More than 200 drawings covering the permanent work as constructed were prepared by the Missouri Pacific alone.

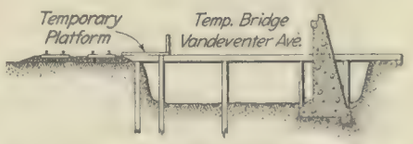
The engineers in charge of the planning and execution of the work were as follows: For the city, E. R. Kinsey, president of the Board of Public Service, C. M. Talbert, director of streets and sewers, and L. R. Bowen, bridge engineer; for the St. Louis & San Francisco Railroad, F. G. Jonah, chief engineer, and Perry Topping, assistant engineer; for the Missouri Pacific Railway, C. E. Smith, formerly assistant chief engineer, during the later stage of construction E. A. Hadley, chief engineer, S. L. Wonson, bridge engineer, and W. D. Hudson, L. H. Davis and S. M. Bate, assistant engineers.

Longleaf Pine Not Inferior as Paving Block Material

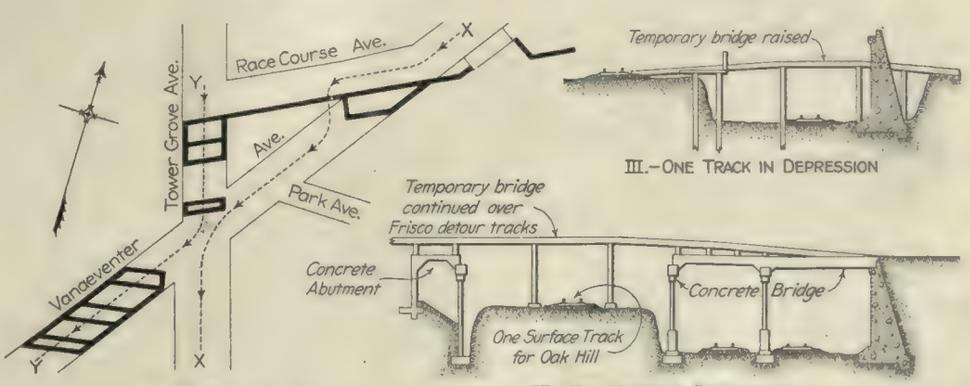
A TYPOGRAPHICAL error in this journal's abstract of the report on paving, submitted to the Boston Finance Commission by Guy C. Emerson, consulting engineer, and published in the Engineering Record of Oct. 23, page 503, reverses the meaning of a sentence relating to wood block. The sentence, as printed, reads: "In some cases the longleaf yellow pine, an inferior wood, has been substituted for the shortleaf variety." The words longleaf and shortleaf should be interchanged, making the sentence, as it appeared originally in Mr. Emerson's report, as follows: "In some cases the shortleaf yellow pine, an inferior wood, has been substituted for the longleaf variety." Mr. Emerson has also informed this journal that his findings on wood-block paving are based entirely upon conditions in Boston.



I.—FIRST SHOVEL CUT WEST OF VANDEVENTER AVE.



II.—1ST CUT CONTINUED THROUGH VANDEVENTER AVE.



PLAN

III.—ONE TRACK IN DEPRESSION

IV.—TWO TRACKS IN DEPRESSION

FOUR STAGES OF MISSOURI PACIFIC WORK—PLAN SHOWING SECTIONS OF PERMANENT BRIDGES IN PLACE WHEN STREET TRAFFIC WAS SHIFTED FROM LOW LEVEL *X—X* TO HIGH LEVEL *Y—Y*

Design of Turbine Draft Tubes Analyzed

Part II—Theory and Formulas Developed in Part I Applied to Typical Problem Embodying Practical Conditions

By A. G. HILLBERG
Hydraulic Engineer, New York City

THE CONVENIENCE of using the formulas in Part I in the design of draft tubes is demonstrated in the following problem. Given a 15,000-hp. wheel operating under a gross average head of 54 ft. The model of the runner has under test given a maximum efficiency of 88 per cent, and by means of the Camerer formula it has been estimated that the full-size wheel will in all probability give close to 90 per cent efficiency. The point of maximum efficiency on the curve has been located at 0.8 gate and the best speed determined accordingly. The

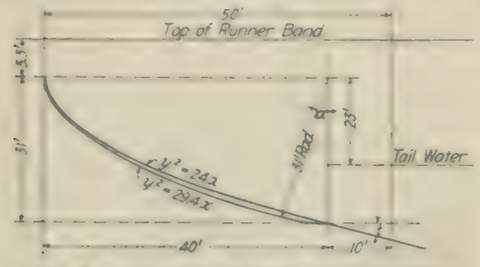


FIG. 6—ADJUSTED CENTER LINE OF TUBE

turbine will be of the vertical type and it will drive a single-phase generator, which will furnish energy for traction purposes. Now

$$h_0 = 54 - (\sqrt{54}/3) = 51.5 \text{ ft.}$$

$$Q = \frac{15{,}000 \times 550}{62.5 \times 51.5 \times 0.9} = 2850 \text{ sec.-ft.}$$

$v_1 = 0.3$ to $0.4\ \sqrt{2g51.5} = 17.3$ to 23 ft. per second,

v_1 being velocity of flow through runner band. Suppose in this case the turbine manufacturer has stated that the design of his wheel is such that $v_1 = 20$ ft. per second.

$v_0 = 0.05$ to $0.10\ \sqrt{2g51.5} = 2.9$ to 5.75 ft. per second.

Suppose the river channel at the power house, however, is narrow and comparatively deep even at the lowest stages of the river. Practically no tailrace, therefore, has to be excavated, so that the outflow velocity is assumed at 3 ft. per second.

DIFFERENCE IN ELEVATION

By means of equation 1 the difference in elevation between the top of the runner band and the lowest tail-water level can be determined. The equation read

$$E = 33.9 - (M - L) - (v^2/2g)$$

In this case the draft tube will be assumed an ordinary length justifying the use of a value of 3 for $(M - L)$, but the power will be used for traction purposes and thus the load variations will be severe. The term $(M - L)$, therefore, is assumed at 4.68. Therefore

$$E = 33.9 - 4.68 - 6.22 = 23.0 \text{ ft.}$$

The top area of the draft tube, that is at the runner band, is

$$A_1 = Q/v_1 = 2850/20 = 142.5 \text{ sq. ft.}$$

and the area at the outflow end is

$$A_0 = Q/v_0 = 2850/3 = 950 \text{ sq. ft.}$$

The top area, as explained previously, must be circular, and its diameter, therefore, is 13.46 ft. The end area can be of several shapes, and it is here assumed elliptical, as a circular area would require too much excavation both in the foundation and the tailrace, the horizontal axis is assumed twice the vertical. Consequently $\pi ab = 950$, and, since $2b = a$,

$$b = \sqrt{950/2\pi} = 12.3$$

The minor axis (vertical) is, therefore, 24.6 ft., while the major axis (horizontal) is 49.2 ft. Should it be found that this width is too great, the permissible width can be determined by means of the spacing of the units and the width of the concrete pier between the draft tubes required to carry the load safely. The calculation is then repeated backwards and the length of the minor axis determined. In this case it is assumed that the length of 49.2 ft. is satisfactory.

As the outflow velocity is small the highest point of the end area will be located 12 in. below the lowest tail-water level.

The distance from the center line of the unit to the downstream wall of the power house has been determined previously in connection with the design of the scroll case, and it is also dependent upon the amount of space required on the generator-room floor. In this case, because of a slight complication, it is assumed that this distance is 50 ft.

TWO POINTS ON CENTER LINE NOW KNOWN

The two points on the center line required in order to locate it are now known. Taking the lowest tail-water level as one axis and the center line of the wheel as the other, one point is at 0/23, while the other is at 50/13.3. The design of the turbine, however, is such that the bottom flange of the lower foundation ring is about 4 ft. lower than the runner band. It is, therefore, determined to begin curving the draft tube at a point 5.3 ft. below the runner band.

Looking at the diagram it is seen that the center line of the draft tube is too long. As the actual length 50 ft. cannot be changed, since this is determined from other requirements than those of the draft tube, the theoretical length is shortened to 40 ft. by building an arch 10 ft. wide inside the wall of the substructure. The intrados at the crown of this arch should project above ordinary stages of the water, and if possible above the highest water level, in order to effect the desired reduction in length of the draft tube. In many instances, however, tunnels located in the substructure, and in some cases the scroll case itself, prevent this arch from being carried as high as might be desired.

A parabolic center line will be used. In order to get as simple an equation as possible, the system of axes will have its origin at the apex of the parabola. The equation then reads $y^2 = ax$, and, as the center point of the end area must lie on this parabola, $y = 31$ when $x = 40$, or

$$a = (31)^2/40 = 24$$

making

$$y^2 = 24x$$

The center line can now be plotted. When this has been done it appears, that the angle between the tangent of the parabola and the horizontal is 21 deg. 10 min. This is too much, and an arc of a circle of 31-ft. radius is, therefore, inserted as shown in Fig. 6.

A new parabola must now be calculated, and it must have its apex at the origin and its branches must be tangents to this circle. As the equation of the circle is

$$(x - 40)^2 - y^2 = 961$$

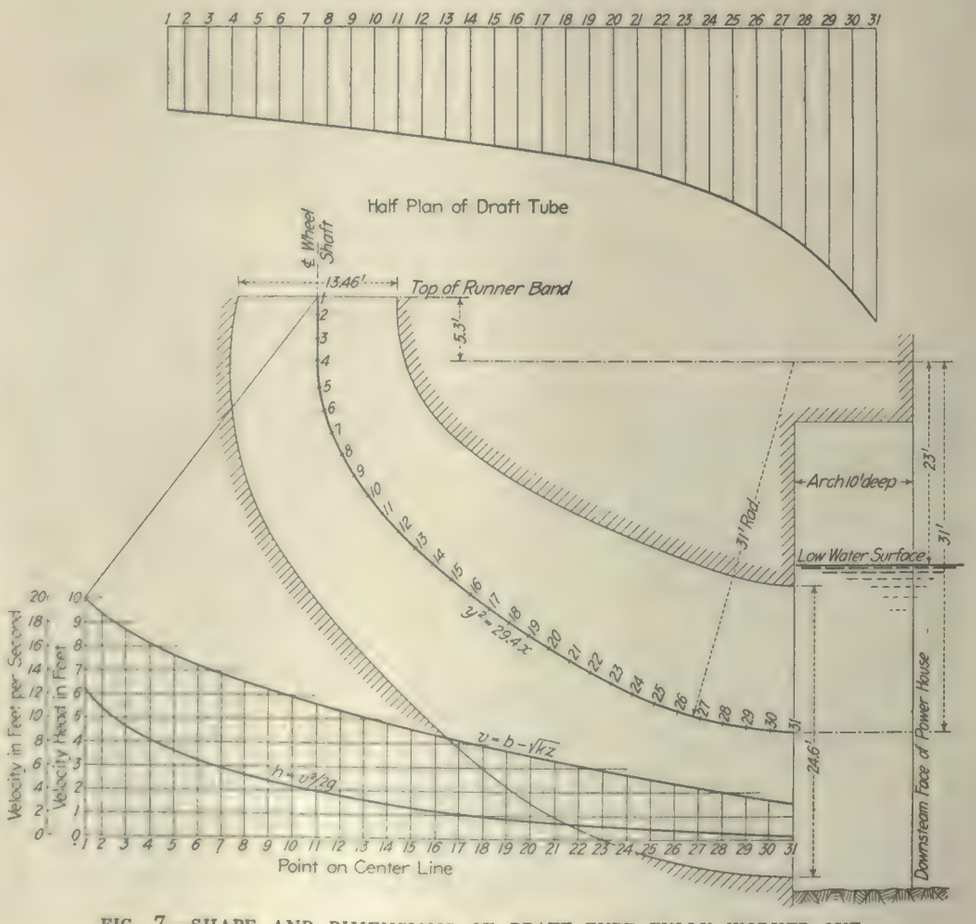


FIG. 7—SHAPE AND DIMENSIONS OF DRAFT TUBE FULLY WORKED OUT

the equation of the new parabola becomes

$$y^2 = 29.4x$$

The true center line can now be plotted. The subtended angle α of the arc is 28 deg. 20 min.

Length of Center Line

In figuring the true length of the center line it must be borne in mind that two different curves must be considered, one a parabola and the other an arc of a circle. The length of the arc is

$$\frac{\pi r \alpha}{180} = \frac{\pi \times 31 \times 28.33}{180} = 15.3 \text{ ft.}$$

The length of the arc of the parabola can be determined by the formula

$$S = \int_{x=0}^{x=y^2/a} \sqrt{1 + \left(\frac{dy}{dx}\right)^2}\, dy$$

so that

$$S = 38.9 \text{ ft.}$$

The total length of the center line, therefore, is

$$5.3 + 38.9 + 15.3 = 59.5 \text{ ft.}$$

Instead of the length of the center line being calculated it can be plotted to a large scale and measured with sufficient accuracy.

In determining the shape of the draft tube the areas should be calculated at points spaced from 2 to 3 ft. apart. As neither of these spacings multiplied by a certain number will equal the length 59.5, the first space will be made to suit. In this case a 2-ft. spacing will be used and the first space will, therefore, be 1.5 ft.

Velocities

Previously it has been determined that $v_1 = 20$ and $v_n = 3$ ft. per second, and now it is also known that $l = 59.5$ ft. Equation 11 consequently becomes

$$v = 23 - 2.57\sqrt{z}$$

In locating v_1 and v_n equations 12 and 13 are used; thus

$$z_1 = 1.37$$

and

$$z_n = 59.5 + 1.37 = 60.87$$

A table is now established giving the values of the different elements of the draft tube. Such a table is given herewith in abbreviated form.

The time required for a drop of water to pass through the tube can be determined by equation 14. In this case $\sqrt{k} = 2.57$, $z_n = 60.87$ and $z_1 = 1.37$, so that

$$t = \frac{2}{2.57}(\sqrt{60.87} - \sqrt{1.37}) = \frac{2 \times 6.63}{2.57} = 5.16 \text{ sec.}$$

The volume of the draft tube is calculated by means of equation 17. In this case $b = v_1 + v_n = 20 + 3 = 23$; $\sqrt{k} = 2.57$ and $Q = 2850$, so that

$$\sqrt{k}/b = 2.57/23 = 0.112$$

$$z_n = 60.87$$

and

$$z_1 = 1.37$$

so that

$$(\sqrt{z_n} - \sqrt{z_1}) \text{ as before} = 6.63$$

Hence

$$m = 1 - 0.112 \times 6.63 = 0.257$$

and

$$\ln m = \ln 0.257 = -1.357$$

Therefore

$$V = \frac{2 \times 2850 \times 23}{(2.57)^2}(0.257 + 1.357) = 32{,}100 \text{ cu. ft.}$$

Values of Different Elements in Draft Tube Design

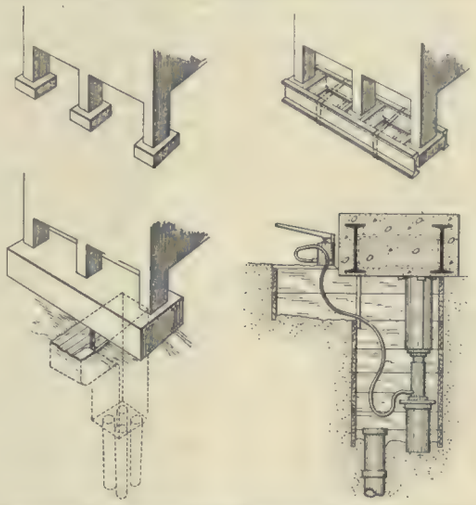
Point on Center Line	Dist. from Upper End of Draft Tube, Ft.	z, Ft.	v, Ft. Sec.	$v^2/2g$, Ft.	$\frac{v_{n+1}^2}{2g} - \frac{v_n^2}{2g}$ Ft.	h, Ft.	$h_{n+1} - h_n$, Ft.	Area, Sq. Ft.	Remarks
1	0	1.37	20.00	6.22		0		142.5	Circle, $D = 13.46$
					0.82		1.5		
II	1.5	2.87	18.65	5.40		1.5		152.3	Circle, $D = 13.97$
					0.74		2.0		
3	3.5	4.87	17.33	4.66		3.5		164.4	Circle, $D = 14.49$
					0.54		2.0		
4	5.5	6.87	16.27	4.12		5.5		175.2	Circle, $D = 14.93$
					0.46		2.0		
5	7.5	8.87	15.35	3.66		7.5		185.7	Circle, $D = 15.38$
					1.48		9.0		
10	17.5	18.87	11.83	2.18		16.5		240.8	Circle, $D = 17.53$
					0.87		7.0		
15	27.5	28.87	9.20	1.31		23.5		309.6	Circle, $D = 19.86$
					0.555		5.8		
20	37.5	38.87	6.98	0.755		29.3		408.0	Circle, $D = 22.80$
					0.360		4.7		
25	47.5	48.87	5.05	0.395		34.0		564.0	Ellipse, $a = 12.3$; $b = 14.6$
					0.226		2.24		
30	57.5	58.87	3.30	0.169		36.24		864.0	Ellipse, $a = 12.3$; $b = 22.4$
					0.029		0.06		
31	59.5	60.87	3.00	0.140		36.30		950.0	Ellipse, $a = 12.3$; $b = 24.6$

Note: The dimensions a and b of the elliptically shaped areas are half the length of the minor and major axes of the ellipses.

Soil Tests Reported and Safe Underpinning Methods in Sand Described

Excavation for New York Subway in William Street Encounters Sandy Soil Which Forces Adoption of Special Precautions

AFTER the first eight months of underpinning operations, during which more than sixty buildings have been successfully supported on William Street for the New York subway excavation in sandy soil, which the property owners had considered so unsafe that they had protested to the courts, the methods of work and precautions taken have demonstrated the possibilities of carefulness and system without the adoption of elaborate or expensive schemes. In an article entitled "Meeting the Soil Halfway on William Street" in the September issue of the *Public Service Record*, John F. Greathead, assistant engineer, has described the tests made and principal methods used on this work. Following is an abstract of the article:



SUCCESSIVE STEPS IN UNDERPINNING A TYPICAL THREE-PIER BUILDING

Rigid Rules Followed

In order to place the underpinning operations on the plane of known facts instead of chance, the following rules have been adopted: (1) To insure *permanent* support, all building foundations are to be extended below the influence of subway excavation—that is, for adjacent buildings—to well below subgrade; (2) to insure *adequate* support, every pile driven is to be actually tested to from 1½ to 2 times the assigned load, and the area of spread foundations is to be based on tests.

The various tests were made under the direction of the Public Service Commission, and the exact nature of the soil was noted in every case. Soil samples, varying from almost pure clay through various graded mixtures of clay and sand to almost pure sand, were numbered from 1 to 10 and analyzed as to constituents and fineness. After an unsuccessful attempt to use dry separation by the No. 100 sieve as a dividing line between sand and clay, a volumetric separation by shaking with water, permitting the sand to precipitate first, has been determined upon as the closest to truth of any easily performed test. The character of the ground exposed during underpinning is constantly compared, either by eye or by the water test, with a set of the standard samples.

Methods of Testing—General Results

The first experiment, to determine the greatest imposed load a certain sand would safely stand without undue or progressive settlement, was made by the use of a triangular test platform, of 12-ft. lengths of 12-in. I-beams, resting at each corner on a 12 x 12-in. vertical timber whose end bearing on the soil was 1 sq. ft. Test loads were then applied, varying from 2 to 8 tons per square foot, and sustained at various intensities for periods up to one week in length. Levels taken on spikes driven in the platform legs indicated the settlement during loading and also the often equally great settlement under a steady load during the time interval.

Unequal settlement at the three corners was observed, probably due to the fact that the bags were swung with some impact at the corner which showed the greatest settlement. The average total settlement at 4 tons per square foot for sand containing 3 per cent clay was ⅜ in.

This test was criticised not only because of the method of loading, but because of the small area of each bearing surface. Accordingly, 4 sq. ft. of bearing area were forced into a similar soil (with 12 per cent clay, however) by successive increments of load from a hydraulic jack. The settlements were more uniform, but otherwise the results corroborated the preceding tests, the settlement being less than ½ in. at 4 tons per square foot.

STEEL-JACKETED PILES

The weapon which has conquered the William Street soil is undoubtedly the 14-in. hollow boiler-plate shell, jacked to the desired depth, cleaned out and concreted. No one would attempt to sink a 4 x 4-ft. foundation pit below ground water in sand. By careful trenching and screened pumping from sumps, the contractor in many cases lowered the ground water, and therefore the pits, many feet. All but the easiest cases, however, required the use of piles.

The diagrams on page 631 show the typical underpinning method in which piles are used under a three-pier foundation in the front of a building. Two I-beams (or lattice girders) are clamped around the outer and inner sides of the foundation slabs and bound together by heavy cables between the piers. The transverse faces of the slabs are also fitted into channels or I-beams whose ends rest above or upon the longitudinal beams. When the whole is concreted solid it forms a substantial grillage.

A pit is then started between the piers, and is carefully sheeted horizontally when large enough to admit a man. This pit is deepened and kept closely sheeted until ground water makes further progress impossible. A 2-ft. cylinder, the first length of a 14-in. pile, is then stood on the pit bottom and jacked down by an hydraulic jack as shown. When completely driven another length is added and the jack load reapplied. The material in the pile is removed by a miniature orange-peel bucket, a helical screw or other simple method.

TESTS OF PILES AND STEEL JACKETS

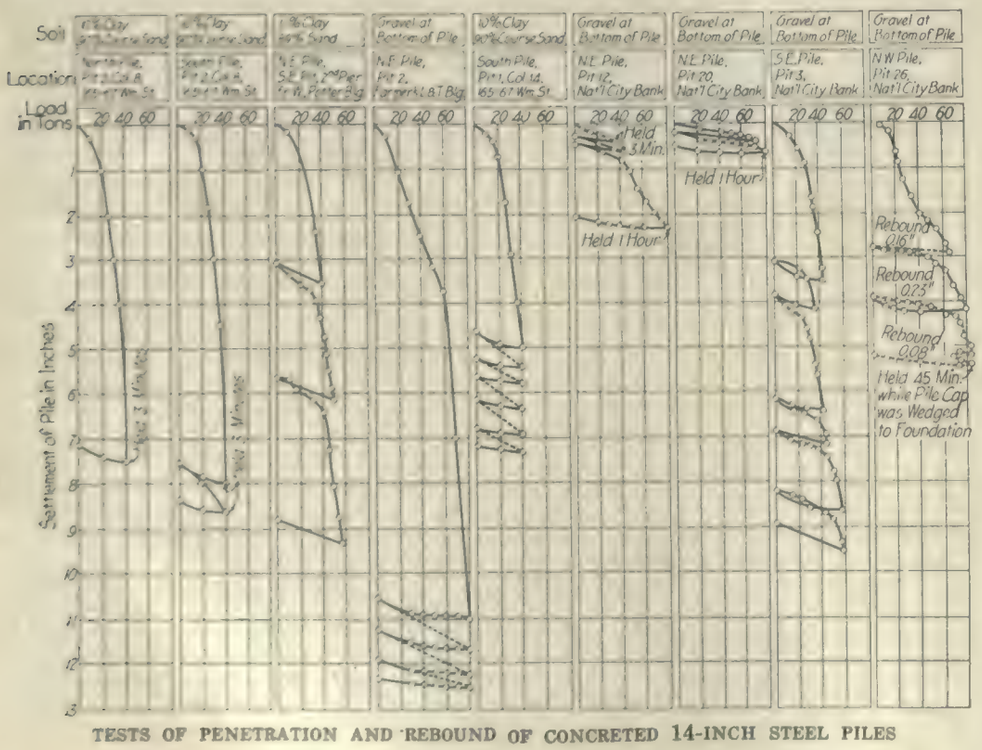
While still newly poured with concrete, each of the piles is tested with an hydraulic jack to a load at least 50 per cent greater than that apportioned to it, being jacked down, if necessary, until it will carry that load with no settlement for a period of observation ordered by the engineer.

A very important operation for minimizing the later settlement of the building then ensues. A column of steel shapes is erected upon each pile and powerfully wedged against the grillage with slender steel wedges. Thus part of the load is immediately transferred to the piles at a time when their settlement will not affect the building, and subsidence due to shrinkage or voids in the pit concrete is also provided against. The pit is now concreted, and in every case grout is introduced under about a 4-ft. head to take up the shrinkage of the concrete and especially to fill all voids, however small, around the old foundation and the new pit.

These pile lengths, although made of only ⅛-in. sheet metal, are very strong, the bearing and driving fit at the joint (2-in. inner lap, outside band) being especially close. An empty length of 14-in. piling supported a total test load of 89 tons with no effect other than a 4-in. farther penetration. In the loosest and coarsest sand available a 2-ft. length, started empty, carried 9½ tons when jacked flush with the ground. When filled with compacted sand and then jacked into the same soil it carried 40 tons, which was maintained for 5 min. This astonishing test was repeated under a near-by building with the same results. Lateral tests of the joint showed similar astonishing strength for this type of pile.

BULB OF SOIL PRESSURE

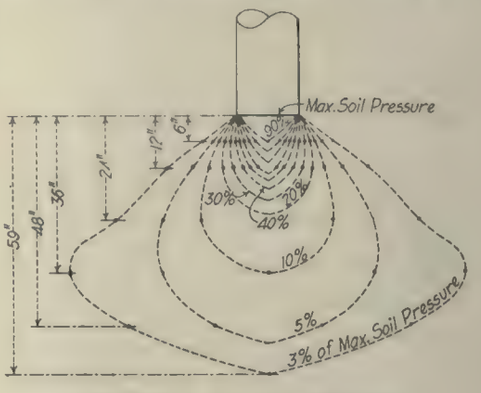
The area of the bottom of a 14-in. pile is about 1 sq. ft., and, furthermore, tests to be mentioned show the value of skin friction with these non-tapering piles to be slight, say 5 per cent. In view of the fact that sand, especially quicksand, is not allowed more than a few tons load for this unit area, it certain would be valuable if we could understand just how 80 tons are regularly supported without settlement during routing tests, and half that in actual practice under real building loads.



TESTS OF PENETRATION AND REBOUND OF CONCRETED 14-INCH STEEL PILES

The results of careful experiments with brown building sand to determine the "distribution of vertical soil pressure" conducted at Pennsylvania State College (see the Engineering Record of March 13, 1915, page 330) have been plotted in an entirely new way in the diagram herewith. Here we have visualized the cone, or more properly bulb, of resistant soil which forms below the base of the pile, radiating the pressures, with diminishing intensities (whose boundaries are shown), in all directions to the limit where no effect is produced by the load.

If the material had been confined water the highly compressed portion under the



DISTRIBUTION OF SOIL PRESSURE

pile would naturally have freely moved away, so that there would have been no limit to the penetration of the pile. With the dry sand represented by the diagram, the pile increases the interior friction of the sand in direct ratio as the load is made larger; and the point arrives where lateral flow of material stops because of this friction. Beyond that the soil compresses until it will stand the pressure required by its relative position from the pile; then the pile no longer sinks under that particular load. It seems obvious that the more liquid the soil, and the greater the clay lubricant, the greater the necessary penetration should be, other things being equal.

Nine actual records of the way piles act under final tests are shown in the accompanying diagram. The loads were read from the pressure gage of the hydraulic pump, and the settlement was measured directly from the pile head to a stretched horizontal string, or by attaching the tape of a deflectometer. All of the curves show the rebound which occurs whenever the load is released. This distance, about ⅜ in., is nearly double the amount due to the elasticity of the pile; the balance must be due to the expansion of the compressed soil below.

WIDE PILE CAP—REDUCTION OF SETTLEMENT

A great forward step has been taken by the introduction of wide plates between the jack and the pile. When the official test to about double the actual dead load is completed, the pressure is held until steel beams are cut (with blowpipe) and wedged from the plates to the grillage of the building, on both sides of the jack, which is then released and removed. This results in a reduction of the rebound to from 0.23 to 0.08 in., as shown by curves for pile 9, clearly indicating that at least half of the 80-ton test load was permanently maintained on the pile below. As this is more than the assigned loads, no future settlement at all is anticipated.

Just enough has been done in the direc-

tion of determining the skin friction of the 14-in. piles to discover the limiting values, and especially the difficulty of accuracy. In the first place, pressure gages capable of recording 100-ton loads on the pile are not very reliable for 5 tons. Also, the amount of muck left in the bottom of the pile is of primary importance. If muck is removed below the bottom of the casing, apparently voids occur at the sides, as little or no recorded pressure is required to sink the shell. It seems at this stage of the tests as though only from 4 to 6 tons of the 40 to 80 tons obtained from a 15-ft. length of pile are due to skin friction; that is, from 5 to 15 per cent. This corresponds to from 150 to 250 lb. per square foot of shell surface.

The contractor on this work is Smith, Hauser & MacIsaac, Inc. The various tests for the Public Service Commission are generally under the direction of Edmund A. Prentis, Jr. Lazarus White is the contractor's engineer, and proposed the wide pile cap and wedging method for preventing settlement.

Maximum E-50 Shears and Moments at Points of Short Beams

By W. M. ELIOT
Dallas, Texas

MAXIMUM shears and bending moments at intermediate points of beams from 8 ft. to 36 ft. in span length due to Cooper's E-50 engine loading may be obtained from the accompanying diagrams. For other Cooper's loadings proportional vertical scales can be made to give results directly, or the usual method of ratios applied.

The diagrams are particularly useful in the design of reinforced-concrete beams or girders, for which not only the absolute maximum shear and bending is desired, but also the values at intermediate points for the purpose of designing the reinforcement.

STANDING TIMBER TOTALING 100,000,000 ft. b.m. is offered for sale by the U. S. Forest Service on the Plumas National Forest, California. About 60 per cent of the timber is estimated to be sugar and yellow pine. Fifteen years is allowed for cutting and removal, with additional time for necessary improvements. Payment is to be made in installments as the timber is cut.

Offer Preliminary Suggestions on Graphic Presentation

Committee Representing National Associations Created at Instigation of Mechanical Engineers Gives Seventeen Principles

SEVENTEEN fundamental principles are set forth in a preliminary report, just issued, of the Joint Committee on Standards for Graphic Presentation, a body representing various National organizations, and created at the instigation of the American Society of Mechanical Engineers. Willard C. Brinton of the latter society is chairman and Leonard P. Ayres, 130 East Twenty-second Street, New York City, secretary. The seventeen suggested principles, which in the report are illustrated, are as follows:

GENERALITIES

1. The general arrangement of a diagram should proceed from left to right.

2. Where possible represent quantities by linear magnitudes, as areas or volumes are more likely to be misinterpreted.

3. For a curve the vertical scale, whenever practicable, should be so selected that the zero line will appear on the diagram.

4. If the zero line of the vertical will not normally appear on the curved diagram, the zero line should be shown by the use of a horizontal break in the diagram.

WHICH LINES TO EMPHASIZE

5. The zero lines of the scale by curves should be sharply distinguished from the other co-ordinate lines. (In the three illustrations in the report, one has a heavy horizontal zero line, at the base, representing zero population, the vertical graduations, representing years, having no zero; the second has both the left-hand vertical and the bottom horizontal lines heavy, representing zero in each case, while in the third, where the horizontal graduations indicate gain or loss, the heavy zero line is near the middle of the diagram.)

6. For curves having a scale representing percentages, it is usually desirable to emphasize in some distinctive way the 100 per cent line or other line used as a basis of comparison. (In the illustration shown the 100 per cent line, like the zero line, is shown heavy wherever it may come.)

7. When the scale of a diagram refers to dates, and the period represented is not a complete unit, it is better not to emphasize the first and last ordinates, since such a diagram does not represent the beginning or end of time.

8. When curves are drawn on logarithmic co-ordinates, the limiting lines of the diagram should each be at some power of ten on the logarithmic scales.

9. It is advisable not to show any more co-ordinate lines than necessary to guide the eye in reading the diagram. (Two contrasting diagrams for the same curve show the confusion caused by too many co-ordinate lines.)

10. The curve lines of a diagram should be sharply distinguished from the ruling.

AUXILIARY INFORMATION

11. In curves representing a series of observations, it is advisable, whenever possible, to indicate clearly on the diagram all the points representing the separate observations.

12. The horizontal scale for curves should usually read from left to right, and the vertical scale from bottom to top.

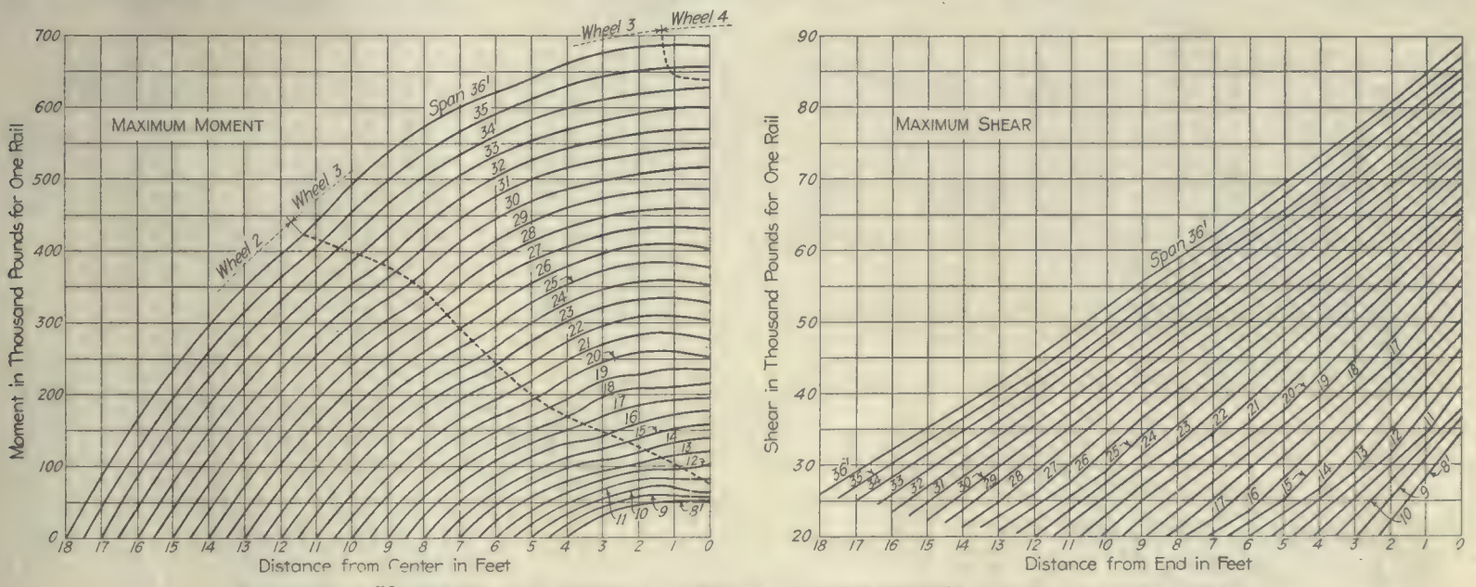
13. Figures for the scales of a diagram should be placed at the left and at the bottom or along the respective axes. (In one of the illustrations shown the axes intersect in the center of the diagram, and the figures, therefore, come within the diagram.)

14. It is often desirable to include in the diagram the numerical data of formulas represented. (In illustrations given, quantities are shown at the top of the diagram, opposite the vertical lines, the lines being time graduations, so indicated at the bottom. Illustrating the inclusion in the diagram of formulas represented, in one of the diagrams the equation is written along the curve.)

15. If numerical data are not included in the diagram it is desirable to give the data in tabular form accompanying the diagram.

16. All lettering and all figures on a diagram should be placed so as to be easily read from the base as the bottom, or from the right-hand edge of the diagram as the bottom.

17. The title of a diagram should be made as clear and complete as possible. Subtitles or descriptions should be added if necessary to insure clearness.



MAXIMUM E-50 SHEARS AND BENDING MOMENTS AT INTERMEDIATE POINTS OF SHORT BEAMS

THE TWIN PEAKS TUNNEL IN SAN FRANCISCO, the city engineer reports, will be completed within the next two years.

St. Louis Municipal Bridge East Approach a Steel Viaduct Nearly 3 Miles Long

Economy Results from the Use of Rolled I-Beams and Longitudinal Girders as Trolley-Rail Stringers—Expansion Joint Details

AFTER considerable delay, the city of St. Louis authorized the bonds last November and recently let the contract for the east approach to the Municipal bridge, the three main spans of which have stood idle since their completion about 1910. These spans of 668 ft., the longest simple spans in the world, were described in the Engineering Record of Oct. 30, 1909, page 487, and of Dec. 31, 1910, page 641. In spite of local disputes between the labor unions and consequent delays, although the city of St. Louis itself is erecting the steel with union labor, it is expected that the approaches can be completed and the bridge opened for traffic by October, 1916.

The east approach is a steel viaduct nearly 3 miles long, and of three varying types of construction—a typical double-track railroad viaduct about 2 miles long, an independent highway viaduct more than ½ mile long, and a combination railroad and highway nearly ½ mile long. The construction here described includes sections of the combination type and of the highway viaduct, details of the expansion joints and bracing, economy in floor design and details of trolley-pole connections and bracing.

General Dimensions

The typical girder and tower spans are 75 ft. and 45 ft. respectively, fixed by the economical length of 15 ft. for the stringers in the highway floor, kept constant throughout for all structures carrying highway loading. In addition to the regular tower and girder construction there are four long spans, of which one is 296 ft. and one 276 ft. long. The total length of the viaduct is 13,300 ft.; the first 2300 ft. is a combined highway and railroad structure, the highway viaduct then diverges to the northeast for 3000 ft. to East St. Louis, and the railroad viaduct continues nearly eastward for 11,000 ft.

The details of the design provide for the future addition of four turnouts from the viaduct now to be built—one to the north for connection with the Pennsylvania lines, and three others toward the south to connect with various other railroads.

Combination Viaduct

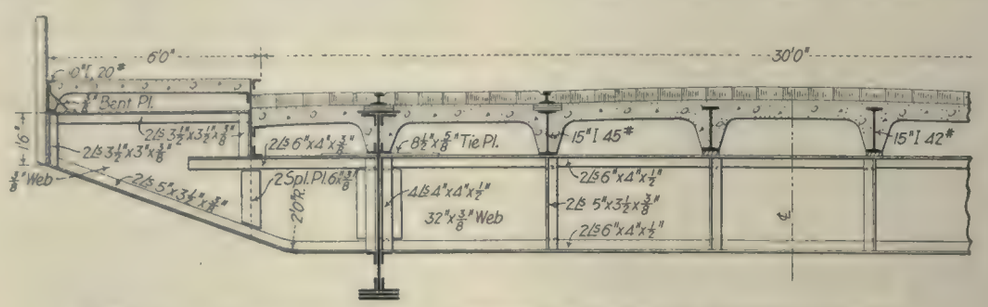
The accompanying cross-section shows the typical details and general dimensions of the combination viaduct. The location of the column on the right fixed the length of the overhanging ends of the floorbeams, and was decided by the desire to keep the loading on the two columns approximately the same. Note that the highway floorbeams are all spaced 15 ft. apart, and one end frames into, while the other end rests upon, a longitudinal girder.

Details of the expansion joint for the 15-in. I-beam stringers and of the supporting chairs for the trolley rails should be noted, also the manner of bracing the built-up trolley poles and connecting them to the floorbeams on one side and to the longitudinal girders on the other, as shown in the drawing. An unusual and effective detail for the lacing of diagonal bracing at the spliced intersection is worthy of mention.

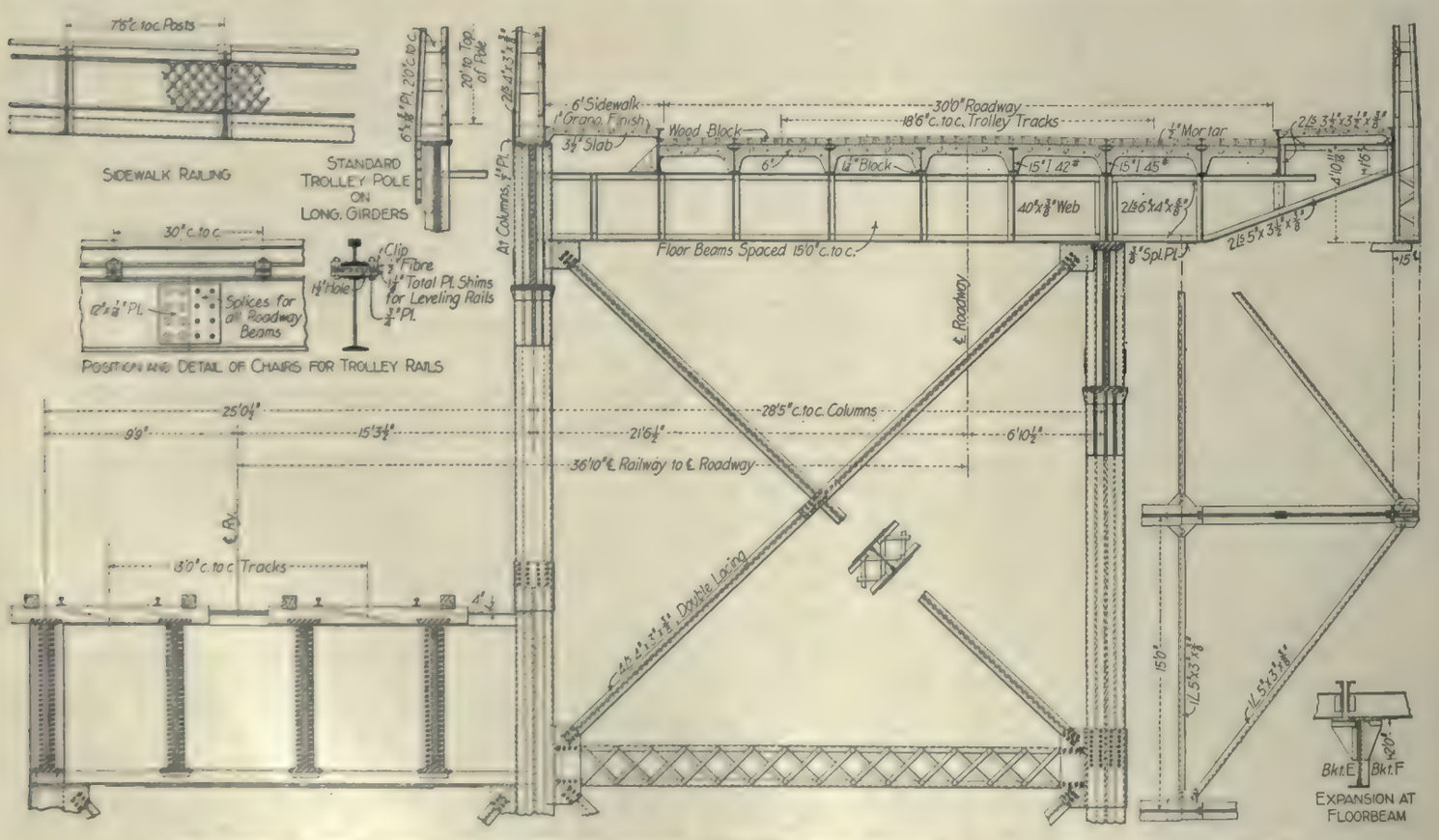
Highway Viaduct

In addition to the large economy effected by the use of rolled I-beam stringers for the roadway throughout, fixing the intermediate floorbeam spacing at 15 ft., added economy in design was accomplished by the scheme shown in the cross-section of the highway viaduct, where the main longitudinal girders are spaced to serve as outer trolley-track stringers. The sidewalks and part of the roadway are thus carried as cantilever loads outside of these girders on the brackets shown.

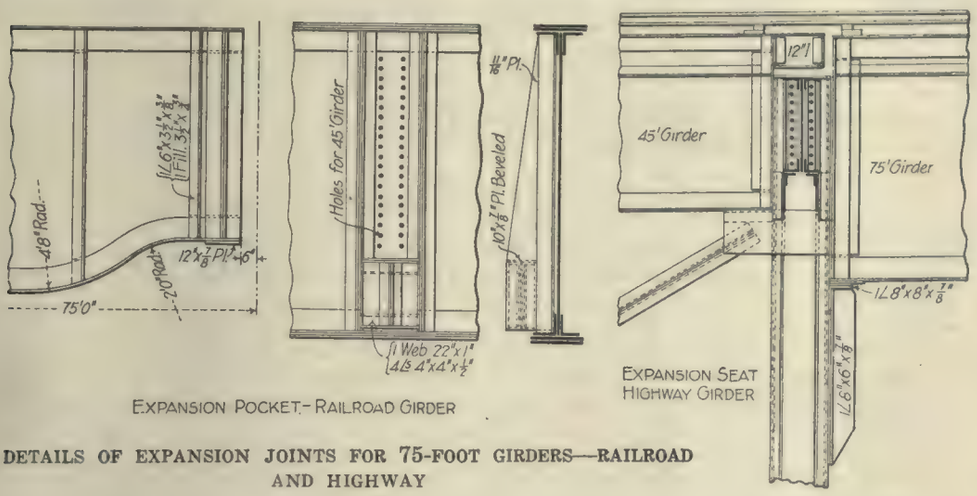
The expansion joints for the railroad girders, which occur in every 75-ft. span, are detailed with the deeper 75-ft. girders reduced to the same depth as the 45-ft. girders by curving the lower flanges, as in-



INTERMEDIATE FLOORBEAM AND CANTILEVER BRACKET ON HIGHWAY VIADUCT



CROSS-SECTION AND DETAILS OF COMBINED RAILROAD AND HIGHWAY VIADUCT OF ST. LOUIS BRIDGE APPROACH



EXPANSION POCKET.—RAILROAD GIRDER

DETAILS OF EXPANSION JOINTS FOR 75-FOOT GIRDERS—RAILROAD AND HIGHWAY

dicated, and carrying them in expansion pockets. The 75-ft. highway girders, however, are supported on brackets on the columns without decreasing the end depth. A tieplate passes through a slot in the web of the longitudinal girder to take the top flange tension produced by the cantilever bracket.

The east approach will contain about 24,000 tons of steel and 35,000 cu. yd. of concrete. The contractor is the American Bridge Company. The designers are Boller, Hodge & Baird, consulting engineers, New York City. Erection is proceeding by city forces under the direction of C. H. Fisk, engineer of construction for the Board of Public Service of St. Louis.

Unit Construction Reduces Quantity of Concrete

J. E. Conzelman Proposes Use of Standardized Railroad Structures and Development of Shop Methods for Concrete

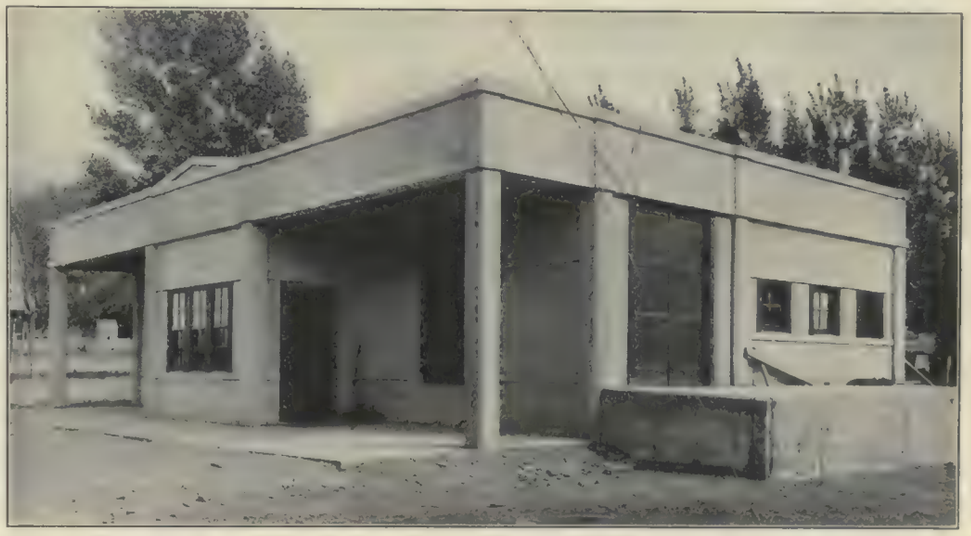
THAT UNIT METHODS of reinforced-concrete construction have proved their practicability during the last six years is claimed by J. E. Conzelman, vice-president and chief engineer of the Unit Construction Company, in a paper entitled, "Recent Application of Unit Methods to Reinforced Concrete Construction," presented before the Engineers' Club of St. Louis, Sept. 22. He states that under conditions favorable to its use unit construction has proved itself greatly superior to the usual or monolithic type, and its adoption has resulted in economy, simplicity of construction, and an opportunity for better workmanship.

Two large unit operations were used for illustration — the Cedar Rapids Power Company plant described in the Engineering Record of July 25, 1914, page 107, and the cotton-handling plant of the Galveston Compress & Warehouse Company, described in the Engineering Record of June 27, 1914, page 740. The following extracts from the address relate to standardized railroad structures and to the relative advantages of unit methods, with criticisms of some of the methods used in monolithic construction.

RAILROAD STRUCTURES COULD BE STANDARDIZED

Railroad work, according to Mr. Conzelman, offers a field for the development of the unit idea. A standardization of such structures as engine houses, freight sheds, snow sheds and track shelters could be made to result, he believes, in great economies by the adoption of this method. Centrally located factories should be established for the manufacture of the units. The amount of work that could be accomplished in this line by a small force working regularly would be surprising, and the cost, if permanent forms were used, would be exceedingly low. The accompanying photographs show typical examples of railroad structures built by the unit method.

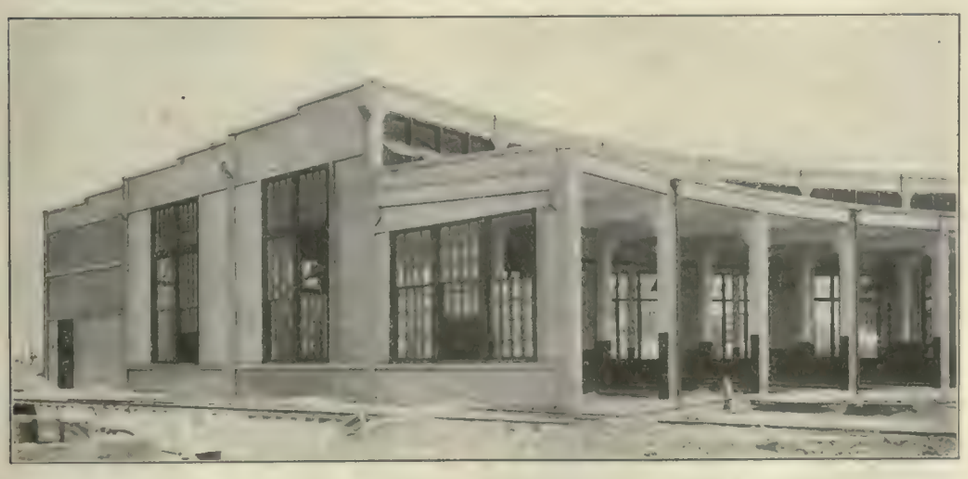
Shop fabrication would also permit the use of lighter sections, because factory concrete, it is claimed, has greater strength and is a more reliable product than the field mixed concrete of ordinary construction. By careful methods there is no doubt in Mr. Conzelman's mind that a large percentage of the concrete ordinarily used could be saved. Buildings would be carried in stock, as are other commodities, and could be "wrapped up" and sent out on short notice and erected in surprisingly quick time. What is true of railroad structures applies with equal force to any development consisting of similar units, such as terminal buildings or manufacturing centers.



COMBINATION RAILWAY STATION AND FREIGHT HOUSE WITH HIGH PLATFORM

MASS CONCRETE MIXED TOO FAST

One of the phases of usual construction methods that needs correction is the haste with which the concrete materials are put through the mixer. Engineers, as well as contractors, seem to be hypnotized by the



SANTA FÉ ROUNDHOUSE CONTAINS PROVISIONS FOR FUTURE EXTENSION



SHELTER HOUSE FOR ELECTRIC RAILWAY

American habit of doing things on a large scale and in the shortest possible time, and perhaps without due regard to excellence and uniformity of product. We want a batch a minute, a floor a week, ten floors in ten weeks, and arrange our plans accordingly. It was recently reported in one of the engineering journals that on a large contract an average of 70 batches an hour was frequently maintained. Can the materials for a yard of concrete develop the close intimacy necessary for a uniformly strong concrete in the 10 or 20 sec. they are allowed after their introduction into the mixer?

WASTE OF CONCRETE MATERIALS

The result of these methods is the production of a concrete of mediocre strength and of uncertain quality. As a consequence it follows that more concrete materials are required than would be used if the materials were properly mixed. Recent experiments show that the strength of concrete can be greatly increased by long and thorough mixing, and it is no doubt true that better construction methods would result in a saving of as much as 20 per cent of the concrete materials without reduction in strength.

A part of this trouble is due to the methods necessarily used in the construction of the ordinary concrete building. After a week or two of carpenter work the forms for one floor are prepared, then all energies are bent to pour the entire floor in one day of concreting. The mixer works about one day out of six and has to do the mixing in one-sixth of the time that should be allowed.

Unit methods are said to give opportunities for making better concrete. A reasonable amount is poured, each day which gives times for thorough mixing, and the concrete is poured into individual forms in comparatively small quantities, so that each batch is inspected and puddled. When the time comes, as it soon will, according to Mr. Conzelman, when units are made in permanent factories by improved processes of manufacture, a perfectly reliable structural material will be obtained, and perhaps 50 per cent of the concrete that is now used will be saved.



BUTTERFLY SHEDS AT LOS ANGELES DEPOT SHELTER TRACK PLATFORMS

THE PRODUCTION OF LIME in the United States in 1914 was 3,380,928 short tons, according to a bulletin of the U. S. Geological Survey. Its value was $13,247,676.

Marysville, Ohio, Sewage-Treatment Plant Provides for High Degree of Purification

Screening, Two-Story Sedimentation Tanks, Crushed-Stone Contact Beds and Intermittent Sand Filters Were Found Necessary

By E. D. BARSTOW
With R. Winthrop Pratt, Consulting Engineer, Cleveland

MARYSVILLE, Ohio, a village of 4000 population, finished last year what is believed to be one of the most complete sewage-treatment plants of the smaller cities of Ohio. Local conditions, to be described later, required the installation of a plant that would give a very high degree of purification, and the plan adopted therefore included screening, sedimentation in two-story tanks, treatment in crushed-stone contact beds and finally sprinkling filters. The chief features of the plant will be here described.

LOCAL CONDITIONS

Marysville has a population of nearly 4000, is the county seat of Union County, and is situated about thirty miles northwest from Columbus, in the midst of rolling farm lands. Through the northern part of the town runs Mill Creek, a small stream with a flow of from 4 to 20 cu. ft. per second, into which all sewage from Marysville ultimately finds its way. About 10 miles below Marysville, Mill Creek empties into the Scioto River at a point 6 or 8 miles above the storage reservoir which impounds the water for the public water supply of Columbus. This situation gave rise to one of the chief reasons for considering the sewage purification problem at Marysville. Of little less importance was the other reason that for years Mill Creek had been rendered locally obnoxious during the summer months by sewage from the town and by milk wastes from a large milk evaporating plant located in the southwest part of the corporation. Town Run, which is nothing more than an open ditch through the middle of the town, was also badly polluted by the discharges from a number of private sewers.

On account of these conditions the State Board of Health ordered the village to construct a sewer system and sewage-treatment plant, requiring that the sewage receive a high degree of purification in view of the fact that it would ultimately contribute to the water supply of Columbus. Accordingly the village council employed R. Winthrop Pratt, consulting engineer, of Cleveland, to make the plans for and superintend the construction of the system.

SEWER SYSTEM

The sewer system was designed to reach practically every portion of Marysville, the ultimate capacity being based on a population of 12,000 people, assuming a rate of 150 gal. of sewage per capita per day. About 10 miles of sewers were built, which will serve practically all of the present population of the town. Arrangements were also made to take care of the sewage from the Ohio State Reformatory for Women, which is being constructed on a site about 1 mile southwest of the village limits. This institution is planned to accommodate ultimately 1000 persons. It was possible to get a gravity flow throughout the sewer system and through the treatment plant to Mill Creek, although the sewers were laid on very low grades in some places.

The contract for the construction of the sewer system was awarded to W. M. Graham & Company, of Columbus, who finished the work early in the summer of 1914. The subsoil is generally dry clay, and little real trouble was experienced in laying the sewers.

TREATMENT PLANT

The sewage-treatment plant was located on the site of an old gravel pit, just outside the northeast village limits, and about one-fourth of a mile from the nearest residences. The site was well above ordinary flood waters, but a dike was built entirely around the plant, the top being about 2 feet above high water of the flood of 1913, which was the worst on record in this section of the country.

The plant was designed for a capacity of 500,000 gal. of sewage per day, and can be increased in size to accommodate any probable growth Marysville will have within the next 50 years. To obtain the required degree of purification, the treatment consists of screening, sedimentation in two-story tanks, treatment in crushed-stone contact beds and filtration in intermittent sand filters, in the sequence given.

SCREENING AND TWO-STORY TANK

The trunk sewer discharges into a screen chamber in which are two sets of steel-bar screens with 1-in. openings. In this chamber, also, are removable stop-planks, by means of which the sewage may be directed into either one or both of the sedimentation tanks. The two-story sedimentation tanks are each 21 x 33 ft. in inside dimensions, placed end to end, with an 8-ft. space between, in which space are placed the screen and outlet chambers. The flow channels are 9 ft. wide, with a sectional flow-area of 87 sq. ft. In passing through the 66 ft. of flow-channel length the sewage has a sedimentation period of 3 hours, based on the assumed ultimate sewage flow.

The sludge-digestion chambers have a capacity of 3500 cu. ft., intended to accommodate the storage of digested sludge for a period of 4 to 6 months. Each tank has two

sludge sumps, from which lead cast-iron discharge pipes. These pipes being below the flow line of the tanks, the sludge may be drawn off at any time by opening a gate-valve in the pipe line. The sludge is discharged upon a sludge-drying bed adjacent to the sand filters.

CONTACT BEDS AND FILTERS

The sewage goes from the sedimentation tanks to the control chamber in the middle of the contact beds. In this chamber are automatic siphons, which dose the sewage out into the contact beds in rotation. There are four contact beds, each 90 ft. square, filled with crushed stone to a depth of 4 ft. They are designed on a basis of 2000 persons per acre-foot. The beds have concrete walls throughout and are drained by 5-in. split tile, laid in rows 6 ft. apart on the 4-in. concrete floor. The controlling apparatus was installed by the Pacific Flush Tank Company.

The four sand filters are each 125 x 175 ft., filled with sand to a depth of 2 ft. The sewage from the contact beds goes into a distribution chamber in the middle of the sand beds, from which it is dosed out onto the beds through hand-operated shear gates, and distributed over the beds by wooden troughs. These troughs go entirely around the concrete walls of each bed with an additional line laid lengthwise of each bed. The discharge from the troughs is regulated by means of adjustable gates.

The sludge bed, 8 x 353 ft. in size, adjoins the sand filter beds and drains into them. It has a 6-in. layer of ¾-in. stone in the bottom, with a 12-in. layer of filter sand over it. The sand filters are drained by lines of 6-in. sewer pipe, laid with open joints and covered with ¾-in. crushed stone, leading to a common outlet chamber in the middle of the beds. From here the outlet sewer leads directly to Mill Creek.

The sand for the filters is a fine lake sand, supplied by the Kelley Island Lime & Transport Company, Sandusky, Ohio, and is obtained from the bottom of Lake Erie by suction dredges. Some difficulty was experienced in getting this sand to keep its effective size constant.

HANDLING EFFLUENT

In the outlet chamber of the filter beds is a centrifugal pump, with a 6-in. discharge and 8-in. suction, direct connected to an electric motor on the floor above. The motor will be started and stopped by an automatic float switch, so arranged that the pump will operate whenever the water in the outlet chamber rises to a certain height. The discharge pipe from the pump runs across the filter beds to a manhole in the outlet sewer. In this manhole is a flap valve, so arranged with counter weight and float that it will close by the action of a backward flow from the creek in the outlet sewer. The flap valve in the outlet sewer operating in conjunction with the pump in the outlet chamber of the filters is expected to prevent any possible flooding of the beds during high water.

Messrs. Epps & Milligan, of Marysville, were the contractors for the construction of the sewage-treatment plant, which was completed and put into operation in the fall of 1914. Alvi Graham is city engineer. The writer was resident engineer on the construction of the treatment plant.

The cost of the sewer system was approximately $65,000, and that of the treatment plant about $55,000.

Port Channels of Venice Kept Clear by Tidal Movement Properly Controlled

Prof. Luigi Luiggi Describes Jetties Built to Improve Natural Channels and Insure Navigability—How to Aid the Forces of Nature

ESTUARIES are notoriously difficult to keep free from deposits of sediment which impede navigation and require expensive dredging or costly construction in navigable harbors. In notes presented before the International Engineering Congress entitled "Works for the Improvement of Navigable Estuaries" Prof. Luigi Luiggi, inspector general of engineers and professor of hydraulic construction at the Royal Polytechnic of Rome, Italy, described the successful construction of jetties in Venice, in relating Italian experience in this work. The following is an abstract of the paper relating to the work at Venice.

PORT CHANNELS OF VENICE

In order to improve the natural channels of approach from the sea to the lagoons of Venice, two jetties were built at the entrance of the port or passage of Malamocco of sufficient length to reach the contour of 26¼ ft. below depth below datum. The width between jetties was fixed at 1542 ft. in order to guide the mass of water that flows from the lagoon lying within, which has an area of 63.2 sq. miles, under the action of the tidal movement. This tidal movement varies from 1.3 ft. at neap tides to 2.4 ft. at spring tides, and exceptionally to 4.3 ft. in equinoctial tides when combined with strong winds.

With this construction, and without the need of dredging, the bar at the entrance of the channel, which was covered only to a depth of from 6½ to nearly 10 ft. at low tide, was carried away by the natural current, and the channel now maintains itself very well at a depth of about 33 ft. at low tide.

A similar construction was carried out at the Lido entrance, which gives access more directly from the sea to the commercial and military harbors of Venice. The lagoon of the Port of Lido having an area of 112.4 sq. miles and the tidal movement being similar to that at Malamocco, it was decided to carry the jetties out to the contour 26 ft. below datum. The width of the channel between the jetties was made 2950 ft. with the hope of thus realizing a tidal current with a velocity of from 2 to 3¼ ft. per second from neap to spring tides, which should be sufficiently strong to maintain the channel clear of obstruction and at the same time give conditions favorable for navigation, by reason both of the width of channel and of the moderate velocity of current.

RESULTS ARE SATISFACTORY

The results have been very satisfactory. Before the work was carried out the depth of water on the bar was 7.9 ft., while at present the depth is 28 ft. However, as a result of the accepted width given to the channel itself, its course is somewhat irregular and tortuous, and certain shoals of sand tend to re-establish themselves.

It would have been better to have given to the channel a somewhat reduced width by building a counter jetty within—as was done at the Hook of Holland in order to correct a similar condition which developed at the mouth of the New Maas—otherwise it will be necessary to dredge out the shoals. It has been decided as preferable, at least for the present, to resort to dredging as being simpler and cheaper in first cost.

CONCLUSIONS

The conclusions to which we are brought, as well by the works of Dr. Corthell as by those of Italian engineers, which are based on the results of experience so successfully executed for the improvement of the ports of Malamocco and Lido at Venice, and of Ravenna, and on which are based the proposed works at the port of Chioggia, are the following:

1. In order to improve the navigability of estuaries it is preferable, in general, to construct jetties which restrict between them and guide to the open sea and beyond the neutral zone the waters of the river or of the lagoon in their movement, especially under tidal influence. For certain special cases, where the construction of jetties may involve an excessive cost or where the bottom may be too unstable, it may be better to depend on dredging.

2. In any case it should be the aim to improve an existing channel and to aid the action of the forces of nature, making the least possible change in their present régime.

3. The jetties should be rectilinear, parallel with each other and tied carefully into the shore formation.

4. The orientation of the jetties should be adjusted with due regard for the direction of the prevailing waves and of the tidal current, in order thus to avoid obstructing, but rather to facilitate, the escape from the estuary of the water and material held in suspension or eroded from the bottom.

5. The extremities of the jetties should be carried to the depth of the contour line which corresponds to the depth which is desired to realize in the navigable channel, and in any case they should be carried at least as far as the neutral zone in accordance with the régime of the sea waves at the mouth of the estuary. It may be assumed that such zones in the upper Adriatic, where the waves may reach a height of about 13 ft., will be found between the contours for from 16 to 23 ft. below datum; in the Mediterranean, where waves are met with to a height of 23 ft., the neutral zone will be found between the contours for from 26 to 29½ ft. below datum; and in the Atlantic and in other cases with waves still higher, the neutral zone may be found at a depth even exceeding 33 ft. below datum.

6. Where aid is available from a powerful mass of water, as from a large river or from strong tidal currents, and especially from large lagoons, in which move alternately great masses of but slightly turbid water, the neutral zone is found in depths sensibly less; hence the jetties need not be carried out so far, and the problem receives a still simpler and more certain solution. It is well to recall, in this connection, the Venetian saying, "A large lagoon makes a good harbor."

7. The section of the channel between the jetties should have approximately the

same area as that found in the branches of the estuary which lend themselves most effectively to the needs of navigation, and in restricting this area it should be remembered that the bottom current must reach at least 2 ft. per second in order to be able to exercise any erosive action and to prevent filling up of the channel, while that in the main body of the channel should not sensibly exceed 3½ ft. per second, in order not to interfere with navigation. In case of doubt it is better to adopt a large width between the jetties, with the process in reserve of a further narrowing by means of an auxiliary or countermole, as experience may determine, rather than run the risk of giving to the channel too small a section, an error which can only be corrected by the removal of one of the jetties, or otherwise by the use of auxiliary dredging, as at the Lido at Venice.

8. The jetties should be constructed in such manner as not to permit penetration by sand and silt which collect on the outside—a condition which gave much trouble at the old jetties at Port Said—and they should be of sufficient height above high tide to prevent ready overtopping by the waves, with a resulting deposition in the channel of the matter which they may carry in suspension.

9. The construction of the jetties should be carried forward with the maximum speed in order to prevent the re-formation of the bar at the outer end in proportion as the jetties advance into deeper water.

10. Due account should be taken of the natural and inevitable development of the shore adjacent to the channel and of the consequent and necessary future prolongation of the jetties.

11. It is useful to aid and to accelerate by means of dredges the first work of erosion of the natural currents which run between the jetties, especially for removing possible banks of clay or conglomerate which the current by itself may not be able to erode. It is further necessary to move old skeletons of ships which have been wrecked on the bar or on the shoals of the estuary, as were met with at the port of Lido at Venice.

12. It is necessary to watch the channel carefully in the early years, and to correct, with suitable work by dredges or with the use of fascines, any possible tendency of the current to follow a tortuous path between the jetties.

The conclusions above enumerated are applicable to estuaries, in general, in order to render them navigable; but there may be very special cases where the use is so continuous and exacting that it may appear, from reasons of finance or urgency, more expedient—as at Liverpool, New York and Buenos Aires—to depend entirely upon the use of dredges rather than to face the heavy initial cost of the construction of jetties. Jetties, however, have given very satisfactory results at the south pass of the Mississippi and at the ports of Malamocco and of Lido at Venice; they demanded a heavy expense for first construction, but have required only slight expense for subsequent maintenance.

A TRANSMISSION LINE IN CALIFORNIA runs 115 miles in a perfectly straight line with the exception of a single angle of deflection. The line carries electrical energy at 110,000 volts from the Drum powerhouse to the Cordelia substation.

Literature

For the Civil Engineer and Contractor

New Publications

BOSTON TRANSIT COMMISSION, twenty-first annual report, for the year ending June 30, 1915. Paper, 6 x 9 in.; 102 pages; illustrated. Boston, Boston Transit Commission.

EQUIPMENT FOR CURRENT-METER GAGING STATIONS. By G. S. Lyon. Water Supply Paper 371, U. S. Geological Survey. Paper 6 x 9 in.; 64 pages, illustrated. Washington, Government Printing Office.

JAHRBUCH DER TECHNISCHEN ZEITSCHRIFTEN-LITERATUR. By Heinrich Rieser. Edition 1915 for the literature of the year 1914. Paper; 6 x 9 in.; 98 pages. Berlin, Germany, Verlag für Fachliteratur, Gesellschaft.

GRAPHICS AND STRUCTURAL DESIGN. By H. D. Hess, M. E., professor of machine design, Sibley College, Cornell University. Second edition, revised. Cloth, 6 x 9 in.; 444 pages; illustrated. New York, John Wiley & Sons, Inc. $3 net.

ELEMENTS OF HIGHWAY ENGINEERING. By Arthur H. Blanchard, C. E., A. M., professor in charge of the graduate course in highway engineering, Columbia University. Cloth, 6 x 9 in., 514 pages; illustrated. New York, John Wiley & Sons, Inc. $3 net.

THE ELASTICITY AND RESISTANCE OF THE MATERIALS OF ENGINEERING. Seventh edition, thoroughly revised. By William H. Burr, C. E., professor of civil engineering, Columbia University. Cloth, 6 x 9 in.; 928 pages; illustrated. New York, John Wiley & Sons, Inc. $5.50 net.

ENGINEERING GEOLOGY. By Heinrich Ries, Ph.D., professor of economic geology in Cornell University, and Thomas L. Watson, Ph.D., professor of economic geology in the University of Virginia and State geologist of Virginia. Second edition, enlarged. Cloth, 6 x 9 in.; 722 pages; illustrated. New York, John Wiley & Sons, Inc. $4 net.

MECHANICAL DRAWING FOR COLLEGES AND UNIVERSITIES. By James D. Phillips, B. S., professor of drawing and assistant dean, College of Engineering, University of Wisconsin, and Herbert D. Orth, B. S., instructor in drawing, University of Wisconsin. Cloth, 6 x 9 in.; 283 pages; illustrated. New York, Scott, Forsman & Company.

INFLUENCE OF TEMPERATURE ON THE STRENGTH OF CONCRETE. By A. B. McDaniel, Bulletin 81, Engineering Experiment Station, University of Illinois. Paper, 6 x 9 in.; 24 pages; tables and diagrams. Urbana, Ill., University of Illinois.

Report of tests of forty-five 6 x 6-in. cylinders, fifty-one 6-in. cubes and sixty 8 x 16-in. cylinders under varying temperatures from 30 to 90 deg. Fahr.

COMPARATIVE RAILWAY STATISTICS—UNITED STATES AND FOREIGN COUNTRIES—1912. Compiled by the Bureau of Railway Economics. Paper, 6 x 9 in.; 78 pages. Washington, D. C., Bureau of Railway Economics.

Tabular matter divided into two parts, Part I consisting of basic statistical tables for the individual countries throughout the world, and Part II giving comparative averages and ratios derived therefrom for such items as total and unit mileages, tonnages, revenues and expenses.

GUIDE TO THE REPORTS OF THE ROYAL COMMISSION ON SEWAGE DISPOSAL. By G. Bertram Kershaw, engineer of the commission. Cloth, 5½ x 8½ in.; 178 pages. New York, D. Van Nostrand Company; London, P. S. King & Son, Ltd. $2 net.

A handy reference to the subject matter in the 30 separate volumes covering the commission's work. From each report all headings and subheadings have been extracted, thus giving in condensed form the subject matter contained in them, with page number and volume number references.

Books Reviewed

The Elements of Mechanics of Materials

Author, C. E. Houghton, A. B.; M. M. E.; associate professor of mechanical engineering, New York University. Second edition revised and enlarged. Cloth 6 x 8½ in.; 216 pages, 94 illustrations. New York, D. Van Nostrand Company. $2 net.

Reviewed by F. H. Constant

Professor of Civil Engineering, Princeton University, Princeton

This is the second edition, revised and enlarged, of a work which appeared in 1909. It is not intended as a treatise on the mechanics of materials as that field has been thoroughly covered by others. But it is an elementary text-book for a short, one-term course. The author presents the subject in a simple and clear manner, and while he may appear to develop very elementary matters in a somewhat leisurely way, the subject is one which students ordinarily find inherent difficulties in understanding. It could not be expected that so small a volume, a little over 200 pages, could touch more than the usual basic topics, and that only in a comparatively elementary manner.

The range of the book is indicated by the chapter headings, covering applied mechanics (the nature of stress, strain and elasticity), riveted joints, beams, the elastic curve, long columns, combined stresses, and compound beams and columns including the mechanics of the reinforced-concrete beam.

The second chapter contains a brief and approximate treatment of the thick pipe which might seem out of place in an elementary work. The theory of the elastic curve is brief but should convey a clear idea of the fundamental principle. In the chapter on long columns, Euler's formula is emphasized, but the other formulas in practical use, Rankine's, Ritter's, the parabolic and the straight line formulas also receive brief mention. Throughout the book an extreme mathematical treatment is avoided, but the calculus is freely used when it leads to clearness.

A valuable feature of the book is the long lists of examination questions and practical problems which follow at the close of each chapter and supplement the text in a very thorough manner. The treatment of the reinforced-concrete beam is the standard one now adopted in all text-books, and covers the simple beam (linear variation of stress), T-beam, shearing and bond stresses, diagonal tension, and a short mathematical treatment of the deflection of concrete beams. There are no accompanying diagrams to simplify the practical use of the formulas.

The book closes with a few tables, in the first three of which are collected for convenient reference the fundamental and derived formulas. The other tables give average constants of materials, properties of sections, standard beams, etc. The book should prove a serviceable little volume for an elementary course. It is intended to be supplemented by Merriman's more complete treatise.

Field Engineering

Authors, William H. Searles and Howard Chapin Ives, professor of railroad engineering, Worcester Polytechnic Institute, seventeenth edition. Leather, 4 x 7 in.; 632 pages, 148 illustrations. New York, John Wiley & Sons, Inc. Vols. I and II, text and tables, in one book, $3 net; separately, $2 for each volume.

Reviewed by A. F. Comstock

Associate in Railway Engineering, University of Illinois, Urbana

Searles' pocketbook needs no introduction to railway engineers. For more than a third of a century it has served as a companion to engineers in both field and office. The new seventeenth edition, which appears under the joint authorship of Searles and Ives, is a thorough revision, retaining the essential characteristics of the previous edi-

tion, but adding approximately 100 pages thereto, divided almost equally between text and tables. Lest the title should mislead those not familiar with the book, it should be said that "Field Engineering" as here used applies to railway engineering only, except in so far as the tables, which comprise half the book, have other application.

Prominent among additions to the text are the following chapters: "The Spiral Curve," Earthwork Tables," "Earthwork Diagrams," and "Haul and the Mass Diagram." By expanding the work previously given on "Cross-Sections" a new chapter of that title has been formed. The same is true of "Tracklaying." A complete revision of the chapter on "Turnouts and Crossings," making the treatment accord with modern practice, has been well executed. Twelve of the nineteen chapters have undergone only minor revisions.

The spiral presented in both the text and tables is the Searles, most of the material for which is taken from Searles' "Railroad Spiral," published in 1890. Why this particular spiral was selected without first discussing its advantages and disadvantages, or at least according some recognition to better known spirals, is not made apparent. There is also a lack of clearness with respect to the method of deriving the fundamental theory. The nomenclature for curves and spirals as adopted by the American Railway Engineering Association has not been followed.

Changes in the tables consist chiefly of additions, sixteen new tables having been inserted. Eight of these are on the spiral, two on turnouts, and one each on triangular prisms, prismoidal corrections and metric curves, while the others are of minor importance. Six-place logarithms have been retained in all of the logarithmic tables.

Since some engineers find need in the field for a book of tables only, either the tables or text may be obtained in a separate volume. Superior quality is plainly evident in the bookmaking.

Simplified Reinforced-Concrete Mathematics

Author, Melvin D. Casler, B. E. Cloth, 5 x 7 in.; 66 pages; illustrated. New York, D. Van Nostrand Company. $1 net.

Although the claim of the author of this little book to having developed formulas and methods which effect a large saving of time over prevalent methods of computation of reinforced-concrete members, even when aided by tables and diagrams, is not wholly justified for the simple beam-and-slab computations, he has developed an ingenious circular scale easily used to find the four variables entering into his new formulas. For computing stresses in columns eccentrically loaded or arch sections where combined bending and direct stress exist the formulas and methods given appear to be easier to handle than the standard formulas now in use.

The book is divided logically into four chapters, treating successively the derivation of formulas, labor-saving devices, illustrative examples and general notes on reinforced-concrete design.

In the first chapter the formulas to be applied are developed with satisfying clearness except in some cases where the logical steps are not stated. The statements of fundamental conditions for equilibrium called A and C are not properly worded to give an exact conception of these important principles. The distinctive basis of the formulas and new set of variables used is the value of x, the ratio of depth of steel *below* the neutral axis to the depth d. A set of ten equations is developed, in terms of four variables containing this quantity x. A table giving values of the constants used in computing bending moments in beams for various end conditions is also given in this first chapter.

The second chapter explains the devices used to save time in obtaining the four fundamental variables in terms of x, including a circular diagram, curves on rectangular co-ordinates, tabular values, and the method of constructing a slide rule. The third chapter gives the typical procedure for solving the various problems and illustrates the use of formulas by actual examples. A comparison of the time and number of distinct operations involved in the solution of the simpler problems given by the author as compared with the standard formulas and diagrams shows the latter to be more direct and shorter. In fact, there is danger that the new formulas, containing terms whose meaning is not capable of definite statement in physical terms, may lead to errors of substitution which might be serious. The problem used to illustrate the application to arches is a reinforced-concrete conduit in which the true line of pressure is assumed to be known, and in this case the author's methods may prove to be superior.

The last chapter, containing a general discussion of the practical phases of reinforced-concrete design, contains little of a new or unusually helpful character. On the whole the book is well illustrated and gives evidence of careful typographical work, especially in the numerous formulas. It should prove to be of special interest to those concrete designers who take delight in new mathematical methods and are not already wedded to any particular set of tables or diagrams.

Letters to the Editor

Comment on matters of interest to engineers and contractors will be welcomed

Civil Engineers' Association Would Better Public Service Conditions

SIR: The Massachusetts Public Service Civil Engineers' Association was organized about four years ago with headquarters in Boston. Its membership numbers 300, and is composed of persons employed in the civil engineering public service of the Commonwealth and of the City of Boston. All members must be on the civil service classified list of the civil engineering service, and are under the jurisdiction of the Massachusetts Civil Service Commission. Monthly meetings are held from October to June inclusive. The chief objects of the association are to increase efficiency and further the interests of its members and the civil engineering profession in the public service.

Much has been accomplished by the association since its organization. For the most part, the attitude of heads of departments and those in charge has been admirable. Some attempts at intimidation of members have been made, but these will be dealt with in due time and in a proper but no less certain manner. In the City of Boston we have succeeded in obtaining a standardization of salaries in the civil engineering service, which, though not what it should be, and imperfect as it is, is an advance in the right direction. It is our aim to have established in the public service of Boston and the Commonwealth a system of automatic promotions in the civil engineering service, based on efficiency and the merit system.

Too elastic and inefficient civil service rules and regulations have demoralized the service. Dissatisfaction with conditions is rampant. Incompetent men are being employed in certain grades of the service without being obliged to qualify by civil service or any other kind of examination. The civil service books are full of temporary and provisional appointments due to the inefficient civil service rules relative to provisional and temporary appointments. This abuse is flagrant, and an immediate revision of civil service rules and regulations appertaining to the civil engineering service in this State seems imperative and desirable, else incompetency will soon run riot, and inefficiency and waste of public moneys be the inevitable consequence.

The Massachusetts Civil Service Commission has seemed unable to cope successfully with the situation, principally because of interference, and lack of proper co-operation of certain department heads. Imagine a situation where a chairman of a State commission, the duties of which are chiefly civil engineering, himself not a civil engineer, defiantly refuses to obey the rules established by the Civil Service Commission. Yet such has been the case. Is it any wonder demoralization exists?

Recognizing this state of affairs the association undertook the task of bringing order out of chaos by preparing a set of regulations, designed to strengthen true civil service, increase efficiency, regulate compensation of those employed in the State civil engineering service, and prevent the employment henceforth of incompetent men, in the form of a bill introduced into the Massachusetts Legislature of 1914. The bill is admittedly an admirable one and lofty of purpose, and was drawn by a committee of civil engineers after long and arduous study. There was no apparent opposition, but on the contrary it met with the approbation of the Civil Service Commission and many public-spirited citizens. Notwithstanding, after public hearings in committees where no opposition was presented, the bill failed to pass the lower House and was referred to the next General Court.

Undismayed, the association again introduced the bill in its original form into the State Legislature of 1915. The committees of the lower House to which it had been referred reported favorably. No opposition was encountered, and the lower House passed the bill by an overwhelming, practically unanimous, vote.

The bill, in regular course of procedure, next went to the State Senate, where it

was referred to the Senate committee on ways and means. Here again, at the public hearing on the bill, there was no opposition whatsoever. Nevertheless this committee, after listening to a masterly presentation in favor of the bill by former State Attorney General Herbert Parker, referred the bill to the State Commission on Efficiency and Economy for a report upon it not later than Jan. 16, 1916. This uncalled for delay, while disappointing, has been accounted for and made clear by developments since come to light. The publicity of the facts would cause a sensation, and will be undertaken at the proper time. However, the association is determined to force a change for the better of conditions so detrimental to the civil engineering profession and inimical to the interests of competent and efficient public service.

We are fearless in the stand we have taken with never a doubt in our minds as to the ultimate result. It is common knowledge that those employed in the civil engineering public service in Massachusetts have long been ridiculously underpaid, and there exists as a result widespread dissatisfaction.

A perusal will show that nothing but justice is asked for in the bill. The salaries prescribed and promotions specified are far less than would be acceptable, or that now obtain in New York, Chicago, Philadelphia and elsewhere in the country. Yet they would be a distinct advance over existing conditions here. The civil service portions of the bill are such that the public service will become vastly more efficient immediately as they are put into effect. Then, all applicants must thereafter qualify by proper civil service examination, an absolute essential to true civil service.

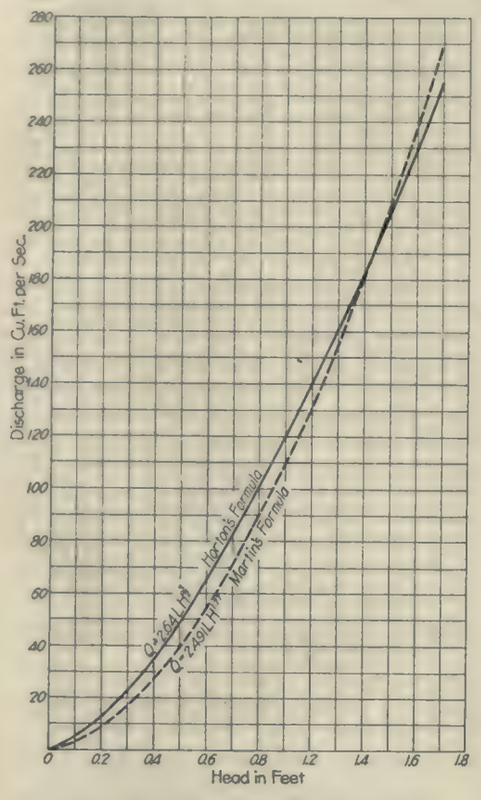
CHARLES C. CARROLL,
Secretary, Massachusetts Public Service Civil Engineers' Association.
Boston.

Run-Off Formulas for Small Spillways Compared

SIR: The spillway of the dam of the Cienfuegos water-supply system on the Hanabanilla River has a width of very nearly 5 ft. and a length of 52½ ft. Its height above stream bed is about 18 ft. Its downstream edge is curved slightly ($r = 1$ ft.). It is thus apparent that the dam and its spillway resemble very closely the Merced dam and its spillway. For the discharge of this spillway W. F. Martin found a coefficient of 2.491 and an exponent for H of 1.77 in the formula $Q = CLH^n$. R. E. Horton in Water-Supply Paper 200, U. S. Geological Survey, found for the same formula a coefficient of 2.64 and an exponent of 1.5 for H, to be used for all dams with a width greater than 2 ft. and within such limits of head that the nappe does not adhere to the downstream face for low heads and does not tend to detach itself from the crest with higher heads.

Both these formulas have been solved for use on the spillway of the dam across the Hanabanilla River, Martin's formula for heads from 0 to 18 in. by eights and Horton's formula for heads from 0 to 1.5 ft. by hundredths of feet, and the two have been plotted for purpose of comparison. It is seen that for heads below 1.24 ft. Martin's values give more conservative results, and for heads above 1.24 ft. Horton's values give more conservative results.

Recently, the height of the spillway was



HORTON'S AND MARTIN'S FORMULAS COMPARED

increased and the capacity increased by lengthening it to 75½ ft. In order to check the value of Martin's and of Horton's formulas, a weir (sharp-edged) will be built a little downstream from the dam, as soon as the dry season starts, and as long as possible gagings will be taken on the sharp-crested weir and the spillway which will serve as additional data to the work of Horton and of Martin, in at least in the way that their work applies to the Hanabanilla dam.

F. M. AGUIRRE,
Chief Engineer, Cienfuegos Water Supply and Sewerage Systems.
Cienfuegos, Cuba.

Activated Sludge and the Baltimore Sewage Experiments

SIR: The communication published in your issue of July 3, page 23, relative to the Baltimore sewage treatment experiments, has only just come before my notice. I should like to comment upon the suggestion contained therein, and to refer briefly to my own experience in this connection.

While engaged as consulting engineer in charge of the sewage works extension scheme for the City of Manchester, at Davyhulme, England, I had much to do with the preliminary work done there on the activated sludge process. I have since given a good deal of thought to the numerous problems arising, and have designed several plants both on the fill-and-draw and continuous-flow methods of treatment.

During July, 1914, F. Fries, chief engineering assistant to Dr. Imhoff, of Essen, was engaged temporarily in my office in the design, under my direction, of special types of tank for the "roughing" of detritus tank effluents, and on the completion of this work, he prepared several proposals for an aeration plant on the Emscher tank principle. In considering the subject we were immediately confronted with the same difficulties which form the subject of Mr. Requardt's communication, and, at the time war broke out and Mr. Fries was compelled to return to Germany, I believe we were well on the way to a solution of the difficulties.

Space prevents one from a full discussion, but I may say that the lines upon which our proposals were drawn up differ materially from those illustrated in the letter of Mr. Requardt. The method shown in the sketch would appear to me to result in the bulk of the inflowing sewage passing across the oxidizing chamber with very little and insufficient aeration, and a danger of stagnation in the lower part of the chamber. It occurs to me that the type of tank illustrated will not give the best results for the continuous flow method, and that to be effective the inlet should be much lower in the tank in a space when there is no possibility of air escaping up the inlet pipe.

This method of treating the problem, however, immediately leads us back to the consideration of the upward flow process, which seems to offer considerable advantages in the direction of bringing about the desired results. I have been brought to the conclusion, after considerable study of the subject, that where continuous flow is adopted, the secret of success may lie in the multiplication of small units so as to allow of different oxidizing periods according to the character and volume of the sewage flow. This will permit of better and more delicate control. A series of units can be so arranged as to allow of continuous flow being used, but constant observation appears to be absolutely necessary, as the process has proved so far very sensitive; but this should be outweighed by the advantages which would accrue.

I have considered numerous proposals for aeration tanks designed on the principle of horizontal flow, and have prepared many designs, but I have come to the conclusion that, to be efficient, the horizontal flow should not be in parallel stream lines, but as sinuous as possible. How this can be done is not at present quite clear. No doubt sufficient agitation can be obtained by power-driven apparatus and an arrangement of baffles. At the same time this brings about the element of complication which is, I think, sufficient in itself to rule out any such proposal.

As the difficulty appears to be in the direction of keeping the particles of activated sludge uniformly distributed, and at the same time in intimate contact with the whole of the flow, without excessive use of air, I have prepared several proposals with a view to overcoming the difficulty.

From what I have learned so far of the process, I may say that continuous horizontal flow tanks covered with aeration tiles do not appear to me to offer the true solution of the problem. Very little is yet known of this subject and much remains to be learned before any technical adviser can be so bold as to recommend the supercession of existing plants by this process.

It therefore behooves engineers to be very cautious in this matter, and prove every step of the process under working conditions. The most efficient plants are those which are, more often than not, the most simple in construction. They are generally the cheapest in the end, both from the view of capital cost and annual maintenance.

O. J. WILKINSON,
Consulting Engineer.
Manchester, England.

HINTS FOR THE CONTRACTOR

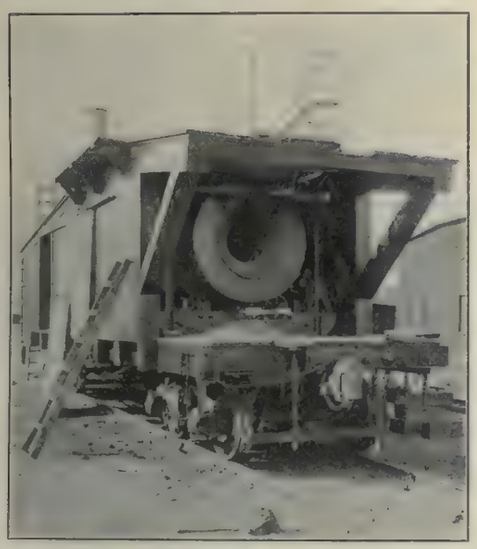
Details Which Save Time and Labor on Construction Work

Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

[*Contributions to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

Mixer Car Placed in Center of Train Saves Wheeling

THE MIXER train shown in the accompanying photograph is one of two complete outfits being used in track elevation work by the Chicago & Western Indiana Railroad, between Seventy-ninth and Ninetieth Streets in Chicago. As will be



SPACE LEFT ON CAR FOR FUTURE TOWER

seen, the car carrying the mixer is placed between the cars loaded with sand and those containing the aggregate. In this way the wheelers never interfere with each other, and the distance the materials are wheeled is considerably lessened. It is said that this arrangement has greatly increased the output of the mixer. Another feature of the mixer cars is a powerful winch mounted in the center of each car. By running a line ahead from this winch, the mixer car is able to pull itself and the entire train, thus doing all its own switching and saving the expense of keeping a work train on the job, which is estimated at $25 a day. At present, the trains are being used to place concrete which is all below the level of the tracks. Later on, retaining walls are to be built for which the concrete must be hoisted. Room has been left, therefore, on each of the mixer cars for building an elevator and installing a hoisting engine.

MIXING PLANT

On each concrete car is mounted a No. 520 Smith-Chicago mixer, a 10-hp. engine and a 20-hp. boiler. There is also a 700-gal. water tank and a smaller 60-gal. feed tank. Each mixer is equipped with a batch hopper, and a swivel chute is mounted at the discharge end of each mixer. These chutes have intermediate openings so that concrete may be discharged at different places. The auxiliary equipment consists of seven stone cars with a capacity of 35 cu. yd. each, three sand cars with a capacity of 35 cu. yd. each and one cement car. Bulk cement is being used on all the work. The work mapped out in connection with this track elevation will take from three to four years. About 25,000 cu. yd. of concrete is to be placed this year, which requires an output of 5000 cu. yd. per month from each mixer outfit. This rate of output is being steadily maintained.

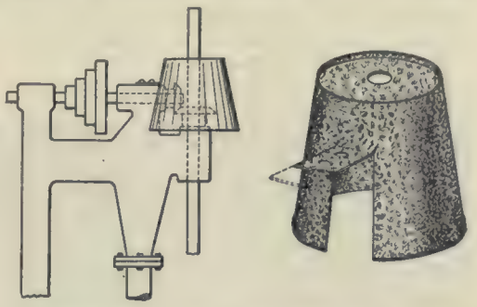
The entire work is being done by forces of the Chicago & Western Indiana Railroad, under Edward H. Lee, vice-president and chief engineer; F. E. Morrow, assistant chief engineer; V. R. Walling, first assistant engineer and C. E. Minor, assistant engineer. The job is a busy one, as the tracks on which the work is being done are used jointly by the Wabash, Chicago & Eastern Illinois, Chicago & Western Indiana, Monon and Belt Line railroads.



A WINCH MOUNTED ON THIS MIXER CAR ENABLES IT TO DO ITS OWN SWITCHING

Bucket Guard for Moving Gears

THE INEXPENSIVE, home-made guard illustrated herewith was found by a representative of the Travelers' Insurance Company in use on a drill press in a garage. The device would be equally applicable, however, to a contractor's machine shop. It consists simply of an inverted



BUCKET GUARDS DRILL-PRESS GEARS

galvanized iron pail, in the bottom of which a circular hole was cut so that it might be slipped over the projecting end of the shaft. Two cuts were also made with a hacksaw on one side of the pail, as shown, and the strip of metal thus freed was bent outward and attached to the frame of the drill press by two cap-screws to hold the pail in position. Although the device is crude it guards the gears effectively. An ingenious person can often make use of homely materials near at hand in this way to fashion them into satisfactory safeguards, at least for temporary use.

Concrete Road Building in Cold Weather Requires Precautions

IF concrete roads are to be built successfully in cold weather contractors must take precautions which are unnecessary during the summer months. The following details of recommended practice are from *Concrete Roads*, published by the Universal Portland Cement Company.

When the average temperature is below 55 deg. and ranges down possibly to 35 deg., the loss of water by evaporation from the fresh concrete is low and the pavement will harden more rapidly if left uncovered so that it may derive full benefit from whatever heat the sun affords. Under these conditions it is advisable to discontinue using earth protection, because, if this be applied and wet down in the usual manner, it will become so cold that all the heat of the sun will be expended in warming the covering of moist earth and will not reach the concrete. To insure proper hardening, however, careful attention should be given to sprinkling the pavement when the temperature is at its highest during the middle of the day. By watching the color of the concrete one can tell whether it is hardening properly or drying out too rapidly, the latter being indicated by a chalky appearance.

If there is danger of frost or freezing temperatures at night, sprinkling should be omitted on work that is only a day or two old, because in comparatively cool weather,

with materials at corresponding low temperature, the concrete may be damaged if the surface of the pavement is saturated with water. This is the season of year when frost or freezing temperatures may be expected almost any night, and to protect against such conditions there should be a sufficient quantity of canvas to cover one day's work at least during the night. Canvas covering is much easier to handle and place and more economical in the long run than tar or building paper, and at the same time affords better protection.

Proper heating of water and aggregates (the cement need not be heated) will result in the mixed concrete having a temperature of from 60 deg. to 70 deg. when deposited. Added warmth introduced through heated materials, combined with that which naturally develops within the concrete during the early setting period, hastens hardening and affords additional security against possible injury from low temperatures when other protection also is afforded.

Engineers, contractors and superintendents on the job should arrange to supply themselves with the Government weather forecasts so that a fair idea may be obtained of temperature changes that may be expected within the following 24 hr.

When the temperature falls to 35 deg. or less, concreting should be suspended. In no case should concrete be deposited upon a frozen subgrade. It is necessary to protect the last concrete laid for at least 48 hr. If straw can be obtained, the day's work may be covered with from 3 to 6 in. of this material as soon as this can be done without marring the surface; the canvas covering then is placed over all. The next day the canvas can be removed and an earth covering placed on the straw. In doing this, make certain that there are no spots only partly covered. After ten days, if the weather is favorable, the covering may be removed and the pavement allowed to harden in the open.

If steam can be obtained, it is practical to use canvas alone. This may be supported on a light framework extending from 18 to 24 in. above the concrete. The steam should be passed under the canvas, thus hastening early hardening. A night watchman can attend to this work by keeping up steam in the mixer boiler. The following day, if weather permits, the canvas may be removed and a straw or earth covering applied, thus making the canvas available for this day's work.

Concrete roads have been utterly ruined by being thrown open to traffic too soon, and every precaution on the side of safety should be scrupulously observed.

Concrete Retaining Wall Spans Cut for Subway Undercrossing

THE NEW three-track Bronx subway at Southern Boulevard and 147th Street, New York City, is being driven directly under a double-track branch of the New York Central Railroad without the use of needling or timbering. The railroad branch is in rock cut, flanked by retaining walls of mass concrete. The rock floor of this cut has to be replaced with the roof of the subway structure. This required cutting out of service one track at a time.

The south track was first taken out and the excavation for the center subway track driven under the retaining wall to the center of the railroad tunnel. The method of blasting under the retaining wall is to shoot cuts, and to drill from the sides of these fan-holes to remove the rest of the rock. These shots did not disturb the wall, although the rock was pulled out practically to the bottom of the wall, giving about a foot clearance in which to set the steel.



LEFT—SOUTH RETAINING WALL OF RAILROAD CUT SPANS EXCAVATION FOR OUTSIDE SUBWAY TRACKS



RIGHT—WEIGHT OF RETAINING WALL WAS TRANSFERRED TO ROOF OVER CENTER SUBWAY TRACK WITHOUT SETTLEMENT

GROUTING WITH A WIRE

The center-track steel was then set and the roof concreted. The water-proofing and the 4-in. backing of concrete were then placed, using form boards across the roof on each side of the wall. These boards came up higher than the top of the wall. This left a slightly dished surface, lacking a few inches of being in contact with the bottom of the wall. A piece of heavy wire was run through this space from side to side of the wall and sawed back and forth across the roof by a man on each end, while the space under the 8½-ft. wall and inside the form boards was poured full of grout from both sides of the wall. The sawing was relied on to work the grout to the center and fill up all voids. That this was accomplished is indicated by failure to detect any settlement of the wall after its weight was transferred to the center track steel and cuts excavated for the two outside tracks. No wedges of any sort were used.

BOTH CUTS FOR OUTSIDE TRACKS MADE AT SAME TIME

The cuts for the two outside tracks were next driven simultaneously in the same way. When the roof over these sections is in place the south railroad track will be restored and put in service while the other track is taken out and the north half of the undercrossing constructed in the same way as the south half. The concrete retaining walls are 18 ft. 9 in. high, 8 ft. 6 in. thick in the base and 3 ft. thick at the top. They have ample strength to span the cut for one subway track as a beam, the maximum unsupported length being not over 25 ft.

In making the first cut for the center track it was thought advisable to take out a small section of rotten rock encountered under the wall on one side, and replace it with a concrete pier. This pier was removed later in taking out the flanking cut on that side. This work was the only temporary construction of any sort required to support the south wall while the subway was being built beneath it.

The work is being done under the direction of the New York State Public Service Commission for the first district, Robert Ridgway, engineer of subway construction. R. S. S. Guerber is section engineer for the commission. H. R. Shailer is general superintendent for the contractors, the Richard Carvel Company, Inc.

CANADA'S SUPPLY OF COMMERCIAL TIMBER at the present time has been variously estimated at from 500,000,000,000 to 700,000,000,000 ft. b.m., and as covering an area of approximately 170,000,000 acres, stated R. H. Campbell of the Dominion Forestry Department, Ottawa, in a paper presented at the recent International Engineering Congress. This estimate of quantity and area refers only to timber of commercial value as saw timber. It does not include pulpwood, firewood, tie and pole material or small timber of any description.

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

Adds 1600 New Members in Four and a Half Days

Engineers' Club of Philadelphia Makes Remarkable Record in Membership Campaign

On Friday Nov. 12, the Engineers' Club of Philadelphia brought to a close a membership campaign which added 1576 new names to the roster, bringing the total membership of the club to 2127 and making it the largest local engineering club or society in the country. Since the close of the campaign 236 additional applications have been received, bringing the total membership of the club to 2363. The roster of the club at the beginning of the campaign showed a total membership of 551, while accessions for the last fiscal year were only 36.

The campaign may be considered the climax of a movement which started in the club in the autumn of 1913. It was then proposed that all the local branches of national engineering societies be affiliated with the club and make use of the club's facilities for their meetings. This plan was consummated early this year. Under it the Philadelphia sections of the American Society of Civil Engineers, the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, the Illuminating Engineering Society and the Alumni Association of the Massachusetts Institute of Technology have become affiliated organizations. Their members are entitled to attend the meetings of their organizations in the clubhouse and to enjoy the privileges of the club on the afternoons and evenings of the meetings. For these privileges the local branches pay annually $1.50 for each of their members.

The suggestion of a great membership campaign was made about a month ago and found ready support with the officers and membership

(*Continued to page 646, first column*)

Sale of $2,000,000 in Hetch Hetchy Bonds Approved

The entire $43,500,000 Hetch Hetchy bond issue, which provides for the construction of the new water supply system for San Francisco, would be sold within the next five years if the Mayor had approved the measure passed by the Board of Supervisors of San Francisco on Oct. 25. The Mayor vetoed the measure, however, on the ground that only $15,000,000 of the Hetch Hetchy bonds could be used during the next five years, the sale of the entire $43,500,000 being a poor business policy.

In his message to the Board of Supervisors, the Mayor recommended the immediate sale of $2,000,000 worth of bonds to obtain funds for the construction of a railroad into Hetch Hetchy Valley. He advocated that further sales be made as the money is needed. It was also recommended that immediate action be taken to have the State Railroad Commission place a valuation upon the property of the Spring Valley Water Company in order that the question of purchase may again be submitted to the voters of San Francisco.

Valuation Discussed from Consumers' and Regulators' Point of View

Commissioners, Lawyers, Economists and Engineers Develop Theories of So-Called Public Side of Problem—Minority Champions Contentions of Utilities

A wide range of theories on the moot questions of the valuation of public utilities, and even on the status of such utilities, was set forth in the conference held in Philadelphia, Wednesday, Thursday and Friday of last week, under the auspices of the Utilities Bureau, as announced in this journal in the issue of Nov. 6, page 583. Commissioners, lawyers, economists, accountants and engineers assembled from all parts of the country; 190 registered, although there were probably 250 present. In the seven sessions, the last being a dinner, seven phases of the great problem were discussed. In general the doctrines presented were those of the so-called public interests, but a sprinkling of champions of the utility point of view voiced their protests and added zest to the meeting. Limited space prevents more than an outline of what seem the principal addresses and comments.

The first session, Wednesday evening, was devoted to the reproduction theory. Morris L. Cooke, director of public works of Philadelphia, and acting director of the Utilities Bureau, explained the purposes of the bureau, and of the conference. He stated that as the utilities were well equipped to present their side of valuation questions, it was thought well for the consumers and regulators to assemble to develop their side.

Reproduction Cost

John M. Eshleman, lieutenant governor of California and former president of the California Railroad Commission, criticised emphatically the reproduction theory of valuation. An abstract of his paper is printed on page 625.

H. F. French, attorney, Baltimore, also decried "reproduction value." He contended

Progress up to Schedule on Quebec Bridge Erection at Close of 1915 Season



SOUTH ANCHOR ARM, INCLUDING MAIN POSTS, NORTH ANCHOR AND NORTH CANTILEVER ARMS COMPLETED, AS THEY APPEARED ON NOV. 9

that if it were used it must logically be applied to the best substitute plant. He thought, however, that utilities would not advocate the reproduction theory if prices of land, labor and material had steadily fallen.

Morris Knowles, consulting engineer, Pittsburgh, took a different view on several ideas that had been expressed. He deplored the confusion of the terms "cost" and "value," and thought if cost figures were treated strictly as such, numerous disturbing factors would disappear. He said reproducing a substitutional plant would be grossly unfair, as substituting hindsight for foresight. He asserted that all elements of cost must be included, even if not shown on the books. He denied that proper estimates were mere guesses. He also denied that "reproduction cost" was an engineers' invention, and averred that legal authority in its support was not lacking. He contended that engineers had a right, as had been previously denied, to express opinions as to value.

Another point made by him was that court decisions do change with the times.

Original vs. Reproduction Cost

Original cost was the assigned subject for the first Thursday session. The first paper, however, by George W. Anderson, attorney, Boston, was on "How to Get Rid of the Reproduction-Cost Theory." He held that the absurdity and injustice of the theory had been fully demonstrated. Its existence he accounted for by the necessity of the courts to establish a basis of value to prevent confiscation, the rate-making legislative bodies having failed to establish any basis. He declared the agency theory of utilities to be the only sound one. He held that utilities were entitled only to fair return on actual investment, and that a code to that effect, like the Massachusetts code, would get rid of the reproduction theory.

Prof. Edward W. Bemis of the advisory board of the Division of Valuation, Interstate Commerce Commission, speaking on "Original Cost as the Chief Basis for Fair Value," also advocated the agency theory, and the disallowing of unearned increment. He voiced a warning that if the increment on land is allowed in the Federal valuation of the carriers the figures will be astounding and will justify startling increases of rates.

Dr. Robert H. Whitten, author of two extensive volumes on the "Valuation of Public Service Corporations," advocated normal actual cost, one reason being its greater stability. He held that rate schedules should not fluctuate with the price of copper wire or iron pipe, and a reproduction cost constantly varying in consequence of such fluctuation.

Edward P. Burch, consulting engineer, Detroit, directed his attention to the engineer's part in valuation. He pointed out that while the engineer should follow the economist and attorney, they furnishing the basis on which he is to get facts, he has had to do his part first. Mr. Burch deplored the fact that engineers could not deal direct with the courts, instead of through lawyers; thought that more attention should be given to the opinion of the engineer, who had spent hours on the subject to the attorney's minutes or seconds; held that the engineer took the ethical view of things, contrasting with the attorney, armed with "twenty decisions for and nineteen or twenty-one against."

In the open discussion F. W. Stevens, general valuation counsel, New York Central lines, and formerly member of the New York Public Service Commission, Second District, averred that reproduction cost was begot not by utilities who thought it would give a higher figure than original cost, but by a noted Nebraskan, representing the public side, who thought it would give a lower. Mr. Stevens thought there was no reason to worry about exorbitant rates if appreciation were allowed; he pointed out that although land values have been going up rates have been going down.

Frederic P. Stearns, consulting engineer, Boston, thought that while actual cost should be the basis for the future, it might be neither possible nor just for the past. He also thought it unfair to exclude expenses of construction that would now be avoided.

Maintaining Inventories

Charles L. Pillsbury, chief engineer, Valuation Bureau, Public Utilities Commission, District of Columbia, read a paper on "The Making and Maintenance of Priced Inventories," laying special stress on the classification of the inventory so that it could be put to any use desired, and on its careful maintenance so that the work would not have to be done again when another valuation was wanted.

Among those who discussed inventorying R. J. Meigs, valuation engineer, Western Union Telegraph Company, urged co-operation on the part of public and utility subordinates as the best preventive of controversies. He also urged the need of uniform instructions and methods.

Valuation by Approximation

Contrasting with Mr. Pillsbury's paper, the first paper of the afternoon session was on "Valuation by Approximation," by John G. Morse, appraiser, Associated Factory Mutual Fire Insurance Companies, Boston. Mr. Morse described short-cut methods used in appraising industrial plants in his work, especially in grouping or lumping small items of little comparative value. He thought much detail useless where so much estimating had to be done. Mr. Cooke, in discussion, expressed similar views. Mr. Stevens deplored haggling over one cent, but said that one cent per crosstie on the New York Central system meant a total of $500,000.

Mr. Stevens also mentioned that he was not worrying, in connection with valuation matters, over the question of rates, but was concerned in the credit of the railroads and their ability to get the money that would be needed for the tremendous expenditures the next ten years would demand.

Franchise Values

Dr. Delos F. Wilcox, deputy commissioner, Department of Water Supply, Gas and Electricity, New York City, read a paper on "Franchise Values." He said it was established as admissible to tax franchises according to present earning power, but that for rate-making purposes franchises need be assigned no separate value except in special cases, and that in some cases they might be liabilities.

Henry DeF. Baldwin, president and counsel of the Queens County Water Company, New York City, did not see the fairness of the diversity of valuations of franchises according to the purpose. He thought more stress should be laid on going value, which he interpreted as covering development cost, including the price paid for the original money, the skill put into the enterprise, and the risk. With suitable recognition of this going value he thought less attention could be given to franchises.

Land matters incited considerable debate in the Thursday evening session. The only formal paper was by Hammond V. Hayes, consulting engineer, Boston. The method by which Mr. Hayes arrives at what the utility would have to pay to reproduce its land, in a manner that he holds will satisfy the courts, is presented in abstract on page 626.

Agency Theory

A. E. Helm, counsel for the Kansas Public Utilities Commission, took an emphatic stand for the agency theory. He declared the railroads to be public highways, and said it was a great fallacy to suppose the companies owned them; the managers were the public agents, and the proprietary rights remained in the State. Hence, as the public owned the lands, the railroads obviously were not entitled to any unearned increment.

Mr. Eshleman said there was grave danger in the agency theory. In California there was a time when the gas company, electric company, irrigation company, was not a utility. The owners of such a company must voluntarily dedicate it to the public use, and companies might not do so for fear of the agency theory. There was, however, a servitude of railroad property independent of the agency theory. The railroad had the right to condemn property, conditional on its use for railroad purposes only. This restriction in use, then, made it less valuable than property unrestricted.

The Railroad Viewpoint

Mr. Stevens took the floor in behalf of the utilities. He said there was no mention of the agency idea in original cases. Then questions of confiscation arose, and the courts said their only function was to prevent confiscation. This gave rise to the use of the term value, which up to then had had but one definition—the power to command other commodities. And the courts have never changed the definition, he said. Various decisions were cited by Mr. Stevens in support of his contention.

Mr. Stevens stated that by the agency theory the public appropriates all of the good things and bears none of the burden of the bad things. He cited the case of the Buffalo & Susquehanna Railroad, built honestly and in good faith for $4,000,000 or $5,000,000, and sold recently for $300,000. He asked why the public had not come to the rescue.

He thought that the laying of great stress on what was actually paid for right-of-way did not make for substantial justice. In a picture which he drew a new railroad by questionable means secured land from A, B, C and D, in 1850, at a low cost. Now, in 1915, X, Y and Z have discovered this and are shocked. They do not, however, try to restore the stolen property to A, B, C and D; they appropriate it themselves.

Milo R. Maltbie, member of the advisory board, Division of Valuation, made an argument for the inclusion of unearned increment as a part of income—this being the same theory unsuccessfully advanced in the decision he wrote, as a member of the New York Public Service Commission, First District, in the Kings County Lighting Case.

Depreciation

Depreciation was the topic for the morning session, Friday, presided over by Mr. Stearns. J. H. Goetz, of counsel, Public Service Commission, First District, New York, discussed the purport of various court decisions on the subject.

Halford Erickson, member of the Wisconsin Railroad Commission, discussed the "Relation of Depreciation to the Fair Value." He developed the idea, presented by John W. Alvord and others before the American Society of Civil Engineers, of the depreciation fund as a trust fund; holding that renewals must be made out of earnings, that the unfairness of making the consumers of one year pay the entire cost of renewing a long-lived part replaced that year made necessary the setting aside of substantially equal annual installments, and that these installments must be wisely invested to produce the proper amounts at the required time. His formula for the basis of fair value was cost new minus depreciation (including accrued as well as actual) plus depreciation reserve. If the latter had been dissipated in dividends it was not entitled to earnings. He thought, however, that no deduction should be made from utilities that had not in the past collected accrued depreciation, as the stockholders had certainly withdrawn nothing from the business.

James E. Allison, consulting engineer, St. Louis, made an energetic argument for the railroad point of view, that there is no depreciation in a composite plant of perpetual life, if properly maintained. What he emphasized especially was the utter unreliability of estimates of expected life, and the failure of engineers to bring out this point forcibly.

Drawing the Curtain on the Past

Prof. John Bauer, Cornell University, argued from the agency theory. He held that in some

cases capitalization of earnings that should have been made and were not would produce a total fair value on which the utility simply could not make a fair return, while in others the deduction from value of exorbitant past earnings would reduce fair value to nothing or an actual liability; that ever since the case of Munn vs. Illinois was decided the public had had the right to hold the utility to reasonable returns only, and that the investor since then had always assumed the risk that the public would exercise its right—in other words, that he had had his day. Professor Bauer would therefore draw the curtain on the past, forego, in the interests of broad justice, futile attempts at individual justice, and adopt a policy for the future that would be as near automatic as possible, holding the utility strictly to a reasonable return.

In the open discussion that followed A. M. Sakolski of the Delaware & Hudson Company valuation committee asked Professor Bauer how he would insure the utility against less than a reasonable return. Professor Bauer asserted that the return could be earned if the existence of the utility were justified and the property were properly managed. Another agency enthusiast proposed that if between rate revisions, even after the desired regulatory system was in full effect, a utility were found to have made too much, it be compelled to repay this by a corresponding reduction in return at the next revision. It was pointed out, however, that such a scheme would hardly encourage good management.

Mr. Eshleman reminded the conference that inducements must be held out for future capital, with greater compensation for greater risks. Having this in mind, he would not attempt to apply future rules rigidly to the past, but would apply them as far as possible within reason. The investor, he said, was entitled to get his capital back and a fair return, but could only have such return as the public could supply the service for, otherwise public ownership was inevitable.

Going Value

Gen. Morris Schaff, of the Massachusetts Board of Gas and Electric Light Commissioners, who presided over the Friday afternoon session on "going value," stated in a brief address that the policy of his commission to allow operating costs, full depreciation, ample and generous profits to good management, and ample allowance for contingencies (this was perhaps the only mention of contingencies in the convention), resulted in few disputes. He made two suggestions, that the financial history of the utility be carefully studied, and that distinction be made between competitive and monopolistic properties.

Clifford Thorne, chairman of the Iowa Board of Railroad Commissioners, read the main paper on "going value." He held that going value consisted of actual development costs and enhancement of value of plant from use since development. He would not allow return on the latter, and to recognize the former he would require proof of early losses not compensated since by excessive returns. In any event, he would recognize the deficits of only the first few years.

Mr. Thorne thinks neither reproduction cost nor original cost should be the sole basis for "fair value," which he concedes is only in the process of being defined. He thinks that original cost is the most effective guide, but that reproduction cost may be important.

William J. Hagenah, public utility statistician, Chicago, disagreed with Mr. Thorne that only the early experimental stages should figure in going value. He held that with the increasing operating costs of utilities, the declining purchasing power of money and the general extravagance of the last generation going value was constantly increasing. He cited the municipal utility in the fast-growing Western city, constantly compelled to extend its facilities into undeveloped sections, and never catching up so as to be in a position to prosper with the community.

Constitutional Protection in Valuation

Friday evening, at the dinner which terminated the conference, Charles A. Prouty, director of valuation, Interstate Commerce Commission, spoke on "The Meaning of the Constitutional Protection in Valuation." There is a twilight zone, he said, between the maximum rate, which the legislative body must fix, and the minimum rate, which the courts decide is confiscatory, and in this zone the rate-making power of the commission, the courts have at last conceded, is supreme. Before the commission, then, can fulfill its duty here it must know the value of the property of which it would fix the rate. The courts will presumably interfere in valuations only in questions of law, or to prevent confiscation, where a valuation has been placed in evidence in some suit involving a rate. The court, it is believed, will not set aside valuations simply because the judge is of the opinion that the amount is too small, unless there be palpable or gross errors. Hence the welfare of the public utilities is largely under the control of the public-service commissioners, and it is of first importance that the utilities and the general public should unite in securing men of the highest grade for the positions.

Opinion Testimony

Prof. John H. Gray, University of Minnesota, spoke on "Opinion Testimony." He first reviewed the evolution of the rules of evidence which resulted in the admission, about 1800, of the opinions of scientists if based on facts testified to by others. As applied to valuation he said the so-called expert testimony of engineers was incompetent; that if value was related to any science it was the science of accounting or economics, but not engineering; that engineers were not trained to a knowledge of wealth or value, and that their expert testimony along these lines was universally regarded by economists as unscientific.

He held that they were not disinterested witnesses, being well paid for their opinions, and hence being in effect assistant counsel testifying. While the main objection to opinion testimony prior to its acceptance in 1800 was held to be the danger of the emotions of man affecting his opinions, Professor Gray thought the present effects of cold calculation more dangerous.

Professor Gray also felt that the public was always at a disadvantage in securing opinion testimony in railroad rate cases, because the railroads could combine and pay more for the testimony, and because eminent engineers feared to testify for the public because of its effect on their futures. Thus courts and juries were likely to be bowled over by the sheer mass of testimony.

The last speaker of the conference was Milo R. Maltbie, who spoke extemporaneously of the shortsightedness of the railroads in making demands which, if granted, would materially alter the public attitude in the future, which attitude, he said, was one of the utility's greatest assets. If, for instance, the roads were to be allowed returns on donated property, there would henceforth be less donated property; and if, as the railroads contend, there is no real depreciation, the public will deny them depreciation reserves.

American Road Builders' Association to Hold Convention in Pittsburgh.

The executive committee of the American Road Builders' Association, acting under authority granted it by the board of directors has decided to accept the invitation of the city of Pittsburgh to hold its annual convention there. The dates set are Feb. 22-25, 1916.

In order to supply the necessary facilities, the Pittsburgh City Council recently appropriated funds to put Mechanical Hall of the Exposition Building in shape for the convention. The building is located in the downtown district, on Duquesne Way, and is easily accessible to the leading hotels.

Bridge Patents Hearings Postponed

At the last session of Congress the United States Senate passed a resolution directing an investigation by a senatorial committee into the granting of patents to Daniel B. Luten of Indianapolis. The committee was duly designated and the first of the hearings set for Nov. 8. Notices of the hearings were sent to the interested parties, but despite the fact that interests in Iowa and Kansas were active in securing the passage of the resolution none of their representatives were present to proceed with the hearing. Moreover, only one of the members of the committee itself, Senator James of Kentucky, was present. Of the interested parties, only Daniel B. Luten and his representatives were on hand to proceed with the hearing.

The committee cannot meet until there is a quorum, which consists of four members, and it is likely that no further effort will be made to proceed with the investigation until after Congress convenes.

California Needs $15,000,000 More for Highway Construction

The systematic completion of the highway system in California depends on the outcome of the new $15,000,000 bond issue proposed by the Legislature at the session early this year, and which is to be voted on in November, 1916, according to a recent statement by Charles D. Blaney, chairman of the California Highway Commission. The $18,000,000 bond issue of 1910 will be insufficient to finish the work, as $9,000,000 of this sum has already been expended, $7,500,000 will be taken up either by contracts already let or for road construction in counties which have bought bonds, and the remainder will be required to cover other contracted work and the running expenses on the work now in hand. Trunk lines are being constructed in Siskiyou and Shasta Counties, and these counties, as well as Modoc, Lassen and Trinity, are in need of State lateral roads connecting the trunk highways, but more funds must be available, Mr. Blaney said, to carry on this work as well as necessary construction in other parts of the State.

Tornado Does Heavy Damage in Middle West

A wind and rain storm that swept over Central Kansas, South Dakota and Nebraska, Nov. 10, caused the death of several persons, the injury of many others and a property loss amounting to several hundred thousands of dollars. Great Bend, Kan., was the greatest sufferer. The storm came up with scarcely any warning, damaging the waterworks and electric light plants and doing considerable damage to buildings. The excessive rainfall prevented a heavy loss from fires.

Technology Group to be Dedicated June 14, 1916

Wednesday, June 14, 1916, has been set as the date for the dedication of the new group of buildings for the Massachusetts Institute of Technology on the Charles River Basin, Boston, according to the announcement of President Richard C. Maclaurin. The time selected assures a large gathering of graduates as class day, with its student festivities, falls on the preceding Monday, followed by the graduation exercises on Tuesday. It also coincides with the annual meeting of the federation of Technology Clubs, which will convene in Boston and that of the Alumni association.

Practically all of the stone work and carving in the group have already been completed. In the interior, the floors are being finished and the rough plumbing is practically all in place. In ten of the buildings the steam heating system is ready and three-quarters of the ventilating systems are in place.

Adds 1600 New Members in Four and a Half Days

(*Continued from page 643, first column*)

committee of the club. Realizing that a campaign of the proportions considered would fail unless skillfully managed, the club decided to call in G. S. Whitslar, who has had special experience in compaigns for increasing society memberships and for raising funds.

It was the judgment of the officers of the club and the membership committee that the addition of 1000 new members, considering the large engineering interests centering around Philadelphia, was not impossible, and that figure was set at the goal to be attained. It was decided further to make the campaign short—from the morning of Monday, Nov. 8 to 12.30 noon of Friday, Nov. 12. The initiation fee was waived for the occasion, while it was pointed out that the annual dues, now $35 per annum, would drop to $15 if 1000 new members were secured.

Organization

The campaign organization consisted of twenty-eight teams of five men each, the captains being selected for their acquaintanceship and energy. These twenty-eight teams were than divided into two divisions, the main contest being between these larger groups. Richard L. Humphrey, consulting engineer, was placed in charge of Division A, and S. M. Swaab, chief engineer of the Keystone State Construction Company, in charge of Division B. D. Robert Yarnall was in general charge of the details of the campaign, while Dr. Edgar Marburg, professor of civil engineering, University of Pennsylvania, acted as general chairman of the campaign membership committee.

As an incentive it was decided that the names of the men of the winning division should be inscribed on a large silver loving cup to be placed in the club house, while individual prizes in the shape of trophy flags and watch fobs were to be awarded to the captain of the team bringing in the largest number of members and to his team-mates.

In order to place in the hands of prospective members data as to the objects of the club and its advantages, a 12-page pamphlet was printed. Individual methods of campaigning varied greatly with the ingenuity of the members. Personal calls, letters, telephone and telegraph messages were resorted to at the judgment of the hustlers. On each of the five campaign days a luncheon was held at the club, and short addresses were made by those with faith in the movement, who might convey a message of hope and enthusiasm to the assembled workers. At these luncheons reports were made by the team captains. At the Monday luncheon 209 applications were reported, this figure probably representing some work done before the campaign was initially under way, for application blanks and publicity pamphlets were handed to members on the preceding Friday. At the final luncheon on Friday, Nov. 12, 651 new applications were recorded, more than three times the number reported on the first day of the campaign. When the captains reported it was customary for them to read off the names of especially prominent applicants, and the daily reports proved that one of the points determined upon in the campaign—to secure the membership of prominent engineers and those of engineering training who had graduated into executive work—was well achieved. On the last day of the campaign the applications of the general manager of the Pennsylvania Railroad and of the Philadelphia & Reading Railway were read. Moreover it was announced on the final day that every engineer in the employ of the Philadelphia Rapid Transit Company had been secured as a member of the club.

The Results

At the close of the campaign on Friday the returns indicated a total of 1672 applications, 831 turned in by Mr. Humphrey's division and 841 by Mr. Swaab's, making the latter group the victor. Later revision of the applications indicated a number of duplications, so that the official count was 1576. However, immediately after the close of the campaign, on Friday afternoon, a flood of holdover applications came in, and the committee in charge of the campaign decided that the duplications in the originally reported list would be filled out from the later applications, so that the team positions remain unchanged. Applications since the close of the campaign bring the total of new members to 1812. The team trophy for the largest number of members secured by a five-man group was awarded to team 7, captained by Richard L. Humphrey.

When at the closing luncheon it was announced that the names of all of the members of Mr. Swaab's division would be inscribed on the cup, Mr. Swaab most generously insisted that, since the results were so close and the members of Division A had done such valiant work, the names of all the workers of both divisions should be inscribed. Upon this being put to the vote, the members of Division B unanimously supported their chairman and by resolution the club endorsed the suggestion.

The closing luncheon was a most inspiring function, the most striking note being the tributes paid by representative speakers to the high purpose and self-sacrificing spirit of those who shouldered the burden of the campaign. The view was expressed, too, that the larger membership involved greater responsibility to the individual members, to the profession and to the community. Tribute was paid to the value of the publicity given the campaign in the press both of Philadelphia and of Eastern Pennsylvania. It appears that some seventy papers printed the publicity matter sent out under the direction of the campaign committee.



COMMITTEE OF ENGINEERS' CLUB OF PHILADELPHIA WHICH MANAGED CAMPAIGN RESULTING IN 1600 NEW MEMBERS IN FOUR AND A HALF DAYS

1, M. Bernstein, team captain; 2, H. A. Moore; 3, M. E. Hibbs, team captain; 4, E. W. Collins, of the Philadelphia Ledger; 5, S. M. Swaab, chairman of Division B, the winning side. 6, Richard L. Humphrey, chairman of Division A and captain of five-man team bringing in largest number of members; 7, Dr. Edgar Marburg, general chairman of campaign membership committee; 8, J. W. Ledoux (president of the club) team captain;; 9, D. Robert Yarnall, chairman in charge of details of campaign, team captain; 10, Dr. Carl Hering; 11, W. R. McLain; 12, F. X. Kern, Jr.; 13, Richard G. Develin.

Corpus Christi's 15-Mile Pipe Line Practically Completed

The new 20-in. supply main of the city of Corpus Christi, Tex., built at a cost of $300,000, which will bring water from the Neuces River, about 15 miles from the city, and increase the daily supply from 600,000 gal. to 4,000,000 gal., is practically completed. The new supply is in addition to that furnished by the old 6-in. and 8-in. mains that have brought water to the city from the same source for the past 22 years. In addition, a new pumping and filtration plant has been built at the Neuces River Station, so that all of the new supply will be filtered. The plans for the consulting engineer of New York City, and plant were prepared by Alexander Potter, it was built under the direction of H. A. Stevens, city engineer of Corpus Christi. Louis Lock of Monroe, La., was the contractor.

Membership of Testing Materials Society Showing Good Growth

An effort has been made recently to increase the membership of the American Society for Testing Materials at a more rapid rate than in the past. As a result of the efforts, since Jan. 1 of this year, 331 new applications for membership have been received, as against a maximum of 277 (in 1912) for any previous calendar year. The membership of the society is now 1962 and the committee feels that an increase to 2500 by the next annual meeting can be hoped for if the membership respond to the appeal for greater activity in this respect.

Application blanks and information regarding membership in the society can be secured from any member or from the secretary-treasurer, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia.

News of Engineering Societies

The Brooklyn Engineers' Club will hold its annual dinner Dec. 2.

The Engineers' Club of Philadelphia heard Morris Llewellyn Cooke, director of the Department of Public Works of the City of Philadelphia, speak on "Impressions of an Engineer in Public Office" at a meeting held in that city, Nov. 16.

The National Civic Federation will hold its annual meeting in Washington, D. C., Jan. 17-19, 1916. The annual dinner will be at the Hotel New Willard. Among the questions which will be discussed are labor conditions, employers' welfare work, educational opportunities, business ethics and political ethics.

The Illinois Society of Engineers and Surveyors will hold its annual meeting at the University of Illinois, Champaign-Urbana, Jan. 26-28, 1916. Papers will be presented on municipal work, drainage, pumping, rivers and waterways, office records and methods, surveying, concrete work, road construction and levees and bridges. E. E. R. Tratman of Wheaton, Ill., is secretary of the society.

The Municipal Engineers of the City of New York will hold a meeting in the Engineering Societies Building Nov. 24, at which John T. Fetherston, commissioner of street cleaning, will speak on "Snow Removal in New York City."

The Associated Technical Men, an association formed in 1914 for the purpose of furthering the interests of technical men, has commenced the publication of a monthly bulletin to keep all members of the society informed as to its progress and to acquaint non-members with the work it is doing. A. M. Wolf, 180 North Dearborn Street, Chicago, is editor of the publication.

The Cornell Society of Civil Engineers elected the following officers at its annual meeting, held recently in New York City: President, John C. Wait, attorney-at-law, engineering jurisprudence, New York City; vice-president, Joseph C. Hilton of Mason, Hilton & Company, engineers and contractors, New York City; second vice-president, Charles E. Curtis of Ithaca, N. Y.; recording secretary, William M. Aitchison; corresponding secretary and treasurer, Ernest A. Truran of Yonkers, N. Y. At the meeting it was announced that the society had 815 members enrolled.

The Engineers' Club of St. Louis discussed the design and construction of the Mill Creek sewer in that city at a meeting held Nov. 17. Clinton H. Fisk, chief engineer of construction, sewers and paving of St. Louis described the arrangement for carrying the alignment on top and under the ground, the types of construction plants used, the use of the pneumatic concrete mixer and conveyor and details of reinforced-concrete sewer work in wet sand. W. W. Horner, engineer in charge of design, sewers and paving, gave a brief history of the sewer system of the city, and particularly that of the Mill Creek Valley sewer. At a meeting of the club to be held Nov. 24 Admiral H. R. Stanford, chief of the Bureau of Yards and Docks, U. S. N., will speak on "The Pearl Harbor Dry Dock."

Personal Notes

JEFFERSON D. DAVIS, formerly superintendent for the Foundation Company, and later for the Jarrett-Chambers Company, on the Hunt's Point Terminal work in New York City, has been appointed superintendent for the Jarrett-Chambers Company on the Bear River improvement in Bear Lake County, Idaho. Previous to his connection with the Hunt's Point work, Mr. Davis was engaged in the development of oil fields in the island of Trinidad. Before that he was with the Empire Engineering Corporation of New York City, as superintendent on New York State Barge Canal work and in a similar capacity on the construction of a 2300-ft. reinforced-concrete wharf at Port au Prince, Haiti.

E. L. LANDORPH, formerly resident engineer of District 2 of the Manitoba division of the Canadian Pacific Railway, has been appointed resident engineer of District 1 of that division, with office at Kenora, Ontario.

P. M. LAU, formerly chief draftsman and resident engineer of Division 2 for the State Highway Commission of California and city engineer of Dunsmuir, Cal., has been appointed chief engineer of the Detroit Construction Company of Detroit, to have charge of interurban railway construction. Mr. Lau first engaged in engineering work in 1907 on the forces of the San Diego & Arizona Railway Company of San Diego, Cal., after a 3-year course in civil engineering at the University of Minnesota. In 1909 he entered the service of the San Diego County Highway Commission. From this work he went to the Detroit, Lansing & Grand Rapids Railway of Detroit, as principal assistant engineer in 1910. In 1911 he returned to California and was appointed engineer on bridge and road construction for the San Joaquin County Highway Commission. He entered the service of the State Highway Commission in 1912.

JAMES TOWNSEND TAYLOR, consulting engineer, of Honolulu, Territory of Hawaii, has been appointed consulting engineer to the water investigating commission to make investigations and surveys of the available water supply for the city of Honolulu.

GEORGE J. RAY, chief engineer of the Delaware, Lackawanna & Western Railroad, received the honorary degree of Doctor of Science at Lafayette College, Oct. 20. Mr. Ray was graduated from the University of Illinois in 1898 and entered railway service as rodman on the Illinois Central in June of that year. He attained the grade of roadmaster of the Dubuque division, in charge of engineering, maintenance and construction, in this service previous to leaving it, in 1903, to become division engineer on the Delaware, Lackawanna & Western, at Scranton, Pa. He was appointed chief engineer of this road in 1909. Perhaps the most notable achievement of his administration has been the construction of the Nicholson cut-off and the Tunkhannock viaduct. Mr. Ray is a director of the American Railway Engineering Association, vice-chairman of the committee on track and a member of the special committee on stresses in track. He is also a member of the American Society of Civil Engineers.

NORMAN C. SMITH, formerly draftsman for the Berlin Construction Company, fabricator of steel bridges, buildings, trusses and steel shapes, of Berlin, Conn., has been appointed draftsman for the McClintic-Marshall Company, manufacturer and erector of steel bridges and buidings, at its Rankin plant. Previous to his connection with the Berlin company, Mr. Smith was for a short time with the New York, New Haven & Hartford Railroad on the electrification work from New York City to Stamford, Conn.

J. L. STARKIE has been appointed assistant engineer of the Atchison, Topeka & Santa Fé Railway, with headquarters at Galveston, Tex.

E. F. KETTER, formerly city engineer of Mexico, Mo., and county surveyor and highway engineer of Audrain County, Missouri, is now with the Atchison, Topeka & Santa Fé Railway on valuation work in the offices at Topeka, Kan. Mr. Ketter finished his work as city engineer and county surveyor in May of the present year. During the period intervening since then and his present appointment he was engaged as engineer on the construction of a 7-mile electric railway extension at Mexico, Mo. He was graduated from the University of Missouri in 1908.

R. T. ROBINSON, resident engineer on the Ohio River bridge for the Chesapeake & Ohio Railway at Sciotoville, Ohio, left that work upon the completion of the 27 piers for the structure last month and is now at Rankin, Pa., in charge of assembling the river span trusses for reaming as they leave the shops of the McClintic-Marshall Company, the fabricator. In the spring, Mr. Robinson will return to Sciotoville, where he will have charge of the erection of the superstructure.

FRANK H. CONSTANT, professor of civil engineering at Princeton University, received the honorary degree of Doctor of Science at Lafayette College, Oct. 20. He was graduated from the University of Cincinnati in 1891 and served as assistant engineer in the contracting and estimating department of the King Bridge Company of Cleveland, Ohio, from that time until 1893, when he was appointed assistant engineer in charge of the design of structural work for the Osborn Company, also of Cleveland. In 1895 he became assistant professor of structural engineering at the University of Minnesota. He continued in that position until 1897, when he was appointed professor of structural engineering at the same university. He left the University of Minnesota to become professor of civil engineering at Princeton in 1914.

EDGAR M. LEDYARD, University of California graduate, and formerly a teacher in the agricultural college in the Philippine Islands, has been appointed head of the agricultural staff of the United States Smelting, Mining & Refining Company, which has interests in California, Utah and South American countries. Mr. Ledyard's duties will be to give expert advice and adjust claims of farmers in the vicinity of the smelters whose property has been damaged by smoke fumes.

ERNEST OWEN, formerly designer and estimator with the Riverside Bridge Company of Martin's Ferry, Ohio, has been appointed structural designer for the Gulf Refining Company at Port Arthur, Tex. Mr. Owen was graduated from the University of Pennsylvania in 1913 and was with the Riverside Company from then until the present appointment.

BURNS & MCDONNELL, consulting engineers, of Kansas City, have moved their offices from the Scarritt Building to the Interstate Building, Kansas City.

L. J. HOTCHKISS, engineer for the Bates & Rogers Construction Company, has opened a contractors' consulting engineer's office in the Monadnock Building, Chicago. For 11 years he was with the Chicago, Burlington & Quincy Railroad Company, successively as detailer, designer, assistant engineer and finally as assistant bridge engineer in charge of all permanent construction east of the Missouri River. Previous to his 2-year engagement with Bates & Rogers he was with the Foundation Company for a year, during which time he had charge of the Scotia dam and the foundation work for the Morgan Building in New York City. Mr. Hotchkiss proposes, in addition to consulting work on heavy construction, on plant layouts and on temporary structures, to make quantity surveys and estimates for contractors.

H. C. BUSHNELL, formerly engineer on the staff of H. E. Molé, consulting engineer, of the New York City, has been appointed mechanical assistant to the superintendent of motive power of the United Railways & Electric Company of Baltimore.

F. G. CAMPBELL, formerly resident engineer for the Chicago, Milwaukee & St. Paul Railway on the work at Oxford Junction, Kan., is now engaged in valuation work for the same company at Chicago.

BLAKE TAYLOR, formerly special district engineer of Grant District, Wetzel County, West Virginia and, more recently, in charge of street improvements at Berkely Springs, W. Va., has been appointed chief engineer of road construction under the $550,000 bond issue in Wyoming County, West Virginia. The work of location and design is already well under way and several miles of road will be ready for contract and construction in the early spring. The entire sum available will be used for bridges and grading purposes, and the question of metalling the main roads will probably be considered in a subsequent bond issue.

THORNTON W. PRICE, formerly designing engineer with the American Bridge Company and for the past two years in charge of a large part of the work on the Panama Canal Coaling Stations, has opened offices in the Woolworth Building, New York City, for the practice of structural and mechanical engineering. Mr. Price is a graduate of the University of Pennsylvania and was five years in the employ of the American Bridge Company, three of them previous to his college course and two after graduation. His work on the Panama coaling stations was done while with the Bergen Point Iron Works of Bayonne, N. J., with which company he was connected for two years.

FRED W. CLAFLIN, formerly resident engineer and superintendent of construction for the Cambria Steel Company of Johnstown, Pa., on its Quemahoning dam and pipe line, has been appointed assistant engineer of grade elimination for the New York, Chicago & St. Louis Railroad at Cleveland, Ohio. He was graduated from Massachusetts Institute of Technology in 1901 and served until 1905 with the division engineer of the Boston & Albany Railroad on grade separation, roundhouse additions, the construction of reinforced-concrete arch bridge over Cook's Creek at East Chatham, N. Y., and other works. In 1905 he was with the signal engineer of the Lake Shore & Michigan Southern, and, in the fall of the year, was traveling engineer, estimator and inspector of coal mines for F. C. Greene, mining engineer, of Cleveland, Ohio. He became connected with the Cambria Steel Company in 1906.

R. E. ANTHONY, formerly civil engineer for the Mountain Slater Supply Company of Philadelphia, has been appointed transitman on the plant enlargement work of the Pennsylvania Steel Company at Steelton, Pa.

T. KITAZAWO, professor of structural engineering at Nagoya Technological College, Nagoya, Japan, is in this country by order of the Department of Education of the Imperial Japanese Government to study bridge constructions.

CLIFTON E. VISEL has been appointed chief engineer of the mining department of the Montezuma Copper Company at Pilares de Nacozari, Sonora, Mexico. He was graduated from Sheffield Scientific School, Yale University, in 1908.

E. C. MEYER, civil engineer with the Trussed Concrete Steel Company, has been transferred from the company's Detroit office to the office at Youngstown, Ohio.

FRANK N. WILMOT, formerly connected with the Casper Ranger Construction Company of Holyoke, Mass., has been appointed to have charge of the concrete work on the new municipal cotton warehouses being constructed at New Orleans.

JOHN A. CROWLEY, formerly assistant engineer of construction with the Interborough Rapid Transit Company of New York City, has been appointed to a similar position with the New York Central & Hudson River Railroad.

GEORGE BRONSON REA, an American, editor of the *Far Eastern Review*, has been awarded the grand prize offered by the Chinese Government for the best program for a National system of railways. Schemes were submitted, it is stated, by British, French, German, Japanese and Chinese engineers, and Chinese Government officials have spent two years studying and comparing the plans. While the details of Mr. Rea's program have not been made public, it is understood that they call for the construction of twenty trunk lines, aggregating 11,000 miles.

Civil Service Examinations

United States.—An unassembled examination for a pulp and paper engineer, salary $3,500 a year, in connection with the Forest Service at its laboratory in Madison, Wis., will be held on Dec. 14. The duties of the position will be to direct the work of the pulp and paper investigations of the service. Applicants must be 30 years of age and must have had eight years' experience in the pulp and paper industry, or four years in laboratory research work. They should be, besides, familiar with the technical problems of the industry and with investigative work. Application blanks are to be filed, properly executed, at Washington, D. C., on or before Dec. 14.

Two other examinations for marine-engine and boiler draftsman and marine-engine draftsman for submarines, salaries from $4 to $5.04 a day each, in conjunction with the machinery division of the United States Navy Yard, New York, and the Inspector of Machinery, Quincy, Mass., and Busch-Sulzer Company, St. Louis, are to be held on Dec. 8 and 9 and Dec. 21 respectively. The duties relative to these positions are strictly technical, familiarity with steam turbines and gas and oil engines being requisite. Technical training, and drafting experience of from two to four years are likewise essential. The forms for application must be on file on the dates of the examinations.

In making applicaton for any one of the above positions candidates should address the United States Civil Service Commission at Washington, D. C., or one of the civil service boards in the principal cities, specifying for the position of pulp and paper engineer, form 2118; marine-engine and boiler draftsman, form 1312, and marine-engine draftsman for submarines, form 304.

Philadelphia.—The Civil Service Commission announces examinations for the following positions open to residents of the city, to be held on the days specified.

ASSISTANT ENGINEER, testing laboratory, Surveys Bureau, Public Works, salary $3,000 a year, to be held Dec. 10 and 13.

ASSISTANT ENGINEER, abolishment of grade crossings, Surveys Bureau, salary $2,500 a year, 25 years of age, to be held Jan. 13 and 14, 1916.

DRAFTSMAN, bridge division, Surveys Bureau, salary $1,200 a year, to be held Jan. 17 and 18, 1916.

Besides these examinations there are several others for minor positions, information for which may be secured by applying to the Civil Service Commission, Room 875, City Hall, Philadelphia.

Illinois.—Following the announcement published in the Engineering Record of last week, page 615, comes the report that the unassembled examination for waterways engineer, salary from $150 to $250 a month, open to non-residents, will be held Dec. 4, application forms to be on file in Springfield, Ill., on or before Saturday, Nov. 27. The duties of the position involve land surveying, supervision of waterways, dams and levees, and report writing. Applicants must be 25 years of age.

International Trade Conference to be Held Dec. 6-8

An international trade conference to commemorate twenty years of practical service to manufacturers has been arranged for by the foreign trade department of the National Association of Manufacturers, to be held at the Hotel Astor, New York City, Dec. 6-8. Papers will be presented by authorities on the several subjects and it is expected delegates from a number of foreign chambers of commerce and banks will take part in the discussions.

Business Notes

M. C. McNeil, formerly connected with the Westinghouse Machine Company and the Westinghouse Electric & Manufacturing Company, has been engaged by the Osgood Company, manufacturer of steam shovels, dredges and other equipment, of Marion, Ohio, to take charge of sales.

The Cleveland Galvanizing Works Company, manufacturer of weldless wire chain and chain products, of Cleveland, Ohio, has acquired nineteen parcels of land—a city block—adjacent to its present location, which will permit it to greatly enlarge its present plant and output as soon as certain leases expire. The property has a railroad siding and fronts on four streets.

The Clark Book Company, Inc., publisher of technical books, a new corporation, with offices at 27 William Street, New York City, has taken over the entire book business—copyrights, plates, sheets and bound copies—of the Myron C. Clark Publishing Company of 608 South Dearborn Street, Chicago, and will handle all books heretofore published by the latter company, together with some others.

The Canton Culvert & Silo Company, Canton, Ohio, has just published a set of specifications for corrugated metal culverts. These have been prepared with a view to co-operating with railway and highway engineers, contractors and others, in supplying them, for reference at least if not for adoption, a foundation for a comprehensive specification for culverts. The specifications are not limited to any single type, riveted or nestable, but rather present a choice of all that the company considers fair and good in the production of a first-class culvert. The various sections embody the experience gained by the company in studying metal culverts. One of the sections covers the analytical features which call for a pure iron, but the company explains that this may be omitted and the remaining clauses cover the best type of culvert construction.

Trade Publications

Raymond W. Dull Company, Chicago. Catalog, 6¾ x 10 in., 80 pages, illustrated. Contains a complete line of sand and gravel plant equipment—screens, elevators, buckets, cableways, etc.

James B. Clow & Sons, Chicago. Catalog, 9¼ x 12 in., 54 pages, illustrated. Covers primarily plumbing fixtures for industrial establishments; describes also cast-iron pipe, faucets, valves and public works fixtures.

Weller Manufacturing Company, Chicago. General catalog 20, cloth, 6 x 9½ in., 560 pages, illustrated. Complete in its subject of elevating, conveying and power transmitting machinery. Clutches, pulleys, transmission belting, elevators, conveyors, buckets, spouters, gears, chains, sprocket wheels, etc., are each treated separately, with complete description and information as to sizes, make, class, price, etc. There is appended as well useful information of the nature of mensuration and conversion tables, and also an alphabetical index covering the entire edition. The value of this catalog to the engineer and contractor lies in its completeness of efficient labor-saving hauling machinery, which should make it a necessary and profitable addition to their files.

Engineering Record

Circulation 20,000 Copies. McGraw Publishing Company, Inc.

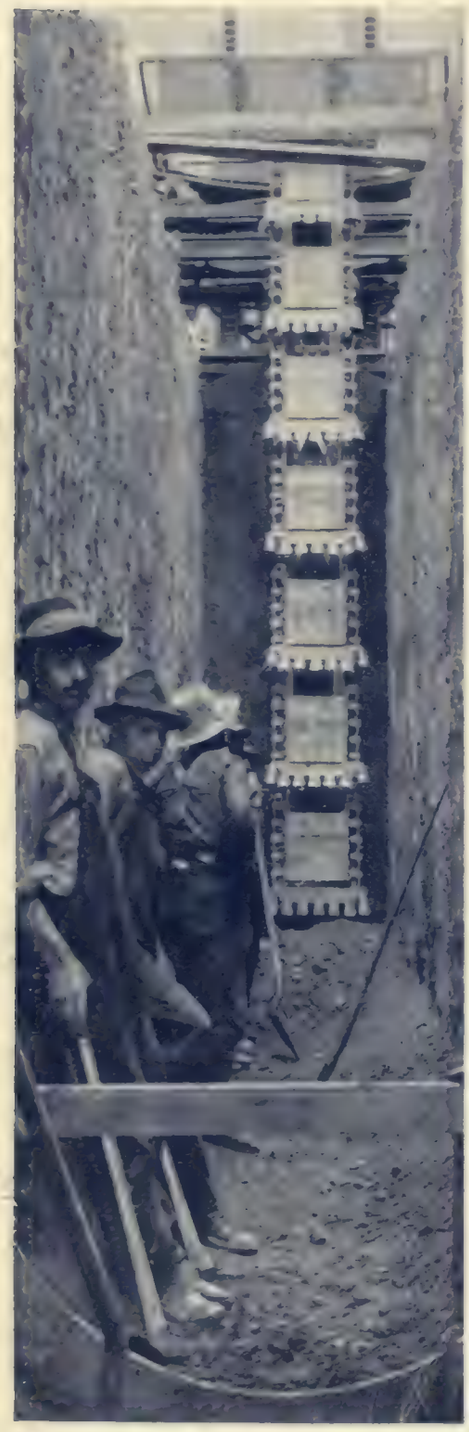
November 27, 1915



anges River Bridge, India

View of Girder Erection from Left Bank

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The "PARSONS" Trench Excavator

"The All-Purpose Machine"

It cuts down the trench gang to a mere handful, besides the pipe layers or concreters—for it leaves a clean-cut trench, ready for water main or sewer.

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A Call to Action—Steel Boom Menaces Cost and Even Actual Execution of Engineering Work

CIVIL engineers and contractors throughout the country have been watching the phenomenal advance in steel-mill activity without realizing that they are soon to be actors in the great drama and not merely spectators. The steel industry will in 1916 play a most important part in the cost and execution of all engineering work. Already prices have increased greatly. The trend is still sharply upward and the rounding of the curve is nowhere in sight. On the contrary, the awakening of the country's domestic business, coming at the same time as the large, and always increasing, volume of war orders, may send the market considerably higher. If the war should end quickly, the situation would change at once, but the safer course is to assume that hostilities are to continue.

Nor is the cost of next year's work alone at stake. The steel industry may determine whether work is to be done at all. The reason is on the surface. Already many mills are sold up to capacity for three or four months, while not a few are committed for their entire output until the second half of next year. That presages not only shortage of the actual steel materials entering into construction—such as shapes and reinforcing bars—but of plates, angles, rounds and other products essential to the manufacture of contractors' equipment. Already one manufacturer reports that the best delivery he can get on rounds for car axles is three months, while fifteen to twenty weeks is the quoted delivery on other finished steel products. Fortunately, equipment and machinery manufacturers are fairly well stocked, but the fabricated and partly fabricated equipment in hand was probably never lower. The first spring rush will consume the supplies now awaiting fabrication, and then will come delays that may be serious enough to cause the postponement of many an important and pressing job.

In the structural field reports from Pittsburgh show that the fabricating shops, too, have felt the pressure, due, of course, largely to the domestic revival. Practically all of them are filled up for the next four to six months, except as to heavy shapes. Some relief is possible from increases in capacity, but this is not expected to make any material difference.

It is the engineer's turn to think fast. The first man to let contracts for next year's work will be the most certain to have them executed and will get the lowest prices. In November many bond issues were voted. There should not be an instant's delay in starting the machinery moving toward the closing of the contracts.

The contractor no less than the engineer needs to understand the gravity of the situation. He would best be in close touch with the equipment manufacturers. He is not likely to commit himself for a new plant until contracts are in hand, but when time for action comes he must know where he can get what he needs, and how soon.

The manufacturers are fully awake to the conditions. They are doing all they can to secure adequate stocks of steel, but belated orders for equipment are almost certain to be accepted only on long delivery terms or to be refused. Then, too, the prices on them will necessarily be higher than for early purchases, though higher price levels must be expected even for the first deliveries.

This is not a time for speculation or procrastination. Where work is authorized, engineers owe it to their clients, municipalities, companies, to let the work just as soon as possible. Where work is imperative, but plans are not yet made or authority secured, the necessary machinery must be started at once. The penalty for delay promises to be severe.

Prosperity

WAR orders have received all of the credit until recently for the very great activity in American industry. It is being appreciated now, however, that there is a general business awakening. Fundamental conditions are excellent. The value of this year's crops over those of last year is over half a billion dollars. This is a pretty good basis for optimism. Railroad earnings are up and the carriers, long out of the market for equipment and renewal supplies, are spending more than they have for a couple of years. Inquiries made of this journal indicate that a busy year can be expected in 1916 in municipal and public engineering activities. The situation will be affected, of course, by the higher prices which supplies will command, and by the likelihood of a labor shortage. The general prosperity, however, will not be much affected. An early close of the war will have the effect of putting a brake on industry, yet many war orders have been taken on the basis of completing delivery, no matter when peace is declared. Industries, too, are preparing themselves as best they can for the reaction which peace must to some extent bring. Altogether, however, the outlook for 1916 is most encouraging.

Strong Local Societies

LAST week the Engineering Record had the pleasure of chronicling the great achievement of the Engineers' Club of Philadelphia in quadrupling its membership in a week's time. This week it presents some striking paragraphs from an address delivered by A. J. Himes before the Cleveland Engineering Society. Mr. Himes has made a strong point: that the strengthening of local societies adds to the influence and membership of national organizations. The strength of an association, a company or a nation is predicated upon the strength and unified action of individuals. Affiliation of the local branches of national societies is a necessary step if the profession is to win a larger place in the nation's life. The way to success in such affiliation has been partially pointed out by the successes in Boston, Philadelphia and St. Louis. The movement should—and must—become general. With the enthusiasm being shown in local organizations at the present time rapid extension of the idea is to be expected within the next year. Mr. Himes has stated the points well. His words deserve the thoughtful consideration of engineers individually, of local bodies and national organizations.

City Manager and Publicity

IF the city-manager form of government is to endure it must develop new means for diffusing knowledge of public activities. As a large portion of these are of an engineering nature, engineers will be called on to supply the necessary information. Those at the head of the movement already see the necessity for some more effective agency than has yet been tried to educate the public to a proper appreciation of what the new form of government is doing for the individual and for the city. The more efficient the government becomes the less impersonal and "colder" it gets. Moreover, the concentration of authority and responsibility in one person focuses on him all the complaints and criticism. No man or no system can stand up against the storm. Safety lies only in dispelling the clouds of

ignorance by educational methods. Engineering facts and budget figures, however, do not make newspaper stories unless the engineer takes pains to point out the head line around which the "story" can be written. Good continuous publicity probably cannot be obtained by every engineer, and certainly not without cost. It requires special talent and aptitude—for which there is always a ready market. Someone must be found with engineering knowledge and with newspaper training to put flesh on the bare bones of engineering facts. It can be done, but the price is not low.

The War and Record Covers

FOR many years a striking red cover has been intimately associated with the Engineering Record. In fact, the phrase "Record Red" expresses to engineers and contractors widely the distinctive shade that the journal has made familiar by its weekly visitation. Now, however, the war threatens to endanger the continuance of this distinctive mark. The impossibility of securing dyes from Germany has resulted in the exhaustion of the particular aniline product used by the paper manufacturers in coating the stock for the Engineering Record covers. A number of mills have been experimenting with substitute products for some time in an endeavor to duplicate or approximate "Record Red." The experiments have proved unsuccessful. A limited supply of red ink is still obtainable, and beginning with the last issue double printing was resorted to. It will be noted that the inside of the covers is now white. How long the supply of red ink will last is problematical, but it is not unlikely that there will be some change in the color scheme.

It is worth mentioning for the information of those who have not followed the aniline situation, that the color supply generally, or such of it as depends on an aniline base, is very low. Manufacturers of clothing have been feeling the pinch for some time; and fast blacks and fast blues in wearing apparel of all sorts, if the war continues, will probably disappear entirely within six months. Not only will the Engineering Record, then, have to change its dress, but all of us may have to resort to lighter colored clothing than past convention has looked upon with approval.

Paving Repairs Over Water-Main Trenches

ALLOWANCES for payment for paving repairs over water-main trenches as made by many municipalities to arbitrary limits regardless of subsurface conditions encountered, are in large part responsible for the poor condition of some city pavements. In one very large city, for instance, payment is made for paving to one foot on each side of the interior diameter of the pipe. In the case of pipe under 12 in. in diameter, under average conditions, such payment is adequate. In the case of a 12-in. pipe it is liberal. In the case of a 20-in. pipe it is deplorable, and in the case of a 48-in. pipe it is absurd.

A contractor laying a 6-in. pipe in sheet asphalt would cut probably 18 in. of paving. This would give him ample room for laying the pipe and calking the joints. The paving company would demand 6 in. additional width for trim. This would give him a 6-in. overpayment under perfect conditions which would make up for greater widths he would be compelled to pay for at worse spots. A 12-in. pipe can be handily laid and calked in a 20-in. trench. This gives the contractor almost a foot of extra allowance.

A 20-in. pipe, however, requires at least a 26-in. width of trench, with bell holes every 12 ft., for this pipe is too large for one calker to get his arms around; he has to "buddy" with another. When all cuttings are taken into account it will be found that there is practically no allowance for "bad going" or wash-outs due to storm. A little loose material, such as is encountered in a filled street, or a little undermining due to water entering an unfilled trench, will be sure to make the contractor's paving bill exceed his payments for that item.

A 48-in. pipe would give him a 6-ft. width allowance. It might be possible for him to get his pipe down and calked in a 5-ft. cut and bell holes, but there would be delay in lowering almost every pipe and the operation would be costly. The logical width for such a cut would be about 5½ ft. Taking into consideration the allowance for trim, it is evident that he is skinning the very edge of his allowance. But, sufficient though this would seem, there is a still greater objection to holding the contractor down to such a width. A pipe of this size will ordinarily require a depth of trench of 8½ ft. When the pipe is laid the backfill must follow. Specifications are very rigid as to the proportion of tampers to shovelers. But, rigid as they are, they connot make it possible for the fill under the middle of the pipe to get much more than an accidental blow at infrequent intervals. The bulge of the pipe, reaching to a distance little more than ½ ft. away from the side of the trench only 2½ ft. from the bottom makes it impossible for the tamper to get his iron in. The result is a soft spot, which later leaves a void, and causes settlement of the pavement.

This method of paying for pavement restored over water-main trenches is not only inadequate, but illogical. It contributes very largely to the percentage of holes in the city's pavements and encourages undermining, the sly placing of a prop under a slab of paralleling pavement that has cracked some distance away from the cut and a trust-to-luck attitude on the part of the contractor that is harmful both to him and to the work.

It would be better for the municipality to take care of the paving restoration itself, or by a contract apart from that for the pipe laying. Allowable widths of trench could be determined in the field, after the subsurface conditions were revealed. The contractor could be rewarded by a bonus for every yard he saved within such limits and penalized for every yard by which he exceeded them. There may be methods better than this, but this is certain, that the present method of paying to arbitrary lines without regard to actual subsurface conditions is costly to both the city and the contractor.

Shall the Irrigation Settlers Be Given Relief?

ELSEWHERE in this issue is a letter regarding the Engineering Record's position on the present status of the United States Reclamation Service. The views expressed by the correspondent (a water user, known to the Engineering Record, who conceals his identity lest he be accused of toadying to the present administration of the Reclamation Service) are in opposition to those held by this journal. He represents what probably is the prevailing opinion in the arid West and, therefore, deserves careful consideration. Yet it must not be forgotten that the water users are parties in interest and that their views on that account may justly be suspected of being prejudiced.

Since the editorial of July 31, on the "Changed Reclamation Service" was written, the Engineering Record has secured further information—partly by personal contact with men in the irrigated sections—and has no reason for altering the views already expressed. It admits, however, to a deeper sympathy with those—and their number is few—who have located on holdings that could not under any circumstances be made a success.

Recently it has been proposed that further measures of relief—in addition to the 20-year extension law passed by the last Congress—be given the settlers. Some advocate a further extension of payment, others that loans (rural credit) be granted the water users, and others that the cost of construction chargeable to the irrigated lands be considerably reduced. It is quite likely that some of these remedies may be proposed in Congress in the near future, and a discussion of the situation is therefore timely.

THE CAUSES

It has been maintained by this journal that the irrigation troubles are due to the inexperience of the settlers in irrigation farming, to lack of capital and of the pioneer spirit. Regarding inexperience, there is no dispute. Even the West admits it. Again, as to lack of capital, there is but little argument, although it is contended that conditions should have been made such that the poor could have succeeded. The point recurs later in this argument and will be passed over here.

The lack of the pioneering spirit is apparent in many of the irrigators. Confident that irrigation farming was a get-rich-quick scheme that could not fail, they were unprepared mentally for wresting a living from the forbidden lands, for pushing back the borders of the desert, for raising a community from a barren waste. In all time, this has been the work of those who expected hardship and loved it. They may

have been spurred on by the hope of getting rich quick, but at least they harbored no delusion that the road was an easy one.

As a result of the mental attitude one could have predicted the outcome—some dissatisfied men, some chronic complainants and agitators.

But are there not hard-working, deserving men who have failed utterly? Undoubtedly—and many of that class have still a hard struggle ahead. The trouble in these cases is generally lack of capital; and indirectly the agitators blame the Government for the shortcomings, financially and in ability, of its citizens. They say that the irrigation projects should have been planned so that a man with small capital could have succeeded. Yet everywhere in the irrigated sections are farms side by side where one man starting with ample capital has lost it all, and his neighbor, beginning with a thousand dollars or less, is to-day a prosperous farmer, or at least clearly sees his salvation ahead. The human element and not capital is the all-important factor. Yet little or no reference is made to it in the West, and nowhere, except from one or two of the strongest men, does one get the radical but businesslike suggestion that the Government be allowed to choose its settlers, to refuse to take those who seem foredoomed to failure.

Venture Unbusinesslike

What is very apparent is that the Government's venture has been very unbusinesslike. It has gone on the assumption that the sum of its duty was to provide the engineering structures for the storage, diversion, distribution and control of the water. This is but one element in successful irrigation. A soil agriculturally good, land leveled and drained, farms well stocked and equipped, crops adapted to the climate, farming methods suitable to the country and to the crops, competent irrigators, and last, but by no means least, good markets and marketing are needed. Theoretically, one would think that a business organization would have investigated every angle of the situation, would have weighed each factor and would have proceeded on strictly business lines. But this is theory. Experience shows that business has fared no better than the Government. Scattered over the West are the wrecks and partial successes of private projects. In fact, the really successful private projects can probably be numbered on the fingers of one hand. Where private capital has so strikingly erred, shall the Government be taken to task?

Unfortunately both the Government and the private interests seem to have regarded irrigation as they would a manufactured product, to be finished in a brief time and then turned off to the purchaser without a further thought from the creator. Irrigation work, however, is a development, a growth. Fifteen years is a minimum for its swaddling age. All parties have failed to realize this, and disaster, at least when measured by the rosy hopes of 10 years ago, has been the result.

But we have learned much. Without a doubt Government projects, if started to-day, would be handled differently. The Government (and private irrigation companies, too) sold the settler a factory unequipped, and the settler was unable to furnish the machinery, or only at a very slow rate. Consequently, there has been overhead but no income. Theoretically, it would have been better to have doubled or trebled the investment, so that there might have been an opportunity to get back the carrying charges and make a profit. The State of Victoria, Australia and the Canadian Pacific Railway have so argued. They level the land, build a house and necessary barns, and provide even the stock and equipment. The settler has a fully equipped factory when he moves on the place. He is ready to start earning at once. There is hope in such a program. The settler has not a five-year fight with nature and his unequipped factory ahead. But note, too, that Victoria and the Canadian Pacific pick their settlers, refusing to sell to those who do not promise well.

Something for Nothing

It is argued in the West that if Victoria and the Canadian Pacific are doing this that the Government of the United States should do likewise. But there is a great difference. In Victoria and in Canada the settlers know that they cannot escape paying for what they get and that meanwhile they must meet the interest on the unpaid balance. On our projects, encouraged by agitators and politicians, the settlers hope to escape a large part of the cost and to unload it on the general treasury of the United States. In fact, many water users predict that if they fight long enough they will have nothing to pay. And in this they are making progress. While presumably they are still to repay the cost in 20 years (instead of in 10, as under the original act), actually they pay interest on the Government's investment for 20 years and then get the works free. They are hoping, too, that the cost-review boards now reporting will help in the process of unloading part of the cost on the Government. The hearings before some of the boards have been disgraceful contests, in which counsel (without a regard for the intent of the Reclamation Act and the compact between the settler and the Government) aided and abetted by inexperienced engineers, have tried to discredit every feature of the projects and to have millions written off. These millions written off, of course, would become a gift from the country at large to the individual settler.

Under these circumstances how can one recommend the Victorian system for this country? It would give the agitator and the politician a still greater stake to play for. Particularly would such a plan be undesirable in this country, where the public would probably not be willing to allow the Reclamation Service to pick its settlers in accordance with their competence.

On one point, though, the Engineering Record agrees with the contention of the water users, that the leveling of the land should be done—or rather should have been done—by the Reclamation Service. This is a very heavy expense and is one of the principal factors in preventing the land from quickly being placed in cultivation.

Relief and Loans

The pertinent question, of course, is what shall be done for the relief of settlers on existing projects. The observation of the Engineering Record indicates that the earnest workers, those who intended to farm their holdings and were competent to do so, are working out satisfactorily. Many of them have had a severe struggle; others are not through yet. The desirable element, by and large, however, is not discouraged, and believes that the dawning day is not far off. In cases where land obviously impossible to cultivate, on account of seepage or other adverse conditions, has been taken, the settler must be moved to holdings where it is possible for him to make a living and work out his salvation. In some of these cases, probably, the settler has lost much. This is unfortunate, but it is impossible to see how any relief can be given. Both the Government and the settler were in good faith. Someone's judgment was wrong.

As to a scheme of farm loans to irrigation settlers, the Engineering Record is very strongly against it if it is to be administered by the Reclamation Service. The settlers have been brought to believe that what they get from the Government through the Reclamation Service can by suitable agitation be gotten for nothing or for less than value. There would be grave danger, if farm loans were made, that there would be an effort to have them repudiated. The Engineering Record is not opposed to the principle of rural credits, but it holds that the management of a rural-credit system must not be in the hands of the Reclamation Service, but in a banking department of the Government. Then the water users would realize that they were dealing with a bank and would have to meet principal and interest in full. To grant such loans through the Reclamation Service would only result in new attempts to get something for nothing from the Government.

Finally, as to the doubts expressed by this journal regarding the future of the Reclamation Service under the present management, a bigger question mark must be written to-day than on July 31. Then the Engineering Record expressed doubts merely, and emphasized the view that the plan was not necessarily an impossible one. Matters, however, seem to have gone from bad to worse, and one must wait longer before passing judgment on the situation growing out of the establishment of the Denver office.

The Engineering Record cannot follow the urging of its correspondent to support the present administration. In fact, this journal would not be surprised if the Secretary himself were losing faith to some extent in the Lane policy. If he read the records of the hearings of some of the review boards he will be disgusted by the recital, by the spectacle of men trying to repudiate their obligations to the Government. Such a reading will likely make him question the advisability of still further softening the terms under which the irrigationists are working.



MATERIAL FORCED INTO CANAL FROM EAST SIDE OF CUT IS BEING REMOVED BY DREDGES

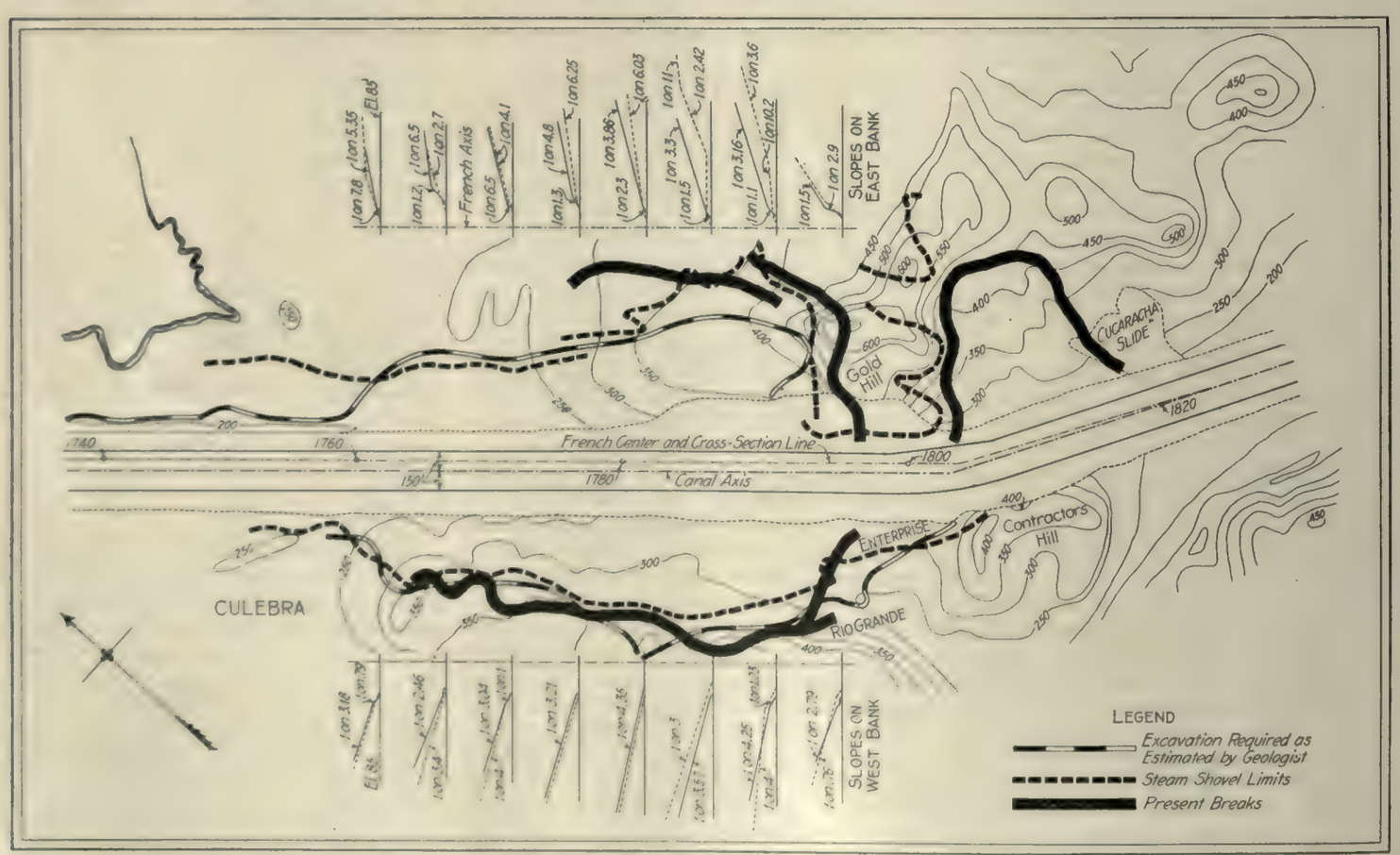
Ten Million Yards of Material Must Be Removed to Stop Panama Canal Slides

General Goethals, in Report to Secretary Garrison, States That, by Rushing Work on Ship Channel, Canal Need Not Remain Closed Until Dredges Have Excavated All Material—Complete History of Slides Outlined

ALTHOUGH he estimates that 10,000,000 cu. yd. of material must be removed before slides at the Panama Canal will be permanently checked, Gen. George W. Goethals, in an exhaustive report submitted to Secretary of War Garrison Oct. 26, lays emphasis on the fact that the canal will not be closed to navigation during the entire period this work is in progress. All efforts are now being directed toward opening up a ship channel wider than the full prism width and dredges are now at work handling nearly 1,000,000 cu. yd. of material a month. On Oct. 6 the length of channel blocked was 1300 ft., and was reduced to 700 ft. at the time General Goethals made his report. Continued movement of the material, however, has made it impossible to break through the closure in the vicinity of Sta. 1787, which is now about 100 ft. in length. By permission of the Secretary of War General Goethals' report is printed below in full:

FULL TEXT OF GOETHALS' REPORT

The following report is submitted on the slides which have closed the canal to navi-



EXTENT OF EXCAVATION AND BREAKS AT CULEBRA CUT FROM OCTOBER, 1913, TO OCTOBER, 1915

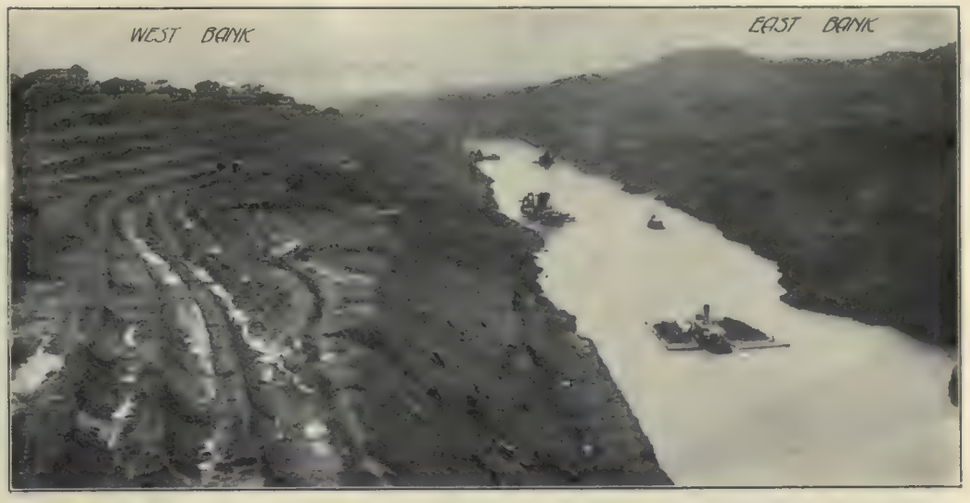
gation. On account of the importance of the subject, I deem it advisable to make a comprehensive report, even at the expense of repetition of the matter contained in previous documents on the subject.

The slides which developed during the construction period were of three distinct types. The first were due to the moving of material from the sides of the prism or cutting, when these were left by the excavation at a steeper slope than that at which the material would remain at rest.

In those of the second type porous material mixed with clay, small rock and spalls, overlaid smooth surfaces of rock or other impermeable substances, harder than the overlying mass, which sloped toward the axis of the canal. In excavating the prism through these sections the removal of the lateral support, combined with the effects of the water permeating through to the underlying inclined strata, resulted in the sliding of the material into the excavated area, the rains assisting and accelerating the movement.

The slides of the third class were designated "breaks," and were of two kinds, best described by the localities—those in the vicinity of Culebra and those at or near La Pita Point. In the former the first manifestation was a crack in the surface of the ground, generally parallel to the axis of the canal, with the ends running to the edge of the prism. This cracking was followed by a depression on the side of the crack away from the cut, and a movement of the mass between the crack and the canal into the excavated area. The sinking movement on the top was accompanied by an upheaving of the bottom of the prism. The cause of these movements was attributed to the poor quality of the underlying rock, which was intersected by vertical seams or seams sloping toward the canal. As the material was excavated not only was the lateral support removed, but the load distribution was changed to an extent that caused the rupture of the underlying weaker strata. After the break the movement into the cut was like an ordinary slide of the first and second classes, though the cause was entirely different.

The breaks in the vicinity of La Pita Point consisted of the moving or pushing out and a subsequent settling down of sections of rock masses which formed the banks; three such breaks occurred and were due undoubtedly to water pressure from the Obispo or East Diversion channel. This source of trouble has been relieved by turning the waters of the channel into the cut.



BENCHES WERE EXCAVATED ON EAST AND WEST BANKS AT CULEBRA IN 1913

The first class of slides gave but relatively little trouble, even during the construction period, and ceased when the material assumed its natural slope. In anticipation of other possible movements of this kind, slopes which seemed too steep have been flattened by use of an hydraulic grader and by starting vegetation where the soil warranted.

CUCARACHA SLIDE CAUSES TROUBLE

Considerable difficulty was experienced with slides of the second class, and the most notable example was the one at Cucaracha, just south of Gold Hill. The only method of handling them was to allow the material to enter the prism and remove it from below, for the adjacent ground did not lend itself to handling the material in any other way ,and attempts to hold the banks by piling, rock covering, or drainage, failed. The slide of this class at Cucaracha consisted of clay mixed with rock and rock spalls moving into the cut, the movement resembling the action of a glacier.

The sliding began during the operations of the French company, and continued to cause trouble until the early part of 1912, when it became quiescent. The material in moving left exposed a mass of rock which the geologist assured us was of ample strength to hold back the clay and other material remaining on the hillside above it. The indications were that the future trouble in this locality would be limited in extent, and caused by small masses of clay washed down by rains or from the usual erosive action to be anticipated in this climate.

These expectations and predictions were not realized, however, for on Jan. 20, 1913, following a few days after a rock movement from the south face of Gold Hill, the rock support broke at some part of its structure near or below the bottom level of the canal, and a mass of clay and rock moved into the cut, completely filling the prism across its entire width and up to a bench that existed along the west face at the 69-ft. level.

The length of the canal blocked by this earth movement was approximately 1600 ft., and the quantity of material to be removed was estimated at 2,000,000 cu. yd. The slide was attacked by steam shovels located on the 69-ft. level on the west side and on the bottom of the 40-ft. level. As the excavation proceeded the material broke away from the higher elevations on the face of the hillside and moved down into the prism.

RELIEVE PRESSURE BY SLUICING

An examination of the top of the hill indicated that there were large masses of clayey material remaining that would eventually move into the cut. The topography of the country lent itself admirably to sluicing operations, by which a large part of the material near the top could be washed into a valley to the east. A sluicing plant was available, and steps were taken to draw off to the east side of the ridge as much of the clay as could be reached by the nozzles of the sluicing plant, and thus relieve the situation in the prism itself. This was successfully accomplished.

The balance of the cut, about 8½ miles, was nearing completion; steam shovels were concentrated at Cucaracha slide and as many were worked as available space permitted. In February eight of them removed 168,677 cu. yd.; six shovels working in March and April removed 203,030 and 204,308 cu. yd., respectively, but these were dry season months. The rainy season reduced the output of the six shovels in May to 148,000 cu. yd. and in June to 124,844



MOVING MASSES OF EARTH FORMED WAVES AT SURFACE



BROKEN-UP CONDITION OF MASS OF SLIDES PRECLUDES USE OF STEAM SHOVELS



HOW THE WEST BANK OF THE CANAL CRACKED DURING MONTH OF JUNE, 1915

cu. yd. The expectation of reaching the bottom at this time had not been realized. Difficulty was experienced in maintaining tracks, not only at the slide but on the dumps, due to the character of the material that was handled. The cost of removing 921,000 and 808,000 cu. yd. during the last two months, respectively, from the entire length of the cut, including Cucaracha, was 62 and 66 cents per cubic yard, respectively. With Cucaracha alone remaining the difficulties and cost would be increased.

There was a dredging fleet available capable of handling larger quantities of material than the shovels; the dredges could work 24 hr. a day, while the shovels could not work to exceed 12 hr.; the excavation could proceed without delays due to upset of steam shovels and disarrangement of tracks, and the material could be dumped in the Gatun Lake. Thus all indications pointed to dredging as the best means, both as to time and money, for the removal of the remaining obstruction. This course was taken.

The steam shovels operating at Cucaracha slide from Jan. 20 to Sept. 11, 1913, removed a total of 1,139,708 cu. yd., or an average of 142,463.4 cu. yd. per month. The dredging operations began on Oct. 23, 1913, and up to Aug. 3, 1914, on which date the first boat went through the canal, the dredges removed 2,767,080 cu. yd., or an average of 286,239.78 cu. yd. per month. The cost of the steam shovel work at Cucaracha was not separated from the remainder of the work in the cut, but the total of 8,225,989 cu. yd. removed during the period under consideration was done at an average cost of 65 cents per cubic yard, while the cost of the dredging averaged 44 cents per cubic yard. Active operations at Cucaracha slide ceased on Oct. 14, 1914, on which date the total amount removed by steam shovels and dredges since Jan. 20, 1913, was 4,679,238 cu yd. In addition, more than 1,000,000 cu. yd., which would have gone into the cut, were removed by sluicing operations at a cost of 20 cents per cubic yard.

BREAKS AT CULEBRA

The first break in the vicinity of Culebra occurred near the old Panama Railroad station in 1907, and affected but a few hundred feet. Subsequently, as the depth of the excavation increased, the breaks became more extensive, both in length and quantities of material involved. Furthermore, they occurred in both the east and west banks, until the upward movement along the bottom of the excavated area affected a length of 2000 ft. north of Gold Hill. As the cause was the unequal distribution of the pressure exerted by the adjacent banks it followed that by reducing the height of these banks the movements would cease or be reduced. Opposition developed to this method on the ground that more material would be removed than was necessary; that by allowing the material that broke off to move into the cut the minimum amount would be handled, resulting in reduced costs, and the material left to itself would assume its natural slope.

Two breaks occurred in rather rapid succession at Culebra in the latter part of 1910. As usual, each completely overturned the tracks at the bottom of the excavation, interrupted drainage, and seriously delayed operations in the prism. The later one of the two breaks determined the change in plan, and in January, 1911, the reduction of the height of the adjacent banks on either side of Gaillard Cut in the vicinity of Culebra was directed and begun. This work continued until December, 1913, at which time 6,533,924 cu. yd. had been removed from the east bank, and 8,797,990 cu. yd. from the west bank, resulting in slopes varying from 1 on 1.5 to 1 on 6.5 for the east side, and 1 on 2.46 to 1 on 4.35 for the west side. Those slopes were in a series of benches. The result of this method of procedure was that when the operations in the cut in the vicinity of Culebra were completed, prior to the admission of water, the breaks in the banks and the upward movement of the bottom had ceased entirely.

Early in 1911 a geologist was employed in connection with the earth movements. He proposed maximum and minimum lines for lightening the banks, together with suggested slopes. On the accompanying drawing are shown the maximum probable limits of the earth movement on the two sides, as predicted by him. The print also shows the areas over which the banks were lightened by excavation, and when the shovels were removed the benches within the areas marked by broken lines were all intact, the shovels having dug so as to remove all evidences of cracks. So far as could be foreseen, therefore, satisfactory slopes had been secured.

In the early part of 1914 small cracks had developed on some of the upper benches on the west side, and similar effects were noted on the east side. During the dry season the surface of the ground in this country cracks as the result of drying out, and in some instances these cracks are of considerable depth and extent. Whether those found on the benches were the ordinary dry season cracks or the result of structural weakness was not known, though



SECTION *A* BROKE AWAY FROM SECTION *B* AT ZION HILL

they resembled the former. To guard against emergencies, however, the shovels were returned and worked on the east bank, reducing the slope still more, until April 1, 1914; and on the west bank the shovels continued until June 14, 1914, by which dates the cracks had been entirely dug out. Steps were taken to drain the various benches.

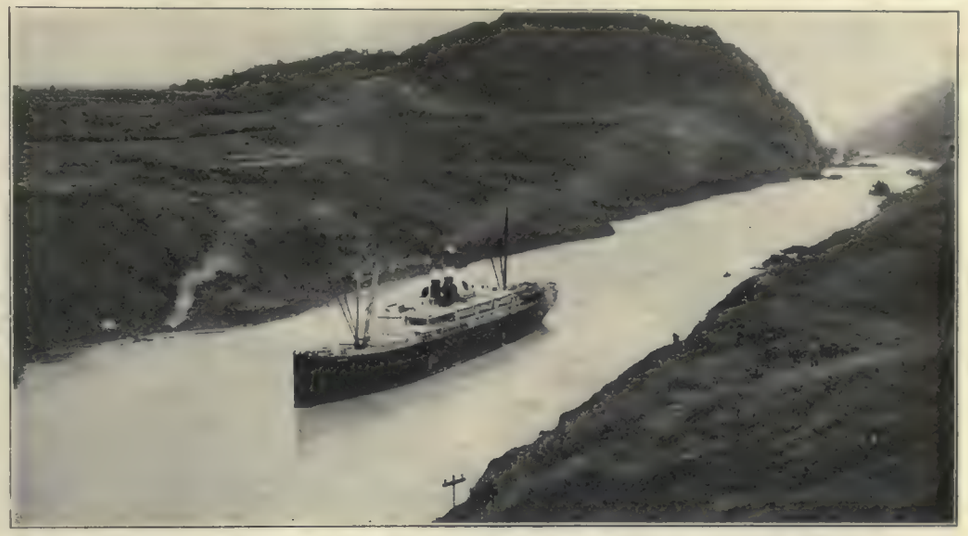
A crack had existed for some years at the foot of Zion Hill, southwest of Culebra. The hill was pronounced as geologically secure against any movement, and when the material had been cut away from this bank the slope of the excavation extended to the crack or the limit marked as the maximum limit by the geologist. On the east side, toward the end of the dry season of 1913, a crack was found north of Gold Hill parallel to the cut, about 1300 ft. back from the face. It was not connected with the slope of the prism at either end. There were no cracks or breaks between it and the cut proper. There was apparently a slight settlement on the side of the crack nearest the cut, but none with the marked indications of a probable break. Steps, however, were taken to lighten the banks between the crack and the cut by sluicing away the high ground and by steam shovel operations. There were no indications of movement, and apparently the work done toward lightening the banks had been effective. It appeared, so far as could be determined, that a state of equilibrium had been secured and the waterway through the section was complete. Subsequent to turning in the water there were small slides on the east bank, north of Gold Hill, and also on the west side, but they were small, the material was easily removed, and they were typical of class-one slides.

East Bank Settles 20 Feet

No change occurred until Oct. 14, 1914, when, without warning, a section of the east bank settled vertically 20 ft. This section measured 2000 ft. along the prism face and extended back about 1000 ft. from the axis of the canal, generally along an irregular curved line. The bank was from 300 to 350 ft. above sea-level, and the extension of the ground eastward was relatively flat country. In the settlement the upper portion that broke away remained practically parallel to its original position, and the benches which formed the upper part of the slide had not changed their relative positions, though they were badly broken up, while the lower strata were squeezed out across the canal. Subsequently the broken mass moved into the cut, and until August, 1915, the dredges were able for the most part to keep up with the movement, when the movement on the west bank occurred, necessitating work on this side to the detriment of the east side.

A crack was found on the slope of Zion Hill in June, 1914, but observation made upon it showed no movement until subsequent to the break on the east side, when a gradual but general breaking up of the west bank began. Subsequently, the cracks on Zion Hill extended to El. 480, the limit of the present break. The movement into the cut from the west bank occurred early in August, 1915, when a section of Zion Hill broke away and settled down.

This year's break at Zion Hill previously referred to, is generally along a curve. The movements from the two sides are toward the central portion of the inclosed area, and at this central portion is the main obstruction to the channel. In coming into the cut the mass on the east side is breaking up into waves which move down into the prism in succession; one now occupies part of the channel and another is forming up the slope of the hill. On the west bank this wave effect is also evident. Here the bank was pushed forward horizontally, the benches in some portions still maintaining their relative position with respect to each other, but the ground in their rear has settled, forming sink holes on the side away from the prism. The plat of the survey shows the earth wave effects. The map also shows the portion of the canal toward which the movement is concentrated, and the projection into the waterway that results. The crack shown on the north side of Gold Hill is a result of a sloughing off of material, the underpinning of which was removed by the break and slide of the east bank, similar to that which occurred on the south side of Gold Hill during the removal of Cucaracha slide.



SECTION OF CANAL AT CULEBRA COMPLETED TO FULL WIDTH AND DEPTH



RUPTURE OF SUPPORTING ROCK MASS STARTED CUCARACHA SLIDE

Resort to Dredging

When the break of Oct. 14, 1914, occurred, it was evident that the large mass of material that had broken away must be handled by the dredges. Turning any part of the material away from the prism by sluicing operations was not possible on account of the natural lay of the ground, and, in fact, all material that could be handled by that method had been removed when the sluicing plant was installed on this bank. Steam shovels and trains could not operate on any portion of the broken mass, which was incapable of giving the necessary support.

There remained a stretch between this and the limiting crack to the east, but this ground was in such condition that before preparations could be completed for beginning work it would be broken up so that steam shovels could effect nothing. Subsequent developments have verified this. No further cracks or indications of a further extension eastward have occurred, and judging from past experience the existing cracks will limit the fracture, which is about 1300 ft. from the edge of the prism. Similar investigations and considerations on the west bank show there is no possibility of handling the material to advantage by steam shovels. The configuration of the ground

is such that all material in the present movement will be taken away long before the area involved could be reached. Like the east side, sluicing could only throw the material into the prism; similarly, it is believed that the limits of the break have been reached.

The conclusion reached, therefore, is that the only method is to remove the material as it comes into the cut by the dredges. These are handling nearly 1,000,000 cu. yd. per month at a cost of less than 30 cents per cubic yard. When the break occurred in October, 1914, and the subsequent breaking up of the west bank became evident, it was decided to augment the dredging fleet by another 15-yd. dipper dredge and three 1000-cu. yd. barges. The latter are in service; the dredge arrived last week and will be ready for use within two weeks.

Estimated Quantities

As to the amounts involved it is difficult to make predictions. As noted above, when Cucaracha broke loose in 1913 it was estimated that 2,000,000 cu. yd. were involved. More than 4,000,000 cu. yd. were taken out of the prism before the slide was entirely removed, in addition to 1,000,000 yd. washed away by the sluicing plant. In the present instance, estimating that the material must be removed from a slope extending from the bottom of the canal, reference 40, on the outward limits of the prism, up to the farthest limits of the breaks, on the theory that all the material above these planes will move into the cut, it is estimated that 7,000,000 cu. yd. will have to be removed before the slides are entirely done away with. If we assume a surface parallel to the existing one, starting from El. 40, the estimated quantity is 13,000,000 cu. yd. The resulting surface, as is the case with other slides that have been handled, will be irregular, and perhaps the more correct estimate will be between these two limits, or 10,000,000 cu. yd.

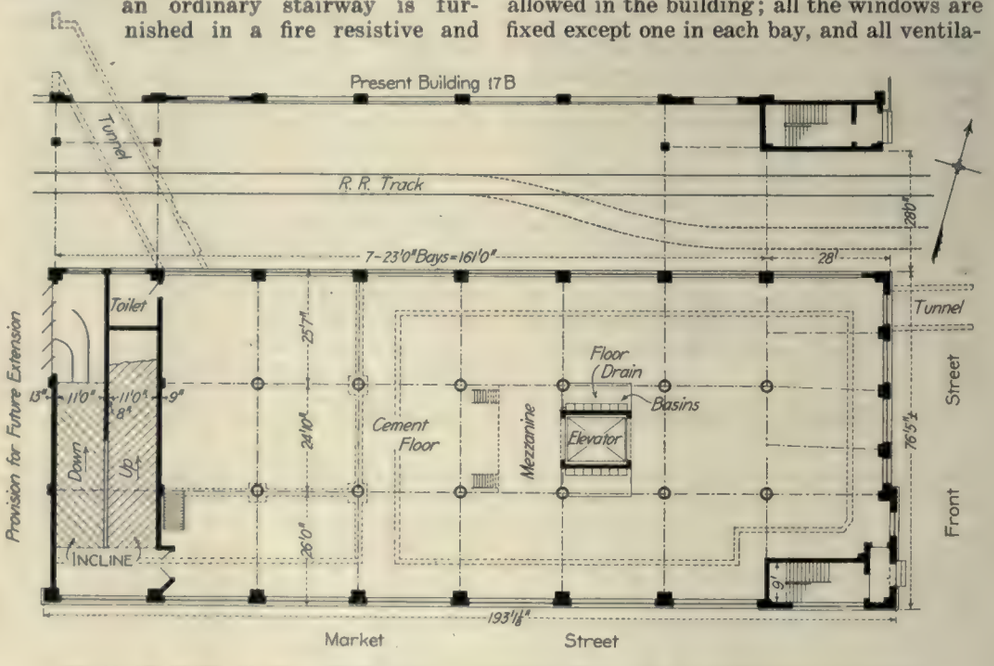
Efforts Being Directed Toward Securing a Channel

While the foregoing amounts are the estimates of what will have to be handled before all moving material is removed it is not to be assumed that the canal will be closed to navigation for this length of time. On the contrary, all efforts are being directed toward securing a channel. The estimated amount in the canal within the limits of the prism was about 500,000 cu. yd. when the prediction was made that the canal would probably be opened by Nov. 1, and the dredges could easily handle this amount within the time limit; but in view of the wave movements and the difficulty of breaking through the central obstruction it was not deemed wise to make any further predictions until the moving mass was in such shape that we had a channel through it which we felt reasonably sure could be maintained. To this end the dredges are operating to cut a channel wider than the full prism width, which will enable the maintenance of a channel more easily than heretofore. On Oct. 6 the length of the channel that was blocked was 1300 ft. This length has been reduced since then to 700 ft., but due to the continued movement we have been unable to break through the closure in the vicinity of Sta. 1787, and which is now about 100 ft. in length. When this is accomplished the lower waves can be more easily removed and more reliable predictions made than are now possible.

Inclined Walkways Replace Stairs and Elevators in New Victor Building at Camden

Safety in Exit Provided at Cost of Floor Space—Special Hollow Cast-Iron Interior Columns for Ventilation System

THE CABINET FACTORY, building 17C of the Victor Talking Machine Company's plant, at Front and Market Streets, Camden, N. J., contains some unusual features in building construction. The floor is similar to that used in other locations in the same plant, and consists of a flat slab supported by beams on the four sides, but with diagonal as well as square reinforcement. Inclined walkways 11 ft. wide, built with gradual slopes between concrete walls and occupying two complete panels at the northwest corner of the building in a practically smokeproof tower, are a unique solution of the problem of providing safe and rapid exit facilities. No passenger elevators whatever are used, but an ordinary stairway is furnished in a fire resistive and smoke-proof tower at the southeast corner, and stairs are provided for exits to the roof.



PLAN OF FIRST FLOOR—FIRST STORY CONSTRUCTION AND UNDERGROUND TUNNELS

In addition to these structural features, the design was further modified by the requirements of the owners that a very complete and effective system of interior heating and ventilation should be provided, the principal apparatus to be installed in a penthouse on the roof. As the floor space throughout is to be kept free from obstruction in order to insure a maximum of light, the interior columns are designed to provide the air ducts. For this purpose 24-in. hollow cast-iron columns 15 ft. long with brackets at the top to furnish seats for the reinforced-concrete beams, and openings on one side for the registers, were used. These columns are shown in the photograph. Some difficulty was experienced in obtaining perfect castings of this size, and a large percentage had to be discarded.

Special Requirements Met

The new cabinet factory is about 193 ft. long by 76½ ft. deep and is connected to the present factory in the rear by a five-story bridge one bay wide, and by a tunnel for the trucking of material. The upper floors are also connected to the recently completed shipping building by a three-story bridge across Front Street, and the lower floor by a tunnel under the street, which is continued inside the building as shown on the first-floor plan. The building is six stories high, the general dimensions being shown on the accompanying plan and elevation, showing the unusually high stories, these being 15 ft. The exterior columns are faced with brick, with trimmings of Indiana limestone and full-panel bays of Lupton-type rolled-steel frame windows.

This building is used for the manufacture of finely finished cases, and therefore presents a special problem in ventilation, especially for the upper floors where the finishing is done. No dust or outside air is allowed in the building; all the windows are fixed except one in each bay, and all ventilation is to be wholly mechanical. The wood-finishing machines on the lower floors are to be furnished with special suction ducts to draw up the sawdust and shavings to an outside separator, from which they are removed to the furnaces and burned.

All floors except the first are built of reinforced-concrete slabs supported by beams on four sides, the exterior beams being carried above the floor in the usual manner to avoid cutting off the light. The building is of fire-resistive construction throughout, with electrical equipment and sprinkler protection. The interior columns are hollow cast iron, protected by 2 in. of concrete and an outside layer of cement plaster on metal lath. The exterior rectangular columns are of concrete reinforced with longitudinal rods and ties, except the columns carrying the steel plate girders of the bridges, which are of built-up I-section.

Design of Floor Slab

The design of the 9-in. reinforced-concrete floor slabs was based upon the usual allowable unit stresses for the concrete and steel. All floors and the roof were designed for a live load of 150 lb. per square foot. The first floor is of concrete on earth fill,



CAST-IRON COLUMNS WITH VENTILATION OPENINGS AND BRACKETS

finished with 1 in. of cement mortar, with Master Builders' hardener. The runways had, in addition, 20 lb. of carborundum dust per 100 sq. ft. to roughen the surface and decrease the wear. All other floors are finished with maple flooring.

A veneer cellar which, to save time, was excavated after the building was erected, occupies several bays in the northeast part of the building. Openings are provided for a large freight elevator near the center, for the transfer of materials from the first floor to the upper floors, also for a special tray elevator from the veneer cellar to the first floor.

INCLINED-WALKWAY EXPERIMENTS

The main exit shown at the northeast corner of the building must provide for all employees of both the old and the new cabinet factory. In order to provide a safe and rapid exit, especially in case of fire, the owners authorized a careful investigation of the subject. Experiments were made to determine the time of exit of the employees in the present cabinet factory. The results indicate that the average time for one person to descend one flight of stairs is 20 sec. The file of men passed through the door at the rate of one man per second. The speed of men walking on the sidewalk was 5 ft. per second.

Based on this and similar data it is estimated that the proposed incline can empty the buildings, containing 3200 men, in 8¾ min. In case of a fire drill, with the four fire towers in use, including those in the present building, they could be emptied in a little more than 4 min. The rapidity of exit depends largely upon the number of doors. It is seen that five doors have been provided at the main exit and that guide railings leading to them insure safety and order in passing through.

The slope of the inclined walkway was selected, after trial, at 1¾ in. to the foot, which requires four inclines with three intermediate landings to rise 15 ft. between floors, as shown on the elevation, except from the first floor to the second, where one longer horizontal run was possible and three inclines could be used. The inclines are simple flat slabs 6 in. thick carried by reinforced-concrete walls.

The building was designed by Ballinger & Perrot, architects and engineers, of Philadelphia and New York, and the contract was awarded to Irwin & Leighton, of Philadelphia. The cast-iron columns were furnished by Phoenix Iron Works Company and J. C. Moyer & Company.

Curves on Winnipeg Aqueduct Built with Straight Sections of Forms

Careful Planning and Method of Laying Out Work Avoids Delay in Concreting as Well as Construction of Special Forms for Curves

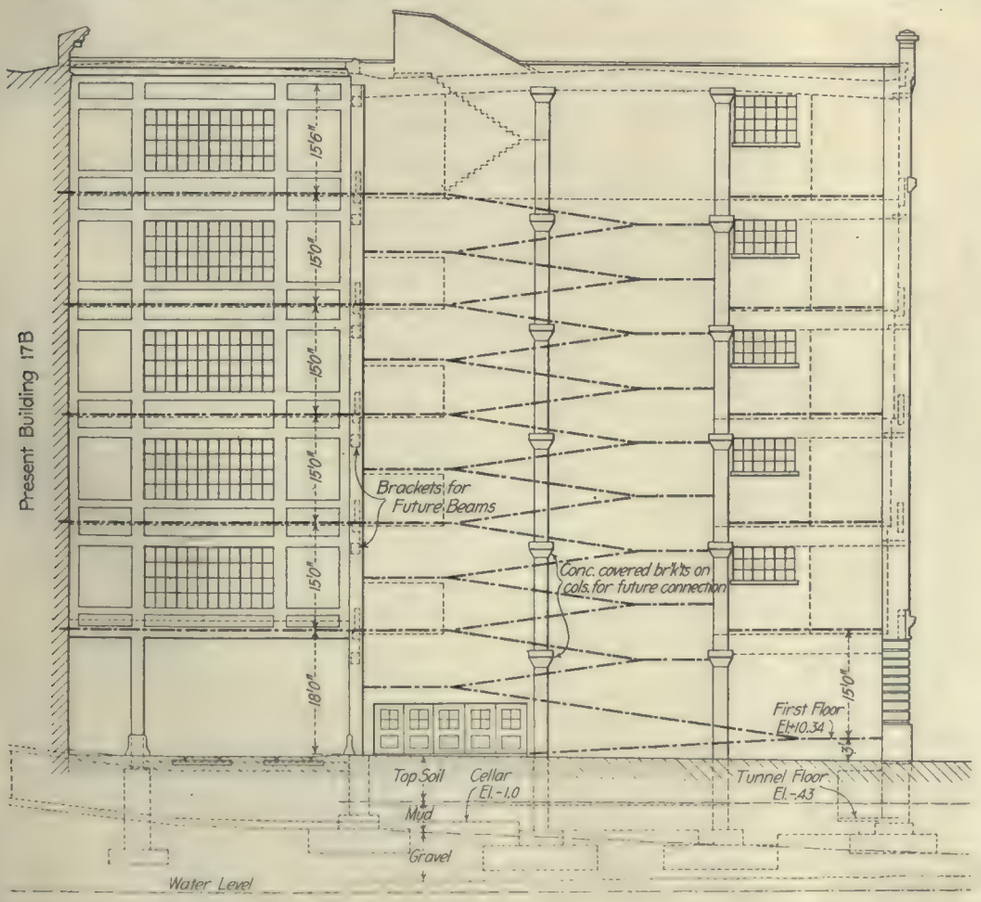
THE USE of special forms for curved sections was done away with in building the Winnipeg aqueduct by making the 45-ft. traveling forms in 15-ft. sections and setting these sections on chords to the true curve. As the forms would not telescope on curves, careful planning of the work was necessary to have all forms, except the form set for the curve itself, advanced past the curve before the curve was concreted. This avoided the loss of a day or more in passing each curve, which would otherwise have been taken in allowing the curved section to set so that the forms under it could be moved ahead to clear the way for moving up any form that might be left behind the curve. This arrangement of the work, and the method of laying out the 15-ft. sections on the ground, were originated by James H. Fuertes of New York City, consulting engineer for the Greater Winnipeg Water District.

In approaching a curve, the contractors were instructed to leave out the curved section until all forms but the one next the gap had been moved ahead. This last form was then to be moved ahead, set in the gap and concreted on the same day with the third form ahead of it. The two intervening forms meanwhile would be concreted on the two days previous, together with the two forms ahead of the advance form concreted with the curve. This made it possible to move the forms ahead two at a time, and to concrete two, strip two and set up two each day.

It was assumed that the contractor would use forms in two sections of 45 ft. each, each 45-ft. section being carried on three travelers 15 ft. long, and each 15-ft. section of arch forms being made up of 5-ft. lengths, bolted together. The plans provided that two 45-ft. lengths of forms would be set up and concreted each day. The invert was laid in 15-ft. lengths, except closures, which were made shorter than 15 ft.

PLAN WHEN WORK STARTED AT CURVE

The aqueduct section on all curves would, when the forms were removed, permit 15-ft. lengths of collapsed form to pass through on the travelers, but would not permit them to pass through when the forms were in place on the curved portion. To build 90 ft. of completed section per day required six 45-ft. lengths, or 270 ft. of forms, to give three days' time for setting of the concrete, removal and re-erection of the forms. It was essential, therefore, in order to avoid



WEST ELEVATION, SHOWING INCLINED RUNWAYS, PLATFORMS AND EXIT DOORS

trouble with moving forms ahead, to follow the schedule shown in Fig. 5 when the concreting of the arch began at a curve. On the fourth day, the forms concreted on the first day were moved forward six spaces. On the fifth day those concreted on the second day were moved up next to the ones set on the fourth day, and on the sixth day those concreted on the third. This cleared the aqueduct of forms, so that the section on the curve could be moved ahead through the open concrete arch.

PLAN WHEN APPROACHING CURVE

When the work approached a curve so that the curved section had to be passed through in moving forms ahead, the forms were left out of the curved section until the last form on the tangent behind was ready to be moved. This was then set in the curve, filling in the gap of 45 ft. at the curve left for it. This required careful planning of the work in order to avoid a day's delay. Wherever possible, the work was laid out so that when the curve was reached the condition shown in Fig. 1 existed.

CURVES MADE WITH SHORT TANGENTS

If work began at a curve, for deflection angles up to and including 11 deg., the total curvature was made at one point, by prolonging the tangents to a point of intersection and placing inside forms on each tangent so as to leave a minimum of 4 in. clear space between the forms at the invert level on the short side of the curve. If the angle was great enough to require more than 4 in. between inside forms when outside forms just touched at the invert level, inside forms were set on each tangent so that the outside forms would just touch. The gap in each case was filled in with wooden forms.

In building the invert forms work began with the 15-ft. section to the rear of the angle point, as referred to the direction in which the work was proceeding. Copper strips were put in each end of this and of all alternate sections ahead. The invert section containing the angle was always built as a monolith.

For deflection angles greater than 11 deg. the curve was made in two angles, by placing one 15-ft. length of form across the arc. This was laid out by prolonging the two tangents to the point of intersection, and turning off at the point of intersection an angle equal to 180 deg. minus the deflection angle. This gave the radial line through the point of intersection. Next, two lines were staked out parallel to this radial line, 7½ ft. on each side, for the ends of the inside form. Then, in line with the tangents, was measured the distance from the end of the inside forms to the end of the last section of invert. This distance, $2a$ in Fig. 2, was divided, and half of it, a, was taken. From the points of bisection the chord was laid out, and where this cut the faces of the inside forms, at each end, was the center-line of the inside form for the 15-ft. section on the curve.

WHEN LAST SECTION OVERRAN POINT OF CURVE

If the work approached a curve and the end of the last invert section did not fall at the exact point for beginning the curve a different procedure was necessary, which was followed for all deflection angles. The tangents were extended to a point of intersection, and the exact ends of a true curve on the center line of the aqueduct were located. On approaching a curve the last invert section to be concreted on the tangent was the one whose front end was nearest to and not more than 5 ft. in front of the true point of the theoretical curve. Next, if the deflection angle in the aqueduct line was small enough so that a 15-ft. chord from the end of the concreted invert at the outside of the outside forms, on the short side of the curve, to the outside tangent did not make a greater angle with either tangent than about 18 deg., one 15-ft. straight section was used to make the bend, as shown in Fig. 3.

If, however, the deflection angle in the aqueduct was great enough to require more than one 15-ft. section of the invert to make the curve, from the end of the last concreted invert section nearest to the curve one 15-ft. section was used to join the end of this section with the theoretical curve of the outside line of the outside form. From this point to another on a 15-ft. chord to the true circle the next form was set, and so on, making the last 15-ft. section fall on the last tangent, as shown in Fig. 4. In Fig. 4, a equals the distance of end of the section past the true point of curve, and b equals the outside width of the outside forms at the bottom, out to out of angles at the ends of the forms.

$$\text{Tan } A = \frac{a}{50 - \frac{6}{2}} \qquad B = 90° + A$$

$$c = \sqrt{a^2 + \left(50 - \frac{6}{2}\right)^2}$$

$$\sin \frac{P}{2} = \sqrt{\frac{(s-m)\ (s-n)}{mn}}$$

in which $m = c$ and $n = 15 + x$, in which x is equal to the clearance for the flare of the angles at the ends of the forms.

$$S = \left[\frac{c + \left(50 - \frac{6}{2}\right) + 15 + x}{2}\right]$$

The deflection angle to the end of the first 15-ft. chord would then be $(90 + A) - P$.

To get the deflection angle for the second 15-ft. chord, there was first turned off the angle K to the left from the chord just found, which gave the direction of the radius.

$$\text{Sin}\frac{K}{2} = \sqrt{\frac{s - \left(50 - \frac{6}{2}\right)(s-n)}{\left(50 - \frac{6}{2}\right)n}}$$

in which s and n are as above. From a right angle to the radius thus found was turned off the angle.

$$\text{arc sin} = \frac{\left(7.5 + \frac{x}{2}\right)}{\left(50 - \frac{6}{2}\right)}$$

which was the deflection angle sought.

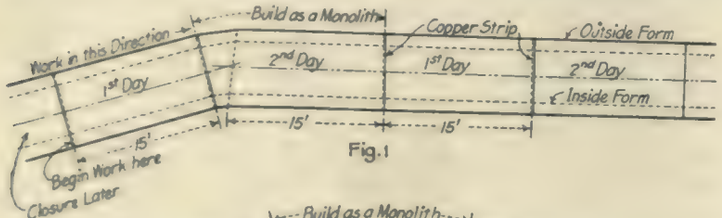


Fig. 1

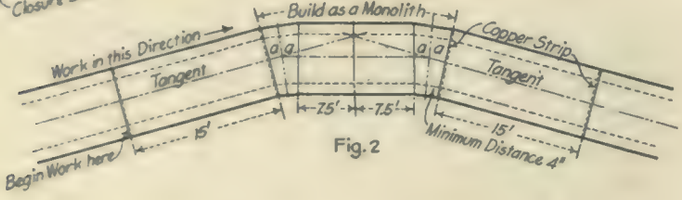


Fig. 2

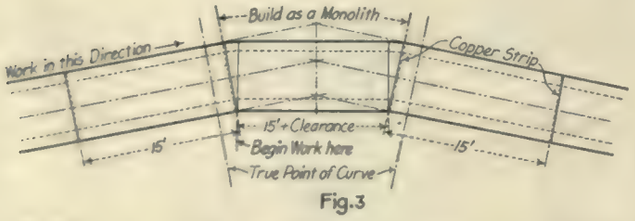


Fig. 3

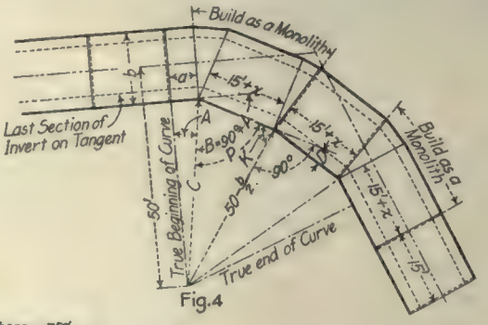


Fig. 4

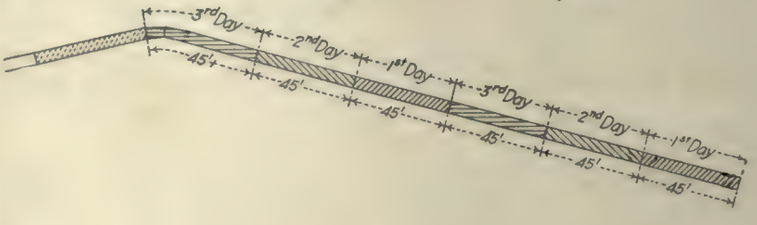


Fig. 5

CURVES ON WINNIPEG AQUEDUCT MADE WITH STRAIGHT FORM SECTIONS, AND WORK ARRANGED TO SAVE DELAY IN MOVING UP

THE RIO GRANDE PROJECT of the United States Reclamation Service in 1914 included 27,302 acres which produced crops valued at $1,160,720, an average of $42.51 per acre. Excluding the Sunnyside project in Washington, this is the highest average, according to C. J. Blanchard, Reclamation Service statistician, attained on any Government project.

Sand for Concrete and Cement Mortar Should Have "Jump" in Grading

New View, Based on Theoretical Grounds and Verified by Tests, Runs Counter to Theory That Particles Should Be Uniformly Graded

By ROBERT H. McNEILLY, C. E.
Assistant Professor of Civil Engineering, Vanderbilt University, Nashville, Tennessee

[*Sand for concrete and cement mortar, according to the accepted theory, should have its particles uniformly graded. Proceeding on theoretical grounds, however, Professor McNeilly argued that there should be a "jump" in the grading. Tests with laboratory mixtures confirmed the theoretical considerations. He concludes that the best sizing will include particles caught between the No.* 4 *and the No.* 10 *sieves, and the "fines" passing a No.* 40 *sieve. In other words, there should be a jump from the* 40*-size to the* 10*-size particles.* —EDITOR.]

IN 1912 the writer became interested in the subject of the fine aggregate in concrete, and since that time has made extensive studies of the various materials available for this purpose at Nashville, Tenn. A large proportion of the results presented in this article are purely experimental work, while quite a number of the tests were professional work for the Nashville, Chattanooga & St. Louis Railway, the Lightman-Sewell Stone & Pulverizing Company, T. L. Herbert & Sons, and others. This will explain the lack of uniformity in the methods used, which arose from the different purposes for which tests were made, and also from the gradual development of methods in the light of completed experiments.

WEAKNESS DUE TO FINE AGGREGATE

There is much evidence to show that the principal weakness in concrete is due to the fine aggregate, because all foreign substances, such as clay, loam and organic matter, naturally gravitate to the "fines" in ordinary crushed material, while natural sands are usually "dirty." Therefore it may be stated as a general principle that if the coarse aggregate be a reasonably strong stone or gravel, the trouble, if trouble does develop in the concrete, may be laid to the account of the fine aggregate in the large majority of cases. For this reason it was deemed sufficient to investigate the mortar only instead of the whole concrete mass. Tensile tests, as they gave so much more uniform results, were considered sufficient to indicate the relative value of the aggregates tested.

With regard to the methods used, the sieving was done by hand, and the mortars were gaged by experience to a rather dry consistency. Standard methods described in Bulletin 33, U. S. Bureau of Standards, were used in all particulars except that the mortars were tamped with the handle of the trowel, which was found necessary in many cases, to force the mortar properly into the molds.

LOGICAL SEPARATION OF SIZES

In beginning the study of an ideal distribution of size of grains based on the theory of "voids," it was first determined to establish a logical separation of sizes, and the following principles were used as a basis of separation: Fig. 1 represents in plan a pile of uniform spheres piled so as to give the least void space. The spheres A_1, A_2, etc., B_1, B_2, etc., C_1, C_2, etc., are on a lower level, while D_1, D_2, etc., E_1, E_2, etc., are on an upper level.

It is evident from an inspection of Fig. 1 that if d_1 is the diameter of the large spheres, smaller spheres of diameter d_2 can be inserted between each set of six spheres, as $A_2B_1B_2D_1D_2E_1$; and still smaller spheres of diameter d_3 can be placed in the openings between each four-sphere unit, as $B_2D_2E_1E_2$. A mathematical examination of the relative diameters of these spheres gives the following:

$$d_1 : d_2 : d_3 = 1 : 0.41 : 0.22$$

(Note: For demonstration see Taylor and Thompson's "Plain and Reinforced Concrete," page 170.)

Therefore the following separation of

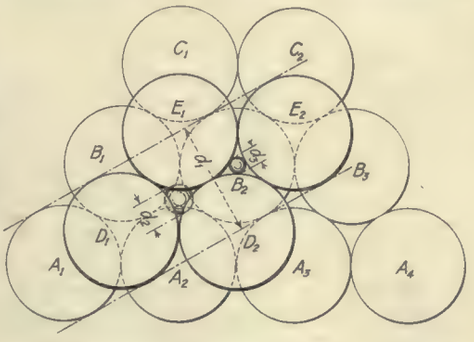


FIG. 1—VOIDS BETWEEN UNIFORM SPHERES

sizes was considered logical: If d_1 is the average diameter of the largest particles considered, then we should divide the material into two other sizes of d_2 average diameter and d_3 average diameter, such that $d_1 : d_2 : d_3 = 1 : 0.41 : 0.22$. We can then take as the very finest material, which fills in between the particles of d_1, d_2 and d_3 diameter, all the particles which pass the sieve upon which the particles of average diameter d_3 are caught.

SIZES OF PARTICLES

Since it is a universal American practice to class all material finer than ¼ in. in size as fine aggregate or "sand," the material which passed a No. 4 sieve and was caught on a No. 10 sieve was assumed arbitrarily to be the coarsest particles to be considered. These particles were found, by experiment on Cumberland River sand, to have an average diameter of 2.93 mm. Therefore, if we assume d_1 as 2.93 mm., d_2 should equal $2.93 \times 0.41 = 1.20$ mm., and d_3 should equal $2.93 \times 0.22 = 0.64$ mm.

Table 1 shows the results of experiments on Cumberland River sand to determine the average size of grains passed by and caught upon certain selected sieves.

From this table we can therefore formulate the following as a proper separation of sizes for a logical sieve analysis under the conditions assumed: The *coarse* particles should be those which pass a No. 4 sieve and are caught on a No. 10 sieve. The *large-intermediate* particles are those caught between the No. 10 and the No. 20 sieves. The *small-intermediate* particles are those which are caught between the No. 20 and the No. 40 sieves, while the *fines* are those which pass the No. 40 sieve. In addition to this it is often desirable to determine the percentage of material which passes the No. 100 and the No. 200 sieves in order that the character of the fines may be more closely studied.

This method of granulometric analysis seems far more logical than the prevalent practice of using a much larger number of sieves, because one becomes lost in a maze of meaningless figures unless a Fuller's curve is drawn, which in turn is hard to grasp unless the same scale is universally used. Furthermore, the methods in use for drawing conclusions from these Fuller's curves are exceedingly uncertain.

TABLE NO. 1—EXPERIMENTS ON CUMBERLAND RIVER SAND TO DETERMINE AVERAGE SIZE OF GRAINS

Sieve analysis: Passed sieve	Sieve analysis: Caught on sieve	Number of grains taken	Total volume displaced, cu. cm.	V, volume of average size grain, cu. cm.	$d = \sqrt[3]{6v/\pi}$ diam. av. grain, mm.	Theoretic size desired
No. 4	No. 10	970	12.7	0.013100	2.93	$d_1 = 2.93$
No. 10	No. 20	2,126	2.5	0.001172	1.32	$d_2 = 1.20$
No. 20	No. 30	20,000	4.9	0.000245	0.776	
No. 20	No. 40	24,000	3.5	0.000145	0.65	$d_3 = 0.64$

Note—The Nos. 4-10 grains and the Nos. 10-20 grains taken in this table were actually counted from carefully quartered volumes of sieved sand; the Nos. 20-30 and the Nos. 20-40 grains were estimated by counting 2500 and 3000 grains of each respectively and then multiplying this volume eight times by balancing a like amount of such grains against these in an analytical balance. These grains were then carefully poured into a burette partly filled with water. The rise of the water was taken as the total volume displaced and the diameter of the equivalent sphere calculated.

MORTAR OF MAXIMUM DENSITY

Having determined upon this logical sieve analysis, let us now attempt to formulate a distribution of these sizes, such that the mortar formed will have the greatest possible density, which should also give the greatest strength and durability to the concrete.

Returning to a consideration of the pile of uniform spheres shown in Fig. 1. Each sphere of d_1 diameter will touch three spheres of d_2 diameter, while each sphere of d_2 diameter will touch six spheres of d_1 diameter. Therefore, in a pile of n spheres of d_1 diameter there will be $3n \div 6 = n/2$ spheres of d_2 diameter. Similarly, since each d_1 sphere touches five d_3 spheres, while each d_3 sphere touches only four d_1 spheres, there will be $5n/4$ spheres of d_3 diameter. Let V_1, V_2 and V_3 be the total volume of the sum of the spheres of d_1, d_2 and d_3 diameter respectively in the pile. Then

$$V_1 : V_2 : V_3 = d_1^3 : \frac{d_2^3}{2} : \frac{5d_3^3}{4}$$

$$= 1 : \frac{(0.41)^3}{2} : \frac{5(0.22)^3}{4}$$

$$= 1 : 0.03446 : 0.01331$$

Therefore, if uniform spheres of d_1 diameter be systematically piled to give the greatest density, and in the openings of these be inserted other spheres of d_2 and d_3 diameter, the weight of the sum of the spheres of d_2 diameter = 3.45 per cent of the weight of the large spheres of d_1 diameter, and those of d_3 diameter weigh 1.33 per cent of the weight of the large spheres of d_1 diameter.

Fig. 2 represents at A the coarse particles of d_1 average diameter of a crushed material when close packed dry. Each particle touches the contiguous grains, and experiment on crushed Lightman limestone showed 37.6 per cent void space instead of the 26

per cent void which they should, theoretically, have shown if they had been uniform spheres systematically piled, or the 44 per cent least void which Mr. Fuller determined by experiment for uniform spheres piled at random. (See Taylor and Thompson, page 170.)

EFFECT OF ADDING CEMENT

Fig. 3 shows at C the effect of adding cement and other fine material to the packed coarse particles of A and making a mortar. The original particles have now been separated until they must present *at least* 50 per cent of space to be filled by the cement and other fines.

However, just as in the case of the dry-packed grains of A we could insert a few grains of d_2 and d_3 diameter (as shown at B in Fig. 2), so we may insert the same number of these intermediate-size grains in C (Fig. 3) without further separating the coarse particles. (This is shown at D, Fig. 3.)

Attention is now directed to Fig. 4, as a suggestion of the pernicious effect of adding too many intermediate particles to the grains shown at C, Fig. 3. The original coarse grains of d_1 diameter are simply wedged apart; their interlocking is destroyed, and the space to be filled by cement and other fines is greatly increased. This is exactly what occurs in most natural river sands—the intermediate and Nos. 40-100 particles vastly exceed the weight of the coarse grains, while to aggravate the condition the material smaller than that which passes the No. 100 sieve is almost entirely missing (having been carried off by the water) and cannot assist the cement in filling in between the smallest spaces.

Referring again to Fig. 3, D, and our previous discussion of the desired ratio of intermediate to coarse grains, we based our analogy on uniform spheres systematically arranged. The coarse particles are not, however, perfect spheres, nor are they systematically placed, yet, since the total void is increased, surely the same number of particles of d_2 diameter, and, say, twice the number of those of d_3 diameter, can be beneficially inserted in the spaces between the grains of d_1 diameter without wedging them farther apart.

Therefore the proportions of each size shown in Table 2 (using the foregoing assumptions) were considered logical ones.

Thus it is evident that the percentage of fines in the aggregate should be decreased as the proportion of cement is increased, and vice versa. For example: A 1 : 3 mortar should have 25 per cent cement and 21.94 per cent fine aggregate passing the No. 40 screen, while a 1 : 2 mix would have 33 1/3 per cent cement and 13.61 per cent similar fine aggregate. (These figures are slightly in error, if we proportion by weight, due to disregarding the difference in specific gravity of cement and aggregate.)

TABLE 2—LOGICAL PROPORTIONS OF SAND

		Sieve Nos.
Coarse	d_1—50 per cent of total volume by weight of particles caught between	4 and 10
Intermediate	d_2—2.45 per cent x 50 per cent = 1.73 per cent of total volume by weight of particles caught between	10 and 20
	d_3—2 x 1.33 per cent x 50 per cent = 1.33 per cent of total volume by weight of particles caught between	20 and 40
Fines	100 per cent—(50 per cent + 1.73 per cent + 1.33 per cent) = 46.94 per cent of total volume by weight of particles which pass the No. 40 sieve, plus the cement.	

Mortars proportioned according to the above and designated, "Theoretical Mixtures," are shown in Table 3 at Nos. 5, 6, 8, 9 and 31; while No. 7 has its intermediate grains increased 50 per cent over the theoretic value and the fines correspondingly decreased.

REVISED THEORETICAL PROPORTIONS

Before leaving this subject and proceeding to an examination of Table 3, it should be noted that the percentage of the d_2 and d_3 diameter particles is so trifling (only 3 per cent of the total) that this weight of intermediate grains would probably be caught with the Nos. 4-10 material in any commercial sieving operation on account of imperfect sieving. Therefore we are justified in revising these theoretic proportions for commercial practice as per Table 4.

It will further benefit the mortar, unquestionably, if the cement and the proper proportion of this pass-40 aggregate be first intimately mixed, probably with a slight grinding or rubbing, not sufficient to materially reduce the particles in size, but merely to a degree sufficient to break down thoroughly the soft lumps in the cement and incorporate the aggregate in it. This may tend to promote the proper hydration of the cement also by helping to prevent its "balling up" when the water is added.

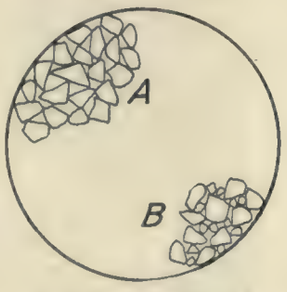


FIG. 2—PARTICLES d_1



FIG. 3—CEMENT ADDED



FIG. 4—TOO MANY "INTERMEDIATE" PARTICLES

A, close packed; B, smaller particles in voids; C, cement only added; D, smaller particles in voids.

TABLE 4—THEORETIC PROPORTIONS REVISED FOR COMMERCIAL PRACTICE

53 per cent (coarse) Nos. 4–10 aggregate.
47 per cent (fine) pass No. 40 aggregate plus the cement.

For a 1:3 mortar this would be:
53 per cent (coarse) Nos. 4–10 aggregate.
22 per cent (fine) pass No. 40 aggregate.
25 per cent cement.

For a 1:2 mortar it would be:
53 per cent (coarse) Nos. 4–10 aggregate.
13⅔ per cent (fine) pass No. 40 aggregate.
33⅓ per cent cement.

(For an extensive study of this lack of proper hydration of cement in concrete see the articles by Nathan C. Johnson in the issues of the Engineering Record from Jan. 28 to March 13, 1915. In these articles on the "Application of the Microscope to the Study of Concrete" many other interesting questions related to the points here discussed are elaborated with profuse illustrations.)

TESTS

Table 3 shows the results of tests on several aggregates proportioned upon this theory as a basis, together with comparisons showing tests on practically every commercial fine aggregate upon the market at Nashville, Tenn.

In testing out the theory it was determined to eliminate, so far as possible, all other influences, such as clay, shale and organic matter, and let the material stand upon the distribution of the sizes of its constituent particles alone. To this end selected magnesian limestone from the Lightman quarry at Nashville was pulverized by hand for mortars Nos. 5, 6, 7 and 31, as well as for the tests made to determine the effect of material finer than that which was caught on a No. 40 sieve.

A chemical analysis of this stone made Feb. 14, 1913, gave the following results:

	Per cent
Insoluble residue (silica, etc.)	3.42
Oxides of iron and alumina (Fe_2O_3, Al_2O_3)	.65
Carbonate of lime ($CaCO_3$)	89.11
Carbonate of magnesia ($MgCO_3$)	6.81
	99.99

Directing attention to Table 3, it will be noted that mortars 42-46 inclusive show that silicious and calcareous fines when mixed with cement in the proportion of 3 cement to 1 fines does not materially decrease the strength of neat cement mortar, and may even increase this strength. Mortars 47-50 inclusive, however, show that if cement is adulterated by one-third of its weight of these fines and then tested with standard sand the strength is greatly decreased. Although mortar 3 shows that aggregate fine enough to pass a 200 sieve is about 35 per cent weaker than standard sand, still mortar 4 shows that the pass-40 fines (which contain one-third of this material finer than 200 mesh), makes a stronger mortar than standard sand. One characteristic of this finely pulverized limestone is worthy of comment—it is exceedingly "smooth," acting almost as a lubricant and thus must promote the density of a concrete in which it is used. (Incidentally these tests show strikingly the fact that standard sand tests are much the best criterion by which to judge the strength of a cement.)

THEORETICAL MIXTURES

The theoretical mixtures 5, 6, 7 and 31 were made of Lightman limestone pulverized by hand and proportioned as has been previously explained. The pass-40 fines of the aggregate were first mixed intimately with the dry cement. (About 600 grams of the mixture was first gently ground in a mortar for about three minutes till the color became uniform and then passed through a No. 30 sieve.)

Mortars 5 and 31 have all the fines which pass the 40 sieve left in while No. 6 has the pass-200 material removed from the fines. This mortar (No. 6) shows the greatest density of any mortar tested, both in the dry mix and in the finished briquette. It also shows the greatest 7-day strength of any mortar tested in the 1 : 3 proportion, reaching the remarkable value of 7 per cent

greater than neat cement. However, its 28-day strength fell slightly under that of No. 5, which would be a far easier material to produce commercially.

Mortar 7 has all the material which passed the 100 sieve removed from the fines, while the proportion of the intermediate grains was increased 50 per cent over the theoretical proportions. This mortar proved to be next to the densest mortar tested, but did not show up so well as 5 and 6 in the strength tests.

Mortar 31 shows exceedingly interesting results in that the highest strengths attained were gotten with this mortar, which is of the customary proportion used in reinforced concrete (1 : 2 : 4). The results, 25 per cent greater than neat cement on the 7-day and 10 per cent greater on the 28-day test, are unprecedented; yet, reasoning upon the analogy of a glued wood joint, where the greatest strength is given by the thinnest joint, it is to be expected that a properly proportioned mortar should give a greater strength than neat cement, and that a point is reached where the addition of more cement weakens the mortar. These tests indicate that this point is reached somewhere near the 1 : 2 mix for Lightman limestone. It is worthy of comment that practically every coarse particle was broken in the briquettes of mortars made of the theoretic mixture of this limestone. The three briquettes tested in 28 days, furthermore, showed a remarkable uniformity, which is exceedingly unusual with such high strengths, and indicates great uniformity of product, which is, if anything, more desirable than mere strength in a structural material. Note also the great density and a specific gravity—as great as Cumberland River gravel, Nos. 16 and 17, with all voids deducted. (In this connection note the high percentage of void in the neat cement mortar No. 1. This is 40.8 per cent—nearly three times as great as the theoretical limestone mixtures.)

Commercial Fine Aggregates

Mortar 10 was made of regular Lightman limestone screenings. The quarry is remarkably clean and free from bands of shale. Moreover the screenings show comparatively little fines and the coarse grains are notably flat disk-like shapes, so that the material, when used alone, has not given entire satisfaction because of a tendency of the cement in wet mixtures to flush out of the screenings and separate from them.

It was for this reason that the material which goes by the trade name of "topping" was put upon the market. This material is prepared by taking the material 3 in. and over in size which has been rejected by the whole screening plant at the quarry and is thus absolutely free from clay, shale, or even the softer portions of the formation; then passing it through a Williams pulverizer, which reduces nearly half of it to a rock "meal," while the larger particles are more nearly spherical and cubical in shape than is the case with the screenings. The name "topping" is taken from its use as a top wearing surface for sidewalk construction, and as such gives a remarkably dense, tough surface very white in color, which is locally replacing to a great extent the crushed granite formerly imported and used for this purpose.

Mortar 11 shows tests upon this topping, and No. 12 shows tests on a mixture of half

Table 3—Detailed Tests on Fine Aggregate

Number of Mortar	Aggregate Used	Specific Gravity of Material	Sieve Analysis: Per cent caught between sieve numbers								Per Cent of Voids in Packed Dry Mixture	Specific Gravity of Briquette	Per Cent of Voids in Briquette	*Tensile St'gth in 7 Days, Lbs. per Sq. In. Av'ge	Per Cent of St'gth of Standard Sand	Per Cent of St'gth of Neat Cement	Relative St'gth	*Tensile St'gth in 28 Days, Lbs. per Sq. In. Av'ge	Per Cent of St'gth of Standard Sand	Per Cent of St'gth of Neat Cement	Relative St'gth
			+4	4 and 10	10 and 20	20 and 40	Pass 40	40 and 100	100 and 200	Pass 200											
1	Sample Royal Cement	3.125	0	0	0	Trace (20-30)	100	7	24	69	45.1	1.85	40.8	597	226	100	4	750	228	100	1
2	Standard sand	2.66	0	0	0	100		0	0	0	27.8	2.17	21.9	264	100	44	16	328	100	44	17
	Laboratory mixtures. 1 : 3 with No. cement sample:																				
3	Lightman limestone	2.703	0 0	0 0	0 0	0 0	100	0	0	100	.....	.. ..	.. ..	161	63	28	21	212	65	28	..
4	Lightman limestone	2.703	0.0	0.0	0.0	0.0	100	51.3	15.0	33.7	38	.....	.....	270	102	45	15	392	119	52	12
5	Theor. mixt. 1, limestone	2.65	0.0	66.6	2.4	1.7	29.3	15.0	4.4	9.9	23.4	2.35	15.1	622	235	104	2	733	223	98	2
6	Theor. mixt. 2, limestone	2.65	0.0	66 6	2.4	1.7	29.3	18.1	11.2	0	21.0	2.38	14.1	635	241	107	1	713	217	95	3
7	Theor. mixt. 3, limestone	2.65	0.0	66.6	3.6	2.5	27.3	27.3	0	0	22.7	2.37	14 4	617	233	103	3	687	210	92	4
8	Theor. mixt. 4, crushed gravel, washed	2.38	0.0	66.6	2.4	1.7	29.3	16.8	8.1	4.4	24 2	2.12	18 1	485	183	81	8	593	181	80	8
9	Theor. mixt. 5, crushed gravel, unwashed	2.38	0.0	66.6	2.4	1.7	29.3	15.2	5.3	8.8	24.0	2.07	20.0	448	169	75	10	589	179	79	10
	Commercial fine aggregates. 1 : 3 with No. 1 cement sample:																				
10	Limestone screenings	2.65	11.0	60.8	18.0	4.3	5.9	2.2	1.0	2.7	. .	2.36	14.8	581	220	97	6	664	202	89	6
11	Limestone topping	2.65	0.0	16.2	24.9	16.6	42.3	17.8	12.2	12.3	....	2.30	16.9	595	225	100	5	657	201	88	7
12	Limestone, ½ topping, ½ screen	2 65	5.5	38.5	21.4	10.5	24.1	10.0	6.6	7.5	.....	2.24	19.1	571	216	96	7	700	214	93	5
13	Crushed gravel, washed	2.38	2.7	47.9	28.7	12.0	8.7	5.1	1.9	1.7	....	2.05	20.8	372	141	62	11	455	139	61	11
14	Crushed gravel, unwashed	2.38	1.7	47.1	20.6	10.5	20.1	10.5	4.3	5.3	....	1.96	24.3	318	120	53	14	354	108	47	15
15	Crushed gravel, unwashed	2.38	3.6	51.1	19.3	8.4	17.6	9.3	3.2	5.1	....	2.15	16.9	480	182	80	9	654	199	87	8
16	River sand, pumped	2.59	0.0	14.1	16.1	20.5	49.7	47.5	1.8	Trace	.....	2.05	25.5	219	83	37	18	319	97	43	18
17	River sand, dredged	2.59	0.0	7.2	9.2	16.2	67.4	66.5	0.9	Trace	.....	1.925	29.2	163	62	27	22	224	68	30	24
18	Limestone screenings		0.0	48.7	20.0	11.4	19.9	10.5	3.9	5.5	.....	.....	.....	336	127	56	13	364	111	49	14
	1 : 3 mix with No. 19 cement sample:																				
19	Sample 19 Royal Cement		....	....	.....	.....	.....	.....	.....	.....	....	....	....	597	273	100	4	729	263	100	1
20	Standard sand		....	....	.....	.....	.....	(40-60)	.....	(Pass 60)	....	....	....	219	100	37	18	277	100	38	21
21	River sand, washed	.....	1.0	21.0	12.1	31.7	34.2	27.1	.....	7.1	....	....	....	191	87	32	20	300	108	41	19
22	River sand, sewage added	.....	1.0	21.0	12.1	31.7	34.2	27.1	.....	7.1	.....	....	.....	151	69	25	23	274	99	38	22
23	River sand	....	0.7	11.3	7.9	18.0	52.1	40.6	.....	11.5	....	..	....	106	48	17	27	146	53	20	27
24	River sand, sterilized	....	0.7	11.3	7.9	18.0	52.1	40.6	.....	11.5	....	....	..	147	67	25	25	240	87	33	23
25	Bank sand	....	0.5	9.5	6.0	28.6	55.4	42.7	.....	12.7	....	.....	....	193	88	32	19	356	128	50	13
26	River sand	.....	0.0	0.5	1.0	42.6	55.8	42.6	.....	13.2	.....	.....	....	150	68	25	24	215	78	29	25
27	River sand	....	3.3	19.8	12.2	11.5	53.2	35.6	.....	17.6	....	....	....	223	102	37	17	293	103	40	20
28	Bank sand	....	0.0	2.2	3.2	25.2	69 4	46.0	.....	23.4	....	....	....	140	64	23	26	175	63	24	26
29	Limestone screenings	...	8.1	44.8	21.4	11.2	14.6	8.1	.....	6.5	....	....	..	337	154	56	12	330	119	45	16
	1 : 2 mix with No. 1 cement sample:							40 and 100	100 and 200	Pass 200											
30	Standard sand	2.66	....	....	....	....	....	....	....	.....	29.4	2 24	20.4	409	100	69	4	478	100	64	3
31	Theor. mixt. 6, limestone	2.65	0	75	2.7	2.0	20.3	10.4	3.0	6.9	28.0	2.39	14.9	748	183	125	1	825	173	110	1
32	Crushed gravel, unwashed	2 38	3.6	51.1	19.3	8.4	17.6	9.3	3.2	5.1	..	2.09	20 5	546	134	91	2	783	164	104	2
	1 : 2 mix with No. 19 cement sample:																				
33	Standard sand	2.66	.....	.....	.....	..	....	..	...	.....	.....	.....	.....	293	100	49	7	396	100	54	6
34	River sand	Same as No. 21									.....	.....	....	359	122	60	6	365	92	50	7
35	River sand	Same as No. 23									.....	.....	.....	135	46	23	11	221	56	30	11
36	Bank sand	Same as No. 25									.....	.....	.....	278	95	47	8	311	79	43	9
37	River sand	Same as No. 26									.....	.....	....	203	69	34	10	294	74	41	10
38	River sand	Same as No. 27									.....	..	...	379	129	63	5	418	106	57	4
39	Bank sand	Same as No. 28									.....	.....	.....	248	85	41	9	364	92	50	8
40	Limestone screenings	Same as No. 29									.....	.....	.....	448	153	75	3	400	101	55	5
	Effect of very fine material upon Portland cement mortar. 1 : 0.33 mix with No. 1 cement sample:																				
42	Limestone	2.703	0	0	0	0	100	0	0	100	.....	.. ..	.....	565	.	95	4	673	.	90	4
43	Limestone	2.703	0	0	0	0	100	0	100	0	.....	.....	.....	565	.	95	4	741	.	99	2
44	Limestone	2.703	0	0	0	0	100	100	0	0	.....	.....	.....	662	....	111	2	652	...	87	5
45	Limestone	2.703	0	0	0	0	100	51.3	15.0	33.7	42.75	...	.....	693		116	1	710	..	94	3
46	Crushed Ottowa sand	2 66	0	0	0	0	100	55	18	27	.....	.....	.....	570	.	96	3	790	..	105	1
	Mortars 43-46, treated as adulterated cement and tested, 1 : 3 with standard sand. (Comparisons with mortar No. 2):																				
47	1 part mortar 43 : 3 parts standard sand		Finest aggregate, No. 100–No. 200								.	.	.	205	77.5	.	2	269	82	.	2
48	1 part mortar 44 : 3 parts standard sand		Finest aggregate, No. 40–No. 100								.	.	.	145	55	.	4	237	72	.	3
49	1 part mortar 45 : 3 parts standard sand		Finest aggregate, Pass No. 40								.	.....	....	158	60	.	3	230	70	.	4
50	1 part mortar 46 : 3 parts standard sand		Finest aggregate, Pass No. 40								..	.....	....	206	78	.	1	285	87	.	1

*Average three briquettes.

topping and half screenings, as used in the construction of the Cleveland Street viaduct at Nashville.

As a suggestion of the probable cost of producing high-grade fines for mixing with cement and adding to the coarse grains of a lower grade aggregate, it may be noted that "topping" sells locally at retail for $1.50 per ton (of 2000 lb.), while screenings brings $1.10 per cubic yard (of 2300 lb.)

CRUSHED GRAVEL

Mortars 8, 9, 13, 14, 15 and 32 show tests upon a new material upon the local market—crushed Cumberland River gravel. This gravel is silicious, and mortars 8 and 9, which were made of a theoretic mixture of this material, failed to show quite as good results as the commercial material. Too much weight should not be given this result, however, because this gravel is of a variable and conglomerate character, and a thorough testing out of the theory on a silicious aggregate would demand that it be tried upon pure quartz crushed by hand to insure cleanliness. However, there is strong indication again that the unctuous "lubricating" effect of the limestone fines greatly assists in producing density in the mortar, and there is also an indication that the chemical reactions in the setting of cement take place better under basic conditions than acid, and unquestionably the set is accelerated.

RIVER SAND

No further comment seems necessary upon the other materials presented in these tests except to say that mortars 18, 29 and 40 represent the usual run of local limestone screenings, which carry more or less impurities of shale and clay, while 16, 17, 23, 24, 27, 35 and 38 show tests upon the great source of fine aggregate at Nashville—the Cumberland River sand. This sand is of a quite inferior quality, as it always contains coal from the coal measures over which the river passes in its upper reaches, as well as silt, floating seeds and small particles of drift. As compared with sands in 21 and 25 it contains a much larger number of bacteria, as the river is formed into a long pool by the Government dam below Nashville, and this pool receives the sewage of the city. Tests 22 and 24 were made to examine into the effect of sewage.

However, by far the greatest objection to this Cumberland River sand is its lack of uniformity, which in this case is very great, but can be urged against almost any natural sand and against many crusher screenings, unless special precautions are taken to insure uniformity; and sand tests, as has been repeatedly urged, are of little value unless the product actually used in the work closely conforms at all times to the sample tested.

CONCLUSIONS

1. The usually accepted theory that a uniformly graded "sand" is the best fine aggregate for cement mortar is not correct. The best type of fine aggregate, certainly for crushed limestone, is one which is composed almost entirely of fairly uniform coarse grains with practically no intermediate sized grains, and sufficient very fine material to fill in, together with the cement, between these grains as they are actually separated in the mortar.

2. The determination of the voids in the dry-packed material, without the cement added, has practically no value in guiding judgment as to a given aggregate.

3. The best sizing of grains in a commercially sieved aggregate is about as follows: 53 per cent to be caught between the No. 4 and the No. 10 sieves; 47 per cent fines to be passed by the No. 40 sieve (this includes the cement).

4. There is every reason to believe that the coarse aggregate in concrete could be beneficially sized on a basis similar to the above; that is to say, there should be a jump in size from very coarse to quite fine instead of the usually accepted "graded" material.

5. The very fine material in the fine aggregate (pass-40 grains) should be exceedingly clean, dependable material, and should be intimately mixed with the cement, probably with slight grinding, before adding it to the concrete or mortar materials.

6. There seems, unquestionably, to be a point where the increase in the proportion of cement weakens the mortar. In the limestone mortars tested this point seems to be about the 1 : 2 mix.

7. The pass-40 limestone in mortar seems to have a "lubricating" effect which makes the mortar easy to work, promotes proper mixing, and insures a denser mortar.

8. On account of the inherent method by which they are produced, crushed materials for fine aggregate approach much more nearly the ideal granulometric analysis than do any natural sands.

GENERAL SUMMARY

A new material is herewith proposed for Portland cement concrete consisting of four ingredients instead of the customary three. These four are (a) coarse aggregate; (b) coarse particles of the fine aggregate; (c) very fine particles of the fine aggregate, which are to be mixed independently with the cement; (d) cement.

Insulate Huge Concrete Building for Cold Storage

Concrete Columns, Flat-Slab Ceiling, Floors and Walls Inclosing Space of 5,500,000 Cubic Feet to Be Covered with Cork

DEMAND for cold-storage facilities in Chicago has recently increased so rapidly that 5,500,000 cu. ft. of storage space in the freight terminal of the Minneapolis, St. Paul & Sault Ste. Marie Railway are now being insulated and fitted up with the necessary cooling machinery. The building fronts on Twelfth Street, is a block wide and five blocks long and was described in the Engineering Record of Aug. 16, 1913, page 188. The ground floor space under the 2½-ft. slab and part of the ground floor under the four-story terminal building at the north end are to be used.

Insulation of a concrete building of this magnitude some time after construction has not been attempted heretofore, and some of the construction methods are novel. Applying the two layers of 3-in. cork board to the flat slab ceiling was preceded by chipping the whole surface with hammers having a 1½ x 2-in. corrugated face. Although the men doing this work were provided with goggles they had to be relieved at short intervals. They were each able to chip an area of about 20,000 sq. ft. per 10-hr. day. The ceilings were then washed down with water and acid. The Nonpareil cork boards, made by the Armstrong Cork Company, are each 12 in. wide and 36 in. long, and have corrugations in the back. Portland cement mortar of 1:2 mixture using sharp torpedo sand is applied to the back of the board in a ½-in. layer, and the board pressed against the ceiling and held there for 72 hr. by a 2 x 4-in. prop, a strip being placed lengthwise of the cork slab to support it the whole length. The cork boards are placed in two



SCANTLINGS SUPPORT FIRST CORK BOARD LAYER BUT SECOND SET IS SKEWERED ON

layers for the purpose of breaking joints. The second set is secured to the first with six ¼ x 6-in. hickory skewers in each board, but the ½-in. cement mortar coat is not omitted.

The round columns and flared heads were covered by cutting the cork board in 3-in. strips and securing the "lagging" by wires. Partitions of brick divide the rooms into the maximum sizes permitted by the underwriters' regulations. The partitions and the floor are covered in the same manner as the ceiling, but over the top floor layer is placed a concrete wearing surface 3 in. thick in the center of the room and 4 in. at the sides to give drainage.

Four rooms of 100,000-cu. ft. storage capacity each are the first to be insulated and are to be used as the sharp freezers—that is, the temperature will be maintained at zero—hence the great care required to insulate every exposed surface, even the columns. For these rooms 500,000 sq. ft. of cork board was used and for the whole plant 3,000,000 sq. ft. will be required. Longitudinally through the structure is a central driveway. Railroad tracks run up to Fourteenth Street and from that street north 2½-ton electric trucks will be used to handle the goods. From the elevated tracks elevators are to be installed to lower the goods directly into the cold storage rooms.

The Westerlin & Campbell Company, Chicago, are installing the refrigerating machinery for the Chicago Cold Storage Warehouse Company, lessees from the terminal company. The Union Insulating Company is doing the insulation work.

Local Organizations Must Lead in Engineering Publicity

National Societies Are Necessarily Conservative—Their Branches in Each Community, However, Should Affiliate

LOCAL SOCIETIES, it was contended by A. J. Himes, valuation engineer of the New York, Chicago & St. Louis Railroad, in an address on Nov. 9 before the Cleveland Engineering Society, can by suitable publicity strengthen their own organizations and by their increasing influence and power arouse interest in the national engineering societies and stimulate their growth. Mr. Himes was speaking on the "Future of the Engineering Profession," and felt that in that future the local engineering society is to play a very large part. For that reason he discussed the means of increasing the influence of local bodies. He advocated, first, affiliation between local branches of the national engineering societies and, then, the use of publicity methods to bring home to the public the importance of the work of the engineer.

The following paragraphs from his address present strikingly the important points urged:

ADVERTISING

Advertising is a very old, conservative, well-tried, respectable and successful device for stimulating business. Is it less fitting that we should acquaint the public with the merits of our wares by description and explanation in print than that we should utilize paper and ink in our computations? Does an inventor bury his product in the earth less perchance some poor unfortunate shall look upon it and be saved? What does the Bible say about hiding one's light under a bushel? It is a barbarous idea that, locked in the secrets of his heart, a man should take with him to the grave knowledge that might be useful to his survivors.

This society has been advertising three years. Look at the record. Does it pay? The increase of membership has been 48.1 per cent. The increase of assets has been 37.7 per cent. Have we suffered in prestige or reputation?

On the contrary. The eyes of the country are upon us, watching our success and eagerly seeking to imitate it.

Assuming it is agreed by the profession to advertise, we arrive immediately at the practical question of intersociety relations. *There must be co-operation.*

CO-OPERATION

The public does not quickly sense the fine distinctions between engineers of different kinds and grades. It has neither patience nor ability to differentiate their needs. *In their relations to the public all engineers should stand together.* For this reason it is well that the local society should, within its field, marshal the full strength of the whole profession. Its local standing will be higher. Its interests will receive greater attention and consideration than would be possible if it were broken into several units representing different branches of engineering.

The preparation and utilization of advertising matter is so laborious and expensive that matter once prepared should be available everywhere. In this way, if all local societies were interested, the unit cost would be a minimum.

The national societies do not seem to be in a condition to join in such an undertaking. They are ultra-conservative, and not inclined to coalesce. The function which they have filled so well in the past, of stimulating the publication of papers and their discussion and of conducting engineering investigations, is of prime importance and should be continued. As organizations there is small hope of aid from them in publicity affairs.

The increase of membership in local societies consequent upon a publicity campaign would undoubtedly increase the interest in national societies and stimulate their growth. For stability the growth must be from the bottom up, and a more lively local interest in engineering would add greatly to the power and influence of the national societies. If it were possible to combine all national societies in a single organization that in matters of legislation and public policy would represent the whole profession, the ideal condition of strength might thus be attained.

Street Flooding Prevented by Wide Storm-Sewer Intakes

THE PROBLEM of handling large volumes of storm water in street gutters without flooding the crossing for pedestrians has been solved in Pasadena, Cal., by the use of long sewer intakes located in the curb adjacent to the street intersections. As shown in the accompanying illustration, the intakes are made 30 ft. long, with a 9-in. opening. The sidewalk slab over the intake is of reinforced concrete, 3 in. thick and supported at the curb line on two steel struts.



SEWER INTAKE THAT LEAVES CROSSINGS HIGH AND DRY

The normal flow line of the gutter is lowered 3 in. and at the end of the intake away from the street intersection this difference in elevation is taken up in a length of 6 ft. At the crossing end, on the other hand, the gutter level is raised to within 2 in. of the sidewalk level at the point where pedestrians cross. This affords a smooth intersection and a "high and dry" crossing, even in times of heavy storms.

The intakes were designed by R. V. Orbison, city engineer of Pasadena.

A CENSUS OF PEDESTRIAN TRAFFIC on State Street, Chicago, recently taken by owners of the newly erected Republic office building indicates that there were 327,710 people passing on State Street in one week, and nearly 200,000 on Adams Street. The relative number of men and women were about equally divided on State Street, but on Adams Street there were 145,000 men. The count was made only between 8 a. m. and 6 p. m. and was limited to those passing along the sidewalk adjoining the building. As this corner is at the center of the seven busiest shopping blocks in Chicago the figures may be of value to engineers and contractors contemplating any construction which would interfere with this week-day State Street stream of from 50,000 to 60,000 persons. On Sunday the number dropped to about 5500 on both streets.

Powers and Duties of the City Manager Defined

H. M. Waite Epitomizes Principles and Relations with the Public at the City Managers' Convention at Dayton

THAT cities will be governed precisely as well as citizens deserve and desire, and that the city-manager form of government is the nearest approach yet attempted to the ideal government are two of the principles laid down by H. M. Waite, city manager of Dayton, at the second City Managers' Convention held Nov. 15 to 17 in that city. Other terse, almost epigrammatic terms used by this engineer now holding the highest executive position in Dayton are given here, because they seem to indicate the frame of mind the engineer must develop if he is to hold successfully a similar position.

Any step toward a more centralized government is an improvement. Successful government must have the continued support of the majority. Good government can advance and improve only so far as the majority of the citizenship is able to appreciate and understand it. Therefore, the ideal government can be approximated as nearly as the majority of the people is able to appreciate and understand it.

The rivalry of communities may lead to the acceptance of a government of too centralized a form to be appreciated by the citizenship. Each community should approach the ideal only so far as the local conditions make it desirable. Each step toward centralization of authority will bring improvements in government and thus the citizens will be gradually prepared for the ideal. The ideal, however, should never be accepted until the large majority of the citizenship is ready to eliminate partisan politics from their municipal affairs, and keep it eliminated.

Men of large affairs demand broad authority. Broad lines of authority develop and attract capable executives. Broad authority carries responsibility. Responsibility attracts executives and imposes on them caution. Executives with broad authority, and using caution, accomplish results.

Communities that, for any reason, cannot give broad authority to the executive, are not ready for the ideal and should accept a more modified centralized authority—and not call it a city-manager form. The executive in the ideal government should have full authority in the administration of government and be held responsible for it. Lack of authority permits excuses and explanations, but clean-cut authority gets clean-cut men and clean-cut results. To get the maximum power and efficiency from the city manager he must be given the maximum authority.

THE CALIFORNIA RAILROAD COMMISSION between March 23, 1912, and May 31, 1915, authorized the issue of public utility securities to the amount of $426,983,980. A large part of the securities thus authorized were for refunding purposes, but the total amount authorized for the construction of additions and betterments has amounted in this period to $239,790,155. The investment which has been made in California as the result of these issues is greater than the investment made by public utilities during any other corresponding period in the history of the State.



THIS IS AN EXAMPLE OF A ROLLED ROADBED WELL SHAPED

Experiment with Gravel Roads in Iowa

T. R. Agg Tells Details of Preparing Roadbed, of Rolling, of Removing Waves in Gravel, and of Necessity for Early Maintenance

IOWA has been experimenting this summer with gravel roads and in the November *Service Bulletin* of the State Highway Commission, T. R. Agg, professor of highway engineering of the Iowa Engineering Experiment Station, recounts the methods used and the results obtained as follows:

While the season was an exceedingly bad one for construction work, it being almost impossible to secure strictly high-class results, neverthless it is believed that the general method followed will prove entirely satisfactory for most Iowa graveled roads.

While it is highly desirable to secure a gravel containing about 60 per cent of material retained on a ¼-in. screen and having from 15 to 20 per cent of clay binder mixed with it, the summer's experience indicates that a good road can be built with any kind of gravel if it be properly handled. On the Fort Dodge road, carrying successfully the exceedingly heavy traffic of the Hawkeye highway, the gravel consisted of pebbles ranging from ½ in. in size down to fine clay. The clay content was about 20 per cent and only about 40 per cent of the material was retained on the ¼-in. screen. The pebbles were of good, hard durable material, and the clay was thoroughly mixed with the sand.

On the Spirit Lake work, several different supplies of gravel were drawn upon. Some of the material was exceedingly coarse, contained pebbles up to 3 in. or more in size and was deficient in bonding material. Other material that was used ranged from about 2 in. down, was fairly well graded and contained about 15 per cent of bonding material.

At Rockwell City an exceedingly variable local deposit was used. The gravel contained at least 60 per cent of sand and 20 to 25 per cent of clay.

Whatever the character of the material happens to be, good results can be obtained if care be exercised in securing uniform mixing of the materials on the road so that the layer will be homogeneous in character and will, therefore, wear uniformly. It is also important to rake out the larger stones and put them in the bottom layer. This was particularly noticeable on the Spirit Lake work. On some of the older roads in that vicinity, the surface was exceedingly rough, due to a lack of uniformity in the gravel, and particularly to the presence of stones larger than 2 in. in diameter. It is believed that no stones larger than will pass a 2-in. ring should be used for the wearing course of a graveled road. If the gravel is deficient in binder, clay or loam from alongside the road can be added to the surface and harrowed in, but care should be taken not to use too much binder.

PREPARATION OF ROADBED

In shaping the trench for the lower course several methods were tried out, some of which did not prove to be very satisfactory. The elevating grader with a short horizontal apron, was used for a few days and apparently will prove to be very satisfactory for this class of work. The material which was excavated in forming the trench for the lower course was delivered



THE LARGER STONES SHOULD BE RAKED IN SUBGRADE AHEAD

by the apron far enough out at the side to form the shoulders for the upper course. Unfortunately, the machine that was being tried out broke down before conclusive ideas had been arrived at as to the exact manipulations necessary to complete a roadbed by this method. Later, the trench for the lower course was plowed by means of the tractor and a heavy road plow, and the material thus loosened was graded out to form shoulders for the upper course by means of a blade grader. This method did not prove to be very satisfactory, because the tractor repacked the material that had been loosened during the plowing, and it was difficult to finish the grading without additional plowing. At another place, the heavy scarifier was used to loosen the road surface, and after it had made a few rounds, the loosened material was graded out with a blade grader for shoulders. Probably the following methods can be used satisfactorily: 1. Elevating grader with horizontal apron. 2. Scarifier and blade grader. 3. Road plow and blade grader, if each furrow is graded out as soon as plowed.

ROLLING THE ROADBED

After the roadbed has been shaped it is thoroughly rolled with a roller weighing at least 10 tons. The purpose of the rolling is twofold: 1. To compact and seal the roadbed so as to make it as nearly waterproof as possible. 2. To develop any fundamental weaknesses in the foundation if such exist. These latter will be evident by spongy places that will not compact. When such places exist before the gravel is placed and are not discovered the gravel road will eventually develop a depression at this point. Probably it will cut through. The cause of spongy places is usually water, either held in a pocket surrounded by impervious clay, or underground water flowing near the surface. In any case it is important to discover the presence of poor foundations before the gravel is placed and to take whatever measures are necessary to correct the condition before placing the surface.

Experience has shown conclusively that one cannot regularly compact a layer of gravel that is more than 6 in. thick. For that reason a gravel road should be constructed in two layers, each of which will be about 6 in. thick before compacting. When the road is built to the Iowa Highway Commission standard the lower course will be 8 ft. wide.



GRADER SHOULD REMOVE WAVES BEFORE FURTHER ROLLING



CRACKS ON THE SURFACE DISCLOSE SPONGY PLACES IN THE SUBGRADE

In order to get just the right amount of material in the roadbed the wagon should be measured and the distance should be computed. The dumper should then be given a stick of the length that a load should spread or should be given a cord of the right length with a stake at each end. If the loads are dumped the right distance apart spreading is considerably easier and when completed the builder is assured that he has the proper thickness of gravel. The spreading may be done with shovels or with rakes as fast as the loads are dumped. But if the hauling is being done by a large force it may be more convenient to dump a number of loads of gravel and then spread them with a blade grader. For this work a light grader that can readily be drawn by two horses is better than a heavier machine.

HARROWING MIXES MATERIAL EVENLY

After the gravel has been spread it should be thoroughly harrowed to evenly mix the material. Everyone knows that the ordinary gravel is exceedingly variable in composition, and that even material hauled from a single pit will vary from load to load. If, however, the material in the road is thoroughly stirred up a sufficiently uniform texture can be secured to give reasonable uniform wearing qualities. The harrowing has another important function, that is, to distribute thoroughly the bonding material through the mass. This bonding material is often clay from the overburden, or from dirty gravel, that is mixed with the better material. Sometimes it is clay that is thrown upon the surface from alongside the road.

The most satisfactory harrow is one that is made of 1¼-in. round iron, spaced about 6 in. apart and extending 8 in. below the frame. The harrow is arranged to be drawn by one corner and weighs about 250 to 300 lb. The teeth must be long enough to stir thoroughly the entire thickness of the layer.

After the gravel has been spread and harrowed it is rolled once over. At this stage it will have a wavy appearance due to the fact that in spite of the utmost care there is a lack of uniformity in the spreading and some difference in the density of the layer of gravel. The blade grader is run over the surface dragging the high spots and depositing the material in the low places. Two or three rounds are necessary to produce the desired uniformity. It is important, however, to take very light cuts with the grader, dragging only a small amount of material along the surface. When once the blade is set it should not be shifted again during the round, otherwise additional uneven places will be formed. The roller is then run over the surface for another round or two and the grader again used to smooth the inequalities. On the work done during the past summer it was usually found necessary to repeat this operation four or five times. But this was due to the unusual weather conditions which made it impossible to secure as favorable a foundation as would ordinarily be the case. Probably during an average season, three times over with the grader between rolling will be enough.

The important thing is to get the gravel so well spread that it rolls down uniformly. As soon as this stage is reached the rolling is carried on continuously until the layer is thoroughly compacted. If the gravel has been placed during dry weather and continues to dry out after being placed on the roadway it is useless to attempt to compact it with a roller or by any other means. It should be kept in shape by frequent trips with the grader until a rain wets it sufficiently to permit rolling. This may be a considerable time at certain seasons of the year, but if the gravel has been spread between suitable earth shoulders the traffic cannot spread it out over the roadway and waste it during the period when it is too dry to pack. When it does receive enough water to pack properly the roller will finish many feet of road a day. During the period when the road is being kept in shape the grader should be used in preference to the drag. The drag has a tendency to increase the waviness of the surface unless provided with runners.

EARLY MAINTENANCE PREVENTS RUTS

No matter how carefully a gravel road has been built it will not be possible to produce the stability and density of texture that would result from years of traffic. During the first year especially traffic will have a tendency to form ruts or depressions in the road surface. Unless these are taken care of immediately upon their appearance they are liable to become a permanent feature of the surface. As the gravel gradually seasons it becomes increasingly difficult to remove depressions or ruts and the economical thing is to prevent the formation of them. This is best accomplished by an occasional trip with a light blade grader until the road reaches that stage where the blade will not touch the surface. After that the plank or split log drag should be used. The drag will not shave the surface but will collect a little loose material as it moves along, and this will be sufficient to fill the small ruts and depressions that may have formed. It should be expected that during the first year the road will need constant attention. After that time it will need oc-

casional maintenance so long as it will be used.

Many miles of gravel road have been inspected during the past season that were really dangerous for automobile travel because of the excessive cross slope. The gravel had been placed on an earth road surface which was itself crowned too highly. The gravel added another 8 or 10 in. to the crown and no shoulders were brought up to the edge of the gravel. These roads were comfortable enough to travel so long as the car was straddling the crown of the road. But if compelled to turn off to the side it was not only very uncomfortable to travel but positively dangerous when the earth side road was wet.

From the cost data obtained at Fort Dodge and on the part of the other experimental roads not yet completed, it is believed that serviceable double-track gravel road can be constructed for $2,500 per mile, where the haul for gravel does not exceed 2 miles and where gravel can be obtained at not to exceed 50 cents per yard.

Publicity Necessary for City Manager Success

Topic Received More Attention at Dayton than Any Other Subject—Managers Declare It Their Greatest Problem

UNLESS constantly supported by the public the city-manager form of government is in grave danger of failure because of its vulnerability to attack by politicians. Its "raison d'etre" is the higher efficiency theoretically obtainable under concentrated control. Yet that control necessarily centers on a single individual all the criticism and complaints that can arise in the manifold activities of a city. Consequently the city manager needs to secure the greatest possible publicity for his actions and policy, for only the truth can furnish an adequate defense against attack.

For these reasons publicity received more attention at the convention of the City Managers' Association in Dayton last week than any other one subject. The principal paper on the topic—describing the publicity policy at St. Augustine, Fla.—was read by Winton Miller, city manager of that place. The following paragraphs give the main points of his paper.

Quality of Publicity Matter

All publicity matter given out must be dignified, clear, concise. Although promises should not be made where it is possible to avoid making them, it is well to take the public into confidence in all matters pertaining to public policy, so as to get before the citizens proposed plans and activities and to give the administration a line on the sentiment of the community with regard to them.

Many officials do not have a knowledge of news value. Appreciating this we have followed the practice established in Dayton of having all correspondence for a day remain in an open file basket in each office until noon of the following day, that the representatives of the press may read all such correspondence and thereby tips. The reporters follow up these tips with interviews in order to get explanations and more detailed information.

Outside Agencies

It is better, too, that publicity should come from other than official sources and it is essential to have some agency pledged to give the public accurate, unbiased information regularly as to the activities in the City Hall. In this the bureau of municipal research is most valuable in cities of sufficient size to support such an institution.

Another agency is the organization known as the Citizens' Committee, Good Government Club, Civic Society, or what you will, devoted to the principle of efficient municipal administration. The function of this organization should be, first, to send out through the press or by pamphlets material showing how the city's affairs are being handled.

Municipal exhibits are most effective in bringing home to the taxpayer and citizen the advantages of the new form of government, to show the actual advantages, particularly of the new functions being taken up by the administration.

The second function of the citizens' committee is that of maintaining a good-sized organization of workers pledged to keep posted on civic affairs, so as to keep the community spirit up to a point that will insure the maintenance of good administration.

Advisory Boards

As a means of getting the formal cooperation and advice of citizens, of assisting in the general scheme of increasing confidence in the government, and of getting wider publicity for the details of the various departments, advisory boards have been appointed on various matters, including finance and taxation, waterworks and fire, park and public land beautification, city planning, and garden development and playgrounds. Each department with which these boards come in contact may soon demand increased revenues and it will be necessary to give the public reasons for these increased demands. The personnel of these boards affords a means of direct publicity.

Personal contact is a strong factor not only in getting before the people matters of interest to them, but of keeping down to a minimum any state of dissatisfaction or unrest. In order to develop the personal factor in St. Augustine, Monday night of each week is given up by the manager to holding "open house" for receiving citizens. In this St. Augustine is not a pioneer, as the manager of Springfield, Ohio, was the first to establish this open-house policy in the new form of government. These open houses have been most beneficial. It gives the citizen a more direct voice in the government. It places him in closer contact and affords a better acquaintance with municipal activities. It provides the man with a hobby the means of getting his suggestions directly before the officials. It gives the man harboring a complaint a chance to get the kick out of his system. It gives the officials a closer line on what is going on around the town.

FORTY-SIX STATES now have commissions for regulating public utilities, according to information assembled by Louis Roth and published in the New York *Public Service Record*. The only States without them are Delaware and Utah. The oldest existing commission is that of South Carolina, created in 1878; the youngest is that of Wyoming, established this year. The earliest railroad commission on record is that of New Hampshire, created in 1844.

How Apportion Costs of Municipal Improvements?

Nelson P. Lewis Discusses Relative Local and General Benefits and Proposes Rule Applicable to New or Widened Streets

A PHASE of city planning discussed at some length by Nelson P. Lewis, chief engineer of the Board of Estimate and Apportionment, New York City, in his International Engineering Congress paper on that subject, but only touched upon in the abstracts already presented in this journal (see the issues of Sept. 25, page 382, Oct. 2, page 415, and Nov. 13, page 597) is that of the distribution of expense for various classes of municipal improvements. Some classes he would assess entirely against the abutting owners. Others bring general as well as local benefits, and should be assessed accordingly. The rule he proposes for new or widened streets assumes the percentage of local benefit to depend on the width of the street. As to parks, the benefits vary more or less inversely as the distance therefrom. The following are Mr. Lewis' views substantially as he expressed them:

If the property in the neighborhood of a new park, public building, rapid-transit line or waterway is to be increased in value by some act of the city, and if the owners of this property are to be enriched by this act, is it fair or just that these owners shall contribute no more per unit of assessed value than do the owners of other property more slightly, if at all, affected? To determine the precise amount of benefit will be well nigh impossible, but the recognition of the fact of the benefit and of the obligation to pay a special share of the cost in return for that benefit seems only a question of elementary justice.

Relative Benefits from Street Changes

In the case of local streets, the purpose of which is simply to furnish light, air and access to the abutting property, that property could fairly be required to pay the entire cost of the acquisition and improvement of the street. When a highway is given a more generous width in the expectation that it will be called upon to accommodate a certain amount of through traffic, the benefit is more general, and the assessment area in such a case may be extended to a line midway between it and the next street of more than residential width. The major part of the expense should, however, be confined to the abutting property, so that the cost to it shall be somewhat more than that of the narrower street. In the case of arterial thoroughfares, or in the case of the first street to be opened through an undeveloped territory, the effect of which will be to give access to and stimulate the development of a large district, the area of benefit will be correspondingly enlarged. Again, in the case of thoroughfares of exceptional width which it is proposed to treat as boulevards or parkways, the entire city or metropolitan district will be substantially benefited and should bear a portion of the expense.

In the case of street widenings or the cutting of new streets through built-up sections, the local benefit is less marked, though it will always follow. The mere fact that a widening or extension is required to accommodate traffic is conclusive evidence that the street has assumed more than local importance. The width of the

road as widened is not an index of its local or general importance. There may be cases where the opening up of a new street of a width commonly given to local streets and extending for a very short distance would, on account of its strategic position, be of great general and of little local benefit. The relative local, district or general benefit resulting from any street or other improvement can be determined neither by its dimensions nor its cost. An improvement involving the expenditure of $1,000,000 in one part of the city may be more distinctly local in its beneficial effect than one costing $50,000 in another section.

RULE FIXING LOCAL BENEFIT

While no definite rule can be adopted to govern the distribution of assessments representing the local district or general benefit, it should be possible to prescribe a method of determining the amount and extent of the local benefit, particularly in the case of new streets, boulevards and parks. Let us assume that 60 ft. is the maximum width required for a local street. Then the entire cost of acquiring and improving all streets 60 ft. or less in width may properly be placed upon the property within a half block on either side of the street. In the case of wider streets that proportion of the cost represented by the ratio which 60 ft. plus 25 per cent of the excess over 60 ft. bears to the width of the street would probably be an equitable proportion to assess upon the local district. Up to a certain limit property fronting a wide street is more valuable; on the other hand, after a street reaches a certain width additional width will not involve additional benefit. It may be assumed that the share of the expense which would be equivalent to paying for a street 80 ft. wide should represent the limit of local assessment. This limit would be reached under the proposed rule when the street becomes 140 ft. wide. The percentages of cost which would be locally assessed would, therefore, be as follows for various street widths:

Width, feet,	Percentage,
60 and less	100
70	89.3
80	81.25
90	75
100	70
150	53.3
200	40

In the case of street widenings involving the destruction of buildings, the same general principles might be adopted as in the case of new streets, but they should apply to the land values only. If the street were less than 60 ft. wide the proportion of expense for the additional land in order to make it 60 ft. would be assessed upon the half block on each side, while for all excess over 60 ft. the same rule already proposed could be adopted. For instance, if a street 50 ft. wide were to be widened to 80 ft., involving the acquisition of 30 ft. of additional property, the first 10 ft. required to make it 60 ft. wide and 25 per cent of the 20 ft. over 60 ft., a total of 15 ft., or one-half the cost of the additional land to be taken, might be assessed locally, the expense involved in damage to buildings being included in the district assessment or in the general assessment if the improvement is of sufficient importance to involve general benefit.

PARK PROBLEM MORE DIFFICULT

In the case of parks the problem is more difficult, the amount of local assessment and the extent of the area of local benefit being determined by the size and shape of the park and facility of access to it from other parts of the city. In any case, no rule should be adopted until it has been carefully tested, and has demonstrated that the assessment levied in accordance with it will constantly decrease as the distance from the improvement increases. A curve to determine the distribution of the assessment after the limits of the district have been decided has been proposed by Arthur S. Tuttle, deputy chief engineer of the Board of Estimate and Apportionment of New York City, in accordance with which about 32.5 per cent of the assessment would be placed upon the first 10 per cent of the distance to the outer limit of the area of benefit, 55 per cent upon the first 25 per cent and 80 per cent upon the district extending halfway to the outer boundary of the area of benefit.

Lift Spans Over Arkansas River Designed for Possible Shifting of Channel

Bridge Near Pine Bluff, Arkansas, Contains Unusual Lifting Mechanism—Chains Instead of Cables—Folding Counterweight

PROVISION for a shifting river channel by using a lift span and five other truss spans of identical design to make possible future transfer of the towers to lift any span desired, the use of counterweight chains of special design instead of the usual wire cables, and the adoption of a folding cast-iron counterweight to control the balance of the lift span and chains are some of the unique features in the recently completed bridge over the Arkansas River near Pine Bluff, Ark. This bridge, which is a combined railway and highway structure, was built by Jefferson County, Arkansas, and crosses the Arkansas River about 4½ miles upstream from Pine Bluff. It was considered advisable to provide for railway traffic in order to furnish a crossing for certain proposed railways, none of which have yet been built.



LIFT SPAN OVER ARKANSAS RIVER WITH LINK CHAINS TO COUNTERWEIGHTS

The bridge is approximately 3010 ft. long, with 1610 ft. of steel structure and 1400 ft. of timber trestle. The steel section consists of seven riveted spans, six of which are 239 ft. 4 in. center to center of end pins, while the one at the north end is 149 ft. 7 in. long. The six long spans each have eight panels and the short span has five panels, all of the panels being 29 ft. 11 in. in length.

LOADS AND ALLOWABLE STRESSES

The live loads used in the design of the superstructure were Cooper's E-50 loading for the railway track, a 10-ton motor truck or 100 lb. per square foot for the roadway floor, and 50 lb. per square foot on the roadways for the trusses. The piers were designed for Cooper's E-45 loading on the railway track and 30 lb. per square foot on the roadway. The impact increments were computed by the following formulas:

For railway loads

$$I = \frac{800}{800 + L + L^2/100}$$

and for highway loads

$$I = \frac{300}{800 + L + L^2/100}$$

where I is the impact increment, and L the loaded length in feet.

The allowable working stresses were specified according to usual practice, except that 17,000 lb. per square inch was allowed for eyebars and laterals in tension, 12,000 for floorbeam hangers, and 16,500 for the extreme fiber stress of plate-girder flanges when computed by the moment of inertia method. Built members having lacing bars were allowed a unit stress of $14{,}000 - 60l/r$, or less than the $16{,}000 - 70l/r$ used for stocky members with solid web diaphragms. Jaw plates or forked ends of compression members were allowed $10{,}000 - 300l/t$, the value l/t not to exceed 16.

The channel of the Arkansas River is liable to shift at any time. At the Cotton Belt bridge, a few miles below Pine Bluff, the

channel shifted from one side of the river to the other, necessitating the construction of a new swing span, so that the bridge now has two swing spans. It was therefore considered desirable in this case to use a type of construction such that the movable span could be shifted to any part of the bridge in case of a change of the location of the channel. This requirement, it was thought, would be best met by the use of a vertical lift type of movable span.

The War Department required a clear channel of 225 ft. between piers and a vertical clearance above high water of 60 ft. when the lift span is raised to full height. This fixed the span length at 239 ft. 4 in. The channel at present is near the north bank, and the five spans to the south of the channel spans were also made of the same length.

ALL TRUSSES ALIKE

The lift span, of course, acts as a simple span under live load, and the members are stressed precisely the same as the corresponding members in the other spans, except that they carry a small additional stress due to the operator's house and weight of machinery. The trusses of all six spans were made alike to provide for this extra loading in case some other span should be converted into a lift span. In case it is necessary to change the location of the movable span, the towers, counterweights and operating machinery will be moved to the desired point, holes being provided in all spans for this purpose.

The weight of the lift span is counterbalanced by concrete counterweights attached to the span by means of steel chains passing over cast-steel sheaves or drums at the tops of the towers. Hence the shoes at the ends of the lift span carry no dead load, the weight of half the span being transferred to the two columns of a tower. Since one of the counterweights weighs the same as half the span, the total dead load at the top of the tower is equal approximately to the weight of the span, which is 610 tons. Consequently the shoes of the tower, which must be fixed, carry a much heavier load than the other shoes.

DESIGN OF SHOES TO ALLOW CONVERSION

In each span there is a fixed end and a movable end, so that in case of the conversion of another span into a lift span it will be necessary to change two roller shoes into fixed shoes and vice versa. The shoes are so designed that the rollers may be removed and a steel casting of the same depth inserted. Each roller nest consists of seven 8-in. rollers, which have a 2½-in. groove at top and bottom in which fit longitudinal lugs on the shoes and bedplates. In the case of the lift span, this lug in descending might strike the edge of the groove and thus prevent the span seating properly. For this reason the lug at the base of the shoe is made removable and is omitted in the lift span.

Both the fixed and the expansion shoes of the lift span are carried up with the span. The rollers are left on the base or pedestal, and are kept approximately vertical by means of two coil springs attached to the top of the middle roller at one end. These springs are attached to the ribs of the cast-iron base in such a manner that they pull in opposite directions, thus keeping the rollers upright.

In order to provide for the heavy load transmitted by the tower columns at the ends of the adjacent trusses, steel castings are used between the end gusset plates. These castings are riveted to the gusset plates so as to transmit the reactions of the trusses to the shoes, and the loads from the tower columns are transmitted directly through them to the end pins. These castings are provided at all the end pins, since it is not known what shoes will be called upon to support the tower load.

The lift span is provided with guides to insure its proper position while ascending and descending. To special end struts are



SPAN LIFTED TO HIGHEST POSITION

attached, by means of turned bolts, steel castings projecting into the rectangular space formed by the web and flanges of the 14-in. Bethlehem H-section of the tower posts and the flange angles riveted to the inside of the 22-in. side plates. At the fixed end of the span each of these steel castings has two longitudinal rollers, and one transverse roller on its center line beveled to suit the inclination of the under side of the flange of the H-section. Thus the span is effectually guided both longitudinally and transversely. At the expansion end of the span the two longitudinal rollers are omitted so as to provide for the expansion and contraction. The rollers are designed so as to be easily removable.

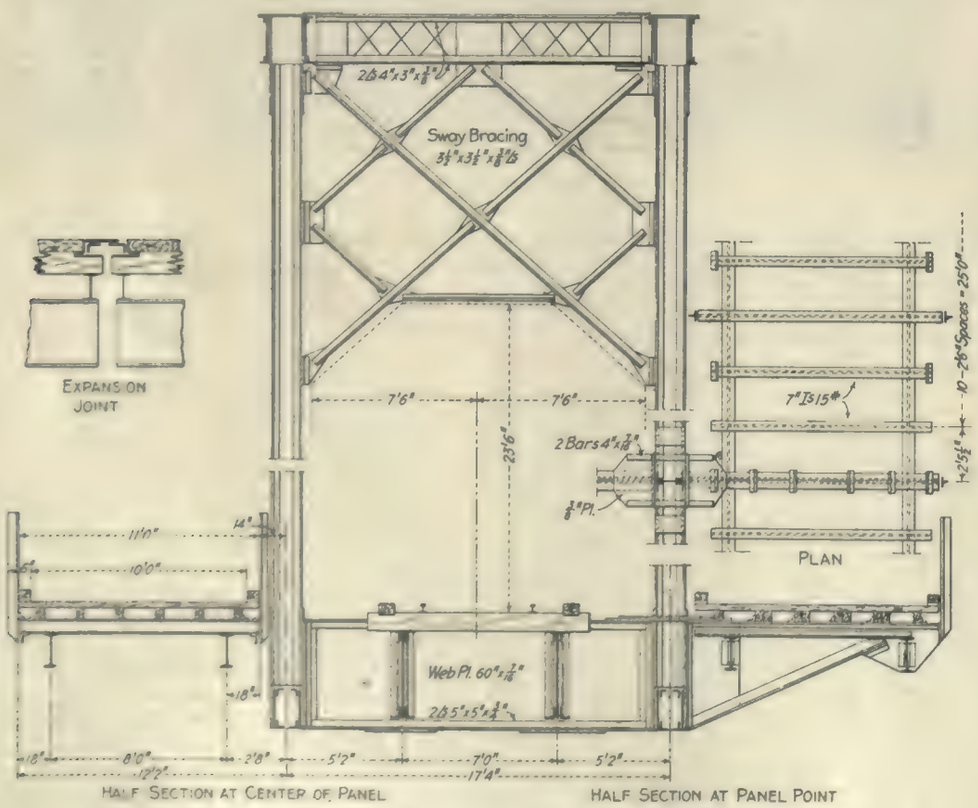
The lift span when in position for carrying traffic is practically suspended in the air, since the shoes carry only the live load. In order to resist the longitudinal thrusts due to braked trains, two castings are provided, one attached to the tower post and the other to the lift span. The casting attached to the lift span has a tongue which engages a recess in the other, preventing the longitudinal movement of the span.

In order to center the span transversely there is attached to the middle of each end floorbeam of the lift span a casting with a tongue which engages a recess in another casting carried on a steel frame attached to the pier. This device also serves to carry the transverse wind load to the pier, since it would be difficult to carry this load through the shoes.

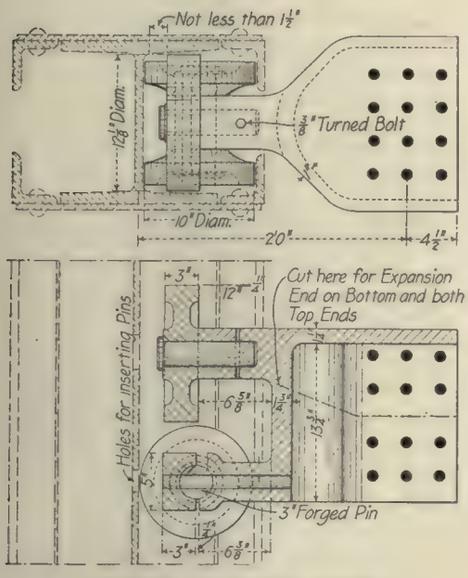
COUNTERWEIGHT CHAIN

Perhaps the most interesting feature of the design is the counterweight chain used to support the span. Other vertical lift bridges are supported by means of wire ropes at each corner of the span attached to a series of horizontal equalizing levers for the purpose of insuring equal stress in all the ropes. There are a number of objections to this type of construction, and it was thought that the use of flat link chains would be preferable to wire rope.

These chains are built up of short links or bars connected by means of 3½-in. pins. The radius of the drum at the pitch line of the chain is 4 ft. 3½ in., and the links running over it are about 1 ft. 8 in. long, center to center of pin holes. The set of links between pins are made alternately rotatable and non-rotatable, with three rotatable links in each section. The heads are forged to a thickness of 4¾ in. so as to reduce the



CROSS-SECTION OF BRIDGE—CANTILEVER BRACKET CONNECTED TO FLOORBEAM



DETAILS OF ROLLER GUIDES

bearing on the pins to 6000 lb. per square inch. These rotatable links are provided with bronze bushings ½ in. thick. In each set of non-rotatable links there are two inside links and two outside links. The pins project somewhat beyond the outside links and are provided in each end with a diametrical hole in which is inserted a 1¼-in. keeper bar, which is bolted to the center of the outside non-rotatable link. The purpose of the keeper bar is to prevent the rotation of the pins with respect to the non-rotatable link and compel the rotation to take place in the enlarged heads of the rotatable links.

No provision was made for lubrication; since the operation of such bridges is rather infrequent, it is believed that very little wear will occur. Even if considerable wear should take place it would not be a matter of consequence, since the operation of the chain depends in no way upon the pitch of the links, center to center of pins.

Bending of Keeper Bars

The keeper bars were designed to overcome a difference of about 2 per cent in frictional resistance. It was thought that the resistance to rotation of the bronze bushed links would be less than that of the thin unbushed links. In some instances this proved not to be the case when the span was put in operation, as rotation took place in the heads of the thin links, which caused the keeper bars to bend, and in some places to break.

It was observed that the bronze-bushed links were a rather tight fit, making it difficult to drive the pins, while the other links fitted somewhat more loosely. Most of the trouble developed on the approach of warm weather, and it seems probable that since bronze has a coefficient of expansion about 50 per cent greater than steel, the expansion of the bushings was sufficient, in connection with the close fit, to produce such a grip on the pins as to compel the rotation to take place in the set of links which were designed to be non-rotatable. The original keeper bars were made of medium steel. They have been removed and replaced with new pins of greater strength.

Folding Counterweight Controls Balance

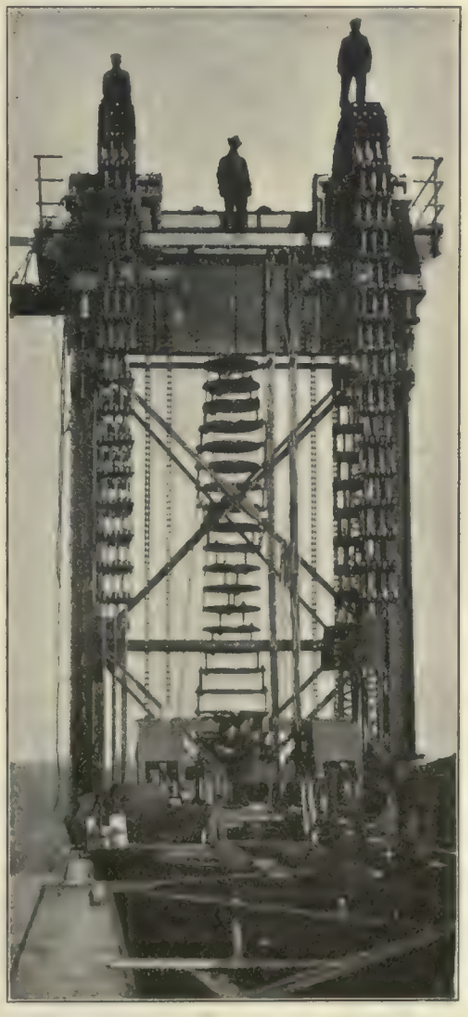
The main counterweights are composed of precast concrete blocks supported in a steel frame. This construction was designed to facilitate the erection of the counterweights and permit of their being taken apart and moved if necessary.

Another feature is the cast-iron supplementary or folding counterweight. This auxiliary counterweight was provided in order to compensate for the transfer of the weight of the chain from one side of the drum to the other. It consists of cast-iron circular disks 3 ft. 5 in. in diameter and 2¼ in. thick, with projecting lugs diametrically opposite having two holes in each lug for 1¾-in. bolts. The upper disk or plate is suspended from the tower by means of two opposite bolts. The second disk from the top is supported from the top disk by means of two opposite bolts from the other pair of holes. The third disk is similarly supported, and each disk is rotated slightly with respect to the one above in order to permit the bolts to clear the lugs when the disks are brought together.

How Folding Counterweight Acts

When the main counterweight is in its lowest position the folding counterweight is extended so that all disks are 1 ft. apart in the clear. As the main counterweight rises when the lift span descends it picks up these disks one at a time until it reaches its highest position, when the folding disks are all superimposed upon one another and the entire weight rests upon the main counterweight. The weight of the disks is such as to compensate in all positions for the lack of balance of the main chain. Thus no power is required to overcome unbalanced loads except such an unbalanced load as may be due to the impracticability of determining the exact weight of the lift span or counterweights.

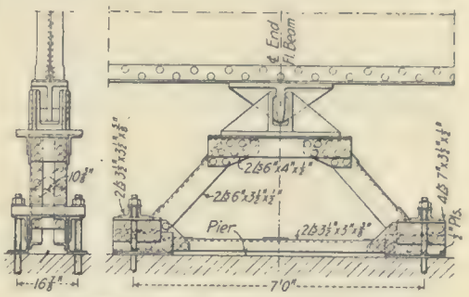
An auxiliary counterweight of this type might be designed to assist in operating the span. Thus, by changing the weight or spacing of the individual disks to secure an overbalance of weight on the counterweight side they would aid in starting the span upward when down, and a corresponding overbalance on the span side would start the span downward when up.



LATERAL CENTERING DEVICE FOR LIFT SPAN AND CONNECTION TO PIER

Operating Machinery

At each corner of the span there are two heavy sprocket chains attached at one end to the top of the tower and at the other



FOLDING DISKS PRESERVE BALANCE

to the cross girder between the tower posts a short distance below the top of the top chord. These operating chains are attached to horizontal links to equalize the stresses and are provided with bolts at top and bottom to adjust the position of the chains and to regulate the tension.

At a point a little above the top chord each pair of sprocket chains is looped back toward the center of the lift span in a horizontal direction between two pairs of idler sprockets and then passes over drive sprockets. These sprockets are operated by a train of gears connected to a motor. There are two motors, one at each end of the span, each operating the two pairs of driving sprockets at that end. The train of gearing, the drive sprockets and the idler sprockets at the corner of the span are all attached to a structural steel frame, and all the parts were assembled and fitted before shipment from the shop.

In order to insure that both ends of the span move together, the mechanism of the two ends is connected by a line shaft. In case a motor at one end should get out of order, the motor at the other end will operate the span, the line shaft being capable of transmitting its power to the other end. To the line shaft is attached the hand-operating capstan near the center of the span.

Source of Electric Current

When the plans were prepared it was expected that the proposed electric railway from Pine Bluff would be built by the time the bridge was completed, and for that reason the span was designed to be operated by means of two 1200-volt direct-current motors rated at 40 hp. Since the electric railway was not built, a transmission line from Pine Bluff to the bridge site had to be constructed. As this transmission line carries 2300-volt aternating current, it was necessary to provide a motor-generator set to convert the alternating current into direct. It was found impossible to procure a 1200-volt motor-generator set without considerable delay, so a 600-volt set was installed and the current supplied is quite sufficient for operating the span.

The span is locked in position by means

of a heavy strut or beam which slides under a roller attached to the cross girder between the tower posts. The upper side of the lock at the end is provided with a beveled casting sloping 4 in. in 18 in., and the mechanism is designed so that in case the span should not be quite seated the lock will force it down to the proper position. It is operated by a rack and pinion actuated by a small motor with speed-reducing gears.

The plans were prepared by Hedrick & Cochrane, consulting engineers, Kansas City, Mo., and the field work was supervised under their direction, with C. S. Reagan as resident engineer. The bridge was erected by the Missouri Valley Bridge & Iron Company of Leavenworth, Kan. The steel was furnished by the American Bridge Company. The consulting engineers attribute much of the success of this construction to the many valuable suggestions made by the engineering departments of the Missouri Valley Bridge & Iron Company and the American Bridge Company.

Literature

For the Civil Engineer and Contractor

New Publications

GENERAL SPECIFICATIONS FOR CONCRETE WORK AS APPLIED TO BUILDING CONSTRUCTION. By Wilbur J. Watson. Second edition, revised. Paper; 8⅛ x 10¾ in.; 56 pages, illustrated. New York, McGraw-Hill Book Company, Inc. $1 net.

PROCEEDINGS OF THE AMERICAN SOCIETY FOR TESTING MATERIALS, Vol. 15, 1915. Part 1, Committee Reports; Part 2, Technical Papers. Cloth, 6 x 9 in.; 485 and 477 pages respectively. Philadelphia, published by the society, Edgar Marburg, secretary-treasurer, University of Pennsylvania

GRAVITY AND PRESSURE TANKS, CONCRETE RESERVOIRS AND VALVE PITS. Regulations of the National Board of Fire Underwriters Recommended by the National Fire Protection Association. Paper; 3½ x 5¼ in.; 88 pages, illustrated. Boston National Fire Protection Association.

ANNUAL STATISTICAL REPORT OF THE AMERICAN IRON AND STEEL INSTITUTE FOR 1914. Cloth; 6 x 9 in.; 118 pages. Philadelphia, Bureau of Statistics of the Institute, 261 South Fourth Street.

Production of iron ore, coal, coke, iron and steel products, imports, exports and average monthly and yearly prices, with numerous tables.

PIT RIVER PROJECT IN CALIFORNIA. By E. G. Hopson supervising engineer, U. S. Reclamation Service. Paper; 5⅞ x 9 in.; 55 pages, illustrated by photos and drawings. Washington, Government Printing Office.

An official report on the Lower Pit River project discussing the irrigation of about 55,000 acres of land in the Sacramento Valley in and in the vicinity of Shasta County, California.

PIT RIVER BASIN IN CALIFORNIA. Prepared by E. G. Hopson, supervising engineer U. S. Reclamation Service under an agreement for co-operative work by the United States Department of the Interior and the State of California. Paper; 5¾ x 9 in., 140 pages, containing colored insert plates as well as an unusually large number of maps and other illustrations. California, State Printing Office.

An official report dealing with investigations made in 1914 and 1915 under the co-operative plan, through engineers of the Reclamation Service and the Engineering Department of the State of California, reviewing the topographic divisions, geology, forest cover and precipitation within the basin and discussing the need of water transportation and irrigation of 177,600 acres of land in northeastern California, lying in Modoc, Lassen, Siskiyou and Shasta Counties.

Books Reviewed

Rivington's Notes on Building Construction

Edited by W. Noble Twelvetrees. Cloth, 5½ x 8¼ in.; Part I: 306 pages, 484 illustrations. Part II 332 pages, 395 illustrations. New York, Longmans, Green & Co. $2.25 net each.

Reviewed by F. H. Constant

Professor of Civil Engineering, Princeton University, Princeton, N. J.

This is an English work in two volumes, of about 300 pages each, intended as a practical guide and compendium for architects and builders. The first edition was published forty years ago, primarily to assist students in their preparation for examinations in building construction under the Board of Education, South Kensington. But the book has had a wider field as a reference work for architects and builders. The first revision was made ten years ago and the present edition (both volumes), has been entirely rewritten to bring it up to date. A unique feature of the work is the different authorship of the various chapters, mostly by architects of high standing. A list of the contributors appears on the front page of each volume.

The work is wholly descriptive and entirely free from mathematical treatment or formulas. The object of the books it to furnish practical information upon the multitudinous details in the building art. In this respect it is characteristically English, placing emphasis upon established custom and practical rules rather than upon mathematical principles and formulas. Since methods and details of practice are different in many respects in the two countries, it is not likely to find a very wide use in this country. Carrying out the original purpose of the book, each volume is concluded with a list of selected examination questions set by various institutes, guilds and colleges.

Surveying and Field Work

Author, James Williamson, A.M., Inst. C. E. Cloth, 8½ x 6 in.; 363 pages; 271 illustrations. New York, D. Van Nostrand Company. $3 net.

Reviewed by A. F. Comstock

Associate in Railway Engineering, University of Illinois, Urbana

To produce a sound textbook on the principles and practice of surveying has been the author's purpose in preparing this work. Though intended mainly for use in technical schools and colleges, the book is meant also as a reference work for practitioners. It is published as one of the British series of Glasgow Textbooks on Civil Engineering.

In arrangement, the time-honored custom of beginning with chain surveying is adhered to. Then the compass, sextant, theodolite and level are treated in the order named, with an accompanying array of applications of the several instruments to typical problems in surveying. Only the work embraced in elementary surveying is attempted, and therefore such subjects as meridian determination, geodetic surveying and plane-table surveying have been excluded. Considerable attention is given to the errors of surveying, and to plotting and computing. A chapter on setting out curves, one on earthwork calculations, and one on sections and contours (topographic surveying) compose the latter part of the book.

There is little individuality to the work, which is due, no doubt, to the large number of books on the same subject in this country. For American needs the book appears to the reviewer to be concerned too much with details to make a desirable text, and to lack the scope usual in the more commonly used reference books. The descriptions of methods, however, are unusually explicit.

Mechanical Drawing for Colleges and Universities

Authors, James D. Phillips and Herbert D. Orth. Cloth, 6 x 9 in.; 283 pages. Chicago, Scott, Foresman & Co. $1.75,

This book is designed to meet the needs of the vocational student and assumes no previous familiarity with the subject. The text therefore presents the various topics in a very elementary way, taking up the different phases of instrumental drawing in a carefully graded sequence so that a beginner may absorb his instruction with the least effort. The book begins with two chapters on sketching, follows this with chapters on mechanical projection drawings, use and care of instruments, conventions, lettering, isometric and cabinet projection drawings, and closes with suggestions for the instructor.

The elementary character of the treatment adapts the book for beginners in a technical high school or in a college where the subject is taught for its cultural value only. For the engineering college, if a text is to be used at all, something more vigorous is needed.

Elements of Railroad Track and Construction

Second Edition. Author, Winter L. Wilson, professor of railroad engineering, Lehigh University. Cloth, 5 x 7½ in.; 396 pages; 210 figures; 32 tables. New York, John Wiley & Sons, Inc., and London, Chapman & Hall, Ltd. $2.50 net.

The first edition of this work appeared in 1908, and was put forth purely as a textbook, in the belief that more elaborate volumes were not suitable for classroom work. The new edition contains numerous revisions to conform to recent developments in the art, and there have also been two new chapters added on "Practical Turnouts" and "Grades." In all 76 pages have been added. It is unfortunate that the overhauling process missed some obsolete matter entirely, and that some of the revisions are now themselves out of date. One sees references to the 1911 "Manual" of the American Railway Engineering Association, but none to the later supplements. Consequently there is no mention, in the discussion of ballast cleaning, of the screens used so successfully by the Baltimore & Ohio for the last two or three years. As to the book itself, while it certainly goes farther than some other railroad textbooks in informing students that a railroad, to be successful as such, must be something more than a single track from A to B, it still fails to give them a very clear idea of how the railroad works.

The author has wisely discussed the elements of the track itself before telling how to build it. After a short historical chapter, he proceeds with permanent way. This chapter has been considerably revised and rearranged, and gives the student a good knowledge of ordinary track. As previously suggested, the revision falls short of being up to date by about four years, which is a long time for tieplates, screw spikes, ballast cleaning and rail specifications.

To the former chapter on circular turn-

outs a new one on "practical turnouts" has been added. They could perhaps better be labeled "semi-practical" as the author treats them. He makes the use of the practical turnout a mere expediency, and fails to show that the abolishment of the stub switch and the introduction of the switch-point angle made the circular turnout an impossibility. The chapter on circular turnouts could well have been discarded entirely. Instead the student is led in the new chapter through various mathematical gymnastics for calculating turnouts that he will probably never use after graduation, but is not informed that these things are standardized for each road, that it will be important for him to learn the switch leads, which are totally different from those given in the author's table, and that certain numbers of turnouts are desirable for certain operating conditions. The author's illustrations and problems are confined to Nos. 6 and 8, which certainly do not clearly suggest best modern practice.

The author's treatment of yards is badly jumbled. He confuses trackage for local business with that for operating the road; first he makes it appear that a yard is essentially an enlarged siding for loading and unloading cars, and then, after indirectly recognizing the terminal switching yard, he implies that along with the passenger and freight station, it should be in the heart of the city. It is too bad that the author could not have given the space filled with mathematics in the chapters on turnouts to an adequate presentation of the vital question of yards and terminals.

In this same chapter is a brief outline of signaling, without, however, any mention of upper-quadrant signals.

The foregoing chapters constitute half of the book. The remaining chapters, though less revised, are better. There is a good chapter on maintenance organization and tools, faulty mainly in ignoring the growing use of machinery for maintenance. Copious space is given to signs. The chapter on the engineer corps for railroad construction has been enlarged and is a useful one for the student. The three succeeding chapters, on the subgrade, trestles and culverts, are substantially as they appeared in the first edition, and are well presented. The importance of the drainage of roadbed could have been emphasized more fully. The book closes with a short new chapter on grades, useful mainly for its information for computing vertical curves.

The reviewer realizes that it is no easy task, in preparing a new edition of a book, to bring it thoroughly up to date without rewriting it completely, and assumes that in this case the revising has occupied several years. It seems important, however, that the student of railroad engineering should be apprised of the latest developments in the field, especially at the date of issue of the book. The author has accomplished his purpose in producing a usable textbook, eliminating the mass of detail the student has neither the time nor the experience to comprehend, and undoubtedly the young graduate who enters the railroad field with a mastery of this book will have a much better understanding of railroads than the average. The way is still clear, nevertheless, for a text that will give correct relative values to the different railroad units and show how they fit into the railroad machine, avoiding the textbook habit of parading facts without explaining their comparative weights.

Letters to the Editor

Comment on matters of interest to engineers and contractors will be welcomed

Decimals of the Full Circle

SIR: I read with interest R. C. Hardman's letter relative to the introduction of the decimal division of the degree in place of the sexagesimal by Prof. William G. Raymond in his new railroad field engineer's manual. Mr. Hardman is evidently under the impression that the decimal subdivision of an ordinary degree is something new, whereas it is the original subdivision used by Briggs as far back as 1633, followed by Roe and Oughtred (all in England). Thomas Graham Gribble designed and had built some time about 1888 what he called his "ideal tacheometer," in which the plate was decimally divided as to degrees. In Gribble's "Preliminary Survey and Estimates" he says:

"By this means (the decimal division of the degree) all the advantages of the centesimal graduation are obtained while retaining correspondence with the published astronomical ephemeris."

"Tables to five places of decimals for the trigonometrical functions, together with logarithms of numbers of five places, can be procured. . . . They are compiled by Dr. C. Bremiker. . . . They are the only tables extant for this graduation. Transits can be adapted by merely changing the vernier."

It may be well to mention that Gribble wrote the above in 1890, since when other tables may have been published. There have doubtless been many attempts, since Roe and Oughtred's, to get rid of the senseless sexagesimal subdivision, which survives in spite of them.

Thus are we hidebound by traditions.

F. H. FRANKLAND,
Bridge Engineer, Highway Department,
Calcasieu Parish, Louisiana.
Lake Charles, La.

"The Changed Reclamation Service" Again

SIR:—Your editorial of above caption in the issue of July 31 attempts to sum up the Reclamation Service situation by saying that disgruntled water users failed to make good their case at Secretary Lane's Washington conferences; that the inauguration of commission control and the opening of the Denver office are presumptively mistakes or at least questionable; that too much has been granted disgruntled elements of the West, and, finally, that the lengthening of the time of payments for water rights (construction charges) was a concession to elements that are never likely to make a success of irrigation farming.

It is believed that your position and conclusions have failed to take into account some fundamental facts that would alter your viewpoint. The writer hopes to point out how Secretary Lane is working out, evidently, a policy that will solve the riddle of irrigation farming success now baffling the West to its greatest detriment, and how the fruition of his policy in the service would point the path for private enterprise which capital now fears to tread, and, in conclusion, how this would again open the field of irrigation construction to innumerable engineers who have had to forsake the field for lack of work. If my analysis is right, the Engineering Record, as one of the foremost authorities in its line, should see in Secretary Lane one of the best friends of the civil engineer, and it should give him its heartiest support in his most difficult task.

To begin with it is beyond argument that the Reclamation Service was organized to bring water to the land to reclaim the desert for homes for worthy Americans, presumably with little or no money or capital, who were willing to work, and who were to *return* the cost. Most unfortunately the old service was immediately most thoroughly imbued with the idea that "reclaiming the land" consisted merely in building reservoirs and leading the water to the land in a ditch; and even at this very moment that definition of "reclaiming the land" is paramount. Though the settlers are to return the full cost of a project as incurred by the engineers, as evidenced by a decision of the Supreme Court of the United States, nevertheless the engineers paid scant attention to the water users and their early successes, though it is most palpably evident that every dollar of the engineers' expenses must eventually come from the ground itself—thus making it imperative that the agriculturist make good. Reports by the thousands fill the service files, but I know of not one upon the achievements of the settler.

Almost immediately there was disappointment among the settlers. The facts were that they were not making good principally because they attempted with $1,000, $500, or almost nothing, to reclaim an irrigated farm. It is confidently asserted that that operation requires $5,000 of outright capital investment and the Engineering Record itself has, in articles from that eminent, able and best posted engineer, Dr. Elwood Mead, published statements that it costs $6,000. In his difficulty the settler naturally turned to the service for help, asking easier terms of payments by a graduated scale that was entirely permissible under the Reclamation Act, but the service was blinder than the settler in seeing what an impossible task had been undertaken. It turned a deaf ear to appeals for aid—even boldly asserted that the settler was shamming and would come across if the cutthroat water contract of the Government was enforced. Furthermore, the service even stated in the advance copy of the Eleventh Annual Report and in the *Country Gentleman* that 80 per cent of the settlers were lazy and shiftless in that it said: "The physical elements of success are now present, and if the majority of the settlers will use the same energy and skill that are practised by 20 per cent of them, general and great prosperity will prevail on all of the irrigation systems. The incompetent and lazy must be weeded out." Only a month or so before Secretary Lane's advent, inspired articles said that reclamation would be an immediate success if only Congress

had the heart (or heartlessness) to enforce the law, which was then, remember, the same cut-throat contract that would automatically confiscate one's holdings by cancellation on failure to meet a payment, such as is so common to land companies anxious to make inordinate profits by that method.

Secretary Lane's Washington conferences resulted. It was quite unfortunate that your representative there was not able to read between the lines. Secretary Lane was able to do so. The settlers' representatives did not make good, it is true, for they were partly self-assertive, self-appointed delegates who, though they asked for twenty-year payments, were more concerned in urging that their organizations might take over administration of the projects, with themselves, of course, at the head of the new forces. Secretary Lane saw what the service had failed to see in ten years till his advent, and what your representative failed to read, that is, that the settler was "up against it," and he took the first progressive step towards common-sense reclamation in obtaining the twenty-year payment law. It cannot possibly take the place of capital in preparing the land to produce crops, but it saved a harvest of confiscation in the West and came as a sign of a sane policy at last. It is merely one step of many already trod by foreign governments long engaged in this work. They have learned more than we have dreamed of. Dr. Elwood Mead's analysis of "Rural Credits" at the recent Irrigation Congress will quite clearly elucidate this to the doubting.

The appreciation of conditions as disclosed by the Washington hearings undoubtedly led Secretary Lane to call his conference of Western Governors, for he stated in the call that reclamation projects were "sick" and their condition called for action. You should know well that he was met half way by politicians eager to fight over Federal control of our natural resources. Our governors never even caught the "scent," and an irrigation policy was as far off as ever.

It should be evident to those who will do a little thinking that Secretary Lane has got no help from the service, from the water users, from the engineering profession, nor from the West. The Irrigation Congress just held in California offers to him the first constructive thought in a large way. His early work necessarily must have been based on his personal investigations. We should appreciate the wisdom of his actions.

Barring some early mistakes necessarily to be expected, the Reclamation Service has a record in engineering that on the whole it may be proud of; the diverse tasks thrust upon it presented more of a problem than the Panama Canal, with its relatively single task of removing a body of earth; the service surmounted its tasks without a question of graft ever coming up. The success of the service, however, hinged on social, economic, legal and agricultural factors that were somewhat overlooked. The just inference was that such a complexity of problems should not be thrust on or trusted to the wisdom of one man, and hence the Reclamation Commission was organized in order that wider experience in these various factors should determine action. The excessive "overhead charges" in Reclamation Service work were most justly subject to attack by the water users who eventually must pay them. Efficient organization of operation and maintenance forces was making for lower costs quite rapidly, but this was not so evident in construction work. The volume of work could not justify the scattered forces in 1914, with principal construction already accomplished. The Denver centralization is certainly justified as making for economy; the efficiency of the office is up to itself. All friends of Western reclamation must hope that the rights and needs of the water users who pay the bills will from now on receive due consideration, that the diverse factors of the work will receive as much thought as the engineering, and that the invaluable experience of years of actual work on the part of the service's trained engineers will unhesitatingly be taken advantage of.

There is ample evidence that Secretary Lane knows that the twenty-year payment law is not adequate to insure the success of the settler, and thereby that of the service. The "sine qua non" of his success is the *engineering* preparation of the surface of the land to suitable grade and shape for successful irrigation with a minimum of 2 or 3-in. applications of water. The resulting duty would be 3 and even 2 acre-ft. per acre, and, above all, no water would be added to the ground water, thereby eliminating 60 per cent or more of the cause of the dreaded, devastating seepage. All of this would mean an eventual crop average of 100 per cent or more in excess of the ridiculous and absurd $20 and $25 per acre average returns now obtaining.

The achievements of the settler are now of paramount importance. If Secretary Lane shows how to give him a chance, it means not merely the rejuvenation of Reclamation Service activities but a revolution in our methods of colonizing and settling projects. The business man, banker, county and State will all then know that the adequately financed settler is the one that spells success for them, and they will take such steps to finance him or provide him with stock as may be necessary.

Considering the sources of information that are open to us it is simply amazing that our leaders in engineering are not aware that the difficulties that have resulted in the quite general abandonment of one of our most important fields of engineering construction work have been investigated, understood and met by other countries some years back. It is hoped that this communication has helped to make clear that we stand in dire need of a demonstration of how to meet the needs of settlers to insure their success; that there is no chance of this through private projects at present, nor through the efforts of any of the States, inasmuch as their efforts would be sure to be more or less negatived on account of a lack of continuity of a policy due to changing administrations; that the Federal Government has adequate means and sufficient continuity of policy to carry to success such a demonstration; that Secretary Lane is doing his utmost to proceed wisely; that success on the part of his water users means an immediate impulse and expansion in irrigation construction work and the expenditure ultimately of millions on the part of the Government and private interests; that the partly abandoned irrigation field is one of the largest for the engineer; that the engineer is not using a grain of his gray matter in helping toward the solution of the problem which rests on Secretary Lane's shoulders.

Only the settler can bring prosperity to the West. Grubstake him properly and, instead of operation engineers now being the only ones left in the work, as indicated by the Engineering Record's editorial of Aug. 21, in its comments on the report of the State Engineer of Colorado, the locating and construction engineer will again be busy. This view is urged on the profession as no idle dream but as absolute fact based on years of study of the decline of irrigation activity.

AMICUS CURIAE.

Public Speaking

SIR: An editorial in the Engineering Record of Oct. 23, page 497, referred to the importance to engineers of acquiring the ability to speak well in public, and suggested that associations of engineers might consider, for the benefit of their membership, the organization of courses of instruction in public speaking, designed especially for engineers.

I heartily concur in your views regarding the importance of this subject to engineers. Facility in expressing one's thoughts clearly, whether to an individual or simultaneously to a group of individuals, is of the greatest importance and value to everyone, without regard to his trade, business or profession. It is, however, admitted by engineers that in general the members of their profession are more deficient in the power of expression than the members of other professions.

The engineering societies afford an opportunity for their members to develop in this respect, by taking part in the presentation and discussion of technical and other subjects and, in fact, I feel confident that a large proportion of the older members of these organizations would, if called upon, testify that opportunity for improvement in public speaking is one of the greatest advantages of membership in such organizations.

However, a much more direct way to become an effective public speaker is to join a class with others similarly interested, under the guidance of a thoroughly competent instructor. Fortunately for engineers and others in New York and vicinity, the opportunity is available at small cost, and I feel sure that you will be doing a real service if you will call attention in the Engineering Record to the excellent course in public speaking given at the West Side Young Men's Christian Association, Fifty-seventh Street, New York, by a thoroughly competent, practical and conscientious instructor, Walter Robinson.

Many business and professional men of this city have profited by instruction in this course in previous years, and highly recommend it. The classes are composed of men of various ages and vocations; lawyers, physicians, engineers, architects and other professions being well represented. This diversification of interests is a decided advantage and the resulting benefits are far superior to those which could be attained in a class composed entirely of engineers.

F. L. HUTCHINSON.
[Secretary, American Institute of Electrical Engineers.]
New York City.

MUNICIPAL HARBOR OPERATIONS AT LOS ANGELES during the past few months are said to hav resulted in the accumulation of a surplus of $40,000 over and above operating and maintenance expenses and investment in permanent equipment.

HINTS FOR THE CONTRACTOR

Details Which Save Time and Labor on Construction Work

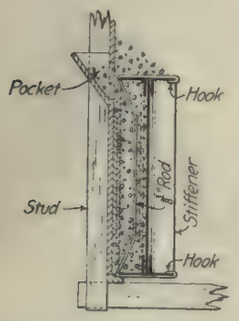
Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

[*Contributions to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

Reinforcing Spring in Place Holds Concrete to Plate Girders

By R. C. HARDMAN
Colorado Springs, Colo.

ON A PIECE of construction work recently completed a number of plate girders 62 and 67 ft. long required a covering of concrete on one side only to secure uniformity with adjoining concrete girders. The simplest method, of course, would have been to punch the web at intervals and insert suitable anchors. As this had not been done, however, and as the work of drilling holes would have been costly because of lack of the proper equipment, the method shown in the accompanying drawing was adopted. As will be seen, ⅜-in. round rods were bent to the desired shape and put on the girders. The ends were then bent around the flanges to form hooks, and each rod drawn perfectly tight by springing it in toward the center of the web. The hook around the top flange was covered by the concrete, while that at the bottom was necessarily left exposed.



The girders were made up of a web 3 ft. 6 in. deep with 4 x 6-in. angles forming the top and bottom flanges and stiffeners. The thickness or concrete required was 7 in., which left but 1 in. space between the form and the flanges and stiffening angles. The space left for placing concrete was thus too small for rapid work, even if a special aggregate were used. Therefore, a form was designed in which small holes, or pockets, were cut at about the center of each panel between stiffeners. In the later forms this was modified by making a larger pocket at each alternate stiffener so that two panels could be poured from one opening. The pockets, which were about 8 x 12 in. in the first form and 8 x 20 in. in the others, were provided with a projecting lip on the outside, which formed a sort of funnel, the opening at its top being slightly above the top of the flange. In pouring the deck of the span the girder form was filled simultaneously by two men, who shoveled concrete off the deck forms into the funnels. To avoid loosely placed concrete it was spaded through the pockets and between the flange and form with a specially constructed tool made of a flat 4 x 6-in. plate welded to the end of a ½-in. hexagonal rod. This spading was done very thoroughly, resulting in a very uniform face. As the material was placed very slowly, it was spaded a great deal more than is usually the case in concrete work.

Ditch Dug with Dynamite at 15 Cents per Cubic Yard

A DITCH 400 ft. long and 12 ft. wide was recently dug with dynamite at Carney's Point, N. J., in one day at a cost of 15 cents per cubic yard. The ditch was across a mud flat from a sluice gate to the Delaware River. The ground was soft, water-filled mud covered with a dense growth of reeds. These were first cleared off for a width of 15 ft. along the line of the ditch. As the ditch was to be only 4 ft. deep, the holes were made by pushing a long shovel handle down full length. Three rows 4 ft. apart were made, with the holes 18 in. apart and 3 to 4 ft. deep. Each hole was loaded with two cartridges of 60 per cent dynamite, one at the bottom and one about 18 in. from the top. Some of the holes in the middle row were loaded with three cartridges, two at the bottom and one 12 or 15 in. from the top. Electric blasting caps were placed every 50 ft., and fired with a No. 5 blasting machine. The result was a perfect ditch, which filled with water at high tide, 3 hours later. The dynamite cost $120 for the 800 lb. used, the exploders 50 cents, and the four men who did the work were paid $8, making a total cost of $128.50. The ditch was constructed under the direction of A. E. Anderson, and was described in the *DuPont Magazine* for November.

Dragline Bucket Picks Up Big Rock

THE accompanying photograph, taken recently, shows a rock containing 136½ cu. ft. of material being handled by a 3½-cu. yd. dragline bucket owned and used by Shnable & Quinn, the contractors for the section of the Calumet Sag Canal on which the photograph was made. The bucket, one of those designed by Mr. Schnable for this work, was under a good strain, as it gripped its unwieldy load only by one end. The big stone was, however, landed in safety. It measured 12 ft. long and 21 in. thick, with an average width of 6 ft. 6 in., and its weight is estimated at 10 1/6 tons.



HANDLING A BIG ROCK

Oil Drillers Develop Good Wire Rope Practice—Do Not Jerk Loads

"POSSUMS" like the one shown herewith are widely used by oil men to save wear on their drilling ropes by preventing friction against the sides of the well casing. When made of tarred marline wound in the form shown, they will last a long time, and can pass over the large-diameter sheaves used on well drills and wind up on an ordinary-sized drum without trouble. They are especially effective in a hole where the casing has gone out of plumb, and without them the casing may easily be cut through by the cable.



CORRECTLY-MADE "POSSUM"

Other instances of the wire-rope practice of oil drillers which should be as useful to drillers and riggers on construction work have been collected recently by A. Leschen & Sons Rope Company. One of these is to run a new drilling line for a few times after it is put on without doing actual work. This allows the line to get its "set." All kinks should be taken out by hammering them with a wooden or copper mallet on a wooden block. Unless this is done, the strands on the outside of the kink will soon wear through.

Experiments made by putting a dynamometer between the cable and its load have shown this company that a load raised suddenly with only 2½ in. of slack in the cable puts a strain on the rope 39 per cent greater than the weight of the load, while with 12 in. of slack the rope stress was triple that caused by picking up the same weight slowly with a taut cable. The obvious conclusion that, where a line is slack, the load should not be raised with a jerk, unless the chief aim of the operator is to increase the consumption of wire rope, applies not only to drilling, but also to driving piles with a drop hammer and to many other kinds of construction work.

Green Brush Used Instead of Close Sheeting in Sand Trench

FRESHLY-CUT brush with the leaves still green was used with success as a substitute for close sheeting in a water-main trench about 4 ft. wide and 6 ft. deep through pure sand on a contract recently completed. Had the necessary lumber been available, the foreman would doubtless have sheeted the entire trench, but, confronted as he was with a material that could be

rapidly shoveled out and a pipe laying gang stepping close on his heels, he could not wait for lumber. He placed his rangers and cross-braces in the same way as is done in ordinary skeleton bracing, but instead of putting breasting planks 6 ft. or so apart, he spaced them about a foot apart and packed in behind and between them the fresh brush cut down in making a road for the teams and clearing the pipe line right-of-way. The experiment proved so successful that the scheme was used in similar trenches throughout the job, with considerable saving of lumber and without any noticeable increase in the cost of labor.

Derrick-Trolley Carries Dirt Beyond Caving Banks

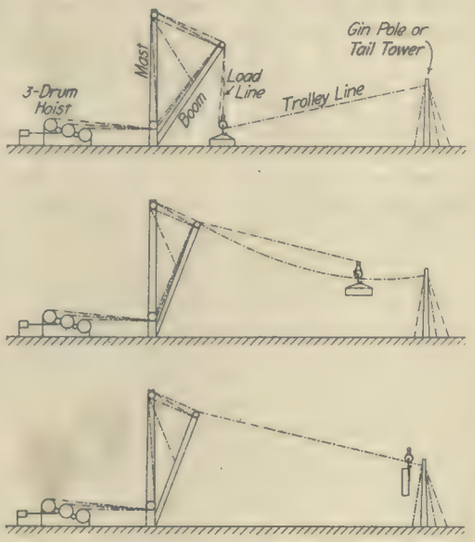
THE TROLLEY rigging illustrated in the accompanying drawing was used at the Sabine-Neches guard lock in Texas to deposit excavated material at a distance from the lock site. This was made necessary by caving banks. The rigging was described by M. A. Milliff, superintendent at the lock, on page 761 of *Profession Memoirs* for November-December, 1915.

The bulk of the excavation for the head bay and tail bay lock pits had been made with a hydraulic dredge previous to building the cofferdam. It was the intention to use wheelbarrows to complete the excavation, but after the lock had been unwatered for a short time the banks began to cave and slide in, and it was found that excavation could not be done economically in this way. A derrick was then set up, depositing the excavated material as far as the boom would reach. The dumping area thus provided, however, proved insufficient, as the weight of the material deposited caused further sliding and crawling of the banks. As the amount of material to be moved did not justify installing a cableway or additional derricks, it was necessary to arrange some way of moving the dirt the extra distance required with the plant at hand.

The three-drum hoisting engine used had the load line wound on the back drum. The trolley line was carried on the middle drum. The load line, which was single, was fastened to the top of a single steel block from which was hung the skip. Through this single block, which served as the trolley block, was rove the trolley line. The end of the trolley line was carried out and made fast to the top of a gin pole set up and guyed far enough from the derrick to permit dumping the excavated material well back of the caving banks. The boom line was wound on the front drum. The boom line was usually dogged, and in one rig was led to a hand crab, using a two-drum hoist to handle the other lines. The boom was always kept in a high position to make the trolleying possible, and its angle was seldom changed. The single block used was of the ordinary type with swivel hook, and with four bolts, one in each corner of the diamond-shaped cheek plates. The bolt on the side of the block which hung next to the mast had, of course, to be removed, as it would have interfered with the trolley cable in operation.

The material box used was an open-end skip of 1 yd. capacity fitted with three chains, one to each back corner and one to the middle of the front side. The front chain was fitted with a trip-hook. Yellow-pine piles 26 ft. long were used for gin poles and were set up on something solid to prevent their sinking into the ground under load.

In operation, the hoisting engineer picked up on the load line, bringing the trolley line tight as the load was raised and swinging the derrick around so that the boom would face the gin pole. When the load was hoisted to the desired height, the trolley line was tightened and the operator held it tight with the foot brake while releasing the load line friction. This allowed the box to trolley toward the gin pole. When the box reached the desired dumping place, the foot brake holding the trolley line was released, allowing the box to drop to the ground. The hook on the front chain was then tripped and the box dumped by bringing the trolley line taut. The box was then returned to position for loading by pulling in the load line, slacking off on the trolley line and swinging the derrick back over the excavation.



TROLLEY IS RIGGED SIMPLY

Two 10-ton steel guy derricks with 90 ft. masts and 75 ft. booms were used on the work. The trolley arrangement has been operated for a distance of 300 ft. with a 12-ft. drop. The load necessary to overhaul the loadline on this flat slope would vary with the condition of the hoist, but it is believed that 2500 lb. at least is necessary. Loading the skip with shovels, one foreman, one hoisting engineer and eight laborers have handled 70 boxes in 8 hr. with this rig. When bailing slush out of one hole, 137 trips were made in an 8-hr. day, with only six laborers employed.

Pipe Line Calker Escapes Injury When Banks Cave In

THE CONTRACTOR who lays large-sized water mains can keep down his liability losses by educating his calkers to emulate a certain "wop" who several times saved himself from caving banks by diving under the pipe he was calking. Many calkers have suffered injury due to the banks caving in while they were in the bottom of deep trenches calking the lower quarter of the joint. A man is often stationed on top to shout a warning if the banks should begin to give. Generally the calker tries to clamber erect and get up to the surface. When the earth moves slowly he often succeeds, but when it comes down with a rush, he is caught. If the calker will slide under the bulge of the pipe in such an emergency, he can generally escape without injury. Those contractors who have tried to backfill their trenches thoroughly know how hard it is to fill the space under large pipes. A falling mass of earth almost invariably leaves a good-sized void in this space, even if both banks cave in. The pipe itself will also serve to ward off any falling rocks of sufficient size to hurt a man taking refuge under it. Even if the calker is completely buried, the void along the bottom of the pipe will enable him to get enough air to breathe to keep him from suffocating until he can be dug out. All he has to do is to lie on his back, keep the tip of his nose up against the iron and retain his coolness, and he may be buried a good many times under large pipes and not suffer in the least.

Cement-Coated Piles Repaired Under Water

WOODEN PILES, wrapped with wire-mesh reinforcing and coated with concrete by means of a cement gun were used by the P. J. Carlin Construction Company in building the San Juan bulkhead in Porto Rico, and described by Mr. Carlin recently in the *Cornell Civil Engineer*. In applying the coating the piles were carried on roller supports 40 ft. apart. As the concrete applied to each pile was 2½ in. thick, the additional weight of the coating averaged 5000 to 6000 lb., which caused some of the piles to sag in turning and handling, producing cracks in the coating.

It may be of interest to explain the method of repairing the damaged cement coated piles under water. This was done by putting on a steel cylinder, about 6 in. larger in diameter than the coated pile, and around the part of the pile to be repaired. All joints were closed and the bottom of the cylinder was made to fit close to the surface of the pile, with the top of the cylinder open. On the deck, above the pile to be repaired, a tank was set up, with a large valve connected to a piece of 1½-in. single ply cotton hose, leading down to the bottom of the space between the pile and the cylinder. Cement grout was mixed in the tank and allowed to run down the hose, a diver keeping the lower end of the hose below the surface of the deposited cement until the top of the cylinder was reached. The cylinder was allowed to remain on for two or three days, then it was taken off and transferred to another pile to be repaired. The results were considered very satisfactory.

It is believed that if some method of rotating the pile, without sagging, during the application of the "gunite" can be devised, and also of handling the pile from the rollers to the seasoning yard, that this method can be satisfactorily, and, of course, economically, employed. It is undoubtedly less expensive than the solid concrete pile.

Mr. Carlin believes that a coating of about 1¼ in. would be very much better than 2½ in. because it reduces the weight on the wooden-pile, and it sufficiently covers the reinforcement.

THE 1914 PRODUCTION OF GYPSUM in the United States, according to the U. S. Geological Survey, was less in tonnage but greater in value than that of 1913. The quantity of crude gypsum mined in 1914 was 2,476,465 short tons, as compared with 2,599,508 tons in 1913. The value of all gypsum marketed was $6,895,989 in 1914 and $6,774,822 in 1913.

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

Stone Heads $50,000,000 World Trade Corporation

New Company Is Empowered to Engage in Engineering Enterprises of Every Character

Charles A. Stone, Stone & Webster, Boston, has been made president of a $50,000,000 corporation, organized to enter world trade on the broadest lines. Not only will it act as a promoter of foreign trade and deal in the securities of foreign corporations, but also engage actively in the development of engineering enterprises—railways, irrigation and hydroelectric projects, water and sewerage systems, etc.

The new enterprise, known as the American International Corporation, has a very strong board of directors, including Edwin S. Webster, of Stone & Webster; W. L. Saunders, president of the Ingersoll-Rand Company; Guy E. Tripp, chairman of the board, Westinghouse Electric & Manufacturing Company; Charles A. Coffin, chairman of the board, General Electric Company; Joseph P. Grace, W. R. Grace & Company; Frank A. Vanderlip, Theodore N. Vail and James J. Hill.

Erie City Council Adopts Flood Prevention Plans

The City Council of Erie, Pa., has adopted the plan recommended by the firm of Farley Gannett, consulting engineer of Harrisburg, Pa., for the prevention of flood damage in that city. The carrying out of this plan, which was described in detail on page 440 of the Oct. 9 issue of this journal, will involve an expenditure of about $900,000 for construction to consist principally of about 12,500 ft. of reinforced-concrete conduit, 22 ft. wide by 18 ft. high., to handle Mill Creek A resolution has been introduced in the City Council for the appropriation of funds for the first year's work. The money will be raised by the sale of bonds, which may be issued by the council without a vote of the people.

State Can Stop Pollution of River

Terminating, so far as the State courts are concerned, a litigation which has been in progress for nine years, the New Jersey Court of Errors and Appeals has sustained the right of the State of New Jersey to prohibit the pollution of the Delaware River, notwithstanding the lack of concurrent action on the part of Pennsylvania.

The immediate effect of the decision is to uphold a decree of Chancellor Walker directing the city of Phillipsburg, N. J., to cease sewering into the river or otherwise polluting the stream through the maintenance of garbage dumps along the banks.

The more far-reaching effect of the decision is to uphold the powers of the State Board of Health to continue its crusade to purify the river by enforcing similar orders against other municipalities along the Jersey shore.

Twenty-Six Cement Companies to Participate in Cement Show

Twenty-six cement companies, shipping cement within 1000 miles of Chicago, will participate in the cement show to be held at Chicago, Feb. 12-19, 1916, at the First Infantry Armory and the Coliseum. The materials for the exhibit will be drawn from the resources of practically the whole cement industry. All duplications of cement companies will be eliminated by a joint exhibit plan, which will enable the manufacturers to install such a display as has never before been attempted.

The Second National Conference on Concrete Road Building will be held at the Auditorium Hotel, Feb. 15-18, in connection with the Cement Show, and it is the intention to have on display at the show such specimens of concrete road work as will be discussed at the conference.

Cleveland Engineers to Print Descriptions of Engineering Works

As a result of a meeting of the Cleveland Engineering Society, Nov. 9, at which the "Future of the Engineering Profession" was discussed, the society has adopted a plan to issue a special number of its journal, containing popular descriptions and illustrations of recent progress in engineering works. The discussion followed upon papers on the future of the profession by E. H. Whitlock and A. J. Himes, the former chairman of the local sections committee of the American Society of Mechanical Engineers, and the latter valuation engineer of the New York, Chicago & St. Louis Railroad and member of the National Committee on Engineering Co-operation.

Engineers Predominate in City Manager Association

On Publicity of Accomplishments and Retention of Public Interest Depend Success of the Manager Movement

Twelve of the seventeen city managers meeting in Dayton, Nov. 15, 16 and 17, at the second annual convention of the City Managers' Association, were engineers. About seventy cities have voted to be run by a manager, but in about twenty the date of appointment has not yet arrived.

Proper and effective methods of getting publicity of results accomplished and what the new movement means to the citizen cropped up in the discussions at all meetings, in addition to a special paper on the subject of Winton Miller, city manager, St. Augustine, Fla., formerly executive secretary in the Dayton manager's office and previous to that a newspaper reporter.



CITY MANAGERS WHO HELD ANNUAL CONVENTION AT DAYTON, OHIO, LAST WEEK *Photo. S. R. Kremer, Dayton*

1, H. G. Otis, Beaufort, S. C.; 2, H. M. Waite, Dayton, Ohio; 3, G. C. Cummin, Jackson, Mich.; 4, Kenyon Riddle, Abilene, Kan.; 5, H. N. Beck, Grand Haven, Mich.; 6, W. C. Miller, St. Augustine, Fla.; 7, S. C. Cornwall, Hickory, N. C.; 8, O. E. Carr, Cadillac, Mich.; 9, S. C. Barnwell, Rock Hill, S. C.; 10, Karl Mitchell, Sherman, Tex.; 11, W. F. Fairbairn, Big Rapids, Mich.; 12, J. S. Ekey, Grove City, Pa.; 13, T. A. Wilson, Clarinda, Iowa; 14, C. E. Ashburner, Springfield, Ohio; 15, M. H. Hardin, Amarillo, Tex.; 16, C. A. Bingham, Norwood, Mass.; 17, R. L. Fitzgerald, Winnetka, Ill.

H. M. Waite, city manager of Dayton, brought out the point that the more efficient the government, the colder from the human interest standpoint it was likely to become. In consequence a special effort had to be made to present to newspaper men some one thing which would make the reporter's ears tingle until he could get his story on paper.

Gaylord C. Cummin, city manager of Jackson, Mich., found public interest decidedly at a low ebb unless a fight were staged. He proposes to build the new city hall as an office building and to show the windows for municipal exhibits, to be changed at frequent intervals.

Mr. Miller has adopted the same scheme as is used in Dayton, viz., that of leaving all correspondence in an open file for one day for the reporters to read over and get tips. Interviews are then granted if desired.

C. E. Ashburner, city manager of Springfield, Ohio, believes the deeds and acts of the city's employees are the best means of arousing interest, although he takes the reporters into his confidence at all times and through them the people at large.

In making reforms be sure not to go too far beyond the people, said Mr. Waite. In Dayton they have stopped promulgating new ideas because the citizens began to weary of the new things.

A campaign for nine bond issues involving

$1,000,000, largely for engineering structures, was won by a 3 to 1 majority by an intense diffusion of knowledge in more or less spectacular ways of what the money would go for.

Necessity for a co-operating citizenry and how it was being attained was a common thought in the reports of all the managers.

Fowler S. Smith, purchasing agent of Dayton, in his paper on "Purchasing Methods" outlined the Dayton system and expressed the opinion that cities should have purchasing agents with experience and tact more nearly equal to that of the various selling agents with whom they must deal. Otherwise the transaction is a one-sided affair with the odds distinctly against the municipality.

Gaylord C. Cummin gave a detailed account of making up a complete budget for Jackson, Mich. The scheme is practically the same as that used in Dayton and Springfield.

To clear the various ideas and experiences gained in trying out new procedures under the new form of government it was decided to have each manager send information to Mr. Waite each month. This will be multigraphed and passed on to those managers who desire it and will bear their share of the cost.

A committee on standard accounts and forms will gather information from the various cities and at the next convention will arrange them in an exhibit.

The officers elected for the coming year are: H. M. Waite, president; S. C. Barnwell, vice-president, and O. E. Carr, secretary and treasurer. The next place of meeting will be decided by Mr. Waite after a conference with the National Municipal League with the idea of arranging another joint meeting. The latter organization will probably not make its decision until next April.

Water Problems Studied by State Committee in California

The State Water Problems Conference, created by the last California Legislature for the purpose of considering and recommending to the 1917 Legislature a unified State policy with reference to irrigation, reclamation, water storage and flood control, with due regard to the needs of water power, mining and navigation, recently held its first meeting in San Francisco. A number of papers on various phases of the water problems of the State were read and a larger number, sent in by mail, were classified and filed for the use of subcommittees.

Sacramento River Floods

E. G. Hopson, consulting engineer of the United States Reclamation Service, pointed out that reservoirs could not be considered a solution of the flood problem in the Sacramento River basin. "All the reservoir sites in the valley are known to us and have been surveyed," he said. "The only two effective sites are those at Iron Canyon and the Pit River, and these could care for only the peaks of the floods. All the sites available for storing flood waters would produce only an insignificant effect." In the discussion following Mr. Hopson's comment it was agreed that the by-pass system of flood control is the only one feasible for the Sacramento valley.

The unattractiveness of irrigation district bonds was ascribed by C. P. Eels, an attorney of San Francisco, to the confusion in the forty laws governing such bonds, the absence of an adequate limit to the amount of bonds which a district may issue, and the lax assessments in the district under which interest is paid and the redemption fund accumulated.

A State Board of Public Works

C. E. Grunsky, president of the American Engineering Corporation, suggested that a State Board of Public Works be formed to handle all State engineering work and to replace the State Water Commission, the State Conservation Commission, the State Highway Commission, the Reclamation Commission and the State Engineering Department. In other words, such a board would handle road construction, dam inspection, construction of public buildings, and irrigation, reclamation and drainage matters. A constitutional amendment would be best, he thought, to give this board a sound foundation.

There should be a complete State Control of all new irrigation developments, Mr. Grunsky thought, and he pointed out the improvement that would result from giving State backing to irrigation district bonds so as to make them altogether independent of the success or failure of the district. Interest and principal should be cared for by special tax assessments. Sinking funds should not begin until 5 years after completion of the projects, and irrigation districts, he said, should have a relation to the State similar to that of school districts.

R. L. Hargrove, attorney and general manager of the Madera Canal and Irrigation Company, declared that privately owned water companies are doomed to absorption by State fostered or controlled districts, as the former cannot successfully compete with the latter. This, he said, is due to the fact that many land owners in privately developed territory refuse to buy irrigation water, but pump cheaply from the water table which has been raised to a convenient height by the irrigation of adjacent tracts. The water companies are thus deprived of much of the revenue the territory would otherwise afford.

The next session of the conference is set for Nov. 29, when representatives of power and irrigation companies and reclamation and irrigation districts will be heard.

Neuces County Causeway Completed

The 8400-ft. Neuces County Causeway, which spans Neuces Bay, in Texas, connecting Neuces and San Patricio counties has recently been completed at a total cost of about $165,000. For a distance of 3600 ft. the structure is of reinforced-concrete with a roadway 19 ft. in width, flanked on the sides by 4-ft. concrete hand railings. For the rest of the length it consists of a riprap fill, with a driveway 40 ft. wide. In the fill the dredge worked through old oyster beds so that a large percentage of the material is pure oyster shell. The entire roadway will be paved with Tarvia. The causeway was designed by Bartlett & Ranney, consulting engineers, of Galveston and constructed by W. L. Pearson & Company, Inc., of Houston.

Texas to Establish Duty Station for Irrigation Tests

For the purpose of discovering, if possible, a more economic method of irrigation, a "duty station," to occupy a plot of 40 acres of land near Mercedes will be established by the State Board of Water Engineers of Texas, according to E. B. Gore, a member of the board. Different processes of irrigation will be tried out on the land and an effort will be made to obtain the best results with the most economical use of water. The establishment of the duty station is in accord with the co-operative work being conducted by the U. S. Department of Agriculture and the State board. While such stations have been established in connection with the rice industry, this will be the first station to be devoted to the study of duty measurements for general agriculture ever undertaken in Texas.

To Abandon Large Temporary Bridge in Indianapolis

The use of the large temporary bridge over the White River at East Washington Street, Indianapolis, that is at present used by car lines and heavy traffic, will soon be discontinued, as construction on the new West Washington Street bridge is rapidly nearing completion.

Cleveland Starts First Large Sewage Screen on New Development

The 14-ft. Riensch-Wurl sewage screens for handling 15,000,000 gal. per day in Cleveland were put into operation this week. This is the first large installation in this country and is located at the West Fifty-eighth Street plant, which will ultimately handle the flow from one-quarter of the area of the whole city, the site, the inflow and outfall lines all being planned for this service. At present the additional work at the station includes two of the ultimate six grit chambers and an outfall of 6-ft. diameter reinforced-concrete pipe, built on land in 18-ft. section, laid from scows and the flange joints bolted up by divers. Two features of the grit chambers, are the movable vanes by which the compartments may be varied in cross-section to get a constant 1-ft. velocity, and sand ejectors built under these compartments to remove the deposited sand hydraulically. R. Winthrop Pratt is consulting engineer in charge of the sewage treatment developments in Cleveland.

Work Started on Apraw Falls Electric Plant in Indiana

Work has been started on the new electric plant at Apraw Falls, south of Bicknell, Ind. The plant will cost approximately $1,000,000 to construct. The preliminary work, according to reports, is under the direct supervision of W. J. Stewart of the Stewart Electric Company, Cincinnati, Ohio. The company has purchased 2500 acres of coal land in the vicinity of Bicknell. On much of this land the coal is so close to the surface that mining is possible without the sinking of shafts. Large plants have been purchased by the company in Detroit and Philadelphia, and are to be dismantled and set up again on the site of the new establishment. A large dam, to be constructed across White River, is to furnish part of the power. The company already has signed contracts for the furnishing of power to all the larger surrounding cities. Work has also been started on a traction line to link Bicknell with Linton, Washington and Evansville, Ind. In addition to this, it is intended to run a line from Bicknell to the American, Indian Creek and Oliphant-Wasson coal mines, several of the large producers in the vicinity.

Construction to Be Started on $150,000 Bridge in Indianapolis

Construction will soon be started on a $150,000 bridge over Fall Creek at the intersection of Meridan Street, Indianapolis, to replace the bridge washed out in the 1913 floods. A temporary bridge is being erected at Pennsylvania Street to carry the traffic until the new structure is completed.

Sewage Disposal Plant Constructed at Y. M. C. A. Camp

A complete sewage disposal plant, consisting of an Imhoff tank, sprinkling filter and slow sand filters, has been constructed at the Y. M. C. A. camp at Altamont, N. Y. The works were designed by and constructed under the direction of Henry W. Taylor, consulting engineer of Albany, N. Y.

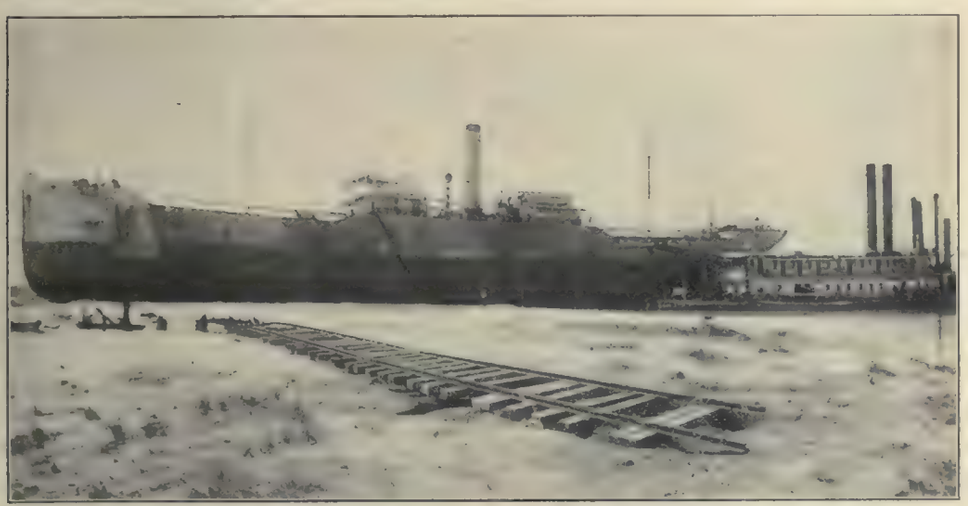
Illinois Highway Commission Refuses Aid in Oiled Road Project

The Illinois State Highway Commission has declined to give State aid in Champaign County's $40,000 oiled road project because the plans of the county board failed to provide for proper drainage in the improvement. A special meeting will be called to give the supervisors a chance to rectify the resolutions, which specified that none of the money should be spent in building culverts or bridges.

Large Wrecking Contract Completed in 44 Days at Galveston

A salvage contract involving the work of floating four stranded 2500-ton tramp steamers and a large schooner, by dredging to and around them and pulling them into the channels cut, was recently completed after forty-four days' work by the Bowers Southern Dredging Company at Galveston. The vessels went ashore in the Galveston hurricane last August. To release two of the steamers, the Eaton Hall and the Harlesden, which were cast up in the middle of the prairie at Swan Lake, a 4½-mile channel, 15 ft. deep and 200 ft. wide, was dredged. The Harlesden, the last of the five ships to be floated, was set free Nov. 1.

The Ribston, the first of the steamers to be released, went ashore at the railroad yards, and struck her nose across several tracks and into a turntable. A channel was dredged to



DREDGE DIGGING OUT STEAMER THAT STORM LANDED IN RAILROAD YARD

and around her, and she was pulled into it stern first by tugs on Oct. 7. The other steamer, the Wallace, and the schooner, Edna V. Pickels, went ashore on Pellican Spit. The channel dredged to release them was in sand. After holes had been dredged around these vessels, powerful jets were used to wash out the sand directly beneath them until they could be pulled free.

It is said that the contract for floating the five vessels involved about $200,000. As soon as it was awarded, five dredges and 300 men set to work on the task of digging out the imprisoned ships. The dredges kept at it day and night, with few stops even for repairs, until the five vessels were afloat.

The long channel required to reach the two steamers stranded at Swan Lake was dug by two dredges, a large boat starting in from deep water and a shallow-draft dredge starting near the shore and digging to meet it. When the dredges met, both moved up to the head of the cut and attacked the remaining excavation side by side.

Royal Engineers Distinguishing Themselves in France

In a dispatch of Oct. 15 to the British War Office, Sir John French, commander of forces in France, commends most highly the courage and spirit of the Royal Engineers—the body in the British army corresponding to our Corps of Engineers and engineer companies. *The Engineer* of London, in its issue of Nov. 12, quotes the following paragraphs from the dispatch:

"I have on previous occasions called your Lordship's attention to the admirable work of the corps of the Royal Engineers. This work covers a very wide field, demanding a high standard of technical knowledge and skill, as well as unflagging energy; and throughout the supreme test of war these qualities have never been found wanting, thus reflecting the greatest credit on the organization of the corps as a whole, and on the training of the officers and men individually. The spirit which is imbued in all ranks from the base ports to the front trenches and beyond is the same. No matter where or how the personnel of the corps has been employed, devotion to duty and energy have been ever present.

"In this dispatch I wish particularly to draw attention to the work of the field units and army troops companies, which must almost invariably be performed under the most trying circumstances by night as well as by day. Demanding qualities of whole-hearted courage and self-sacrifice, combined with sound judgment and instant action, the work of officers, non-commissioned officers and men has been beyond all praise. The necessity for skilled labor at the front has been so continuous that Royal Engineer units have frequently been forced to forego those periods of rest which at times it has been possible to grant to other troops; but, in spite of this, they have responded loyally to every call on their services. Notwithstanding the heavy casualties sustained by all ranks, the esprit de corps of the Royal Engineers is such that the new material is at once animated by the same ideals and the same devotion to duty is maintained.

"I desire to call your Lordship's attention to the splendid work carried out by the tunneling companies. These companies, officered largely by mining engineers, and manned by professional miners, have devoted themselves wholeheartedly to the dangerous work of offensive and defensive mining, a task ever accompanied by great and unseen dangers. It is impossible within the limits of a dispatch to give any just idea of the work of these units, but it will be found, when their history comes to be written, that it will present a story of danger, of heroism and of difficulties surmounted worthy of the best traditions of the Royal Engineers, under whose general direction their work is carried out."

New California Highway Has Been Opened to Traffic

The Tejon Ridge Highway, a new trunk road connecting Los Angeles and Bakersfield, Cal., was formally opened to the public Nov. 16 after a period of rush construction in which special effort was made to have the roadway compacted and oiled before the winter rains set in. The road opens up an entirely new route between the two cities and will be 60 miles shorter than the Tehachapi Pass route and 35 miles shorter than the road via the Tejon Pass. The new route was described by N. D. Darlington, California State Highway Commissioner, in an article in Engineering Record, Sept. 11, page 322.

1192 Engineering Students Enrolled at the University of Illinois

The number of students registered in the College of Engineering of the University of Illinois up to Nov. 1 was 1192.



A CHANNEL, 4½ MILES LONG, WAS DREDGED TO REACH THESE STEAMERS, STRANDED BY THE GALVESTON STORM, RELEASING THEM IN 44 DAYS

News of Engineering Societies

The Lincoln Highway Association officers for the coming year elected at the meeting of the directors in Detroit, Nov. 10, are: President, Henry B. Joy; vice-president, Roy D. Chapin; treasurer, Emery W. Clark; secretary, Austin F. Bement.

The Engineering Society of Buffalo held a dinner at the Hotel Statler, Nov. 17, at which John Calder, president of the Metal Coating Company of America described a new spraying process by which, he stated, a non-corrosive surface can be put on iron and steel.

The Harvard Engineering Society of New York will hold its annual dinner at the Harvard Club in New York City, Dec. 11. The speakers will include F. A. Delano, vice-chairman of the Federal Reserve Board; Major-General Leonard Wood, U. S. A.; Prof. C. R. Mann, of the Carnegie Foundation, and Prof. George F. Swain.

The National Drainage Congress will be held at Cairo, Ill., Jan 19-21, 1916.

The Society of Constructors of Federal Buildings will hold its annual convention at Washington, D. C., Jan. 3-6, 1916. It is expected that President Wilson, Secretary McAdoo and Postmaster-General Burleson will address the convention.

Personal Notes

JAMES FORGIE, consulting engineer, of New York City, has been awarded a Telford Gold Medal by the Institution of Civil Engineers (British) in recognition of his paper on "The Laxaxalpam Aqueduct Tunnels in Mexico" and his engineering work in connection with that project. Among other Americans who have received this honor are: Col. W. H. Harts, William Barclay Parsons, W. J. Wilgus and J. V. Davies. Mr. Forgie was born and educated in Scotland, graduating from Gordon's College, Aberdeen, in 1885. From that year until 1899 he was a pupil of G. Gordon Jenkins, civil engineer. Later he served with Mr. Jenkins as resident engineer on the Insch Waterworks. From 1890 to 1892 he was engaged in railway work and, for the next three years was engaged in tunnel work, a good part of the time as chief assistant engineer on the construction of subaqueous and other tunnels of the Waterloo & City Railway, London. He also was consulting engineer on various other works of a similar nature. He came to the United States in 1902 as chief assistant engineer of the North River division of the Pennsylvania, New York & Long Island Railroad Company on the construction of the Pennsylvania Railroad tunnels under the Hudson River, New York City. He later served on the construction of the Hudson & Manhattan tunnels under the same river.

A. E. TRIPPLETT, formerly assistant suintendent of the Galveston, Harrisburg & San Antonio Railway, has been appointed division engineer of the Missouri, Kansas & Texas, at Parsons, Tex.

C. C. BROWN, editor of *Municipal Engineering*, will direct the courses at Purdue University formerly administered by Professor Sackett. A notice of Mr. Brown's connection with Purdue as published in these columns, Oct. 23, gave rise to some misunderstanding, so, to be clear on the matter, this journal wrote W. K. Hatt, professor of civil engineering at the university. In his reply Professor Hatt stated: "We are fortunate in having Mr. C. C. Brown as lecturer in sanitary engineering. He will direct the courses formerly administered by Professor Sackett and will be resident at the university one day each week, giving lectures and attending the drafting room periods."

LOGAN WALLER PAGE, director of the Office of Public Roads and Rural Engineering, has resigned as a director of the American Road Builders' Association, on account of the action of that organization in setting a convention for next February. Mr. Page believes that the Road Builders' action is in violation of the agreement made with the American Highway Association when it was decided to hold the Pan-American Road Congress in Oakland, and he feels compelled, therefore, to terminate his official connection with the Road Builders.

JOHN CLAYTON TRACY, formerly professor of structural engineering at Sheffield Scientific School, Yale University, has been promoted to succeed the late Prof. A. J. DuBois as head of the department of civil engineering. Professor Tracy was graduated from Sheffield Scientific School in 1890, and received the degree of Civil Engineer in 1892. During the year 1891-2, and in subsequent summers, he was engaged in bridge construction work.

New Professor of Civil Engineering at Yale University



Photo. Yale Alumni Weekly

JOHN CLAYTON TRACY

He was appointed an assistant on the Sheffield Scientific School faculty in 1892, instructor in 1894, and professor of structural engineering in 1915. During his period of twenty-three years at Yale Professor Tracy has devoted much time and thought to the study not only of the needs of his own department, but of the problems which have confronted other leading universities as well. He has also been active in the Yale Engineering Association, which was recently formed to promote the cooperation of the alumni in the development of the engineering courses at Yale. Professor Tracy is the author of the following works: "Introductory Course in Mechanical Drawing," "Plane Surveying," "Exercises in Surveying for Field and Office Work," and "Descriptive Geometry."

B. S. STALEY, who has been engaged in contracting work for many years at Centerville, Iowa, has organized the B. S. Staley Supply Company in conjunction with William Kindig to engage in a general contracting business at Centerville.

BROWN & CLARKSON, civil and mining engineers, specializing in topographic engineering for city planning, reclamation and power development, of Washington, D. C., have moved their offices from the Star Building to the Oxford Building in that city.

ERNEST MCCULLOUGH, consulting engineer, of Chicago, has been elected second lieutenant in Battery B in that city, which has had a continuous existence since before the Civil War.

G. E. WRIGHT, formerly connected with the Poughkeepsie Engineering & Contracting Company on the construction of a dam and reservoir for G. F. McKinney at Crouses Store on Fiskhill Creek, New York, is now with the New York State Public Service Commission, First District, on the construction of the East River tunnels from Whitehall Street to Montague Street, New York City.

CLIFFORD M. PRITCHARD, formerly designing and contracting engineer for the Oklahoma Iron Works, has opened offices in the Robinson Building, Tulsa, Okla., to engage in a general structural business, both designing and construction, particularly in connection with industrial plants where engineering is an important feature. Mr. Pritchard was graduated from Earlham College in 1893 and received a degree in civil engineering at the University of Michigan in 1902. His first work was as chainman and transitman on construction for the Norfolk & Western Railroad in the summer of 1892. Later he was with the Cincinnati, Hamilton & Dayton and, in 1897, he was awarded first prize for the design of a 120-ft.-span steel arch at LaSalle, Ill. He also served with the Toledo Bridge Company at Toledo, Ohio, the Gillette-Herzog Manufacturing Company and the American Bridge Company, mostly on design. For the past twelve years he has been engaged as designing and contracting engineer for the Kansas City Structural Steel Company, the Missouri Valley Bridge & Iron Company and the Oklahoma Iron Works.

PAUL L. REED, civil engineer, U. S. Navy, has been transferred from the Bureau of Yards & Docks, Navy Dept., Washington, D. C., to the Public Works Office, Navy Yard, Charleston, S. C. Mr. Reed was graduated from the Rensselaer Polytechnic Institute in 1894 and served from then until 1897 with the U. S. Coast & Geodetic Survey and the Chicago Bridge & Iron Company. In the latter year he went to Europe as technical assistant to Lindon W. Bates, designer and contractor for hydraulic dredging and dredges, and was, for 1½ years, stationed at Liege and Antwerp, Belgium, as his representative in charge of the construction of two large hydraulic dredges for the Russian Government. He also was representative and resident engineer on the construction of four sea-going suction dredges, for Australia and India, by Sir William G. Armstrong, Whitworth & Company at Newcastle-on-Tyne, England. He returned to this country in 1902 and, after serving for a short time with the Bucyrus Company of South Milwaukee, was appointed civil engineer, U. S. Navy, in which capacity he has served on various works in this country and the Philippine Islands.

Obituary Notes

FRANCIS G. WARD, for the past fourteen years commissioner of public works of Buffalo, died in that city, Nov. 16, at the age of fifty-nine years. With the exception of his work at Buffalo, his most notable achievements were in connection with the reconstruction of the wharves and plant of the Panama Railroad, for which he was general superintendent from 1885 to 1887, and in connection with the construction of the Turkish-Asiatic railways to Damascus and the Persian Gulf. His education was completed at *L'Ecole des Ponts et Chausses* in France, after which he was engaged from 1877 to 1885 in the transportation department of the New York Central & Hudson River Railroad. From this work he went to Panama and, from there he went to the Turkish-Asiatic Railway. Returning to the United States, in 1890, he engaged in the manufacturing business until 1896, when he began his service with the city of Buffalo as superintendent of waterworks.

WILLIAM L. CRAWFORD, who was for many years associated with the late Henry M. Flagler in the development of Florida and was for many years general manager of the Florida East Coast Railway, died in Garwood, N. J., Nov. 13, at the age of seventy-four.

C. C. WENTWORTH, principal assistant engineer of the Norfolk & Western Railway, died in Roanoke, Va., Nov. 11.

J. B. WILSON, a former city engineer of Walla Walla, Wash., died at Montour, Idaho, Nov. 13, at the age of sixty years.

Civil Service Examinations

Philadelphia.—Although the examinations for minor positions were mentioned in last week's issue, page 648, they have proved to be sufficiently important to enumerate separately. They are as follows, and are open to residents of Philadelphia who are over twenty-one years of age:

ASSISTANT ENGINEER, squad boss, department of city transit, salary from $2,000 to $2,200 a year. Applicants should have a technical school education and at least five years' experience in drafting, especially of structural design. The duties involve the supervision of a squad of draftsmen in the preparation of drawings for subway and elevated railway construction. Examination, Dec. 21 and 22.

ASSISTANT ENGINEER OF DESIGN, collectors and sewage disposal works, bureau of sewage, salary $3,000 a year. Applicant must have three years' experience in the charge of design and maintenance of sewage disposal works. The work requires designing sewage disposal works, including grit chambers, screens, tanks, percolating filters, disinfecting devices, and sludge-drying beds, and supervising their operation. Examination, Dec. 6 and 10.

ARCHITECTURAL DRAFTSMAN, department of city transit, salary from $1,500 to $1,800 a year. Applicant should have five years' practical experience in architectural design. This position like the first is in connection with subway and elevated railroad construction. Examination, Dec. 27 and 28.

DRAFTSMAN, department of city transit, salary from $1,200 to $1,500 a year. Applicants need three years' experience in drafting and must be familiar with steel and masonry construction. The duties relate to subway and elevated railroad construction. Examination will be held Dec. 29 and 30.

DRAFTSMAN, department of city transit, salary from $1,000 to $1,200 a year. Applicants must have one years' experience in drafting and a working knowledge of materials of construction. Duties involve making of preliminary and working drawings of subway and elevated railroad construction. Examination is to be held Jan. 4 and 5, 1916.

LABORATORY ASSISTANT, physical, Bureau of Surveys, salary from $900 to $1,000 a year. Applicants for this position must be graduates of a technical institution or must have had two years' experience in the practical testing of materials. The position relates to the assisting in the physical testing of cement, concrete, iron, steel, paving materials, building materials, etc. Examination, Jan. 4, 1916.

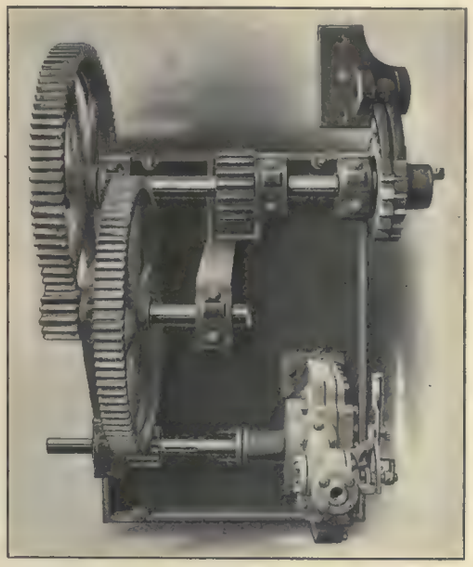
STRUCTURAL DRAFTSMAN, department of wharves, docks and ferries, salary from, $1,200 to $1,500. Applicant must have three years' experience in bridge and structural drafting, with a knowledge of pier design. In this position the duties will be to make designs, computations and drawings of structural steel work, pier foundations, bulkhead walls and other river and harbor improvements. Examination, Jan. 7 and 10, 1916.

ARCHITECTURAL DRAFTSMAN, salary from $900 to $1,200. Requires general knowledge of drafting and architectural design. The duties involve crayon work of elevations and perspectives of structures. Examination, Jan. 24 and 25, 1916.

There are, beside these examinations, examinations for pitometer operator, assistant draftsman, tracer and rodman, to be held Dec. 20, Dec. 20 and 31 and Jan. 6, 1916, respectively.

Compact Spud Hoist Eliminates Costly Equipment

Ease of operation, compactness and elimination of overhead rigging are features claimed for the Dake spud hoist which has recently been placed on the market. The machine, which is designed for raising and lowering spuds on dredges, is equipped with a reversing engine, which has no dead center and which will start, stop or reverse instantly.



EACH SPUD HAS A HOIST ALL ITS OWN

The hoist, as shown in the accompanying photograph, is bolted directly to the spud guides and its pinion meshes in turn with a rack on the spud. Being reversible, steam can be used for either picking up the spud or driving it down firmly. The hoist is manufactured by the Dake Engine Company, Grand Haven, Mich.

Mat System Lowers Cost of Concrete Forms and Strengthens Structure

Curved timber templets supporting flexible wooden mat-bearers upon which 26 gage sheet-metal mats are laid, as shown by the accompanying photographs, effect a saving which is claimed to vary from 3 to 5 cents per square foot over hollow-tile or metal domes. This form of joist construction for floors or roofs has been approved by the building department of the city of Cincinnati for 4-in. joists spaced up to 3 ft. on centers, while for the same total amount of steel and concrete, metal domes are allowed but 24 in. spacing.

It is claimed for this type of adjustable forms that a stronger construction results for the same amount of materials, that the forms are stiffer, and that the triangle shape of the top flange of the concrete beams resulting from the use of the curving haunches increases the strength appreciably by increasing the depth to the center of compression concrete.

In the case of hollow tile, the saving is estimated at about two-thirds of the cost of the tile, but the tile construction has a bottom upon which to plaster, and in the case of plastered ceilings saves the cost of the metal lath. Even taking this fact into consideration, however, the net saving for this new construction is claimed to be the values above quoted.

Full information will be furnished by Edward O. Keator & Company, 2851 Melrose Avenue, Cincinnati, Ohio, sole agents for the Hodges system of adjustable forms for concrete work.

New Drill Rotation Saves Air and Reduces Moving Parts

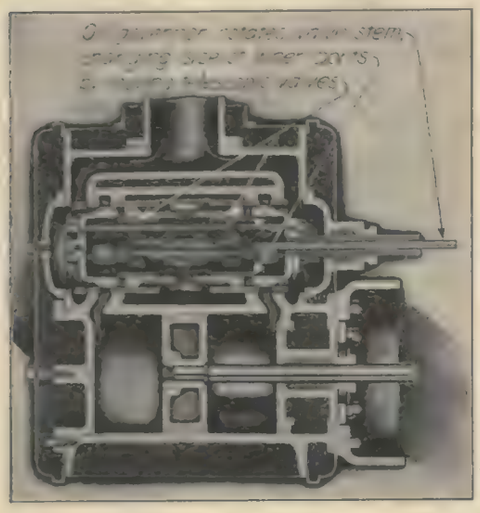
Air enters the rotation motor of the new hammer drill being made by the Chicago Pneumatic Tool Company first, and from there passes to the valve chamber of the main piston chamber. Thus the advantage of using one air supply for operating both piston and rotation is combined with that of having a separate motor for the rotation. This design eliminates ratchets and pawls and makes possible sturdy and compact construction of both the rotation and the main piston parts. The rotating motion is constant in one direction. It is secured by gearing a small, high-speed air motor, mounted on top of the drill, to a shaft, pinion and gear, which revolve the drill chuck. The top gear accomplishes the necessary speed reduction between the motor and the drill chuck by a worm thread on the motor shaft which meshes with a worm gear on the main shaft. A ball valve gear of simple and rugged construction is a feature of the design of the main drill cylinder. The drill, known as the "Hummer," is manufactured in 40, 55 and 65 lb. sizes, drilling ⅞, 1 and 1⅛-in. holes, 6, 8 and 12 ft. deep respectively.



MAT SYSTEM OF CONCRETE FORMS APPLIED TO ROOF CONSTRUCTION

Air Compressor Valve Is Designed for Super-Heated Steam

The balanced-piston steam valve gear shown in the accompanying cut has been developed to meet the increasing use of super-heated and high-pressure steam in air compressing. These factors are rendering the various forms of slide valve obsolete, as high temperatures warp such valves, causing leakage, and render them difficult to lubricate, causing excessive wear and loss of power. The cut-off valves illustrated herewith are right- and left-hand threaded to a cut-off valve stem, which is rotated by a speed and pressure regulator to



EFFICIENT VALVE FOR HIGH-PRESSURE STEAM

vary the cut-off. This regulator is essentially a chain-driven rotary oil pump, which acts against a weighted plunger. The oil pressure maintained by this pump on the plunger varies with the speed of the compressor, thus changing the amount of steam admitted to the cylinder in accordance with the load. The regulation thus takes place in the valve chest, instead of outside the valve chest, as with an ordinary governor. Steam admission is through the center of the valve, the exhaust steam passing around the ends of the valve. It will be noted on studying the operation of the valve that practically all the packing is protected from high-pressure steam and exposed only to the exhaust steam.

This method of regulation maintains a constant speed by changing the steam pressure, and also varies the speed to suit the rate at which air is being used.

The machines on which this valve is used are built with high and low pressure cylinders, connected by a "steam receiver," a special expansion joint being provided to guard against the tendency of temperature changes to throw the cylinders out of alignment. These compressors, called "Imperial" type XPV, are built by the Ingersoll-Rand Company of New York in capacities from 608 to 3620 cu. ft. per minute, and for discharge air pressures ranging from 10 to 110 lb. per square inch. In appearance and general design they are similar to the "Imperial" types now in service, having force-feed lubrication for the air and steam cylinders, closed frames, reciprocating parts with automatic lubrication by the bath system and completely water-jacketed air cylinders.

Business Notes

B. H. Rader, formerly eastern sales manager of the Universal Portland Cement Company and recently vice-president of the Hagar Portland Cement Company, has resigned to become western sales manager of the Lehigh Portland Cement Company, with headquarters in Chicago.

W. J. Johnson, manager of the Pittsburgh office of the Lidgerwood Manufacturing Company of New York City, will also have charge of the new offices that company has opened in the Widener Building, Philadelphia.

Robert E. Belknap has been appointed district sales manager of the Pennsylvania Steel Company and the Maryland Steel Company at New York City, succeeding R. W. Gillispie. The New York offices of the company are located in the Empire Building, 71 Broadway.

The Blaw Steel Construction Company sales engineers held their annual convention in Pittsburgh, Nov. 12-13. They met at the works at Hoboken, Pa., on the morning of Nov. 13 and viewed a number of new devices, after which they were entertained at luncheon in the dining room of the Blaw plant. In the evening a banquet was held at the Concordia Club.

Carl M. Bernegau, vice-president and treasurer of the Keuffel & Esser Company, manufacturer of drawing materials and mathematical and surveying instruments, of Hoboken, N. J., was the guest of honor at a dinner given by the firm, Nov. 16, in celebration of the twenty-fifth anniversary of his connection with the company. The dinner was attended by 500 employees.

J. P. Beck, formerly publicity manager of the Hagar Portland Cement Company, has resigned to undertake an extensive investigation along extension and publicity lines for the Association of Portland Cement Manufacturers. Mr. Beck is secretary of the Conference on Concrete Road Building and general manager of the Cement Products Exhibition Company which holds the Cement Show in Chicago. He was formerly publicity manager of the Universal Portland Cement Company.

Gustave Reinberg, vice-president of the McKiernan-Terry Drill Company, New York, following a ten-days' illness with pneumonia, died in New York, Nov. 22. He was widely known in the mining and contracting fields on account of his long association with companies selling to those classes. Years ago he was with the Forcite Powder Company and when that corporation was taken over by the DuPont interests Mr. Reinberg was for a time associated with the larger company. In 1891 he and S. J. McKiernan organized the McKiernan Drill Company, which in 1910, upon consolidation with the Terry Core Drill Company, became the McKiernan-Terry Drill Company. Mr. Reinberg was injured when his automobile ran off a ferryboat last January. On account of the exposure he had been in a weakened condition ever since.

Trade Publications

The following companies have recently issued trade literature:

Link-Belt Company, Chicago. Catalog 158, 8½ x 10¾ in., 38 pages, illustrated. Illustrates Link-Belt locomotive cranes.

A. D. Cook, Lawrenceburg, Ind. Catalog 12. 7 x 10 in., 68 pages, illustrated. Contains complete data on Cook's deep-well pumps and machinery.

Lansing Company, Lansing, Mich. Catalog 12C, 8¾ x 11¼ in., 36 pages, illustrated. Concrete batch mixers and numerous models of continuous mixers.

Foundation Company, New York. Catalog, 8 x 11 in., 32 pages, illustrated. Difficult underground construction in connection with bridges, buildings, dams, bulkheads and mine shafts.

Southwark Foundry & Machine Company, Philadelphia. Catalog, 8¼ x 11 in., 44 pages, illustrated. Describes in detail Southwark-Harris valveless engines, Diesel principle, stationary and marine types.

International Motor Company, New York. Booklet, 9 x 12 in., 40 pages, illustrated. An account of the performance of Mack armored trucks at the encampment at Plattsburg, N. Y., of the United States Army School of Instruction.

H. B. Sackett Screen & Chute Company, Chicago. Catalog 41, 6 x 9 in., 16 pages; illustrated. The design, construction and prices of various types of concrete spouting equipment are carefully described and illustrated in this booklet.

Ruggles Machine Company, Poultney, Vt. Catalog, 9 x 6 in., 96 pages, illustrated. A descriptive and ready reference book on Ruggles gas and gasoline engines, explaining the principles of heat engines, with instructions for their operation.

Weller Manufacturing Company, Chicago. Bulletins 28 and 29, 6 x 9 in., 4 pages each, illustrated. Describe one-man elevators for stone and ore-crushing plants and an automatic power shovel for handling cement, sand, ore, clay, etc., respectively.

Vulcan Process Company, Minneapolis. Catalog, 6 x 9 in., 12 pages, illustrated. Vulcan process of oxygen and hydrogen gas generation by electrolysis. Catalog, 6 x 9 in., 32 pages, illustrated. Vulcan process of oxy-acetylene welding and cutting of metals.

Southern Pine Association, New Orleans, La. Booklet, 9 x 11 in., 24 pages; illustrated. Opinions of civil engineers, paving experts, street commissioners and citizens' leagues on creosoted wood block pavements and tests of the United States Forest Service on shearing.

Mott Sand Blast Manufacturing Company, 1157 East 138th Street, New York City. Four bulletins, 6¾ x 8½ in., 4 pages each, illustrated. Direct-pressure sand-blast machine, sand-blast tumbling barrels, types P. V. S double and G., and sand-blast accessories for cleaning small grey iron, brass or aluminum castings are described in these bulletins.

Westinghouse Church Kerr & Company, New York City. Folder, 6 x 9 in., illustrated. Sets forth the merits of the new engine terminal of the Central Railroad of New Jersey at Communipaw, Jersey City, which was designed and built by this company in collaboration with the engineering staff of the railroad.

Simplex Concrete Piling Company, Tacony, Philadelphia. Catalog, 9 x 7½ in., 96 pages, cardboard cover, illustrated. This book presents concisely and logically the important features of Simplex piles and their various forms to meet ordinary and unusual conditions, and shows in clear reproductions tests made and many structures using these piles for foundations.

Sullivan Machinery Company, Chicago Bulletin 72, 6 x 9 in., 24 pages, illustrated. The edition dated August, 1915, describes in detail the Sullivan drill sharpener, a compressed air machine for forging and sharpening rock drill and hammer drill bits and forming shanks by hammering. The machine itself stands 6 ft. high over all and occupies a floor area of 5 x 2½ ft., weighing about two tons.

Carnegie Steel Company, Pittsburgh, Pa. Booklet on Bulb Sections; paper; 5 x 7½ in.; 16 pages, illustrated. Bulb angle sections suitable for both shipbuilding purposes and in steel railroad car construction. The shipbuilding bulb angles rolled to conform to British standards are included, and miscellaneous sections and bulb beams are described in the usual manner by diagrams and tables.

American Pulverizer Company, East St. Louis, Ill. Catalog 21, 3¾ x 9 in., 12 pages, illustrated. Describes ring and combined ring and hammer pulverizers for crushing brick, Portland cement, rock and the like. The descriptive matter accompanies the illustrations, other matter being in the nature of testimonials, explaining one or two instances of actual operation of pulverizers.

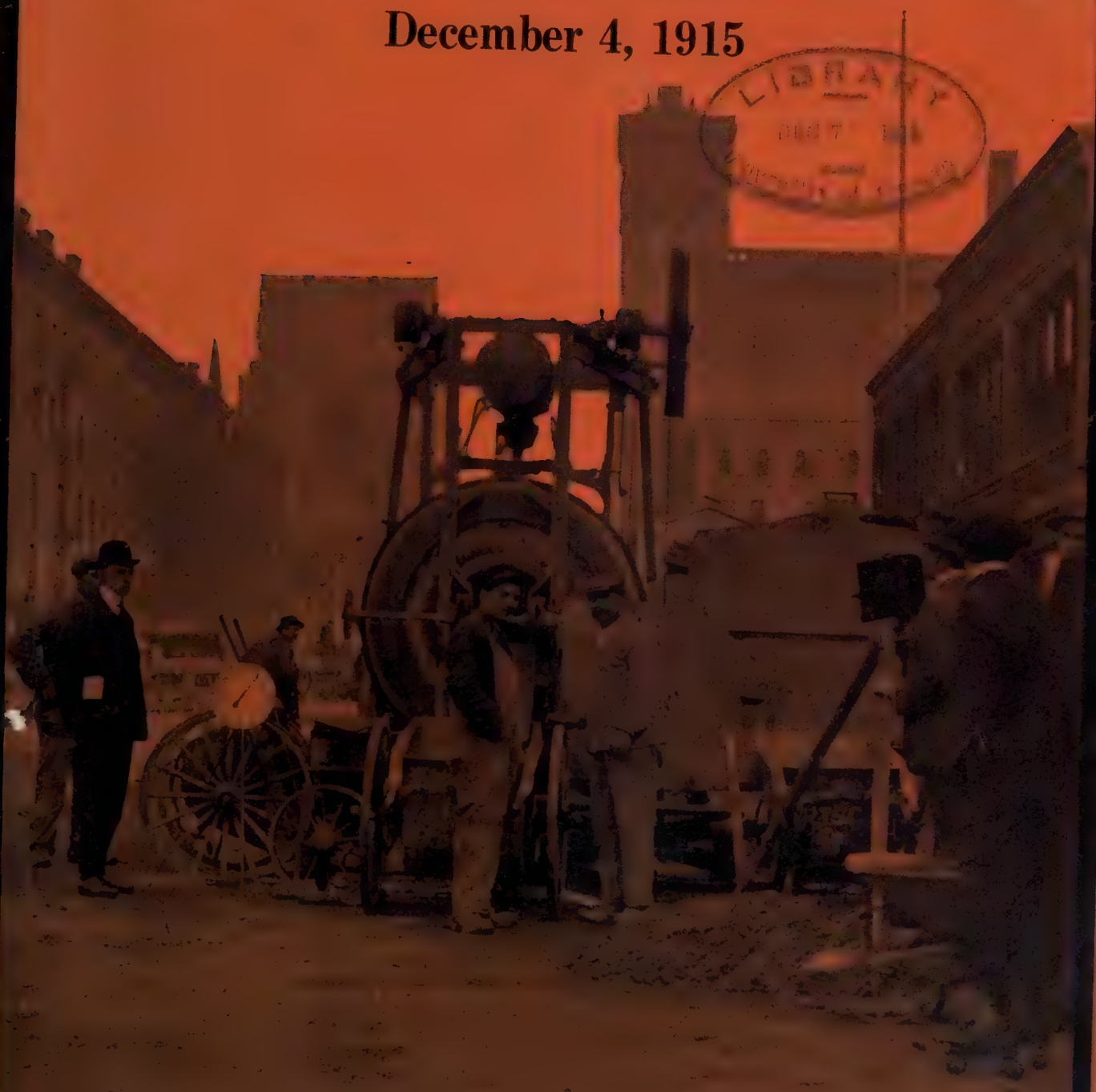
Mastic Bond Company, Inc., 18 East Forty-first Street, New York City. Folder, 8½ x 11 in., 4 pages. Deals with Par-Lock, a method of bonding plaster, stucco or cement finish permanently to structural surfaces. The process involves the application, by air pressure, of a mastic damp-proof bond into which a closely graduated crushed rock is driven, forming a rough surface which, when dry, engages the plaster finish. The process, it is claimed, produces a surface waterproof and free from cracks or stains at no greater cost than for a finish applied in the usual way. The weight of a Par-Lock ceiling is said to be only about one-third that of a ceiling plastered under the ordinary specification.

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December 4, 1915

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Materials vs. Methods

Testimony of Moving Pictures in the Study of Concrete

By NATHAN C. JOHNSON
Consulting Concrete Engineer, New York

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Engineering Record

A Weekly Journal Devoted to Civil Engineering and Contracting

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Proportioning of Fine Aggregate

THE intensive study being devoted to the constitution of concrete augurs well for its future quality. Necessarily in such a subject investigations are fully warranted even though their immediate practical application is doubtful. They may develop new theories, which after further research will result in radical changes in materials, proportions or methods. The very careful and interesting studies made by Professor McNeilly, of Vanderbilt University, published in the last issue of the Engineering Record, seem at present at least to have chiefly a theoretical value. In other words, it seems to be doubtful whether the type of fine aggregate which he found to give such good results is commercially feasible. Possibly there will be conditions which would justify the necessary expense. His researches, however, have a larger value, in helping us to get closer to the real constitution of one our most important engineering materials.

Ramps Instead of Stairways

INDUSTRIAL engineers will find in the article on the Victor Building in last week's issue, page 656, food for thought on the entrance and exit facilities of factory buildings. The designers of this structure have discarded both stairways and elevators under the conviction that ramps insure greater safety in case the building must be emptied hurriedly. While ramps are a rather common expedient in public buildings, such as railway stations and theaters, their use as the sole means of communication from floor to floor in a high building is believed to be novel in the Victor plant. Their adoption is in harmony with the policy of the Victor Talking Machine Company to do the utmost feasible for the safety of its employees. Apparently there is nothing to interfere with the success of the adopted plan. It seems logical to assume that the capacity per foot width would be greater than that of a stairway. Actual experience with the construction will be of great interest to industrial-plant designers.

Columns as Ventilating Ducts

IN ONE other respect the article on the Victor Building merits special consideration from the industrial engineer. Hollow cast-iron columns of large diameter have been used and serve not only for supporting loads but also as ventilating ducts. This design involves a number of interesting economic problems. Normally one would expect to use reinforced-concrete columns in a structure of this type. Then comes the question as to the economy of the design used compared with concrete columns and separate heating and ventilating flues. But the question cannot be decided on such simple lines, for floor space was an important factor. Even if the cost of the alternative design would have been the same as that used, floor saving would probably have thrown the balance in favor of the design adopted. Certainly with a similar set of conditions—and they are not extraordinary—the design adopted merits more than passing consideration.

Why Not Pebbles?

WHEN authorities disagree, there is perhaps excuse for wide differences in individual interpretation of the meaning of a particular term. Since dictionaries are not entirely in accord, it is not surprising that the individual misinterprets the meaning of "gravel," from the standpoint of its necessary requirements for concrete aggregate. This fact is often responsible for the use of bank-run material, as there are definitions for gravel which describe it as "small stones or pebbles, or a mixture of sand and small stones." There is no definite differentiation between cobblestones and boulders, as regards minimum and maximum limits of size. Bank-run deposits may contain particles large enough to fall within the common conception of either, to say nothing of the presence of foreign matter, such as clay and loam, that render the material unfit for concrete aggregate. Why not use a term that would suggest a clean material as well as one consisting of particles fairly well limited as regards minimum and maximum size? Pebbles, in the minds of most people, are clean, rock particles made so by attrition in streams or otherwise. If "pebbles", ranging from a certain minimum to maximum, were specified as coarse aggregate, such specification would immediately carry the idea of cleanliness and freedom from particles below and above a certain minimum and maximum. As such material cannot be found in a natural deposit, the specification of pebbles would imply the necessity for preparation, thus rendering the material fit for use as concrete aggregate.

Lost Time with Motor Trucks

IN ORDER to realize the greatest benefits from motor-truck haulage on contract work it is necessary to give careful thought not only to the machine itself but to the method of operation. It is not enough to purchase good trucks, man them with intelligent drivers, and keep the outfits in repair by replacing broken or worn-out parts. The motor truck is a high-priced plant unit and the economies which it can effect can be realized only if it is kept on the road actually hauling materials. It is the time lost in loading and unloading that eats into the profits of motor-truck haulage. Therefore, the contractor who devises methods for reducing delays at the ends of the route will be amply repaid for his trouble. This point was emphasized by several English engineers at the conference of the Institution of Municipal and County Engineers in Westminster last summer. Ernest J. Elford, borough engineer of Southend-on-Sea, summed up the matter when he said that, from the financial point of view, the most important factor is rapid loading and discharging. Loss of time with motors makes all the difference between profit and loss. It is essential, therefore, that good facilities for loading and unloading be provided, so that as large a proportion as possible of the working hours be spent in traveling. There is, of course, nothing new in this advice. Too often, however, analysis of delays is neglected, and the owner does not know whether he is getting the most out of his plant. Contractors with motor trucks will do well to analyze the idle time of their machines and study the possibilities of increased efficiency by better organization of their loading and unloading operations.

Disregarding Facts for Expediency

WHENEVER utilities, particularly railroads, attempt to get into reproduction cost, for valuation purposes, figures for land that show, what all railroad real-estate men know, how much in excess of normal market value railroads have to pay for their right-of-way, they are confronted with that section of the Minnesota rate decision which states that multipliers based on mere conjecture cannot be allowed. The insincerity of some who quote that decision is typified by the opinion of the Railroad Commission of California on the valuation of the Quincy Western Railway, briefly abstracted on page 698. Here the realm of conjecture is replaced by one of absolute fact, for the reason that the road was built only five years ago, and the company actually did pay three times the normal market value for its right-of-way. Nevertheless Commissioner Loveland would disallow this multiple, even calling upon the Minnesota decision to support his view. He makes no accusation of extravagance or bad judgment on the company's part in its land transactions. True, he mentions peculiar conditions that forced the company to pay an abnormal price, and if these conditions have changed the multiple for the reproduction cost should be modified accordingly. He does not say, however, that conditions have changed, and his manner of referring to "a special and higher 'railroad value'" and "actual present-day average conditions"

suggests that he would probably consider the amount any railroad paid at any time abnormally high. If so, he does not seem to agree with the view expressed at the recent Philadelphia conference by John M. Eshleman, formerly president of his commission, that the company is entitled to a fair return on the actual investment. Rather, he seems to support what this journal has already suggested, that some commissioners are as ready to advocate whatever basis gives the lowest valuation as the utilities are to claim whatever gives the highest. It would be interesting to know whether Commissioner Loveland would apply the "basis of actual present-day average conditions" to donated lands, and disregard the fact of the donation on the ground that land is not often donated in the general market.

Quick Action and the Bond Market

LAST week the Engineering Record in its leading editorial urged engineers to put their work for next year under contract just as soon as possible. Quick action will insure the best prices obtainable next year, and also give greater certainty that the work will be done. The shortage of steel promises to be such that work let late in the spring will have to be postponed for another season, not only because the steel actually entering into the construction will be difficult to secure, but because contractors will not be able to buy new plant. Already the manufacturers of contractors' equipment are having difficulty in securing adequate stocks.

With the newspapers filled with stories regarding the present state of the steel trade, it is not difficult to convince engineers that an unprecedented condition will face them next year. Their natural inquiry, however, will be regarding the possibility of securing the necessary funds. On this subject one can speak with certainty and with emphasis.

Not for many years has the market for high-grade bonds been as good as it is now. Money is plentiful and promises to be so for some time, unless the war should suddenly end. Such a condition naturally results in turning the attention of investors to high-grade securities.

Particularly is the municipal bond market in a favorable condition just now. In fact, the demand is better than it has been for six years. About eighteen months ago municipalities were very active in putting out securities. For a time, in fact, the market was flooded. These issues, however, have all been absorbed and the supply is now less than the demand. Whereas under normal bond conditions high-grade securities sell on a 4.10 to 4.40 per cent basis, high-grade issues are now being marketed at 3.80 to 4.10. For example, the bonds of the city of Buffalo are selling on a 3.85 basis. The conditions are somewhat exceptional in New York just now, because of taxation agitation, but in general high-grade municipals are on less than a 4 per cent basis.

The condition, therefore, is very favorable for municipalities and other interests with high credit. If they contemplate doing work next year, they can do no better than to get their securities on the market at once and then let the necessary contracts for their work. Forehandedness is certain to be well repaid under the present abnormal conditions.

This Lax Inspection Typical

A CASE of lax lumber inspection has recently been given publicity in Chicago. It appears that 1,100,000 ft. of No. 1 common longleaf pine was ordered for the construction of a new pumping station for the city. Apparently the timbers were carefully inspected for injurious wind shakes, unsound and loose knots and other defects, though little attention was paid to species, at least in the earlier shipments. While many of the timbers were probably on the border line—might have been longleaf, shortleaf or loblolly—a certain other proportion, and quite a sizeable one, could not have been anything else than loblolly or shortleaf. The lax inspection was discovered and the later shipments, presumably, have been examined with reference to the specifications as a whole.

While considerable comment has been made on the case in Chicago, the Engineering Record knows from inquiry among lumber interests that lax inspection of this sort is very common. It seems to be due, too, to ignorance on the part not only of the inspectors but of the purchasing departments, and applies not only to big cities but to million-dollar corporations as well. Within the year there have been two very flagrant examples of the sort at New York, both shipments going to big corporations—one an industrial concern of international prominence, and the other one of the largest railroads in the country. In both cases the shipments, while made on a longleaf specification basis, were composed of 30 to 40 per cent of timbers very evidently of loblolly or shortleaf origin. Yet the dealers were getting longleaf prices, while the engineers had predicated their designs upon the use of the stronger material for the structures they intended to build.

Apparently, then, the lumber dealers are not alone at fault. While their dishonesty cannot be condoned, one cannot but condemn also the ignorance of the purchasing and inspection divisions which accept the materials not complying with specifications. It is just these conditions which have resulted in the agitation for better specifications and higher standards of timber marketing within the last few years.

The practical application of the incident should not be lost upon the reader. If he is specifying timbers it is his duty to see that his inspectors really know how to pass intelligently upon the material being bought. Certainly the engineers of the railroad and of the industrial company at New York who were getting 30 to 40 per cent of shortleaf on a longleaf order did not concern themselves much about what their purchasing and inspection divisions were doing.

Responsibility of Methods for the Quality of Concrete

ELSEWHERE in these columns comment is made upon the great number of studies which have been made on the nature of concrete. More of these, however, have been directed at the quality of the materials, at the variation in proportions, at the effect of different combinations of concrete and steel. Rare and superficial have been the studies of mixing and placing, while the design of mixing machinery, given much study from the mechanical standpoint, has had relatively little thought put upon the actual mixing process itself.

In this issue Nathan C. Johnson begins a series of articles which are directed not at the materials or the inner constitution of concrete, but at the mixing and placing methods. The burden of his argument is that the methods are no less important than the materials. He does not state that they are more important, but it would be easy to conclude from the evidence he adduces that such is the case.

We have rightly heard much criticism of late against "batch-a-minute" concrete. Mr. Johnson's argument backs up those who have criticised current methods. He contends, however, that time-economy is a factor that cannot be overlooked, and while he deplores the quality of material produced under present "batch-a-minute" procedure he insists that this ideal should be kept in mind. In other words, if by a different type of mixing apparatus, or auxiliary equipment to be used in connection with present types, first-class material can be secured at the "batch-a-minute" rate, he is strongly in favor of adherence to the present time ideal.

His articles, therefore, will be as much welcomed by the practical man as by those who on theoretical grounds are fighting for a better product.

A word, finally, as to the method he employs—the motion-picture camera. This instrument has been effectively used in making studies in industrial establishments. Now that Mr. Johnson has shown its possibilities in the concrete field, can we not confidently look for its extension in other directions having a direct bearing on the work of the civil engineer and the contractor? For the work on which Mr. Johnson used it, its advantages are obvious and striking. As engineering grows more complex, new methods of research and new instruments of investigation are to be expected. Possibly not the least of these will be the moving-picture machine.

Contract Fallacies from Australia

IF the report of Maurice E. Kernot, abstracted on another page of this issue, is a fair index of the way the Australian Government has dealt with railroad contractors, it is not strange that the contract work has proved unprofitable for both parties. It would prove so in this country, or in any other where only outline plans and specifications were furnished to bidders; where anyone who could get financial backing was allowed to take contracts, whether or not

he had equipment or previous experience; where, although long delays occurred in preparing plans and letting contracts, the actual time allowed for figuring the work was very brief; where the contractor was invariably held to unprofitable mistakes, and had to assume every risk, and where a premium was put on procrastination by invariably failing to enforce time contracts. The marvel is that the Government was able to find any contractors worthy of the name who would do business under such a system. Certainly no American railroad can run its affairs that way and expect to make its new construction pay dividends. The advantages claimed by Mr. Kernot for the day-labor system are doubtless actual when compared with such a contract system, though his chief arguments are based on fallacies so hoary that they are almost forgotten in this country. Where work is started on the heels of the surveying parties, it goes without saying that the location is apt to suffer. The location becomes permanent before matters like river crossings and other troublesome features can be properly decided.

To say that the staff required to prosecute the work by day labor is only half what it was under the contract system is merely saying that the former system was conducted by the Government in a ridiculously extravagant fashion. Under proper conditions competition so cuts down the return to the contractor that the abnormal profit, of which Mr. Kernot speaks, is nonexistent. By and large, contractors are rewarded in proportion to their skill and the risks they take. On broad economic grounds, therefore, contracting is no more profitable than other lines of business requiring equally sound judgment and ability. Actual experience, too, bears out the theory, as all contractors and fair-minded engineers will testify. Had the conditions of contract work in Australia been fair, the alleged advantages of the day labor which Mr. Kernot sees would not have existed.

Labor Decisions Which Affect Contract Work

TWO labor decisions of the greatest importance to those concerned with the cost and execution of engineering work have been handed down within a month by the United States Supreme Court. Both of them are on anti-alien labor laws—the one in the so-called Arizona case, and the other involving the employment of aliens in the construction of New York's subway. The decision in the Arizona case was handed down Nov. 1, while the court announced its findings in the New York case Nov. 29. Of the two, the New York case has the more immediate bearing on construction work, though the ramifications and possibilities of the Arizona law were so much greater that had the State been sustained the precedent might have become a serious menace not only to all construction work, but to industry in general. The importance of the cases is therefore apparent.

Briefly put, the court declared that the Arizona law was unconstitutional and that the State could not limit the percentage of aliens employed on private work. The New York case did not concern private work, but was concerned solely with the employment of aliens on public work. Here the judgment of the Supreme Court affirms the validity of the statute. It has, therefore, been established that any State has it in its power to prohibit the employment of aliens on public work, whether done with State funds and under State supervision or under any of the governmental divisions subordinate to the State—counties, cities, villages, townships and district organizations.

Arizona's anti-alien law provided that any company, partnership, association or individual who employed more than five workers at a time must employ not less than 80 per cent qualified electors or native-born citizens of the United States. An employee discharged as a result of the enactment brought suit, contending that the law was in violation of his rights under the Fourteenth Amendment to the Constitution. The special court of three judges convened to hear the case supported the plaintiff, and his position has now been affirmed as correct by the Supreme Court.

Touching the authority of the State to promote the health, safety, morals and welfare of those within its jurisdiction, the justification sought for the act, the court says:

"But this admitted authority, with the broad range of legislative discretion that it implies, does not go so far as to make it possible for the State to deny to lawful inhabitants, because of their race or nationality, the ordinary means of earning a livelihood. It requires no argument to show that the right to work for a living in the common occupations of the community is of the very essence of the personal freedom and opportunity that it was the purpose of the (Fourteenth) Amendment to secure. If this could be refused solely upon the ground of race or nationality, the prohibition of the denial to any person of the equal protection of the laws would be a barren form of words. . . . . The authority to control immigration—to admit or exclude aliens—is vested solely in the Federal Government. The assertion of an authority to deny aliens the opportunity of earning a livelihood when lawfully admitted to the State would be tantamount to the assertion of the right to deny them entrance and abode, for in ordinary cases they cannot live where they cannot work, and, if such a policy were permissible, the practical result would be that those lawfully admitted to the country under the authority of the acts of Congress, instead of enjoying in a substantial sense and in their full scope the privileges conferred by the admission, would be segregated in such of the States as chose to offer hospitality."

It was also argued by the state that the act was not in contravention of the rights of aliens, because it was not "a total deprivation of the right of the alien to labor"; that is, that the restriction applied only to businesses and persons having more than five employees, and to the ratio fixed. As to this contention the court says:

"If the State is at liberty to treat the employment of aliens as in itself a peril requiring restraint, regardless of kind or class of work, it cannot be denied that the authority exists to make its measures to that end effective. If the restriction to 20 per cent now imposed is maintainable the State undoubtedly has the power if it sees fit to make the percentage less. We have nothing before us to justify the limitation to 20 per cent save the judgment expressed in the enactment, and if that is sufficient, it is difficult to see why the apprehension and conviction thus evidenced would not be sufficient were the restriction extended so as to permit only 10 per cent of the employees to be aliens or even a less percentage, or were it made applicable to all businesses in which more than three workers were employed instead of applying to those employing more than five. . . . The discrimination is against aliens as such in competition with citizens in the described range of enterprises and in our opinion it clearly falls under the condemnation of the fundamental law."

The New York case is decided on the same basis as that taken by the Court of Appeals of the State of New York. Justice McKenna in his opinion quotes from a previous decision of the United States Supreme Court to the effect that "it belongs to the State, as guardian and trustee for its people, and having control of its affairs, to prescribe the conditions upon which it will permit public work to be done in its behalf, or on behalf of its municipalities. . . . No court has authority to review its action in this respect. Regulations on this subject suggest only consideration of public policy. And with such considerations the courts have no concern."

Further in the decision the court says that "the labor law of New York and its threatened enforcement do not violate the Fourteenth Amendment or the rights of the plaintiff in error under the provisions of the treaty with Italy."

Other contentions are considered but are completely swept aside. Governmental agencies throughout the country, and contractors working for them, or accustomed to do public work, may, therefore, take it for granted that the anti-alien statutes, where they exist, are valid. Further violation of them, accordingly, will be at considerable risk.

One cannot but rejoice that the Arizona law was declared invalid. Had it been supported the possibilities for mischief are almost impossible to estimate. Very likely in the States that would be most seriously affected, the industrial centers of the Middle West and the East, public opinion would have prevented the enactment of a similar statute. Yet vigorous labor unions can accomplish much, as witness the full-crew laws which have been imposed on the railroads.

As to the prohibition of aliens on public work, this journal repeats its former position that it considers such an enactment unwise. If the Government allows aliens to come into this country, its subordinate divisions should not be the first to refuse them employment. Simply and solely the laws are an evidence of the power of the labor unions.

Materials vs. Methods—Testimony of Moving Pictures in the Study of Concrete

First of Three Articles on the Making of Better Concrete—Part I, on Mixing, Suggests Necessary Function of a Concrete Mixer, and Points Out the Evils of the Short Mixing Period

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[*Methods, and not merely materials, are to blame for bad concrete—or, as Mr. Johnson puts it, will be largely responsible, when improved, for better concrete. In this series of articles he takes up the handling of concrete from the raw materials, through the mixing and transportation stages, to the product in place. The common errors in hand and machine mixing, in distributing with carts and with chutes, are studied with the aid of moving pictures. Remedies are indicated, so that the series will stand as a constructive contribution to the literature of the subject.*—EDITOR.]

IN BUYING and selling services for construction work, cost and profit are necessarily primary considerations. Quality of commodities is assumed commensurate with the price paid, but in concrete work, either no guarantees, or at most only limited guarantees, as to endurance are either asked or given.

This question of dollars and cents pivots on the element of time. Therefore, from the standpoint of money consideration alone, *SPEED* is of prime importance to construction undertakings. The wages men earn, the interest on money invested, or money borrowed, all increase with time; and in addition, the contractor is usually under a time limit for completion, since the owner desires to use the structure as soon as possible, to minimize the time his capital is invested without return. And in concrete work in the North, a further potent reason for economy of time is the briefness of the open season.

CARELESSNESS

Necessarily, however, this demand for speed and saving of time has resulted in carelessness of working methods. Remembering that the dependence for strength in all concrete rests primarily upon a chemical reaction between water and cement; that each of these substances is as important as the other; that to insure this chemical reaction taking place properly, a certain amount of mechanical manipulation is necessary to bring about incorporation of the liquid and dry materials; and that definite quantities only will serve to produce proper results, it is plain that haphazard deviation from these requirements must bring about, at best, uncertainty of result.

If all concretes were thoroughly satisfactory there would be no need for this investigation, or of the many other investigations that are being carried on to-day at great labor and expense, with a view to finding the secret of better concrete. Unfortunately it is all too true that these investigations are warranted. Without attempting to estimate their percentage of the total, it is evident to all who deal with concrete that defective constructions, in which signs of deterioration show to a greater or less degree according to local conditions, are regrettably prevalent. Indeed, so common are these defective concretes and so accustomed have we become to seeing them, that citation of unsatisfactory conditions is met with statements that such disintegrations (to quote literally) are "natural to the material" or that "they always happen in concrete" or that they "really do no harm." In other words, structural standards for concrete have been unconsciously lowered to meet supposed limitations imposed by lack of appreciation and understanding of the real nature and possibilities of the material.



FIG. 1—CONCRETE IS BEING DISCHARGED AT ONE SIDE WHILE MIXER IS BEING CHARGED AT OTHER

Granting, then, the need for general improvement in the quality of concrete; and remembering that concrete is a composite produced by the mixture and manipulation of cement, sand, stone and water, it is evident that either the quality of the materials must be at fault or else the processes during and after manufacture must be held responsible for any inferiority. Eliminating the qualities of materials from present consideration, because of the extensive study already devoted to them, it seems possible that valuable knowledge may be gained by considering carefully the mixing and placing of the materials.

TIME OF MIXING

Any investigation of process troubles may properly start with a determination of the time-cost-per-cubic-yard for each phase of the manipulation, together with the effect of such costs upon the proper performance of each operation.

In this motion picture study, attention was therefore first directed to this time-cost factor as it might affect the process of mixing. To determine its value, both hand-mixing and machine-mixing methods were investigated, a considerable number of jobs, covering different classes of work being studied on all-day runs. On fourteen machine-mixed jobs, timing records were taken, with a large seconds-clock in the field of the motion-picture film, in order that each phase of the cycle might be timed with precision; and these camera studies were supplemented by others with a stop-watch. It should also be understood that for each second's duration of any process photographed, from 16 to 30 separate pictures are made, or for each minute's duration, from 960 to 1800 separate pictures, according to the speed with which the camera crank is turned. Not only does this result in a large mass of data, especially when it is remembered that some 35,000 such individual pictures have been made and studied in the course of this research, but it further gives very accurate data as to the processes under investigation. Timing data in regard to mixing as obtained by this means, together with long-time observations taken by stop-watch on the same jobs, are given in Table 1.

RESULTS OF TIME STUDIES

In these time studies, it is interesting to note, first, that the average duration of actual mixing for all jobs is but 28 sec.; and that omitting two jobs, on which the material could not be disposed of as fast as made, this is lowered to 17 sec. Nor is it unusual to find on individual runs 4 or 5 sec. only given to mixing, with, in some

TABLE 1—SUMMARY OF TIMING DATA ON CONCRETE MIXERS
Time given in minutes and seconds.

Run No.	Kind of mixer	Loading means	Loading	Unloading	Actual mixing	Actual total	Loading and unloading, total	Time of mixing batch, minimum schedule
1	Lakewood, 1 yd.	Batch hopper	0:51	0:59	0:11	2:02	1:50	—0:50
2	Koehring, 1 yd.	Batch hopper	0:36	0:34	0:42	1:51	1:10	—0:10
3	Smith, ¾ yd.	Batch hopper	0:15	0:19	0:25	1:01	0:34	+0:26
4	Foote, ¼ yd.	Side loader	0:16	0:17	0:20	0:54	0:33	+0:27
5	Foote, ½ yd.	Side loader	0:23	0:27	0:25	1:15	0:50	+0:10
6	Chain Belt, ½ yd.	Side loader	0:07	0:35	0:28	1:10	0:42	+0:18
7	Koehring, ½ yd.	Side loader	0:12	0:32	0:21	1:05	0:44	+0:16
8	Lakewood, 1 yd.	Side loader	0:11	1:02	1:11	2:25	1:12	—0:12
9	Ransome, 1 yd.	Batch hopper	0:35	0:40	1:40	2:57	1:15	—0:15
10	Ransome, ¼ yd.	Side loader	0:08	0:12	0:54	1:10	0:20	+0:40
11	Chain Belt, ¼ yd.	Side loader	0:13	0:27	0:11	0:51	0:40	+0:20
12	Ransome, ¼ yd.	Side loader	0:18	0:38	0:46	1:32	0:56	+0:04
13	Koehring	Side loader	0:17	0:29	0:20	1:06	0:46	+0:15
Average			0:21	0:33	0:28	1:29	0:53	+0:6
Average, omitting 8 and 9			0:19	0:29	0:17	1:17	0:49	+0:10

Note—Mixer 8 had very poor blading. Mixer 9 was fed by derrick bucket. Long mixing due to inability to get raw material and to dispose of mixed concrete.

extreme instances, the unmixed materials being delivered into one side of the machine at the same time that the "concrete" was being sent to the forms from the other.

Such mixing is clearly shown in the series of motion-picture photographs, Fig. 1. The materials are seen sliding from the hopper into the drum, at the same time that the flow of concrete continues from the discharge end. Nor is this an isolated case. It is found repeatedly; and in one case, while this exhibition was going on, the foreman was explaining that his mixer had worn blades and apologized because his gang, owing to being green, was below speed!

Evidently, on each of the jobs thus studied, the time-cost-per-cubic-yard for mixing has been cut as close as circumstances permitted; and it seems fair to assume that like conditions prevail generally, since all the contractors concerned are of good repute. But while this one desirable end, of low mixing cost, is thus attained by speeding up, what of its reaction on the quality of concrete? And how far may this brief time of mixing be held responsible for the recognized defects?

Heavy-Bodied Grout

For instance, it is known beyond question that cement and water stirred together for 17 sec. do not give the heavy-bodied grout that is produced by more prolonged mixing. It is further known that cement stirred with water for this short period, particularly when the mixture is thin, tends to settle by gravity into layers of the several sizes of particles; and that equal quantities of like materials, when properly incorporated by prolonged mixing, do not tend thus to segregate, but form instead a heavy-bodied "gravy" capable of sustaining in suspension larger and heavier particles, such as sand or stone. And it is further known that the ultimate product produced by the first process is not the same as that produced by the second, but lacks in strength, hardness and durability—desired qualities in a substance which binds together the loose, inert materials of concrete. When these matters are considered,

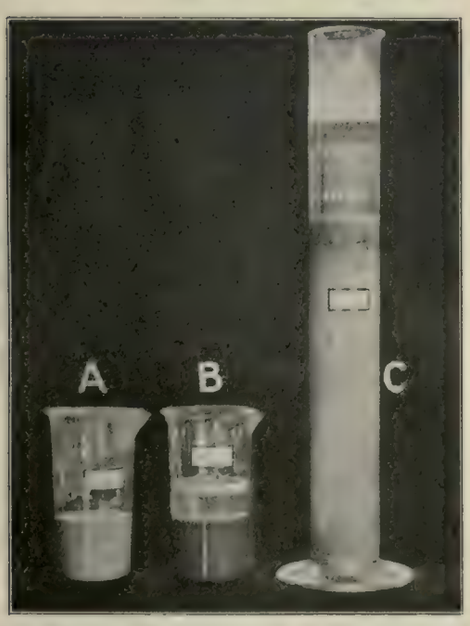


FIG. 2—EQUAL QUANTITIES OF CEMENT AFTER STIRRING WITH WATER FOR SHORT AND LONG PERIODS

(*a*) Dry cement. (*b*) Same quantity of cement mixed with water for 17 sec. (*c*) Same quantity of cement mixed with excess of water for 6 hr.

it seems possible that this gain in the time-cost-of-mixing factor may prove an ultimate loss, through its reaction on the quality and endurance of the concrete.

The comparative effects of long and short mixing of neat cement and water are made visually evident by Fig. 2. The first glass, (*a*), contains 200 grams of loose, dry cement. The second glass, (*b*), contains the same quantity of cement, mixed for 17 sec. with 100 per cent excess water over that required for normal consistency, photographed after being allowed to settle for 10 min. The third glass, (*c*), contains the same amount of cement stirred for 6 hr. with 500 per cent excess of water, photographed after settling for 96 hr. This latter excess is, of course, used for experimental purposes only.

It is needless to point out the volume ratios of (*b*) and (*c*) or their comparative surface-covering and void-filling ratios. Nor are the cementing properties of (*c*) destroyed. Experiments made by Michaelis have proved that with this "colloid," products of the greatest strength and durability may be produced; and the view first propounded by him that the most valuable properties of Portland cements are due mainly to colloidal products of hydration is steadily gaining in favor. Evidently, then, the source of many deficiencies of concrete might be sought with reason in the usually incomplete incorporation of cement and water brought about through undue emphasis on the time-cost element of the mixing process in the interest of initial economy. (For further discussions of extent of hydration in concretes see articles by the author in the Engineering Record, Feb. 6 and March 13, 1915, pages 160 and 320.)

Actual Time of Mixing

But still further light is shed by these studies on the mixing of concrete. Following through the complete operation, note was made of the time required on each run for the batch to enter the mixing drum, whether the machine was charged by a side-loader skip, or by a batch hopper; of the time the materials were actually in the drum, from the last of the charging to the delivery of the first concrete; and lastly of the total time to discharge the mixer. In some cases the duration of these several operations was so prolonged that on a "batch-a-minute" schedule, which is probably the usual basis in the computation of concrete costs, the mixing time would be wholly negative.

The maintenance of a "batch-a-minute" schedule under such conditions would, of course, be an absurdity. Mixing of some sort is essential, for not only must the cement and water be properly incorporated to produce a binding substance, but the inert materials—the sand and the stone—must be covered closely with and filled between by this binding substance, if the concrete is to be dense and strong. But although it is to be granted that insufficient mixing may be responsible for a portion, at least, of any lack of quality and that longer mixing may be beneficial, it must yet be recognized that a low mixing time-cost is highly desirable; and that an increase of this factor, unless unavoidable, would impose a general hardship, particularly under conditions of competitive bidding, where "concrete is concrete" and money alone needs guarding.

With a view to overcoming this objection through increased mechanical efficiency and also to determine to what extent the time-of-mixing factor by itself should be held responsible for deficiencies of concrete, the actions that take place inside a concrete mixer of the common type were caught by the camera and carefully studied. As such a mixer is seen in operation by the human eye, the sequence of individual actions that go to make up the complete cycle is so rapid that they cannot be distinguished one from another. The camera, on the other hand, by recording an instantaneous and unconfused impression on the advancing film,

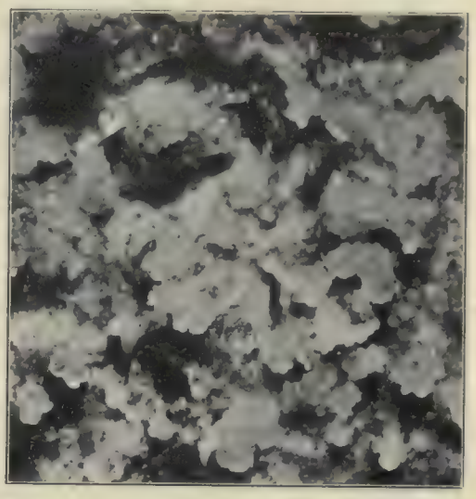


FIG. 3—ROUGH FRACTURE OF A WATER-SOAKED, DEFECTIVE CONCRETE

Cement mortar only showing. Each of loose, white spherules has within it a center of unhydrated cement. Enlargement, 100 diameters.

catches these individual actions, and permits their being analyzed in later examination.

But in order to evaluate properly these process records, a thorough understanding must be obtained not only of the results it is possible to obtain through proper procedure, but also of those which are commonly secured through the usual mixing operations. For such an understanding, recourse is had to an intimate study of ailing concretes, in much the same way that physicians study ailing humanity, not to exaggerate ills, but to learn from disease how to mitigate its ravages and to prevent its recurrence.

What "Ailing" Concretes Show

An examination of rough fractures of water-soaked, defective concretes reveals an interesting condition. The value of the colloidal, or amorphous constituent produced by proper union of cement and water has been already noted. Properly, the cement matrix, in which are embedded the sand grains and pieces of stone, should be an even-textured, structureless mass, if it is formed of colloid. What is usually found, however, is a structure that seems when magnified to be composed almost wholly of individual grains, white in color, spherical, or nearly-spherical, in form, possessing little attachment to their neighboring particles, so that they may be freely moved about by poking with a pin, the whole closely resembling a mass of white cornmeal mush.

These several features can be clearly seen in Fig. 3, taken through the microscope. Evidently, in such concretes the amorphous, or colloidal, products possible of production are at least in inferior quantity, if not wholly absent; and since other concretes, prepared with special regard to this produc-

tion of colloid, exhibit a quite different structure; and since these latter do not possess the deficiencies of the non-colloidal concretes, it would seem that an undue reduction of the time-cost-of-mixing factor might prove to be poor economy in the long run.

It has been already shown that an increase of colloid without increased cement can be produced by prolonged stirring of cement and water. It is known further that 8 hr. or more of mixing produces concrete of a tacky consistency, quite unlike the loose, unregulated mixture generally made by the 17-sec. process. (See Bates, *Proceedings*, American Society for Testing Materials, 1915.) Yet such prolonged periods of mixing, though desirable from a quality standpoint, are economically prohibitive in commercial work.

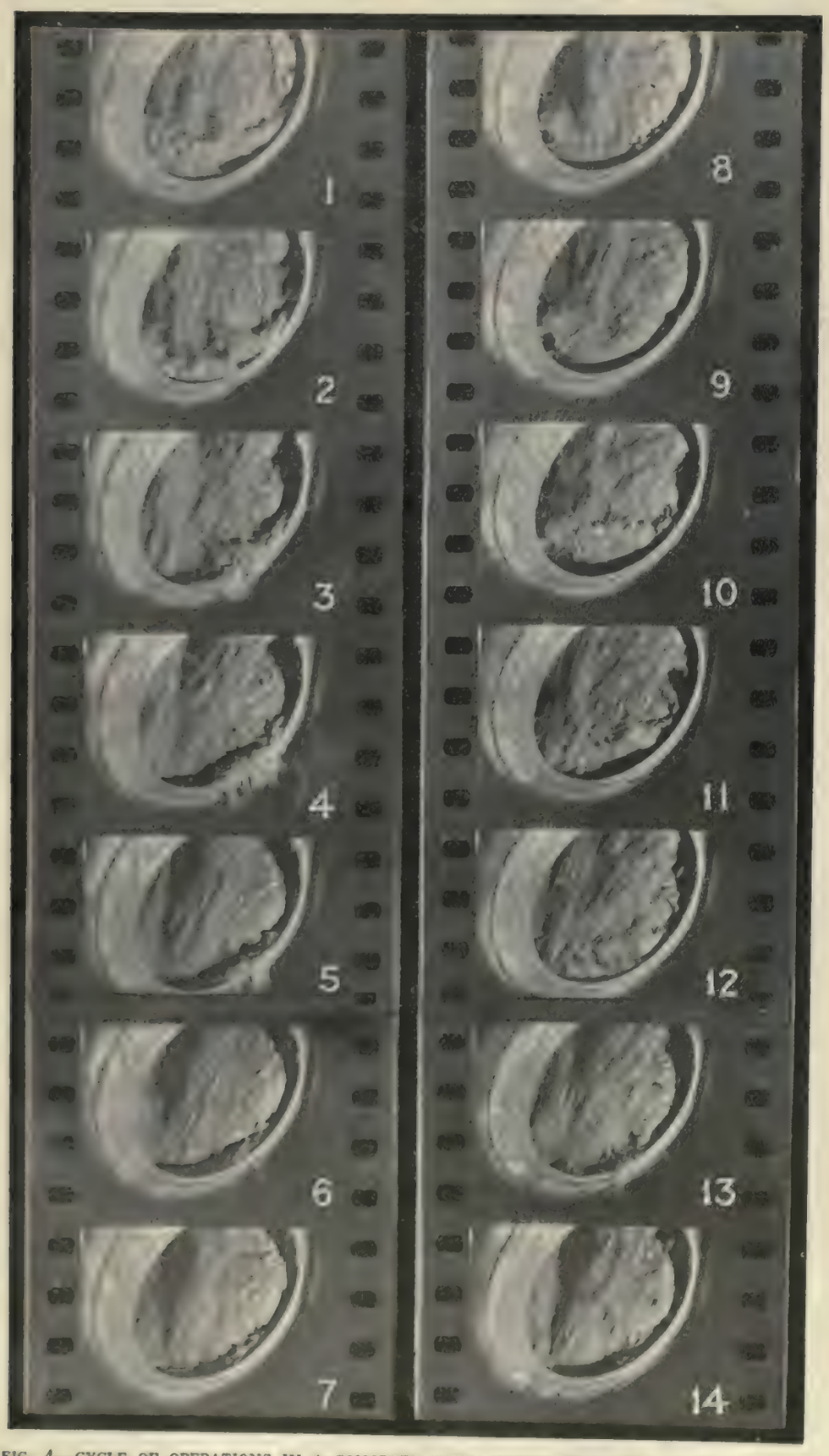


FIG. 4—CYCLE OF OPERATIONS IN A CONCRETE MIXER VIEWED FROM THE DISCHARGE END—ROTATION COUNTER-CLOCKWISE

1, 2—Rising bucket strikes falling concrete. 3, 4—Resulting splash and spill. 5, 6—Pieces of stone separate. 7, 8—Bucket begins to pour. 9, 10—Pour, aided by bucket above, increases. 11, 12—Grand splash to bottom. 13, 14—Next bucket starts it all over again.

Bearing in mind then, the spherical form of the grains found in defective concretes; knowing that calcium hydrate, produced in profusion during the reaction of cement with water, tends to take this crystal form; and realizing the low strength possessed by this substance and its possible masking within it of other and stronger products essential to durability, it is evident that a most desirable type of mixer would be one which by forcible, positive, mechanical means would grind off any isolating substance or substances formed by the first water contact. This would secure thorough and rapid contact between water and fresh, successive, layers of the individual grains of cement, thus producing in a shortened time a nearly perfect solution of cement, this solution to be used as a coating of, and filler between, the particles of aggregate. Furthermore, the whole process must be accomplished without prohibitive increase of time and without the requirements of expensive mechanisms or skilled labor, so that the time-cost-per-yard factor may be kept within permissible limits. Such a device would seem to be a large order, but it is not impossible that the studies of deficiencies in existing apparatus outlined in the following paragraphs will eventually lead to its development. The reality and extent of the need, with commensurate rewards, certainly offer sufficient incentive.

With this knowledge as to structural deficiencies of defective concretes and the process of mixing desirable, if not absolutely essential to their prevention, new appreciation is had of the usual mixer actions as portrayed on the film.

Furthermore, when it is remembered that while it is endeavored to incorporate the materials, it is also desired not to introduce an undue quantity of air into the mass, it is at once evident that at least this one principle of proper mixing is violated hundreds, if not thousands of times a minute, through the splashing, lifting and pouring brought about by the paddles, buckets and blades. The less air in concrete, the better its quality, for not only does occluded air displace solid, stress-resisting materials, but it further permits the later entrance of solvents and disintegrating agents into the mass. From this standpoint, the actions portrayed in sequence on the motion-picture films are highly undesirable, for the lifting, pouring and splashing must be churning air into the mass in an all-too-efficient manner. It it were desired to aerate the mass, the drop of plastic material from a height, the splashing and the wild turmoil, would be nearly ideal.

"INSIDE THE DRUM" PICTURES

In Fig. 4 is shown the cycle of operations as observed from the discharge end of the mixer drum. Fig. 5 gives a few views from the charging end. Though it is possible to follow the operations at the charging end satisfactorily with the films, the prints do not reproduce well. In studying these records, it will be remembered that the materials, stone, sand and cement, charged into the drum, with water added at one time or other, are caught first by sloping transfer blades and advanced, with more or less stirring, to the forward end of the drum. Scoop blades of one form or another, attached to the drum interior at this end, then elevate them nearly to the top of the drum, when they are poured to the bottom. The transfer blades again advances them to the elevating scoops, and so on, through

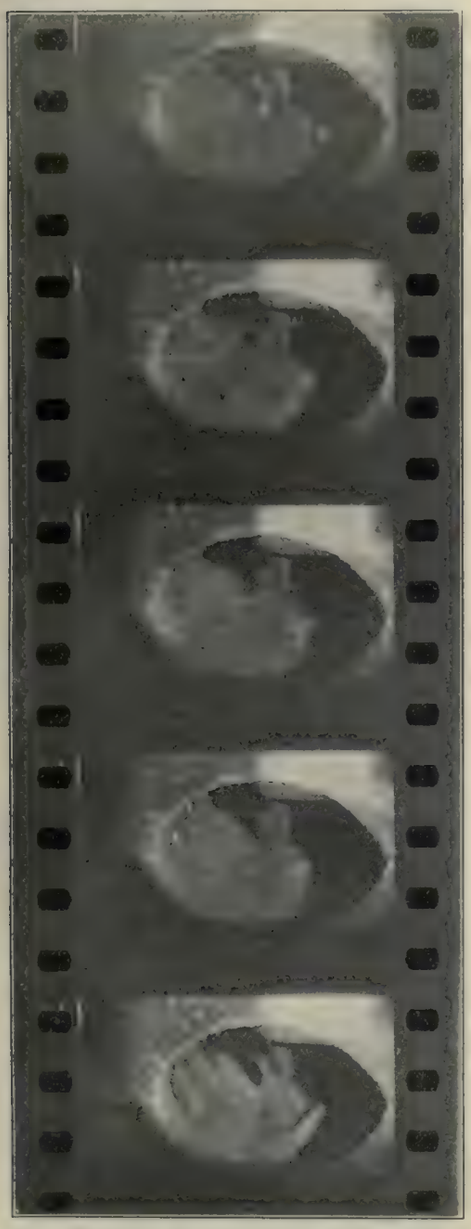


FIG. 5—CYCLE OF OPERATIONS VIEWED FROM THE CHARGING END—ROTATION CLOCKWISE

indefinite numbers of repeating cycles.

There is no question as to the efficiency of this process as a distributor of the several materials. But, aside from the question of churning air into the mass, is it producing that desirable solution of cement, through grinding with water of the individual particles, in so brief a time? Is it possible, especially in view of the superwetness of the average concrete, to secure this result through intimate contact of the sand and cement? And if this thick-bodied product is not thus secured, in what manner is segregation of sand and stone and unconverted cement to be prevented and a durable, uniform concrete to be obtained?

The answer is that few of the latent possibilities of concrete materials are now being realized, partly through the imperfections of these mixing processes. Water must occupy space when added to the mass; and unless it stays by itself, which is ridiculous to suggest, it must lie between the particles, fine or large. If it lies between the particles, as it is known to do, it prevents their contact. If it prevents their contact, it prohibits grinding actions by cushioning and lubricating, thus cutting down the proper supply of positively dissolved cement, wherewith the sand and stone may be covered, and their interparticle spaces and air voids filled. It is certainly important that the mixing-time-cost-per-yard of concrete be kept low, but if this is to be done without sacrificing strength and permanence, a new type of mixer, or an improvement on present types, must be developed. Its advent in the near future is not unlikely.

The operations analyzed above are very important in their effect, but they may not be held wholly responsible for process defects of concrete without further investigation. In the following papers of this series, other operations will be discussed in the light of motion picture studies, together with their economic and scientific bearing on the production of more durable concrete.

[*The second article in this series will appear in next week's issue.*]

Colonel Sohier Tells of California's Concrete Roads

Describes Methods of Construction and Maintenance at Meeting of Massachusetts Highway Association

AN informal talk on California highway construction, by Col. W. D. Sohier, chairman of the Massachusetts Highway Commission, was a feature of the quarterly meeting of the Massachusetts Highway Association in Boston on Nov. 11.

Since 1912, Colonel Sohier said, about 1176 miles of State highway have been built in California under the general direction of Austin B. Fletcher, State highway engineer. By the end of this year $16,000,000 will have been expended out of a total appropriation of $18,000,000, and the State will vote this year on the expenditure of some $15,000,000 more in order to complete the State highway system. In the last five or six years the various counties have expended over $20,000,000 in constructing new roads, in addition to what the State is doing. The State work now completed consists of 306 miles, graded only; 800 miles of concrete with thin bituminous top; 21 miles of concrete with asphalt paving; 19 miles of oil macadam, penetration method; 17 miles of macadam with asphalt top (Topeka); and 13 miles of waterbound macadam.

Bulk of Roads Are Concrete

Mr. Fletcher is building practically all his roads now of concrete, mostly 4 in. thick, though some of it is 4.5 in. thick. The mix is 1:2:4, the larger stone being 1¼ in. A most excellent sand is secured and all materials are tested in the laboratory before using. In most cases the concrete is cured by building small earth dikes, about 8 in. high, and 6 or 8 ft. apart, keeping the road covered with water, which often has to be piped 8 or 10 miles. This method cures better than an earth covering, especially in a hot climate. About 10 days are required for the setting of the concrete. The roads are now being paved 15 to 18 ft. wide in the country districts, the width of the grading in the valleys being 30 ft., and that of the location, from 60 to 100 ft.

The sand used on the 4-in. concrete roads in the valleys is rated at 90 per cent by the Ottawa standard. The concrete costs on an average $6.25 to $6.50 per cubic yard in place, cement being $1.40 net in bags. Oil surfacing, depending upon the oil and haul, costs from 7.75 to 10 cents per square yard, including the pea stone and sand.

In the country districts where the traffic is not extremely heavy, the roads are coated after three months or one year, as the case requires, with asphaltic oil from Cat Canyon. This oil has to be heated in a tank car and spread at about 325 deg. under pressure. In spreading, ¼ gal. is applied to the concrete and covered with pea stone, which is then rolled in. Another ¼ gal. is then spread and covered with an excellent grade of sand, the sand varying up to ¼ in. This is rolled in also, and the road is kept covered so that it will not pick up. Before applying the first coating the practice is to wait until the first scum on top of the concrete is worn off. Colonel Sohier saw some of these oiled surfaces in excellent condition after three years' service; at some places patching had been done. The average cost of maintenance is less than $20 per mile, and Mr. Fletcher's opinion was that the patches were made necessary because of lack of covering, thus allowing the oil to bleed on a hot day and pick up. In construction it was found impossible to make the oil stick to the concrete when it was fresh, until the traffic had worn off the first scum as above outlined.

The average cost of grading in the valleys is from $1,100 to $1,400 per mile for a 30-ft. width. The concrete roads are built on a natural base varying from adobe mud to silty sand.

On roads graded 30 ft. wide the average cost of construction is 87.5 cents per square yard for the 4-in. concrete, with a top which adds 7 to 9 cents per square yard.

Grading

All grading which Colonel Sohier observed in the West was being done with some form of steel shovel with either two or four horses when the material had to be moved more than 300 or 400 ft. The steel shovel is mounted on wheels. In other places a steel shovel drawn by two or four mules is used. The so-called Fresno drag has four mules. In hard material like hardpan a gang plow is sometimes employed to break up the material, after which the material is removed and placed for grading with the Fresno drag. Stones up to ½ cu. yd. are moved in this way.

In getting gravel out of pits a skid is built up with a hole in the middle, excavating sufficiently below the skid to back in a team. Gravel is secured from a large area by the use of two horses and a steel scoop revolving around the pit, taking off successive layers and dumping from the shovel into the cart below the skid.

No expansion joints are laid by Mr. Fletcher in the 4-in. concrete roads. The concrete cracks transversely in the first year of service about as frequently as expansion joints are located in usual practice—every 25 to 30 ft. After the top scum is worn off by traffic the surface is brushed clean before the oil is applied; the first application of asphaltic oil then runs into the cracks and there is no surface indication that any crack has ever existed. The roads themselves look like first-class asphalt pavement at present. There are very few places where the asphaltic oil has peeled, patches being attributed, as stated, to insufficient covering. The Cat Canyon asphalt oil grades as 90 penetration and 80 per cent bitumen by the California standard. It is very sticky and costs 85 cents per barrel of 42 gal.

Mr. Fletcher expects to pave the whole mountain section with concrete before

many years at an average cost of $28,000 per mile for the completed road. The crown on the concrete is ¼ in. per foot, and in most cases in the valleys there is no drainage except the side ditch. Mr. Fletcher states that although the mud formation swells a good deal in wet weather, in only one or two cases has it thrown the road up so that it will not come back. In some cases where he is building concrete the frosts are severe because of the 5000-ft. altitude. The valley roads are frequently subjected to very heavy commercial and farming traffic.

ROAD OVER SIERRA NEVADAS

One road is being built over the Sierra Nevadas; it is 40 miles long and is to have a maximum grade of 7 per cent. The grading on the first section, 14 miles long, cost $10,500 per mile; on the second section, 14.5 miles long, $20,907 per mile. On this section there were 639,000 cu. yd. of excavation, the maximum cut being 126 ft. The contractor used steam shovels in the cuts and actually moved over 1,000,000 cu. yd. The price for unclassified excavation was 41 cents per cubic yard. This included taking out the rock, almost all of which could be done with steam shovels. Some concrete is used on the 7 per cent grade. The third section cost $15,938 a mile, since the grading was less heavy. The contractor had 150 days for moving the material. The average haul was 20 miles from the railroad. Natural gas was piped from a line in the district to the steam shovels. The contractor moved his material at an actual cost of 15 cents per square yard. On the mountain roads no guard rails are used. Colonel Sohier averred that guard rails are a snare and a delusion, because they are never strong enough to actually hold an automobile on the road, and where there are no guard rails, the moral hazard is so great that the driver operates slowly and keeps strictly to his own side of the road around corners.

Wisconsin Using Standardized Bridge-Abutment Plans

How the State Highway Commission Has Simplified Abutment Designs—Use of Zinc Etchings and Table of Standard Quantities

DESPITE the great number of variations in abutments, the bridge department of the Wisconsin Highway Commission has evolved a method for standardizing abutment designs in such a way as to reduce appreciably the amount of drafting and still give an individual design for each substructure. The commission each year prepares plans and specifications for about 900 bridges of all sizes, the majority being steel bridges of moderate span. The superstructure designs were standardized at an early date, and the necessity of preparing a special superstructure design rarely arises.

USUAL PRACTICE OF THE COMMISSION

The usual practice of the commission, according to M. W. Torkelson, bridge engineer, is to use mass concrete in abutments, making the thickness of the abutment at the footing equal to one-third of the distance from the roadway to the footing, with a bridge seat of the size necessary to carry the superstructure. These superstructures are of four types, I-beam, pony Warren girder, high Pratt truss and plate girder, the design of the abutments for each type not varying materially except at the bridge seat.

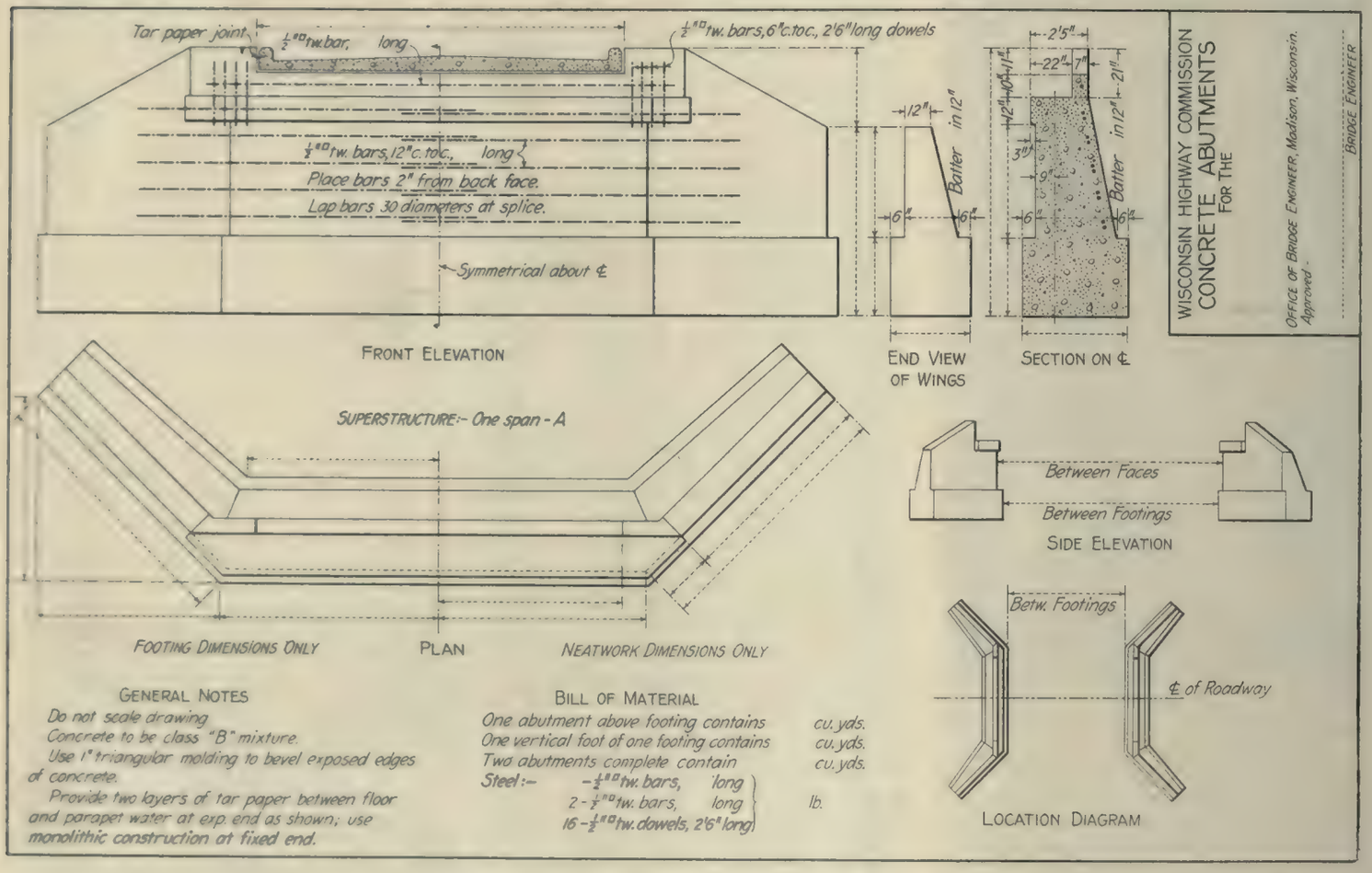
Typical drawings of abutments for each type of superstructure were prepared. These included all dimension lines and all constant dimensions, but omitted all varying dimensions. From these drawings zinc etchings were prepared and copies printed on thin white paper. A table was also prepared giving all variable dimensions for each difference of 1 ft. in elevation of abutments, together with the quantities of concrete in the battered work and the footing for each height computed. The computations included a combination of each height of abutment with three different lengths of wings.

USE OF TABLE OF STANDARDS

Whenever it is desired to prepare an abutment plan for a case not presenting unusual features, the practice is to take one of the printed copies made from the zinc etching and supply all necessary dimensions, which, with the quantities, are taken directly from the table.

There is also, in the drawing, space for sketching a location diagram and for indicating all line and elevation monuments, and space in the title for indicating the date of the design and the name by which the particular bridge is known. The completed drawing is given its serial number, and as many copies as are desired are made by blueprinting. The drawing is then filed as a permanent record.

The economy in this method lies in the fact that nearly all the labor of making the drawing is avoided, it being necessary merely to supply the dimensions, and take the quantities from the table already prepared. Not only is the labor diminished, but opportunity for error in computing quantities is largely decreased.



THIS STANDARDIZED ABUTMENT DESIGN CAN BE USED FOR SPECIAL CASES

Wreck 15-Story Building and Replace with 17-Story Structure in 142 Days

$16,000 Worth of Material and Labor per Day Put Into Construction of Skyscraper on Chicago's Busiest Corner

HIGH PROPERTY VALUES on the busiest street in the loop district of Chicago were responsible for the speed with which the 15-story Champlain Building was replaced by a 17-story structure 67 x 104 ft. in plan between July 18 and Nov. 1.

The old structure was wrecked in the ordinary manner, using Oxweld torches cutting close to the columns and girders in order to obtain as long shapes as possible. The structural steel recovered was in excellent condition, although it had been up 23 years, as described in the Engineering Record of Aug. 21, page 223. It is interesting to note that the steel shapes from the old building have already been placed in another building. Despite the fact that the corner of Madison and State Streets is one of the busiest in the city no accidents occurred either in the wrecking of the old structure or the erection of the new. The heavy traffic at the corner, however, made it difficult to store the materials. All material that could not be placed inside the building had to be delivered as needed.

As the Champlain Building was torn down the adjoining walls of the Boston Store were cut through and temporary partitions placed without interfering with the use of the elevators in the latter building or with its business. The supporting beams of the elevator guides were supported on the wall to be torn out, and, as a result, the beams had to be shored from top to bottom—17 stories. This was accomplished without accident or hindering elevator traffic.

Using air drills and wedges the old foundations, consisting of 12 or 15-in. I-beams with cast-iron separators concreted in the ordinary manner, were removed. The work was carried on day and night, excepting Sundays.

Open wells averaging 8¾ ft. in diameter and driven 93 ft. below the basement excavation were carried down to solid rock. The soil consisted of 50 ft. of blue clay, 10 ft. of stiff clay, 20 ft. of hardpan and the remaining distance to rock, a water bearing sand and gravel. The new foundations were completed in 16 days. The structural steel was set by two derricks, one carried up with the steel and the other placed on the roof of the adjacent building —the main portion of the Boston Store. The use of the former derrick was discontinued at the eighth floor.

All cutting for connections to the existing structure was made with acetylene torches, and measurements for steel had to be made at the site, rendering the furnishing of steel a relatively difficult procedure.

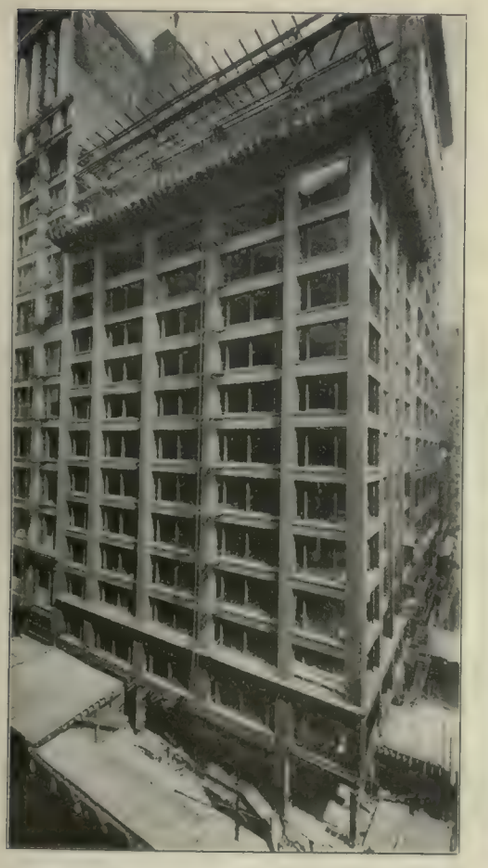
Special Steel Erection

The east panel of the Boston Store on Madison Street was found to be 2 ft. shorter than the standard panel length due to the former Champlain Building connection. In the new structure the plans called for all panels to be of the same length. As a result it was necessary to remove the old column and erect a new column 2 ft. east.

This was accomplished by erecting the steel of the new structure and then removing the old columns by starting at the top, shoring the spandrels from adjacent floors and transferring the spandrel to the new column by splicing a section of the spandrel girder. This was done without removing the masonry of the old building except where connections were made.

Fire-preventive measures were taken with all beams and girders by covering them with tile, except the tops which were concreted with 2 in. of 1:2:4 concrete. The terra cotta floor arches were placed between Aug. 16 and Sept. 24. All steel columns were protected with 4 in. of concrete. The beams were plastered with cement mortar before the installation of the arches.

In one month, September, 45 per cent of the total value of the work was completed and in another 20 days the first four floors were turned back to the owners for occupancy, in spite of the fact that a great deal of trouble was encountered with workmen. As many as 1000 were at times at work per shift. The erection was car-

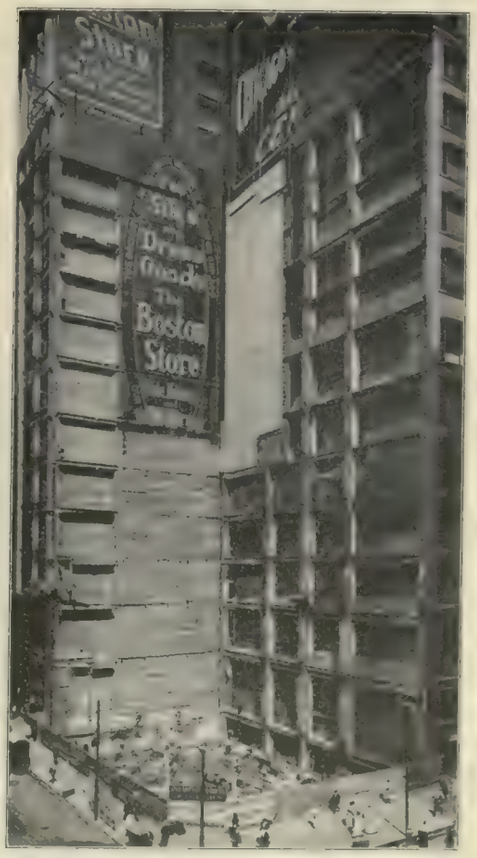


WRECKING THE OLD BUILDING JUNE 16

The structural steel recovered was in good condition.



NEW BUILDING WITH LOWER FLOORS OCCUPIED OCT. 21



REMOVING OLD FOUNDATIONS JULY 16

Beams in building on left shored for seventeen stories.

ried on throughout every hour of the twenty-four, and 2500 tons of steel were erected and 10,000 tons of terra cotta were placed during this month of September.

The W. J. Newman Company was the contractor for the wrecking, and the structural steel was furnished by the American Bridge Company. John Griffiths & Son Company was the general building contractor. The Ruud-Nilsen Company was the shoring contractor and Holabird & Roche were the architects.

Seattle Uses Ejector to Clean Sewer Catch Basins

Three Men Remove 22 Cubic Yards of Detritus in One Day, Labor Costing $9 and Water $3

By A. W. HOWARD
City Engineer's Office, Seattle

BY adapting the principle of the hydraulic lift to the removal of detritus from catch basins the city of Seattle has been able, with ejectors, to effect marked economies in the maintenance of its sewerage system. Cost of maintenance is one of the factors in any sewer system. There are surface catch basins, sand catchers and the sewer to be cleaned at intervals and this work generally is slow and tedious, being done by hand in most of our large cities.

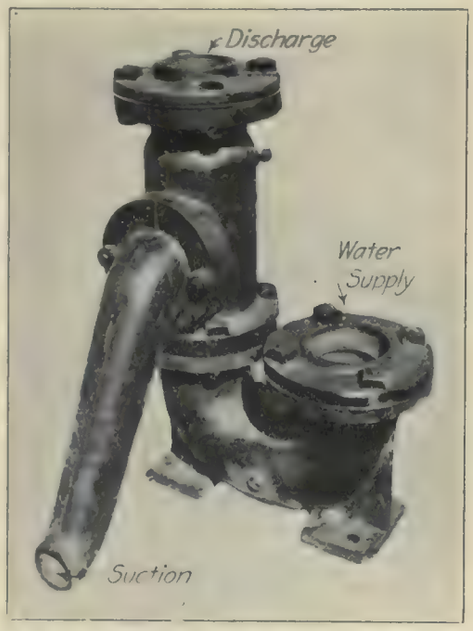
GRIT CHAMBERS COLLECT DETRITUS

The City of Seattle, Wash., has just completed a large trunk sewer system, 22 miles in length. The sizes of sewer range from an 18-in. vitrified pipe to a 12-ft. concrete sewer draining approximately 10,000 acres. A large portion of the system is in districts that have no paved streets and, as a result, large quantities of sand, gravel and débris find their way into the sewer through manhole covers and catch basins. To collect this heavy detritus and hold it in one place large sand catchers or grit chambers were built in the line of the sewer. The sand catcher is divided by a central wall into two compartments so that the sewage flow can be shut off from one side while it is being cleaned.

The cleaning of these big chambers, each of which holds from 10 to 30 cu. yd. of detritus, has been quite a problem. Some of them have a depth of from 45 to 54 ft. and it was necessary to use a windlass and bucket to hoist the material to the surface. This was only part of the problem, however, for the reason that the detritus was so offensive that it had to be carted long distances to some convenient place and buried. This was necessarily expensive. The cost to the operating department of the city was from $45 to $60 every time one of these sand catchers was cleaned. It required the services of seven men and a team for two days and a half to clean both sides of the sand catchers.

EJECTORS USED

The writer, at the request of A. H. Dimock, city engineer, spent some time trying to devise a more efficient method of cleaning these chambers and corresponded with a number of large cities of the East, but until recently could not discover any better method than the one in use. George Otterson, a mining engineer of Seattle, then suggested that the problem could be solved by the use of a hydraulic ejector. This ejector works on the same principle as any ordinary hydraulic lift, having a water supply pipe connected to a nozzle which throws a stream of water at high velocity through a contracted throat, thus creating a vacuum and causing a suction. The height that sand and gravel can be elevated by this ejector is governed entirely by the pressure of the water supply. It is very simple in its construction, as can be seen from cut. There are no movable parts to get out of order. All wearing parts are made of hardened steel, thus insuring a life of several years before they have to be replaced. When this is necessary it requires but a few minutes' time to slip the old parts out and put the new ones in place.



SAND EJECTOR HAS NO COMPLICATED PARTS

With Mr. Otterson's ejector it requires but three men for one day at a labor cost of $9 and water cost of about $3 to clean out both sides of a sand catcher holding about 22 cu. yd. The sand and gravel and all foreign material is thoroughly washed by the large quantity of clear water used in lifting it to the surface. It is collected in large settling basins on the surface, from which it is easily shoveled into wagons.

Because of the thorough washing all offensive matter is removed and the clear sand can be dumped in any convenient place. The use of the settling basin is temporary. It is expected that a suitable wagon will be built and the material deposited direct from the ejector into the wagon. The surplus water carrying organic matter and light material will be conducted back to the sewer by means of a suitable drain pipe and hose. This method will also do away with the little piles of offensive débris left by the cleaner alongside the catch basin until the wagon comes to remove it.

Seattle has installed seven of these ejectors. On one sand catcher it was necessary to install a double ejector, one above the other, the top one acting as a booster. This is necessary where there is a high lift and the water pressure is insufficient.

The last six ejectors have only recently been installed and as yet no reliable cost of operation has been secured, but there is no doubt but that they will show as great a percentage of efficiency as the first one installed. The single ejector can be installed complete for about $500.

FOREST FIRES IN ALASKA during the past summer burned between 2,000,000 and 3,000,000 acres of timber, according to a recent report of H. S. Graves, chief forester of the United States, who made a tour of the northern territory. In the last fifteen years the area burned in Alaska comprised approximately 15,000,000 acres, Mr. Graves estimated, so that the destruction this year has been two or three times the average.



REMOVING SEWER BASIN MUCK WITH EJECTOR



TEMPORARY BASIN FOR STORING EJECTED MATERIAL



600-FOOT INLET CHANNEL LEADS TO PUMPING STATION



INTERIOR OF PUMPING STATION—NOTE OVERHEAD DISCHARGES

Water for Prickly Pear Irrigation Project Raised 160 Feet with Financial Success

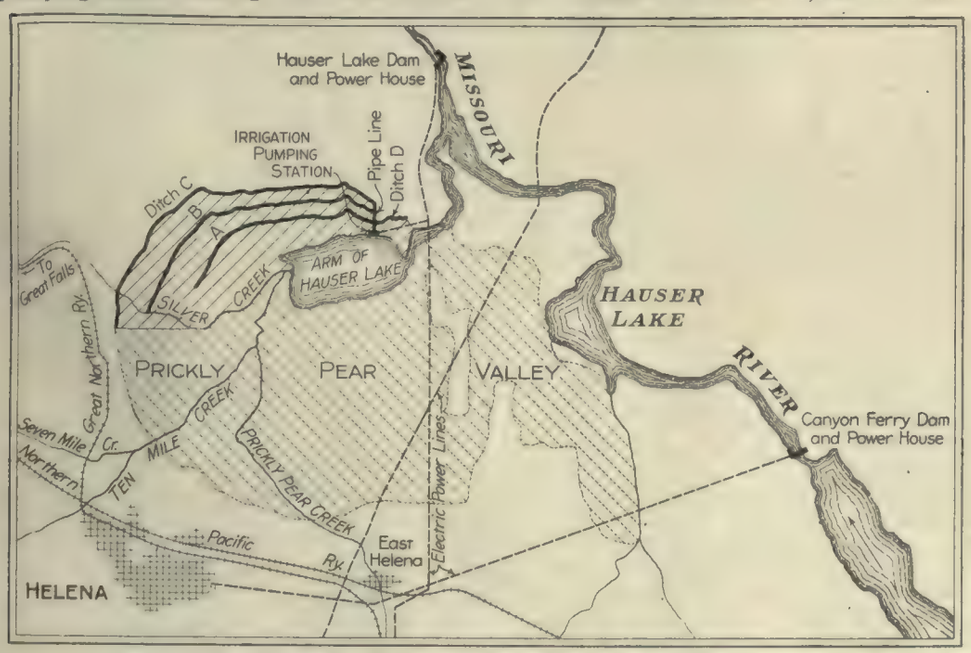
Electrically Pumped Water Supplies Land Near Helena, Montana, from an Arm of Hauser Lake Formed by the Dam Where Power Is Generated

HAUSER Lake dam backs up water through a narrow canyon leading to the Missouri River from Prickly Pear Valley, a 50,000-acre saucer-shaped depression of fertile land lying to the northwest of Helena, Mont. The climate permits growing fruits, vegetables, grasses, grains and root crops. Plans for irrigation by pumping have been under consideration for a number of years. Early in 1912 the Montana Reservoir & Irrigation Company undertook the installation of the first unit, comprising 8000 acres of land on the north side of the valley. Water was in the ditches and everything in readiness for service within twelve months of the time work started. The company which owns the pumping plant and main canals now delivers water to the farmers' turnouts at $1.75 per acre-foot. Briefly, the plant consists of a pumping station housing three motor-driven units capable of delivering a total of 100 sec.-ft. of water equally to canals at three different levels through three 36-in. wood-stave pipes.

PUMPING STATION

Nine 12-in. Allis-Chalmers centrifugal pumps are operated in three units, each unit being driven by one 600-hp. Allis-Chalmers induction motor so arranged that each motor is shaft connected to three pumps, each of which deliver into a different header or pipe line. This was done to give the greatest possible flexibility and economy in operation. The elevations of the three canals are 70, 110 and 150 ft. above normal lake level, and the pumps are so set that from 6 to 14 ft., varying with the lake level, of the total head pumped against is suction.

Electrical energy for operating the motors is obtained from the 70,000-volt transmission system of the Montana Power Company, three transformers stepping the voltage down to 2200.



8000 ACRES ARE IRRIGATED BY FIRST UNIT, 3500 BY AUXILIARY PLANT

Only the land supplied by the first installation is cross-hatched, that first supplied being cross-hatched in solid lines.

Leaving the lake, the water traverses 600 ft. through the inlet channel, which has a bottom width of 15 ft. with 1½ : 1 side slopes and a water depth of from 4 to 12 ft., varying with the lake level. The water enters the 28-ft. 9-in. x 38-ft. 4-in. suction chamber underlying that part of the pump house occupied by the pumping units. Three horizontal-shaft centrifugal pumps, discharging upward at an angle of 45 deg., are mounted with the motor on a single frame resting on an 18-in. concrete slab reinforced with 30-lb. rails in addition to the corrugated bar reinforcing. The rails were placed upside down.

TAPERS

In a length of about 30 ft. the tapered steel headers over the pumps increase in size from 2 to 3 ft. from the entrance of the first tapered discharge to the connection with the wood-stave pipe, 9½ ft. outside the building. The pipe supports consist of 4 x 4-in. angles resting on the floor. The main line is of ¼-in. plates and the headers are of ⅜-in. plates. Provision is made at the back end for future extension to connect one more unit to each pipe.

Where the taper pipe passes the 18-in. wall of the pumping station two collars of 3½ x 2½ x ⅜-in. angles are riveted on, 7 in. apart. These collars and the skin friction are designed to transmit the impact pressures to the concrete wall and entirely remove them from the pumps. The maximum pressures were estimated for the pipe feeding the highest canal at 120,000 lb. total, under the assumption that the maximum pressure from small water hammer would increase the static pressure 100 per cent. As shown in one of the drawings, reinforced-concrete cantilever trusses forming the end of the substructure are designed to care for these loads.

The tapered suctions for the pumps are of 3/16-in. riveted steel plates, 2 ft. 6½ in. in diameter at the bottom and 14 in. at the pump connections. They extend to within 18 in. of the floor, above which the normal water level will be 7 ft. Two rows of the suctions are held against any tendency to sway by ⅝-in. and ¾-in. rods with turnbuckles running each way each side of the pipes to the concrete walls, in which anchor rods are

embedded. The suctions for the other three pumps, set nearly over the outer wall, are offset away from it and are held in place by angle irons embedded in it.

The foundation for the substructure consists of a grillage of 12 x 12-in. timbers drift-bolted together. A floor of 3-in. planks, spiked to the grillage, forms the footing for the concrete side walls. To anchor the base of the walls to the foundation, ¾-in. drift bolts were driven with 1 ft. left projecting up into the concrete. A 12 x 12-in. timber all around the base on the inside was set to help care for the inward thrust of the earth when there is no water in the chamber.

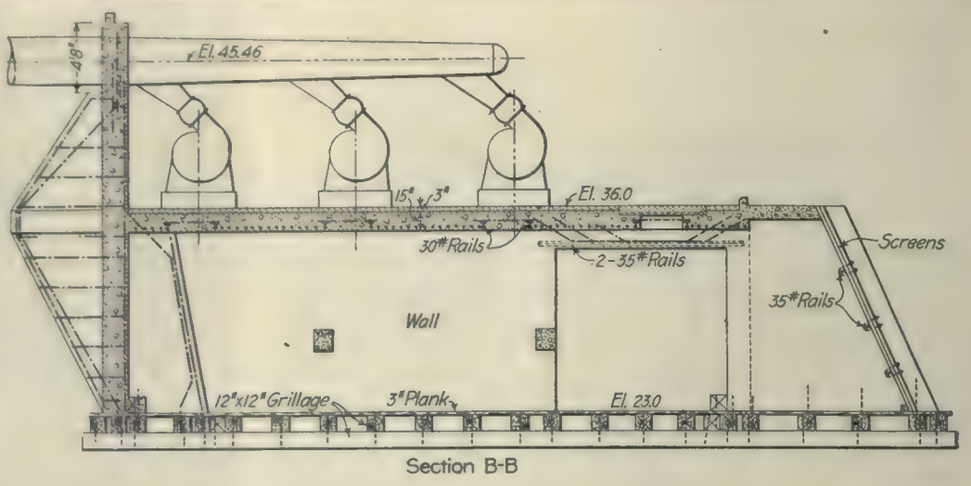
Above ground the station consists of inside and outside sheets of galvanized corrugated sheet metal over a steel frame supporting the crane girder, on which is a hand-operated 5-ton triplex block. The roof is of galvanized corrugated No. 24 plates supported on steel trusses. The Minneapolis Steel & Machinery Company furnished the steel material for the building, pipe headers and crane.

PIPE LINES AND CANALS

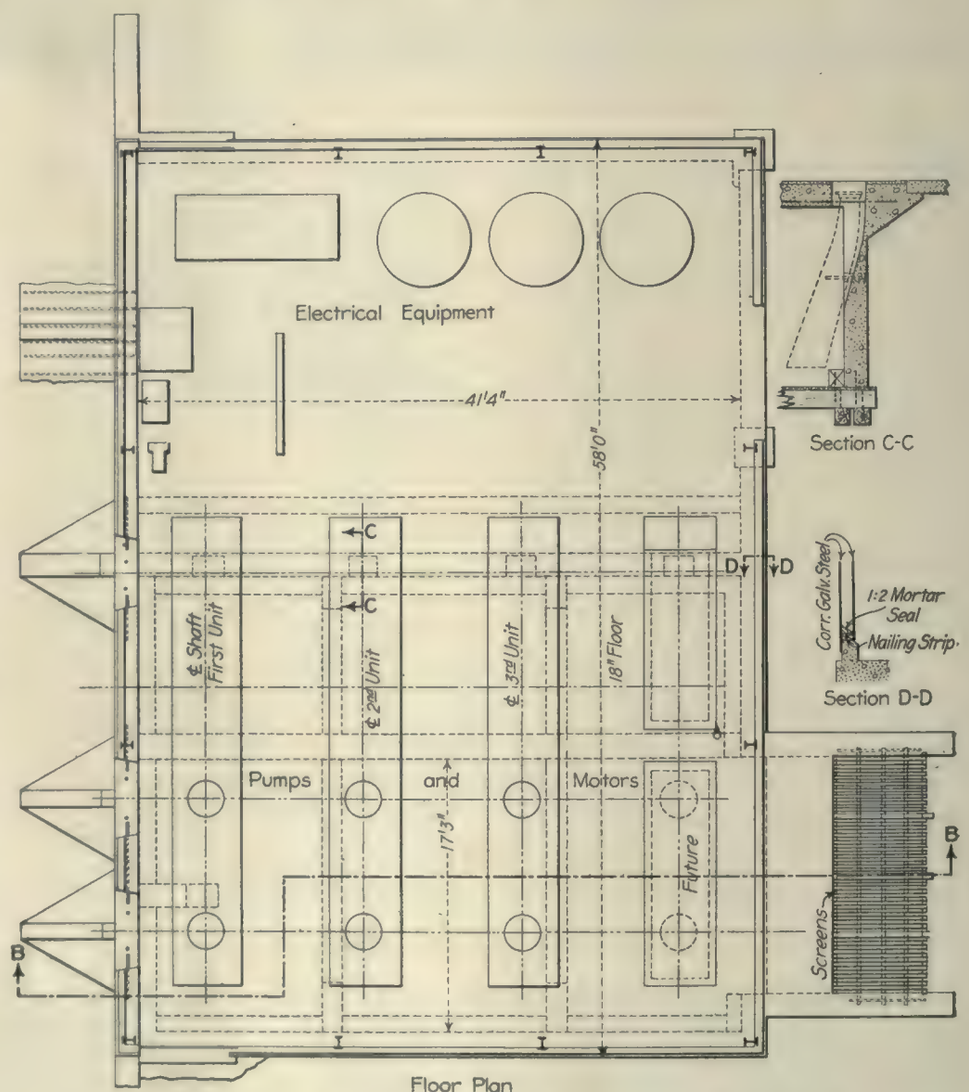
Connection to the three wood-stave pipe lines at the pumping station was made by an 8-in. sleeve riveted to the outside of the steel header, a 2 x 1½-in. bent and welded bar intervening so as to form a socket to receive the staves. The bar was double calked and the wood-stave pipe was calked with pitch and oakum.

The three pipes are 1340, 2290 and 2980 ft. long. They are laid in the same trench on 7-ft. centers and have a minimum cover of 1½ ft. No unusual features were encountered in laying the pipe, which was built by the Portland Wood Pipe Company. At the outlet end each pipe discharges into a concrete head opening into the main canals. Details are shown of the heads with the accompanying weirs for calibrating the pumps and back pressure checks to prevent influx of water down the pipe in case of storms during shut downs for repairs to pipes or pumps. Screens of 2-in. mesh are provided to keep out animals when the pipe lines are not in use.

The canals were built on a grade of 2.112 ft. per mile, starting from the ends of the pipe lines at the three levels and following their respective contours around the valley. These various elevations were chosen to get an equal acreage under each of the three

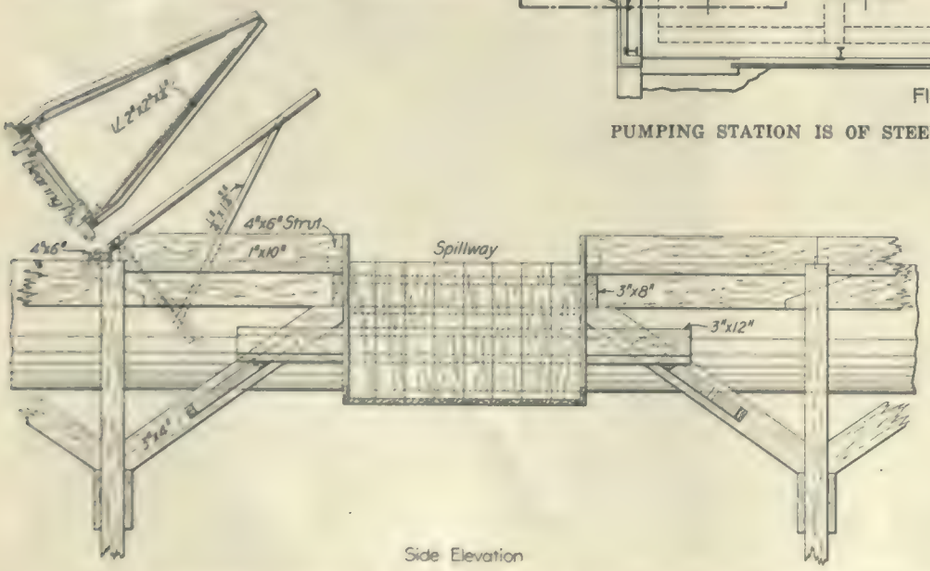


Section B-B

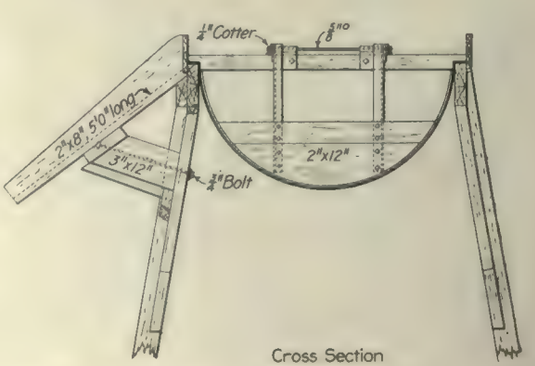


Floor Plan

PUMPING STATION IS OF STEEL AND CONCRETE ON TIMBER GRILLAGE



Side Elevation

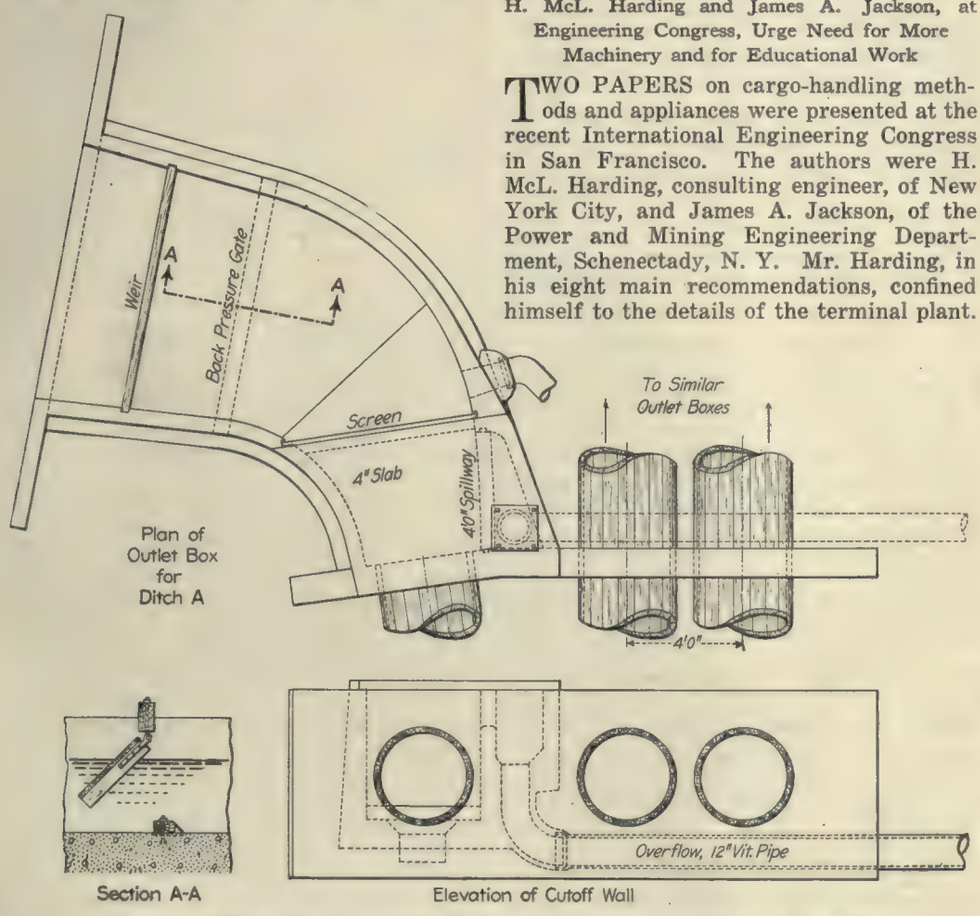


Cross Section

AT EIGHTEEN POINTS IN THE FIRST UNIT SPILLWAYS AND SWINGING CHECKS WERE CONSTRUCTED IN THE FLUMES

ditches. On them are 2280 ft. of semi-circular Toncan metal flumes over ravines, each provided with a steel inlet and outlet of No. 20 gage metal. At eighteen points spillways and swinging checks were constructed in the flumes as shown in one of the drawings. The remaining overflows and checks were of the ordinary wooden type. All main canals are in unlined earth excavation. The farmers' turnout gates are of concrete and steel, the water being taken through the canal banks in tile pipes, there discharging into wood measuring boxes provided with weirs and control gates. Measurement of all water pumped is made at the outlet of each wood-stave pipe.

The canals were designed after the Kutter formula, with $N = 0.035$, the velocities for the unlined sections being kept below 1½ in most instances. The flumes, the longest of which was 272 ft., spanning a ravine at an elevation 20 ft. above ground, were figured to have a carrying capacity based on $N = 0.012$ in the Kutter formula.



MEASUREMENT OF ALL WATER PUMPED IS MADE AT THE OUTLET BOXES

AUXILIARY PLANT

During 1914 an auxiliary plant having a capacity of 75 sec.-ft. was installed to irrigate an additional 3500 acres of land to the east and south of the original project. This plant contains two Worthington centrifugal pumps direct-connected to General Electric motors. The pumps discharge under an average head of 160 ft. into a steel header, and this in turn into a wood-stave pipe line which conveys the water to a point where it is discharged into a 9-mile earth canal delivering water throughout its entire length to lands on Spokane Bench. The main plant, together with the auxiliary plant, has been in operation during the 1915 season with marked success, according to the engineers, who also state that the project has demonstrated that irrigation water for grain and forage crops can be pumped 150 ft. high and still be a commercial success.

All metal flumes were furnished by the Enterprise Sheet Metal Works, of Billings, Mont. Boomer & Hughes of Spokane, Wash., excavated the canals by slip scrapers and fresnos. The plant and works were designed by M. H. Gerry, Jr., consulting engineer, of Helena, Mont., and were constructed under his direction. A. W. Verharen was resident engineer in charge of work in the field. The property is owned by the Montana Reservoir & Irrigation Company, which is affiliated with the Montana Power Company.

How to Make Cargo Handling More Efficient

H. McL. Harding and James A. Jackson, at Engineering Congress, Urge Need for More Machinery and for Educational Work

TWO PAPERS on cargo-handling methods and appliances were presented at the recent International Engineering Congress in San Francisco. The authors were H. McL. Harding, consulting engineer, of New York City, and James A. Jackson, of the Power and Mining Engineering Department, Schenectady, N. Y. Mr. Harding, in his eight main recommendations, confined himself to the details of the terminal plant. Mr. Jackson laid great stress on the need for educational work and scientific investigation, through technical committees and the machinery manufacturers. He also recommended electric machinery to relieve the immediate needs.

THE TERMINAL PLANT

Mr. Harding's recommendations were as follows:

1. On the ship there should be at least two double winches for each hatchway, and sufficient booms for burtoning the load, simultaneously, either upon the shore or upon lighters.

2. On the quay or piers there should be traveling gantry jib-cranes, one for each 100 ft. of linear frontage, spanning two or three railway tracks, which tracks are located between the shed and the quay wall.

3. Within the shed there should be overhead movable cross tracks connecting with fixed side tracks, so as to assort and distribute the freight and serve every cubic foot of space (tiering) by a continuous succession of movements, without rehandling and without using floor space; and, also, so as to afford a short path across the shed from the vessel on one side of the pier to another vessel on the other side.

4. The freight should be moved without congestion or delay, by burtoning between the hooks of the gantry cranes or of the ship's winches and the hooks of the traveling hoists.

5. Freight should be transfered between the shed and any floor of a warehouse by one direct movement of the gantry cranes.

6. To secure the greatest rapidity and economy in the above freight movements, the design of the ship and the plan and layout of the elements of terminals should receive careful study.

7. For bulk material the mechanism should be able to reclaim as well as store, and to distribute at a considerable distance from the quay walls.

8. To obtain the greatest return from investments in ships and terminals, the latest mechanical appliances should be installed for speed and economy of transference and handling.

EDUCATIONAL WORK AND INVESTIGATION

To bring about the best ultimate solutions of the various problems of cargo handling, Mr. Jackson made the following suggestions:

The complete mechanizing of such an immense, cumbersome business as cargo handling must necessarily take time, study and expense. Co-operation and system are essential, in order to reduce these factors to a minimum. At present the few interested parties seem to be working along different lines, as individuals. These facts have been kept in mind by the writer in making the following suggestions:

1. The appointing of committees on mechanical cargo handling by the various interested engineering, architectural, naval and marine societies. Such committees could do much educational work which would stimulate interest by encouraging papers on the subject, to be presented before the societies. Such papers would lead to investigations, tests and a closer study of actual conditions.

2. A committee of naval architects to study the design of ships, with special reference to rapid loading and unloading of cargo. The improvement in the design of bulk freight vessels would indicate that much could be done to improve vessels for miscellaneous freight, if given due consideration. A radical change in design may be in order, as indicated by one vessel recently launched, and one completely designed by a naval architect on the Pacific Coast but not built. The vessel launched is a bulk freighter with a complete self-contained conveyor-type unloader, which completely unloads the entire cargo, with no manual labor, and deposits it on a stock pile on shore. The second vessel is equally well adapted to bulk or package freight. Her freight is loaded into barges, which are floated into the boat through hinged gates in her bow, after which the gates are closed and the water is pumped from her ballast tanks until the barges rest on sills in her hold.

3. A committee of pier and wharf engineers to study the design of piers especially adaptable to the use of machinery. Existing piers are poorly adapted to the use of

machinery, and such points as ratio of length of dock space to pier capacity, in square or cubic feet, seem to have been given very little consideration. Some piers lately built have berth space for ten 10,000-ton ships, and a floor space capable of holding about one and one-half ships' cargoes. Machinery might make a two or three-story pier feasible and economical.

4. The possibility of using wet docks, where tidal conditions are bad. Wet docks, with the help of ballast tanks and pumps aboard ships, would hold a vessel at a constant height, regardless of tide or load, and under this stability, some type of conveyor might be used from the hold to the pier. A conveyor is the ideal machine, as it keeps freight flowing in a stream, with no abrupt changes in handling, and its speed can be so adjusted that it is actually a reservoir in itself, which prevents freight from piling up.

5. An investigation of the situation by municipal, State and National governments. Governmental departments already exist which should consider such investigations their legitimate duty, on account of the vital interest of the public at large in this problem. Port cities should strive to make their municipally owned piers the acme of perfection, thus setting an example which private corporations would soon follow.

ELECTRIC MACHINERY RECOMMENDED

The following suggestions were made by Mr. Jackson with the view of relieving the immediate situation:

1. The use of electrically operated portable winches, controlled by portable controllers and driven by power from the pier. The advantages of this scheme are: (a) Constant source of power, as it would be entirely independent of the ship's boilers; (b) the portable controller makes load visible to operator at all times, this preventing loss of time and the danger of signaling; (c) the winchman gets familiar with his equipment, instead of having to get accustomed to a different winch with each ship; (d) the winches, being owned by the stevedores, could be kept in first-class condition. Ships' winches are often in bad repair and time is lost making them operate satisfactorily.

2. The use of electrically driven portable conveyors and stackers, for unloading, distributing and piling where conditions permit.

3. The use of storage-battery operated trucks, truck cranes and tractors for distribution of cargo.

4. The efficient lighting of piers, wharves and docks.

5. The employment of trained engineers to supervise and direct the handling of freight.

RAIL-FAILURE STATISTICS for the year ended Oct. 31, 1914, are tabulated in the September *Bulletin* of the American Railway Engineering Association. As a general average the failures per 10,000 tons of Bessemer rails were about double those of open-hearth rails. A table is given showing the ranking of the mills as regards rate of failures for the rollings of the years 1909, 1910, 1911 and 1912, and a comparison with last year's statistics indicates, as a general average of all of the mills, a gradual decrease in the rate of rail failure of rollings for the successive years since 1908, with which year's rolling the records started.

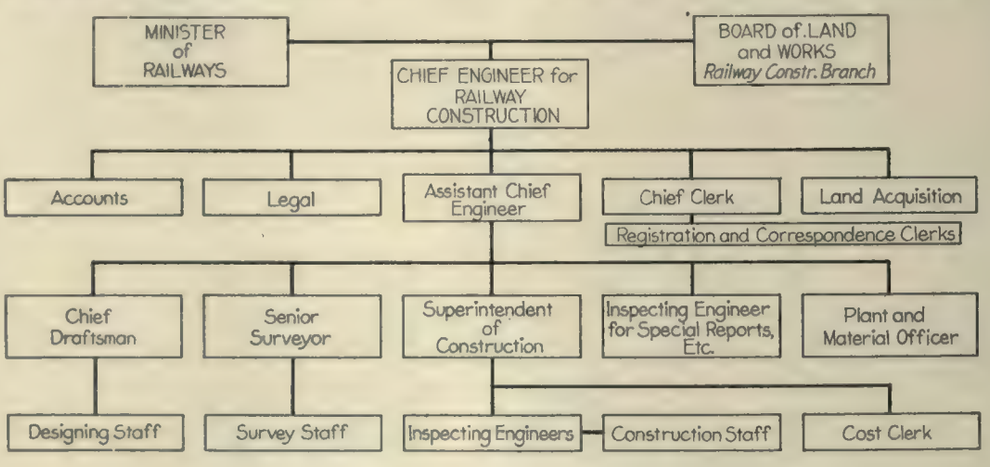
How Australia Builds Its Railroads

Maurice E. Kernot Tells International Engineering Congress Why Direct Labor Has Supplanted the Contractor for Government-Owned Lines

SIDELIGHTS on Governmental procedure in railroad construction in Australia were given by Maurice E. Kernot, chief engineer for railway construction, Victoria, Australia, in a paper presented at the recent International Engineering Congress. Formerly the work was done by large contracts, but in the last generation the direct-labor method has largely supplanted the contract method, and is believed to have the advantage of both time and cost. Following are extracts from Mr. Kernot's paper, together with a diagram he presented of his organization.

Ninety-eight per cent of the railways in Australia are owned by the Governments of the States and Commonwealth, and a similar percentage of the construction in progress is being carried out by the same public authorities.

Two principal methods are followed in carrying out railway construction, viz., (1) Large contracts, and (2) direct labor. The large-contract method was the general one from 1854, when railway construction in Australia commenced, till 1892. Since then it has given place largely to construction by direct labor.



ORGANIZATION OF GOVERNMENT RAILROAD CONSTRUCTION DEPARTMENT

CONTRACT WORK

On contract work a money deposit of 5 per cent on the total contract amount, as arrived at from the estimated total quantities of work and the contract rates, is required, and 10 per cent of the value of work done to date is held back from progress payments as further security for the satisfactory completion of the contract, until the amount held is sufficient to give full security for satisfactory completion.

The conditions of contracts generally throw all risks on to the contractor, and give the constructing authorities very full powers for making alterations and additions to the work. Specifications are usually couched in general terms, and only in the case of small contracts do they describe the work in detail.

ERRORS IN ARITHMETIC FREQUENT

The schedule to the contract shows the actual quantities of work required to be done as shown on the plans, sections and drawings, which form part of the contract. The number of items in the schedules is large, it being common practice to schedule all main-line cuttings separately and also all stuff required to complete each separate embankment, and many contractors quote separate prices for each. In this way the number of items in the schedule often runs up to more than 1000. As a consequence of the large number of items in the schedule, and the hurry with which contractors usually complete their tenders or bids, mistakes in arriving at the total amount are often made. It is the practice to keep a contractor to the amount shown at the foot of his tender, and require alterations in prices to adjust errors in arithmetic.

Tenders may be submitted by anyone, without restriction, so long as the proper deposit of money is made along with them; and the practice is to accept the lowest tender, it being assumed that all contractors are of equal merit, unless they have been formally disqualified, which is very rarely done.

Contractors often adjust the prices in their contracts, thus speculating on the probability of the quantities shown in the schedule being exceeded or diminished, and also with the idea of getting in their profits chiefly from the items of work which have to be first carried out, and so practically having a set-off against their money deposit. The conditions of contract give power to the chief engineer to insist on adjustment of unreasonable prices, or he may make a deduction from payments to protect the constructing authority.

The critical item of railway construction contracts is usually that for ballast, and the question whether the contractor shall make large profits or lose money on his contract often hangs on the opinion of the chief engineer as to whether ballast from a certain source complies with the specification.

DELAYS

In carrying out the contracts there is often much delay, as contractors think it pays them to wait over wet seasons or for a fall in market prices of materials, and take their chance of obtaining a remission of penalties for delay. In actual experience the penalties have seldom been enforced, and the effect on contract work has been bad.

It has been the general practice to provide for a settlement of disputes which arise in settling up contracts by arbitra-

tion. The results of arbitration have been unsatisfactory. Contractors in many cases took up railway work at non-paying prices, either through ignorance of the value of the work or in the hope of making up losses by claims for extras and concessions. In such cases, and in many others where the contractors had good prices, enormous claims for extras and allowance were made, and very heavy expenses were incurred in investigating or resisting and contesting such claims, and very large awards were in many cases made in favor of the contractors by irresponsible arbitrators.

Costs of Arbitration

In Victoria alone in a period of ten years seventeen contracts for 384 miles of railway, aggregating a cost of $6,340,339 under the chief engineer's final certificate, went to arbitration. Extra claims amounting to $1,999,651 were made by the contractors, on which the arbitrators awarded $537,566. The expenses incurred and paid by the constructing authority in addition came to $144,000.

An appeal to the Supreme Court was also made by contractors on the ground that the powers given to the chief engineer by the conditions of contract were excessive and inequitable, but the court held that when a contractor had signed the conditions with his eyes open he was bound to them. In recent years the chief engineer has, in some cases, been made sole arbitrator, and this practice has, on the whole, worked well. The chief engineer, in such cases, holds himself aloof from direct supervision of details of the contract.

Direct Labor

The difficulties and large expenses incurred in the settlement of contracts, the frequent long delays in completion of contracts, the desire to obtain more economical railway construction, and the wish to start work promptly in time of depression, when large numbers of unemployed men are in want of work, led to the introduction of the direct-labor system in Victoria in 1892, and since that date it has been used for all railway construction in Victoria, and largely followed in the other states of the Commonwealth, where, however, the practice has oscillated between the two systems—large contracts and direct labor—with a gradual increase in the proportion of direct-labor work.

The following notes apply particularly to the working of the direct-labor system of construction in the State of Victoria.

All expenditure is charged directly to the money voted for the particular line. A strict continuous audit is made by an outside auditor.

All the work has been completed to the satisfaction of the railways commissioners in whom the lines are vested for operation on their completion, except in one case where the estimated cost had been cut down by Parliament against the advice of the chief engineer.

Tests of System

This system has been tested on two occasions by calling for tenders or bids for 30-mile sections of construction. On the first occasion the lowest tender received was 10 per cent higher than the departmental estimate. It was rejected and the department carried out the construction of the line by direct labor, and finished it at a cost below its own estimate. In the second case, a tender was received which was 1¾ per cent lower than the departmental estimate, but after investigation it was decided not to accept the tender, and the line was built by direct labor at a lower cost than if the contract had been accepted.

In carrying out work under the direct labor system, an engineer is placed in control of the job, with suitable assistants, including a pay clerk, who acts as his accountant and is directly responsible to him, while he is responsible for the whole of the work, including all money payments made on the job. His duties thus cover a large scope, as he is manager of the work as well as engineer, and great care has to be exercised in selecting new men for the positions.

In employing workmen it is usual to put on suitable men who make application on the spot. Experienced railway workers find their way to new works in considerable numbers. When, however, the supply of these is not sufficient, requisitions are made on the Government Labor Bureau.

The men are provided with tents and cooking utensils, for which they have to pay in installments. Laborers have to pay for their own shovels, and tradesmen have to provide their own small tools or pay for them; other tools are provided by the department. The tents and tools supplied are not taken back from the men, except in cases where they leave before they have earned sufficient money to pay for them.

Piecework and Gang Work

Piecework is used as far as it can be applied to advantage. Simple work, such as barrow-led earthwork and bridge carpentry, are done by gangs working at fixed rates, while work requiring the use of horses and plant is generally let in petty contracts made locally with men on the works. The pieceworkers and petty contractors sign a simple form of contract, which gives power to the engineer in charge to stop the work at twenty-four hours' notice for any good reason.

When a local contract is taken up by one man, who employs other men, the form of contract provides further that his employees are to be paid directly by the department at standard wage rates, and the amounts of such payments are deducted from the amount coming due to the contractor. Offers to carry out work at prices so low that there is no reasonable prospect of the contractors' earnings being sufficient to pay standard wages are rejected.

Fixed rates are arranged at the head office and are adjusted from time to time so that efficient industrious men may make standard wages or a little more. Piecework men who fail to make earnings up to standard wage rates after a fair trial, and wages men who fail to work efficiently, are promptly dispensed with, the aim throughout being to pay prices which are fair both to the worker and the employer and to get a fair day's work for the day's pay.

There is an increasing tendency to do more of the work with gangs employed on day wages. These gangs, when under the control of capable gangers, working under effective supervision, and with a regular weeding-out of men who do not work efficiently, do good work, and, in many cases, do the work at rather less cost than pieceworkers.

Time-Keeping and Payment

All the work, whether done by the piece, by contract, or by day labor, is measured up fortnightly and the costs compared with other work, so that inefficient gangs may be promptly dealt with.

A thorough system of time-keeping is kept in operation, and includes the apportionment of the time to the different items of work in a rather elaborate schedule of apportionments, including sufficient information for an analysis of costs. The workmen are paid fortnightly.

The staff in charge of a construction job is provided with quarters in temporary buildings and tents, and the department provides the cook and mess equipment. In return for these concessions, the members of the staff are required to be available at any hours which the engineer in charge may desire, but any officer who is kept on duty over an extended period for long hours can apply for and be allowed time off in consideration. The organization of the staff is shown in the accompanying diagram.

Two Main Advantages of Direct-Labor System

The direct-labor system has shown the following advantages:

1. *A saving in time.*—The period required under the old contract system for completing surveys, plans, quantities, specifications and drawings, advertising and letting contracts, which extended over many months, has all been saved, and the expense so incurred largely reduced; also, the actual work of construction has been carried out, on the average, in about two-thirds of the time taken by contractors. Work is often started on the heels of the surveyors who locate the line.

2. *A saving in cost.*—Instead of a contractor paying a staff to carry on the work, while the department paid another staff of officers and inspectors to supervise them, one staff under the department now does all the work, while the workmen do the work as well and as cheaply for the Government as for a contractor, when properly handled.

The contractor's financial and commercial arrangements were often badly made and caused loss to him, and loss and trouble to the constructing authority. The percentage included in the contractor's prices to give him a profit is saved. Money with which to carry on the work is obtained by the Government at half the rates of interest which contractors often pay.

The heavy claims which were made in connection with large contracts and only settled with great expense and trouble, often by tedious and costly arbitration, are quite avoided.

Partial stoppages of work, shifting of station sites, and alterations of design, which usually led up to the large claims, are now made more freely and, in most cases, have only small effect on the cost of the works; while other unforeseen contingencies are dealt with promptly and easily. Full advantage is taken of cheaper materials discovered when carrying out works, and of fluctuations in market rates. Modifications in design and execution are freely introduced when economy or efficiency may result. Contractors, when tendering, had to make large allowance for providing plant, including locomotives and trucks, which might be left idle on their hands, with poor opportunities of realizing at reasonable prices, and, in many cases, made shift with very inferior wasteful plant in consequence. Under the direct-labor sys-

tem, all construction in the State being done by one party, better plant is provided and it is more regularly utilized, the cost for any individual line being thus largely decreased.

OTHER ADVANTAGES

Another advantage of the direct-labor system is that it has been possible to distribute employment systematically and fairly among the unemployed workers of the State, and also to secure payment of standard rates of wages without the difficulties which have occurred in enforcing the minimum wage clauses under contracts.

Generally speaking, the men have worked contentedly. Complaints from them have been fewer than might have been expected and have been fairly met and dealt with. In twenty-three years there has not been one large strike, and occasional small ones have been handled easily till they fizzled out.

In comparison with contract work, the department officers may not have the stimulus of increased profit to urge them on to strict economy and keep them keen in reduction of costs, but with diligent effective supervision and control by competent officers, the efficiency of working is little, if any, behind the average of contract work.

Concrete Cantilever Trusses Support Large Pipe Line

Structure 2424 Feet Long Carries Sewer Across Barwon River in Australia—Footpath with Girder Handrails a Feature

FURTHER EVIDENCE of the possibilities of reinforced-concrete construction is strikingly offered by the new cantilever truss design for carrying a reinforced-concrete sewer over a crossing nearly half a mile long of river flats in Australia. The accompanying illustrations give an idea of the unusual character of the structure. It is located in Victoria, Australia, and was adopted after alternative designs in both steel and reinforced concrete had been made to carry the sewer, which is part of the recently installed sewer system of Geelong across the River Barwon and the river flats.

The total length of the structure is 2424 ft., consisting of thirteen spans of 176 ft. and one span of 136 ft. The suspended spans are 40-ft. girders, free to move at one end. The cantilever design is economical and has a further advantage in the fact that all temperature variations can be provided for by horizontal movement at expansion joints. This consideration ruled out the possible alternative of a series of arches, in which temperature movements are vertical and would create a series of undulations very undesirable, because the grade of the sewer is only 1 in 2500.



FALSEWORK CONSTRUCTION AND TRAVELING CONCRETING PLANT



SPREAD OF CANTILEVERS GREATER AT PIERS THAN AT ENDS

CANTILEVER TRUSSES SPREAD TOWARD PIERS

The distance between cantilever trusses is increased toward the piers in order adequately and economically to resist the horizontal wind forces. The lateral bracing consists of transverse struts with knee braces to the main chords, as seen in the photographs.

The reinforced-concrete pipes are oval in form and cast in 8-ft. sections, which correspond to the 8-ft. panel lengths of the trusses. Cross beams and struts thus support the pipes at their joints. The same forms were used for the pipes on the structure as for the main sections of the sewer.

TENSILE REINFORCEMENT OF PLAIN RODS

The reinforcement throughout is of ordinary steel rods, the full tensile strength being developed at the splices by laps; in no case are they mechanically connected. The rods in the upper chord are arranged in concentric rings, the laps of which break joints along its length. The diagonals are in tension, and the ends of the rods through them are accurately bent around the rods in the upper and lower chords.

A footpath is provided throughout the whole length, and the details of its treatment add very considerably to the appearance of the work. The handrailing of the footpath is sufficiently reinforced to act as a girder. It was thus possible to maintain a continuous footpath form.

The structure was designed and constructed by Stone & Siddeley, reinforced-concrete engineers, of Sydney, Australia, for the Waterworks and Sewerage Trust of Geelong, of which R. T. McKay is chief engineer.

ARKANSAS HAS 36,000 MILES of public roads, with less than 1000 miles, or 3 per cent, of them improved. Since the inauguration of a State highway commission in 1913 plans have been prepared by that body for work costing $2,315,366. In 1914, states H. R. Carter, State highway engineer, in his first biennial report, about 93 miles of roads were constructed under the supervision of the highway department at an average cost of $5,300 per mile.



CANTILEVER TRUSSES AND CROSS BEAMS SUPPORT OVAL PIPE—REINFORCED-CONCRETE CONSTRUCTION THROUGHOUT

Automatic Siphons Used in Italian Dams

Satisfactory Service of Many Years Proves Efficiency of Unusual Construction Which Replaces Ordinary Spillways

ITALIAN irrigation was discussed in a paper presented at the International Engineering Congress by Prof. Luigi Luiggi, inspector general of engineers and professor of hydraulic engineering at the Royal University of Rome, Italy, which contains the following illustrations of unusual arch construction and the use of automatic siphons. Other examples of European siphon installations have been given in an article by A. G. Hillberg in the Engineering Record of May 3, 1913, page 488.

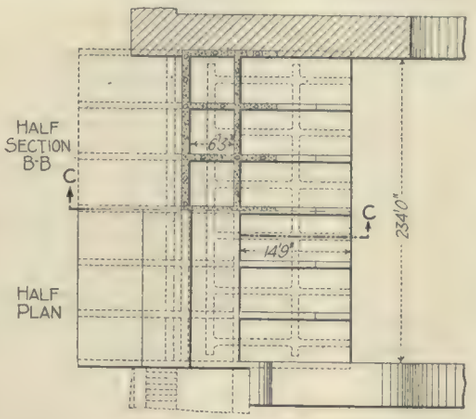
Arch Dam and Automatic Siphons

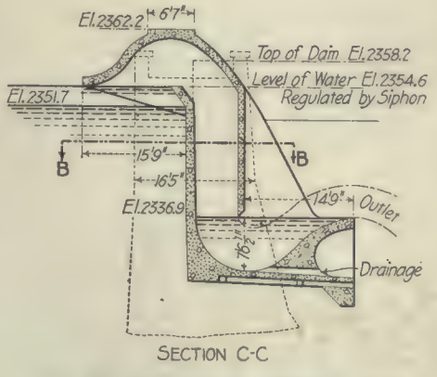
An interesting dam, very daring in design, and with a cross-section similar to the Bear Valley dam in California, is the Corfina dam shown in one of the accompanying drawings. It is not a gravity dam, but an arched dam 116 ft. high, of the dimensions given, and with a radius of only 75 ft. It was built in 65 days by pouring the 1:2:4 concrete, mixed rather wet, into wooden molds. It gave very good results, technically and financially. The cost was only $30,000 and the unit cost only 12 cents per 1000 gal. of storage capacity.

The most important group of dams, five in all, just finished on the River Gorzente near Genova, included the Badana dam. This dam is 188 ft. high, at present the highest in Italy. It is 715 ft. long at the crest, contains 132,000 cu. yd. of masonry, and cost approximately $465,000, making the unit cost 45 cents per 1000 gal. of storage capacity.

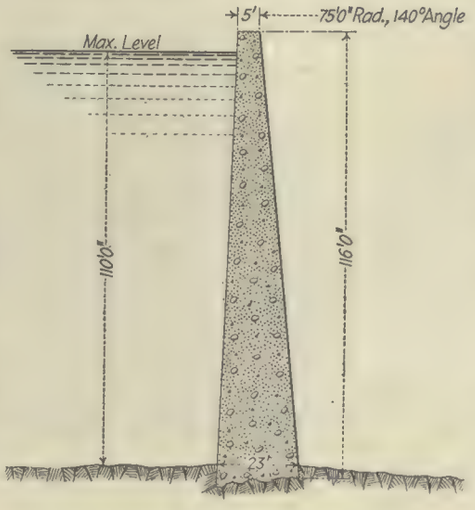
A special feature of the dams of this group is that the flood-water is not discharged over the usual overflow spillways, but by means of a series of automatic siphons. In the Badana dam are six siphons with a total discharge of 3150 sec.-ft., with dimensions as shown on the drawing. In the Lagolunge dam there are ten siphons. This is, perhaps the largest group of automatic siphons existing. They have given excellent results for several years.

The inverted siphon of masonry under the River Sesia on the Cavour Canal, which discharges 3884 sec.-ft., is another example of unusual construction. The dimensions and general outlines of this five-way siphon are shown on one of the accompanying drawings.

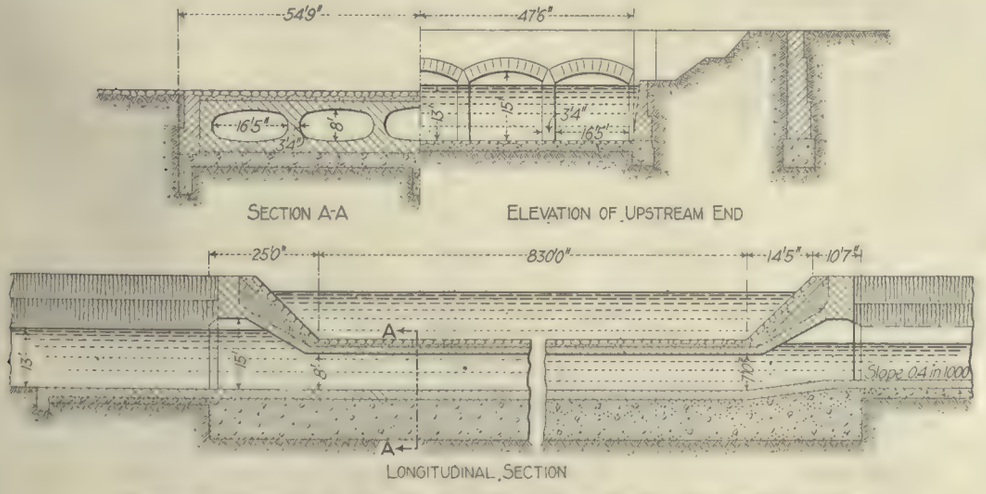




SIX SIPHONS IN BADANA DAM



HIGH CORFINA DAM OF ARCH TYPE



INVERTED SIPHON OF MASONRY UNDER RIVER SESIA ON CAVOUR CANAL

California Commission on Four Valuation Questions

Purpose of Utility Irrelevant—Rate More Than Traffic Will Bear—Contracting Away Rights —Actual Land Multiples Not Allowed

FOUR DECISIONS involving minor valuation questions were handed down by the Railroad Commission of California in October. Summaries of them are here presented, not because of any connection with one another, but because they deal with questions that may be raised anywhere. In one case the fact that a utility was built to enhance the value of property which was subsequently sold at a considerable profit was held to be insufficient ground for denying the utility a fair return. In the second, contrariwise, it was held unfair to compel a meager consuming population to support by high rates an expensive plant. In the third case a contract between utility and municipality for service at a certain rate was held as not eliminating the jurisdiction of the commission. In the fourth, the reproduction cost of a railroad built five years ago was found to be less than the original cost, mainly because a smaller multiplier for the land is allowed than was actually required.

Purpose of Utility Irrelevant

In the first case the Sweetwater Water Company had applied for authority to raise its rates in unincorporated territory, contending that under the existing schedule its revenues were insufficient to provide operating expenses and a fair return on the value of the system. The application was opposed on the ground that the water system had been constructed solely to enhance the value of the property it served, and that this property was later sold at a considerable profit. The commission ruled that this contention was not pertinent—that profits made on realty could not be considered as detracting from the value of the water plant, and that the system was still entitled to a return on the reasonably useful value, excluding unnecessary extensions.

More Than the Traffic Will Bear

Contrasting with this case is that of the Sacramento Valley West Side Canal Company, an irrigation company having an expensive initial plant with as yet few consumers. The company had contended that the existing rates were insufficient to earn a fair return over and above operating and maintenance expenses and an allowance for depreciation. The commission held that while this matter must be considered, the reasonable value of the service to the public must also be taken into account, and in this case the small number of consumers could not be expected to pay higher rates than surrounding communities paid for the irrigation of identical crops. The company's predicament, the commission held, was merely typical of that of irrigation companies in their first years of operation. Quoting from the commission, "If attempt were made to apply the principle urged by petitioners herein, the rates would be so high that nobody could afford to buy land in the project and hence the project would permanently be deprived of an opportunity to make good."

Towns May Not Contract Away Rights

The question in the case of the town of Sausalito vs. Marin Water & Power Com-

pany was one of the jurisdiction of the commission. The town entered into a contract with the company to secure water in wholesale quantities for ten years dating from Aug. 1, 1909. The town now contends that the rate is unreasonable and discriminatory, and desires the commission to establish a reasonable rate. In the proceedings just concluded the company claimed that as the town had the right to enter into the contract, and did enter into it voluntarily, the State could have no jurisdiction in the matter during the life of the contract. The commission finds otherwise, however, and quotes numerous court decisions in support of the ruling. The finding does not in any way pass upon the reasonableness of the rate.

ACTUAL LAND MULTIPLES NOT ALLOWED

Actual multiples entering into the land costs of the Quincy Western Railway, built in 1910, are not allowed in the reproduction cost reached by the commission in an investigation made on the commission's own initiative. The commission holds 1½ to be a high enough multiplier, although the company actually paid on the basis of 3. As a consequence the reproduction cost of the 5-mile line is less than the original cost.

Commissioner Loveland, who wrote the opinion, makes no accusation of extravagance or bad judgment in the purchase of the land, but states that "owing to the peculiar conditions arising at the time the right-of-way was acquired the company was forced to pay an abnormally high price for lands purchased, and accordingly asked that in determining reproduction cost a multiple of 3 be allowed." In the same paragraph he says: "Under the heading of 'reproduction cost' it is necessary to determine the present value of these railroad lands, and the question arises if this present value should be the same as the present market value of adjoining and similar lands, or if a special and higher 'railroad value' attaches to lands owned by a common carrier. If the latter alternative is allowed, as constantly insisted upon by railroad companies, the multiple theory is appealed to. . . . I am ready, however, to say now that if a multiple be allowed, it should be determined on the basis of actual present-day average conditions, and I can see no reason whatsoever why in this case present-day land values should be multiplied by 3 simply because at the time of the original purchase of the land the carrier found it necessary to pay so largely in excess of the actual values."

Large Frog and Switch Plant at Easton Built in Practically One Year

New Works of Wharton Company Occupy 25 Acres, Replace Three Former Plants and Were Designed with Special Attention to Facility of Operation

A MAIN SHOP 420 ft. square, exclusive of various annexes, a foundry 115 x 460 ft., a blacksmith shop 110 x 420 ft., and a storage yard inclosed by a circular track of 175 ft. radius are the chief elements of the new plant, just put into operation, of William Wharton, Jr. & Company, Inc., manufacturers of frogs and switches, at Easton, Pa. Great care was exercised in the design of the layout to facilitate the different sequences of operation of the plant and minimize the moving of heavy parts. Among the engineering features may be mentioned the complete sewer system, including a septic tank; the high foundation pedestals for the buildings on filled ground, built prior to the filling; the smooth-face tile exterior walls laid in cement mortar colored to match the tile, and the wood-block floors, in which the "sweating" of the creosoted blocks was utilized to bond the blocks together.

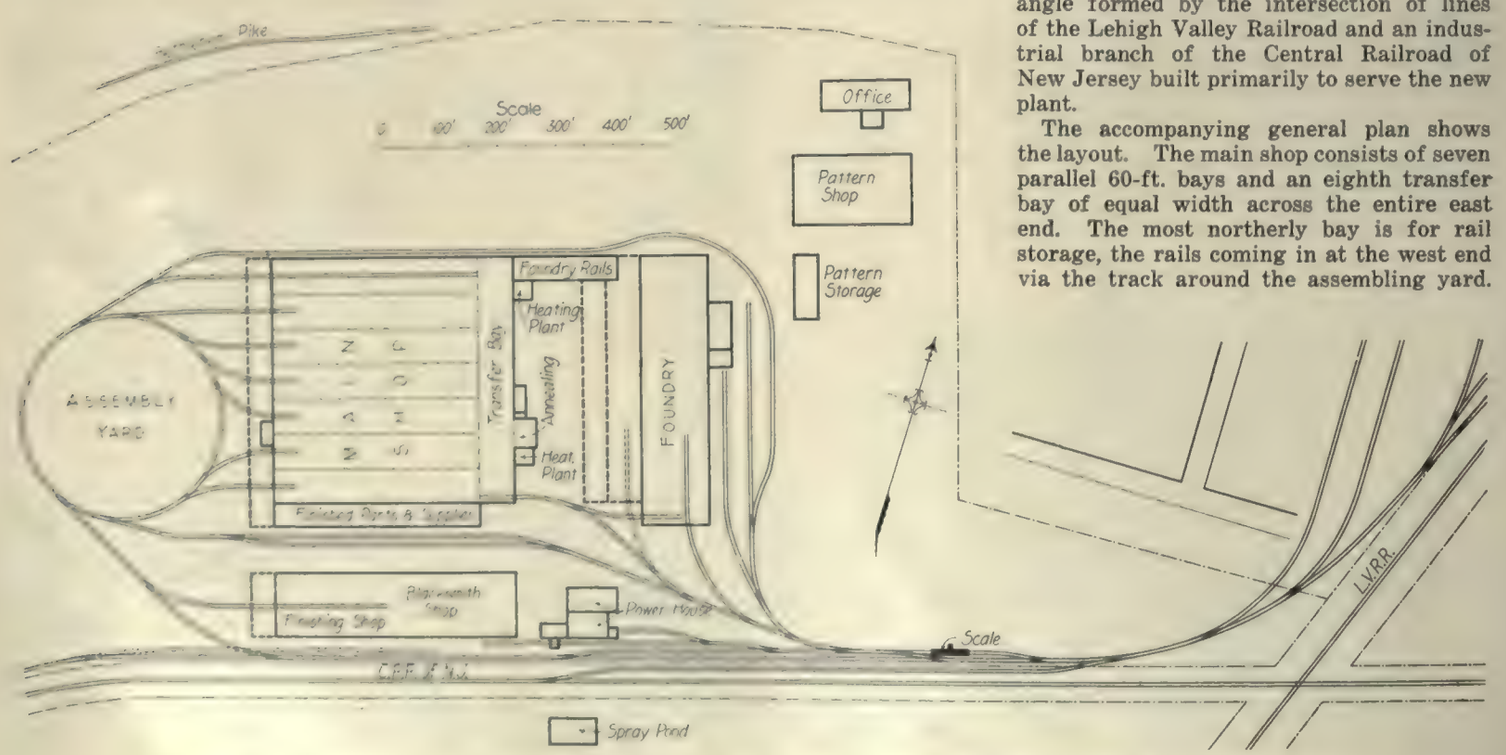


FOUNDATION PEDESTALS OF MAIN SHOP BUILT IN ADVANCE OF GRADING

THE PLANT

The plant occupies a tract of some 50 acres, about half of which has been graded for present needs. It replaces the company's plants at Philadelphia and Jenkintown, Pa., and also that of the Tioga Steel & Iron Company at Philadelphia. It is located about 2 miles west of Easton, in an angle formed by the intersection of lines of the Lehigh Valley Railroad and an industrial branch of the Central Railroad of New Jersey built primarily to serve the new plant.

The accompanying general plan shows the layout. The main shop consists of seven parallel 60-ft. bays and an eighth transfer bay of equal width across the entire east end. The most northerly bay is for rail storage, the rails coming in at the west end via the track around the assembling yard.



LAYOUT WAS DESIGNED TO FACILITATE SEQUENCE OF OPERATION WITH MINIMUM MOVING OF HEAVY PARTS

Small parts, such as bolts and nuts, come in via the stock-room siding, and are stored in the east end of the stock-room, whence they pass into the main shop. The west end is used for storage of small parts ready for shipment. Alongside the stock-room is a billet yard, served by a traveling crane for forge shop material. The manganese steel castings which form the bulk of the product of the shops are received on cars on the track which leads into the southeast corner of the main shop, whence they are moved northward along the transfer bay, passing through a specially designed press

In a general way the first bay south of the rail-storage bay is assigned to curved rails and split-switch work; the next bay is assigned to plain bolted frogs and crossings; the next to cast-steel girder and T-rail work; the next to manganese-steel track work; the next to manganese girder-rail work, and the next to cast-iron and miscellaneous track work.

CRANES

All bays in the main shop are equipped with 5-ton overhead electric traveling cranes, those in the east-and-west bays

quired, part of which was in rock. The yard level was fixed to balance the cut and fill and provide easy grades for the railroad tracks. The deepest cut is about 16 ft., while the deepest fill is 14 ft.

With the exception of the office, which is a two-story reinforced-concrete building, all structures are of the one-story, shop-constructon type, with complete skeleton steel frames supported on concrete foundations. The buildings on filled ground rest on high pedestals built in advance of the filling. Above the bases the walls are of 6-in. and 8-in. smooth-face tile laid in cement mortar



UPPER AND LOWER VIEWS OF THE MAIN SHOP WERE TAKEN FIVE WEEKS APART, OCT. 23 AND NOV. 28, 1914

to bend or straighten them as may be required, after which they are transferred into the grinding department.

MAIN OPERATIONS

The two main products of the plant are switches and frogs. Work on both starts at the north end of the transfer bay, and the finished parts pass out at the west end into the assembling yard, where they are fitted together and loaded for shipment. The switch rails pass from the saws at the north end of the transfer bay into the split-switch and bending bay adjacent to the rail-storage bay, and from there into the machine shop and out to the assembling yard. The frog and other parts requiring foundry work move to the east, through the foundry-rail annex, into the foundry, whence they come back into the main shop via the track from the south end of the foundry. Hence they have access to any section of the main shop, and when finished pass out to the assembling yard.

being so located that they extend on cantilever tracks into the transfer bay for easy transfer of materials. The tools in the shop are also served by traveling jib or wall cranes.

At the northeast corner of the foundry is the pattern shop, and beyond that, fronting on the Bethlehem Pike, is the office building. Between the main shop and the Central Railroad of New Jersey is the blacksmith shop and the power house, while on the opposite side of the railroad is the spray pond, which cools the condensing water and also, with its capacity of 180,000 gal., serves as an emergency reservoir for fire protection. The whole plant is served as shown by a standard-gage industrial railroad connecting direct at various points with the main siding. Macadam roads will connect all shipping and receiving departments with the Bethlehem Pike, and also provide for easy handling of materials by motor trucks between shops.

About 95,000 cu. yd. of grading was re-

colored to match the tile, and the effect is very satisfactory.

LIGHT AND HEAT

Much attention has been given to the considerations of light and heat. The abundance of large windows and skylights, with the sawtooth roof construction of the main shop, make the buildings, it is believed, unusually light. Heat is supplied by the indirect method. Two plants are arranged to draw fresh air from outdoors or to recirculate in extreme cold weather. Underground ducts supply the heat, the feature being the large number of outlets (approximately every 40 ft. each way). The ducts are of graduated sizes carefully calculated to distribute the heat equally.

The floors of the main shop, foundry-rails annex and finishing end of the blacksmith shop are made of 3-in. longleaf yellow-pine blocks treated by the Rueping process with 8 lb. of preservative oil per cubic foot. These blocks were laid on a

pitch cushion on top of a 5-in. concrete base, which was brought to a true surface and mopped with hot pitch, in which the blocks were laid as close together as possible. Slag sand was swept over them and into the joints as the blocks were shrinking, and the "sweating" of the creosote blocks in conjunction with the slag sand, cemented them together. Pitch-filled expansion joints were provided every 60 ft.

DRAINAGE

The rock underlying the plant is so seamy that once water reaches it it disappears. The surface water of the yard is drained into basins built at these crevices. All buildings are connected with a sanitary sewer which discharges into a septic tank and settling chamber. The overflow of the septic tank leads into a cesspool which extends 40 ft. deep to rock, through the crevices of which the effluent will flow away.

The design and construction of the entire plant were handled by Wesinghouse Church Kerr & Company, of New York City, collaborating with William Wharton, Jr., & Company, Inc., through its vice-president, Victor Angerer, and its general superintendent, A. B. Davenport, Jr. R. A. Marshall was engineer in charge for Westinghouse Church Kerr & Company. Ground was broken for the plant in June, 1914, and partial operation of the plant was begun in July, 1915.



LEFT—INTERIOR OF MAIN SHOP, WHARTON PLANT—NOTE CRANE WAYS AND JIB CRANES

Tearing Up of New Pavements Not Allowed in Springfield

UNDERGROUND utilities are stripped in Springfield, Ohio, before new pavements are laid, and then the pavements may not be torn up for five years. Sixteen blocks of the downtown district, 37,000 sq. yd., have been completed this season in four months, a period two weeks less than called for in the specifications. The pavement is of longleaf yellow-pine wood blocks treated with distillate oil laid on a ½-in. layer of sand over a 6-in. concrete foundation. The time includes replacing the street-car tracks with 100-lb. rails and all manganese steel specials, laid on steel ties embedded in concrete. J. Hanan, Springfield, was the contractor. J. Bahin is city engineer, reporting to C. E. Ashburner, city manager.

SAVANNAH, GA., is the city in which is operated the refuse destructor to which E. R. Conant's data published in the Engineering Record of Oct. 30, page 532, referred. Through an error the location of the destructor was given as Atlanta, Ga.

Trained Buyers Save Big Sums in City Purchases of Supplies and Equipment

Fowler S. Smith, Purchasing Agent of Dayton, Tells City Managers' Convention of Economies Possible Under New City Manager Administration

SURPRISING economies in buying municipal supplies can be made by cities if they will devote to the selection and training of their purchasing agents the same intelligence that is displayed by private corporations in developing a sales force. Dayton, under the city manager form of administration, has profited by revising the former clumsy routine of the purchasing agent's office and is now able to stock up when the market is low, buy in bulk for several departments simultaneously and make substantial savings in many other ways. The methods in force were outlined at the City Managers' Convention in Dayton last week by Fowler S. Smith, Dayton's purchasing agent; the following extracts are from his address:



RIGHT — WINDOW AND SKYLIGHT SYSTEM MAKES PATTERN SHOP LIGHT DESPITE WIDTH

RANGE OF PURCHASES WIDE

The diversity of the lines to be purchased for municipal use is almost unbelievable—much greater than would be required in any one business. Consider for a moment the ramifications of the work of a thriving, modern city government. There are the fire and police departments; service department with sewers, streets, bridges, garbage and ashes, waterworks and motor vehicles; the welfare department with the health, laboratory, recreation, parks, playgrounds, prisons, hospitals, greenhouses; and besides these there are the special printing, office supplies and equipment for all departments. With the city purchasing agent it is, first, an automobile repair job, next, material for streets, then food supplies or women's stockings for the workhouse or perhaps marbles, jackstones or baseballs for the playgrounds.

DAYTON'S SYSTEM

The Dayton charter provides that there must be full and open competition on all purchases; that no order shall be issued unless there are sufficient available funds to cover the purchase; that a sufficient sum shall be set aside and held ready to pay the bill when rendered; and that the city manager shall approve every order. Besides fully covering all of these points the system provides a requisition in duplicate signed by division and department heads and inquiry for prices to vendors in such form that specifications and details are identical for all, even as to cash discount and freight or delivery charges. A simple filing system, so that all details on outstanding inquiries and orders are quickly accessible, is kept. A copy of the purchase order is sent to the successful vendor, a copy retained for the purchasing agent's files, and one each forwarded to the city accountant, the requisitioner, and the inspector, all with spaces to record date of delivery, amount received, date of payment, etc. The system requires a force of only two men in addition to the purchasing agent.

MUST WATCH MARKETS

One place where a city buyer can make a big showing is by watching the markets closely on all lines and buying as nearly as possible at the low point. Very little attention as a rule has been paid in city work to this phase of buying in the past, and yet it is one of the most important things to be done. Dayton purchased cast-iron water pipe at an exceptionally low price by going into the market at the right time, when the iron market was at its lowest point and the pipe foundries wild for business to allow them to keep running. Mr. Smith waited three months after he knew that he would need the pipe until he judged conditions were right. After the purchase was made the market advanced several dollars a ton within two months and as he used 6300 tons, the saving on this one item was sufficient to pay the expenses of the entire division for more than four years.

The city contracted for a year's supply of gasoline on Aug. 1 at 9 cents per gallon, the lowest point in the market. The advance to date has been 4 or 5 cents a gallon and a good prospect of a further advance. As there was used 75,000 gal., the city already is $3,000 ahead. Next spring it is expected to build three bridges which will require approximately 800 tons of reinforcing steel. Instead of waiting to buy when plans are completed and contracts placed, or letting the contractor furnish it

at a high price, the city purchased it Oct. 1 and at to-day's market for the same material there is a saving of $2,400, and with conditions as they are at present in the steel trade, Dayton will be $4,000 ahead by the time delivery is needed.

ELIMINATING "INFLUENCES"

Political and personal influence and still more questionable tactics are often used in the effort to land a big order and the purchasing agent's biggest work, before asking for bids, consists in drawing up specifications which are fair to the bidder and to the city, and in other ways convincing the bidders that the old methods don't go. A large percentage is usually allowed on the prices of these items to cover "selling expense." As no selling expense is possible under present methods in Dayton, Mr. Smith always tries to have the prices cut this amount and has several times succeeded in saving 25 per cent.

Dayton advertises only its larger purchases. The small legal advertisement, Mr. Smith believes, is not seen by twenty people in a daily paper. The city does not require a certified check or bond with bids. All contracts, of course, are secured by bond, but it has been found that a great deal of the dissatisfaction among merchants and dealers with city business lies in the necessity of depositing a certified check. Mr. Smith cannot see where it is any protection to the city and he has received more and better bids since he discontinued the practice.

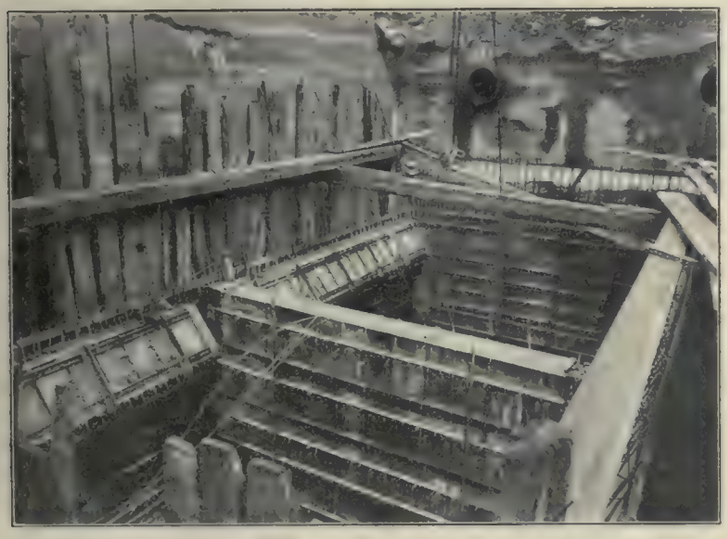
SAVING IN COAL

On coal, of which Dayton uses about 10,000 tons per year, the city has been very successful in buying on a B.t.u. basis. The coal is used in two power plants, the waterworks pumping station and the reduction plant, and in stoves and furnaces in the various departments. Contracts are for the coal of various grades, in carloads, f.o.b. cars Dayton, and a separate contract is made to cover hauling to various points. Where formerly coal was purchased from retailers for furnace and stove purposes at $4.75 to $5 per ton, with no guarantee as to quality, the city now buys in car lots and delivers a much better coal, fully guaranteed as to quality, at a price of $2.46 to $2.63 per ton, depending upon point of delivery and hauling charge. Every car of coal is sampled as received; samples are analyzed and the car is paid for on the basis of this analysis. On the last twenty-five cars delivered Dayton has paid a premium on twenty-two cars and deducted a penalty on three. The cost of sampling and analysis is 2 cents per ton. In the waterworks pumping station alone, where in former times 275 to 290 gal. of water were pumped per pound of coal, it is now possible to pump 375 to 390 gal. per pound, a saving of over 30 per cent, due to a certain extent, at least, to the quality of coal burned. The average analysis of twenty-five cars received since July 1, when shipments on the present contract began, has been over 14,200 B.t.u. and the ash about 5 per cent.

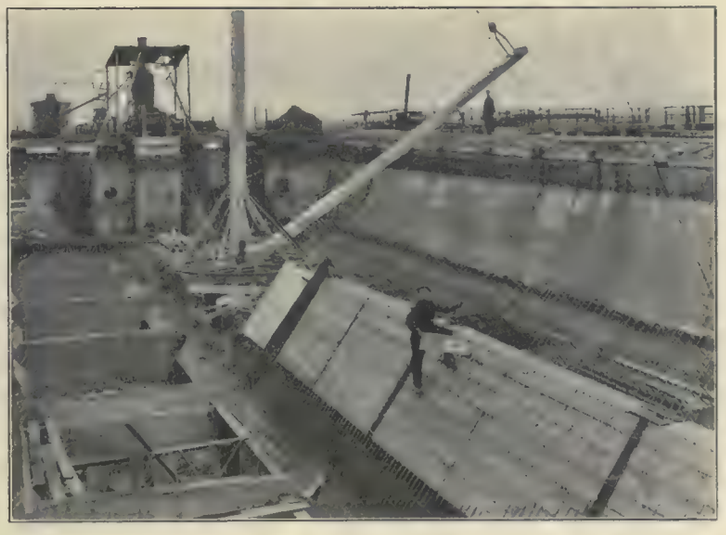
CITY STOREHOUSE A SUCCESS

One of the very important changes made has been the establishing of a city storehouse. There are in all cities any number of articles which are used by several departments. Usually the quantity used by any one department is not enough to get the lowest price, but by combining the purchases each one has the advantage of the other's usage.

The city of Dayton has a stores fund from which are purchased such items as can be moved quickly and then sold direct to departments, turning the money back into the stores fund. The percentages saved on items handled in this way run from 40 to 80 per cent and the total amount saved in a year will pay the cost of the storeroom many times over. Besides this the city can give quicker service than if it had to go outside and buy each item. Just a few examples of the large savings in this way are carbon paper reduced from $3.50 to 65 cents per box; typewriter ribbons from 75 to 25 cents each; typewriter paper fom $1.25 to 54 cents per box; rubber bands from $4 to $1.35 per pound, and paper clips from $1 to 25 cents a thousand. This stock room has a complete system and takes care of a great many of the little orders which would otherwise be very hard and slow to handle. It also carries cement, hay, oats, and other more important items, bought when the market is advantageous and held in stores until required.



1. FORMS IN PLACE FOR SLUDGE SUMPS



2. SUMPS COMPLETED AND WALL REINFORCEMENT PLACED

Columbus Changes Sewage Tanks to Imhoff Type

Standard Light Steel Wall Forms Used in the Work of Reconstruction—Walls of Old Tanks Retained

WITHOUT causing a complete shutdown at the Columbus sewage treatment plant the original settling tanks are being converted into Imhoff tanks by the use of light steel wall forms in standard units, supplemented by specials for intersections of surfaces in different planes. While half of the tanks are thus being modified the other half are continued in operation, taking the entire flow of the plant. The outer walls of the original tanks are left in place and are used as the outer walls of the Imhoff tanks. The work, naturally, is being spread through two seasons.

The contractor for this work, D. W. McGrath of Columbus, is using Blaw light wall forms for practically all of the new work, excepting the end channels for the admission and outflow of the sewage. The latter are of such variable form as not to permit a sufficient amount of re-use of the forms to justify the employment of steel.

SUMPS FOR SLUDGE

The first operation consists of excavating below the bottom of the old tanks, and constructing pits with concrete walls and sumps in their bottoms for the collection of the sludge. The forms are set up for one of these pits complete, a height of 8 ft. above the top of the sump. These forms are filled and removed before the wall is carried up higher, being used again on another sump as soon as they are taken away from the first one constructed.

Photo 1 shows the steel forms filled with concrete for the construction of one of these sumps. The system of liners, holding the forms rigidly in position, is well shown, and it will be noted that on the overhanging wall the liners are bent so as to produce a wall of exactly the right profile.

Photo 2 shows the appearance of the work in one of the old tanks when the sumps for the Imhoff tanks in the bottom have been completed, and the wall reinforcing is being placed for the dividing wall between the two Imhoff tanks; for two Imhoff tanks are being built in each one of the old tanks. This photograph shows a wooden form for the under side of the dividing wall, this being found necessary, as it proved impracticable to place the back-

fill on such a steep slope in a manner sufficiently secure to make it practical to dispose the concrete direct upon the earth fill. To secure additional strength, provision was made for cross walls through this earth fill at intervals as shown. The wooden forms, of course, are left in place.

In Photo 3 the steel forms are erected ready to receive the concrete for the dividing walls and the upper portion of the cross walls between the sumps. The picture illustrates how each part of the work is duplicated and how the form is stiffened by the liners and special splice plates at the intercepting angles. In this case, also, the form was provided with a bracket at the top so that a platform or walk was cast at the top of the wall at the same time the wall was cast. In placing concrete in this wall the form was first set up to an elevation about on a level with the shoulder of the man shown in the picture, and filled with concrete to that level, after which the rest of the form was set up to the top of the wall and filled.

How Forms Are Handled

The forms used on this work are, with the exception of the specials provided for the intersections, strictly standard light wall forms, adjustable for use on all plain wall work, where the height poured at any one time does not exceed 10 ft. These forms are attached to the liners before they are erected, and may be shifted either in units 2 ft. wide and 10 ft., 12 ft. or 14 ft. long, as desired, with the horizontal liners attached, or in larger units with the vertical liners attached, in which case it is necessary to employ a derrick to handle the form on account of the weight. The form weighs about the same per square foot of surface as a well made wooden form, but occupies less space and has much greater stiffness.

On this particular job the forms used in the sumps were shifted by the derrick in units 12 ft. wide by 8 ft. high or 96 sq. ft. to a unit, similar units being used on the upper sections. In shifting these large units they are picked up by the derrick and swung around into a new place wherever desired, necessitating little handling.

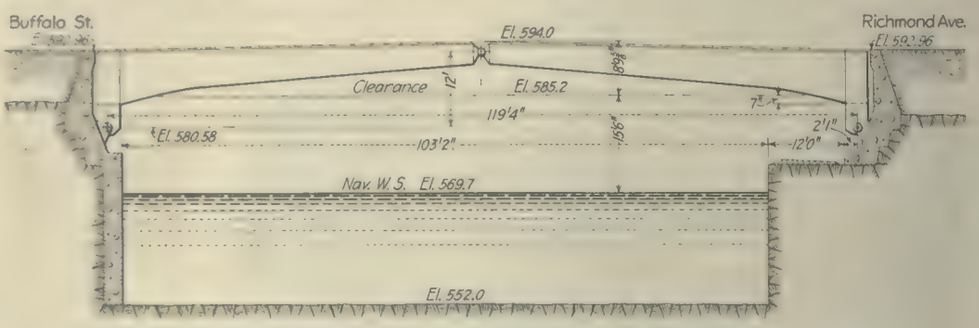


3. FORMS READY TO RECEIVE CONCRETE FOR DIVIDING WALLS

Three-Hinged Arch Girders with Vertical Ends Provide Barge Canal Clearance

Main Street Bridge at Lockport Required Special Design Because of Limited Distance from Underclearance Line to Street Grade

UNUSUALLY limited vertical distance from street grade to clearance line resulted in the adoption of a special type of three-hinged arch girder span over the New York Barge Canal locks at Lockport, N. Y. Fortunately the profile of the rock formation at the site was exceptionally favorable to an arch type of structure, because inexpensive abutments to resist the thrusts could easily be constructed. The general method of design of the arch girders and the details of the shop splice at the end joints between the vertical posts and the main girder will be given.



ROCK FOUNDATION WAS VERY FAVORABLE TO ARCH TYPE OF STRUCTURE

Location and General Dimensions

The bridge is located at the intersection of Main Street with Richmond Avenue on one side of the canal and Buffalo Street on the other, the double-track street car line on Main Street running diagonally across the structure. This location is in the center of the business section, and as other streets intersect at this point it was decided to make the bridge unusually wide and use it as a public square. The total width in plan at one end is 307 ft. 6 in., including a triangular corner approach carried by plate girders. A 10½-ft. sidewalk is used on either side of the principal street crossing the bridge, the balance of the floor being finished with 4-in. creosoted planking and 3-in. creosoted paving blocks supported on I-beams connecting the main arch ribs.

The arch girder ribs are spaced at various distances from 7 ft. 6 in. to 13 ft. 6 in. on centers. Span lengths varying from 116 ft. 10 in. to 124 ft. 2 in. between centers of end pins are used, as the width of the canal prism is changing at this point. The clearance of 15 ft. 6 in. above maximum navigable water level required by the State Barge Canal Commission for all overhead bridges on the canal combined with the fixed location of street grades to limit the available distance for total depth of bridge to only 7 ft. 9 in. for these long spans. The unusual form of three-hinged arch girder with vertical ends, as shown in the accompanying typical elevation, was adopted. A slight grade of about 1 ft. up to the center line of the bridge made possible a greater rise of arch to the center hinge.

Assumed Loads and Allowable Stresses

The design of the floor and arch rib was based on assumed live loads on the trolley tracks as follows: A train composed of cars of 50 tons capacity on either track, each weighing 74 tons when fully loaded, giving axle loads of 37,000 lb. spaced 5 ft. 6 in. apart in trucks 21 ft. 6 in. on centers, the cars assumed 34 ft. on centers; on the second track a train of electric cars weighing 100,000 lb. when fully loaded, and axle loads of 25,000 lb. spaced 5 ft. 6 in. apart in trucks 22 ft. on centers, the cars assumed 40 ft. on centers. The car loads cover 11 ft. in width, and the two tracks are spaced 11 ft. on centers. The balance of the roadway is loaded with 80 lb. per square foot of load.

The allowable stresses used in the design were 20,000 lb. per square inch for tension, and $20{,}000/[1 + (l/r)^2/18{,}000]$ for compression. To allow for deterioration due to corrosion of the steel, the sections in the arch girders were increased in thickness about 1/16 in. above the section theoretically required, and 20 per cent was added to the required section modulus of the I-beams in the floor. Impact allowances of about 50 per cent for uniform loads and 95 per cent for train loads were made.

As the span length of the arches varied in the four groups and the position of the tracks loaded with cars varied in relation to



SPECIAL THREE-HINGED ARCH BRIDGE REQUIRED BY SMALL OVERHEAD CLEARANCE

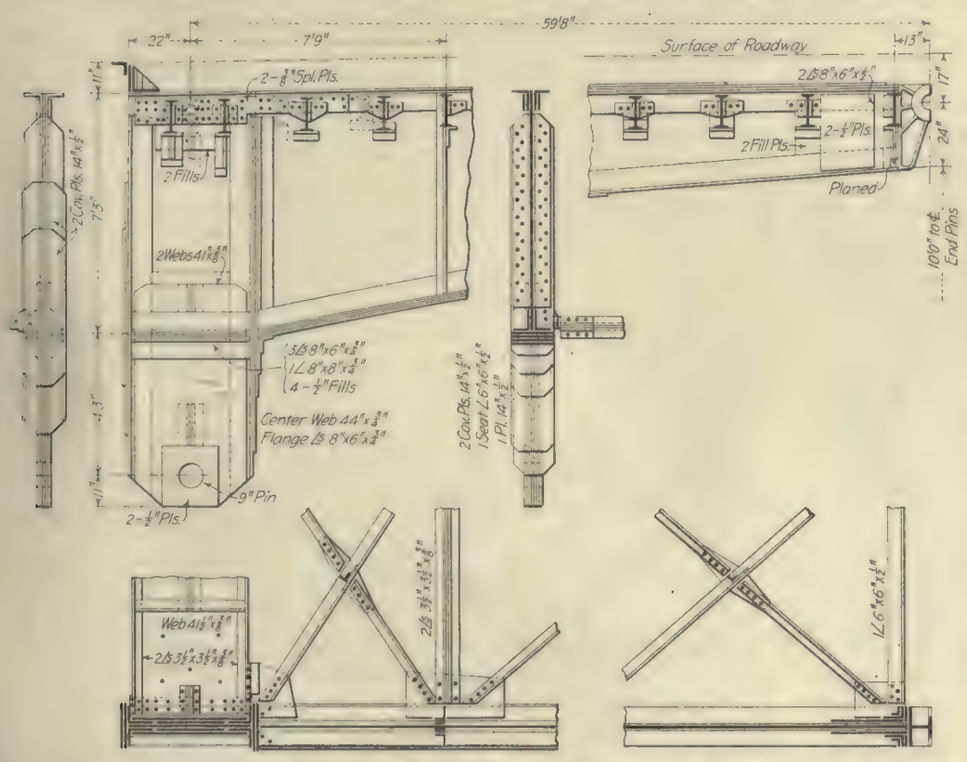
the different arch ribs, it was deemed advisable to construct unit-load influence lines for the stresses in each flange of the arch girders for each of the four groups of the arch spans. This was done by a tabular computation of sections spaced 5 ft. apart. Positions of wheels giving maximum stresses and maximum horizontal thrusts were determined. For uniform loading the area of the influence diagram was used to make the computation of the stress comparatively simple.

Design of Flanges—Details

In general one-sixth of the web plate area was counted as flange area when in compression and one-eighth when in tension. If the stresses in the two flanges were of opposite kind, and one stress was over 50 per cent less than the other, these proportions were increased to one-fourth for the compression flange and three-sixteenths for the tension flange, and if the stresses in both flanges were of the same kind, one-third was used for compression and one-fourth for tension. In all cases the flange stress was computed by moments about the center of gravity of the opposite flange, assumed at 0.15 ft. from the back of the flange angles.

The accompanying detail drawing of the end hinge and shop splice between the vertical end and the main girders shows the material used for the transfer of bending, direct stress and shear. The splice between the web plates is vertical and the heavy compression in the bottom flange of the main girder is transmitted into the end web, reinforced by two 41 x ⅜-in. plates, through the heavy horizontal stiffeners. The end girder strut and lateral bracing in the plane of the bottom flange are indicated in the part sectional plan.

The bridge was designed in the office of the State engineer of New York, under the supervision of W. B. Landreth, special deputy State engineer, by W. R. Davis, chief bridge designer and inspector. The contractor was Larkin & Sangster of Seneca Falls, N. Y., and the total cost was about $1,027,000.



DETAILS OF END HINGE, VERTICAL SHOP SPLICE AND CENTER HINGE

Wayne County Roads Preserved by Maintenance

Repair Crew Responsible for Good Condition of 125 Miles of Concrete Highway, According to Annual Report

"WE have over 125 miles of concrete road in Wayne County, Michigan, some of it in its seventh year of service. All of it is in good condition and we have never taken up and replaced a 25-ft. section since we have been building and developing this type of road. This, we think, speaks volumes for our low annual maintenance costs."

This statement is from the ninth annual report of the Board of County Road Commissioners of Wayne County, Michigan, covering the period from Oct. 1, 1914, to Sept. 30, 1915. It would be natural to assume that it would be reinforced with detail figures indicating what the maintenance costs have been, but the reader will search for them in vain. This year's report, like its predecessors, dodges the issue of costs, although a number of pages of lump sum figures are given which are of no practical use, for they are in a form which precludes comparison on a unit basis. The report, however, describes the methods of maintenance used last year, and extracts from this portion of the document are given below.

Tar Treatment for Cracks

A crew of seven men, a team and a tar kettle are used for the maintenance work. The foreman is paid $5 a day, the team and driver $5 a day, tar man $3 a day, two laborers, $2.50 a day each, and two laborers, $2.25 a day each. The tools used consist of several wire bristle brooms, a wheelbarrow, a couple of shovels, a tar bucket and sprinkling cans. Two men are utilized to sweep all cracks or spalled joints clean with the wire brooms, after which the man with the tar can fills the cracks with tar which is heated to about 225 deg. Fahr., allowing it to stand for a few moments to prevent it from bubbling. It is then covered with a clean, coarse, dry sand, spread from a shovel.

Pit holes are similarly treated. An excess of tar and sand is used and traffic is allowed to iron it out. The Wayne County officials use a special tar mixture graded between Tarvia A and X. Where an imperfection exists that does not extend through the road but is over an inch in depth, the practice is to clean it out and dry it carefully, paint it with hot tar, after which it is filled with stone of a suitable size graded to fill the voids as nearly as possible, tamped down or rolled into place. Hot tar is then poured over the patch, the quantity being gaged so that the tar will be taken up by the remaining voids without any large excess being left on the surface, and coarse, dry sand is then spread with a shovel over the surface. Holes of a lesser depth and any joints from which the filler has wholly or partly disappeared come in for the class of treatment already described for cracks and joints.

A maintenance crew will cover from 1 to 3½ miles of road in a day and one trip over

the work yearly is usually all that is required. During the past season the maintenance crew had gone over the entire concrete mileage for the year by the middle of August. On Fort, Grand River and Gratiot roads there is a total of about 2 miles of concrete road where the entire surface is covered with a bituminous carpet. This mileage has also been taken care of as during the past. The same grade of Tarvia is used as for other maintenance purposes. Instead of sand, washed and screened pebbles are used. It is necessary to resurface about one-third of this mileage annually in addition to touching up spots here and there throughout the entire season. The method followed has been to sweep the spots to be treated with wire brooms after which the tar is poured. The pebbles are then spread over the tar from barrows or a wagon, and traffic imbeds the pebbles in the tar, forming the wearing surface. The surfaces of these roads become wavy under traffic and are not as desirable as an all-concrete wearing surface either from the standpoint of the comfort of the user or from the standpoint of ultimate cost. A few holes 2 or more inches deep have been repaired by cleaning them out, painting them with a cement grout, and filling the cavity with a concrete mixture of the same proportions as that used in the construction of the original road, the concrete being mixed to the same consistency, as nearly as is possible, as that of the original construction. The repaired portion is cured by being kept wet for at least 7 days and protected from traffic until thoroughly hardened. The Wayne County concrete roads, the report states, possess the special feature of presenting a surface that wears but slightly and uniformly, a surface that does not give way in any one spot and withstands traffic over its entire surface. This is made possible by careful selection of materials, careful methods of proportioning and mixing, and care in finishing and curing, resulting in a concrete having a uniform texture, which is a big factor in eliminating maintenance costs.

BRICK ROADS CARED FOR

On the brick mileage the cracks which have developed and the bricks that were not too badly chipped are treated in the same manner as the cracks on the concrete roads. It has made a very satisfactory repair, according to the report, and gives promise of adding materially to the life of the brick roads. Broken brick have been replaced from time to time and the roads given an occasional sweeping and cleaning.

It has also been found advisable to use a road scraper to keep the snow leveled down during the winter months, more especially on the roads on which there are street car tracks. The scraper was drawn behind a motor truck and made travel much safer besides distributing it over a wider area of roadway. In fact, every effort is made to keep the roads in proper condition for travel throughout the entire year with a minimum of expense.

It has been deemed advisable to widen out some of the roads to accommodate the largely increased traffic brought about through their improvement. Some of the 12-ft. concrete roads have been increased to from 15 to 18 ft. Crushed limestone was used for this purpose, giving an additional width of macadam of 8 ft.

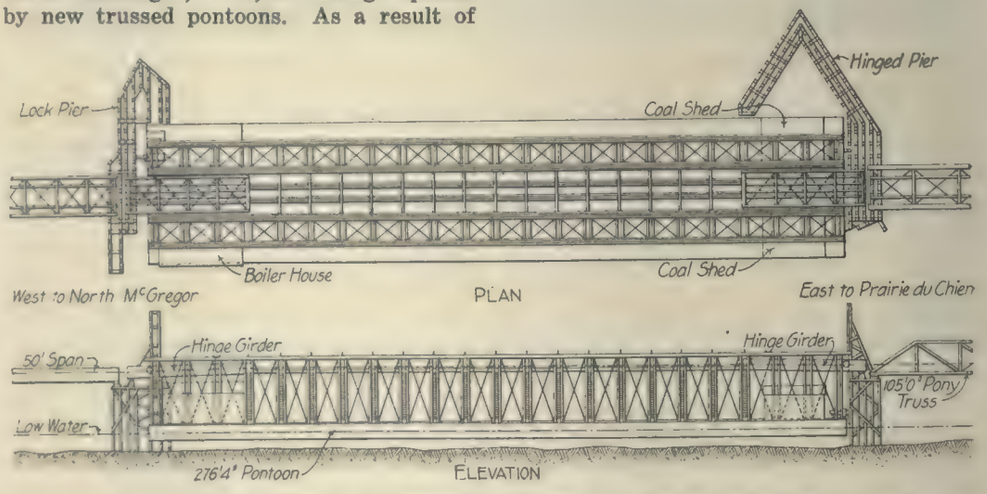
At the end of each construction year all machinery is returned to the sheds at Wayne. Ample space is provided in these sheds for mechanics to overhaul the equipment. A machine shop has been installed and the facilities are at hand to make any practical repair. During the winter months a small force of mechanics and laborers is employed in painting and repairing, and when the equipment is ready for operation in the spring it is always in first-class shape. Nothing is overlooked that will tend to stay depreciation and decay.

The Board of Wayne County Road Commissioners consists of Edward N. Hines, chairman; John S. Haggerty and William F. Butler; the engineers are George A. Dingman and George F. Key.

Long Pontoon Bridges Carry Heavy Railway Loading—Floor Lifting Devices

H. J. Hansen Describes Design and Construction Details of Unusual Structure Carrying C. M. & St. P. Railway Over Mississippi River

LONG PONTOON BRIDGES designed to carry railroad loading, used since 1874 at the Mississippi River crossing of the Prairie du Chien division of the Chicago, Milwaukee & St. Paul Railway Company between Prairie du Chien, Wis., and North McGregor, Iowa, are being replaced by new trussed pontoons. As a result of long experience, showing short life of the older types due to excessive deflection, the new pontoons are stiffened by deep trusses as described by H. J. Hansen in a paper recently presented before the Western Society of Engineers. The general methods of design, of swinging the pontoon, of raising the bridge floor and operating the hinge girder spans at the ends are included in the following abstract.



PLAN AND ELEVATION OF PONTOON BRIDGE AND HINGE GIRDER SPANS

PRESENT PONTOON BRIDGES

About a mile and a half north of this railway crossing the Mississippi River is divided into two navigable channels by an island. The total length of each of the structures bridging the two channels is about 2000 ft. The present bridge across the east channel consists of a 209-ft. 4-in. pontoon flanked by a girder span on the east end and a truss span on the west end, the remaining portion of the track across this channel being carried on a pile trestle. This pontoon was placed in 1914, at which time the U. S. Government allowed a reduction in clear opening from 350 ft. to 160 ft. In addition to the main draw opening, the space under the flanking spans provides a passage for small boats.

The present bridge across the west channel, built in 1900, is composed of a 405-ft. pontoon flanked at each end by a 100-ft. Howe truss span, the remainder of the structure being a pile trestle. This pontoon consists of a scow 405 ft. long, 41 ft. wide at deck level, 36 ft. wide at the bottom and 6 ft. deep. Three longitudinal bulkheads consisting of 8 x 16 and 8 x 12-in. timbers bolted together extend the entire length of the pontoon, the shear between these timbers being transmitted by 2-in. tree nails. The top and bottom joists are 6 x 10-in. timbers, and the sheathing is 3 x 10-in. planks.

OPERATION AND DIFFICULTIES

This bridge is swung open about 1000 times during a season, which averages about 4.5 openings daily, the greatest number of swings in one week being about 60. The pontoon bridges have given good service with the exception that during high water with heavy wind storms excessive rolling of the pontoons is experienced, sometimes delaying trains for a considerable length of time. Their term of service has also been rather short, it being necessary to renew them about every 15 years. This, to a great extent, is due to the excessive deflection under live loads, which opens up the joints in the sheathing and works out the calking strips, thereby causing excessive leakage and deterioration.

On account of this large deflection and the heavier loading required, the new pontoons are stiffened by four longitudinal trusses, which eliminate this excessive deflection. The actual measured deflection of the new Prairie du Chien pontoon hardly exceeds ½ to ¾ in. for any position of the load, and there can be no doubt that the trussing of these bridges will greatly increase their term of service and reduce the cost of maintaining them.

NEW PONTOON IN WEST CHANNEL

The new pontoon now being constructed for the west channel to replace the present

405-ft. structure is 276 ft. 4 in. long, 55 ft. wide at the deck, 44 ft. wide at the bottom and 7 ft. 2 in. deep at the center. It is of the same general type as the new east channel pontoon and is designed to carry Cooper's E-50 loading, modified to include only one locomotive. The aim has been to provide adequate stiffness to prevent excessive rocking due to wind and waves, and to provide machinery for operating the floor and end lifts.

The accompanying figures show a general plan of this bridge and the general arrangement of the pulling chain. A part cross-section at typical panel points and a typical half section between panel points are shown. The four longitudinal trusses are proportioned to resist the bending and shear forces in that direction, the inside trusses carrying about two-thirds of the live load and the outside trusses the remaining one-third, the transverse shear between the two being transmitted by the vertical transverse bracing at each panel point.

Details of Trusses

The web members of the trusses consist of vertical posts and diagonal adjustable rods. The vertical struts are composed of four 8 x 8 or 8 x 10-in. timbers spaced 1 ft. 4 in. apart so as to serve the double purpose of guiding the floorbeams and at the same time act as compression members. The chords are composed of 8 x 16-in. timbers packed and spliced with the railway company's standard Howe truss packing washers and splice clamps, both top and bottom chords being treated alike in this respect on account of the reversal of stress.

The transverse bracing is designed to resist the forces produced in this direction by latching the pontoon at top and bottom to prevent rolling. Web members in both the vertical and horizontal bracing are composed of diagonal timber struts for compression members and upset steel rods for tension members, connected to the trusses with cast-iron angle blocks.

Scows and Floor System

The scow is calked on all sides with oakum and calking strips are nailed on the top of the oakum to prevent it from working out. All the timber in the pontoon is creosoted except the sheathing, the oak blocks and the machinery supports. The sheathing is not creosoted, as previous experience shows that the creosoting process, which has a tendency to soften the wood, makes it impossible to obtain a perfect calking seam. It was, therefore, decided to paint the sheathing with Carbolineum after the pontoon is completed instead of creosoting it. On the upstream side the scow is protected against the scouring of ice by ¼-in. steel plates bolted and nailed to the sheathing as shown in the cross-section.

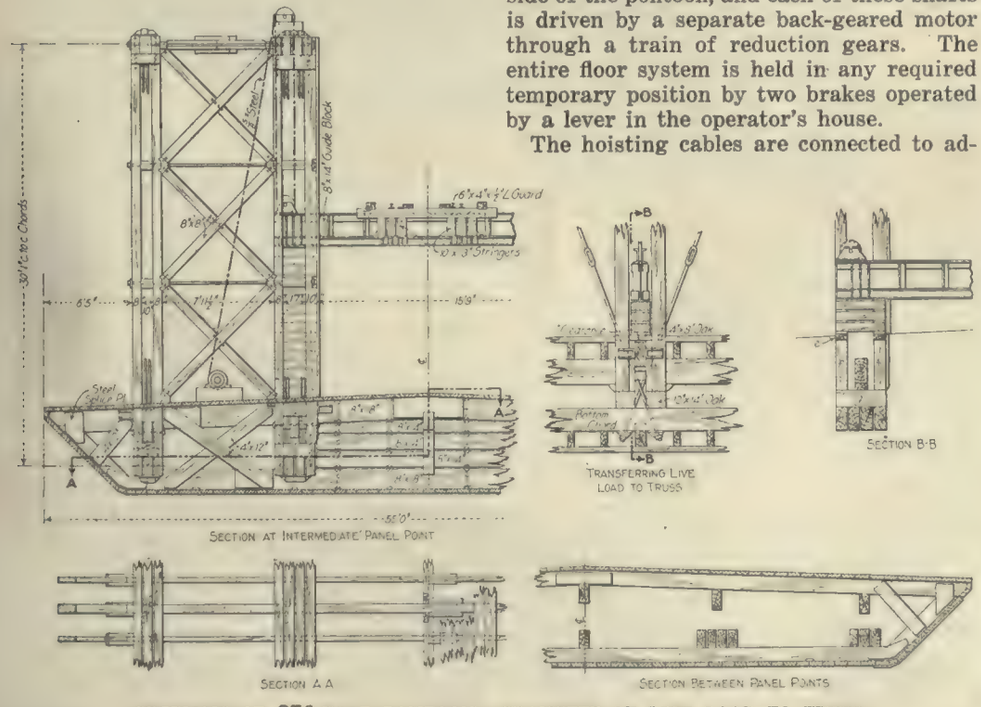
The floor system consists of shallow steel floorbeams and timber stringers connecting up with a 50-ft. hinge span at the third panel point from each end of the pontoon. The floorbeams are supported by blocking piled between the vertical posts of the inside trusses. This blocking rests on the oak bearing blocks, *e*, of the accompanying figure, which transfer the loads to the short strut, *f*, supported on the oak bearing blocks, *g*, of the inside trusses. The track is kept lined up horizontally by timber blocks bolted to the floorbeams and guided by the vertical posts. Vertically the track is regulated by varying the number of supporting blocks under the floorbeams.

Water Level Variation—Raising Floor

The variation of the water level in the Mississippi River is considerable, the difference between the extreme high and extreme low water being approximately 22 ft. This extreme difference, however, does not occur very often. Provision is therefore made for regulating the track over a range of 16-ft. rise and fall of the river. When the water rises to a higher stage, the approaches have to be raised.

On account of the heavier loading for which this bridge is designed, the floor system is too heavy to be conveniently or economically handled with jacks and, therefore, electrically operated machinery is provided for adjusting the track. The floorbeams are suspended from thirty-four ⅝-in. steel cables winding on thirty-four cast-iron drums. These drums are mounted on two longitudinal drum shafts, one on each side of the pontoon, and each of these shafts is driven by a separate back-geared motor through a train of reduction gears. The entire floor system is held in any required temporary position by two brakes operated by a lever in the operator's house.

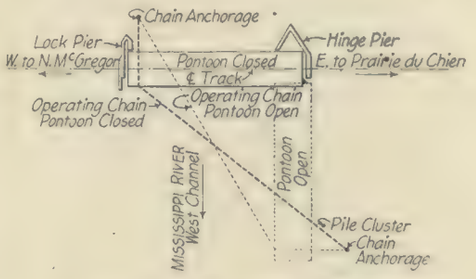
The hoisting cables are connected to adjustable eye-bolts at the upper side of the top chords and doubled by leading them through loose sheaves running between brackets connected to the top flanges at each end of the floorbeam. The cables are then led over loose sheaves on the top of the top chord to the drums.



SECTIONS OF 276-FOOT PONTOON—TRANSFER OF LIVE LOAD TO TRUSS

Hinge Span Operation

The hinge span is of the through plate-girder type and is suspended from two steel cables, one on each side of the span,



PONTOON OPERATED BY CHAINS

by loose sheaves connected to the outside of the girders near the abutment end. These cables then are led over loose sheaves on the top of the top chord to a cast-iron drum located on the deck. This drum is driven with an electric motor through a train of reduction gears.

The electric power for operating the floor lift and end lift machinery is furnished by a 25-kw. generator placed on the pontoon and receiving its supply of steam from the boilers that furnish the steam for swinging the bridge. The swinging machinery, together with the 60-hp. steam engine from the old bridge used for the new installation, is located on the pontoon. The pontoon is rotated about a hinge pile composed of heavy wrought-iron pipe fitted around a wooden pile. The hinge pile is braced to the hinge pier by movable steel straps. The time required to open or close the pontoon 90 deg. is about 5 min., including the time required to lift the girder ends off of the abutments.

General Method of Design

The stresses in a pontoon affecting the structure as a whole are produced by unbalanced weight and buoyancy forces. These stresses are transmitted to and carried in the main longitudinal and transverse trusses. In addition to these stresses, the various members may be subject to local stresses caused by concentrated loads on the structure. The local stresses are obtained by the ordinary method employed for stationary structures, and there is nothing new in the theory leading to the main stresses.

The design of the west channel pontoon just described was in direct charge of Mr. Hansen, under the supervision of H. C. Lothholz, engineer of design, and C. F. Loweth, chief engineer of the Chicago, Milwaukee & St. Paul Railway.

Auto-Truck Upkeep in the street cleaning department of Springfield, Ohio, according to Charles E. Ashburner, city manager, was $63 last year for a mileage of 12,000 miles with a 2-ton Kelly truck. Allowing for depreciation, wear and tear, he finds that the cost of operation of each truck (Springfield has three), as against the necessary amount of teams to do the same work, is $15 per day in favor of the trucks.

Literature

For the Civil Engineer and Contractor

New Publications

ANNUAL REPORT OF THE WATER SUPPLY COMMISSION OF PENNSYLVANIA, 1914. Cloth, 6 x 9 in.; 399 pages; illustrated. Harrisburg, Pennsylvania Water Supply Commission.

THE GYPSUM INDUSTRY IN 1914. By G. F. Loughlin. Part II, Mineral Resources, calendar year 1914, U. S. Geological Survey. Paper; 6 x 9 in.; 8 pages (261-270); illustrated. Washington, Government Printing Office.

EXCAVATING MACHINERY USED IN LAND DRAINAGE. By D. L. Yarnell, drainage engineer. Bulletin 300, Office of Public Roads, U. S. Department of Agriculture. Paper, 6 x 9 in., 39 pages, illustrated. Washington, Government Printing Office.

THE CEMENT INDUSTRY IN THE UNITED STATES IN 1914. By Ernest F. Burchard. Part II, Mineral Resources, calendar year 1914, U. S. Geological Survey. Paper; 6 x 9 in.; 38 pages (221 to 259), illustrated. Washington, Government Printing Office.

CONDITIONS REQUIRING THE USE OF AUTOMATIC GAGES IN OBTAINING RECORDS OF STREAM FLOW. By C. H. Pierce. Water Supply Paper 375-F, U. S. Geological Survey. Paper; 6 x 9 in.; 8 pages (131 to 139), illustrated. Washington, Government Printing Office.

THE CONSTRUCTION OF THE PANAMA CANAL. By William L. Sibert, brigadier general U. S. A., division engineer, Panama Canal, 1907-1914, and John F. Stevens, chief engineer, 1905-1907. Cloth, 5 x 7½ in.; 338 pages; illustrated. New York, D. Appleton & Company. $2 net.

STREAM-GAGING STATIONS AND PUBLICATIONS RELATING TO WATER RESOURCES, 1885-1913. Part XII, North Pacific Slope Drainage Basins. Compiled by B. D. Wood. Water Supply Paper 340-L, U. S. Geological Survey. Paper; 6 x 9 in.; 31 pages (147 to 178), with indexes. Washington, Government Printing Office.

RESULTS OF MAGNETIC OBSERVATIONS MADE BY THE U. S. COAST AND GEODETIC SURVEY IN 1914. By Daniel L. Hazard, computer, division of terrestrial magnetism. Special publication No. 25, U. S. Coast and Geodetic Survey. Paper; 7½ x 11½ in.; 69 pages, with tables. Washington, Government Printing Office.

ANNUAL REPORT, DEPARTMENT OF STREET CLEANING, New York City, for the year 1914. By John T. Fetherston, Commissioner. Paper, 10½ x 6¾ in.; 78 pages; illustrated. New York, Department of Street Cleaning.

Contains statistics and costs of department work, including street cleaning, removal of refuse, and snow removal. In the snow work, emergency men are employed in large numbers as soon as a storm begins and sewers are utilized for disposal.

IMPERIAL VALLEY AND THE SALTON SINK. By H. T. Cory, civil engineer, with introductory monograph by Prof. W. P. Blake, University of Arizona. Cloth, 6 x 9 in.; 420 pages; illustrated, and containing a large number of maps, diagrams and tabular data. San Francisco, John J. Newbegin. $3.50 net.

A review and history of the region at the head of the Gulf of California, the Colorado River watershed, Colorado River Delta and the Imperial Valley. Irrigation and river control are discussed and a comprehensive account is given of what the reclamation project has done to render productive the fertility of Imperial Valley. A major part of the book is devoted to the reprint of a paper by Mr. Cory before the American Society of Civil Engineers, together with the discussions of the paper that appeared in the Transactions of that society. The author announces it as the purpose of the book to place before the public at large an amplification of the information that developed in the discussion of the original paper.

Books Reviewed

Influence of Pile Driving on Ground Conditions

DIE RAMMWIRKUNG IM BODEN. By Dr.-Ing. Karl Zimmermann, Königlicher Regierungsbaumeister. Paper, 12 x 7 in., 90 pages, 14 illustrations. Berlin, Germany, Wilhelm Ernst & Sohn. $1.50 net (6 marks).

Reviewed by A. G. Hillberg

Civil and Hydraulic Engineer, New York City

It is a well-known fact that driven piling tends to improve the existing condition of the ground by compressing it, and that, in order to get the full benefit, piles should not be driven too close together. It is also well known that the penetration of a pile decreases as the depth increases. Little, however, is known regarding how much the ground is compressed and how far out from the axis of a pile such compression extends. It is equally true that the relation of penetration to blow has been considered in the derivation of all formulas for the bearing power of piles, but it is not generally known that this relation is to a certain extent a function of the size and shape of the pile itself.

In dealing with this subject the author discusses and classifies experiments he has made along these lines. Shape of pile, shape and length of pile shoe, weight of hammer and other variables are analyzed by tables and diagrams.

The last thirty pages of the book sum up the results of the experiments and deal with bearing tests on the piles. It is shown that the bearing power of piles is in direct proportion to the work required in driving them. It is also shown that the error in the existing formulas is too great to permit their use.

The author has dealt with the subject in a very interesting way, and his observations and conclusions deserve the attention of engineers and contractors in the field of foundation work. The publisher has given the book a fitting typographical make-up.

Public Utilities—Their Present Value and Return

Author, Hammond V. Hayes, Ph.D., consulting engineer. Cloth, 5¼ x 8½ in.; 207 pages. New York, D. Van Nostrand Company. $2 net.

Reviewed by C. W. Stark

Associate Editor, Engineering Record

This book is founded on the agency theory of regulation. Two points emphasized throughout are that the utility, or undertaking, as the author elects to call it, is entitled to no more than a fair return, and that this return is cumulative from the beginning of the business, so that there is always an attempt to balance the account to date between the public and the utility. The reviewer, believing that the agency theory is neither just, tenable nor expedient, and that cumulative treatment is unfair, both because the records of the past fail to tell the true story, and because the public has no right to date its regulatory measures backward, finds it difficult to appraise the structure the author has built up on these theories.

Chapter 1 is introductory. In chapter 2 the author proceeds to the burden of his argument, that fair present value should be based on what the stockholders have put into plant useful and now in use. He discusses various cases, according as the capitalization is less than both the original and replacement cost, depreciated, is intermediate, or exceeds both. For the last, a special case, he offers no general rules.

For the first type he finds present value to be original cost less depreciation—not a summary of amounts actually spent, covering in part elements no longer in use, but an estimate of what the present useful and used parts ought to have cost. He assumes in this case that reserves for renewals have been earned and allowed to go into new plant.

For the second type he makes original cost new the fair present value. This apparent inconsistency he explains on the ground that if capital exceeds original cost (representing existing plant) it "shows with a certainty that cannot be questioned that users of the past did not pay the full cost to the company of producing the service." He seems to overlook the possible dissipation of earnings in unwarranted dividends. As to the possibility of this higher valuation exceeding the existing plant, he satisfies his conscience by the makeshift of allowing enough appreciation of land to offset the depreciation of plant.

Chapters follow on fair rate of return, replacement cost and actual original cost. As replacement cost, with its so-called unearned increments, is incompatible with the agency theory, the author gives little space to the subject, except to forecast the theme of his chapter on going value. The chapter on actual original cost is of interest primarily because, as previously stated, it interprets the term to mean, not the sum of actual expenditures, but an estimate, applying to the identical inventory used in determining the replacement cost the unit prices prevailing at the time of construction.

Perhaps the best chapter in the book is that on going value. The author argues for a re-allocation of overhead expenses that will result in three distinct groups of cost: Preliminary expenses; cost of physical property, which is stripped to actual cost, engineering, contingencies and contractor's profit; and going value, which is made up of organization, general and legal expenses, taxes and interest during construction. In one respect he is surprisingly liberal. He dates the right of the undertaking to a fair return from the beginning of construction, and on this basis holds that the investors are entitled not merely to interest during construction, but to interest and profit.

The author closes with a chapter on depreciation in which he describes at length the various methods of figuring depreciation, the straight-line method being the one he favors. What he does not explain, what nobody has explained or can explain, is how to determine the length of life of the unit, which is the foundation of all the methods.

To those of the author's faith the work is commended. The theory is clearly presented, and little space is wasted arguing the fundamentals which those of his school will agree are "beyond question." Even those who, like the reviewer, disagree absolutely with those fundamentals can profitably look into the author's interpretation of actual original cost and going value—not to mention the desirability of knowing the viewpoint of the opposition on the whole momentous subject of valuation.

DRAINAGE DISTRICTS IN HILLSBORO COUNTY, FLORIDA, are being actively promoted by the Tampa Board of Trade, which believes that a great part of the future prosperity of the county will be dependent upon the agricultural development of the surrounding country. There is a district of about 30,000 acres north of Plant City, and there are two others of equal size, one north of Seffner and the other north of Thonotosassa. These districts are still in the formative stage and it is uncertain, as yet, as to when construction work on them will be started.

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

Agreement Reached in Famous Imperial Valley Suit

A settlement has been tentatively agreed upon by the litigants in the case involving the California Development Company and water rights in the Imperial Valley, California, whereby all properties will be taken over and operated by the farmers of the Imperial Irrigation District. The development became insolvent in 1907 and has since been managed by a receiver. Claims against the company totaling about $1,000,000 were entered by the Southern Pacific Railroad and the New Liverpool Salt Works.

The plan of settlement is for these two largest creditors to pool their damage claims, bid in the property at a foreclosure sale and then immediately convey it to the Imperial Irrigation District in exchange for the $1,000,000 in bonds recently voted by the district to buy the property.

One of the provisions of the agreement will be that dredges will be allowed to go into Mexican territory at once to clear the Alamo Canal for next summer's flow. A report presented at the conference showed the California Development Company to be a going concern with $200,000 in the bank and $900,000 in collectible water rates. In thirteen years the business has grown to 380,000 irrigated acres, producing annually crops valued at $16,000,000.

Iowa Men Form Section of American Waterworks Association

The Iowa section of the American Waterworks Association met for the first time at Iowa City, Dec. 3 and 4. J. H. Dunlap of the State university, issued the call and sent out a program on which are noted twelve papers and a round-table discussion, in addition to the business of ratifying the work of the committee in charge of the formation of the chapter.

Standard Oil Company Seeking Men for China Service

Representatives of the Standard Oil Company held meetings at the University of Illinois for the purpose of interesting students there in foreign service, particularly in China. Those selected for the positions are to be started at an annual salary of $2,000 a year, with a weekly allowance of $17.50 to defray their expenses while attending a training school in New York City.

Information obtained by this journal from the main office of the company, at 26 Broadway, New York City, is to the effect that it is still seeking men for the work, which consists of developing markets. While a knowledge of engineering is not essential, engineers should be well qualified to take up the work on account of their training and experience.

Fender Chains at Panama Tested by Vessels

On Oct. 26 and again on Nov. 16 the fender chains on the Panama Canal locks were tested by allowing vessels traveling at different speeds to run against them. The tests were made on Oct. 26 with the Allianca, and the position of the chain and vessel when the latter was stopped in two of the tests is shown in the accompanying views.

As a result of these tests with the Allianca, certain changes were made in the fender machinery, and on Nov. 16 the Cristobal, laden with most of her cargo from New York, was run against the chain. No data regarding the results of the tests are available, but presumably, lacking reports of difficulties, were satisfactory.





ALLIANCA TESTING THE FENDER CHAINS ON ONE OF THE PANAMA LOCKS

Left-hand view shows vessel, which had been traveling at a speed of 1.6 miles per hour, in contact with fender chain. Right-hand view shows vessel brought to stop from speed of 2.8 miles per hour. Deflection of chain at center of lock, 52 feet. Note in both cases rope casing of chain and timber mat on bow, to prevent damage to vessel.

The accompanying views were taken by H. U. Birdseye and were furnished to the Engineering Record through the courtesy of Henry Goldmark, who was in charge of the design and installation of the lock gates and fenders at Panama.

Work on $1,500,000 Pier at Baltimore Will Be Started at Once

In announcing the placing of contracts for its new $1,500,000 coal pier at Curtis Bay, Baltimore, officials of the Baltimore & Ohio Railroad stated that all work would be started at once, it being expected that the improvement will be ready for operation during the season of 1915. H. S. Kerbaugh, Inc., 6 Church Street, New York City, will construct the bulkhead and pier and do the dredging. The contract for grading was awarded to the Smith-McCormick Company, Northampton Bank Building, Easton, Pa. The pier will have a capacity of 10,000,000 tons per year, and is said to be the largest structure of its kind ever planned.

To Retain Engineers to Advise on Sealing Cedar River Reservoir

A. H. Dimock, city engineer of Seattle, has been authorized to retain engineers to advise with him on the sealing of Cedar Rapids Reservoir. An appropriation of $3,000 was made to pay for such assistance.

Committee Declares Electrification of Chicago Terminals Financially Impracticable

Commerce Association's Engineers After Four-Years' Study Give Minimum Cost as One Hundred Seventy-Eight Million Dollars

The complete electrification of the Chicago railroad terminals as a means of abating smoke is technically practical but financially impractical. This is the finding of the Chicago Association of Commerce Committee of Investigation on Smoke Abatement and Electrification of Railway Terminals, which has been studying the problem since early in 1911. The committee, in addition, holds that the elimination alone of the steam locomotive would produce a hardly perceptible betterment of the Chicago atmosphere, and urges the appointment of a permanent Municipal Pure Air Commission, which, through both instruction and coercion, would reduce all sources of air pollution to a minimum.

The association committee, as a result of its investigations, reaches the following conclusions:

That the minimum cost of electrification as a means in smoke abatement would be $178,127,230.

That the more probable cost, due to the necessity for improvements and rearrangements, which would be precipitated by electrification, would be $274,440,630.

That the least net annual operating deficit produced by electrification would be $14,609,743.

That Chicago, under the state constitution, cannot aid in meeting this expense.

That an arbitrary tax on terminal traffic to support the capital for electrification would constitute a burden upon the business interests of Chicago.

That the cost would be so heavy that no court would uphold an electrification ordinance.

That the Chicago electrification would equal the combined electrifications of the whole world, would involve problems never heretofore met, and would be the first ever undertaken for air betterment where terminals were adequate from an operating viewpoint.

That before the steam locomotive is eliminated pollution must first be reduced to a minimum from the three more damaging services, high pressure steam plants, metallurgical and other manufacturing furnaces and domestic fires.

That the steam locomotive stands third among smoke producing services, using but

12 per cent of the fuel consumed, and that its elimination would reduce the gaseous pollution of the air only 5 per cent and the solid pollution less than 4 per cent.

That electrification, hydroelectric and other long-distance transmission being inapplicable, would add power-house smoke in quantities sufficient to offset much of the gain through elimination of locomotive smoke.

That suburban passenger services, such as those of the Illinois Central and other roads, produce but 1.54 per cent of the total visible smoke, and 1.97 per cent of all the dust and cinders.

That electrification will involve at least 3476.4 miles of track.

That electrification would subtract only 1,291,282 tons of coal from the total of 21,208,886 tons now consumed annually.

That all smoke regulation in Chicago and elsewhere has erred in confining itself to the visible aspects of smoke, whereas the really harmful factors are the invisible gases and the solids of combustion, sulphurous gas and mineral dust in particular.

That Chicago air is polluted annually by the introduction of 304,391 tons of soot, dust and cinders and of 5,008,111,106,758 cu. ft. of sulphurous and other gases.

That, despite the fact that Chicago burns more coal annually than any other large city —eight tons per capita as against four for Manchester and one and one-half for Berlin —its air is better than that of most large cities.

That Chicago air has the benefit of better sun, wind and rain conditions than that of most other cities.

That the loop is the smokiest district, with the stock yards and South Chicago a close second and third.

That, in Chicago air, the products of combustion constitute only two-thirds the total pollution, the other third being due to avoidable and unavoidable dirt from the general activities of the city and from poor municipal housekeeping.

Mexican Government Contemplates Early Construction of Railways

The early construction of a large mileage of railways in Mexico is contemplated by the Carranza government, according to statements given out by Rafael E. Musquiz, inspector of that country's consulates in this country. The most important construction planned is a 500-mile line from Nuevo Laredo to Piedras Negras, along the Rio Grande, and thence to a connection with the Matamoras-Monterey division of the national railways. A 450-mile road from Monclova to the City of Chihuahua, which will traverse a region said to be rich in coal deposits and valuable minerals, is also proposed. Construction is to be resumed very soon on the Tampico to the City of Mexico cut-off, which was being built when the revolutionary troubles commenced.

New $2,500,000 Thames River Bridge for New Haven Road

The old Thames River bridge of the New York, New Haven & Hartford Railroad Company at New London, Conn., built in 1888, is to be replaced by a modern structure, which will ultimately carry four tracks. The new bridge and approaches, located about 185 ft. upstream from the present bridge, will cost approximately $2,500,000. It will consist of five spans, one a lift span of the Bascule type, electrically operated, designed to carry the heaviest loading now known to Eastern railway managers or contemplated in the future. The length of the spans will be, from east to west, 185 ft., 330 ft., 212 ft. and two 330 ft., with approaches 1300 ft. long on the west and 1600 ft. long on the east end. About 5000 tons of steel will be required. The superstructure is to be built for two tracks at the present time, but with a substructure to accommodate a future four-track bridge.

The end abutments will be of reinforced concrete, and the four piers must be carried down from 75 to 142 ft. to reach suitable bearing strata. The piers will be of concrete, faced with masonry between high and low water, three constructed by the open well dredging process and one by a pneumatic caisson. The extreme dimensions are about 42 x 98 ft., and about 48,000 cu. yd. of concrete will be required to construct all the piers.

The plans were worked up by the engineering department of the New Haven road under the supervision of Edward Gagel, chief engineer; I. D. Waterman, construction engineer, and W. H. Moore, bridge engineer. The engineers consulted in regard to the design were: E. A. McHenry, Gustav Lindenthal, J. T. Snow and Ralph Modjeski. The old bridge is to be given by the New Haven road to the State of Connecticut for use as a highway bridge.

Corps in Field to Monument New Jersey Ship Canal

An engineer corps to monument the center line of the proposed New Jersey Ship Canal has been placed in the field by the New Jersey Board of Commerce and Navigation. The canal is to extend from Bordentown, on the Delaware River, to Morgan, on Raritan Bay, a distance of about 33 miles. The type of canal has not been decided upon, but the plan proposed by the special board of army engineers contemplates a sea-level canal 25 ft. deep, with a 125-ft. bottom width, estimated to cost $45,000,000. B. F. Crosson, Jr., is chief engineer of the Board of Commerce and Navigation.

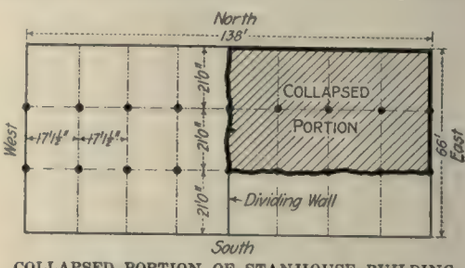
$51,300,000 Needed for Jersey Road System

In his latest annual report Col. E. A. Stevens, state road commissioner of New Jersey, estimates that $51,300,000 is needed to place the highways of the State in proper condition. "We must put on the job," said Colonel Stevens, "a body of experts, give them the power to get results and judge them thereby. We cannot afford any amateur trifling in our engineering nor any political interference in the administration of our roads. No legislation will satisfactorily solve our difficulties which ignores these principles."

Frozen Concrete and Weak Supports Wreck Building

Two Floors of Stanhouse Structure in Rockford, Ill., Collapse—Slender Form Posts Bend Under Load

Frozen concrete and form supports of 2 x 4-in. scantling, spliced in pairs and pieces and so slender that they were bent out of a vertical line by the load they carried, are believed to have been the cause of the collapse of two floors of the Stanhouse Building at Rockford, Ill., Nov. 19. Two laborers, who were removing the forms and had been at work only about



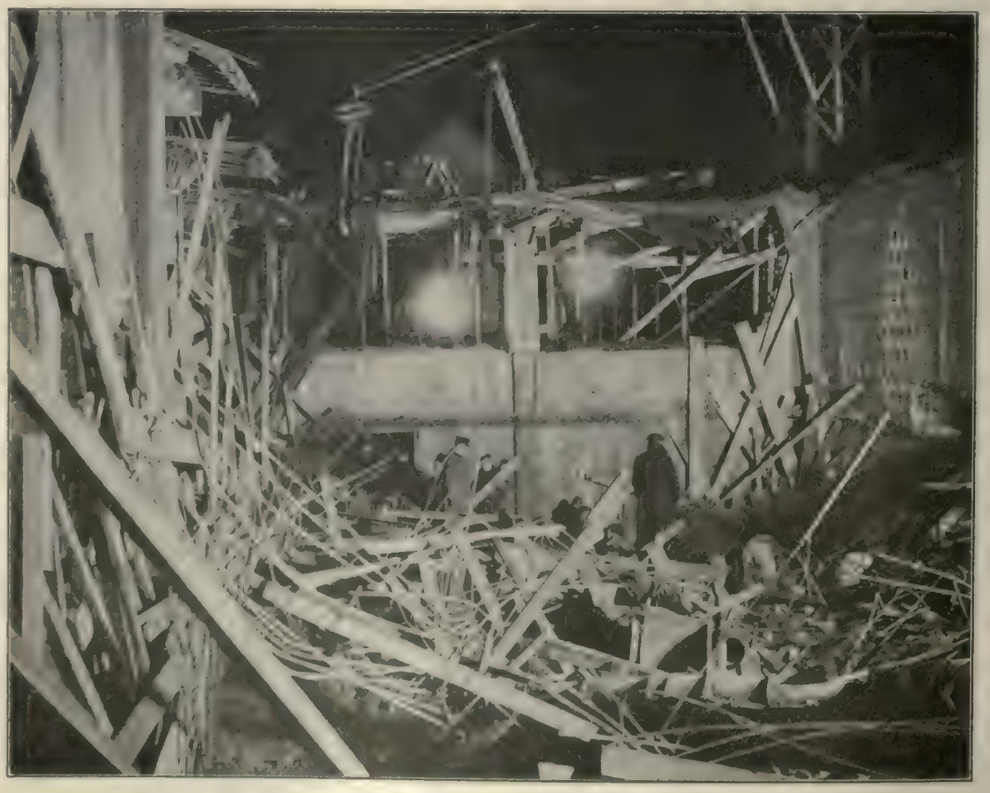
COLLAPSED PORTION OF STANHOUSE BUILDING

1½ hr. were killed by the falling débris. The wrecked structure was examined, shortly after the accident, by Ernest McCullough, consulting engineer of Chicago, and the following are extracts from his findings:

Ernest McCullough's Findings

The concrete from the second floor was not set and appeared to contain considerable frost. It lay all over the basement, most of it in as loose a state as the original materials of which it was composed. The steel was all clean, showing that the bond could not have been good. This seemed to be characteristic in many places of the steel stripped from the concrete on the first floor as well as that on the ruined second floor. Even the best of the concrete appeared to have been very greatly slowed up in setting and probably contained considerable frost. If this is the case, then the bond between the concrete and steel cannot be good anywhere in the building. Mr. McCullough's opinion is that all the floors now in place should be removed and new floors poured.

The contractor stated that the pouring of the first floor took place between Oct. 16 and



TWO FLOORS OF STANHOUSE BUILDING COLLAPSED, KILLING TWO LABORERS



FORM POSTS OF SPLICED 2 x 4-INCH SCANTLING WERE SO SLENDER THAT THEY WERE BENT OUT OF VERTICAL LINE

21, so at the time of the failure it was about one month old.

The sand, gravel and water should have been warmed, Mr. McCullough believes, and the building should have been inclosed with some form of artificial heat applied under the floor. The contractor stated that he warmed his sand, but did not warm the water or gravel and did not think the temperature was low enough to call for artificial heating of the structure during or after the pouring, nor for any extraordinary precautions. He evidently poured his concrete in the manner he would have poured it in good weather, except for the heating of the sand.

Concrete Was Frozen

Two pieces of concrete about the size of a man's fist, or slightly larger, were broken out of the edge of the first floor, still in place, and placed in a bucket of hot water. Before placing in the bucket an attempt was made to break them by striking on some steel bars. It was very difficult to break the pieces in this way, but they appeared moist to the eye and felt moist, or damp. After immersion in the hot water for three or four minutes it was a very easy matter to break them to pieces in the fingers, the edges sloughing off in the water. This test, according to Mr. McCullough, makes it apparent that the concrete was not fully set and that it contained considerable frost, or was frozen before it had set hard.

Form Supports Faulty

At the time of the failure the first floor had not strength enough to carry its own weight without the assistance of the forms and centering, and when the second floor was poured the additional weight had to be carried entirely by the supports under the first floor. The reason for the failure in Mr. McCullough's opinion, was the faulty form supports. In some cases the supports were 4 x 4-in. posts, but the majority consisted of 4 x 4-in. pieces made by nailing together two pieces of 2 x 4-in. stuff. A great many of these supports are spliced. That is, one piece is full length and the other half consists of several pieces, some two, some three and some four.

In the front of the building, under the portion of floor still standing, cross plank are nailed in two directions to the uprights, thus bracing them in two directions. The bracing is all horizontal, and none is at an angle. Not all of the uprights, however, have this cross bracing. The contractor claims that some of that now standing without cross bracing was braced at one time, but the braces had been removed. The uprights were examined for marks of nail holes to indicate that bracing had been used, but only a few were found, not enough to lead to the belief that even one-half of the uprights now standing had ever been braced. In the rear of the building all the uprights under the first floor are still in place and there are no cross braces there.

In the examination made, Mr. McCullough failed to find one perfectly upright support. All the 4 x 4-in. solid pieces were straight, but they were slanting. Every built up support is bent and those which are braced have two curves in them, in one direction in the lower half below the brace and one in the opposite direction above the brace. The unbraced pieces have very decided curves. One bulged over 6 in. at a height of 5 ft. above the floor.

It is believed that all the uprights started to bend when the concrete was poured and they continued to bend until the concrete set enough to relieve them of part of the load imposed on them. This bending was constantly taking place during the setting of the concrete, until it was wholly stopped on account of low temperatures and moisture conditions. Because of this movement the steel was all the time slowly moving and, therefore, there is no proper bond between the concrete and steel. For this reason, Mr. McCullough believes, all the floors are now unsafe and should be torn out.

Idaho Changes Policy Regarding Opening of Irrigation Projects

Irrigation projects will not be permitted to be opened in Idaho hereafter until the irrigation company having charge of the construction of the canal and reservoir system has water actually ready for delivery. This stand was taken by the State Land Board, in approving the contract for the Wickahoney Land & Irrigation Company, which will reclaim 30,000 acres of land in Bruneau County. Promoting companies in Idaho in the past have been permitted to sell water rights, before the water was available for delivery and, in some cases, permitted the settlers to occupy the land before the canals were built. The board also decided to supervise the construction of canals and to see that the systems are constructed according to the contract terms.

Washington Society of Engineers Celebrates Its Tenth Anniversary

The Washington Society of Engineers celebrated its tenth anniversary at a dinner held in Washington, D. C., Nov. 23. G. R. Putnam, commissioner of lighthouses, the president of the society, acted as toastmaster. Among the speakers were: Josephus Daniels, Secretary of the Navy; W. L. Saunders, president of the American Institute of Mining Engineers and vice-chairman of the Naval Advisory Board; Gano Dunn, consulting engineer and past-president of the American Institute of Electrical Engineers, and Arthur P. Davis, chief engineer and director of the U. S. Reclamation Service.

To Build New Type of Gravel Road on Lincoln Highway in Iowa

A new type of gravel road, recommended by the State Highway Commission, will be put in on the Lincoln Highway, west of Jefferson, Iowa. The first course of gravel will be laid 8 ft. wide in a shallow trench in the center of the roadway, using 600 loads of gravel to the mile. This will be rolled and a second course of gravel spread, and likewise rolled.

Three Engineers to Study Chicago Transportation

A new study of the Chicago transportation problem on a unified basis, including subways, is to be undertaken by three engineers if the recommendations of the local transportation committee of the City Council are adopted. One of the engineers is to be from Chicago and the other two must be familiar with the transportation problems of New York, Philadelphia and Boston. The investigation is to be financed from the city traction fund and is to be completed by March 1, 1916. That the report is to be a real step to solve the problem is evidenced by the co-operation of the surface and elevated officials.

South Carolina Drainage Levy Held to Be an Assessment, Not a Tax

In a decision handed down at St. Matthews, S. C., Judge Prince of the lower court held that the levy on property owners for drainage work was not equivalent to establishing and increasing the bonded debt of communities in which it might operate in a manner which was contrary to the constitution. It is not a tax, but an assessment. The law is invoked in a way similar to the law which allows levies upon abutting owners on streets in towns and cities where the required number of holders have subscribed to the petition. The suit was a friendly one and will be referred to the supreme court for a final judgment.

News of Engineering Societies

The Associated Engineering Societies of St. Louis held a joint meeting in that city, Dec. 1, to hear H. F. Hackedorn, president of the Hackedorn Construction Company of Indianapolis, and of the American Society of Engineering Contractors, on "Equitable Contracts and Specifications."

The American Society of Civil Engineers will hold its sixty-third annual meeting in New York City, Jan. 19-20.

The Washington Association of County Engineers and County Commissioners will hold its annual convention at North Yakima, Wash., Nov. 30 to Dec. 2.

The Engineers' Society of Western Pennsylvania will hear E. C. Brown, chief civil engineer of the Carnegie Steel Company, speak on the "Utilization of Iron and Steel Works Slags" at a meeting in Pittsburgh, Dec. 7.

The New England Waterworks Association will hold its December meeting at Hotel Brunswick, Boston, Dec. 8. Papers will be presented on: "Some Waterworks Experiences" by Caleb Mills Saville, chief engineer of the Hartford Waterworks; "The Middleboro, Mass., Reinforced-Concrete Tower" by George A. Sampson, civil engineer, of Boston, and "Causes of Explosions of Domestic Boilers" by William A. Bradford.

The School of Good Roads, established at West Virginia University under the 1913 State Legislature, will hold its third annual session at the university, Jan. 11-21, 1916.

The National Association of Bridge Contractors will meet in Chicago, Dec. 27 to 30.

The Oregon Society of Engineers, Portland, Ore., held a banquet, Nov. 18, at which J. C. Ralston, of Spokane, spoke on "The Broader Duties of the Engineer." The dinner was in the nature of a welcome to the students of the College of Engineering, J. L. Fouilhoux acting in the rôle of a college professor.

The American Association of State Highway Officials will meet in Chicago, Dec. 7 and 8, at the LaSalle Hotel. While all but the dinner Tuesday night will be executive sessions, the problems to be discussed by the members, highway commissioners and chief highway engineers, will be road construction, uniform road laws in the different states and government aid for road building. Joseph Hyde Pratt, Chapel Hill, N. C., is secretary.

The American Association of Engineers will hold its first convention at the Hotel LaSalle in Chicago, Dec. 10-11. Ways and means of co-operating with other organizations to advance engineering opportunity will constitute an important part of the deliberations. Among the speakers scheduled are: F. H. Newell, professor of civil engineering at the University of Illinois; T. B. Lambert, power engineer of the Chicago Telephone Company; Richard Yates, formerly Governor of Illinois, and J. H. Prior, chief engineer of the Illinois Public Utility Commission.

Personal Notes

W. B. SAUNDERS, formerly consulting engineer of Minneapolis, and previous to that a member of the field staff of H. M. Byllesby & Company of Chicago, has been appointed engineer for the Railroad and Public Service Commissioners of Montana. Mr. Saunders received his professional education at the University of Wisconsin and first engaged in engineering work on the forces of the Union Pacific Railway in 1901. He served with the Rocky Mountain Bell Telephone from 1903 to 1904, and with the Salt Lake Route for a short period in 1905. From the latter year until 1906 he was engineer and construction supervisor for the Michigan State Telephone Company, leaving that work to become assistant engineer in the U. S. Reclamation Service. He joined the forces of H. M. Byllesby & Company in 1910 and continued with them until 1913, during which time he made numerous large surveys and had charge of the construction of the Blue Earth dam and power plant near Mankato, Minn., and of similar work at Coons Rapids, near Minneapolis. He opened offices to engage in consulting practice in the latter city in 1914.

R. M. MORTON has been appointed engineer for the Sacramento County (Cal.) Highway Commission by the board of supervisors.

C. H. BRYSON, city engineer of Lima, Ohio, is in Los Angeles, Cal., on a four months' leave of absence. J. F. Cupp will serve as acting city engineer of Lima until his return.

W. R. HOLWAY, formerly connected with the Rhode Island Company, has been appointed to a position on the forces of the Providence Water Supply Board.

EDWARD GILLETTE, consulting engineer, of Sheridan, Wyo., has been appointed chairman of the board of review of the northern division of the U. S. Reclamation Service. He was graduated from Sheffield Scientific School, Yale University, in 1876 and was engaged for the next four years on the coast survey and the geographical surveys west of the hundredth meridian for the U. S. Government. From this work he went to the Rio Grande Western Railway, where he worked as locating engineer and chief draftsman for a similar period. During the following ten years he was locating engineer for the Chicago, Burlington & Quincy, with which company he also served six years as superintendent. He was superintendent of water division 2 in Wyoming for four years and engineer in charge of railroad location surveys for the U. S. Government in Alaska for one year. Following this he served for a four-year term as state treasurer of Wyoming, and, since 1911, has been engaged in consulting practice at Sheridan. In his new office it will be his duty to recommend the proper charges for the Government to collect from settlers on reclamation projects for water. This will necessitate examinations of the costs of engineering works, operation, maintenance of canals and the distribution of water, also the value of soil products, improvements and general conditions relating to the settler's business and financial condition.

H. E. BARTLETT, assistant engineer of the smoke abatement and electrification committee, Chicago Association of Commerce, for the last four years, has been made first assistant engineer of the Illinois Public Utility Commission. He is one of the early enthusiasts of the American Association of Engineers. From 1906 to 1910 he was in the engineering corps of the Missouri Pacific Railway Company.

T. MCLEAN JASPER, captain, 172d Brigade, Royal Field Artillery, writing from the training camp at Aldershot, England, states he has completed his course of instruction. By now he should be on the continent. He was formerly assistant engineer with Alvord & Burdick, consulting engineers, of Chicago, and later was secretary to the Chicago Wastes Commission. His wife is at her home at Treviddo, Liskeard, Cornwall, and letters may be addressed to him through her.

E. L. FULKERSON, secretary of the municipal waterworks of Waco, Tex., will be the administrative head of that department, performing the duties formerly discharged by the late S. J. Quay, superintendent of waterworks. Mr. Fulkerson is secretary of the Southwestern Waterworks Association.

L. A. CANFIELD, formerly deputy county engineer of Skagit County, Washington, has been appointed city engineer of Mount Vernon, Wash., succeeding John Meehan.

LEON L. MOISSEIFF, formerly engineer of design, Department of Bridges, New York City, has opened offices at 69 Wall Street, New York City, to engage in practice as consulting engineer. Mr. Moisseiff was graduated from Columbia University in 1895 and was engaged from then until 1896 with the New York Rapid Transit Railroad Commission. From this work he went to the Dutton Lock & Engineering Company of New York City, for whom he worked principally on the design of lift locks, drydocks, gates and lock improvements for the Erie Canal and the proposed Newark and Cohoes locks for a year and a half. In the latter part of 1897 he was appointed bridge engineer and draftsman in the department of street improvements of the Borough of the Bronx, New York City. He entered the department of bridges of the city in 1898 and continued in that service until recently, being engaged in work in connection with such structures as the Manhattan and Blackwell's Island bridges, over the East River and the Queens approach to the latter structure. He also prepared plans for reconstructing Brooklyn bridge and had charge of plans for the proposed Henry Hudson Memorial bridge, as well as of the design and execution of the work of strengthening the Williamsburg bridge.

CHARLES E. PAUL, professor of mechanics at Armour Institute, Chicago, has been retained as consulting engineer by the National Lumber Manufacturers' Association.

ROBERT J. LOVE and JAMES V. RICHARDS, architect and architectural engineer, respectively, of Chicago, have formed a partnership to be known as Love & Richards, for the practice of architecture in that city. Mr. Love was graduated from the University of Illinois in 1908. Since that time he has been employed by J. C. Llewellyn, Chicago. Mr. Richards was graduated from the University of Illinois in 1910. He has been with J. C. Llewellyn as well as Perkins, Fellows & Hamilton, Chicago.

W. A. CATTELL, consulting engineer of San Francisco, who so successfully filled the office of secretary-treasurer of the International Engineering Congress, has been retained by the Honolulu Rapid Transit and Land Company as a witness in the injunction suit brought by the Territory of Hawaii against that company. He will investigate the plant of the company and testify as to the physical valuation and cost of its property.

W. L. SEDDON, assistant to the president of the Seaboard Air Line Railway, and head of the engineering department, has been made vice-president of that company. Mr. Seddon was born in Virginia, and was graduated from the University of Missouri in 1884. His early engineering experience was acquired with the U. S. Engineer Department, with the St. Louis Electric Railway & Power Company and on the St. Louis waterworks. Most of the period from 1890 to 1898 he was in private business. His service with the Seaboard Air Line Railway dates from 1898. In 1901 he was given charge of all construction south of Columbia, S. C. Four years later he was made chief engineer, which office he held until January, 1913, when he was made assistant to the president. Mr. Seddon is a member of the engineering committee of the President's Conference Committee, the organization representing the railroads in the Government valuation work. He is also a member of the committee on yards and terminals of the American Railway Engineering Association.

WYNKOOP KIERSTED, consulting engineer, of Kansas City, is closing his Kansas City office on account of personal interests at Liberty, Mo., which will be his future address.

JOHN A. LOGAN, of the Logan & Gietz Construction Company of Elgin, Ill., has been appointed a member of the Illinois Waterway Commission at a salary of $5,000 per year by Governor Dunne of that State.

DR. H. P. CORSON, formerly chemist and bacteriologist at the University of Illinois, has been appointed sanitary chemist in the U. S. Public Health Service at Grove City, Pa. Dr. Corson received his professional education at New Hampshire College and later took post graduate work at the University of Illinois. He was appointed to his former position in 1911.

W. THOMAS WOOLEY, city engineer of Syracuse, N. Y., has accepted an appointment as city engineer of Schenectady, N. Y., same to take effect Jan. 1, 1916. Previous to becoming city engineer of Syracuse in 1913, Mr. Wooley served for two years as city engineer and architect of Schenectady. Before that he was city engineer of Auburn, N. Y., and engineer of the Public Improvement Commission of Hoosick Falls, N. Y. He was graduated from Rensselaer Polytechnic Institute in 1900.

CLAUDE E. COX, formerly assistant valuation engineer for the Chicago, Milwaukee & St. Paul Railway at Chicago, has been appointed engineer of estimates for the Union Station Company of that city. He entered railway service as a rodman on the Indianapolis & Vincennes division of the Pennsylvania Lines West of Pittsburgh in 1901. In 1904 he was appointed engineer in charge of location and construction for the Duluth, St. Cloud, Glencoe & Mankato, and in 1905 left that service to go to the Chicago, Milwaukee & St. Paul as assistant engineer in the office of the district engineer at Minneapolis. He was appointed assistant valuation engineer in 1912.

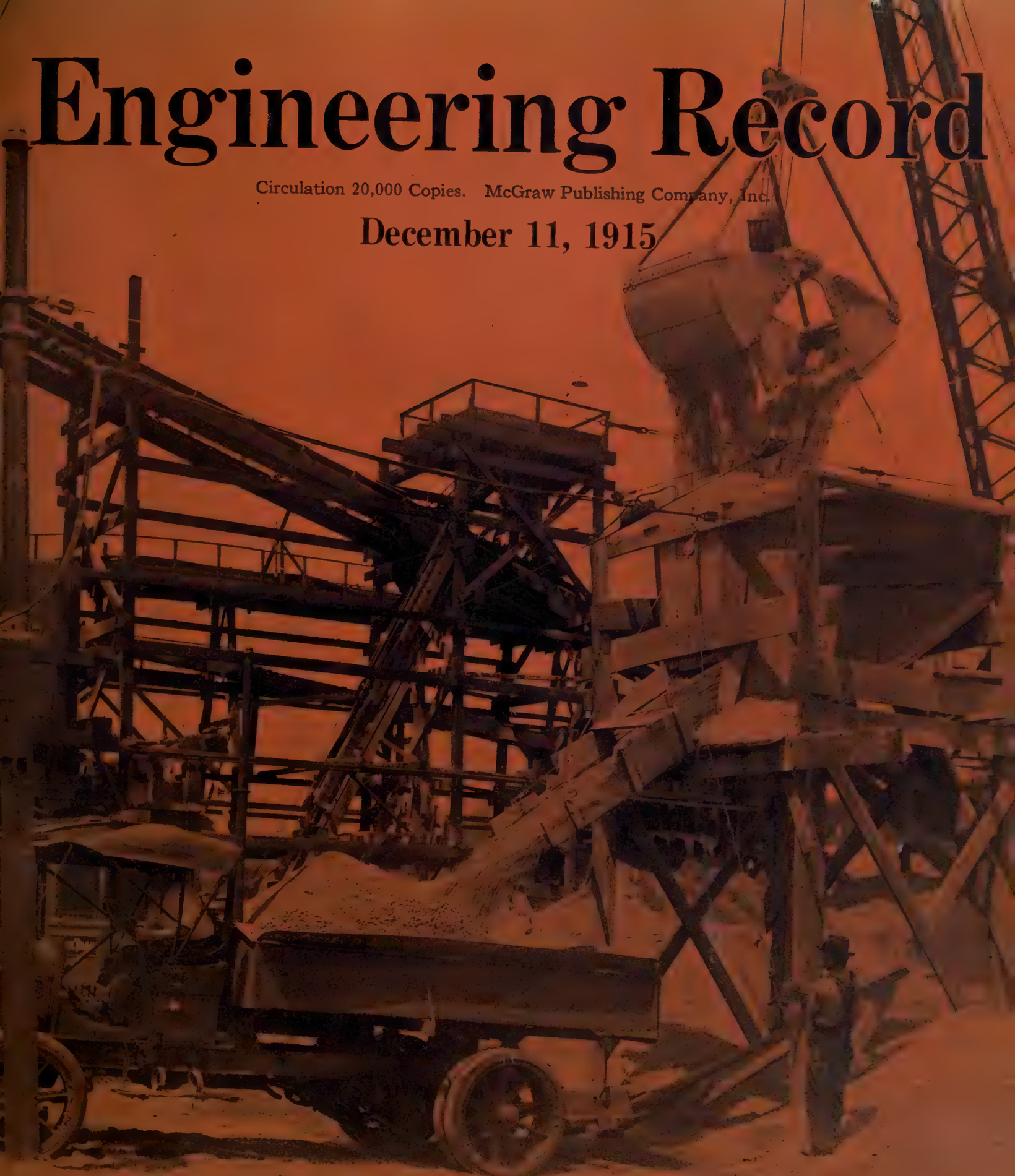
ABERTHAW CONSTRUCTION COMPANY, specialists in concrete, of Boston, has moved its offices to the recently erected Niles Building, 27 School Street, Boston.

MORRIS K. TRUMBULL, vice-president of the National Lumber & Creosoting Company, has been placed in charge of a new office of the company recently opened in the Commerce Building, Kansas City, to supplement the offices in Houston, Texarkana and El Paso. Previous to his entry into the lumber and creosoting field, Mr. Trumbull was for two years engineer of track elevation for Chicago, returning to his old company, the Chicago & Western Indiana Railroad Company, as principal assistant engineer in 1910.

Engineering Record

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December 11, 1915



The Motor Truck

No Longer an Experiment but a Permanent Addition to the Contractor's Plant

In this Issue:

Two Articles on

Motor Truck Economics

and a

LIBRARY



Architects: Bonfoey and Elliott, Tampa, Florida
General Contractors: McGucken and Hyer, Tampa, Florida
Roofers: Eagle Roofing and Art Metal Works, Tampa, Florida

On Tampa's New City Hall—

TAMPA is building this fine, new city hall at a cost of several hundred thousand dollars. The plans were open to competition and this interesting design was the winner. The size and nature of the contract naturally attracted the ablest architects and as the first-class architects of the country appreciate the superiority of Barrett Specification Roofs, this type was selected to cover the Tampa City Hall.

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The President's Message

DISCUSSION and more or less authoritative interviews had given the country some insight in advance into the military preparedness program outlined by the President in his annual message to Congress last Tuesday. The closing paragraphs, however, outlined a broader program for effective defense than had hitherto been hinted at from official sources, though suggestions regarding it had come from various societies and individuals. The President points out that there must be possible a mobilization not only of the country's military resources, but of its economic resources as well. Railroad experts, manufacturers and the leaders in technology must be brought in touch through systematic consultation with the directing officers of the army and the navy, in order that no means of strengthening ourselves for a contest may be overlooked. In making these suggestions the President is but repeating the ideas advanced by Mr. Dixon, on page 737 of this issue; the industrial preparedness program outlined by Martin J. Gillen, which was described in this journal Nov. 13, 1915, page 589, and the views expressed by various engineering bodies—excellent suggestions, all of them, to which the engineering profession will heartily say "amen."

For the Railroads

THOUGH his language is carefully guarded, it seems evident that the President at the end of his address was pleading for a cessation of anti-railroad legislation. He does not say that the railroads have been persecuted, he does not antagonize the radical element that has mercilessly persecuted the carriers; he pleads only for fairness, a study of the whole problem "in the full light of a fresh assessment of circumstance and opinion." He asks that a commission be appointed to investigate the railroad situation and that legislation await its conclusions. In theory no one could differ with this proposal. In practice one despairs of any good result, not only because the problem is so tremendous, but because any such commission appointed through Government agencies is sure to be overloaded with theorists. Practical railroad men seem to be taboo as advisers of the Government in its dealings with the railroads.

Planning with Pins

AT every turn the picture is demonstrating its usefulness as a means of conveying at a glance information which it would take pages of text to explain. But in spite of daily reminders from the press and the screen, engineers have been slow to adapt the pictorial form of recording facts to their own work. That it holds great possibilities as a time saver in aiding the administration of large-scale engineering operations is apparent to one who reads the story of Mr. Connell's planning board for the work of the Philadelphia Bureau of Highways. The planning board is essentially a picture—a large map of the city street system, on which the status of paving work involving 750 contracts is represented by pins of various sizes and colors. A white pin, for example, may indicate that contracts have been authorized, a red pin that work has started, a yellow pin that resurfacing is needed, and so on. With the pins adjusted each morning a composite picture of the work of the entire highway bureau is available at a glance, a result impossible of attainment with printed records of progress. Then, too, the planning board shows up, as no other method can, unbalanced work—the concentration of activities in one section of a city while other districts, fully as much in need of improvement, are neglected. It is also invaluable in routing new work. While it is applied, in Philadelphia, to highway administration, the planning board idea can be used in practically every line of engineering activity. The Philadelphia executives are so enthusiastic about its success that engineers elsewhere will do well to study its possibilities in their own offices.

Wet-Batch Rating for Mixers

IT IS a source of gratification that most of the manufacturers of concrete mixers now rate their machines on a wet-batch basis. That is, a machine called in their catalog a ½-yd. mixer will actually hold ½ yd. of mixed concrete, ready to be carried to the forms. Contractors without number have bought machines which they thought would give them ½ yd. of mixed concrete, only to find that the manufacturer based his machine on the volume of the unmixed material. These bulk larger than when incorporated as concrete, so that the actual output of a mixer rated on dry-batch measurement is less than the stated rating. There are still a few manufacturers who adhere to the former policy, but with few exceptions the wet-batch rating is now employed. The latter is the more logical in that it is the truer measure of what the plant can be expected to do in service.

Tribute to James B. Francis

ONE of the most pleasing tributes to an engineer to be found in contemporary technical literature is the article on James B. Francis in the 1914-1915 number of the annual historical volume published by the Verein Deutscher Ingenieure. It is written by Dr. Karl Keller of Munich, and is prompted by the fact that this year marks the hundredth anniversary of Francis' birth—a fact almost wholly overlooked in this country. The appreciation occupies fifteen pages of the volume, and describes interestingly, though briefly, considering the magnitude of Francis' work, the noted experimenter's developments in hydraulic lines. Chief attention is given, of course, to the development of the Francis turbine. The article closes with the following quotation: "As long as water shall find its way to the valleys, there to be used in turbines, the name of James Bicheno Francis will stand as that of a great hydraulic engineer." One cannot but feel gratified that amid the terrible tumult of the European war, scientific men can rise above the strife and bickerings to acknowledge the worth of work outside their borders, even among those who may have incurred the displeasure of the scientist's own people.

The Broad View

RAILROAD terminal problems are admittedly among the most complex which the railroad engineer is asked to handle. Obviously, they require thorough familiarity with terminal needs and a board grasp of railroad and municipal problems. In taking up the railroad situation in Dallas, Tex., John F. Wallace might have contented himself with the separation of the 160 grade-crossings in that city, preserving the present alignments, and with working out over- and under-crossing designs with a view to economy from the standpoints of construction and property damages. In fact, in his report, abstracted on page 722 of this issue, he does treat the problem comprehensively from this point of view. However, with a thorough understanding not only of railroad terminal needs, but of the municipal problems that hamper or make for the good of a thriving and aggressive city, he breaks away from this narrow consideration of the problem, and has shown the possibility of something better for the city than a network of elevated railroads cutting it up for all time. The conditions lend themselves admirably to the throwing of an intercepting belt line around the greater part of the city and shutting the bulk of the railroad traffic out of the inclosed area. A study of the plan showed it to be by far the best solution both for the railroads and for the city. He has taken even one further step, for he has pointed out how some of the rights-of-way can be turned into broad through streets, and made the framework of a real city plan. The conditions in Dallas seem to be quite favorable to the plan outlined. It is not so difficult at almost any city to intercept through freight business and send it around the city, nor to carry all passenger trains over one line to a union station. It is not often, however, that all local freight terminals are so placed near the loop and each other as to form virtually one terminal district immediately inside of the belt system. Nevertheless full credit must be

given to the broad character of a study which has ended in what appears to be a satisfactory solution from the standpoint of the immediate needs of the railroads and the city, and at the same time will greatly benefit the latter in its future development.

City Plan Supreme

IN CASE the belt line proposed by Mr. Wallace at Dallas is built, it will be interesting to see how long it will be before the tracks disappear from their present locations, if they ever do. In general, neither individuals nor corporations are educated to the making of sacrifices for the good of the city plan. The Dallas railroads that have the best locations will presumably object to surrendering their advantages, just as the industries along them will oppose being ousted. Even though new industries be forced to locate in the segregated districts, the old ones will doubtless want to expand; renewals of plant and equipment will be constantly going on, and a sharp line will have to be drawn somewhere. At Chicago, when the union station question was up, the railroads generally agreed that the line could not be drawn, and the resulting ordinance was something of a compromise. Nowhere else, however, is the problem as big or as complex as at Chicago. Mr. Wallace's proposal for Dallas is novel but rational. It seems only a question of time and education until the city plan is made supreme. Some European cities have already made it so.

What the Exposition Accomplished

LAST week the Panama-Pacific Exposition passed into history. Time must elapse before its influence can be rightfully gaged, but even now some of its accomplishments may be noted, for they stand out strongly and unmistakably. Probably the most important of its results is the better understanding in the East of the spirit and ambitions of the Pacific Coast. This is due to the advertising which the Coast received through the medium of the exposition and also through the visits of people from east of the Rocky Mountains. The number of Eastern visitors, it is true, formed a comparatively small percentage of the total number that passed through the exposition gates. Each of these visitors, however, on returning East is sure to spread his enthusiasm for the West and its people. As for the advertising, it is estimated that the publicity which San Francisco and the Coast received through the publication of special editions of magazines, colored supplements and newspaper and magazine articles, was equal in value, if it could have been purchased, to the total cost of the exposition itself. As an educational force, too, the exposition had high rank. Its value in this respect cannot at present be estimated. Finally, it must be said to the credit of the Coast that the exposition was entirely a Western product. Its success has been on the large scale for which the West is noted, the mere fact that it did not run behind financially making it stand out as a wonder in exposition history. This thought, too, should be coupled with an understanding that, unlike Chicago, Buffalo and St. Louis, a coast city has a tributary area which is a semi-circle, so far as available attendance from the vicinity is concerned. While in dollars and cents San Francisco may have made a good bargain in holding the exposition, the real accomplishment, even the Coast willingly grants, is far larger. The gulf between East and West is a step nearer to being bridged. Sympathy will be closer, divergent business points of view better understood, and greater unity insured for the carrying out of whatever projects the nation as a whole decides to adopt.

The Taxpayer and the Engineer

THE ADMINISTRATION of city government in America is often such that the taxpayer is continually losing money which the engineer ought to save him. Two flagrant examples of this sort have just come to public attention in New York City. Perhaps it is not fair to cite New York, as the arrangement in force there of having a State commission administer some strictly city affairs necessarily causes delay.

The city will lose heavily on the change of a rapid-transit route from the Queensboro Bridge to a new tunnel to be constructed for the crossing. The city depended on a contractor's offer to submit a bid not greater than a certain sum for the work. The facts overlooked, that the city could not accept this offer without advertising for competitive bids, and that gathering the information for other contractors to bid on would take not weeks but months, have caused a condition that will make the change more expensive than was counted on. Prices of steel and other materials have advanced by leaps and bounds, and the work cannot now be done for anything like the estimate of ten months ago. Indeed, the contractor has already called the city's attention to the fact that the time limit of six months on his offer expired last August. It will be remembered that the city itself delayed action on the matter for many months after the proposal was first made.

Again, in the matter of right-of-way for a pair of lower East River tunnels the State commission had driven a bargain with a certain dock company whereby the city would acquire at no expense to the taxpayers rights that will now cost them half a million in cash, and a further sum for extra construction expense. The city was to exchange property worth much more to the dock company than to the city for the right-of-way, with a cash consideration. This consideration was balanced by the agreement of the dock company to construct its new piers over the tubes, so that a sum about equal to the cash consideration, which would otherwise have to be spent to protect the shore ends of the tubes from damage by vessels, would be saved the city. Dilatory tactics indulged in by the city have caused the offer to be withdrawn. The public will never learn the lesson of such examples unless the engineer drives it home. The politicians are not interested in exposing their own mistakes. Engineers and engineering bodies who have popular influence or access to the daily press should not hesitate to use these means for a campaign of education. Such a campaign alone can put public management of engineering works on a better basis.

Preparedness—Its Application to Contract Work

PREPAREDNESS is the watchword of the minute. Its chief significance now bears on our military and naval establishments. To the civil engineer and contractor it should, however, have an added meaning—preparedness for a construction season which promises to be beset with unprecedented difficulties.

The situation has been emphasized in editorials in this journal the last two weeks. It will bear brief restatement. The steel market has risen sharply, so that higher prices must be expected next year, while the congestion at the mills is such that it is impossible for them to accept orders for early delivery. Four to six months are the terms now being quoted. The consequence is that important work will surely be delayed unless contracts are let for it immediately.

Nor are conditions, so far as the consumer is concerned, improving. Prices are still going up, while the quoted deliveries are later each week. Not only will it be difficult to secure the steel actually going into construction, but manufacturers of contractors' plant will probably have difficulty in getting adequate supplies. Already there is complaint on the latter score.

Under these conditions it is due the engineer and the contractor to be prepared—to get into the market just as soon as possible. That can only be done if the engineer will recognize his responsibility and see to it that his contracts are let at once.

Some engineers, evidently, are appreciating the situation, for contracts for tremendous tonnages of structural steel were placed in October and November. One fabricating plant reports that in the past three weeks it has closed a larger tonnage than ever before in its history, and that much of the volume was from those who ordinarily do not come into the market until late in February or early in March.

On the average, prices for reinforcing bars and shapes range 50 per cent higher than at this time last year. Other construction materials, undoubtedly, will move up in sympathy. In fact, the movement in cement prices is now well under way.

As an indication of what will happen in the equipment field, one manufacturing concern has recently announced that its new catalog would show price advances of from 40 to 60 per cent. Other manufacturers of contractors' plant, who are paying high prices in order to have available the necessary stock, will certainly be obliged to pass the increase along to the purchaser.

From every point of view, therefore, it is urgent that the engineer should act at once upon his contracts. He is the pivotal factor in the situation. He controls it absolutely, for no contractor will invest in new plant until his contracts are in hand. Furthermore, manufacturers of equipment

cannot well forecast the probable demand for their products until the engineer has signified what he proposes to do.

The engineer has a professional duty to his client, whether it be a private company or a governmental organization, to get into the market just as soon as possible. Delay is sure to be penalized.

Expenditures for Highways in the United States

THE Office of Public Roads and Rural Engineering of the U. S. Department of Agriculture has issued recently a circular (No. 52), the value of which is not to be measured by its modest size and appearance. The circular, prepared by the Division of Road Economics, presents for the first time a comprehensive statement of road expenditures in the United States. Its five pages of concise statistical information show what was spent for both local and State work in each State for 1914 (with the distribution of the State funds to administration, engineering, construction, and maintenance), the totals spent for State work since its inception, and the mileage of various types of roads, as well as the total accomplishment of the States and the mileage built in 1914 by State aid. Bringing together this information, scattered as it was through records extending over twenty years, has been a long and arduous task, and no small credit is due the Office of Public Roads for its inception and successful completion.

The circular has brought together all of the costs for State highway work so that there is a broad foundation on which to base similar data in the future. It is now possible to compare costs, progress and financial burdens of one State with another.

The statistics for 1914 are in considerable detail, requiring an almost incredible amount of labor to assemble. It would be supposed that local officials would make reports so that the State departments would have at hand information as to the cost of current work. If a given work is badly managed, to the extent that its cost records are incomplete, what is to be said for the management of the road work in nearly every State when it takes months to unearth a mass of figures which requires a corps of experts to put it into intelligible shape? It is significant that in very few States is it possible readily to secure road-cost data which mean anything. And under such lack of system there is spent annually in the United States $250,000,000. This large amount includes $75,000,000 spent under the control of the State highway departments.

The total that has been expended for State-controlled roads since their inception some twenty years ago amounted, at the close of 1914, to nearly $212,000,000. With this sum there have been constructed 35,500 miles of roads, at an average cost of nearly $6,000.

It is interesting to note the greatly increased cost per mile for 1914, when 6800 miles were built at an average cost of $11,000. This brings out forcibly the influence of changed traffic conditions—which are still in a transition stage. A very complex problem is presented that will require the best efforts of highway engineers to solve.

A study of the cost of engineering and administration in the different States is instructive. As the percentage cost for the States is not given in the Government's circular this has been computed for only a few States for our purpose. There is found to be a wide variation; thus in Massachusetts the cost is 8.4 per cent; in New York, 6.9 per cent; in California, 6; in Maryland, 3.2, and in Wisconsin less than 2 per cent. Whether these differences are due to management, to character of service rendered, or to the various systems of cost keeping, cannot be told; but there is probably more variation due to the latter than to the other two together. It is evident that there must be more uniformity in the cost-keeping systems of highway work if intelligent comparisons are to be made. Too precise conclusions, therefore, should not be drawn from these data.

The circular announces that it is the intention of the office to issue additional data as each year's work is completed. Future issues will be of increasing value, in proportion to the greater number of annual comparisons available.

Engineers' Interest in Preparedness

WHEN 300 men listen to after-dinner speeches from 9 o'clock until well past midnight without displaying the signs of unrest evoked by the usual brand of after-dinner oratory, there is just one inference to be drawn—that they are vitally interested in the subject under discussion. To anyone who was present last week at the annual banquet of the Brooklyn Engineers' Club it is clear that the technical man, as personified by this representative group of engineers, is vitally concerned in the question of military preparedness. The dinner committee of the club very shrewdly sensed this interest, and made "Preparedness" the keynote of the meeting, securing as speakers Major General Leonard Wood, commander of the Eastern Department of the Army; Admiral N. R. Usher, commandant of the Brooklyn Navy Yard, and others qualified to tell of the present status and future needs of the army and the navy, and how the technically trained man can serve his country in any program that Congress may adopt for national defense. A report of the meeting appears in the news section.

This is one way in which the engineering society can extend its field of usefulness. Primarily, of course, the engineering club or association is organized to deal with matters of strictly engineering interest, but many are now convinced that this is not the technical society's sole function. It has a large duty to perform with reference to questions of public policy. Until recently engineers have avoided these issues, largely because they were not organized to do effective work along these lines.

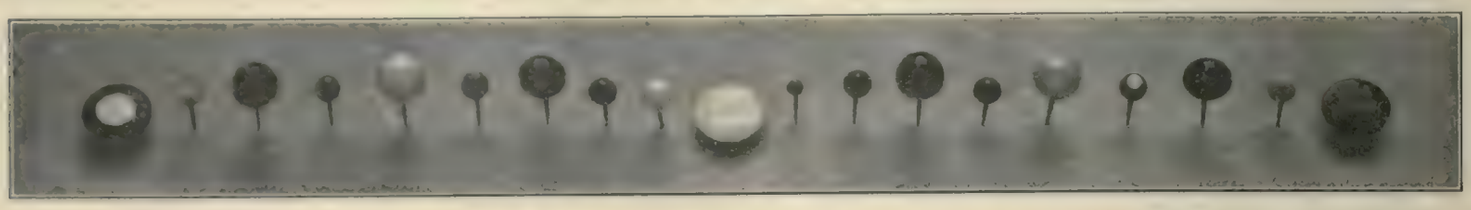
The tide is turning, and in the matter of military preparedness, depending for its effectiveness so largely upon the organization of the technical brains of the country, the engineer must play an important part. General Wood left in the minds of his Brooklyn audience no doubt as to the engineer's responsibility in the conduct of modern warfare. But in spite of the great need for his services, in case of a national crisis, there is, at present, no available machinery for preparing him in advance for the important duties which he would surely be required to perform. Every military authority emphasizes the fact that the untrained soldier is little better than useless, and yet there is no opportunity for the technical man to learn the rudiments of the soldier's duty unless he enlist for three years in the National Guard, a solution which does not carry a strong appeal to men with responsibilities which do not allow much time for outside interests.

Many engineers, however, would willingly devote a few weeks each summer to intensive training at military camps, such as the one established at Plattsburg this year. In fact, this is the plan which the joint committee of members of five of the national engineering societies—civil, mechanical, electrical, mining and consulting—has favored. At the Brooklyn dinner William Barclay Parsons, the committee's chairman, announced that a bill for an engineer reserve corps, to be recruited from men in private practice, had been drafted and would be submitted to Congress immediately. The scheme is to develop engineer officers for the reserve by brief tours of field duty and, possibly, by correspondence courses of instruction during winter. Mr. Parsons merely mentioned these two phases of the program and did not touch upon further details of the proposed legislation.

There are other ways in which the technical knowledge of the country can be capitalized for the purposes of preparedness. General Wood laid particular emphasis upon the fact that we are not giving our college students training in the fundamentals of military duty. Even students in the military institutions and the Land Grant colleges, where some training is given, are not gotten into camps of instruction under regular army officers and given the final training needed to fit them as efficient reserve officers. Harvard, Yale, Princeton and other great non-military universities have an opportunity of doing effective work in inaugurating military courses and counting these as part of the requirements for a degree, reinforcing this training by field service in summer.

The Brooklyn meeting is not the only evidence of the engineer's interest in preparedness. In addition to the activities of the national engineering bodies, the Western Society of Engineers, the Engineers' Club of Baltimore, have had preparedness meetings, while the Harvard Engineering Society of New York has appointed a committee to report on methods of military instruction for its members this winter.

These are straws in the wind. The engineer is beginning to see that he is a real factor in the Nation's defense program, and, seeing, he is laying the foundation of a course of military training, which will equip him to perform intelligently the duties of an engineer officer.



Millions for Paving Controlled by Handful of Pins

William H. Connell, Chief Engineer, Devises Planning Board Giving, on City Map, Daily Composite Picture of Status of Operations of Philadelphia Highway Bureau—Appraises Condition of 750 Contracts at a Glance

"HELLO! Is this the chief engineer? How long are you going to keep us waiting for that repaving work on Blank Street?"

An impatient Philadelphia taxpayer has phoned City Hall and is bombarding the Highway Bureau's chief, William H. Connell, with a volley of rapid-fire questions. "Is there any money available for doing the job?" the questioner continues. "Have Councils authorized the work? What kind of material are you going to use for the surfacing? How many of the streets in this territory are scheduled for repair and at what points will the work begin and stop?"

The taxpayer has sent in over the wire a large order to a very busy man. A visitor, who had been conferring with the chief when the phone bell rang, sensed the gist of the conversation and expected that Philadelphia's highway executive would employ the usual rubber-stamp methods of disposing of the inquiry by saying that he "would have the matter looked up" and answer the questions by letter when the information could be dug out of the bureau's files. Nothing of the sort happens. Instead Mr. Connell swings around in his swivel chair until he faces a huge city map, on the wall. It is not an ordinary map, for it is bristling with large-headed pins of every conceivable size and color, arranged in large and small groups and singly, with no apparent regularity. These pins Mr. Connell studies briefly, then turns to his phone and gives the taxpayer the information for which he has asked. There is no delay. The whole incident transpires within the space of a few seconds.

Planning Board a Time Saver

"You can readily see," says Mr. Connell, "what a great time saver that pin-dotted chart is. I call it a 'planning board.' Every street in the city on which work is contemplated or under way is marked with a pin whose size or color tells me all the information I need in order to know the exact status of the work in that section of town. With the entire city marked up in this way I can visualize in a moment's time how the work is going, where improvements are most urgently needed and whether I am neglecting one section of town in favor of another. It would be a hopeless task to try and get this composite picture of operations by rummaging through files and daily reports. This planning board solves the problem. It is not a toy, but a graphical clearing house of information on Philadelphia's highway work, which I find of immense value. Of course, we keep detail records of our proposed work and our contracts in the files, and it must not be assumed that the planning board can supersede these. It is, rather, supplementary to them. It discards confusing detail and presents the main facts about Philadelphia's paving work in picture form so that the data can be quickly and easily assimilated.

"You heard me give that man the information he wanted over the phone with the help of the planning board, but that is only one of its fields of usefulness. Primarily it is for my own information. It helps me route the work in my bureau intelligently and assists in laying out the schedules for my division and district engineers.

Philadelphia Paving a Big Problem

"Consider the problem we have to deal with here in Philadelphia," continues Mr. Connell. "The area of the city in 129 sq. miles; there are 1800 miles of improved streets and highways representing an asset, figured on first cost only, of $109,000,000. These city streets correspond to the 'plant' of an industrial establishment, and for keeping them in repair and new construction we are spending about $6,000,000 a year. It is absolutely necessary to keep this 'plant' in good working order, and after a paving contract is completed our real work, maintenance, begins. The operations of the bureau are on such a huge scale that before I introduced the planning board feature of keeping track of the work I often found myself lost in a maze of detail."

Mr. Connell glanced up at his board. "There is always the chance of introducing too much 'system' into the management of an office. I have seen examples of it frequently. What I mean is that one is apt to spend on systematizing more money than is justified by the results obtained. Now this planning board is nothing more than a large sheet of paper and a handful of pins which you can buy at any stationery store. One of my young engineers, receiving $82.50 a month, keeps the board up to date by spending less than 15 min. every morning changing the positions of the pins according to the developments of the previous day. The whole scheme is simplicity itself."

Every Color Has a Meaning

The planning board is the dominant feature of the chief engineer's office. As you enter the door you face it—an 8 x 10-ft. map, framed and hung on the wall with a row of concealed electric lights at its upper edge, following the lighting scheme in an art gallery. Every street in the city is shown by name on the map and is colored to indicate the type of paving. The symbols used are as follows: Unimproved roads, yellow; asphalt, blue; asphalt block, blue with black bands; concrete or granolithic, green; vitrified brick, red; slag block, red with black bands; granite block, purple; cobble or rubble, orange; macadam, brown; bituminous macadam, gray; wood block, black cross-hatching.

New paving is indicated by a dash line of the color corresponding to the kind of material used. This line is placed alongside of, and parallel to, the color area between the curb lines so that it may be readily distinguished. Obviously if the dash line were marked on the center line of the street the colors would merge and nothing would be shown, so that it is offset for emphasis. The ends of the dash line indicate the limits of the work authorized.

Pins of various kinds indicate the status of the city's paving work. On the chief engineer's board a large, white-headed pin means that a contract has been awarded and executed. When work starts the white pin is replaced by a red one. Large blue pins indicate work in progress by municipal forces and a large black pin is used as a "trouble marker."

Pins Classify Work

Pins with small, colored heads are employed for the detailed classification of authorized work. The following are the symbols for the pin markers: Green, grading; red, paving; blue, repaving; white, surfacing; brown, resurfacing; light blue, extensive repairs by municipal forces; gray, dust layer treatment; yellow, bituminous surface treatment; yellow with red dot, surface treatment urgent; yellow with white dot, material ordered; yellow with black dot, material delivered; small black-headed pin, ordinance pending; dark green, park, boulevard and special construction; large yellow pin, outstanding "tickler" (referring to reminder in letter files scheduled for attention on a specific date).

Visible Index Supplements Map

Of course, such information as dates, sums of money spent, etc., cannot be shown on the planning board, but this information is available in a cabinet alongside the map. The cabinet contains a visible card index. The cards, as shown in the accompanying illustrations, are filed alphabetically, by streets, and instead of being in boxes are arranged on vertical metal leaves which can be turned like the pages of a book. The cards indicate the proposed work and work in progress. Samples of the cards are shown herewith. When in position on the vertical leaves the top line of every card in the filing system is visible, and it is a simple matter if, for example, information on Chestnut Street is wanted, to turn to the C's in the index and pick out the card dealing with the section under consideration. This filing device was supplied by the Index Visible Company of New Haven, Conn.

Unbalanced Work

A very important feature of the planning board is its disclosure of what might be

Planning Board Gives Composite Picture of Paving Status in All Sections of Philadelphia by Means of 8 x 10-Foot City Map and Colored Pins

Type of Paving on Every Street Indicated by Colors—Pins of Various Sizes and Colors Show Where Improvements Are Needed and Progress of Work Under Contract—Locations of Pins



termed "unbalanced work"—giving one section of the city more than its fair share of improved streets to the neglect of another. Mr. Connell illustrates this very clearly. "See that bunch of red pins at the center of the map," he says, "and then notice this mass of white pins near the lower right-hand corner. The red means that work is under way, while the white shows that contracts have been authorized and nothing further done. Manifestly the work is not justly distributed, but this condition is the result of being dependent upon the old method of record-keeping, however thorough it may be, and I didn't realize this state of affairs existed until I started the planning board. It is explained by the fact that a live business men's association is constantly at work for good pavements in the area marked by red pins, while the people in the white area are not organized to look after their own interests so effectively. It is our job here, however, to show no favoritism and from now on the planning board will enable us to serve all sections of town impartially."

The planning board in the office of the chief engineer is not the only one in use by the Philadelphia Highway Bureau. Each division and district engineer has a similar board differing from the one at headquarters in that they give more detailed information than the chief's board. However, the general principle is the same and the colors and shapes of the marking pins are standardized throughout the department.

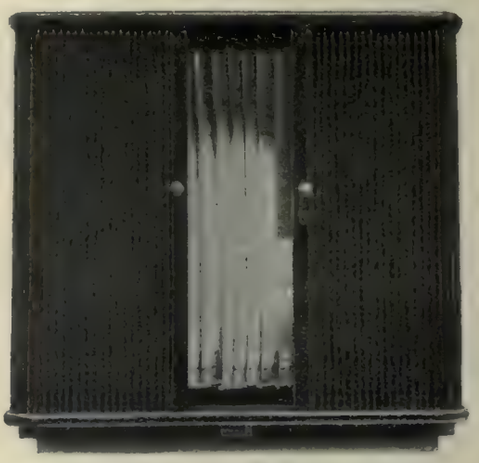


VISIBLE INDEX CARDS ARE CARRIED ON VERTICAL LEAVES AND CONTAIN DETAILED DATA ON PAVING WORK, SUPPLEMENTING INFORMATION SUPPLIED BY PLANNING BOARD

Instructions for District Engineers

Here are some of the planning board instructions as to the colors of pins issued to all district engineers:

Large red pin, a definite location in a dangerous condition, requiring immediate attention. Small red pin, a definite location requiring attention as soon as economically possible. Black pin, a definite location where repairs are desirable, but not necessary. Light blue pin, a street or road requiring general, but not extensive, repairs. Dark blue pin, a street or road requiring extensive repairs. Green pin, a street or road requiring repaving or resurfacing. Light green pin, a street or road requiring repaving or resurfacing which has been recommended to be placed under contract (this pin should always be placed beside a dark green pin). Large dark green pin, a street or road which the main office is placing, or has placed, under contract, or on which contract work is being carried on.



VISIBLE INDEX IS CONTAINED IN SMALL CABINET NEAR PLANNING BOARD

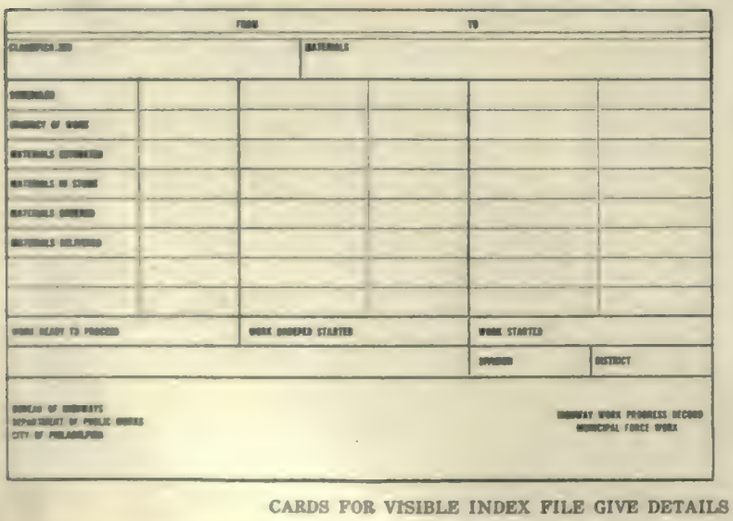
The following two additional pins are used in connection with country road work: Lavender pin, a road requiring general attention on shoulders and gutters, but not requiring patching. Amber pin, a road requiring surface treatment.

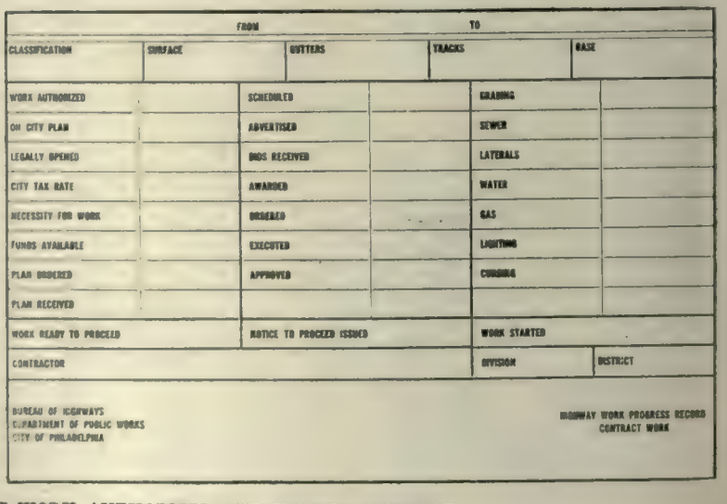
All locations reported on patrol or police reports or reported by complaint or otherwise are scrutinized and turned over to the man operating the planning board, and the location pinned. When finally repaired it is noted on the records and the pin removed. Streets requiring general or extensive repairs or repaving are handled in the same manner.

Route Sheets Prepared

The man operating the board in each district is the man who is detailed to take general charge of the paving gangs, and it is his daily duty to formulate, from the planning board, route sheets for each gang operating in the district. Great care is exercised in making out these route sheets to see that the locations are as close together as possible and also that they include the greatest possible number of locations where early attention is desirable, or which have been marked with the red pins.

Philadelphia's planning board scheme has been in service since last August, long





CARDS FOR VISIBLE INDEX FILE GIVE DETAILS OF WORK AUTHORIZED AND UNDER CONTRACT

enough to demonstrate that it is an efficient method of handling one of the big problems of large-scale highway department administration. It has not yet reached its ultimate development and minor improvements are constantly suggesting themselves. The board is an outgrowth of a realization on the part of Chief Engineer Connell that the running of a highway department is a business enterprise and, if the work is to be well done, methods of giving the chief executive immediate control over the operations under his direction, such as would be adopted in a big industrial establishment, must be followed in the efficient administration of public work.

New Method Renders Wooden Shingles Fire Retardant

A METHOD for rendering wooden shingles fire retardant has been developed at the Forest Products Laboratory, Madison, Wis., in an experimental way. The method consists essentially in treating the air-dried shingles with a solution of borax in water. The shingles are then kiln dried to about 10 per cent moisture and a second treatment with a zinc-chloride solution is applied. The shingles are again dried and are then ready for use. The solutions must be applied under heavy pressure, and retorts capable of withstanding high pressure are necessary, together with pressure pumps, measuring tanks and other comparatively expensive equipment. Therefore the method cannot be used except where large quantities are being treated.

Theoretically, the process depends upon the formation of an insoluble salt, namely, sodium borate, by the zinc chloride and the borax. This salt is practically insoluble in water, and fuses when highly heated, coating the cell walls and rendering them resistant to fire. It has been found that shingles treated by this method and soaked in running water for two weeks still retain their fire-resistant properties.

The treated shingles when subjected to strong heat will burn, but they will not burn with a flame. They therefore, prevent spreading of fire from one part of the roof to another by falling firebrands.

The process has been developed in an experimental way only, and thus far no shingles treated by this method are being placed on the market.



FIG. 6—HAND MIXING—LAYERED MATERIALS IN BED IN LEFT-HAND VIEW—CUTTING DOWN WITH HOSE AND SHOVELS IN RIGHT

Moving Pictures Show Need for Better Practice in Delivering Concrete to Forms

Second of Three Articles on Better Concrete—Abuses Common in the Handling of Sloppy Wet Mixtures

By NATHAN C. JOHNSON
Consulting Concrete Engineer, New York

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[*In the first article of this series, published last week, some considerations were presented in regard to the essentials concretes must possess to be strong and lasting, together with a discussion of the influence that reduced time, brought about by competitive bidding, has had on the mixing of the raw materials which are to form the concrete. An analysis of the operations in a mixer, by means of motion-picture studies, was also made, various undesirable and inefficient actions being pointed out and suggestions made for increased mechanical efficiency as a means of bettering the product, without proportionate increase of cost. In this article a like analysis of hand mixing and of transportation to and placement in the forms will be made, the several operations being considered both from the economic and the quality standpoints.*—EDITOR.]

HAND mixing, as commonly practised, has most of the bad elements of machine mixing, with additional uncertainty as to the incorporation of materials. One method of hand mixing in particular, characteristic of certain construction in New York City, requires only a pile of gravel, a pile of sand and a bag or two of cement, placed near the funneled opening of a vertical chute leading to the forms. Men with shovels throw now one, now another of these materials into the funnel, while a man with a hose runs water on them. Good or bad, sloppy wet or bone dry, all cement or no cement, the concrete goes into the forms, fills them and is paid for. The wonder is not that such concrete is sometimes poor, but rather that it stands up at all. It is to be granted that the mixing cost is low with such methods; not only is it reduced by the brief time required, but there is no overhead cost for machinery. However, it is so haphazard as to result as to

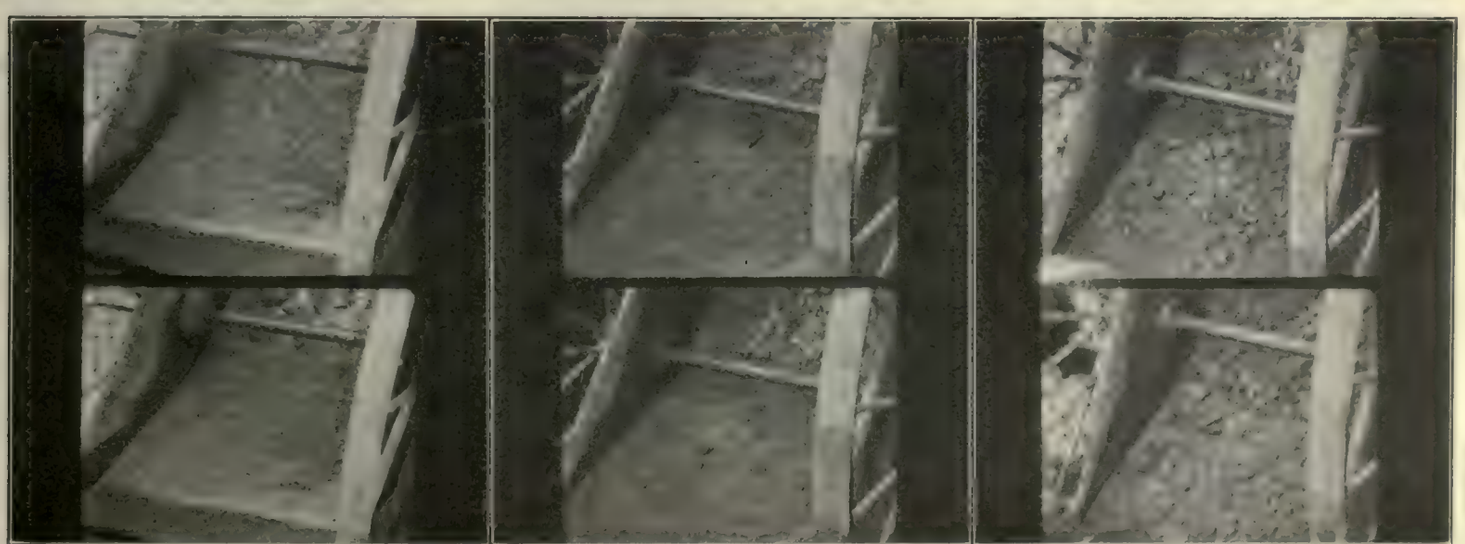


FIG. 7—MOTION PICTURE CAMERA SHOWS HOW MATERIALS SEGREGATE WHILE BEING CARRIED TO FORMS
Left—Liquid on top carries laitance and dirt with it. Center—Lighter sand and some cement come next. Right—Heavy stone and almost no cement or sand last; must ofter be scraped out with shovel.

be beyond the pale of intelligent approval.

In other hand-mixing operations the work is more carefully done. Experimental observation, together with the use of the moving-picture camera, indicates that the best of hand mixing can bring about as thorough an incorporation of materials as does the usual machine mixing, and even better than does such machine mixing as permits the materials to pass through the drum without any adequate interval between charge and discharge.

In one of these better classes of hand-mixing operations it is customary to spread the raw materials in more or less even layers, the final bed being about a foot in thickness, as in Fig. 6, left-hand view. These layered materials are then cut down with shovels, while the hose is played on the mass, as in the right-hand view, Fig. 6. This "mix" is then shoveled directly into concrete barrows and taken to the forms. Viewing the character of results obtained



FIG. 8A—CONCRETE SPILLS FROM BARROW INTO FORMS; FIRST THE LIQUID IN A RUSH, THEN HEAVY PORTIONS MORE SLOWLY

in this way, some portions showing bare aggregate with no cement, and others sloppy wet, but with no stone and an indefinite proportion of sand, what the poorer methods of hand mixing must produce is not hard to conjecture.

DUMPING INTO FORMS

Remembering the almost unavoidable lack of initial incorporation due to such inadequate methods as the foregoing, whether machine mixing or hand mixing; and remembering further the sloppy consistency that is customarily favored, particularly in reinforced-concrete construction, without production of heavy-bodied grout, it is of interest to examine the behavior of concretes after mixing, during the several operations before they reach their final position and solidify.

It becomes of importance, then, to observe closely so simple a process as the dumping of a barrow-load of concrete into the forms, to see if proper relations are maintained. In Fig. 7 is shown in composite photograph this operation as caught by the motion-picture camera. It is noticed that the liquid top goes first into the forms, carry-

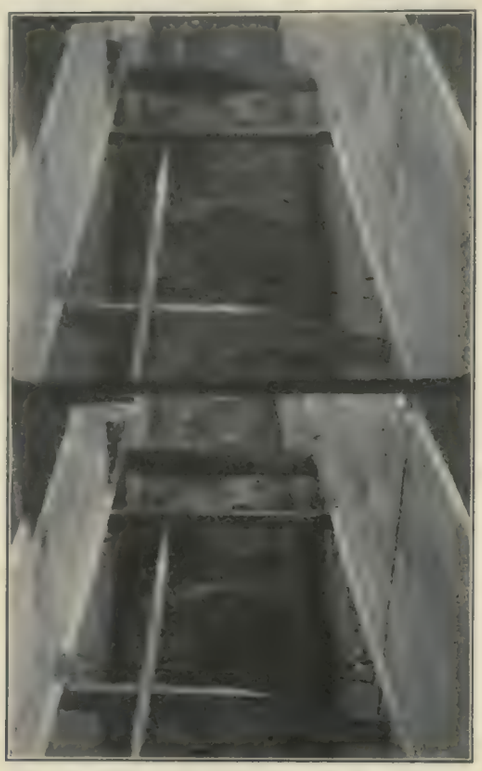


FIG. 8B—DUMPING BEING DONE FROM CONVENIENT RUNWAYS; HEAVY MATERIALS ARE PILED UP AT THESE POINTS

ing with it the dirt and scum and light particles called "laitance." A poor bond, these, yet they are going first into the forms, where they will coat the concrete last



FIG. 8D—DEEP WATER POOLS FORMED

poured. It is often argued that "averaging," or automatic, even distribution of overlying through lower strata occurs by gravity. Field concretes when sectioned do



FIG. 8C—WATER AND LIGHTER PORTIONS OF CEMENT, LEAVING STONE NEARLY BARE, HAVE RUN TO LOWEST PARTS OF FORM

not, however, attest the correctness of this supposition; nor even if it were correct would it overcome this coating action, particularly if concrete previously deposited has set.

After this first rush of dirty fluid, comes the gray of the finer cement and sand, in a sort of soup that constantly thickens with increasing quantities of coarser cement and sand as the pouring goes on. Next comes the heavier sand and finer stone, sometimes washed nearly clean of cement; and at the bottom of the barrow lies the heavier stone, which, refusing to flow, has to be scraped

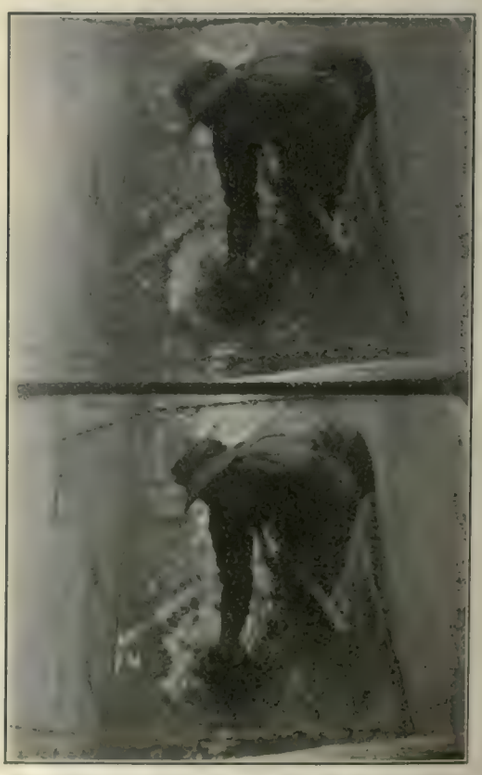


FIG. 8E—POOLS MAY BE SCOOPED UP BY HANDS OF MAN WITH HOE

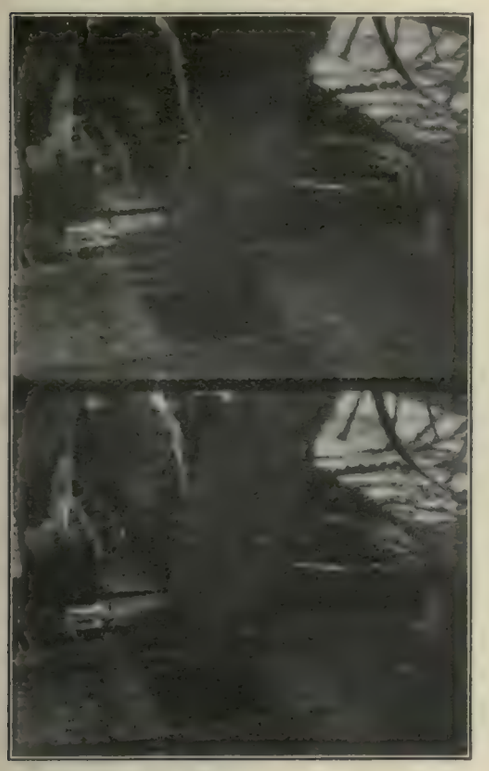


FIG. 9—EXTREMELY WET CONCRETE GOING INTO BEAMS AND ROOF SLABS OF REINFORCED BUILDING

out with shovels. All this is done in a few seconds—not more than a minute after the mixture was delivered by the mixer, for the cost of placing must be kept low—yet the materials have become almost completely separated. A little more time, as in a longer haul to the forms, and this separation, or "segregation" might be complete.

But what of the mass in the forms? How does it lie—in layers, as it went down? What of its endurance? And what of its strength? Is careful design useless? Or is the concrete being used in such bulk, regardless of initial cost or actual possibilities, that nothing would matter, save almost total lack of cement? The answer is that consciously or unconsciously, "Everybody's Doing It," and is "getting away with it"; and if Luck turns thumbs down and if something happens in the far-off Future, there are so many inanimate things that can be blamed when the time comes that the risk is held to be negligible and unworthy of consideration compared to present profits.

If the practices illustrated above occurred only in isolated and infrequent instances they would have little bearing on the general quality and endurance of concretes. Unfortunately, however, they are all too prevalent; and although their impropriety is recognized when pointed out, they are yet of general daily occurrence and will continue so until more general understanding is had of their economic fallacy. When this understanding becomes general, such procedure in the manufacture and placing of concrete will be no more tolerated, by owner, engineer or contractor, than would the distribution of fire-producing chemicals throughout the structure of an inflammable building. Under certain favorable conditions the two might prove equally potent for trouble and damage.

MATERIALS SEGREGATED

The preceding discussion and the photographs of Fig. 7 covered the dumping of the concrete into the forms, viewing that operation from the outside. Fig. 8 shows the concluding phases of this operation, viewed within the forms, as the concrete is received from the barrow and settles into final position. Although the time interval shown in the few pictures of each section of this illustration is very brief, in the first section may yet be seen a marked slackening of the flow from the barrow as the more liquid portions pass off in the first rush, leaving the slow-flowing, heavier particles behind through segregation. The same first rush of liquid and slackening as the solid materials passed over, was observed in the pouring from the barrow in Fig. 7.

But as this delivery to forms continues certain features of the received mass become prominent. It is natural, in order to keep down the placing cost per yard, that as few temporary structures as possible should be built. For this reason one or two runways only per section of form are provided for the barrows; and this necessarily results in a heaping of materials at points adjacent, with less materials at other portions of the forms, which are left as low spots. But since, for economy of time, this concrete has been mixed not more than 22 sec.; since it is sloppy wet, in accordance with tacitly approved procedure; and since it has become segregated, or separated, because the heavy-bodied, sustaining cement grout possible of production with adequate incorporation of cement and water was not produced in the initial mixing, the lighter portions—water, cement and light sand—run off the piled-up portions directly below the barrow runways and into the lower places. But in doing this these valuable and necessary materials leave bare stone piles behind them, while they themselves form knee-deep pools of uncertain composition and questionable final value, which the man hoeing the heavier materials down toward them is perhaps obliging enough to scoop up with his hands, in order to show it as wholly fluid.

But what of the endurance of this concrete? Is it, or can it become, through subsequent "averaging," sufficiently uniform in composition to meet the stresses for which it was designed, unless, as was before pointed out, it has been provided in such bulk, regardless of first cost, that there is really no design operative which is worthy of the name? And, should this concrete be subject to water action, will it be found sufficiently impervious to prevent percola-

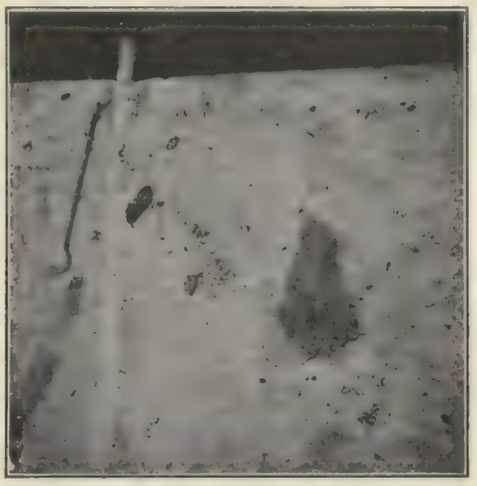


FIG. 10—SHRINKAGE CRACKS CAUSED BY EVAPORATION OF EXCESS WATER

tion, solution and disintegration, even though its surface defects be covered, according to custom, by floating after the forms are stripped? And if it should fail, shall the cement be blamed, or the aggregate? Even though it were granted, for the sake of argument, that less than first-grade materials were used, the abuses of making and placing, brought about by the false economy of ruthless speed, are too glaring in this case to make either cement or aggregate the scapegoat.

The ultimate loss, however, falls on the



FIG. 11—UNMAGNIFIED PHOTOGRAPH SHOWING WATER VOID WITH MUD OR LAITANCE AND SHRINKAGE CRACKS IN CONCRETE FROM DEFECTIVE STRUCTURE

owner. Cement is a wonderful servant, standing much abuse. Trouble will probably be some time in coming and by then the contractor will be paid and away. Nor has there been any moral obtuseness on the part of the latter. He has done his work probably as well as he knew how, in full accordance with average practice, and as carefully as his bid rate-per-yard has permitted with the making of a reasonable and fair profit.

Obviously, the remedy lies first of all in better understanding of concretes, not on the part of those whose knowledge is beyond question, but on the part of the great army of every-day workers, on whom dependence must so largely rest. If improved methods of mixing can be produced which will secure better results without increased cost the problem is much simplified, but if this cannot be accomplished, there will have to be an economic readjustment all along the line, with the securing of better quality concrete and a proportionate recompense to the owner in the quality and endurance of the structure he has purchased.

Passing mention has been made to the sloppy wetness of the average concrete. The evils of old-fashioned dry concretes, tamped into place, are usually cited in support of the use of sloppy mixtures, as well as the greater convenience of the latter. It is certainly to be granted that very wet concretes are easier to mix and to place than are dry concretes, particularly in reinforced work, where the mixture has to flow into odd corners and maintain close contact with irregular shapes of steel. This applies with special force in building construction, where the various structural members are of small section, as compared with other classes of concrete work. But while the time cost of placing, for sloppy concretes, may be much lower than that of a less fluid concrete, which would require puddling and longer mixing, it is by no means to be conceded that the results obtained with the former are superior to those that more advanced practice produces, or even that their economic features offer sufficient inducement for their continued use in the face of their disadvantages.

Excess Water Causes Cracks

In Fig. 9 is shown an extreme example of such sloppy-wet concrete applied in reinforced building construction. The usual period of mixing was allowed on this concrete, yet even as it was going into the forms, segregation was observable, while over their tops and from their every joint poured streams of water to form lakes on the floor below, while everywhere, over the finished surface, were puddles and pools of water that slowly evaporated in the sun.

But what is to take the place of excess water lost after the time of initial set? Since it occupied space, it must, if lost, leave a void behind. And what of those dissolved products lost with it, which once were part of that cement, purchased at such high cost? And how closely related and knit together are the strong, inert particles of aggregate between which lay the lost water, forcing them apart by its presence in the mass?

The answer is seen on every hand. Shrinkage cracks, such as those appearing within four hours of placing on the surface of this same structure and shown in Fig. 10, together with a myriad others not seen, penetrate the concrete on every hand, cutting down its strength, as any planes of cleavage must. If protected by a moist atmosphere it is true that these may heal through the production of colloid and slow hydration of cement. But in order that form costs per cubic yard may be kept low it is customary to strip forms for re-use as soon as the concrete is at all self-sustaining, so that rapid drying in the air in a large measure precludes this possibility. Concrete may be "good enough as it is," yet there are few who would not rejoice to see it bettered.

But lest the thought occur that these statements are hypercritical, in Fig. 11 is shown, full size, a fractured concrete, taken at random from a massive structure. It will be observed that here the water space is of very appreciable size and that radiating from the main fissure are smaller fissures and pores of indefinite direction and depth. Certainly these pores and fissures, whether full of water or air, possess no structural strength. Since like fissures are prevalent in concretes the conclusion is inescapable, because structures of concrete stand up and are useful, that general practice must be to use concrete in enormous bulk at low stresses, without regard to first cost or secondary losses due to restricted useful space, in order that those objectionable practices which have become habit may be followed undisturbed. It is not exaggeration to say from what is indisputably known as to the possibilities of concrete that once there is secured a general appreciation of the unfortunate results of improper procedure, and particularly if more efficient apparatus is devised by which better procedure will be made economically possible, that present products and practices will be looked back to as belonging to the dark ages of concrete. It is the history of every industry; and the many able investigators throughout the world engaged on concrete research are bringing the time of realization close to hand.

In further connection with the use of sloppy concretes for the saving of money, an amusing phase of the situation may not be unappreciated. Each bucket of excess water in concrete takes as much space as half a bag of cement. Two buckets could replace a whole bag of cement on a basis of volumes. True, eight extra buckets of water per yard would change 1:2:4 concrete into 1:2½:6 concrete or worse, but the mixture will probably stick together pretty well and no guarantees of endurance are asked or given. And think of the total saving! Holding out a sack or two of cement per batch is rarely or never thought of nowadays by anyone. The gentler and albeit unconscious method of achieving the same end, approved by nearly everyone, is to *add water.*

[*The next article, which will appear in an early issue, will take up other phases of the problem of concrete manufacture as shown by motion-picture studies. Particular reference will be made to the spouting of concrete and its uses in special classes of construction, together with further studies of the effect of excess water on the quality of concrete.*—Editor.]

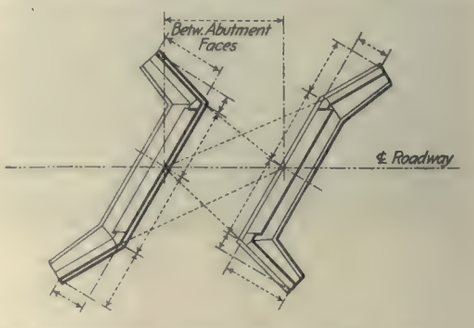
Prices of the Materials that go to the making of dynamite rose from 18 to 585 per cent between July, 1914, and August, 1915, according to figures compiled by the *DuPont Magazine.* The price of sulphuric acid has risen 476 per cent to $75 per ton, while the price of saltpeter has risen 240 per cent and that of glycerin 33 per cent.

Skew Abutments Laid Out Without a Transit

Wisconsin Highway Commission Uses Standard Plans—Sides of Triangles Computed to Locate Determining Points

In many parts of Wisconsin the highways follow section lines closely, and since the streams do not always flow toward any of the four cardinal points of the compass, it is often necessary to build skewed bridges. In the cases of trusses this complicates the shop work slightly, but I-beam or plate-girder steel bridges can be built on a skew without increasing the shop work materially.

It is not usually possible to have a transit on the ground to lay out the skews and so in the early designs of the Wisconsin Highway Commission it was customary to show



MEASUREMENTS USED IN LAYING OUT A SKEW WITHOUT A TRANSIT

skews by means of offsets from lines at right angles to the center line. This method, however, gave great opportunity for error and a simple and more accurate method has recently been devised, utilizing instead dimensions for three sides of a triangle.

The location diagram shown herewith gives the distance along the center line between neat work of the two abutments, and these points are staked in the field. The distances from these points to the points where the wings turn back are computed, and these points may then be laid out by two measurements. The direction of the wings is given by right angle offsets from a continuation of the line of the face.

The idea previously explained in the Engineering Record of Dec. 4, page 688, has been utilized in the preparation of standard designs for skewed abutments for I-beam bridges. Typical drawings have been prepared, one for the case where the skew is right-hand forward and the other for the reverse, and the zinc etchings and printed copies made. These are used as previously explained except that no effort has been made to standardize dimensions nor calculate quantities in advance.

Forty Miles of Concrete Road have been laid this year in Milwaukee County, Wisconsin, outside of the city limits of Milwaukee. H. J. Kuelling, county highway commissioner, states that this now gives nine different routes complete to the county limits. Last year 33 miles of concrete road were built. The percentages of the various types of the 100 miles of improved roads in the county are as follows: Concrete, 86 per cent; sheet asphalt, 7 per cent; brick and sandstone block, 2 per cent; tar macadam, 2 per cent; waterbound macadam, 3 per cent. Plans for 1916 and 1917 include a 40-mile loop around the city of Milwaukee connecting the radial routes.

Keep the Wheels Turning to Make Motor Trucks Profitable for Contractors

Hire Best Drivers, Keep Trucks in Good Repair and Provide for Quick Loading and Discharging, Says Manager of Motor Haulage Company

TO KEEP the wheels turning is the secret of making the motor truck pay on contract work, in the opinion of Clinton Bretell and R. H. Matthiessen. These men, under the name of Motor Haulage Company, have been doing a paying business for some time in hauling materials for road contractors and others in the vicinity of New York City. According to them, if teams are to be replaced by motor trucks with economy several conditions must be met. The trucks bought must not only be good, but must be kept in first-class repair. Only first-class men should be put in charge of motor trucks. The hauling should be done over roads the greater part of which are good enough for a speed of at least 6 miles an hour, and roads which permit a speed of 8 or 9 miles an hour make the use of motor trucks much more profitable. Mechanical loading and rapid dumping are almost necessities if motor trucks are to show a profit over horses.

KEEP TRUCKS IN GOOD REPAIR

The waiting time of a team and wagon seldom amounts to more than 50 cents an hour. The waiting time of a 6-ton auto truck is seldom less than $2 an hour. For this reason, even discounting the additional delay to the contractor's forces from having a larger unit put out of service, a motor truck soon eats up all the profit it has made if it is allowed to get in a condition where breakdowns are frequent. The loss due to a day's delay, when there is work waiting for the truck, will offset the price of new drive chains, and the man who fails to buy new parts when they are needed soon pays more than their value in time lost from having his trucks laid up. Like all other machines, when one part of a motor truck is kept in service after it is badly worn, other parts begin to wear more rapidly than they should, and general breakdown soon results.

One hundred thousand miles is not too much to expect of a well-cared-for motor truck before upkeep becomes so high that it pays to buy a new truck. A good truck, properly used, however, should pay for itself in four years and still show a very fair profit. This length of time should be used in figuring depreciation. Seven thousand miles may be expected of a good set of rear tires when hauling only on paved streets, but for hauling road materials, where a large mileage is made over rough going, 5000 or 6000 miles is all that can



DRIVER IS IMPORTANT FACTOR

be asked. Front tires should give considerably higher mileage. Drive chains will last 7000 miles before they stretch so as to wear the sprockets unevenly, and to cause frequent broken links. When this happens they should be replaced at once. Old chains need not be scrapped, but may be taken apart and the little-worn pieces used in repairing other chains.

When a frame breaks, or a car is wrecked, it must be taken to the shop. Nearly all other repairs, however, can and should be quickly made in the field by the driver. Spare parts, even to extra springs, are kept on hand by the Motor Haulage Company and distributed to the different trucks as needed in a light runabout. The drivers and Mr. Bretell himself watch all the trucks closely. At the first sign that a new part will be needed, that part is bought and kept on hand. When the old part wears so as to attract attention in running, or even before that, it is at once replaced. These men have found that it does not pay to use parts until they are entirely worn out or break. The delays to operation and the strain and wear on other parts make such a course very expensive in the long run.

GOOD DRIVERS A NECESSITY

The best drivers to be had are considered a good investment by Mr. Bretell, and should be for any contractor. These men not only know their trucks thoroughly and how to drive under all sorts of road and traffic conditions, but they also know something about the work of the contract on which they are employed. A stupid driver, who has not a rough general knowledge of how contract jobs are worked, nor how to handle his truck so as to keep that end of the job going, can cost a contractor a great deal of money. As with all other classes of labor, generous dealing with good drivers has been found to pay well. Men employed by the Motor Haulage Company frequently work at odd times and on Sundays to keep their trucks in shape. It is made worth their while to do this, and they do it gladly. The result is contented employees and greater efficiency.

ROADS A BIG FACTOR

To compete with the horse, motor trucks should make at least twice his speed. This means that in going where a greater speed than 4 miles per hour is impossible for any vehicle, the horse will have the advantage. However, such places are becoming rare, and only include the worst conditions under which hauling can be done at all. A short stretch of haul over subgrade on a road job, even where a culvert or so has not been placed, does not make hauling with



SHORT STRETCHES OF THIS SORT OF ROAD DO NOT BOTHER MODERN MOTOR TRUCK



QUICK DUMPING ON ROAD WORK

motor trucks unprofitable. It also takes a succession of extremely steep and bad hills to put the modern motor truck out of the race.

Short hauls are less profitable, because of the multiplied waiting time in loading and unloading. Where first-class facilities requiring stops of little more than a minute at each end are at hand, round-trip hauls of little more than a mile have been made profitable. Loading with chutes from an overhead bin, with a grab bucket, or with a steam shovel, are most necessary, and holding a large-capacity truck an hour or so on each trip to load it by hand soon eats up all the saving it can make. Unloading should be done by dumping the material in a pile, or by spreading it on the return trip. This last was done recently with economy in building a macadam road near Little Ferry, N. J., where trap rock was



QUICK LOADING IS ESSENTIAL

spread. In this instance the trucks of the Motor Haulage Company not only replaced poorer transportation, but eliminated a large crew formerly employed in spreading the stone by hand. In spreading stone for concrete road work each truck load is dumped separately at proper distances along the subgrade.

It is seldom economical to drive motor trucks up on a high pile of material. They can, however, be handled with success on dumps unless a great deal of sticky material has to be hauled in wet weather.

TYPE OF TRUCK MUST SUIT THE WORK

For general hauling of road materials this company has had great success with 6-ton units of medium weight and strength. Locomobile and Pierce-Arrow trucks have been used, holding from 4 to 5 cu. yd. of stone or sand. If a very rugged truck is bought for use under severe conditions, its owner must remember that it will cost more to operate under good conditions than a less heavily built unit. The stronger truck has more dead weight to pull around, and, having a larger motor, is not so economical of gasoline. The trucks used by the Motor Haulage Company are all power-dumping with back-tilting bodies, and have high removable sides for hauling coal, ashes and light material.

TWO TRUCKS REPLACE TEN TEAMS

On a State-road contract near Ridgefield, Conn., from twelve to fifteen teams were employed last summer with such bad results that hauling costs were eating up the profits of the job. There were such a large number of units on the long haul that it was hard to keep track of them, and much time was wasted by the drivers. The Motor Haulage Company persuaded the contractor to replace five of these teams with one truck, with the result that two trucks were soon on the job and practically all the teams had been dispensed with, only a few being kept for very short hauls. Conditions were fairly good for motor-truck service, material was always there when the contractor needed it, the truck drivers were reliable and on hand when wanted, and the job soon began to show a profit.

The foregoing is only one instance of what the contractor may do with motor trucks. Even the hauling of large girders and structural steel for buildings has been a view to the class of work required, and facilities are to be had. The experience of the Motor Haulage Company seems to show that motor trucks, when bought with a view to the class of work required, and run with ordinary good judgment, will make money for contractors in a wide range of operations.

Belt Line Is Proposed as Solution of Dallas Grade-Crossing Problem

By Intercepting Through Business John F. Wallace Thinks Railroad Lines in Heart of City Could Ultimately Be Removed and Replaced by Streets

A BELT LINE that would intercept all of the railroads that now run through or into the heart of the city of Dallas, Tex., and carry all of their traffic, except perhaps that of local industries, around the business district, rather than the elimination or protection of the existing grade crossings, is the solution of the whole Dallas problem offered by John F. Wallace, consulting engineer, of Chicago and New York, in an extensive report submitted Nov. 22 to the mayor and commissioners of that city. He estimates that to eliminate all of the existing crossings, except such as could reasonably be closed, would cost about $5,000,000. In general it would be necessary to elevate the tracks, depressing the streets only to a limited extent; some of the railroads occupy city streets and would have to be carried on steel elevated structures. To protect all of the existing grade crossings by watchmen, gates and bells, and capitalize their maintenance, would cost about $3,200,000. On the other hand, by utilizing existing lines in part, and closing the gap by new construction, a belt line without grade crossings could be provided for about $900,000. For the time being the existing tracks could be allowed to remain to serve the existing industries, with restrictions as to speed and hours for operation. New industries would be obliged to locate in assigned districts, however, and ultimately Mr. Wallace would have the existing tracks within the loop removed and the rights-of-way taken over by the city and converted into broad through streets, of which the city is greatly in need.

Following is an abstract of Mr. Wallace's report. The table is a condensation of voluminous data presented by Mr. Wallace and does not appear in this form in the report. Space limitations also preclude reproduction of more than bare outlines of some of Mr. Wallace's drawings.

THE PRESENT NETWORK

Dallas, like most American cities, has grown up without any well-defined plan. Topographically the location of the city was accessible from almost any direction. Railroads were welcomed as assisting in the development of the city, and the rights-of-way were sought and secured along the lines of least resistance. The result is shown in Fig. 1, in which it is seen that the railroad lines intersect the city in various directions, and that there are in addition various spurs and connections.

The Texas & Pacific Railway was the first to enter the city, and its location to a large degree fixed the main retail business district, which is restricted to about three streets extending east and west, parallel to this railway. The wholesale district extends along the western end of the Texas & Pacific and somewhat north and south of this line. The population of the city has increased from 10,000 in 1880 to 110,000 or more in 1915, and high-class residential districts have developed in almost all sections of the city. Some of these are separated only by the inferior districts along the railroads.

THE INDIVIDUAL ROADS

The Texas & Pacific crosses the city in an easterly and westerly direction. For 6000 ft. east from the Trinity River it occupies Pacific Avenue, along which are the freight houses and numerous industries. The main yard is just east of the Houston & Texas Central crossing. The Houston & Texas Central crosses the city in a northerly and southerly line about ¾ mile east of the geographical center, and reaches into the heart of the city by the Marilla Street Branch, at the end of which are its freight terminals. The main yard is at the junction. The Texas & New Orleans originally extended southeasterly from the Texas & Pacific, but since the construction some years ago of the Warren Avenue connection to the Houston & Texas Central the use of the old line has been mostly confined to the service of the industries along it. The road has no local freight house.

The Gulf, Colorado & Santa Fé is situated similarly to the Houston & Texas Central, crossing the city outside of the business center and reaching its local freight terminals in the heart of the city by a spur. Its main yard is between the Houston & Texas Central and the Texas & New Orleans. The Missouri, Kansas & Texas follows Turtle Creek and the Trinity River. Its main yard and local facilities are just north of the Texas & Pacific. The St. Louis Southwestern is also along the river front. It owns the Dallas Terminal Railway & Union Depot Company, which is building the union station. [See the Engineering Record of Aug. 22, 1914, page 212.] In the southerly part of the city a line of the terminal company intercepts the Gulf, Colorado & Santa Fé, the Houston & Texas Central and the Texas & New Orleans, and reaches the Texas & Pacific. The St. Louis Southwestern has local

freight terminals east of the Union Station. The Chicago, Rock Island & Gulf has no grade crossings in the city, and no terminal facilities of its own.

Data concerning the mileages within the city limits are given in the first columns of the accompanying table.

After a careful study of the profiles of the various railroads in the city and the topography of the adjacent territory, the conclusion was reached that the elimination of the grade crossings on their present locations could best be brought about by the elevation of the tracks and the depression to a limited extent of the intersecting streets, except in a few individual cases where it would be desirable to carry the streets over the railroads. As a preliminary a careful study was made of the street system with a view of determining which streets would be most desirable to be provided with undercrossings, having in mind the best circulation of traffic between the different parts of the city, and a map was prepared [not shown in this abstract], showing the location of the subways.

The same standards of construction were



FIG. 1—THERE ARE ABOUT 160 GRADE CROSSINGS IN THE EXISTING NETWORK OF THE EIGHT RAILROADS

uniformly used. As all of the railroads with few exceptions penetrate a good class of residential territory, it was thought desirable to adopt a standard subway design that would offer a pleasing appearance without going into excessive cost. The type chosen is of the unit reinforced-concrete type, with underclearances of 13½ ft. and floor depths of 3½ ft., making the base of rail 17 ft. above the street surface. Simple architectural ornamentation is applied to the concrete.

The standard for steel viaducts in the streets consists of bents from 35 to 50 ft. apart, the two columns being 40 ft. on centers. Where there are only two tracks these are carried on girders connecting the columns. By means of cantilevered extensions of these girders industrial tracks can be carried, with room for platforms between them and the main tracks.

A paneled design of retaining wall with plumb face and no coping was adopted to hold the embankments where the right-of-way is insufficient for natural slopes.

SOME OF THE INDIVIDUAL PROBLEMS

The accompanying table gives the estimated cost of eliminating the grade crossings on each of the individual railroads, together with a summary of the number and kind of structures involved. Some of the individual difficulties are as follows:

Texas & Pacific.—It is proposed to carry the 6000 ft. along Pacific Avenue on a steel viaduct. Along this structure numerous industries with side tracks are provided for. In order to avoid cutting off several of the streets along the river it was thought necessary to carry the track elevation across the river. The plan is developed with the idea of carrying the tracks on the top chord of the existing bridge with a slight rearrangement of the structural details. The connection with the Union Station would be from the west on the lower grade, and it is proposed that the industrial facilities of the Texas & Pacific Railway between the Union Station tracks and Lamar Street be continued at the present level, access to them being through the north throat of the Union Station tracks. The existing freight house would be rearranged to fit the elevated tracks.

Houston & Texas Central.—The special difficulties encountered by this railroad are at and south of the Texas & Pacific crossing. Over this crossing, from Commerce to Live Oak Street, because of the narrow right-of-way and the question of damages, an elevated structure was figured. From Commerce south to Eakin Street is the main yard of this road, and it is proposed to maintain this on its present grade, with some of the tracks stub-ended on the north. Eakin and Taylor Streets, the only ones carried across, would be carried on viaducts. Most of the Marilla Street Branch would be carried on an elevated structure. The existing freight house would have to be adjusted to the new level.

Texas & New Orleans.—The old line to the Texas & Pacific might be retained at grade and operated under restrictions. The estimates, however, provide for its elevation.

Gulf, Colorado & Santa Fé.—A 1-per cent grade beginning at the east bank of the Trinity River would bring this line high enough to cross over the Missouri, Kansas & Texas, and at Wall Street the tracks of the Dallas Terminal Railway & Union Depot Company would be crossed at grade. The existing yard between Orleans Street and the Texas & New Orleans would have to be elevated to the same plane as the main-line elevation, but the engine terminal could be left on the existing level and reached from the elevated line with a rather steep descending grade.

Missouri, Kansas & Texas.—From the south city line to the north line of the yard north of the Texas & Pacific crossing no changes are proposed except those involved in the construction of the Union Station. Up Turtle Creek the line is on broken side-hill and lends itself to the construction of the necessary subways with very little change in the track profile until the line leaves the creek, near Walter Street. Considerable study was given to this section of the line, which would be part of the belt line proposed. In the scheme adopted a number of the streets are straightened, and it is believed that adequate intercommunication is provided between the sections of the city east and west of the line for all time to come.

From Walter Street north it is proposed to depress the tracks and carry them under Knox Street, the total depression at this

MILEAGES, EXISTING GRADE CROSSINGS AND ESTIMATED COST TO THE INDIVIDUAL RAILROADS OF ELIMINATING THEM

Railroad	Mileage in City: Main line	Mileage in City: Total trackage	Existing grade crossings	Proposed separated crossings: Total	Sub-ways	Open steel	Street viaducts	§Estimated cost
Texas & Pacific	3.70	11.80	25	23	9	14	..	$1,250,000
Houston & Texas Central	†6.74	13.81	53	49	29	18	2	1,655,000
Texas & New Orleans	2.85	3.88	12	17	17	..	..	443,000
Gulf, Colorado & Santa Fé	‡5.98	17.82	17	21	21	..	..	800,000
Missouri, Kansas & Texas	7.65	20.07	11	14	12	..	2	¶220,000
*St. Louis Southwestern	5.10	9.80	23	8	6	1	1	307,000
Chicago, Rock Island & Gulf	3.50	....	0	..	..	..	..	.....
Total	35.52	77.18	141	132	94	33	5	**$4,675,000

*Including Dallas Terminal Railway & Union Depot Company.
†Includes Marilla Street Branch, 1.32 miles long, leading to freight terminal.
‡Includes down-town branch, 2.10 miles long, leading to freight terminal.
§In case fewer or more subways are to be provided than are shown on the plans, $9,000 for single track and $12,000 for double track should be deducted or added for each subway.
¶$394,000 for double track.
**To this should be added $110,000 for changes to industries, mainly those along the Texas & Pacific.



FIG. 2—COMPARATIVELY LITTLE NEW CONSTRUCTION IS NEEDED TO FORM A COMPLETE BELT LINE INCLOSING MOST OF THE CITY

point being 13 ft. The line would come to grade a short distance south of the Houston & Texas Central crossing.

St. Louis Southwestern.—South to Corinth Street no changes are contemplated in this line or that of the terminal company other than those required incident to the construction of the Union Station. From this street an ascending grade will bring the road to a crossing with the Gulf, Colorado & Santa Fé, and from there north to Ervay Street the two roads would be parallel and on the same plane. From Ervay Street north to the Houston & Texas Central the line occupies Coombs Avenue, and would have to be carried on a viaduct. Beyond the Houston & Texas Central the line would cross two streets and then come down to grade, passing under the Texas & New Orleans and the Texas & Pacific Railways. Operation over this part of the line would be restricted to the night hours.

$3,200,000 to Protect Present Crossings

There are at present within the city limits about 160 grade crossings. The cost of installing a set of crossing gates with bells is estimated at approximately $400, and if the gates were installed at all of the existing crossings they would require an expenditure of $64,000. The wages of operators for these gates, together with the necessary repairs, would represent an expenditure per annum for each crossing of about $1,000, or $160,000 in all, which, capitalized at 5 per cent, would represent $3,200,000. The capitalized effect of installing gates and bells at all crossings would therefore be $3,264,000. In practice it might be found that some of the crossings included in this total would not require gates, and in some other instances it would be necessary to station operators only at certain hours in the day. These modifying conditions would reduce the total shown above.

Conditions Ideal for Belt Line

The topography of the city and the location of the routes of entrance of the various railroads present an almost ideal condition for the construction of a belt line for the joint use of all of the railroads for their through passenger and freight business and for access to their present local freight facilities, which could continue to be operated by the individual roads in their present locations without fear of interference with the development of the city.

It is believed that the construction of such a belt line and the ultimate removal of tracks within this loop would be for the best interests of both the city and the railroads. For the city it would remove obstacles to harmonious development and make possible an improvement in the city plan, which would be very desirable. For the railroads the construction and operation of this belt line would solve the grade-crossing problem at but a fraction of the expense of track elevation, and would for all time solve the problem of railroad and industrial development in the city.

Fig. 2 shows a suggested arrangement for this belt line. It is proposed to use the existing lines, improved, from the crossing of the Houston & Texas Central with the Missouri, Kansas & Texas on the north to the point at the south end of the city where the latter railway turns to cross the Trinity River, passing around the Union Station. Two alternative locations are shown for new construction to the Gulf, Colorado & Santa Fé, the last of the lines running eastward. Suitable wyes would be constructed to each of the lines intercepted. The loop could be closed by a short extension to the power-house spur of the Missouri, Kansas & Texas.

Two general freight yards, A and B, are suggested. At these sites there is sufficient area available for the development of facilities equal to double the capacity of all of the individual terminal yards of all of the railroads entering the city. It may develop on further study that it would be more desirable for each of the railroads to build its own facilities along the belt line. In this event the best arrangement would probably be for them to use the same location indicated for the two general freight yards. The precise location of the part of

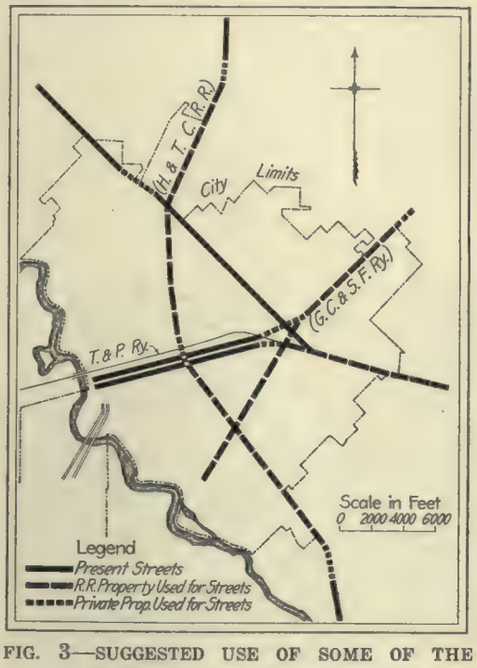


FIG. 3—SUGGESTED USE OF SOME OF THE ABANDONED RIGHTS-OF-WAY

the belt line to be constructed could also best be worked out by the railroads themselves.

In order to avoid the crossing of the south throat of the union-station layout at grade to reach the local freight facilities along Young Street, it is entirely feasible to separate the grades of the freight and passenger tracks at this point by carrying the freight tracks under. By removing the Marilla Street Branch these local freight facilities could be rearranged to good advantage.

The functions of the present terminal company might be extended to provide for the construction of this belt line and the taking over of the necessary trackage rights, or a new terminal company might be organized for this purpose, this terminal company in turn to lease trackage rights to the various railroads or perform a switching and terminal service for them.

Use Present Rights-of-Way for Streets

With a belt line provided the question as to the disposition of the tracks of the individual railroads inside the city limits remains to be disposed of. The ultimate solution would be the entire removal of all tracks within the city limits other than those necessary in reaching the local freight facilities and the industries adjacent thereto. This would leave the territory between the Trinity River and Akard Street extending from the Gulf, Colorado & Santa Fé on the south to Young Street on the north, as well as the territory along the river in the vicinity of the two yards A and B, to be developed for local freight and industrial purposes. Nevertheless, in Dallas, as in almost any city, the railroad situation is intimately related with the development of the street plan. The presence of the railroad has in a measure controlled the nature of the development, but this has only extended for a short distance on either side of the railroad, and in all sections of the city there are areas of good residential property separated only by the lower-class developments adjacent to the railroads. The removal of these roads would ultimately result in these various better-class residential districts expanding to a unified whole.

Through Streets Needed

The city is suffering from a lack of through streets extending from one end of the city to the other. The removal of the railroad tracks as suggested presents great opportunity for the taking over of these rights-of-way as continuous streets and the widening and development of them. The possibilities in this direction are indicated in Fig. 3. With the connecting links shown there might be developed thoroughfares to all sections of the city, these forming a natural central axis in the vicinity of Commerce Street and the present line of the Houston & Texas Central. The possibilities are presented of developing a splendid municipal park and civic center, extending from the present line of the Houston & Texas Central to the present location of the City Hall.

The attempt to bring this about immediately would probably not be found desirable. For the present it might be preferable to have an arrangement made between the railroads and the city which would restrict future industrial development to the part of the city naturally segregated for industrial development, and the gradual removal of the existing facilities to this district, permitting in the meantime switching to and from the existing industries over the existing tracks during the night hours, under such precautions as to speed and flagmen as would protect the street traffic of the city.

THE TOTAL WORK OF THE U. S. RECLAMATION SERVICE, completed up to the beginning of the present fiscal year, according to a summation prepared by the service, includes 9592 miles of canals and ditches, the excavation of eighty-nine tunnels with an aggregate length of more than 25 miles, the building of 4622 bridges with a total length of 19 miles, the construction of 82 miles of railroad and the erection of 1068 buildings, such as power houses, pumping stations, offices, residences and store houses. Dams of masonry, earth crib and rock fill have been constructed with a total volume of 12,200,000 cu. yd. The available reservoir capacity at the time of the summation was approximately 6,500,000 acre-ft., or sufficient to cover the States of New Jersey and Delaware to a depth of 12 in. Culverts built number 5714 and total 36 miles in length. There are now in operation 298 miles of pipe line and 85 miles of flumes. Wagon roads have been built to an aggregate length of 784 miles, many of them in what were inaccessible mountain regions.

Test Truck and Six Trailers on Long, Steep Grade

Demonstration of Haulage in Train of Six Wagons Made for Cincinnati Street Cleaning Department

IN ORDER to test the practicability of motor truck and trailer haulage a demonstration for the Street Cleaning Department of Cincinnati was made last August. A section of granite paved street 7000 ft. long, with a mean grade of 6.2 per cent and maximum and minimum grades of 8.3 and 1.8 per cent respectively, was chosen for the experiment. The six trailers used were the ordinary municipal type of dump wagon, as shown in the picture, and the truck was a Knox machine.

In making the demonstration it was specified that there should be no load on the rear wheels of the tractor, and the entire test was made with the whole load trailed and no weight on the tractor platform. The load was pulled by a chain connection between the trailer platform and the hounds of the first trailing wagon, the chain being passed under the rear cross members of the trailer platform and through the bearing plate. With the load drawn, this tilted the trailer platform to the rear to the limit of the stay-chains, but no undue strain on the platform springs was apparent at any time.



MOTOR TRUCK HAULS TRAIN OF TRAILERS UP STEEP GRADE IN CINCINNATI

In coming down the grade the entire load was held back by the tractor only, the brakes on the trailer not being set at any time. The tractor was brought down the entire length of the 7000-ft. grade in low gear. Two stops were made at the hardest parts of the grades to demonstrate the ability of the tractor to hold back the load. The descent of the grade was made without mishap. Both the jackshaft and rear brakes operated satisfactorily.

The train was started from the bottom of the hill, made the ascent, turned at the top of the hill without stopping and returned to the foot of the hill with the stops noted.

The weights of the trailers used are given below:

Where six wagons, loaded with mud, were used—First two wagons, 11,600 lb.; second two wagons, 18,000 lb.; third two wagons, 16,070 lb.; total, 45,670 lb.

Where five wagons were used—First two wagons, 11,600 lb.; second two wagons, 18,000 lb.; fifth wagon, 8950 lb.; total, 38,550 lb.

Colorado District Court Rules Against Luten Patents

Recent Decision by Judge Robert E. Lewis in Washburn Infringement Suit Denies Validity of Seven Bridge Reinforcement Claims

IN A DECISION handed down by Judge Robert E. Lewis of the United States District Court, District of Colorado, in the case of Daniel B. Luten vs. George Washburn and Weld County for the infringement of seven bridge patents held by the complainant, the validity of the Luten patents was denied and the case decided in favor of the defendants, who employed Prof. M. S. Ketchum as technical expert. The opinion was filed Nov. 13.

The decision, which was filed Nov. 13, 1915, after citing the seven patents on which the suit is based—Nos. 852,970, 853,183, 853,202 and 853,203 issued in 1907; 933,771, issued in 1909; 979,776, issued in 1910, and 989,272, issued in 1911, rules out of the case, as of little weight, all previous decisions in favor of the complainant, mainly because they were made "either pro confesso or by agreement, or if not by agreement, it is admitted that no defense was in fact made." Then follows a statement in some detail of the character of six of the patents, the patent 933,771 not being introduced at the trial. The decision contains the following significant paragraphs:

"On consideration of prior patents and publications introduced by the defendants to meet the separate and several claims, I am unable to rid myself of the firm belief and conclusion that each and all of complainant's claims were non-patentable at the time he made his several applications, and also at the two times prior to applications when he claims he first, within two years prior to such applications, made practical use of the claimed inventions in those two instances. The prior patents as anticipations and the prior patents and publications as showing the then state of the art lead to the clear conviction that complainant in each instance only then made application of mere mechanical knowledge and skill, and that what he did is in no sense a demonstration of inventive genius. This is also the opinion of the defendants' expert witness.

PLACING OF STEEL

"The complainant as a witness disclaimed that his patents, or any of them, embodied anything beyond or more than placing 'the steel in a new way that produces better results in a more efficient form. Now, in a concrete bridge the greatest efficiency is always secured by resisting tension or pull with steel rods. That has been established for half a century; not perhaps with curved tension members, but the basic idea is very old. There is no question about that.'

"But none of complainant's patents in its specification, including drawings and in the claims, gives any specific direction as to just where any of the reinforcing members should be placed. This I suppose would in each instance depend upon the maximum load to be carried, the length of the spans, and other elements which involve mechanics only, and would necessarily, I assume, be worked out in determining the amount of compression and tension under the established formula in statics. In a general way the points of greatest stress can be roughly approximated without the use of mathematical tables, but this is centuries old—that is, it is open to common observation, and the fundamental purpose of reinforcing concrete was to strengthen the structure at these points; such a discovery in Luten's day is no evidence of inventive genius.

EARLIER PATENT

"The earliest patent relied upon in anticipation against all of the claims is that issued to Francois Coignet in 1869 (No. 88,547), described in the specification as being improvements in artificial stone, monolithic structures and artificial stone articles, in which the second claim reads: 'The introduction, in the body of artificial stones, or in the body of artificial stone monolithic structures, made of agglomerated artificial stone paste, of skeletons, or metallic frame-work, linked or arranged so as to strengthen the same.'

"I see nothing more than mechanical skill in tying the wings and abutments together, the circular knee-brace in the outer girder with a reinforcing member, binding it to the adjacent abutment and girder, and in carrying the transverse member in the roadway into the outer side of the upper spandrel or girder and upward and over the longitudinal reinforcing member in that girder. In view of the Coignet letters and of the prior state of the art as evidenced by his patent and the publications introduced as above noted, he made specific claim to a 'metallic frame-work linked or arranged so as to strengthen the same.'

"The views above expressed make it unnecessary to consider the defense of non-infringement of some of the claims. It is ordered that the bill be dismissed at complainant's costs."

The Engineering Record has received word from Daniel B. Luten that the case will be appealed.

$600,000 Inquiry Finds Electrification Will Not Solve Chicago's Smoke Problem

Expenditure of $275,000,000 to Abate 22 Per Cent of Visible Smoke Is Considered Unwarranted, but Plan Is Technically Feasible

ELECTRIFICATION of all the railroad trackage in Chicago is financially unwarranted to abate the small air pollution of which the roads are guilty, although the plan is technically possible. This is the conclusion reached as the result of the $600,000 investigation begun four and one-half years ago by a committee of the Chicago Association of Commerce. The committee's $274,440,630 cost estimate is a smoke abatement cost, and all trackage within the city limits and the necessary mileage outside were counted in. If the idea had been to plan an efficient electrification, it is pointed out, the estimate would have been different, and, further, there is nothing in the report to indicate that the electrification of certain roads is not feasible and financially warranted.

Dean W. F. M. Goss, chief engineer of the committee after the death of Horace E. Burt in 1913, and previous to that a member of the committee, has produced a 1177-page report covering every phase of the smoke problem and its relation to the railroads. The Association of Commerce has fathered the investigation, although the railroads have paid for it. The latter and the city each had four representatives, and the association named the remainder of the seventeen members of the committee.

Realizing that any adequate abstract of the contents would be impossible of attainment within a reasonable time, the committee's editor, C. S. Sale, prepared for the press a 15,000-word abstract covering the principal features. This abstract, further condensed, is given below:

Final Conclusions

Some of the final conclusions, aside from the financial ones, are as follows:

That the Chicago electrification would equal the combined electrifications of the whole world, would involve problems never heretofore met, and would be the first ever undertaken for air betterment where terminals were adequate from an operating viewpoint.

That before the steam locomotive is eliminated pollution must first be reduced to a minimum from the three more damaging services, high pressure steam plants, metallurgical and other manufacturing furnaces, and domestic fires.

That the steam locomotive stands third among smoke producing services, using but 12 per cent of the fuel consumed, and that its elimination would reduce the gaseous pollution of the air only 5 per cent and the solid pollution less than 4 per cent.

That electrification, hydroelectric and other long-distance transmission being inapplicable, would add power-house smoke in quantities sufficient to offset much of the gain through eliminating locomotive smoke.

That suburban passenger services, such as those of the Illinois Central and other roads, produce but 1.54 per cent of the total visible smoke, and 1.97 per cent of all the dust and cinders.

That electrification will involve at least 3476.4 miles of track.

That all smoke regulation in Chicago and elsewhere has erred in confining itself to the visible aspects of smoke, whereas the really harmful factors are the invisible gases and the solids of combustion, sulphurous gas and mineral dust in particular.

That, despite the fact that Chicago burns more coal annually than any other large city—8 tons per capita as against 4 for Manchester and 1½ for Berlin—its air is better than that of most large cities, because of the better sun, wind and rain conditions.

That the loop is the smokiest district, with the stock yards and South Chicago a close second and third.

That, in Chicago air, the products of combustion constitute only two-thirds of the total pollution, the other third being due to avoidable and unavoidable dirt from the general activities of the city and from poor municipal housekeeping.

Pure Air Commission the Remedy

It was suggested that the only program by which air pollution may be reduced to the minimum is to create a Pure Air Commission, the membership of which shall be made up of experts whose duties would be to investigate all sources of air pollution, to determine, by experiment or otherwise, the most effective means for mitigating or eliminating such pollution, and that, so far as practicable, it be invested with power to enforce obedience to its decisions.

That no materials shall be employed in paving, without the consent of the commission, to the end that dust-creating pavements may be abolished.

That the paving and cleaning of alleys and other highways shall be subject to the supervision of the commission.

That the commission shall have power to require that the wrecking and erection of buildings shall proceed by methods which will protect the air from all unnecessary pollution.

That the commission shall have the power to require roofs to be cleaned and other minor sources of air pollution to be abated.

That new installations of boiler and other furnaces be permitted only as licensed by the commission, which shall have power, under reasonable rules to determine the character of the installations.

That the commission be charged with the duty of investigating present practice in the construction and operation of domestic furnaces, with a view to so perfecting such practice that fuels now used may be burned without objectionable air pollution, or to so changing the character of present fuels as to accomplish the same result.

That the commission be charged with the duty of investigating the construction and operation of metallurgical and high pressure steam boiler furnaces, with a view to eliminating, so far as practicable, the air pollution for which such furnaces are responsible, and that it formulate and enforce regulations under which such furnaces shall hereafter be constructed and operated.

That the commission be charged with the duty of investigating the pollution of the air by railroad locomotives, by steam boats and by other transportation agencies making use of movable engines, of devising methods of abating air pollution from these sources, and of enforcing such provisions for the suppression of air pollution as may be found necessary.

It is not the opinion that radical action should be expected of the Pure Air Commission, or that action involving abandonment of the use of Illinois and Indiana coal is either advisable or practicable, or that action involving the general abandonment or rebuilding of existing boiler or heating plants, either stationary or portable, is advisable or practicable, or that the immediate or general electrification of railroads for the purpose of eliminating their part in air pollution is under present conditions advisable or practicable, but that all efforts to improve existing conditions shall be carried on with due regard to the responsibility of each of the fuel consuming services for their contribution to the pollution of the atmosphere, and that such changes as may be determined upon may be gradually made, with due regard to financial and mechanical difficulties.

Total Electrification Financially Impracticable

As regards the financial practicability of electrification the committee submits these findings:

(1) The complete electrification of the railroad terminals of Chicago as a betterment to be brought about by the railroads through the investment of free capital is, under present-day conditions, financially impracticable.

(2) Any procedure designed to bring about the complete electrification of Chicago's railroad terminals which is based upon a financial program involving municipal co-operation is, under present-day conditions, impracticable.

(3) Any procedure designed to bring about the complete electrification of Chicago's railroad terminals which is based upon the application of an arbitrary to the traffic of Chicago will constitute a tax which must be borne by the business interests of the city. The practicability of such a tax is a matter which has not been studied by the committee.

(4) The preceding conclusions apply to the complete electrification of Chicago's railroad terminals. The financial practicability, under present-day conditions, of electrification as it might be applied to individual roads or to a single service of individual roads, is a matter which has not been investigated by the committee and concerning which no opinion is expressed.

(5) The credit of the individual railroads, the properties of which make up the Chicago railroad terminals, differs greatly. Some have high credit and could secure funds for almost any project which their

managements might care to propose; others must prove the profitable character of a particular project before underwriters would consider the placement of their securities; others would find it difficult to borrow on reasonable terms even if the particular project for which the funds are sought promises some return; and still others are in the hands of receivers, their administrative function being performed by the courts. These facts cannot be overlooked in estimating what portion of the potential credit of the railroads is available for the purpose of electrification.

(6) Certain railroads making up the Chicago terminals operate entirely within the prescribed zone, while for others the great predominance of traffic lies outside the terminal limits. There is more to this contrast than is implied by the fact that some of the roads involved are switching roads while others are long-haul freight and passenger roads. Complete electrification, from a financial point of view, would affect but a relatively small part of the fixed investments of some roads, while for others it would require practically the rebuilding of the property.

(7) Electrification is a matter which may present greater advantages in connection with certain classes of service than with other classes of service; for example, the electrification of a railroad having a large suburban business would be more effective in developing opinion favorable to the railroad concerned than the electrification of a road the activities of which are wholly those of freight switching yards. A few only depend upon passenger traffic within the city limits for any considerable amount of their revenue. A larger number derive passenger revenue within the terminals from the movement of through passengers only; while other roads perform little passenger service or no passenger service at all.

(8) The extent to which individual railroads have recently made large capital expenditures for terminal improvements, track elevation and enlargement of facilities in Chicago, and the extent to which they are committed to further expenditure for these purposes, must have a material bearing on their ability to make expenditures for new projects.

The committee holds that the city might well be expected to share in the burden of electrification, seeing that it would be undertaken for the public benefit, but a perusal of court decisions shows that this is impossible.

Overhead Contact System Believed Best

Notwithstanding the engineering difficulties that would have to be overcome in electrifying the terminals, the committee believes that these difficulties can be surmounted. Its work leads it to the conclusion that the only feasible means of electrification will be by the overhead contact system or trolley. Great obstacles exist to the installation of any system, but it is believed the trolley wire more nearly meets all demands than the third rail. The committee states its conclusions as follows:

1. A limited mileage of track in Chicago (approximately 1 per cent of the total) cannot be equipped with any system of contact. The electrification of this is not technically feasible.

2. While the third-rail system of contact might be extensively used in Chicago, there are, at intervals throughout a considerable percentage of the total trackage, conditions which would make difficult the use of this form of contact. The third rail is applied with difficulty wherever special track work abounds, where street and railroad crossings occur at frequent intervals, and in switching yards. In locations where employees must be between or must cross tracks, as in freight yards, it constitutes a physical obstruction which is highly objectionable. For these reasons the third rail is not considered feasible for general use in the Chicago terminals.

3. The facts developed show that any form of overhead contact which can be placed high enough above the rail to give the clearance necessary to permit men to ride and perform necessary duties on the tops of freight cars, is not objectionable from a technical point of view. The application of an overhead contact system to the terminals of Chicago, will, however, require the contact wire to be lowered in many places in order that it may pass under structures presenting minimum clearance. The great number of points at which the contact wire must be lowered will require the installation of many warning devices, or the enforcement of rigid rules governing the presence of trainmen on tops of cars.

Smoke Map

The study of atmospheric pollution carried on by the committee is said to be by far the most extensive and scientific ever attempted. One of the exhibits produced is a smoke map of the area under investigation. This covers Zone A, which includes all the territory within the city limits, and Zone B, which includes adjoining territory from Gary on the south, through Ham-



SUGGESTED EXTENT OF COMPLETE AND MAIN-LINE ELECTRIC OPERATION

Heavy circles indicate proposed outside limits of main-line electrification.

mond, Whiting and East Chicago, on around through the large railroad yards at Godfrey, Proviso, Clearing and Dolton, to the lake north of Evanston. This map shows just what part each district plays in smoke production. All the figures, both on smoke and on electrification, are for the year 1912.

The total annual per capita consumption of coal in 1912 in the city limits was 7.7 tons. In Zone B, outside the limits, it was 13.7 tons. The average for the two zones was 8.3 tons. The average square-mile consumption of coal within the city limits was 10,797 tons for steam locomotives as against 79,436 tons for all other services combined.

In the industrial centers and the heavily populated districts the steam locomotive coal consumption and smoke production is small when compared with the total volume for all sources. In outlying districts where the population is small and where there is no grouping of industries, the steam locomotive sometimes becomes the greatest smoke producer.

In only four out of the twenty-seven districts do steam locomotives use more than half the total fuel consumed, and these districts are sparsely populated and have very limited smoke producing services other than smoke from residence chimneys.

For the purpose of its investigation the committee considered smoke in the following aspects: Visible smoke, solids in smoke, gases in smoke. Smoke, in each of its phases, was found to have undesirable features. Smoke from each service was found to have a definite relation to the total volume of smoke pollution, both as to quantity and as to particular features of pollution. In order to ascertain which services produced the visible smoke, the solids of smoke and the gases of smoke, and in what proportion 11,976 observations were made of locomotive smoke, 1241 high pressure smoke stacks were put under observation, 2801 low pressure stacks and 280 stacks of metallurgical and other furnaces.

The following table shows the results of these observations:

WHO MAKES CHICAGO SMOKE?*

Responsibility of each service for smoke pollution within Chicago, on percentage basis

	Visible smoke, per cent	Solids of smoke, per cent	Total of smoke, per cent	Gaseous carbon, per cent	Gaseous sulphur, per cent
Steam locomotives	22.06	7.47	10.31	10.11	18.22
Steam vessels	0.74	0.33	0.60	0.55	0.45
High pressure steam stationary power and heating plants	44.49	19.34	44.96	40.68	53.70
Low pressure steam and other stationary heating plants	3.93	8.60	23.00	23.06	19.73
Gas and coke plants	0.15				
Furnaces for metallurgical, manufacturing and other processes	28.63	64.26	21.13	25.60	7.90

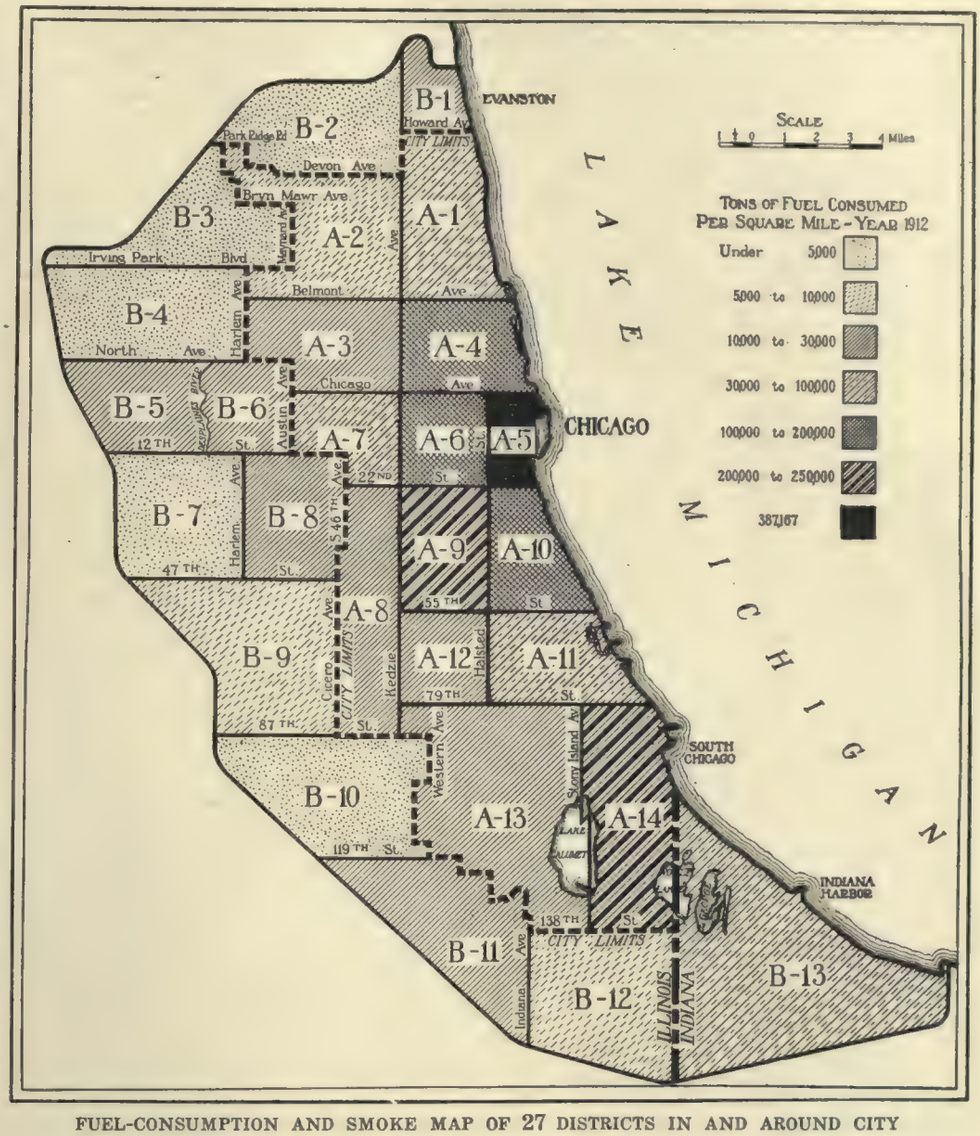
*One-third of all air pollution is due to dirt other than that of combustion. These percentages refer to the remaining two-thirds.

FALLACY OF VISIBLE SMOKE AS AIR POLLUTION INDICATOR

A significant fact disclosed by the researches of the committee is that which emphasizes the relatively great importance of the solid constituents of smoke. Hitherto most discussions concerning smoke, and practically all measures designed to show the extent of atmospheric pollution resulting from it, have dealt only with its cloud effects. It now appears that the cloud effects are of secondary importance, as compared with effects produced by the soot and dust of smoke. The problem of smoke abatement, therefore, as viewed in the light of the committee's disclosure, is not entirely or largely a problem of suppressing visible smoke, but is one of suppressing the shower of soot, dust and cinders constantly falling from a smoke-polluted atmosphere.

Smoke arising from solid fuels was found to be never free from such solids. The amount of solids discharged has no direct relation to visibility. A stack may appear smokeless to the eye, it is said, and yet be the source of a heavy discharge of dust. The adoption of anthracite coal or of coke as a fuel, the committee asserts, will serve to make stack discharges invisible but will not eliminate the dust discharge.

Owing to the finely divided state of the solids emitted in the smoke of high-pressure steam stationary power and heating plants, says the report, the resulting pollution may be regarded as affecting wide areas, since such materials are easily carried by the wind and air currents. Chemical analyses of the solid materials emitted in the smoke of high pressure steam stationary power and heating plants indicate that the discharges contain 60 per cent of ash, 33 per cent of combustible carbon or particles of unconsumed fuel, 4 per cent of sooty materials condensed from the distillates of fuel, and 3 per cent of sulphur.



FUEL-CONSUMPTION AND SMOKE MAP OF 27 DISTRICTS IN AND AROUND CITY

A-5, the down-town district, is the worst; A-9, the stock yards, and A-14, South Chicago, rank next.

It has been estimated that within the city of Chicago there are approximately 17,000 high-pressure (10 lb. or more) steam boilers, served by not less than 11,000 smokestacks and more than 11,000 low-pressure steam boilers.

There are also several hundred thousands domestic heating furnaces and stoves in houses and stores. In point of number of establishments, therefore, the service included by the classification "low pressure steam and other stationary heating plants" is many times larger than any other service considered in the committee's investigation.

SMOKE CONTRIBUTED BY ENGINES

The following is a summing up of the contribution of locomotives, in various services, to the smoke nuisance:

Locomotives engaged in suburban passenger service contribute 1.54 per cent of the total visible smoke, 1.97 per cent of the total dust and cinders of smoke, and 0.74 per cent of the total polluting gases of smoke discharged annually into the atmosphere of Chicago. Similar percentages for other services follow:

Locomotives engaged in through passenger service contribute 2.07 per cent, 1.80 per cent, and 0.89 per cent respectively.

Locomotives engaged in all passenger

services combined, including suburban passenger, through passenger and passenger transfer, contribute 3.80 per cent, 3.81 per cent and 1.73 per cent respectively.

Locomotives engaged in road freight service contribute 2.01 per cent, 1.18 per cent and 0.66 per cent respectively.

Locomotives engaged in yard freight service contribute 10.25 per cent, 1.73 per cent and 5.17 per cent.

Locomotives engaged in all freight services, including road freight, yard freight and freight transfer services, contribute 16.85 per cent, 3.34 per cent and 7.57 per cent.

No Substitutes for Steam Satisfactory

As a preliminary to its study of electrification for Chicago steam roads the committee made an investigation into other methods of conducting transportation. It had been hoped that some type of self-propelling motor might be found, and the danger, engineering difficulty and expense of electrification be avoided. But this hope was not justified.

While it was found that progress had been made in adapting the gasoline engine to the requirements of light or special railroad service, the power requirements of heavy and diversified traffic, it is stated, are still beyond the gasoline-driven unit. The Diesel oil-burning marine engine has the power but neither type is self-starting, an imperative requirement for switching work. A new Diesel experimental locomotive was examined in Switzerland. Much had been hoped from it, but the inventor himself was doubtful of its success in such heavy yard switching work as would be required here and to limit its future to light express work with constant speeds and infrequent stops.

Much, also, had been hoped from the storage battery, but it was found to lack power, to be too expensive and to share, with electrification, the disadvantage of producing power house smoke. The internal combustion motors are also smoke producing and are regarded as adding a new hazard of operation through their fuel tanks. Compressed air and hot water motors were found impractical, but their use is suggested on those sections of Chicago track that cannot be electrified.

"There is available at this time," says the report, "no form of locomotive carrying its own power capable of handling the traffic of the Chicago railroad terminals, which could be substituted for the steam locomotive, and there is no prospect of the immediate development of any such locomotive."

Central Power Plant

"The electric operation of Chicago's railroad terminals must depend upon the existence and operation of a steam-driven electric generating station. The conclusion has been reached that a single power-station, located near the south branch of the Chicago River in the vicinity of Ashland Avenue, would satisfactorily meet all requirements. The load center, under the plan of electrification as already defined, falls within the limits of the Union Stock Yards. The location indicated is not far from this point and is such as satisfies other requirements of the problem."

The committee finds that steam locomotives, in 1912, consumed within the city 2,099,044 tons of coal and that, for the single central power station, 807,762 tons would be required, the net saving being 1,291,282 tons.

The committee finds that it would make no practical difference whether the roads manufactured their own electric power or purchased it from public-service corporations.

Mileage

The committee's plan contemplates the electrification of all track within the city limits and the conclusion of electrified trackage on each railroad as close outside the city limits as is practical. The mileage involved by this conception may be summarized as follows:

	Miles
1. Main track	1,475.59
2. Yard track	1,456.64
3. Industrial track owned by railroads	277.19
4. Industrial track owned by industries	229.72
5. Industrial track, railroad repair track and shop track so located in streets at grade, in buildings or under structures employed in industrial processes as to require some type of self-propelling motor	37.26
Total	3,476.40

While in general the committee decided to terminate electrification at the first convenient point outside the city limits, this could not be accomplished on certain roads which conduct a suburban passenger service. It would be impracticable, according to the findings of the committee, to operate these frequent suburban trains part way by electricity and part way by steam. It has hence been decided that certain lines must be partially electrified beyond the limit of complete electrification, to the terminals of the suburban service. Through passenger and all freight trains are to be operated by steam on the partially electrified extensions, which will be for use only by multiple-unit suburban trains, resembling "L" trains, but of heavier construction.

Systems of Electric Traction

As yet no system of electric traction has been developed, the committee finds, which can be accepted as standard for all conditions on all railroads. If it were decided to proceed at once with the electrification of the Chicago terminals, it would be difficult for any group of men, the committee believes, to choose a system which would not be criticised by other men as able as those upon whom the choice of the system developed.

The system selected for Chicago, it is pointed out, must be suitable not only for passenger terminals and through line work but also for yard switching and transfer work. It must be applicable to the requirements of railroads having a heavy suburban traffic, and also to those roads conducting freight yard and switching service. It must not only be satisfactory in its application to the terminal portion of a trunk line railroad, but it must lend itself to an indefinite extension of the limits of electrification over other and adjoining portions of the road.

Obviously, the report adds, the project must be regarded as too important to permit of the introduction of methods in any way questionable, or of a type of construction of untried value. Furthermore, it is not permissible to consider any methods which might serve to tide over a temporary condition anticipating the later selection of a permanent and stable system.

The committee, after obtaining complete engineering data on these three systems selected the third as cheapest and most desirable:

1. Third rail contact, direct current at 600 volts.

2. Overhead contact, direct current at 2400 volts.

3. Overhead contact, single-phase current at 11,000 volts.

The third-rail system was given up as the least practical of the three, because of the difficulties to be met. Not only would the presence of the third rail be a danger to employees in the yards and make necessary a large amount of reconstruction, but there would be trouble in operating trains, owing to the large number of gaps in the third rail due to switches, street intersections and other such obstructions.

The difficulties of trolley installation would also be great, but less, it is believed, than those attending the use of the third rail. The great trouble found is with low bridges and other structures over the tracks.

Within the area of investigation there are 492 permanent structures which fail to have sufficient clearance over tracks to allow the installation of the overhead conductor at the desired height of 24 ft. 2 in. Of these obstructions, 221 cannot be changed without great inconvenience and expense both to the city and to the railroads. There are 385 structures which have clearances of less than 25 ft.; 163 of these interferences can be changed to provide the desired clearance, but not without material expense, and 222 cannot be changed without great inconvenience and expense. There are seventy of these structures which have less than the minimum clearance of 16 ft. 6 in. permissible where trainmen are excluded from tops of cars. The conclusion follows that a sufficient clearance to permit employees to ride on tops of cars cannot be obtained throughout the Chicago terminals.

The adoption of the overhead contact (trolley) system would permit the use of either a high voltage direct current or an alternating current of much higher voltage. The use of the first would result in damage to property by electrolysis. The use of the second would "kill" telephone and telegraph wires adjacent to the tracks, through inductive interference. Both conditions could be remedied, though with difficulty and at considerable expense.

Precipitated Costs

Following the work of the committee, a number of the Chicago railroads have made a study of the cost which would be imposed upon them in excess of those set forth by the committee. Eight of these railroads have filed with the committee the results of their investigations. The excess costs, including costs due to extension of the plan and precipitated costs, in per cent of those which are covered by the committee's estimates were 54.07 per cent. The committee's estimates of the net cost of electrification for all the roads of Chicago total $178,127,230. Therefore, carrying forward the same ratio, the committee finds that the total added and precipitated costs for all the railroads would amount to $96,313,400.

For example, in fixing the limits to be observed by the Chicago, Burlington & Quincy Railroad, the committee has specified complete electrification to a point 6.8 miles (Hawthorne) beyond the boundaries of the city, and partial electrification to provide for suburban service only to a point which is 21.3 miles (Downers Grove) from the city terminal. In reviewing the work of the committee, the officers of this road

have reached the conclusion that if they were required to electrify, it would be necessary to provide for the electric operation of freight service to a point 33.4 miles (Eola) from Chicago and for suburban service to a point 37.4 miles (Aurora) from the city terminal.

By far the most important factor in this list of indeterminate costs is that of terminal rearrangement and improvement. The city's terminals have grown up without preconceived plan, additional facilities being added now and then at points farther out as the expansion of business and of the city dictated. Many of these changes might not become imperative for a decade, but under electrification would have to be made at once. Track elevations would be extensive in order to avoid grade crossings with trolley lines. Signal systems that are now somewhat out of date, but might be continued in operation for a number of years, will have to be altered and it is probable many roads will decide to put in entirely new systems.

According to figures from the Michigan Central these additional costs—not included in the committee's estimate—would amount to $5,000,000. The Burlington places its additional costs at $2,501,080. The Chicago & Alton would, according to the estimates of its engineers, have to spend an additional $820,000, the Illinois Central several millions, and the Chicago & Western Indiana $10,000,000, which would otherwise be strung along through a series of years. The North Western, which has made complete estimates, paralleling these of the committee, figures its total costs would be 30 per cent more than those of the committee's report.

On the staff of the committee under Dean Goss were L. H. Evans, terminal engineer; Hugh Pattison, electrical engineer; Theo. H. Curtis, mechanical engineer; James Walker, assistant engineer; Gibbs & Hill, consulting electrical engineers; George R. Henderson, consulting mechanical engineer, and W. M. Whitenton, operating engineer. Judge Jesse Holdom was chairman of the committee.

California Has Sanitary Bureau

A SANITARY engineering bureau in California was established by the recent Legislature, which appropriated $30,000 for its maintenance. The new bureau will act under the State board of health and will include among its duties the examination of all water-supply systems having more than 200 service connections. All such systems require a permit from the Board of Health, application for which must be accompanied by a full description of the works, including all sanitary conditions. The State board may make such investigation as it considers necessary and must give a permit if the water is found to be pure. It shall deny the permit if the water is unsafe, but in such a case may grant a temporary and revocable permit under such restrictions and conditions as may be specified in order that time may be given for investigation and the installation of a safer supply. Such conditions imposed, might include chlorination.

THE DIAGRAM FOR E-50 SHEARS AND MOMENTS in the Engineering Record of Nov. 20, page 633, should be corrected by changing the unit given on the left for the ordinates of the maximum moment diagram to read "thousands of foot pounds" instead of "thousand pounds."

Making Motor Truck Pay on Short Hauls

Efficiency Test of Motor Truck on Short Haul Work Produces Record of 384 Tons Hauled in 8 Hours—What a Cartage Company Is Doing in Its City Work

TO test the efficiency of motor trucks on short-haul work a Chicago teaming contractor sublet his teaming contract to the Arrow Motor Cartage Company at 40 cents a yard, the prevailing team rate in Chicago on hauls of less than 1 mile. The data given herewith apply to the performance of the latter company's motor trucks and show how a 5-ton Pierce-Arrow machine made sixty-four 1-mile trips, hauling 384 tons of gravel and sand in a little less than 8 hr.

CONDITIONS ENCOUNTERED

The motor truck's task consisted in furnishing a continuous supply of materials for a section of concrete road on Western Avenue ⅜ mile long. Paralleling Western Avenue and one block west of it are the team tracks of the Baltimore & Ohio Railway, from which the materials were hauled, extending one block south of the south limit of the work. Western Avenue is traversed by a double-track street car line. As only one concrete mixer was assigned to the work the two roadway sections were handled separately, the work progressing up one side and down the other.

The mixer, of course, was always a little in advance of the newly laid base, while the storage piles of gravel and sand were placed still farther ahead. A fixed route for the motor truck was quickly decided upon and followed throughout the day. After receiving its load at the team track it proceeded north to the end of the railroad yard, then east to Western Avenue and north on the street car tracks to the point of dumping.

QUICK LOADING METHOD

At the team track the truck was loaded directly from the railroad cars by Lee loaders. Each loader consists of a collapsible steel framework mounted on wheels, which is placed alongside the car to be unloaded. On top of this standard is carried a large sheet metal bucket, which is tipped toward the car while being loaded and away from it while being dumped. In unloading a car one loader is placed alongside it at each end, so that the shovelers inside the car work from the ends toward the center. In some cases three loaders are used. It is estimated that ordinarily three good shovelers can fill a 2-yd. loader in 16 min., each man having a capacity for handling 25 cu. yd. in 10 hr. When the car is about half empty the loaders are moved toward the center of the car, the two shoveling crews still remaining on their respective sides of the central pile of material.

THE LOADING SEQUENCE

On the day in question, when 384 tons were handled, a crew of sixteen shovelers with four 2-yd. loaders was employed, four men being assigned to each loader. Under these conditions one loader could be filled in about 12 min. Sixteen men were deemed advisable because the weather was extremely hot, although twelve exceptionally good shovelers could have done the same work without delaying the machine.

Each pair of loaders delivered a complete load on every second trip of the motor truck, the two sets being filled and dumped alternately. Two complete round trips of the machine required about 15 min., so that each crew of eight shovelers, after filling its two loaders in 12 min., had a respite of about 3 min. before the arrival of the machine for its load. This gave the men an opportunity for rest and provided a reasonable margin of safety in case the machine should return sooner than expected. By taking alternate loads in this way from the same crew on one car delays were avoided and the supply was able to keep pace with the demand.

This 3-min. margin of safety also provided time to allow for moving the loaders from the ends of a car to the center and from one car to another. Such a change requires simply that the stay chains be released and the loaders be rolled into and chained in their new positions. It can easily be accomplished in 2 min. by two or three shovelers.

CONDITIONS IN RAILROAD YARD

The team track from which the loads were taken is a block long, and this fact caused some variation in the length of the individual trips. The north end of the track is on a level with Thirty-fifth Street, but the rails lead up a slight grade all the way to Thirty-sixth Street, where the switch connects with the elevated tracks of the main line.

Of the nine cars unloaded during the day four containing only 3¾ carloads of material were spotted during the forenoon at the upper or Thirty-sixth Street end of the switch. The average haul in working from these four cars was a little over 1 mile. The five cars unloaded in the afternoon were spotted at the lower or Thirty-fifth Street end of the switch. This made a difference of nearly two blocks in the length of each trip, bringing the average round-trip haul to about ⅞ mile.

This variable factor in the length of haul was confined to the railroad yard and affected only a few of the items shown in the accompanying table. The remaining portion of each trip was practically identical with respect to mileage.

As delivered on the team track by the railroad company the day's consignment consisted of nine cars containing 8¾ carloads of material, two of sand and six and three-quarters of No. 9 gravel. These materials were taken away by the motor truck in the approximate proportions as used in the work, two loads of gravel and one load of sand, followed by more gravel and more sand in the same proportion, with occasionally an extra load of one or the other according to the requirements of the mixer. This demanded some shifting of loaders from one car to another which would not otherwise have been necessary.

LARGE CREW PREVENTS DELAYS

An early analysis of the conditions showed the advisability of employing a sufficient number of laborers to preclude any possibility of delay to the machine. Sixteen shovelers were used when twelve might have done the work. By using the larger crew a reasonable factor of safety was introduced and the risks of interruption, while not eliminated, were reduced to the minimum.

Similarly, at the dumping place, an extra man was put at work. His business was to

open the tailgate of the motor truck when it arrived and to put in place the block that was used as a platform in dumping. The part of the street on which the material was dumped was several inches lower than the street car tracks, and it was necessary to dump the load in such a way that the pile would not spread over them. This was accomplished by backing the machine in at an angle while the extra laborer at the dumping point placed the block under the overhanging rear wheel. Twisting of the chassis frame was thus avoided and no undue stresses were imposed upon the body hoisting mechanism. At the same time the load was dumped clear of the car rails and in a convenient position for the mixing gang.

The dump body employed is operated by the power of the motor truck engine and can be controlled by the driver without leaving his seat. The device is also arranged so that after discharging the load the body can be lowered to its normal position while the machine is moving forward on its return journey. This provision played a small but important part in making the record day's work possible.

The great saving by the reduction of idle time was accomplished at the loading end.



1. AT RAILROAD YARD READY FOR LOAD
2. HOW TIME WAS SAVED IN LOADING
3. TRAILER LOADED—LOADING TRUCK
4. OFF FOR THE JOB
5. DUMPING AT THE JOB
6. RETURNING FOR ANOTHER LOAD

Truck No. 14 Day Work Hrs. 10 Night Work Hrs. ____ Date June 7 1915

Capacity 5 Tons		No.	Hrs.	Rate Hr.	Rate Ton Yd.	Labor Cost	Tons	Yds.	Cart'g Price	Extra Per Ton	Total Price	Income	Net Results
Job No. 1 City Hall	Car Laborers	4	—	—	.08	.56	6.8		.50		.50	3.40	
	Extra "												Net Income
Job No. 2 Chicago Ave.	Car Laborers	4	—	—	.09	2.95	32.5		.50			16.25	47.09
	Extra "	1	4	.20		.80							Profit
Job No. Rogers Park Lake View Sta.	Car Laborers	3 1	— 3	.20	.09	.54 .60	6.2		.60			3.72	17.48
	Extra "	3 1	— 2½	.20	09	4.26 .50	47.4		.50			23.72	Loss
All Jobs Supt's.						350							
TOTAL						13.71	92.9				TOTAL INCOME	#4709	
Driver La Grosse		Charge Truck				4.00	Cost per Mi.		06.4	Income per Mi.		76.2	Inc. per Ton 50.6
Overhead Expenses		Ins. Garage & Etc.				2.50	" " "		04.	Cost per Mi.		47.1	Cost per Ton 31.8
Trips 62 Miles @ ~~10c~~ 15c per Mi.		Tires, Gas, Repairs, Etc.				9.30	" " "		15	Profit per Mi.		29.1	Profit per Ton 18.8
Scales 1 Load @.10						.10							
Truck, Driver, & Labor Cost						29.61	Cost per Mi.		25.4	Loss per Mi.			Loss per Ton

No. Tons 92.9 Yds. ____ Trips 15 Av. Ld. 6.19 Miles 62 Av. Trip 4.13

REMARKS

HOW ONE CONTRACTOR KEEPS HIS MOTOR TRUCK COST RECORDS

It was possible to perform in 30 sec. or less with the portable loaders what would have required all of 15 min. without them. Although it needed on an average only 12 min. for shoveling 4 yd. of material into the buckets, 15 min. or more would have been necessary had the shoveling been done direct from the cars into the motor truck. By reducing the length of the shovel throw the loaders lowered the shoveling time by 20 per cent and increased the shoveling capacity of each man by an equal amount.

The machine handled 256 yd. or 384 tons of material in 8 hr., or 1 load of 4 yd. every 7½ min. At 10 cents a yard the Arrow Motor Cartage Company earned on this day's performance a gross sum of $102.40. This at the rate of $12.80 an hour, or 21 1-3 cents a minute.

ANALYSIS OF MOTOR TRUCK'S USEFUL AND WASTED TIME

Morning Work—24 Trips

Operation	Trips Considered	Best Time M—S	Worst Time M—S	Average Time M—S
Maneuvering for load	22	:50	2:25	1:07
Loading	21	:20	1:01	:26
Maneuvering after loading	22	:20	1:10	:23
Running time out	22	1:20	3:05	1:58
Maneuvering for dumping	24	:10	1:35	:25
Dumping	24	:15	:50	:25
Maneuvering after dumping	24	:05	:55	:18
Running time back	22	1:15	3:00	2:01
Loading and unloading	21	:40	1:25	:56
Maneuvering, loading and unloading	22	1:10	3:25	1:31
Running time out and back	21	3:10	5:20	4:04
Running and maneuvering time	21	5:30	7:40	6:04
Trip time (all items)	20	6:30	9:10	7:48

Afternoon Work—40 Trips

Operation	Trips Considered	Best Time M—S	Worst Time M—S	Average Time M—S
Maneuvering for load	37	:10	1:05	:32
Loading	36	:15	1:00	:30
Maneuvering after loading	40	:05	1:05	:31
Running time out	40	1:00	2:40	1:46
Maneuvering for dumping	39	:10	1:10	:37
Dumping	40	:10	1:15	:20
Maneuvering after dumping	40	:05	1:15	:24
Running time back	40	1:05	3:50	2:20
Loading and unloading	37	:30	1:55	:54
Maneuvering, loading and unloading	37	:15	2:00	1:02
Running time out and back	40	2:35	5:15	4:29
Running and maneuvering time	37	4:25	7:20	6:00
Trip time (all items)	36	5:30	9:00	7:14

LOST TIME COSTS MONEY

An example of what the lost minutes mean can be seen in the irregular trips. Because the supply of sand became exhausted two trips, 20 and 21, to a distant yard were necessary. Together the two trips consumed 49 min. 40 sec., or 34 min. 40 sec. more than two normal trips. Here was a direct loss of $7.38. Then, waiting for material between 10.25 a. m. and 12.47 p. m. consumed 2 hr. 20 min., worth $29.63. These avoidable losses were deducted from the total elapsed time, giving the actual working time of approximately 8 hr.

On trip 1, due to hand shoveling direct into the motor truck, 17 min. and 45 sec. were wasted, a loss of $2.64. On trip 19, traffic delays cost nearly 7 min., or about $1.47. On trip 37, waiting for buckets cost almost 9 min., or nearly $1.89. Hundreds of other leaks—some avoidable and others not—contributed their share in holding down the efficiency of the machine. The mere difference in the length of the morning and afternoon hauls cost nearly $2.50.

The significance of avoiding time leaks is illustrated in the accompanying table. The average time for each morning trip was 7 min. 48 sec. For the afternoon trips it was 8 min. 14 sec. The average for the day was 7 min. 31 sec.

The best time made on any morning trip was 6 min. 30 sec. The best time for the afternoon trips was 5 min. 30 sec. The average of the two is 6 min. This is 1 min. 30 sec. better than the actual average. On the day's work of 64 trips this difference would have increased the motor truck's earnings by $20.32, or more than enough to pay the cost of operating the machine.

During the week of Oct. 18, 1915, the cartage company hauled 1571 tons of coal and 738 cu. yd. of gravel to twelve different jobs, making 467 trips averaging 875 miles with one 5-ton Pierce-Arrow truck and a Troy trailer of 3½ cu. yd. capacity. The gross income for the week was $1,058.56 and the net profit $336.09.

ADAPTATION TO CITY WORK

The truck is equipped with a three-way dumping body of 8 cu. yd. capacity that was built for hauling coal to a pumping station. In hauling gravel about 5 cu. yd. composed the truck load. The advantage of the side dump for city work, according to the contractor, lies in its ability to dump clear of the tracks when working along street car lines. The material clears the wheels, piles up high and does not spread over a large flat area. The length of the train shown in the accompanying photograph is 33 ft. The average speed attained is 12 miles per hour and the maximum 14 miles per hour. The truck runs as fast with the trailer as without, and according to the records the trailer adds very little more to the fuel cost. The average speed of the truck loaded is about the same as when empty. The men at the loaders are paid 11¼ cents per yard of stone, sand or gravel.

STREET-CLEANING DATA on seventeen American cities compiled by the committee on standard forms of the American Society of Municipal Improvements indicate that an average of 16,462 sq. yd. of pavement per sweeper and driver were covered per day. The contributing population was 1785 and the sweepings amounted to 29.76 cu. yd. per 1000 sq. yd. per year. Only ten cities gave information on this last point, the amounts varying from 12.3 cu. yd. at Washington to 58.9 cu. yd. at Boston. Average figures obtained for refuse collection are 2296 persons per collector, 2477 cu. yd. per collector per year and 1141 cu. yd. per 1000 population per year. The last item varied from 128 at Erie to 1780 at Toronto.

Letters to the Editor

Comment on matters of interest to engineers and contractors will be welcomed

Are Timber Pads Under Crushing Machinery Desirable?

SIR: The writer would appreciate a discussion in these columns upon the use of timber pads under crushing machinery. The manufacturers of these machines call for timber pads between the base castings and the concrete piers. There are several reasons why the use of timber for such purposes is objectionable, and the writer does not see any logical reason why, in most cases, these pads may not be left out, the machines bolted directly to the piers, and the vibration transmitted through the pier to be absorbed in the earth. Is it not a fact that the use of these pads is a survival of a theory which may be questioned?

J. MASTELLA LE GRAND,
Designing Engineer, United Verde Copper Company.
Clarkdale, Ariz.

Sand for Concrete

SIR: I have read with keen interest the article on sand for concrete, by Prof. Robert H. McNeilly, in your issue of Nov. 27, page 659. These observations are, in a large measure, confirmed by results which have been obtained in our laboratories in making commercial tests of sand during the past several years.

The accompanying tests illustrate the value of a high content of material passing the ¼-in. sieve and retained by the No. 10 sieve, and also indicate that a notable quantity of dust passing the No. 100 sieve is not necessarily detrimental to the quality of the aggregate. These tests were made on two samples of crushed limestone. They were manufactured from the same stone, the only difference between them being the method of screening.

GRANULOMETRIC ANALYSIS

Sieve number	Per cent passing "Run of crusher"	Per cent passing No. D material
¼-in.	95.0	100.0
10	56.0	97.0
20	48.0	73.0
30	41.0	44.0
40	35.0	20.0
60	28.0	6.0
100	20.0	5.0

COMPARATIVE TENSILE TESTS, POUNDS PER SQUARE INCH

(Briquettes stored 1 day in air and 6 days in water)

1 part cement, 3 parts Ottawa sand, 9.2 per cent water	1 part cement, 3 parts No. 10 material, 12.5 per cent water	1 part cement, 3 parts "run of crusher," 12.5 per cent water
415	250	280
390	235	290
360	250	265
425	260	300
320	225	285
Average 318	246	284

(Briquettes stored 1 day in air and 27 days in water)

405	465	465
435	465	485
415	455	475
450	445	490
400	460	510
Average 417	458	484

In commenting on these tests I would point out that the "run of crusher" contains 41 per cent of material caught between the ¼-in. and No. 10 sieves, and 35 per cent of material passing the No. 40 sieve. This material is, therefore, fairly close to Professor McNeilly's preferred sizing.

The material designated "run of crusher" has been for several years in very successful use for fine aggregate in concrete, and although users are at first reluctant to use it, it is considered by many users of several years' standing to give far better concrete than natural sands from the same locality.

Although for the sake of convenience in sand testing tensile tests are usually employed, I have, for several years, been doubtful of their value in forming a true opinion as to the quality of sand. We have had several cases wherein sands which made a very poor showing in comparative tests with Ottawa sand gave high values when tested in concrete in the form of 6-in. cubes or 8 x 16-in. cylinder specimens. I feel that comparative compression tests for sand mortars should be substituted for comparative tensile tests.

The conclusion of Professor McNeilly that a point exists above which an increase in the proportion of cement causes a weakening in the mortar, has been confirmed on numerous occasions in this laboratory. In a series of comparative compression tests, the specimens being 8 x 16-in. concrete cylinders, it was found that with reasonably good fine aggregate an increase in cement resulted in lower compression values at 30 and 90 days. It was only with fine aggregates of extremely poor quality that an increase in cement showed higher strength under compression. The first series of cubes were on the 1:2:4 basis, while those containing a higher portion of cement were on the 1 1/16:2:4 basis.

E. L. CONWELL,
Vice-President, Henry S. Spackman Engineering Company.
Philadelphia.

Opinion Testimony of Engineers and Economists

SIR: In your issue of Nov. 20, page 645, Prof. John H. Gray, University of Minnesota, is reported as having expressed at the recent conference in Philadelphia on valuation, his views on "Opinion Testimony," which are nothing short of arrogant.

I quote from your report: "As applied to valuation, he said the so-called expert testimony of engineers was incompetent; that if value was related to any science it was the science of accounting or economics, but not engineering; that engineers were not trained to a knowledge of wealth or value, and that their expert testimony along these lines was universally regarded by economists as unscientific."

My first comment is, so much the worse for the economists of Professor Gray's class. I have no doubt that many of the book-economists, men who have cultivated in their minds certain theories by reading each others' books, would so disqualify engineers and all others outside of their little circle, provided they had the power.

But there are economists and economists. Judge Prouty, formerly chairman of the Interstate Commerce Commission, and now chairman of the government valuation board, and Professor Daniels, now a member of the Interstate Commerce Commission, and formerly a professor of economics in Princeton University, have lately expressed the opinion in public addresses that engineers, by reason of their training and experience, are the ones best qualified to testify on values.

Again quoting from the report, "He held that they (engineers) were not disinterested witnesses, being well paid for their opinions, and hence being in effect assistant counsel testifying." Do professors of economics testify without pay? I have the impression that some of them are being well paid for their services and that they are peculiarly open to the charge of mental dishonesty. I should be sorry indeed to believe that on the average the engineers who give opinion testimony are as incompetent and unfair as some of the professors of economics who enter this field.

If there is selected an engineer who is a specialist and a broadly educated man, who has had a wide experience in design, construction and operation, and so has had his theories, designs and constructions tested in the fire of operation and practice, it hardly seems to be open to question that he must be better qualified to advise on values than a book-economist who has never been called upon to make good on the theories he has so glibly expounded to his students.

Does Professor Gray imagine that because a man is an engineer he is thus shut out from a knowledge of accountancy and economics? If so, then the facts disprove his contention. There are in the United States a large number, increasing year by year, of administrative engineers who possess a knowledge of accountancy that is not a matter of textbooks alone, but is qualified, tested and strengthened by the constant demand for the solution of vexing questions.

ALEX. C. HUMPHREYS,
President, Stevens Institute of Technology.
Hoboken, N. J.

Bridge Patent Hearing to Begin About January 1

SIR: Your issue of Nov. 20, page 645, contains an item concerning the investigation the Senate Committee will make concerning the fraudulent obtaining of patents by Daniel B. Luten of Indianapolis, Ind., and the illegality of the issuance of these patents by the Patent Office.

In this you state: "The committee was duly designated and the first of the hearings set for Nov. 8. Notices of the hearing were sent to interested parties, but despite the fact that interests in Iowa and Kansas were active in securing the passage of the resolution none of their representatives were present at the hearing."

This statement gives an erroneous impression, in that no notice was received by the state highway departments or the departments of justice in Iowa or Kansas, nor was Senator Kenyon of Iowa, who is a member of the committee, notified that the first hearing would be held Nov. 8.

This hearing will begin about the first of January, and Iowa, Wisconsin, Nebraska, Oklahoma and Kansas will have representatives present.

W. S. GEARHART,
State Engineer of Kansas.
Manhattan, Kan.

HINTS FOR THE CONTRACTOR

Details Which Save Time and Labor on Construction Work

Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

[*Contributions to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

Clean Boiler Water Secured from Muddy Streams with Well-Points

BOILER water difficulties were acute on the dredges of the California Development Company, which owns and maintains the main canals of the system supplying the Imperial Valley, in southern California and the northern part of lower California, until the superintendent of the river division, H. M. Rouse, hit upon the plan of using a well-point. Previously various devices had been used, the most satisfactory being a large settling tank on each dredge, in which a boiler compound was used, to counteract the slight alkalinity of the water. These tanks, however, were difficult to clean, and at best gave an unsatisfactory water.

The plan hit upon and now used exclusively on the company's fleet of dredges is to jet down a 3-in. well-point, inside of which is the 1-in. jetting pipe. One of these points is hung from a spud-frame of each dredge, and can be jetted down in a few minutes wherever the dredge is working, and pulled as easily for moving. The pipe is jetted down into the channel bed itself, taking care that the screen is well below the channel bed. Thus advantage is taken of the natural filtering action of the stream bed material. When the point is down to proper depth the feed pump, whose suction is attached to the well-point by a hose, is started, delivering directly to the boiler.

Painting a Pipe Line by Machine

A GASOLINE engine-driven machine has recently been developed in California for applying a protective coating to 8 and 10-in. steel pipe after the joints have been made and just before the pipe is lowered into the trench. The pipe line to be treated, belonging to the Valley Pipe Line Company, was 170 miles in length and the cost of applying the paint coats was very materially reduced by fitting up a device that first cleaned the pipe by means of a revolving brush and scraper and then applied a liquid priming coat by means of other revolving brushes.

Two machines of somewhat different type were used, the one for cleaning and applying the priming coat was driven by gasoline engine, while the second, for applying the coat of bitumastic enamel, which is solid at ordinary temperatures, was driven by hand power. The cleaning and priming machine carried a scraper and revolving bristle brush on the front end, while the brushes for applying the paint followed on the rear end, the paint being forced to the outer edge of the brushes by centrifugal force. The entire equipment was self-contained, the 6-hp. gasoline engine which provided motive power revolved all the brushes, and the engine frame carried three tanks, one each for water, gasoline and paint.

A crew of two men operated the first machine, which was attended by three other men operating a long lever mounted on wheels. With this lever the pipe was raised from the 4 x 6-in. wooden skids across the trench provided by the pipe-screwing crew, and as the priming machine moved ahead the skids were replaced behind it.

No less than two hours behind the priming machine, which was the minimum period required for setting of the priming coat in good weather, and not more than four hours later, the enameling machine went over the line and placed the ⅛-in. coating of bitumastic enamel. The enameling machine was operated by hand, by turning a crank which caused it to move along the pipe. Large kettles mounted on wheels were used for serving the machine with melted enamel, the kettles being heated by petroleum distillate fuel. After being placed, the enamel coating was retouched where necessary and finally subjected to a rigid inspection, in which a mirror was used for examining the underside of the pipe.

The contract for placing the protective coating was executed by Hill, Hubbell & Company, San Francisco, who developed the machines described.

Pneumatic Drill Closes Doors on Hopper Scow

THE CRANKS closing the bottom doors of a 305-yd., 5-pocket dump scow being used in dredging at Montreal harbor are now being operated with a "Little Giant" drill motor. Although the cranks were designed to operate by hand, and the motor was made to run a reaming and tapping machine, the combination works to perfection. The scow, which is one of those tending a dredge of the Dominion Government, in charge of Captain MacIninch, has pockets closed on the bottom by heavy double doors. These are 8 in. thick, 4½ ft. wide and 18 ft. long. It formerly took six or eight men from 40 min. to an hour to wind up the doors of all five pockets. Using the drill motor instead of the special hand wrench provided with the scow, two men can close all the doors in 20 min. The square shank of the drive shaft, which is geared to the winding shaft, fits, of course, into the chuck of the drill, which is connected by a hose to the dredge. The machine is carried from pocket to pocket till all the doors have been shut.

Oil and Spare Parts Carried to Trucks at Work by This Car

GETTING spare parts, oil, lighting tanks and extra drivers around to a lot of trucks operating at scattered points is admitted by those who have tried it to be a hard job. Its difficulties are materially lessened for Clinton Bretell, whose work is described on another page of this issue, by a small Ford car with a special platform and tool box built on the back end. When the lid, shown raised in the photograph, is shut it furnishes a substantial platform on which an oil barrel, Prest-o-lite tanks, etc., may be lashed. Under the lid next the back of the seat is a locked tool box in which "valuables" like wrenches and brass parts may be transported. Behind this under the lid is a large open space for heavy spare parts.



REMOVABLE BOX AND PLATFORM FOR SUPPLIES AND OIL BUILT OVER TOOL BOX

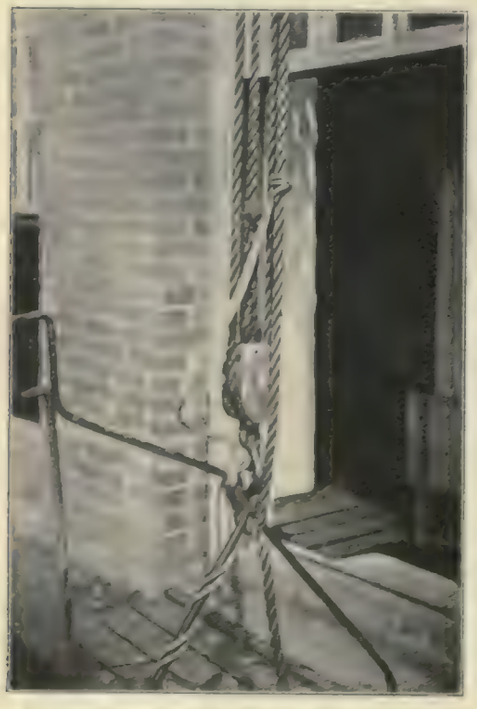
The lid and sides of the box are made of plank with angle-iron corners, which bolt together and to the platform which makes the floor of the box. By taking out a few bolts the three sides and the lid may be removed, leaving the tool box, which furnishes a good seat for two extra passengers. This feature has been turned to good account in carrying extra drivers and mechanics around to the trucks.

This simple arrangement has made it possible to keep the truck drivers on road work supplied with all necessities, without taking their time and that of the heavy trucks to make trips to the nearest railroad station.

Hitch with Sash Cord Prevents Scaffolds from Falling

A SAFETY device which can be rigged in a few minutes by anyone, which is easy to use and which will prevent accidents in raising and lowering scaffolds if one of the men should, for any reason, lose his hold on the rope is shown in the accompanying illustration. The small swinging scaffold widely used by painters, concrete finishers and others is operated by two men, one at each end of the platform. When the scaffold is to be raised or lowered the supporting ropes at the ends of the platform are detached from the hooks to the scaffold, to which they are tied while the men are at work, and each man pulls in or slacks off on his fall, according to whether the platform is to be raised or lowered. Accidents have often occurred from one of the men losing hold of his rope for some reason while it is not fastened to the hook, causing one end of the scaffold to fall and one or both of the men to be thrown to the ground. Although various attempts have been made to find a safeguard for such accidents, the devices hitherto tried have not met with any great favor.

The safety rigging illustrated herewith consists essentially of an auxiliary rope of stout cord at each end of the platform, arranged so as to hold the hoisting ropes securely and prevent them from moving



SAFETY HITCH MADE WITH SASH CORD

except under the control of the operator. The idea can be carried out in a number of ways. The arrangement shown in the photograph consists of wrapping the middle part of a strong, new sash cord, of about ⅜ in. diameter, three times around the free part of the supporting fall. The two parts of the window cord are then fastened together near the fall by binding them with stout cord. The hanging ends of the cord are then made fast to the scaffold-iron so that the part that encircles the free rope of the main fall can stand at a height of about 4 ft. above the platform when the cord is extended. In raising or lowering the scaffold each workman grasps the free end of the fall at his end of the platform in such a way that one of his hands holds the part of the window cord that encircles the fall part. As he shifts his hand up or down on the rope, he slides the loop of cord along it at the same time. If either workman should lose hold of the supporting rope, the end of the scaffold where he stands will descend a few inches until the window cord is drawn taut, when the stopper-hitch of the window cord around the free part of the main fall will prevent further movement. The danger in using this device is that the men may come to rely on it to hold the scaffold while they are working. The free end of the supporting rope, however, should invariably be hitched in the usual way. Unless this is done, the advantage of having two fastenings will be largely thrown away.

This device was originated by the Royal Typewriter Company of Hartford, Conn., and in experiments conducted by the Travelers' Insurance Company proved to be capable of performing its functions satisfactorily and with certainty.

Pile Driving with a "Can"

By P. L. McGEADY
Wilkes-Barre, Pa.

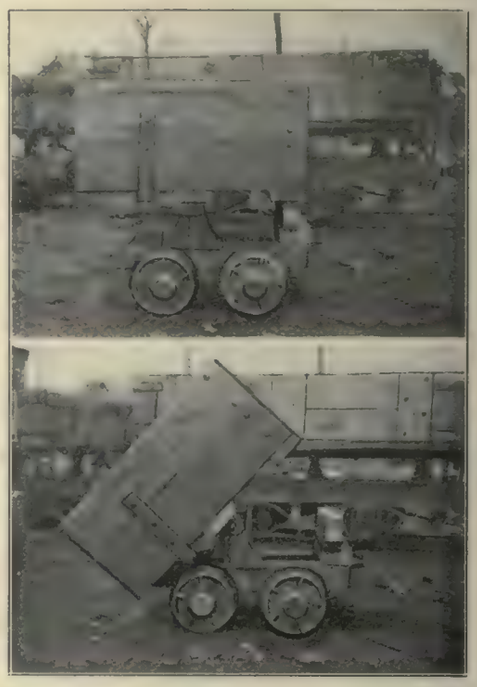
PILE-DRIVING contractors are more or less familiar with the difficulty encountered in driving piles in deep water to cut-off, when the cut-off grade is much below the water surface, and the tedious operations made necessary in cutting off piling not driven to grade. These difficulties may be practically eliminated by use of what may be termed, for want of a better name, a "can." Though the use of this device is not new, the saving it makes over using a simple follower and its general advantages are not usually appreciated. The "can" consists of a steel or wrought-iron pipe having a diameter a few inches larger than both the largest pile to be driven and the follower to be used in driving the piles, and having some means for attaching a chain or cable to one end so that it may be readily handled. An extra pile line on the rig saves time and facilitates the double handling, but where this cannot be readily installed the utility of the "can" is sufficient to make its use worth while, even in very strong currents. Here it is often necessary to guy the pipe to prevent it from tilting over while the follower is being picked up and lowered into it, and also to keep it plumb while the pile is being driven home.

After the pile is set, the "can" is placed over it and the pile driven home with the follower. The "can" is then picked up and used on the next pile. It is often found advantageous to start several piles before using the pipe and follower and then drive all these home, after which the rig may be moved back and another set placed and driven and this procedure continued to the end. This method insures speed, but requires a great deal of care on the part of the foreman to prevent skipping any of the piles. This is a very easy thing to do, since, usually, the tops are already submerged.

This method was used on the foundation for a dock wall recently completed at Toledo, Ohio, where piling was driven to cut-off at a depth of 24 ft. below normal water level. When the cofferdam was pumped out and the excavation completed, it was found that the piles were so nearly uniform in grade as to require cutting off less than 3 per cent of those driven.

Well-Balanced Dump Cars Made on New York Subway Contract

HALF-A-DOZEN end-dump cars of the type shown in the photograph are saving expense in taking out the earth top headings of a deep cut on 138th Street, west



CAR DOES NOT TURN OVER WHEN DUMPED

of Second Avenue, in constructing the west branch of the new Bronx subway in New York City. Three cars are used on parallel tracks in each heading. End-dump cars are desirable for this work, as they can be loaded from the rear side, run back to the edge of the bench and dumped down chutes on the face of the lower cut without requiring trestlework to run them out over cars on the lower level. As is well known to those who have used them, cars of this type are hard to balance so that they will dump easily and not kick off the track. These cars, however, dump without trouble and do not require holding down with that nuisance necessary to badly balanced cars—a lever through the truck frame.

The cars were built of timber, using old wheels and dump-car castings at hand on the job. All the material except the oak lumber used would be considered scrap, so that the cars were provided for little more than the labor used in making them. They were designed by H. R. Shailer, general superintendent for the Richard Carvel Company, Inc., on whose section they are being used.

SAND SHOULD ALWAYS BE TESTED, according to Sanford E. Thompson in a paper on "Concrete Aggregates" presented before the International Engineering Congress. A table of results of actual tests showing variation in strength of mortars made with different sands compared to standard Ottawa sand is given in proof of this conclusion. The most satisfactory test is the determination of the strength of the mortar made up with the cement and fine aggregate to be used on the work in comparison with identical specimens made in the same proportions with standard sand.

Adequate Railway Systems a Basic Element in Military Preparedness

George Dallas Dixon Tells International Trade Conference How Pennsylvania Lines Could Serve in Case of War

UNLESS the railroads of the United States can be depended upon for the transportation of huge numbers of men and vast quantities of munitions and supplies, in the event of a threatened attack by a foreign power, any plan of preparedness involving the Army and Navy exclusively will be incomplete in one of its most vital features. This, in effect, was the contention of George Dallas Dixon, vice-president in charge of traffic of the Pennsylvania Railroad, made in an address delivered Dec. 6 at the International Trade Conference in New York City. Taking the Pennsylvania system as an example, Mr. Dixon explained in detail the service it could render, with its trained force of 200,000 men, including 700 civil engineers and 200 mechanical engineers, if war should be declared. Arguing on the ground that the railroad is a military necessity, as shown by the events of the war in Europe, Mr. Dixon made a plea for treatment, on the part of the federal and state governments, which will insure the healthy growth of the common carriers. His address, slightly condensed, follows:

Transportation a Military Question

"It has often occurred to me that in all the discussions of preparedness one of its most important phases, possibly its most important—transportation—has been overlooked by the majority of people. It is every bit as important that our railroads should be prepared for national defense as it is that our Navy and our Army should be prepared. As we are virtually pledged against another war of aggression, our military plans must necessarily be plans of defense, with a greater navy, primarily, and a greater army, secondarily, as the most obvious needs. There is danger, however, that the very obviousness of these necessities in any plan of preparedness may blind the eyes of Americans to another necessity, which is less obvious but by no means any less vital, and that is, adequate preparation for the mobilization and co-ordination of the internal resources of the country. This means good railroads. Not merely as good as we have now, but better. Suppose that a hostile army was about to invade our land. What part would the American railroads play in the scheme of national defense and what would be expected of them?

Value of Railroads in Preparedness

"There are, to be sure, abundant commercial reasons why it would well repay the American people to conserve and encourage their railroad systems and make their more rapid expansion and upbuilding possible. Well-constructed, well-equipped, properly manned, skillfully managed and solvent railroads are necessary to a healthy state of business. But as a military resource, a vital element in preparedness, they would be valuable beyond the possibility of expression in terms of money.

"During the period from which we are just emerging, when business was, to say the least, quiet, our railroads were unable, for financial reasons, to improve their properties in anticipation of a return to what I might call a prosperous era. Their earnings were not sufficient to warrant investors in supplying the capital needed to provide facilities for a greatly enlarged traffic, nor were they enough to enable the roads to put by a surplus for better cars, heavier bridges, more modern signals, and all of those things which go to make up a good railroad, but which, except to a very small extent, do not increase a railroad's earning power. Private capital is ready to-day to invest in our American railroads and needs only the assurance that the people and the government wish to see it allowed a fair and reasonable return. Just consider how helpful it would be now to the country's welfare if our railroads had the facilities needed at this very moment to handle our export commerce—I might almost say, under existing circumstances, the world's commerce.

"Certainly the present situation in which the railroads of this country find themselves should be adequate proof to the people that our railroads should be prepared for any possible emergency, whether it be to handle an extraordinary quantity of traffic such as is now being offered for transportation, or for any extraordinary service the government might call on them to perform. The very existence of the nation, in the unhappy event of a war, might well hinge upon the ability of our interior transportation systems to bear the tremendous burden that would be put upon them, without collapsing. To be certain of so doing, they need great strength, much more than, as a whole, they have to-day.

War's Lessons in Europe

"The war in Europe has taught no surer lesson than this, that great forces of men, however courageous or admirably trained, are of little military value without the means of moving them with promptness and order and of keeping their many needs continuously supplied. This means transportation facilities that can be counted on to work with the smoothness and certainty of a machine. Without such facilities, all other preparations are useless, and the effort put into them wasted. The railroads have played an important part in all the great wars of the last three-quarters of a century, that is, in every principal struggle of nations and rulers since the wars of Napoleon. But never before have they assumed the importance that they hold in the present war. Practically every great campaign in Europe during the last fourteen months has centered, at some crucial stage, about the possession of a railway line or junction point, control of which meant rail communication, or the loss of it, for one side or the other. The whole land campaign in the Balkan states, and the intricacies and ramifications and intrigues of diplomacy that have accompanied it, resolve themselves into a struggle, on the one hand, to establish a line of railroad communication between Central Europe and Turkey, and, on the other hand, to prevent the establishment of such a line.

"The ability of the Germanic allies, thus far, to exist within the 'iron ring' and not only to prevent it from contracting with a crushing pressure, but to push it back here and there and even to break through it in places, is of course due to many factors, but certainly to none more than to that perfection of plans and facilities for railroad transportation in every direction, at any time, which was one of the principal elements in Teutonic preparedness. By her railroads Germany has kept her armies and material resources liquid and they have flowed from one frontier to another with the swiftness and smoothness of water. The German railroads were built and developed, under a militaristic system, with a first eye for military use. Our railroads were built by private capital to serve the needs of the commerce of a non-militant people, and are in themselves commercial enterprises. This, however, in no way detracts from their value for military purposes, since economic law has seen to it that they connect the centers from which men and supplies must be drawn in case of war.

American Roads' Needs

"The American people can make no wiser investment in military preparedness, and can buy no stronger assurance for the preservation of the nation's integrity, than by allowing their privately owned railroads sufficient income at all times:

1. To bring all track and roadway up to standard conditions and maintain it thus.
2. To construct the double, triple and quadruple tracking and to make the terminal extensions and improvements that are required now, by the needs of peace, and which would be of immeasurably greater value if the railroads were ever called upon to assist in military operations.
3. To acquire sufficient supplies of locomotives and cars of modern types, and to reconstruct or replace all obsolete equipment.
4. To hold in the service a sufficient number of well-trained, well-paid and satisfied men, both officers and employees, to assure prompt and efficient operation in any emergency. Some railroad systems are substantially in this condition at the present time, but many, less fortunately situated, are not. If all were enabled to become so, within a reasonable time, the nation would be possessed of a military resource of inestimable value.

The Pennsylvania System

"Take the Pennsylvania Railroad system, with its associated lines, and consider what part it could play and what it could offer the nation in time of need. In the first place, it could offer a trained and disciplined army of more than 200,000 men for the performance of those indispensable transportation services without which the army and navy forces would be helpless. It would probably not be within the province of any railroad management to decide where its men could perform the greatest service—on the battlefield, or in engine, train and shop—or to interfere with personal freedom as to enlistment, but the government would no doubt decide that every consideration of wisdom lay in maintaining the organization of this and other railroad systems substantially intact. The English railroads sent a considerable number of men to the trenches early in the war, but in the first few weeks of the struggle England learned the value—indeed, the absolute necessity—of unhampered transportation, even though the actual battlefields are not

on British soil. Both England and France have learned the lesson of the extreme unwisdom of sending to the front those men who have the special mechanical and other training and experience needed to keep up with the enormous demands made upon the national resources for production and transportation.

"The Pennsylvania Railroad could offer the nation a physical transportation system which handles the most extensive commercial railway traffic in the world—a system embracing more than 11,000 miles of line and over 26,000 miles of track, with terminals in the three largest cities of the country and in eight out of ten largest centers of population. This system operates only about one-twenty-fifth of the total mileage of the country, but it carries almost one-eighth of the freight traffic and more than one-eighth of the passenger traffic. The railroad's rolling equipment consists of the following: 7500 locomotives with a combined tractive power of 250,000,000 pounds; 7000 passenger cars, with a carrying capacity of 330,000 people; 275,000 freight cars, with a carrying capacity of 13,000,000 tons.

"The locomotives owned by the Pennsylvania have power sufficient to haul, simultaneously, over any ordinary grades, soldier trains of 100,000 cars in all. These trains could move an army of from 5,000,000 to 6,000,000 men and would fill a stretch of track as long as the system's main line from New York to Washington and from Philadelphia to Chicago. No simultaneous movement of men on such a scale would be actually possible, but the figures give some idea of the extent of the transportation facilities of one system which would be available for the service of the nation.

"In addition to carrying facilities, this system has vast shop resources and a great body of skilled mechanics. The railroad shops at Altoona, Pa., alone—the largest of their kind in existence—employ 12,000 hands, a large proportion of whom are highly trained machinists. Counting all the shops on the Pennsylvania system, the total of men who might be called upon for specialized service is 64,600.

CIVIL ENGINEERS INVALUABLE

"The road has in its service many other men highly trained in the professions and trades, or in special duties which from the standpoint of preparedness might make them invaluable to the nation. There are in the service of the system over 700 civil engineers, all of whom have had experience—many of them years of it—in railroad construction and maintenance. Think of the value of these men to the country in directing the work of planning and building the special railroads and bridges that would be required for military purposes. On the payrolls also are 200 mechanical and chemical engineers, who direct the motive power work at the various shops and round houses, including the repair and construction of locomotives and cars, and supervision of the testing of materials. These men could as readily turn their ability and technical knowledge to military purposes.

"For military purposes all of our railroads would have to be regarded from the viewpoint of their possibilities as one system, and the nation can ill afford to allow any part of this country-wide system of 250,000 miles of steel highways to deteriorate or to continue anywhere impoverished or inefficient, for what I have said of the importance to the nation of the Pennsylvania applies, in a varying degree, to all railroads. Next, to an adequate army and navy, if not indeed of equal importance, is the condition of the railroads of the United States as a factor in national preparedness. Only railroads of the highest efficiency can truly unify the country and keep its resources of men, money and materials in a liquid and mobile state. As a military precaution, if for no other reason, it would be in the highest degree wise and profitable for the American people to see to it that their railroads have sufficient financial resources to be able to serve this end properly, and that the federal and state governments accord them treatment which will insure their healthy growth at all times."

Large Baltimore Drain Has Multiple Harbor Outlet

Necessity for Reducing Velocity of Storm Flow Caused by Mooring of Vessels Near Discharge Point

IN DESIGNING the storm-water drainage system for the city of Baltimore one of the large problems which presented itself to Calvin W. Hendrick, at that time chief engineer of the Sewerage Commission, was the relief of the Harris Creek or Harford Run intercepting drain. This drain takes care of the entire flow of the Harris Creek, Upper Harford Run and Ogiers Run drainage areas, or approximately 2371 acres. The lower portion of the drain was known to be inadequate, with a large part of the tributary drainage area only partially developed.

After careful study it was found that if the drainage area of Ogiers Run, the major part of which lies outside of the present city limits but drains toward and into the city, could be intercepted by the construction of a relief drain, the present Harris Creek drain would be just adequate to take care of the drainage area of 1621 acres for which it was primarily designed.

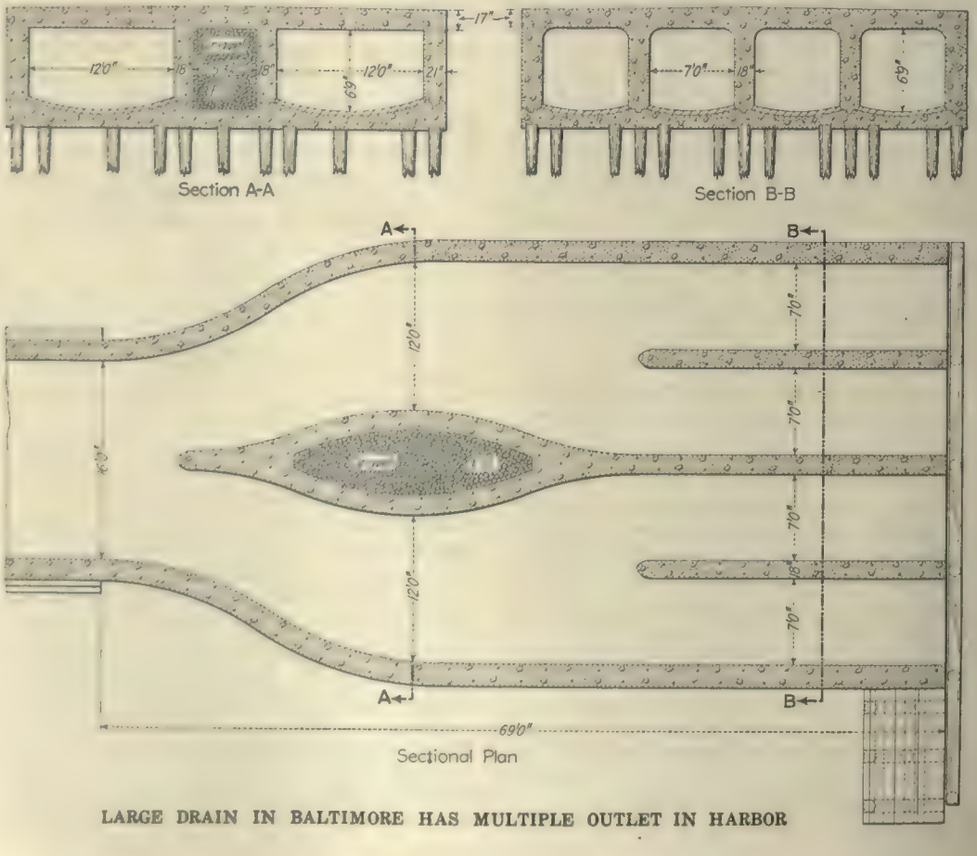
The Ogiers Run drainage area of 750 acres is largely undeveloped but its future development promises to be very rapid, and it was decided to put the relief drain under construction as soon as the necessary right-of-way along the waterfront could be acquired. The major portion of the drain, located in the bed of Linwood Avenue between O'Donnell and Lombard Streets, was completed as section 1, pending the acquisition of the necessary right-of-way for the outlet section, known as section 2.

TYPES OF CONSTRUCTION

Section 1 consisted of 4236 lin. ft. of 147-in. concrete drain, 2000 lin. ft. of which was constructed in tunnel. The outlet section consists of 530 ft. of 147-in. concrete horseshoe drain, 200 ft. of 192 x 81-in. reinforced concrete rectangular drain and a multiple outlet section 70 ft. in length.

As the outlet discharges through the harbor bulkhead, which is used for the mooring of vessels, it was necessary to lower as rapidly as possible the height of the storm flow in order to reduce its velocity and at the same time lessen its effect after its issuance from the drain. The multiple outlet consists of four short tubes, each 7 ft. wide by 6 ft. 9 in. high, with an invert elevation at the bulkhead line of —2.0. The outlet structure is built on wooden piles, with a row of concrete sheet-piling at the bulkhead line, the purpose of which is to retain the fill under the drain and back of the bulkhead. The necessary fender piles for the proper protection of the bulkhead against damage by vessels are also provided.

As the lower portion of the excavation is considerably below the tide level of the harbor a large cofferdam at the outlet is necessary, and the excavation is unwatered by means of two 6-in. centrifugal pumps electrically driven. The contract price of the work is $58,134.35. The contractor is the Raymond Concrete Pile Company, of Baltimore and New York. Alfred H. Hartman, division engineer, was in charge for the Baltimore Sewerage Commission.



LARGE DRAIN IN BALTIMORE HAS MULTIPLE OUTLET IN HARBOR

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

Blow-Out in East River Tunnel Result of Difficult Ground

The blow-out which occurred at 9.30 p. m., on Dec. 1, in the south heading of the Old Slip tunnels being built under the East River in New York City was not a serious one, aside from delaying the work in one heading for a short time. It resulted directly from the very difficult and unusual condition of having rock over most of the tunnel face with three feet of mud at the top. This formation makes it necessary to do blasting with the constant danger of disturbing the thin cover of mud over the shield.

While the shields of these tunnels are in rock, bottom headings 6 ft. wide by 5 ft. high are being driven in advance of the shield. In this a concrete cradle is laid, with embedded steel rails on which the shield slides. When 150 ft. of this heading has been driven, work in it is shut down and the shield is advanced till it reaches the end of the section. The shield is then stopped and 150 ft. more bottom heading and cradle completed. In advancing the shield, the rock is shot into the bottom heading. As the rock is seamy, it is necessary to carry 15 lb. of air pressure to balance the full hydrostatic head at the bottom of the advance cut. At the time of the accident a section of bottom heading had been finished, and the shield had advanced to within 120 ft. of its end. It is thought that the light blast fired in the rock section above the bottom heading just before the blow-out loosened the mud above and in front of the shield, reducing the 15 ft. of cover at that point so that it was possible for the air pressure to blow out into the river.

When the blowout occurred there was an outrush of air at the shield, which caused the air pressure in the tunnel to drop to 11 lb. Water and muck began to come in and, although every effort was made to hold the heading by throwing bags of sawdust into the blowhole it soon developed that the escape of air could not be controlled. No one was injured, although the crew remained in the heading until the water forced them to retreat to the emergency lock. Water filled the 300 ft. of tunnel to a depth of several feet.

The hole made in the river bottom was an inverted cone 25 ft. across at the top. Its filling with clay dumped from barges is still in progress, and the unwatering of the tunnel will not be begun until the parallel heading for the adjacent tunnel has been driven well beyond the line of the blowout, so that the same section of river bottom will not be subjected to pressure from both headings at once.

The East River tunnels are being driven by the Flynn-O'Rourke Company, Inc., of which George H. Flynn is president and Major John F. O'Rourke vice-president and chief engineer. For the Public Service Commission for the first district of New York State, Alfred Craven is chief engineer and Robert Ridgway engineer of subway construction. George S. Rice is engineer of the division including the work, and Clifford Holland is engineer in charge of all the East River tunnels.

No New River and Harbor Projects to Be Provided for This Year

No new river and harbor projects will be provided for during the coming session of Congress, according to an opinion expressed by Chairman Sparkman of the Rivers and Harbors Committee, after discussing the subject with President Wilson.

Engineers and Contractors Are Vital Factors in Plans for Military Preparedness

General Leonard Wood Tells Brooklyn Engineers' Club of Technical Man's Importance in National Defence—Engineer Reserve Corps Bill Drafted

Awakened to a new conception of their duties as engineers and as citizens, three hundred members of the Brooklyn Engineers' Club listened until well past midnight to inspiring messages on military preparedness, delivered at the club's annual banquet at the Hotel Bossert, Dec. 2, by Major-General Leonard Wood, Commander of the Army's Department of the East, and other military and naval authorities. Through each of the addresses there ran the same undertone—that the engineer, properly trained in military duties, must form the backbone of any comprehensive plan for national defense.

Tells Brooklyn Engineers' Club Members of Their Part in Military Preparedness Plans



Photo Am. Press Ass'n.

MAJOR-GENERAL LEONARD WOOD

Carrying with them the weight of authority these utterances were received with absorbing interest, and it was apparent that the straightforward presentation of the facts regarding the present status and future needs of the army and navy aroused in the members of the audience of engineers a realization of a great opportunity to serve their country, not only by individual preparation in the simpler military duties which the technically trained man is best fitted to perform, but also by a nation-wide co-operative movement embracing the intelligent organization of the vast resources which lie dormant, at present, in the engineering profession at large.

That such a movement is shortly to emerge from the visionary stage was made clear by William Barclay Parsons, who, as chairman of the joint committee of representatives of five of the great national engineering organizations, announced that a bill creating a reserve corps of engineers in private practice had been drafted and would be submitted to Congress this month. If this measure is acted upon favorably it may be possible to put into effect next summer a plan of field instruction for the preliminary training of engineer officers for the proposed reserve corps.

The need for such advance planning is a vital issue to-day. This fact was attested by Admiral N. R. Usher, commandant of the Brooklyn Navy Yard, who reminded the engineers that the bulk of the world's wealth is now being amassed in the United States while industrial progress elsewhere has been strangled by the European war. With such a prize as this country to be had for the mere taking—unless the United States is able to defend itself—there would be presented a strong inducement for some foreign power, with fighting forces highly developed and national coffers empty, to strike a swift blow from over seas in order to rehabilitate its own crippled finances.

Military Organization Needed

After an able summing up of the club's purpose in making preparedness the issue of the evening, Nelson P. Lewis, chief engineer of the New York Board of Estimate and Apportionment, acting as toast-master, introduced General Wood, who first emphasized the need of organization in any plan for military efficiency. Transportation, he said, is one of the big factors which concern the engineer, and in case of attack a great load would immediately fall upon the railroads. It would be folly, General Wood pointed out, to attempt to replace the existing personnel of the carriers with army engineers unfamiliar with the details of the transportation problem. The solution is to devise in advance a plan whereby every employee is assigned to specific duty which he is best qualified to perform. Thus the complex mechanism of traffic could be turned from the demands of peaceful com-

Testing Materials Society Changes Technical Committees Regulations

The following change in the regulations governing technical committees has been authorized by affirmative action on the part of the executive committee and the committee on technical committees of the American Society for Testing Materials: "As a general policy, only one representative from a given firm, company, corporation, laboratory, or other institution shall be eligible *to independent membership* on a given committee, although exceptions to this rule may be permitted at the discretion of the committee concerned. *If the membership on the committee is held in the name of a firm, company, corporation, laboratory, or other institution, more than one representative may, at discretion of the committee concerned, participate in its activities, with the understanding that such representatives shall jointly command only a single vote.*"

merce to those of war without any extensive reorganization and its resulting confusion. So it is with the other industries—the steel mills, motor truck plants and even the bakeries. The size, capacity, and method of operation of each industry must be studied in advance so that it can immediately be fitted in to the new program which a national emergency might call for.

People are apt to forget, General Wood pointed out, that the men on the firing line are a comparatively small portion of the huge organization which modern warfare demands, and that the actual fighter must be supported by men miles back of the trenches who supply him with clothing, food, ammunition, construction materials and hundreds of other necessities.

Officers Must Be Trained

One of the most vital elements of preparedness, according to General Wood, is properly trained officers. The military and Land Grant colleges and technical schools are producing each year a wealth of material, which, so far as military usefulness is concerned, is absolutely wasted. That is to say, the men who have had this training, some of it excellent and some less satisfactory, but all of it under officers of the Army detailed at the universities, are not gotten into camps of instruction under regular officers in conjunction with regular troops and given that final training which is needed to fit them for efficient reserve officers or officers of volunteers. There is a great opportunity for the large non-military universities of the type of Yale, Harvard and Princeton in the East to inaugurate courses in military art and so train men during the collegiate course that this training, in conjunction with two or if possible three camps of intensive training during the summer vacation, each of about five weeks duration, under officers of the Army and alongside of regular troops, will fit these young men for the lower grades of volunteer officers and, in any case, give them thorough grounding in the essentials of a soldier's training. It seems likely that a number of the country's influential universities will establish such courses and count them as part of the curriculum required for a degree. In fact, a movement is now on foot to standardize the courses of college military instruction throughout the country.

General Wood favors the adoption, in the United States, of the Australian or Swiss military systems, in which a light program of military training is begun in the secondary schools and continued for a few years after graduation at camps of instruction, generally requiring only a few weeks' service each year. The untrained man in war is almost entirely useless, and even if the United States could raise an army of a million men between sunrise and sunset, as certain visionary pacifists claim, the men would merely serve as targets for the enemy rather than as an effective arm of protection.

Military Training for Engineers

Engineers and contractors would be best qualified, with proper training, to direct the construction of defensive works in case an attack were threatened. They know where to get the men and the materials and how to use them, but under present conditions there is no means of organizing these men for the Army's use, in spite of the fact that they would undoubtedly be sought at the first call to arms. If a plan of military instruction were carried out the engineers, when called upon, could at once begin work as officers, with contractors' foremen and shift bosses, all selected well in advance, serving as their sergeants and corporals, thus preserving, in effect, the very features of organization and team-work under which successful construction contracts are carried out. But the important part of such a program, General Wood emphasized, is that it cannot be rushed through on a day's notice. Its success must be predicated upon a plan prepared well in advance, so that each available officer may be listed in the War Department's records, assigned a definite task to do and given the necessary training to do it efficiently.

Other phases of the subject of preparedness were discussed by Admiral N. R. Usher, commandant of the Brooklyn Navy Yard, Elmer A. Sperry, authority on the gyroscope and member of the Naval Advisory Board, Commander Jessup of the Navy and Captain Kilbourne of the General Staff.

Bill for Engineer Reserve

William Barclay Parsons' announcement that the joint national committee of civil, electrical, mining, mechanical and consulting engineers, of which he is chairman, has drafted a bill for the creation of a reserve corps of engineers, which will be submitted to Congress this month, was greeted with enthusiasm. The proposed plan is to develop engineer officers from men in private practice, by a brief tour of field service each summer and possibly by a correspondence course during the winter months. Engineers were urged to impress upon their representatives in Washington the desirability of supporting this measure. To a session dealing with preparedness in the abstract the news that the first definite step toward securing the legislation necessary to carry out the plans proposed came as a fitting climax to a memorable meeting.

Chicago Council Ignores Findings of Smoke Report

Five days after the smoke abatement and electrification report of the Chicago Association of Commerce committee had been made public, the city council passed an order directing its railway terminals committee to take up for immediate consideration the subject of electrification of steam railways within the city of Chicago, and to report at an early date such ordinance as in its judgment may be necessary to bring about the adoption of electricity as a transportation power where steam power is now employed.

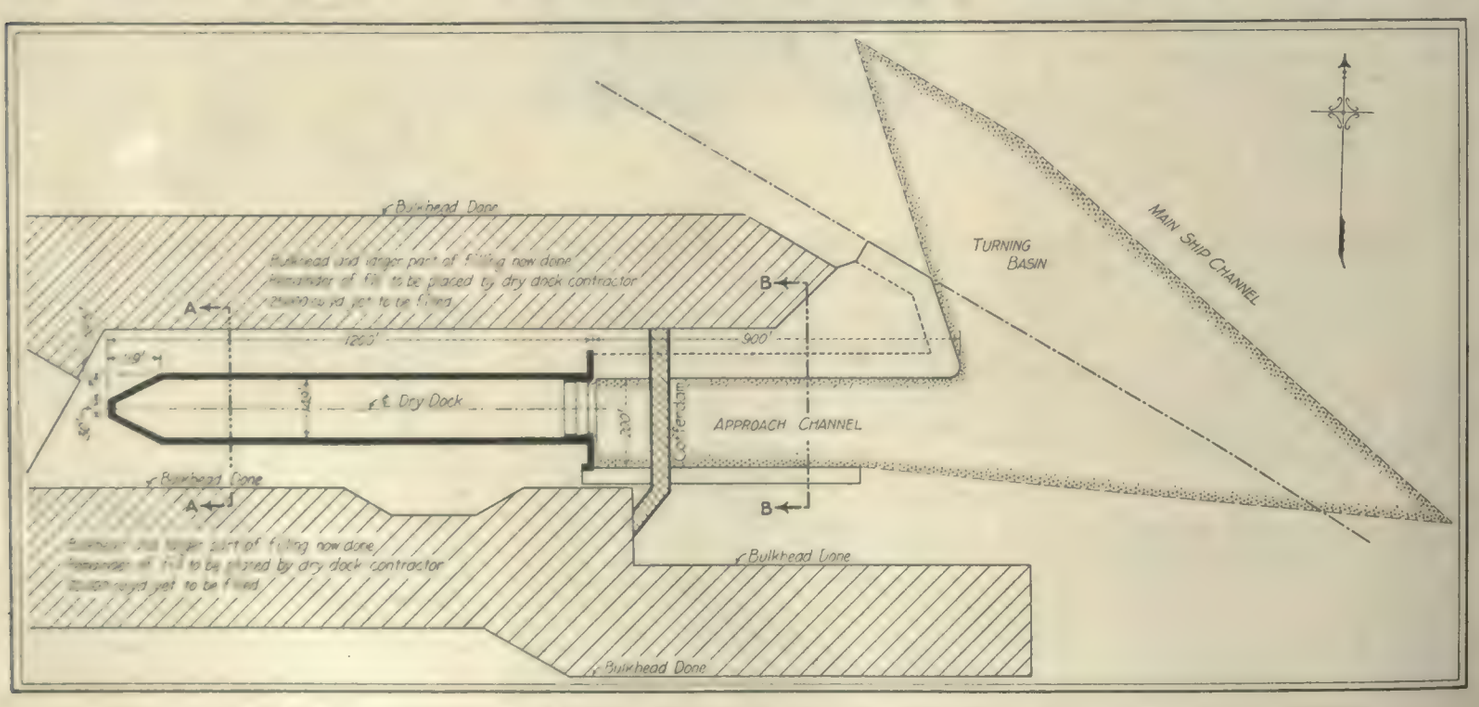
The report was called a disappointment, and the old figure of 43 per cent of smoke as being caused by the railroads was quoted from the 1911 report of the city smoke department. It was held that an annual financial loss of $17,600,000 was chargeable to the smoke nuisance. It was suggested that the matter be taken up first with the Illinois Central and the North Western.

Construction of Largest Drydock Will Require Use of Varied Plant

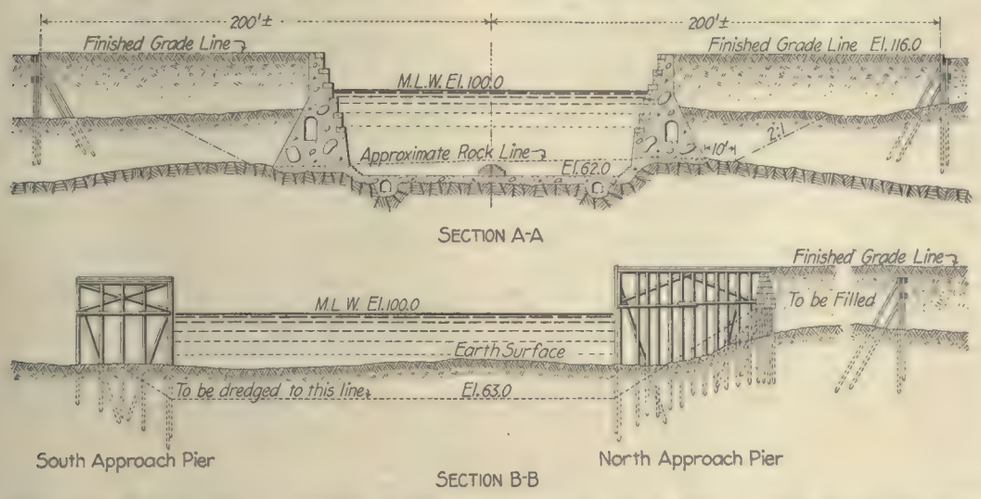
The new South Boston drydock is to be the largest in the country, being 1200 ft. by 149 ft. in over-all dimensions. A wide variety of plant, including cableways, locomotive cranes, compressor plant for drills, mixing plants, a variety of floating plant, and, indeed, about everything but steam shovels, will be used by the Holbrook, Cabot & Rollins Corporation in carrying out the contract.

A dredge is already at work on the site of the dock proper, and Morris & Cummins of New York, who have this part of the work on a subcontract, are expected to bring up one of the biggest dredges on the Atlantic coast, which can handle 150,000 cu. yd. of material per month, and which will make short work of the 450,000 cu. yd. to be dredged from the dock site proper and dumped at sea.

As may be seen from the accompanying drawing, two large areas of land, between which lies the site of the dock and approach channel, have already been made by filling in between recently constructed bulkheads. The



LARGE AREAS ALREADY BULKHEADED AND FILLED WILL BE USED TO ADVANTAGE BY CONTRACTORS FOR BIG BOSTON DRYDOCK



FILLS BETWEEN DOCK WALLS AND BULKHEADS WILL TAKE CARE OF MATERIAL FROM BOSTON DRYDOCK SITE AND APPROACH CHANNEL—ROCK NOT EXCAVATED TO FULL DEPTH UNDER WALLS

balance of this fill will be made, after the dock is finished, from the material dredged out of the approach channel. This material will also be used to complete the fill between the bulkheads and the dock walls, after a heavy bank of riprap to be excavated from the dock floor has been placed around the outside of the walls.

About 85,000 cu. yd. of rock must be excavated all over the dock floor. Considerable saving has been effected in the design by the plan of excavating beneath the walls only enough to secure a solid foundation, a sloping blanket of concrete joining the toe of each wall to the floor concrete of the dock.

The Directors of the Port of Boston designed the dock and will supervise its construction. Edward F. McSweeney is chairman and Robert E. Barrett chief engineer. DeWitt C. Webb, civil engineer, U. S. N., has been detailed by the Navy Department at the request of the Boston board to assist in the design and supervision of the work.

The contractors will spend the time until the dock site is dredged assembling plant. Then a cofferdam will be thrown across the lower end of the site as indicated, and the water pumped out. Active work on removing the rock will not start before the middle of next spring. The work is under the direction of Mr. Rollins of the contracting firm, but the name of the man who will have direct charge of the construction has not yet been given out.

Exposition Gates Close After Successful and Profitable Season

The Panama-Pacific International Exposition officially closed its gates at midnight, Dec. 4, with ceremonies attended by record-breaking crowds. The official count of 458,000 admissions on closing day is said to represent, with one exception, the largest number of people ever gathered at one spot in the United States. The total attendance since the opening date has, by far, exceeded expectations, and great satisfaction is expressed by all concerned in the complete success of the project that seemed at one time so seriously handicapped by the European situation.

Closing day exercises began at high noon in the Court of the Universe, when President Moore of the Exposition read a toast from President Wilson and a reply thereto. The meaning of the Exposition and a closing message were given symbolically to all the world by President Moore through a group of young men who appeared on the speakers' platform one after another, each receiving his message and passing out beneath the crossed rifles of the guards. The first of them was a boy scout to whom was given a message to all the children of the world.

Came next a journalist, and to him President Moore said, "To the splendid representatives of the press, who have supported from the first our ideals and our efforts and who have aided in the fruition, has been appointed the great task of carrying the meaning of the exposition to all men. Go, good friend, there is work for you to do." Others who appeared were a toiler in workman's clothes, a cowboy, a surveyor, a soldier and a sailor, and to each was assigned a part in taking the message to all quarters of the earth.

The several palaces were closed by President Moore's party making a tour of the grounds, meeting the chief of each department at the entrance to each palace, where there were a few words of official congratulations after which a herald in the historic costume of the town crier announced the building closed. Prosperity week electrical parade, aeroplane flights and a continuous illumination and fireworks display during the evening were features of the program. At midnight President Moore closed a switch in the Court of the Universe, turning off the lights and leaving the grounds in semi-darkness. This was a signal for a corps of buglers on the darkened Tower of Jewels to sound taps in requiem toward the four points of the compass.

Financial Success

When the exposition period was two-thirds over the last debt was paid off and a surplus began to accrué. After the gates closed on Dec. 4 the total number of admissions recorded was 18,876,000, of which approximately 13,000,000 were paid. In addition to this source of income, a number of the zone concessions, operated on the percentage basis, contributed to exposition coffers.

Reviewing the financial history of the Exposition in a general way, it may be said that the overall construction cost, including ground, totaled about $18,365,000. Prior to opening day assets totaled $16,989,000, so that the gates were opened with a deficit of $1,376,000. The income during the operating period paid all operating expenses and in addition gradually accumulated a surplus which amounted to $2,572,000 at the closing date.

The estimated net cost of restoring the grounds to their original condition is $165,000 and this, plus the deficit on opening day, deducted from the surplus, leaves a net earning of $1,360,000. The Municipal Auditorium, costing $1,086,000 and constituting the bulk of the opening day deficit, was presented to the city by the Exposition as a memorial. The disposal of the net profit from the operating period has not yet been decided upon, but efforts are being made to induce stockholders to assign it to the preservation of parts of the exposition, particularly a boulevard that would follow the present Marina and connect with the Ocean Highway.

The foregoing total cost figures include some 1500 pieces of sculpture and other decorations of the grounds, but take no account of State and foreign buildings or zone construction work and are, of course, exclusive of the 400,000 exhibits that were on display.

Committee Continues Water Problem Studies in California

The question of whether irrigation or navigation should have prior rights was debated at the second session of the California Water Problem Conference which convened in San Francisco, Nov. 29. A paper by Frank Adams, in charge of California irrigation investigations for the federal goverment, pointed out that there are between 750,000 and 1,000,000 acres of land in the State for which irrigation facilities are available but unused. He mentioned also there are over 20,000,000 acres of land in the State that need irrigation, but for which the water supply is nowhere near adequate. In fact, particularly in the San Joaquin Basin, very little more water for irrigation could be developed without storage.

Mr. Adams thought there should be a central authority over water development, instead of the present arrangement whereby six commissions have some voice in the matter. He recommended a more direct State control of irrigation districts which would, he thought, greatly improve the market for water district bonds.

The importance of economical use of water was emphasized by L. A. Nares of Fresno, who said that in his district an excess of irrigation water was damaging the land. Sixty thousand acres had been temporarily rendered useless, he said, by excessive irrigation, which had raised the water table and brought alkali to the surface. A. Griffin of Manteca, agreed with Mr. Nares and pointed out that acre-feet methods of measuring water should be used rather than the second-foot plan.

The suggestion that the office of State water master be created under the direction of either the water commission or the railroad commission was made by W. A. Johnstone of the water commission, as a means for enforcing the economical use of water. This suggestion was very favorably considered by the conference.

W. A. Beard of Sacramento, presented a paper on water storage which took up in detail the question of storage for flood control, for irrigation and for power development. He argued that public rather than private backing should be urged for developing water storage so that all three of these uses could be made more effective.

After reviewing the papers and data which had been submitted to the conference, five committees were appointed to work separately and report again to the conference after digesting all the information received. This work was divided under the following classifications: Committee on riparian rights—to consider various phases of this question and particularly to arrive at an opinion as to the stand of the Supreme Court on the matter; committee on centralization of authority—to consider centralizing all State water authority in one body; committee on irrigation—to consider unification of irrigation laws, duty of ditch water, rights of underground water, and care of ditch systems; committee on State financial assistance to irrigation and reclamation districts—to consider the question of State aid for water districts; committee on flood control, reclamation and navigation—to consider these subjects in the light of safety and most advantageous use of the water, together with State control of storage dams. Still another committee already in existence is investigating water disputes between States.

Theodore Jacobs, president of the State Inland Waterways Conference, announced that Feb. 21, 22 and 23, 1916 had been decided upon for a general convention of water interests in San Francisco, at which would be considered the proposal of C. E. Grunsky to have all California commissions relating to water matters consolidate into a State board of public works. Mr. Jacobs reported having made an extended canvass for this meeting, which would also take up certain other water problems, and said that he expected to have present a total of 1000 delegates from various parts of the State.

$38,000,000 More Wanted for U. S. Public Works This Year

The Sixty-fourth Congress assembled in Washington Dec. 6, and President Wilson delivered his annual address the following day. The greatest appropriations ever asked for during other than a war period were presented by the Secretary of the Treasury in the annual estimates. They totaled $1,285,857,808, an increase over last year of $170,843,614, the majority of the increases being for increased military preparedness.

The total public works appropriations asked for, exclusive of the military and naval establishments, amount to $132,180,157, an increase over last year of approximately $38,000,000. Some of the items under this head are as follows: Public buildings, about $10,000,000; rivers and harbors, $46,000,000; Panama Canal, $19,000,000; reclamation service, $8,938,000; Indian reservation irrigation, $1,000,000; lighthouses, beacons and signals, $2,000,000; Bureau of Standards, $250,000; immigrant stations, $175,000; Alaska railroads, $8,000,000.

For surveys of public lands, $2,220,520 is asked; for the Office of Public Roads and Rural Engineering, $600,000 for salaries and general expenses; for the Bureau of Standards, $50,000 for equipment, $15,000 for the high potential investigation, $150,000 for testing structural materials, $40,000 for investigating fire resisting materials, $10,000 for clay products tests and $120,000 for testing rail materials.

New York Bridge Investigation May Lead to Extensive Reconstruction

It is expected that important changes will result from the investigation being conducted by the joint Senate and Assembly committee appointed during the last session of the Legislature to investigate the condition of highway bridges throughout the state of New York, of which Assemblyman Charles O. Pratt is chairman.

The committee has power to make such suggestions as it sees fit relative to the rebuilding and maintenance of bridges outside of cities. There are 33,000 such bridges in the state, only 11,000 of which have been found capable to sustain a load of more than 8 tons.

The resolution for the formation of such a committee was introduced by Mr. Pratt and was indorsed by the New York State Automobile Association. It is based on the laws, passed since 1887, exempting villages and towns from paying damage claims arising from bridge accidents in certain cases. In 1887 the Laws of New York exempted towns from all liability for any damage resulting from the breakage of a bridge by a traction engine weighing more than 5 tons. In 1890 this was extended to include sluices and culverts and, in 1908, the towns were exempted from any liability resulting from the breakage of a bridge, sluice or culvert by a traction engine, portable piece of machinery or load over 8 tons.

Modern conditions and the advent of the automobile have created new problems, and scarcely a day passes but that loads weighing anywhere from 8 to 20 tons pass over bridges that were built to sustain a load of only 4 tons. In many instances the bridges have been posted to warn people that they cannot safely sustain a load of more than 2 tons. Their location, however, sometimes makes it impractical for the driver to turn back and cross another bridge. This is held to account for many of the accidents which have resulted of late on the state highway bridges. Furthermore, the committee has found that while some of the bridges are strong enough to sustain a weight of more than 8 tons they lack sufficient width to permit the passage of two automobiles at one time, and that the approaches, in many instances, are in very poor condition and in some cases blocked.

The committee has power to examine all such bridges, as to the method of construction and maintenance, and must make its report on or before Feb. 15, 1916. It is also empowered to introduce such bills as it deems necessary to provide for a uniform method of construction and maintenance of highway bridges and, it is further believed, its report will lead the Legislature to pass laws that will determine which should construct and maintain the highway bridges, the state or the township.

The New York State Automobile Association has taken a very keen interest in the investigation and is aiding the committee in every way. The State Highway Commission is also actively assisting the committee and, while no report is available at this time, it is believed that the investigation will result in a complete change in the method of constructing and maintaining highway bridges throughout the state and in the rebuilding and strengthening of a great many of them.

Philadelphia Engineers Advanced to Important Posts

Speculation as to appointments to the important headships of technical departments in Philadelphia has been brought to a close by the mayor-elect's announcement that George S. Webster, long chief of the bureau of surveys of that city, would be made commissioner of the department of wharves and docks, and that George E. Datesman, principal assistant engineer under Mr. Webster, was to be made commissioner of the department of public works, succeeding Morris L. Cooke. The appointments come as the reward of long, conscientious and valuable service to the city of Philadelphia.

Under Mr. Webster the bureau of surveys has grown from a small department, of a dozen or so men, to a tremendous organization, handling such projects as the $24,000,000 South Philadelphia improvement, the separation of dozens of grade crossings on the Pennsylvania and the Philadelphia & Reading railways, and the preparation of plans for disposal of the city's sewage.

Mr. Datesman, while acting as principal assistant engineer to Mr. Webster and handling a wide range of duties, has given special attention to the question of sewage disposal. In the course of his studies he made a trip abroad and prepared a comprehensive report on practice in European cities.

As an indication of Philadelphia's views on the appointments, the following is quoted from an editorial in the Philadelphia *Ledger:*

"These two appointments are so good that even if the others fell short of public expectation they would entitle the mayor-elect to warm commendation. He has made a promising beginning."

Commission Appointed to Advise on Panama Canal Slides

In compliance with a request from President Wilson, who is desirous that General Goethals have the benefit of the best assistance possible in solving the problem he has in hand, the National Academy of Science has designated a commission to investigate the subject of slides on the Panama Canal and to make a report to the President concerning them. It is expected that the commission will sail for the Canal Zone to-day.

Those appointed on the commission are: Charles R. Van Hise, president of the University of Wisconsin; Brig.-Gen. Henry L. Abbot, hydraulic engineer, of Cambridge, Mass.; John C. Branner, president of Leland Stanford, Jr., University; Whitman Cross, of the U. S. Geological Survey; John F. Hayford, director of the college of engineering, Northwestern University; Harry F. Reid, professor of geology at Johns Hopkins University; Dr. Charles D. Walcott, president of the Smithsonian Institute; Rolla C. Carpenter, professor of experimental engineering, Cornell University; Arthur P. Davis, chief engineer U. S. Reclamation Service, and John R. Freeman, consulting hydraulic engineer, of Providence, R. I.

News of Engineering Societies

The Oklahoma Society of Engineers will hold its annual meeting at Oklahoma City, Dec. 28.

The American Association for Labor Legislation convention will be held at the Shoreham Hotel, Washington, D. C., Dec. 28-29.

The American Concrete Pipe Association will hold its annual convention in Chicago Feb. 17 and 18, 1916, during the week of the Cement Show.

The Engineers' Club of Philadelphia will hold a meeting in that city Dec. 21. Barclay Parsons, consulting engineer, of New York City, will speak on "Railways in China."

The Manitoba Branch of the Canadian Society of Civil Engineers held a meeting in Winnipeg Dec. 2. W. P. Brereton presented a paper on "Grade Separation in the City of Winnipeg."

The Engineers' Club of Trenton held its annual meeting in that city Dec. 9. Samuel T. Wagner, chief engineer of the Reading Railway System, presented a paper on "Some Grade Elimination in Philadelphia."

The American Society of Civil Engineers will hold a meeting in New York City Dec. 15, at which Benjamin F. Groat will present a paper on "Chemi-Hydrometry and Its Application to the Precise Testing of Hydro-Electric Generators."

The South Atlantic Road Congress will be held at Richmond, Va., Jan. 17 to 20, 1916, to determine a policy, devise means and outline routes in a comprehensive road-building campaign in Maryland, the Carolinas, Georgia, Florida and Virginia.

The American Concrete Institute will vote on the following candidates for office next month: President, Leonard C. Wason; vice-president, Henry C. Turner; treasurer, Robert W. Lesley; directors, Charles R. Gow, Edward P. Boyer and J. G. Treanor.

The Brooklyn Engineers' Club held its annual meeting Dec. 9. The following officers were elected for the ensuing year: President, Ernest M. Van Norden; secretary, Joseph Strachan; treasurer, Harry E. Funk; directors, Bernt Berger and Carrol S. Dunphe.

The American Waterworks Association's New York section will hold a regular monthly meeting at the Hotel Manhattan, Dec. 15; luncheon will be served at 12.30 p. m. "Filter Troubles" will be discussed by G. E. Willcomb, F. E. Hale, E. M. Hoopes, F. W. Green, G. R. Spalding, Elmer G. Hanahan, S. M. Van Loan and A. A. Tolson.

The Engineers' Society of Western Pennsylvania will hear James W. Rollins, president of the Holbrook, Cabot & Rollins Corporation, engineers and contractors, of Boston, speak on "The Relations Between Engineers and Contractors" at a meeting of the structural section, to be held at Pittsburgh, Jan. 4, 1916.

The Utah Society of Engineers will hear E. C. La Rue, hydraulic engineer for the water resources branch of the U. S. Geological Survey, speak on "The Colorado River Problem" at a meeting to be held in Salt Lake City Dec. 17. The monthly journal of the society will be increased from 16 to 22 pages in order to publish, in full, the papers presented in the future, according to C. J. Ullrich, assistant State engineer of Utah, its editor.

The Seattle Association of Members of the American Society of Civil Engineers received a report on the final form of the articles of association for the Affiliated Engineering Societies of Seattle at a meeting held in that city Nov. 29. The slight changes made in the articles by the joint conference committee were approved and the representatives previously appointed, Robert Howes and John L. Hall, were empowered to act in the matter.

The Engineers' Club of St. Louis will hold its annual dinner in that city Jan. 26, 1916. Dr. Elmer L. Corthell will be the guest of honor. The nominating committee of the club has submitted the following nominations for

officers for the ensuing year: President, F. E. Bausch; first vice-president, H. I. Finch; second vice-president, F. G. Jonah; third vice-president, J. T. Garret; treasurer, F. T. Cutts; directors, W. E. Rolfe, O. F. Harting and W. O. Pennell.

The Cuban Society of Engineers will hear Eduardo Beato, formerly engineer in charge of the work, speak on the "Construction of Sea Walls in Havana Harbor," at the December meeting of the society, to be held at the clubhouse, Paseo de Marti, 76, Havana, Cuba. At the January meeting Luis Morales, chief engineer of municipal engineering, Department of Public Works, will present a paper on the sewerage and paving work in Havana, which cost approximately $17,000,000.

The Nebraska Engineering Society will hold its annual meeting at Lincoln Dec. 17 and 18. Papers will be presented on surveys and records, roads, waterworks, irrigation, hydroelectric development and valuation and legislation. Among the speakers will be: Robert Harvey, state surveyor of Nebraska; W. S. Gearhart, state engineer of Kansas; George T. Prince, chief engineer, Metropolitan Water District, Omaha; H. C. Diesem, investigation engineer, U. S. Department of Agriculture; John Hodge, civil engineer, of Boelus, and C. E. Hurd, consulting engineer, of Lincoln.

Personal Notes

JOSEPH A. ROURKE, formerly assistant engineer in the public works department of the city of Boston, has been appointed engineer in charge of the high pressure water service of that city. He was graduated from Worcester Polytechnic Institute in 1887 and first engaged in mechanical and electrical work. In 1896 he joined the forces of the Boston Transit Commission on the studies and designs for the Tremont Street subway. He has been with the streets and public works department of the city since 1901.

WILLIAM VERNON KERNS, formerly engaged on paving work for the city of Moline, Ill., has been appointed to a position in the office of the chief engineer of the Chicago & Eastern Illinois Railroad.

WALTER ANDERSON has resigned from the office of city engineer of Centralia, Wash., to accept an appointment with the Berger Manufacturing Company of Minneapolis, Minn.

C. A. RING, consulting engineer for the Brompton Pulp & Paper Company, has been appointed chief engineer for the Deerfield Pulp Company, Mount Mills, Vt., which is constructing a 30-ton sulphate mill. He also continues in his connection with the Brompton company.

A. G. HILLBERG, hydraulic engineer, of New York City, has been retained to design the proposed 30,000-hp. hydroelectric plant at the mouth of the White Rock Canyon on the Rio Grande in northern New Mexico, contemplated by the Rio Grande Light, Heat & Power Company, of which Charles G. Wilfong is the president.

EDWARD N. LAKE, formerly in charge of the Chicago office of the Stone & Webster Engineering Corporation, has become a partner, with Fred A. Krehbiel, in the Krehbiel Company, engineers and constructors, Marquette Building, Chicago. Mr. Lake has specialized in electricity and its commercial application with the Arnold Company and Bion J. Arnold, the Western Electric Company, the Chicago Edison Company, the Chicago board of supervising engineers and the Stone & Webster Engineering Corporation. Mr. Krehbiel has made fuel, steam and mechanical engineering and construction his specialties. He also was with the Arnold Company and Bion J. Arnold for several years.

W. L. HEMPHILL, U. S. transitman, with the General Land Office, has been transferred from Northern Idaho to Southern California for the winter and is now in the Imperial Valley on the execution of public land surveys. For the past four years Mr. Hemphill has been with the Bureau of Lands at Manila, P. I., as cadastral surveyor, but in June was transferred by the War Department to the federal service.

LEONARD F. BURRAGE, JR., formerly connected with the U. S. Reclamation Service on the construction of Arrowrock Dam, has been appointed to a position with the Miami Conservancy District, at Dayton, Ohio. Mr. Burrage was with the U. S. Reclamation Service for the past 6 years, having been engaged on the construction of the Kochess and Keechelus earth dams in Washington previous to his transfer to the Arrowrock work.

IRWIN S. OSBORN AND VIRGIL D. ALLEN have opened a consulting engineers' office in the Rose Building, Cleveland. Mr. Osborn is still retained on the construction of the garbage disposal plant in Toronto, which is practically completed. Mr. Allen was, until recently, building commissioner of Cleveland. The firm proposes to handle architectural, mechanical, industrial and municipal work.

W. D. BEERS, state engineer of Utah, has moved his offices into the new State capitol at Salt Lake City.

A. P. M. FLEMING, superintendent of the British Westinghouse works at Manchester, England, has been sent to the United States by his government to make an investigation of institutions organized to conduct industrial research. He is at present in consultation with Prof. E. B. Paine, head of the electrical engineering department of the University of Illinois.

MAJOR WILDURR WILLING, Corps of Engineers, U. S. A., in charge of the St. Louis district of the Western division, will deliver a series of four lectures on military engineering before the Engineers' Club of St. Louis, beginning in February.

EDWIN L. GRIMES, consulting engineer, of Troy, N. Y., is assisting James M. Caird in the valuation of Bangor (Me.) waterworks.

JOHN A. LOGAN of the Logan & Giertz Construction Company of Elgin, Ill., whose appointment as a member of the Illinois Waterway Commission was noted in these columns last week, has been engaged in the contracting business for the past twelve years. The Logan & Giertz company, of which he is president, constructed a large part of that city's sewer system as well as sewers at Sterling, St. Charles and Carpentersville in Illinois, and has done considerable paving work in Elgin, Downers, Grove and Woodstock.

JOHN A. GILES, city engineer of Binghamton, N. Y., has been appointed commissioner of public works, to be effective Jan. 1, 1916. His successor as city engineer has not yet been named. Mr. Giles was graduated from Union College in 1897, and entered the service of the Delaware & Hudson Railroad immediately after. From this work he went to the U. S. Deep Waterway Commission for a short period in 1899 and from that service to work on an electric line from Albany to Thompson's Lake. In the later part of the year he was appointed bridge inspector for the Chicago & Northwestern Railway. After serving as expert computer on New York State Barge Canal surveys in 1900 and 1901, he became assistant engineer for the Chicago & Northwestern Railway, in which capacity, among other works, he had charge of subways, track raising, pavements, retaining walls and the reconstruction of water mains, conduits and sewers in connection with track elevation in Chicago. He was appointed city engineer of Binghamton in 1908.

NORMAN M. STINEMAN, assistant engineer, Chicago, Milwaukee & St. Paul Railway Company, was elected chairman of the Chicago chapter of the American Association of Engineers Dec. 3. Other officers are as follows: S. C. Van Etten, secretary, and W. J. Mauer, treasurer.

R. WALTER CREUZBAUR, of the firm of R. W. Creuzbaur, and Charles L. Parmelee, engineers, Woolworth Building, New York City, has been re-engaged as consulting engineer of railroad improvements for the city of Elizabeth, N. J. Among other works upon which he is representing the city are the six tracking plans of the Pennsylvania Railroad and the straightening of that company's line between Newark and Linden. He is also in charge of the work proposed by the Public Utilities Commission and the city for grade separation along the Central Railroad of New Jersey. Mr. Creuzbaur has been engaged in engineering work since 1877, his first service having been as rodman on the New York elevated railroad work. For many years he was connected with municipal works in New York City, during which period he served for five years as consulting engineer of public works of the Borough of Brooklyn. He was originally retained on the Elizabeth work in September, 1914.

Obituary Notes

J. HERBERT SHEDD, consulting engineer, of Woonsocket, R. I., and chairman of the Rhode Island State Harbor Commission, died, Nov. 27, at the age of eighty-one. He first engaged in civil engineering in 1856 as a student in a Boston engineer's office. In 1859 he opened an office in his own name in that city, which he continued for 10 years. His first engagement for the city of Providence, for which a large part of his work was done, was in 1866, when he was retained to make an examination relative to a public water supply for that city, and to design a sewer system for the Brook Street district, which was the first step in a comprehensive plan for the entire city. Subsequently, he designed and constructed the Providence waterworks, which cost $4,500,000, and the city sewer system costing $5,500,000. He was appointed chairman to the State Harbor Commission in 1876 and held the office up to the time of his death. In 1890 he was appointed city engineer of Providence, which office he occupied for seven years, after which he was appointed consulting engineer. He became a member of the American Society of Civil Engineers in 1869.

JAMES MAPES DODGE, past president of the American Society of Mechanical Engineers, vice-president of Franklin Institute and chairman of the board of directors of the Link-Belt Company, died in Philadelphia, Dec. 4. He was sixty-three years old. His professional education was received at Rutgers College and Cornell University. During his lifetime he devoted special attention to the improvement and manufacture of conveying machinery and devices. He became a member of the American Society of Mechanical Engineers in 1884 and served as its president in 1903.

O. E. DAVIS, prominent in the development of the sugar growing industry and organizer of the Stewart Sugar Company, died in New York City, Dec. 4. He was born in Matanzas, Cuba, in 1862, and was educated at the Boston Polytechnic Institute, in this country, and in technical colleges in Germany.

THOMAS R. CROWELL, city engineer of Lebanon, Pa., died in that city, Nov. 25, at the age of fifty-seven. He was graduated from Lafayette College in 1879 and worked with the U. S. Coast & Geodetic Survey, the Pennsylvania Railroad and, as chief engineer, with the Cornwall & Lebanon Railroad previous to becoming city engineer of Lebanon, about 15 years ago.

Six-Wheel Motor Truck Takes Load Off Traction Wheels

To take the load off the traction wheels and relieve them of carrying and pushing the load, the Chicago Pneumatic Tool Company, Fisher Building, Chicago, has placed on the market the Little Giant six-wheel truck.



TRUCK CAN BE TURNED AROUND IN A 36-FOOT SPACE WITH LOAD OF LUMBER 40 FEET LONG

In the ordinary four-wheel truck the power is applied through the traction wheels and motor truck practice is to place the entire load, or the greater portion of it, directly over or slightly forward of them. The power of the motor is utilized to draw the load instead of carrying it and pushing it, and only sufficient of the load is placed upon the chassis of the truck to secure proper traction. The weight so imposed is not rigidly fastened to the chassis, but rests upon a ball race, making it a live or floating load. This feature is said to relieve the running gear and engine from the shock and strain which a load ordinarily transmits as a result of the constant vibration due to irregularities of roadbed, and also affords relief from strain in starting and stopping. The rear wheels, it is claimed, absolutely track and the driver need have no more concern for the movement and guidance of the load than in ordinary four-wheel construction. It is able to turn around in a 36-ft. space, even when carrying lumber 40 ft. long.

Machinery Exposition to Be a Feature of Drainage Congress

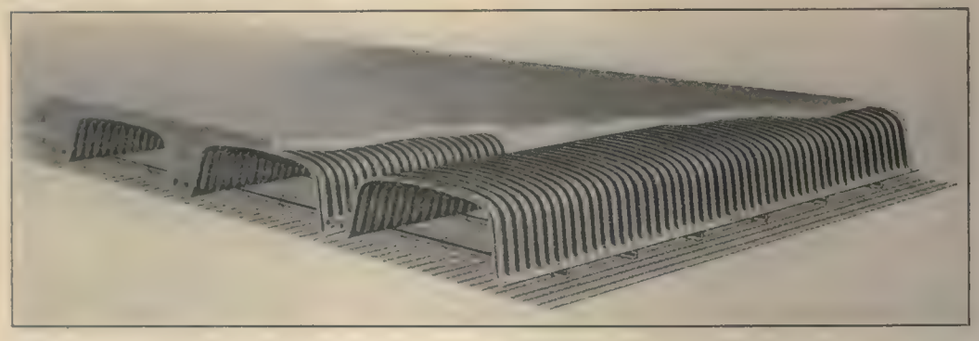
In combination with the Sixth Annual Drainage Congress, to be held at Cairo, Ill., Jan. 19-21, 1916, there will be held an exposition of ditching and dredging machinery and other machines related to drainage work. George Parsons of the executive committee, Cairo, will furnish information in regard to this feature.

New Steel-Tile to Lower Cost of Concrete Floors

Permanent steel forms for concrete floors designed of the T-beam type are being placed on the market by the General Fire Proofing Company of Youngstown, Ohio. In an illustrated booklet of 32 pages, just issued and entitled "GF Steel-Tile—an Economical System of Floor Construction," the new system of construction is fully explained and tables are given for safe live loads on the various sizes of tiles and spacing of joists.

It is claimed that the new construction, examples of which are shown in the accompanying photographs, is particularly effective in such buildings as schools, apartment houses, hotels, office buildings, lofts, warehouses and stores, and that it will result in a substantial saving in cost. The solid steel forms lap tightly at both ends and are joined by a simple but effective centering on the sides, preventing any leakage and waste of concrete. Forms are made of pressed sheet steel and are easily transported without danger of injury.

Form work of simple skeleton timber with runners under the line of joists is illustrated in detailed drawings given in the booklet, accompanied by specifications for both the concrete and the forms. It is claimed that the new steel tiles can be quickly laid. They are furnished in 6, 8, 10 and 12-in. heights and 30 and 35-in. lengths. Cost data will be furnished by the General Fire Proofing Company. Metal lath for ceilings can be easily attached and smooth ceilings obtained.





DETAILS OF CONSTRUCTION—STEEL TILE PLACED IN FLOOR OF SCHOOL BUILDING

Business Notes

The Yeomans Brothers Company, 231 Institute Place, Chicago, has taken charge of the sale and installation of the Shone pneumatic sewage ejectors throughout the United States and Canada.

R. E. S. Gear and John F. Stevens, Jr., have been appointed managers of the Chicago office of the T. L. Smith Company, manufacturer of concrete mixers, of Milwaukee, in the Old Colony Building, Chicago. Mr. Gear was formerly sales manager of Templeton-Kenley & Company, Ltd., of Chicago, and Mr. Stevens was secretary of the same company.

Trade Publications

Kingsford Foundry & Machine Works, Oswego, N. Y. Catalog 18, 6 x 9 in., 24 pages, illustrated. Turbine multi-stage pumps for high duty work. Waterworks, irrigating, fire pressure and boiler feed pumps are shown.

Barrett Manufacturing Company, New York, Chicago, etc. Folder, 10 x 12½ in., illustrated. This artistic and well-printed folder presents reasons why Barrett Specification Roofs were chosen for the National Lamp Works of General Electric Company at Nela Park, Cleveland.

Engineering Record

Circulation 20,000 Copies. McGraw Publishing Company, Inc.

December 18, 1915

LIBRARY

16 Miles of Winnipeg Aqueduct Finished at Close of First Year's Work

Cold Weather Has Stopped Concreting on New 100-Mile Water Supply Conduit Being Built as Joint Project to Deliver 100,000,000 Gallons Daily to Seven Canadian Municipalities at Estimated Cost of $13,000,000.



Kreolite Wood-Block Floors

"They outlast the factory"



Kreolite Wood Block Floor in Machine Shop of Michigan Central Ry., St. Thomas, Ont., Can.

Where the Wear Comes

on the ordinary floor in a manufacturing plant, foundry or shop, is the place where expense commences to pile up.

IT costs money to truck material over uneven floors. It is harder on the men to work without a good footing, and the depreciation on the average floor is a big item in operating cost.

In a Kreolite Wood Block Floor

the wear is hardly noticeable. All the blocks are manufactured from slow growth, air seasoned, long leaf yellow pine, treated against decay by the Kreolite process, thus insuring a maximum amount of wear with no maintenance expense.

KREOLITE Wood Block Floors are unequaled for foundries, machine shops, pickling rooms and loading platforms, because of the unusually severe conditions met with in this class of work.

LET us prove to you that a Kreolite Wood-Block Floor will be a paying investment in your plant.

A card today will bring you a copy of our booklet on factory floors. Shall we send it?

THE JENNISON-WRIGHT COMPANY

323 Huron Street, Toledo, Ohio

Pioneers in Perfect Floors

Engineering Record

A Weekly Journal Devoted to Civil Engineering and Contracting

Published by McGraw Publishing Company, Inc.

Volume 72 NEW YORK, SATURDAY, DECEMBER 18, 1915 Number 25

American International Corporation

NOTE was made in this journal recently of the organization of a $50,000,000 international promotional and trading corporation, known as the American International Corporation. The organization of the new company has been rightly hailed as the greatest single step taken by American business to cope with the problems of international trade. In saying this, the progress made by the United States Steel Products Company, the Standard Oil Company, and other large American businesses in foreign markets is not lost sight of. The new company, though, in its function as a financing and development agency, has a wider scope. From the caliber of its management one would expect every means essential to the widest success to be employed. Consequently the purchase of seven ships from the Pacific Mail Steamship Company this week need not cause surprise. The promptness of the company's start augurs well, however, for its progress.

Railways and Preparedness

COMMENTING last week on Mr. Dixon's views on the relation of railways to military preparedness, which were published in the Engineering Record of Dec. 11, page 737, the New York *Times* expressed views which need no comment in this journal. They are very much to the point at a time when the President has urged a new study of the railway problem. The *Times* says: "The war on the railways by the enemy within the gates is a more serious matter than the need of the railways against imaginary hostilities in an indefinite future. The indemnities which Germany is levying upon the lands which it has conquered are surpassed by the tribute on our railways by those who are extorting rates below cost and wages above merit." The *Times* does not disagree in the least with Mr. Dixon. It merely takes advantage of the occasion to express aptly the need of the railways for fairer treatment.

Let Contracts Early

MUCH favorable comment has been received by the Engineering Record upon its editorials urging engineers to let their contracts for next year's work as early as possible. One correspondent, after expressing the view that the editorials were not strong enough in urging the engineer to action, remarked that a similar campaign should be waged each year. He pointed out that the records of the cement companies show that the maximum shipments are in September and October, at a time when the construction peak should be past and cement consumption be on the decline. While all work is not made more expensive by cold weather, concreting certainly costs more when there is danger of frost. Our correspondent's advice is well worth while. Taken generally, contracts are not let early enough, and if there be need in normal years for urging the engineer to be forehanded, there certainly ought to be much greater emphasis at the present time upon early contract letting. Shortage and high prices of materials and of contractors' equipment are to be expected. Under such circumstances the contracts let earliest will have the greatest advantage.

Economy Records

OCCASIONALLY records for economy have been made by blindly neglecting necessary public-works construction. The public is dazzled by the contrasting figures, invariably well advertised, but remains ignorant of the amount of necessary work that has been delayed. Generally the deception succeeds in its purpose—that of enhancing the reputation of the fact-suppressing official. If the public were fully informed as to the means by which the record was made, the plan would not be quite so popular The taxpayer would not be elated at a large saving if he were shown that the neglect of the distribution system in his waterworks department had kept his insurance rates abnormally high or caused them to be raised. Nor would any saving to the city treasury mollify his feelings if the postponement of filtration work was menacing his family constantly with typhoid. Economy in office is highly commendable, but should not be attained at the expense of necessary construction. Economy under such circumstances is not an achievement. The public's health, comfort and safety are of more value than its dollars.

Prejudicing the Young Engineer

A CORRESPONDENT who is deeply interested in the movement now afoot to give the engineer his proper place in public life points out what he considers the failure of engineering instructors to impart to their students an appreciation of their reciprocal obligations toward the public. If, he reasons, the public is to have a proper respect for the engineer, the engineer in turn must be in sympathy with the public and tolerant of its point of view. Instructors in engineering are wont, he says, to pick to pieces in a sarcastic and contemptuous way the proposals regarding public projects made by representatives of the people. Such a procedure amuses the class, but puts the students in the same frame of mind as the instructor—entirely out of sympathy with the people he serves. References to the mayor of a town as "a gentleman of average intelligence" or to a town council as "a body of farmers," when said with a sarcastic inflection, do not conduce to the development of the sympathetic relations which should exist between the engineer and the public. The Engineering Record agrees heartily with its correspondent. Certainly a superior attitude of mind on the part of the engineer toward those whom he serves will sooner or later show itself and result in refusal to accord the professional man the position that he believes should be his. In time, no doubt, this superior attitude would be dispelled by frequent contact with clients, but meanwhile much irretrievable damage may have been done.

New York Pier Construction

MAXIMUM economy in combined first cost and maintenance is claimed by C. W. Staniford, chief engineer of the New York Department of Docks and Ferries, for the pier construction now being used in South Brooklyn. Extended study has convinced him that the best solution of the pier problem, as presented in the Port of New York, is a combination of a concrete deck with a pile substructure. The deck is absolutely permanent, while the substructure is permanent below about high-water line, and easily and cheaply repaired above that level. Except for the asphalt covering of the concrete deck, the new type costs no more than the timber-decked piers formerly in use, while the cost of deck repairs is almost entirely eliminated. A description of a pier of this type will be found in an article elsewhere in this issue. One noteworthy advantage of the timber and pile substructure over all-concrete construction, aside from the matter of cost already mentioned, is its greater flexibility and elasticity under the inevitable shock from vessels. Either the vessel or the pier, with the concrete design, is in danger of serious damage. The timber structure, on the other hand, acts as a shock absorber, and dissipates the effect of impact for both vessel and pier. Another point deserving note in connection with the structure described is the cargo-hoist design. Much attention has been given in this country to various types of apparatus for handling cargo economically. These have been considered by the Department of Docks and Ferries, and the decision reached to adhere to the device customary in American harbor practice. It is more simple than the derricks and cranes of European ports and, in the judgment of the department, is economical and effective.

Constructive Commission Work

THERE was much speculation when the Federal Trade Commission was authorized by Congress, and also at the time of its appointment, regarding the attitude it would

take toward the work entrusted to it. There was a chance for mischief, measurable only by the tremendous size of the business interests of the country. It is gratifying to record, therefore, the constructive attitude which the commission has taken, an attitude apparent in the investigations it has made, and still more so in an address delivered early this month by the vice-chairman, Edward N. Hurley, before the Association of National Advertisers in New York City. The theme of his address was the way in which the commission may be helpful to American business. After commending the spirit in which the commercial interests of the country have placed facts at the disposal of the commission, he pointed out that great good may come from the collection and publication of essential data regarding American business conditions. Investigations so far made disclose the astonishing fact that of the 250,000 business corporations in this country, over 100,000 have no income whatever, 90,000 make less than $5000 a year, while only 60,000 make over $5000. Among the measures which Mr. Hurley suggests as contributing to the solution of this undesirable situation is the standardization of cost systems, so that business men will have ready access to methods which, after comparatively brief application, will disclose their true condition. He points out other activities for the commission, all of them aimed at helping, and not harassing, business. Enough has been said, however, to indicate that the fears expressed have, so far at least, proved unwarranted.

Why Is Registration in Civil Engineering Decreasing?

ELSEWHERE in this issue are curves showing that the registration of students in civil engineering has fallen off markedly since 1910. While there are data regarding some Eastern schools, most of the curves relate to Middle Western colleges. Apparently, the causes, whatever they may be, are operating over a wide area.

At first thought one cannot but characterize the tendency as alarming. Any decrease is to be suspicioned, at least, as a sign of decadence. On the other hand, it may be an evidence of necessary adjustment to changed conditions.

So far, certainly, as the colleges are concerned, the tendency presages difficulties. Buildings and equipment in the older institutions are provided for double the number of students forecast for a time three years hence when the effect of the declining curves will be felt in all four classes. Faculties, too, have been developed to care for the larger numbers. Unless the curves soon change and tend upward again, faculty readjustments and idle educational plant are sure to follow.

Whether the tendency is so serious from the standpoint of the profession generally is open to question. Has not the supply of graduates in the past been larger than the demand? College professors say that it has not, but how then can one account for the very large numbers of engineering graduates who, with fresh diplomas or after a year or two of technical experience, desert engineering paths for sales and executive work? Moreover, if supply is not greater than demand, why are engineering salaries at a level which, justly or unjustly, has caused quite general complaint? If investigation should prove that the decrease in registration is an effort to approximate supply to demand, the condition should not cause disquietude.

The Engineering Record believes that one of the causes for the downward tendency is a clearer understanding on the part of young men to-day of the financial prospects in the engineering world. Ten and fifteen years ago the profession was over-boomed. Popular magazines carried stories about the marvelous achievements and handsome incomes of engineers. Electrical engineering then, too, was rounding out the first fifteen years of its wonderful development and carried young men to a high pitch of enthusiasm. The misunderstanding regarding the compensation of engineers was quite general. That condition has changed, and among the public at large it is now well understood that extraordinary financial returns are not to be looked for in engineering work.

Furthermore, other courses of strong appeal to young men have come to the fore or been developed within the decade. Prominent among these are the so-called business courses, which aim to put economic studies on a practical basis and to give the student a close insight into money, banking and corporation organization and management. With "big business" occupying the center of the stage of national life the attraction toward courses in business has naturally been strong.

Then, too, scientific agriculture has bounded to the front. The remarkable work of the Department of Agriculture and the publicity given to the possibilities in scientific farming have opened new vistas to farmers' sons and the boys of small communities, who formerly shunned farming on account of its drudgery.

These two causes—a truer understanding of the financial return in engineering and the popularity of new courses—are undoubtedly operating. There are probably others. They should be clearly understood and their relations to the problem as a whole fully developed. Only with all of the facts in hand can the significance of decreasing registrations be appreciated, and the proper remedy, if one is needed, applied. Manifestly it is not a question for the college professors alone. The profession at large has a vital interest. For this reason the Engineering Record invites its readers, in the colleges and out of them, to contribute their views on the subject.

Zuyder Zee Reclamation Postponed by War

ONE of the important engineering projects postponed by the war is the reclamation of the Zuyder Zee, plans for which have been discussed for 25 years. Two years ago a bill covering the reclamation work was prepared, with the intention ultimately of presenting it to the Parliament. It was necessary first to have it approved by the various departments of the Government which would be affected by the work or the new conditions created. All of the civil departments have approved the measure, but the war department, deeply engrossed in more immediate affairs, has been unable to get at the plan, though it has been in its possession for the past year. The reclamation of the Zee will make necessary the modification of present plans for the national defense and, consequently, nothing can be done until the war department has signified its approval of the measure.

For this reason alone the measure will probably be delayed. But financial considerations are entering, by reason of the European complication, which may mean the indefinite postponement of the project, even after the war is over.

The scheme as planned will cost 300,000,000 guilders (a guilder is valued at 40 cents), while the land reclaimed will have an area of 190,000 hectares (about 47,000,000 acres). While the whole amount of 300,000,000 guilders would not be needed at once, because the building program extends over many years, the expense of Holland's mobilization will for some time be a tremendous burden on a population of only 6,000,000 people. Until September Holland had expended 275,000,000 guilders on mobilization within its European limits, while 65,000,000 had been spent in a similar way in the colonies. Since then a 200,000,000-guilder war loan has been floated, and the expectation was that the total expenditure on account of military preparations would be about 600,000,000 to the end of 1915. If the war should last another year not less than 1,000,000,000 guilders would be spent. Considering that the purchasing power of a guilder in Holland is not much less than a dollar here, it will be seen that Holland must suffer an economic setback due to its enforced military program.

The problem, from the technical and economic standpoints, is an extraordinarily interesting one. Not only are there involved a tremendous mileage in inclosing dikes, huge locks to connect the canals with the sea, and large pumping stations, but economic problems of a very unusual sort. For example, the salt-water fishing industry now thriving there will be destroyed. It is expected that some compensation will have to be made to the interests affected. On the other hand, there will replace the salt-water fishing a fresh-water fishing industry of large proportions. This in turn will have to be evaluated, and consideration given to the extent by which it offsets the loss due to the destruction of the salt-water fishing industry. Again there are now on the shores of the Zee towns which have built up a considerable shipping business. Naturally these must retain their water communication facilities, so that an auxiliary canal system must be provided. Moreover, the construction problem is not so

simple as levee building generally is in this country. A tremendous quantity of willows will be needed for mattress work, such quantities, in fact, as cannot be obtained immediately. It will be, necessary, therefore, to grow them expressly for the work. Likewise a supply of suitable levee-building material is a most troublesome one, clay being notably scarce in the Zuyder Zee district.

These technical difficulties, naturally, only serve in the present economic crisis to put off still longer the day when this most interesting engineering work will be put under way. Doubtless it will come eventually, but certainly not until the courageous little country on the North Sea has had an opportunity to recover in part at least from the draft on its resources which its part as a near neighbor of the fighting European nations has imposed on it.

Flaw in the Proposed Officers' Reserve Corps Bill

INSOFAR as it affects engineers, the proposed bill for the creation of an Officers' Reserve Corps of the regular army, as now drafted in a tentative way, contains one provision which will prevent the technically trained man of broad experience from offering his services as part of the plan for adequate national defence. This undesirable feature of the measure relates to the ages at which men may be admitted as reserves. The bill states: "No person shall be appointed or reappointed a second lieutenant in the Officers' Reserve Corps after he has reached the age of 32 years, a first lieutenant after he has reached the age of 36 years, a captain after he has reached the age of 40 years, or a major after he has reached the age of 45 years." The bill is not yet in final form and there is time for the joint committee of members of the five national engineering societies—civil, mechanical, electrical, mining and consulting—to use their influence in having this portion of the proposed legislation amended.

If this country should be called upon to defend itself from attack by a foreign power, engineers of all degrees of training would be urgently needed, but the bill, in its present form, would admit to service only the comparatively young men. They, of course, would fill a most important place. They could be used to best advantage in those duties requiring strong physiques, capable of enduring the most vigorous kind of service at the front.

Another group of engineers, however, would be of equal, if not greater service—the mature members of the profession, with judgment ripened by years of experience, the consulting engineers, chief engineers and department heads. The present age limitations would exclude them from the reserve corps.

The great asset which this group represents must not be thrown away. These are the men of broad executive experience, who would be able, for example, to take the War Department's plans for a series of large-scale defensive works, get contractors together, and push the work through expeditiously.

The present number of regular officers in the engineer corps of the army would be absurdly inadequate to cope with the manifold military engineering problems which a threatened invasion would present for solution. The weakness is not in training or efficiency, but in numbers. The corps must be reinforced in the event of a national crisis and any bill creating a reserve for this purpose should provide for using the senior members of the engineering profession as well as those under 45 years of age.

Chicago Electrification Report

THOUGH the committee on smoke abatement and electrification of the Chicago Association of Commerce after a four years' investigation has decided that electrification is too expensive and will contribute but slightly to smoke abatement, no one with confidence in the progressive spirit of Chicagoans and of the American people generally will believe that electrification is a dead issue in Chicago. Should any be inclined to take that view, the action of the Chicago City Council in directing its terminal committee, within a week after the presentation of the report, to study the problem would convince them that Chicago does not intend to take the report as final. There is good reason to believe, too, that within a comparatively short time at least two railroads, the Chicago & Northwestern and the Illinois Central, will be actively engaged in electrification work. In fact, the president of the Northwestern is reported to have said that the trackage of his road in Chicago would be electrified as soon as the money was obtainable. Nevertheless, general electrification of Chicago terminals has probably been postponed for some time, and that, undoubtedly, is what the railroads wanted. It is unlikely that the Chicago City Council will pass a mandatory ordinance, obliging all of the roads to abandon steam power. Some compromise measure may be put through, but at all events agitation for electrification will continue.

In reading the report, one is impressed strongly with the idea that the prevailing notion in the study was as to the effect of electrification upon the total volume of smoke produced. While this was the primary purpose in the appointment of the committee, its function, judging by the report itself, was evidently a broader one. It has, it is true, reported upon electrification as such, but in the background always there appears to be the relation of electrification to smoke abatement. That feature, too, is likely to induce many to accept, with little argument, the conclusions of the report negative to the electrification plan.

After finishing its discussion of electrification with reference to smoke abatement, the problem of electrification in itself—its effect upon operating expenses—is exhaustively studied. The second phase of the study, however, should not, it seems to this journal, have been the final one. There are benefits of electrification which should have been evaluated and which are too important to be lightly passed over. The report does recognize that there are "indeterminate results," such as increased capacity of terminals, greater reliability of electric than of steam operation, larger return from the use of railroad property, greater health, comfort and convenience for the public and a reduction of the loss and damage to property now occasioned by locomotive smoke. Relatively speaking, these may be indeterminate advantages, though as to that there is question, but certainly they deserve more than eight pages in an 1177-page report—and eight pages is all that is devoted to them.

If one wants tangible evidence of some of these advantages, it is readily procured by studying the conditions which recently obtained at the Grand Central Terminal, New York, and of the conditions there to-day. A district formerly cursed with locomotive fumes and gases, and constantly stirred by the ringing of bells and locomotive noises, remained, as does most property adjacent to railroads, backward and undesirable. Since the change, great hotels, fine apartment houses and clubs have been erected on the terminal site, while upper Park Avenue now displays an imposing group of the most expensive apartment houses in the city. Are the advantages in the probable appreciation of land values any less determinate than many of the scientific engineering problems which the committee had to consider? Moreover, is there any reason why such property appreciation should not help pay for the work by means of an assessment of benefits?

This brings up the further point that Chicago, so the committee states, cannot participate in the cost of electrification work. Chicago does participate, however, in the elimination of grade crossings within its limits. Are not benefits, comparable to those in the Grand Central Terminal section of New York City, public advantages just as much, though not of the same kind, as grade-crossing elimination? To admit that the constitution offers a permanent bar to a desirable civic improvement is an admission of weakness that the American public should not condone.

In sum, therefore, while the Engineering Record accepts the report as postponing for a time the general electrification of Chicago terminals, it believes that a great opportunity has been lost to show a broad vision of the relations between the railroads and civic development. It believes, too, that as a business proposition Chicago could well participate in the first cost of the work. The advantages upon which this journal lays emphasis are admittedly impossible of absolute determination, but so are many other important elements and results in every great engineering work. Dogmatize, if you can, regarding the value of a pure and adequate, as against a polluted and inadequate, water supply. Yet some appraisal is possible, and in a broad view of a great problem adequate place must be given these so-called "indeterminate" factors. They are no less important because relatively difficult to value, nor in the Chicago case are they necessarily so insignificant as not to change the conclusions of the report.



THE FILTER PLANT WAS SIX MILES FROM THE EXPOSITION GROUNDS

Wooden Filters Prove Economical for Temporary Exposition Water Supply

Expensive Construction Avoided at San Francisco by Designing Tanks and Basins as Timber Flumes—Operating Data and Costs

By E. C. EATON

Superintendent of Filtration Plant, Panama-Pacific International Exposition

BY SELECTING wood as the chief material of construction for the mechanical filtration plant at the Panama-Pacific International Exposition in San Francisco the designers were able to effect marked reductions in the cost of the works, which, because of their temporary service of only a few months during the life of the Exposition, did not warrant the larger expenditures which a permanent plant would have justified. This consideration, naturally, was responsible for a number of departures from ordinary practice in the design and construction of rapid filters. Among them are a simple but novel underdrainage system using a high velocity of wash water without air; an automatic control of the coagulant in proportion to the flow of water, and the use of timber flume construction for the several tanks of the plant. Most of the raw water is secured from deep wells, which caused a good deal of trouble with sand, but the plant proved adequate for the Exposition's needs. More detailed information on the well pumping troubles will be found in the "Hints for the Contractor" section, page 769.

SOURCES OF SUPPLY

Water for the Exposition was secured from several sources—a sump 200 ft. long, 14 ft. wide and 30 ft. deep in Golden Gate Park; five wells averaging 82 ft. in depth, and from the Government and Spring Valley Water Company's supplies. An estimate of the available average daily yield is given in Table 1.

The estimated daily requirements of the Exposition were from 1,400,000 to 2,500,000 gal., based upon data obtained during the pre-Exposition period. Analyses of the water made in May, 1914, from the North Windmill sump and from an old sump known as Rolandi's, in Golden Gate Park, gave the following results: *North Windmill sump,* bacterial count 110 per cubic centimeter, and B. coli not detected in 1 cu. cm.; *Rolandi's sump,* bacterial count 850 per cubic centimeter and B. Aerogenes present in 1/1000 cu. cm. Both bacterial and sanitary analyses indicated that the water should be carefully watched and, therefore, a filtration plant was decided upon.

The site of the proposed plant was approximately 6 miles from the Exposition grounds, and to reach this an elevation of 365 ft. had to be crossed. At the summit of this elevation, and distant 19,300 ft. from the plant was the 6,000,000-gal. storage reservoir of the Government's Lobos Creek plant. This reservoir is divided by a concrete retaining wall and one half set aside for Exposition purposes.

The Exposition waterworks system consisted, in brief, of a sump and five deep wells delivering water to a filtration plant; a main pumping plant, pumping water through a 12-in. steel pipe line to a height of 365 ft., a distance of 19,300 ft.; a reservoir of 3,000,000 gal. capacity, and a gravity pipe line to the Exposition grounds, 5,200 ft. long.

FILTERS OF WOOD

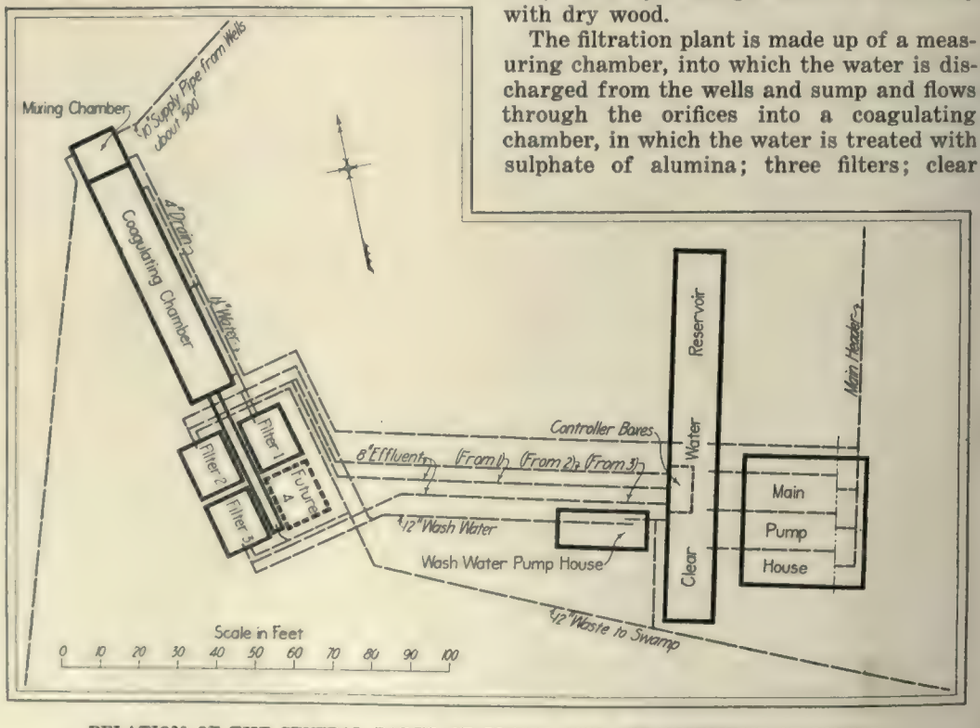
Owing to the temporary nature of the filter plant, a timber flume structure was decided upon, having a uniform framing throughout. The side posts are composed of two 3 x 6-in. timbers, bolted to 4 x 6-in. sills, having side blocks bolted on the sills to take the thrust from the side posts. The side posts are similarly bolted to a 4 x 6-in. cap. The standard spacing between side posts is 4 ft., and every third post is braced with two 2 x 6-in. braces. The whole flume rests on five 6 x 12-in. stringers, under which 8 x 12-in. mud sills are placed, resting on 3 x 12-in. plank.

In the wooden tanks or flumes a spline joint was used, having specially tapered grooves cut in the edges of the 3-in. plank, into which the splines of kiln-dried fir were placed, these splines being a driving fit. A good deal of discussion took place as to whether or not the splines and edges of the plank lining should be given a coat of asphaltum, with the result that one of the structures, the raw water flume, was left untreated, while the clear water reservoir was painted with asphaltum on the joints. The results show that the untreated splines made eventually the more watertight joint. It has been the writer's experience, covering a good deal of flume and wood-pipe work, that no better joint can be made in timber structures intended to be watertight than the clean wood to wood joint, allowing the free swelling of the wood throughout; also, that any calking should be done only with dry wood.

The filtration plant is made up of a measuring chamber, into which the water is discharged from the wells and sump and flows through the orifices into a coagulating chamber, in which the water is treated with sulphate of alumina; three filters; clear

TABLE 1—AVAILABLE AVERAGE DAILY YIELD

Source	Yield, gal. per day
Sump in Golden Gate Park	350,000
Wells—5 wells at 260,000 g.p.d. each when operated alone, capable of the yield per day multiplied by 2¾ times	650,000
Spring Valley Water Company	150,000
Wells on Exposition grounds	150,000
Presidio (Lobos Creek)	800,000
	2,100,000



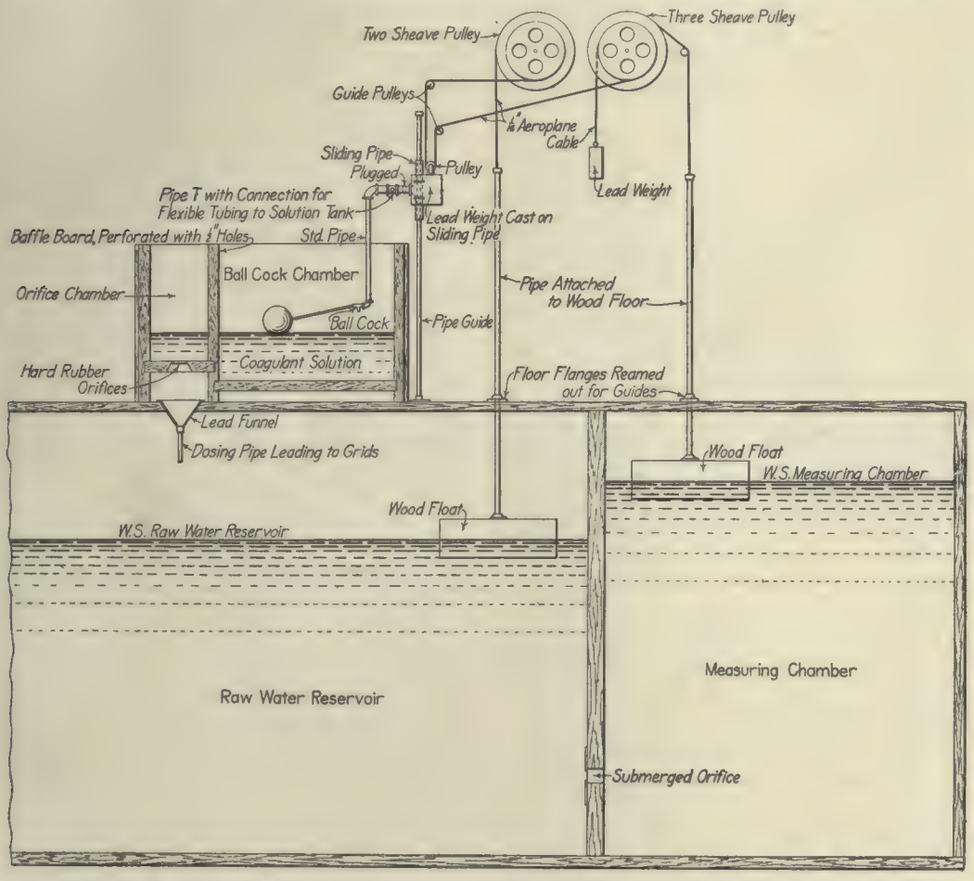
RELATION OF THE SEVERAL PARTS OF PLANT AND ARRANGEMENT OF PIPING

water reservoir; and a main pump house containing units, which raise the water to the main reservoir supplying the Exposition.

MEASURING CHAMBER

The measuring chamber is formed by bulkheading off one end of the coagulating chamber, thus forming a chamber 12 ft. 6 in. wide, 9 ft. 6 in. long and 9 ft. 3 in. high. Through this bulkhead two submerged orifices 4 in. high and 12 in. long are cut; over them bevel-edged plates are fastened. The pipe lines from the sump and deep wells discharge through openings in one end of this chamber. These discharges are provided with a simple type of float valve, operated by a light cable from floats in the raw water reservoir, the height of water thus being maintained constant.

The coagulating basin consists of a flume structure 12 ft. 6 in. wide, 8 ft. high and 64 ft. long, into one end of which the water is discharged from the measuring chamber, and at the other end is taken out by a small supply flume 2 ft. wide and 3 ft. high, running between the rows of filters. Ten-inch shear gates are fitted over openings cut in the sides of this flume, admitting water to the three filters.



DIFFERENTIAL EQUIPMENT FEEDS COAGULANT SOLUTION AUTOMATICALLY IN PROPORTION TO FLOW OF WATER

FILTER STRAINERS UNIQUE

There are three filters, each capable of filtering 500,000 gal. of water per day. In construction each consists of a section of flume framing 12 ft. 6 in. wide, 8 ft. deep and 14 ft. 8 in. long, with a bulkhead at each end, forming filter units of 183 sq. ft. surface each. At the rate in general use in filters of this type—2 gal. per square foot of sand surface per minute—this gives a capacity per filter of 366 gal. per minute, or over 500,000 gal. per day per filter.

The strainer system has for its advantage extreme simplicity, low cost and successful operation, and is a design developed by Prof. Charles Gilman Hyde, of the University of California. In the upper side of the header openings are provided, to which 3-in. nipples are cemented, connected to 2½-in. tees, in which lateral pipes are screwed. The 2½-in. lateral pipes are spaced 6 in. on centers, and have 5/16-in. holes drilled on the underside on 3-in. centers.

Four graded layers of gravel were put in above the strainer system, as follows:

Layer 1—From bottom of filter to 2 in. above the tops of the lateral pipes, clean gravel of such a size that it was retained on a circular opening 1½-in. in diameter and passed a 2½-in. opening.

Layer 2—Above layer 1 and 3 in. deep gravel passing a 1½-in. opening and retained on a ¾-in. opening.

Layer 3—Three inches deep, gravel passing a ¾-in. opening and retained on a ¼-in. opening.

Layer 4—Three inches deep, gravel passing a 4-mesh sieve and retained on a 12-mesh sieve. Above this was placed the filter sand, 26 in. deep, having an effective size of 0.35 mm. and a uniformity coefficient of 1.5.

A grade of sand was located about 60 miles from San Francisco which was admirably suited for the purpose. In size this was somewhat finer than it is now the practice to use in filtration plants, as bacterial efficiency of filtration was the important consideration, the water containing very little turbidity. Above the sand, provision is made for a 30-in. head of water. The filter effluent is carried by gravity through 8-in. pipes to the controller chambers in the clear water reservoir.

The filters are controlled at the filtered water reservoir. A simple type of controller was designed, consisting of a special casting containing a vertical piston. A walking beam and wood float operate the valve from full open to closed positions in a 2-in. travel of the float. Ordinary wood floats dipped in hot asphaltum were used, and have proved entirely satisfactory, and as sensitive as required. An auxiliary float is provided in the clear water reservoir, so that, in case the water rises too high in the reservoir, the controllers are shut off until the water again reaches a lower level.

Through each controller chamber and located 12 in. above the bottom of the chamber a submerged orifice is cut by which the water passes from the chamber to the clear water reservoir. As the controller maintains, within a margin of 1 in., a constant head of water in the chamber, and as the main pumps are regulated to keep a constant level in the clear water reservoir, there is a practically constant difference of head over this orifice, thus keeping a uniform rate of flow from each filter. The filters will, of course, "respond to the pumps," until a prearranged maximum rate per acre daily is reached.

A loss-of-head gage is installed at each filter, consisting of a glass tube 6 ft. long, and connected to the effluent pipe just after leaving the strainer header. This is provided with a gage board graduated in feet and tenths. The loss of head with filter running at full capacity and sand clean is 1.7 ft., and, under ordinary conditions of service, reaches a value of 6 ft. in from 10 to 15 hr., at which point the filters are washed.

WASH WATER SYSTEM

In almost all the filtration plants in operation to-day a combined air and wash water system is installed, the air performing the function of keeping the sand stirred up while the water cleanses it. It was believed that a considerable saving would be effected by using a high velocity wash water system and doing away with the air. A 10-in. centrifugal pump was installed in a separate house located close to the clear water reservoir, from which the suction pipe runs. The rate of washing employed is a 2-ft. vertical rise per minute. The time required for actual wash is 2 min. and a 1-in. flow over the weir edges of the troughs is maintained by the wash water. At this rate of washing the sand is raised bodily 12 in. and kept in motion, while the wash water passes up through the whole. For the purpose of collecting the wash water two V-shaped wood troughs, 24 in. wide by 18 in. deep, were built longitudinally over the filter. The weir edge is 2 ft. above the sand level. The troughs discharge the wash water through a 16-in. shear valve into a 12-in. drain, which terminates in a slough near the plant.

The total quantity of wash water used for the month of June was 692,000 gal., or 2.1 per cent of the total quantity pumped, and gave an average run per filter between washes of 15 hr. A considerable saving has been effected by using the high velocity wash water system instead of the older air and water system. Records of plants employing the latter system show that a column of water 6 ft. high is required, the rate being 7 gal. per square foot of sand surface per minute. By using a rate of 15 gal. per square foot per minute a 2-ft. column only is required, thus saving 2700 gal. per wash, as well as a considerable amount of time. In this connection, how-



TIMBER FLUME CONSTRUCTION
REDUCED COST OF TANKS AND FILTERS

ever, it should be remembered that this plant operates with a water which contains no appreciable amount of clay. No wire screens have been used over the gravel and below the sand, and no appreciable disturbance of the gravel was noted on examination after the filters had been in operation a month.

COAGULANT

The equipment for dosing the water is located in a house built directly over the measuring chamber and consists of the mixing tanks, orifice box and their piping, and the dosing grids. The two mixing tanks, of 500 gal. capacity each, are located on a platform above the floor of the house. Fastened to the inside of each of these tanks is a semicircular wooden box, with a removable galvanized iron screen for a bottom. Over the top of this chamber is located a distributor, consisting of a 1½-in. galvanized iron pipe perforated on the underside with ⅛-in. holes. The operation of mixing a stock solution is carried out by putting a weighed quantity of sulphate of alumina crystals into this compartment and allowing the water from the distributor to spray over it.

In the bottom of each of the mixing tanks is located a grid of ¾-in. pipe, perforated with 1/16-in. holes, connected to a No. 3 Roots blower run by a ½-hp. motor. This is operated for a few minutes every 3 hr. and keeps the solution well stirred. From the bottom of the tanks 1½-in. pipes are run, terminating in a ball-cock located in the orifice box, which maintains a uniform head over the orifices.

At one end of the box are located the orifices, two 3-in. hard-rubber disks, in each of which is a ¼-in. hole, through which the solution is admitted to the water, the quantity, of course, being proportional to the head over the orifices.

The solution falls from the orifices into a lead funnel connected to a 1¼-in. pipe running down the center of the raw water reservoir and above the water surface. A tee is located every 12 ft. in this pipe, from which a pipe extends to 12 in. below the water surface, having a ¾-in. pipe running across the reservoir. On the underside of this pipe are drilled ¼-in. holes on 6-in. centers. The whole forms a set of distributing grids, by means of which the coagulant solution may be admitted, at chosen points, to give the required period of coagulation, allowing a partial forming of the floc before entering the filters.

In order that the coagulant system should be as nearly automatic as possible a simple differential equipment was installed to alter the level of the solution over the coagulant orifices in proportion to the quantity of water flowing from the measuring chamber into the raw water reservoir. As this flow is proportional to the difference in height of the water in the measuring chamber and raw water flume, a wood float was placed in each of these, to which a 1-in. pipe was attached, passing through the floor. The ends of these rods were connected to a 1/16-in. aeroplane cable, each terminating in a drum. This drum was provided with a smaller sheave, to which another section of cable was attached, which imparts a raising or lowering motion to the ball-cock mechanism in proportion to the alteration in levels in the raw and measuring chambers. The equipment has worked satisfactorily throughout and requires no attention except the mixing of the solution and cleaning of the equipment.

CLEAR WATER RESERVOIR

The clear water reservoir is of standard flume framing, 12 ft. 6 in. wide, 7 ft. 6 in. high and 96 ft. long. The effluent pipes from the filters each terminates in a compartment in which are located the rate controllers. The reservoir is roofed over to protect the water from contamination. From the bottom of the reservoir, and located on the side directly opposite that on which the controller boxes are situated, three 6-in. suction pipes are taken out, running to each of the three main units in the pumping plant. Over the part of the reservoir containing the controllers a house was erected which contains the sterilizing equipment.

Although the treatment given the water by the filters has been found to remove all contamination, a chlorine treatment was adopted as an additional safeguard. This was supplied as an exhibit by the Electro-Bleaching Gas Company, of New York.

The main pumping plant contains three 5-stage, 6-in. turbine pumps, each rated at 500 gal. per minute under 220 lb. per square inch pressure, 1550 r.p.m., belted to 125-hp. motors. These pumps send the filtered water through a 12-in. steel pipe line, with Dresser couplings, 19,300 ft., to the main reservoir, from which a gravity pipe line 5200 ft. long runs to the Exposition grounds.

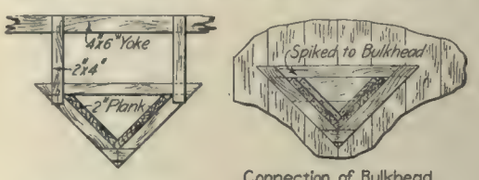
Up to July 7 the plant was not required to run at its full capacity. The main reservoir holds a little over a day's supply and the water pumped over is, therefore, regulated by the demand at the grounds.

COSTS

The actual costs of operating the plant for the month of June are given in Table 2.

Aluminum sulphate containing 17¼ per cent Al_2O_3 cost $1.75 per 100 lb., delivered at the plant in lots of thirty 250-lb. sacks. Chlorine cost 14 cents per pound, including freight both ways on cylinders, from and to Niagara Falls, N. Y.

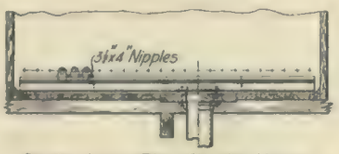
It was found by trial that a dose of aluminum sulphate of 1 grain per gallon of water to be filtered, combined with a coagulating period of 30 min. before the treated water was admitted to the filters, produced a very satisfactory floc and gave an effluent from which all contamination had been removed. Using a very much longer period than this caused the floc to settle down in the coagulating chamber before it was admitted to the filters, and a heavier dose required more frequent washing of the filters.

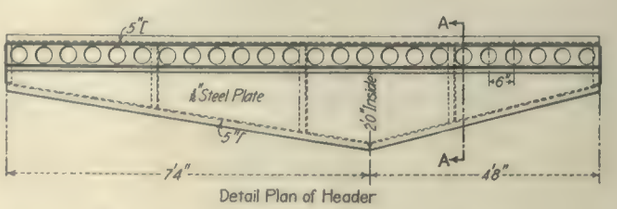


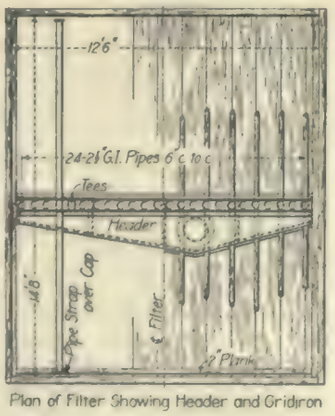
WASH WATER TROUGH DETAILS

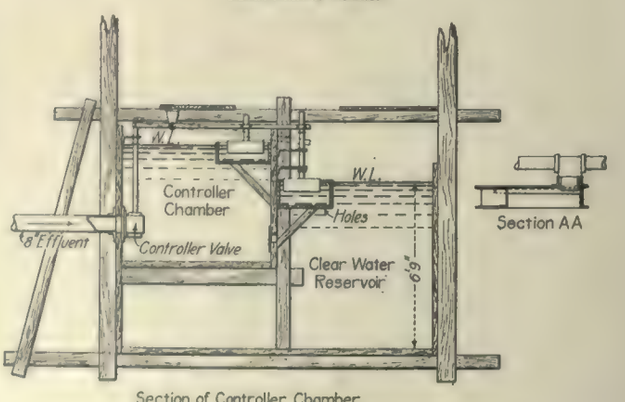
TABLE 2—COSTS OF OPERATION PER THOUSAND GALLONS

	Cost in cents
Pumping from deep wells:	
Power	0.846
Operators and superintendence	.607
Repairs to pumps	.047
Oil and grease, waste, etc.	.017
	1.517
Filtering and treating water:	
Sulphate of alumina	0.250
Chlorine	0.056
Wash water	0.045
Operators and superintendence	0.623
	0.974
Pumping to main reservoir:	
Power	3.300
Operators and superintendence	0.631
Oil, waste, etc.	.004
	3.935
Total cost per 1000 gal.	6.426









FILTER UNDERDRAINAGE SYSTEM IS NOVEL; EFFLUENT CONTROLLER CONSISTS OF WOODEN FLOATS AND WALKING BEAM DEVICE

The dose of chlorine used is 3 lb. per million gallons of water treated, or an equivalent of 21 lb. of hypochlorite per million gallons.

Tests of the water were made at weekly periods by the federal laboratory, under the supervision of Dr. C. C. Pierce, chief sanitary officer of the Exposition. In no case has contaminated water been discovered in any of the tests made at the reservoir. Analyses of the raw water show very little variation and the following is a representative test: Raw water—Gas in 10 cu. cm. Colon types; count 100 per cubic centimeter. Effluent—Gas in none of the specimens; count 12 per cubic centimeter.

The filtration plant and first five wells were constructed by contract; the costs are given in Table 3.

TABLE 3—CONSTRUCTION COSTS

Filtration plant, including deep wells and main pump houses and pipe lines, but exclusive of cost of wells and pumps		$14,575.00
First 5 wells, at $7.50 per foot		3,075.00
Pumps, consisting of three 5-stage main pumps; one vertical centrifugal sump pump; five deep well turbine pumps; one wash water pump		4,962.00
Well No. 6 (drilled by Exposition Company):		
Casing	$159.25	
Gravel filling 2.8 yd. at $2	5.60	
Cement, 0.32 bbl. at $2.75	.88	
Labor	70.00	
		235.73

. Per lin. ft., $3.89.

The estimates of available supply and Exposition requirements and investigations as to the use of Lobos Creek and the vicinity of Golden Gate Park as a source of supply were made by A. H. Markwart, assistant director of works. The successful design, construction and operation of the system is the result of co-operatin between the civil and mechanical engineering departments of the Exposition Company, under G. L. Bayley, chief mechanical and electrical engineer, and E. E. Carpenter, chief civil engineer. The services of Prof. Charles Gilman Hyde were secured in a consulting capacity in connection with the design of the filtration and water purification plant. Surveys and other preliminary work, together with construction of the sump, first wells and main pipeline, were under the direction of C. C. Blee. The design and construction of filtration plant, construction of new wells and operation of the system were under the supervision of the writer.

THE PRACTICE OF MAKING DIRECT SURVEYS by parties made up of regular employees of the U. S. Department of the Interior, instead of by contract with private surveyors, as was the practice for half a century, has been in operation two years and, according to an announcement of the department, has resulted in greater accuracy and efficiency. In all, there are 150 surveying parties so employed.

Bridge Spans Moved Bodily to a New Site

Canadian Pacific Railway Bridge Across Pitt River Was Purchased by the Provincial Government and Moved to Site Where New Highway Crosses the Stream

WHEN the Canadian Pacific Railway replaced its single-track bridge over the Pitt River in British Columbia with a double-track structure, the provincial government officials saw a chance to expedite greatly the completion of the proposed highway which parallels the railroad at this point, and accordingly opened negotiations for the purchase of the railroad bridge. A mutually advantageous agreement was made, and while piers for the highway bridge were being constructed about 200



ONE OF THE SPANS EN ROUTE

yd. upstream, the seven spans of the railroad bridge were placed on temporary pile supports along the bank of the river.

When the new piers were ready the steel spans were one by one floated on barges, towed to the new site and lowered carefully into place on the piers. Under this plan a steel bridge 2059 ft. long, including nine concrete piers, with a drawspan and pivot pier, was completed and placed in service in several months less time than would have been possible if spans had been fabricated to order. Of course the piers had to be designed and spaced to suit the spans, and are probably closer together than would have been the case for a bridge built for the lighter traffic. However, this was more than made up for in the lower cost of the superstructure and the time saved.

The spans were moved from temporary supports to the new piers by barges on which timber framework had been built up to carry the spans at the proper height. The barges were equipped with seacocks by means of which water could be admitted, causing them to settle to a lower level in the water. When a span was to be moved the barges were partly filled with water before being placed beneath it, and the water was then pumped out, causing the barge to rise gradually and assume the weight of the steelwork. The spans were allowed to settle in place by simply opening the seacocks after the barges had been properly placed at the new piers.

Nine new piers were built at the new site, most of which were 37 x 20 ft. in plan, the pivot pier for the draw span being of octagonal shape with a diameter of 28 ft. Four of the piers were 90 ft. or more in height, but all were sunk by dredging in open caissons. The total amount of concrete required was 19,180 cu. yd. The total weight of the steel in the seven spans was 1,098.43 tons.

The contract for the construction of the piers and the moving of the steel spans was held by Armstrong, Morrison & Company, Ltd., of Vancouver, B. C.



FORMER RAILROAD BRIDGE IS NOW IN HIGHWAY SERVICE

"Cubic Performance"

A Term Intended to Designate the Rate of Volumetric Work Done by Sewage and Water Treatment Devices

By LESLIE C. FRANK
Sanitary Engineer, U. S. Public Health Service

THE purpose of this paper is to present and to define the term "cubic performance," which has been devised in an attempt to express the rate of volumetric work done by sewage and water treatment devices in such a manner as to be independent of any particular volumetric unit.

There is at present no term in general use which gives a simple, comparative picture of various sewage or water treatment devices from the standpoint of volumetric rate of work done. In comparing one Imhoff tank with another it is often customary to state the relative sedimentation periods, the relative sludge storage periods, and the relative sludge supernatant volumes. Such a comparison involves a simultaneous mental co-ordination of six terms, obviously awkward. Or, if it is desired to compare volumetrically an Imhoff tank with an activated sludge tank, the Imhoff tank would be described by stating the sedimentation period, the sludge storage capacity and the sludge supernatant capacity, while the activated sludge tank would be described by stating the oxidation period and the sedimentation period. The difficulty of coordinating so many factors simultaneously is apparent.

It is necessary for certain purposes, of course, to know the various factors, but for convenience of stating the volumetric rate of a device as a whole these factors ought to be combined in such a manner as to result in a single expression. The term "cubic performance" is offered as such a single expression.

"CUBIC PERFORMANCE" DEFINED

The cubic performance of any sewage or water treatment device may be defined as the number of unit volumes of liquid treated per unit volume of device in a unit of time. The unit of time selected is arbitrary, but it is believed that two particular units of time would be most serviceable—the day and the year. The daily cubic performance, for example, of a sprinkling filter 8.5 ft. deep, dosed at the rate of 2,500,000 gal. per acre per day would be the number of gallons of sewage treated daily on an acre divided by the number of

gallons of filtering material represented by an acre; or:

$$2{,}500{,}000 \div (7.48 \times 43{,}560 \times 8.5) = 0.9$$

That is, the sprinkling filter in question will treat sewage at the rate of 0.9 its own volume per day.

Again, an Imhoff tank with a mean detention period of 2 2/3 hr., a sludge storage capacity of 1 cu. ft. per 100 gal. of sewage per day, and a sludge supernatant volume of 0.5 cu. ft. per 100 gal. of sewage per day, would have a daily cubic performance of 4.48. This is derived as follows: 100 gal. of sewage in 24 hr. is equivalent to 11.1 gal. of sewage in 2 2/3 hr., so that for each 100 gal. of sewage per day there must be provided a sedimentation capacity of 11.1 gal. or 1.49 cu. ft., which, with the added volumes for sludge storage and supernatant gives for every 100 gal. per day a total tank volume of $1.49 + 1.0 + 0.5 = 2.99$ cu. ft. As 100 gal. equals 13.4 cu. ft. the daily cubic performance is:

$$13.4/2.99 = 4.48$$

The daily cubic performance of a plain post-filter sedimentation tank with separate sludge digestion chambers is computed as follows: Given a mean sedimentation period of 2 2/3 hr. and a separate sludge storage capacity of 0.5 cu. ft. per 100 gal. of sewage per day. The volume of tank, per 100 gal. of sewage per day, for sedimentation and sludge digestion purposes is, as previously shown, $1.49 + 0.5 = 1.99$ cu. ft. The daily cubic performance of the post-filter system, therefore, would be:

$$13.4/1.99 = 6.74$$

Devices in Series

The daily cubic performance of any group of devices through which sewage flows in series is the reciprocal of the sum of the reciprocals of the individual performances. This relation will be obvious when it is remembered that daily cubic performance means "volume of sewage per day per volume of device" and that the reciprocal of daily cubic performance means "volumes of device per volume of sewage per day." Hence the addition of the individual reciprocals will give total volumes of devices per volume of sewage per day, which is naturally the reciprocal of the daily cubic performance of the series of devices. To illustrate the daily cubic performance of sewage devices acting in series assume a sewage treatment plant which makes use of Imhoff tanks, sprinkling filters and plain post-filter tanks with separate sludge digestion, all of these devices having the same characteristics as the examples previously discussed. The individual daily cubic performances are: For the Imhoff tanks, 4.48; for the sprinkling filters, 0.9; and for the post-filter system, 6.74. In accordance with the above rule, therefore, the combined daily cubic performance of these devices operating in series will be:

$$1 \div (1/4.48 + 1/0.9 + 1/6.74) = 0.675$$

In other words, the above sewage treatment plant, considered as a whole, will treat 0.675 of its own volume of sewage per day.

Devices in Parallel

The cubic performance of sewage devices acting in parallel will equal the reciprocal of the sum of the individual cubic performance reciprocals, each weighted according to the proportion of total flow taken by it. For example, if a given sewage treatment plant consists of Imhoff tanks having a daily cubic performance of 4.48 and plain sedimentation tanks with separate sludge digestion having a daily cubic performance of 5.35, operating in parallel, the plain sedimentation tanks taking 0.8 of the flow and the Imhoff tanks 0.2 of the flow, the combined daily cubic performance will be derived as follows:

$$1 \div (0.2/4.48 + 0.8/5.35) = 5.13$$

In other words, operated in parallel, with the total sewage flow divided as above stated, the combined sedimentation and sludge digestion system in question will treat 5.13 times its own volume per day.

Relation of Cubic Performance to Mean Detention Period

Cubic performance is the reciprocal of mean detention period, if the mean detention period be expressed in the same unit of time in which cubic performance is expressed. By mean detention period is meant here the detention period which will result from dividing the total effective inside volume of the device by the total volume of sewage treated per unit of time. For example, a plain sedimentation chamber with a mean detention period of 3 hr., or one-eighth of a day, will treat eight times its own volume of sewage per day and hence have a daily cubic performance of 8, i. e., the reciprocal of the nominal detention period.

Relation of Annual Cubic Performance to Cost Data

The term annual cubic performance which, of course, is 365 times the daily cubic performance, bears a simple relation to the cost of treatment of water or sewage. The total volume of any device multiplied by its annual cubic performance gives the total amount of liquid treated by the device annually. Therefore, the cost of treating a unit volume of liquid will be the total annual operating expense and capital charges of the device divided by VP_a, V representing the total inside volume of the device and P_a representing its annual cubic performance.

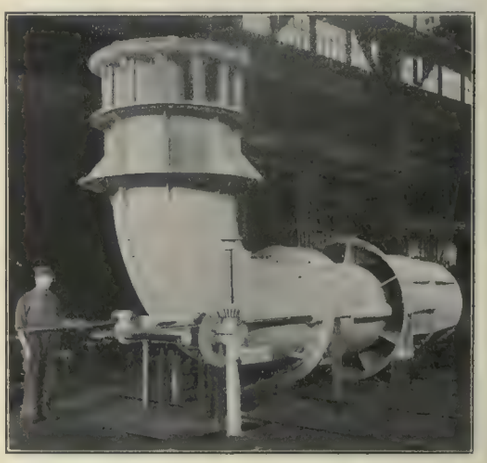
If it be desired to compute the volume of sewage treatment plant required for a given sewage flow and for a given type of plant it is necessary simply to divide the sewage flow per day by the daily cubic performance of the type of plant selected. The result will be the volume of plant required expressed in the same unit of volume used in expressing the daily sewage flow. The arithmetic of the relation is obvious. It may be used conveniently in approximate preliminary estimates.

In presenting the expression "cubic performance" there is no intention of *replacing* such terms as "sedimentation period," "sludge capacity," "sludge supernatant capacity," etc. The term is intended to act merely in a supplementary or embrasive sense. A particular field of application will be found in experimental work. It is being used, for example, in studies of the United States Public Health Service upon the new method of sewage treatment by means of activated sludge, and it is proving easy, thereby, to keep clearly in mind at all times the volumetric relation of this process of sewage treatment to other processes.

Discharge Accelerators Increase Power at Low Head

Device Utilizes Surplus Run-Off When Rising Tail-Water Cuts Down Power

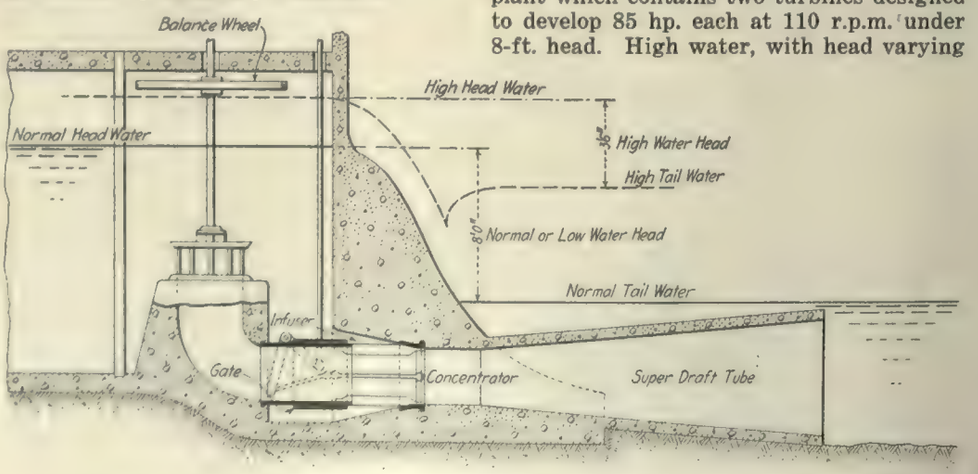
TURBINE discharge accelerators, so called, built into the draft tube of waterwheels at the Henry Ford farms, Dearborn, Mich., have shown a considerable increase in power during low-head conditions. A wheel giving 90 hp. under an 8.25-ft. head, without the accelerator in service, developed 116 hp. at 6.94-ft. head with the accelerator in operation. These data and a general description of the apparatus were presented by Mark A. Replogle of Akron, Ohio, in a paper read before the annual meeting of the American Society of Mechanical Engineers in New York last week.



INFUSER AND TURBINE ERECTED IN SHOP

Plant

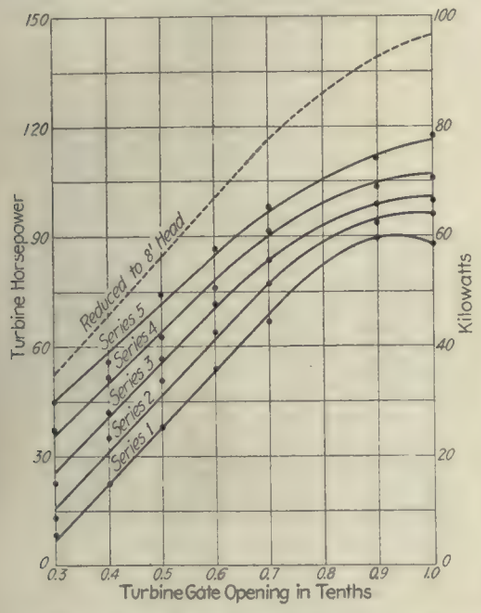
The accelerators are installed in a power plant which contains two turbines designed to develop 85 hp. each at 110 r.p.m. under 8-ft. head. High water, with head varying



CYLINDRICAL GATE CONTROLS AMOUNT OF ACCELERATING WATER USED

from 2 ft. to 5 ft., may obtain for weeks at a time, so that provision to meet this condition was necessary. The accelerator design was accordingly developed. The general features of the apparatus are shown in two illustrations herewith. The purpose of the accelerators, evidently, is to transfer energy from surplus water, otherwise running over the dam and being wasted, to the turbines, augmenting their power under subnormal heads, after they have reached their normal power at those heads.

It will be noted from the illustrations that each accelerator consists of a super-draft tube, a concentrator and an infuser. The infuser is provided with a gate, by means of which the quantity of accelerator



POWER OBTAINED WITH DIFFERENT TURBINE AND ACCELERATOR GATE OPENINGS

Series 1—Accelerator gate closed. Series 2—Accelerator gate open 20 per cent. Series 3—Accelerator gate open 40 per cent. Series 4—Accelerator gate open 60 per cent. Series 5—Accelerator gate open 80 per cent.

water may be varied at will, or shut off entirely.

Results

The curves shown are plotted from tests made on one of the accelerators. The increase in power with wider opening of the accelerator gate is apparent. In series 4, though the power increased, the accelerator was sucking air. This sucking continued in series 5, though in that test, too, the power increased. The excessive taking in of air prevented the further opening of the accelerator. The curve in series 5 shows that 116 hp. was developed at 6.94-ft. head. This curve, reduced by formula to an 8-ft. head, shows that 143.5-hp. can be obtained by the use of the accelerator from an 8-ft. head in connection with the identical turbines that have been guaranteed to develop only 85-hp. with this fall.

No attempt was made to measure the accelerator water used, though it is intended to make investigations during which this factor will be observed.

Charted Cost Data in Dayton are kept on many of the city's activities for the use of the lay workman. After plots of the amounts of certain supplies used for the same purpose by several men in a department were posted, automatically the curves of the careless users soon dropped to a normal figure.



FORMS FOR CASTING ALTERNATE 10-FOOT BAYS—STEEL RODS SECURELY HELD

New South Brooklyn Pier at Thirty-fifth Street Is the Longest in New York

Work Is Progressing on Structure 1740 x 175 Feet with Railroad Tracks Placed Outside the Shed on Each Side

THE design of the Thirty-fifth Street, Brooklyn, pier, in New York City, differs from the usual type in this vicinity in the fact that the company which will lease the pier from the city desired the railroad tracks to be placed at the sides of the pier rather than in the center. This required about 25 ft. greater width than the center-track type, at an added cost of nearly $50,000. The advantages claimed are in the possibility of direct transfer from ship to cars, which the Luckenbach Steamship Company, Inc., the lessee, claims its cargo shipping system will make possible.

The provisions for cargo hoists are typical of those adopted in New York pier construction as the most efficient and simple device for handling the packages of variable sizes and shapes which must be transferred from ship to truck or car. Details of the cargo cables and high steel cargo columns used in this system are shown, and the general design of the substructure and the steel pier shed illustrated.

General Dimensions and Location

The pier, 1740 x 175 ft., is the longest in New York City. The shed is nearly 140 ft. wide, and the tracks are placed outside the shed, one on each side as shown in the typical half-section. The floor slabs of reinforced concrete span 10 ft. between the transverse rows of piles. The added loads from the light one-story shed columns are provided for by increasing the number of piles, as indicated on the plan views.

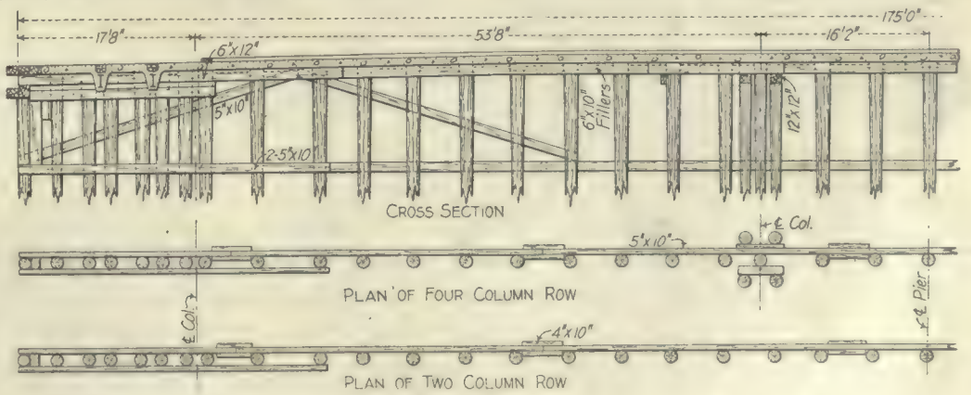
The pier is located at Thirty-fifth Street, South Brooklyn, on Gowanus Bay, and will be connected, ultimately, to the Brooklyn Marginal Railway, which forms part of the tentative, but extensive, plans for increasing the port facilities of New York City. Two other piers, at Twenty-ninth and Thirtieth Streets in South Brooklyn, are also under construction.

Details of Pier Construction

The pier construction is typical of the other designs of New York piers in the use of pile bents spaced 10 ft. apart and braced as indicated in the half-section. The reinforced-concrete slabs are laid in alternate strips 10 ft. wide. The main reinforcement, running longitudinally, consists of ⅝-in. square rods on 6-in. centers bent up and hooked at their ends, with an over-all length of 19 ft. 10 in. By staggering these rods, so that every other rod stops over an intermediate bent, one rod runs through on the bottom, and the alternate rod is bent up to take shear, as shown in the photograph. Transverse spacers ⅜ in. square and about 18 in. on centers are used in lengths from 12 to 20 ft., with 12-in. laps.

The supports for future track rails are 15-in. I-beams carried on steel saddles at the bents and inclosed in concrete as shown by the transverse section giving details of the track system.

The pier shed is a steel-frame structure of the usual mill building type, with roof



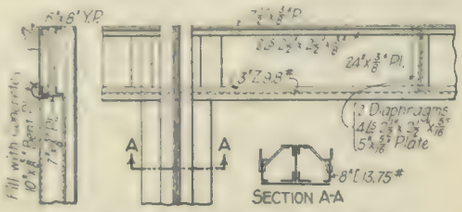
SECTION AND PLANS SHOW TYPICAL CONSTRUCTION OF PILE BENTS—TRACK DETAILS

slope of 1 in 5, triangular trusses, and built-up I-section columns. The standard bays between roof trusses are 20 ft. long, and four columns are used in the typical section. The intermediate columns, however, are placed 40 ft. apart and the roof trusses and loads are carried by the 40-ft. longitudinal trusses shown in the drawing. Lift doors are provided in the outside walls of all panels except the first two on the inshore end, as these two bays are to be occupied by offices. Galvanized corrugated steel siding is used throughout.

Twenty-five of the outside row of columns are extended upward to a total height of 50 ft., with a 12 x ⅜-in. cover plate, 28 ft. long, on the outside. A star-angle backstay to the roof truss holds the top of the column transversely as shown in the half-section drawing. The upper ends of these columns are provided with plates for the connection of the 2¼-in. cargo hoist cables and 1½-in. longitudinal stay cables.

Two of the 60-ft. bays in the total length of 1440 ft. between the high end columns are braced by 2¼-in. diagonal cables carried down to roof level, and the end columns are tied by a diagonal 2¼-in. cable anchored into the pier. A special form of door-head girder, shown in the accompanying detailed drawing, not only supports the heavy doors but acts as an eave strut. The 24-in. plate and 8-in. channels of the intermediate columns, also indicated on this drawing, make an effective detail for the door jambs. The bottom door sill is formed by an iron casting 8 in. wide, with vertical ribs 2¼ in. high to act as an asphalt stop.

The assumed live load on the pier is 500 lb. per square foot. For the roof, 70 lb. per square foot live and dead load, with a horizontal wind pressure of 20 lb., were used. The usual allowable stresses, based on 16,000 lb. tension, governed the design of the roof trusses and columns. The cargo cable is designed for three 3000-lb. loads spaced 20 ft. apart, and for the backstays an impact of 100 per cent was added. The assumed angle of application of the loads



DETAILS OF DOOR-HEAD GIRDER

for maximum backstay stress was 22½ deg., giving a stress of 18,500 lb. in these members. The stresses in the roof truss members from this force were relatively so small that no modification of the sections found by the ordinary analysis for dead, live and wind loads was required.

The details of cargo-cable connections to columns and adjustable turnbuckles, and the connection to the pier at the end to secure the longitudinal stays, shown on the drawing, are typical of the construction used in New York piers having cargo cables. Experience has shown that no direct access to the cargo cable is necessary. The blocks for use with pier or ship winches are attached to the cable by any ordinary method desired by the steamship company using the pier.

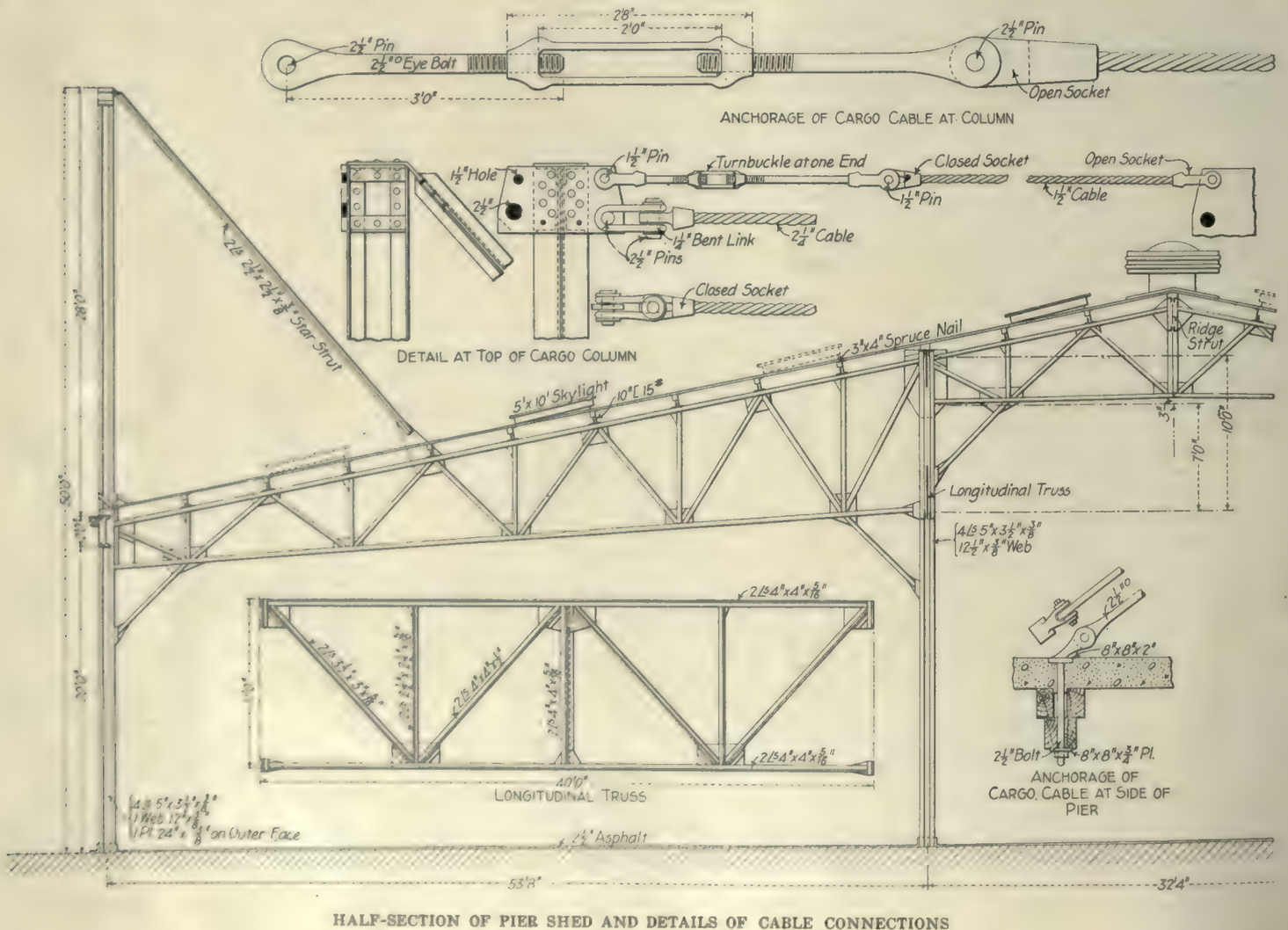
The contractor for the substructure is George B. Spearin, and for the steel shed Post & McCord, of New York City. The design was made under the supervision of R. A. C. Smith, commissioner, Department of Docks and Ferries, of New York City, and R. C. Harrison, deputy commissioner, by C. W. Staniford, chief engineer, and T. F. Keller, assistant engineer.

Concrete Tests Compare Gravel, Limestone and Broken Slag

A SERIES of tests recently reported by the Pittsburgh Testing Laboratory was made for the purpose of comparing the compressive strength of concrete made with either gravel, limestone or broken slag for coarse aggregate. Standard 8 x 16-in. cylinders of 1 : 2 : 4 concrete were made and tested at the end of seven days, twenty-eight days, ninety days and six months. The accompanying table gives the average results of these tests. The number of specimens tested in each group was four, except the last six-months group, where the average for three specimens is given. It is seen that the concrete with slag aggregate is of practically the same strength as the limestone concrete, and both average much higher at all ages than the gravel concrete. The slag was furnished by the Duquesne Slag Products Company of Pittsburgh.

AVERAGE COMPRESSIVE STRENGTH OF STANDARD CYLINDERS IN POUNDS PER SQUARE INCH

Aggregate	Strength at age of			
	7 days	28 days	90 days	6 mos.
Gravel	468	1,001	1,521	1,430
Limestone	792	1,476	2,201	1,904
Slag	788	1,457	2,294	2,288



HALF-SECTION OF PIER SHED AND DETAILS OF CABLE CONNECTIONS

Segregation and Entrained Air Weaken Concrete Dropped from Height Into Forms

Last of Three Articles on Better Concrete — Moving Pictures Show Reasons for Lack of Homogeneity in Finished Mass

By NATHAN C. JOHNSON
Consulting Concrete Engineer, New York

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[*In the two preceding articles of this series there were discussed certain of the basic requirements of concrete and their relation to the limitations imposed on processes of manufacture by economic necessity and by imperfections of mixing apparatus. There were also shown, in relation to common defects of concrete, certain undesirable phases of current practice through analysis of the successive, instant actions of these operation cycles, as caught by the motion-picture camera. In this article further analytical studies are made in regard to the placing of concrete by methods in present vogue and the effect such methods have upon the quality and durability of concrete.*—EDITOR.]



FIG. 12—SPOUTING CONCRETE FROM A HEIGHT TO ILLUSTRATE EFFECT OF DELIVERING INTO TALL FORMS



FIG. 13—AIR BUBBLES, AT LEFT SIDE OF STREAM, CAUSED BY SPLASH BOARD AT END OF CHUTE, PASSING INTO THE MASS

FROM a time-money point of view, if from no other, there are no operations incident to the manufacture of concrete more important than those of properly placing the mixed materials in the forms. Concrete is very heavy, weighing approximately 2 tons to the cubic yard. It is readily understandable, therefore, that on a job involving from 500 to 200,000 cu. yd., the transporting of this material from mixer to forms and placing it in final position is an economic and engineering problem of no mean order. This phase, of itself, would be sufficient warrant for an intensive study of delivery systems, but when, in addition, it is remembered that these physical operations have a most profound effect on the quality of concrete and the value of structures a detailed examination is made imperative.

FOUR METHODS OF CONVEYING CONCRETE

There are virtually but four usual means of conveying concrete from mixer to forms. Ranked in approximate precedence, according to extent of use, they are:

1. Wheelbarrows or two-wheeled concrete barrows, holding about ¼ cu. yd. each, propelled by man-power.
2. Gravity chutes or spouts, supported and fed from a tower near the mixer.
3. Tilting or bottom-dumping buckets, where the materials can be handled by derricks or cableways.
4. On very massive constructions, side-dumping or bottom-dumping cars of 1 cu. yd. or more capacity running on tracks above or beside the forms.

In the majority of concreting operations either the first or second method is used, or a combination of the two. Considered comparatively, the spouting or gravity system is probably the more favored, especially on work of considerable size. Its economic features are undeniably attractive. To raise concrete vertically in a tower by means of a skip bucket and hoisting engine, distributing by gravity through channels which can be arranged in convenient sections to cover any area inclosed by a radius of from 30 to 200 ft. from the base of the tower, rather than to transfer that same material over specially constructed runways to the several parts of the work, appeals strongly to one's engineering and business sense. Further, the speed of handling by gravity is materially greater; and, conversely, the time cost of placing per cubic yard is much less than in transferring the same quantity of material in hand barrows over more or less expensive and frequently shifted gangways, in cableway buckets or in cars. In addition, better distribution in the forms is secured by a swinging spout end, with prevention of some of those difficulties due to localized deliveries, as explained in last week's article.

Yet in spite of its many good points this spouting system has encouraged many abuses, the effects of which are being appreciated to an increasing extent as the deficiencies of some of the concretes placed by its means are brought to the attention of engineers and contractors through cumulative disintegrations. To consider one feature touched upon in a previous article, it is obvious that to flow readily through chutes concrete must be very smooth and plastic, while, as usually made in 17-sec. mixing where the lubricating quality of flocculent, well-hydrated cement is absent, it is exceedingly sharp and gritty. It is not to be wondered, then, that the lubrication and ease of flow of spouted concretes secured by increased wetness has encouraged the use of large excesses of water, especially on those jobs where the obtainable slope of spouting is very slight, as is frequently the case with a tower of moderate height and tall forms, as in pouring retaining walls.

EXCESS WATER IN SPOUTING

On spouting operations, therefore, inducements three-fold lead to the use of excess water. The first, which applies equally to other means of placing, is ease of mixing. A wet concrete churns far more readily by reason of the lubrication of interparticle water, and presents a more uniform appearance in less time than does a dry, or a semi-wet concrete; this phase of the question has been referred to in the first and second articles of this series. The second inducement is ease and rapidity of flow through the chutes or spouts. The third is the ease of working the plastic mass in the forms, also due to interparticle separation and fluid lubrication. Beyond a question, ease of transportation and manipulation, with low time costs, are highly important, but not sufficiently so to warrant the unmodified continuance of present methods, should it be proved that details attendant upon the practice of these methods are the causes of serious limitations to use and defects in the product.

To determine whether or not spouting methods, as such, are to be held responsible for inferior results, or whether attendant practices are more at fault, a detailed study by means of the motion picture camera is of service. In Fig. 12 is shown the spouting of a very sloppy concrete for use in the reinforced flooring of a pier in New York Harbor. To make clearer the characteristics of the flow and also for special reasons to be pointed out later, the spout was elevated 12 ft. above the forms, the concrete being discharged for a short time from this height. It should be understood, however, that neither on this job nor on other jobs studied by the motion-picture camera was the consistency, distribution, or rate of production of the concrete changed in any way, either for illustrative or for other purposes. In every case the endeavor was rather to photograph unchanged routine, considerable intervals often being allowed to pass in order that normal conditions might be assured, free



FIG. 14—SLOPPY CONCRETE BOILING AND BUBBLING FROM A SPOUT IN NORMAL POSITION LOWERED ALMOST TO SURFACE OF FORMS

from the embarrassment men sometimes feel when being photographed with attendant breaking of routine.

Aside from this element of unusual height, the operations of Fig. 12 may, therefore, be taken as characteristic of spouting a gravel concrete, the sloppy wetness of which may be judged both by the volume flow from the spout and from the reflections in the water-covered surface of the material already in place. It becomes of general interest and importance, then, to examine the actions as portrayed in this series of instant pictures.

This falling, semi-fluid column of concrete is, of course, a composite of sand, cement, gravel and water. Mixed by a gravity mixer with indeterminate actions, it is safe to assume in this mixture a no more thorough incorporation of materials, and particularly of cement and water, than obtains in concretes made by the 17-sec. machine mixing processes studied in a previous article (Engineering Record, Dec. 4, page 684). This falling column, then, is a more or less homogeneous mixture with water of solid, undissolved particles of cement and of the other solid materials mentioned above, each particle free from attachment to its neighboring particles, save for such viscosity as exists in the water lying between them. Each particle occupies an indefinite and accidental position in the mass, and each is ready to leave that position at any instant in obedience to any new or chance conditions that may arise.



FIG. 15A—CONCRETE BEING DUMPED FROM MIXER TO SKIP WITH DOUBLE FALL

SEGREGATION IN THE FORMS

Disregarding for the present such segregating or separating actions as may take place during transit through the spouting, assume this stream of concrete to be homogeneous at the instant of issuance. Can this same homogeneity hold after delivery in the forms?

Each particle, solid or liquid, in the descending stream possesses a kinetic energy equal to its mass multiplied by the square of its velocity. If such a solid particle, whether of cement, sand or stone, strikes a relatively unyielding surface, it will use up its kinetic energy either in deformation or in rebounding to an uncertain position, for it is essentially unattached to neighbor particles. If it strikes a yielding mass it will penetrate that mass until its energy is dissipated. Remembering the consistency produced by 17-sec. mixing with excess water, without production of a heavy, sustaining grout, segregation in the forms from different mass energies, if from no other cause, is to be expected. Unless some agency should operate to prevent, it is difficult to see how this placing segregation is not later to be aggravated by gravity settlement of the heavier aggregate at the bottom of the slab, where it will be in tension, and concentration of fine sand and the weaker cement, greatly diluted by water, at the top of the slab, to serve as a resistant to compression. The existence of such actions is proved by sectioning concretes placed under these conditions.



FIG. 15B—THE SKIP BEING FILLED WITH CONCRETE—AND AIR

AIR BUBBLES IN FALLING STREAM

Another deduction from this characteristic operation becomes evident on closer study. There is evident in Fig. 13 several very large air bells in the falling stream, passing down into the mass. And, in this same connection, what must be the air-impounding action of that falling fluid mass? An old-time device for gathering and compressing air, known as a "water tromp," is duplicated in action by this falling column of concrete, so that what the mixer left undone in regard to churning air into the mass is probably completed subsequently by this or other pouring actions, whether from barrows, buckets, or spouts of one kind or another.

Although seldom observed because of intervening walls of wood it is evident to any thinker that the conditions attending this open delivery from a height must be duplicated daily in pouring concrete into high forms. The pouring of slabs by an elevated spout, as shown in the pictures, is condemned by all, or to quote the objection of the engineer in charge to the request to elevate the spout: "It will spoil the concrete." Yet identical conditions in closed form work, with a much higher drop, excite no comment. In operations of this general character it is doubtful justice to place responsibility for inferior work on materials alone.



FIG. 15C—RUSH DOWN SPOUT AFTER PASSING DEFLECTOR PLATES FOR RE-ESTABLISHING MIX

There are, however, other features typical of spouting concretes which are illustrated in the photographs of Fig. 14. In these photographs, taken on the same job, the spout is in normal working position—lowered almost to the surface of the forms. By reason of its fluidity and the slope of the spout the concrete is delivered with considerable velocity. In this case also, as in the falling column of concrete, each of the component, unattached particles possesses kinetic energy proportional to its mass; this energy must be dissipated be-

fore the particle comes to rest. In addition, the descending concrete stream carries air in quantity into the plastic concrete previously deposited, causing it to bubble and boil vigorously, as may be seen in the photographs. It is no wonder that concretes so placed carry a bulk of entrained air of sometimes 20 per cent of their bulk.

It is recognized that certain of these more or less undesirable actions seem at present to be exceedingly difficult of overcoming. A certain amount of air is certain to be occluded in a plastic mass, and variation in distribution and proportions of materials is an evil attendant upon rough, volume measurements. In spite of these shortcomings, much trouble could be avoided were the primary mixing sufficient and effective, so that a heavy-bodied, viscous grout might be had at the outset, and were every effort made to prevent those unin-

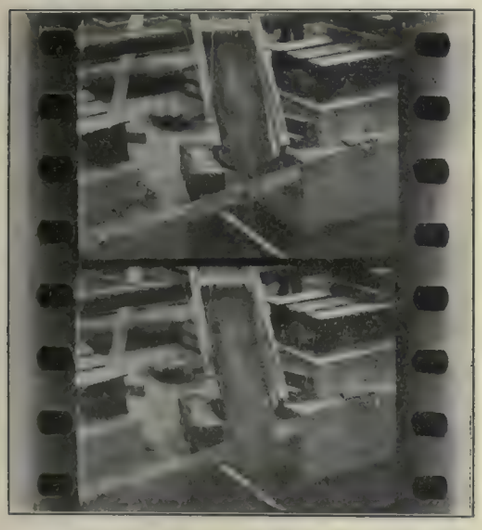


FIG. 15D—EXIT, WITH LIGHTEST AND WETTEST MATERIALS IN EXCESS

closed pourings and separatings and splashings that now form so conspicuous a part of most field practice. A gentler, more careful and more thorough handling of concrete is both advisable and necessary and is not inconsistent with speed of construction or the realizing of profits.

Moving Picture Evidence

As illustrating customary procedure in the handling of an average concrete, consider the series of operations on a spouted job, incident to placing the mixed materials in the forms, as shown in Figs. 15a to 15f.

Starting with its discharge from the mixer, the concrete is seen (Fig. 15a) falling into a skip at the tower base in an aerating double cascade, occasioned by striking an auxiliary chute placed to prevent wastage. In Fig. 15b is shown the skip bucket from above, full of concrete—and air—ready to be hoisted into the tower. Then the skip bucket, high in the tower, dumps with another cascading into the receiving hopper at the chute ahead, whence the concrete passes into and through the chutes. In Fig. 15c is caught the first grand rush of finer and softer materials through the last section of chute, catching up with the heavier aggregate separated out and left from the last batch. Fig. 15d is the exit of these materials from the chute end in so fast-flowing a stream that the camera could catch only a blur; while in Fig. 15e is a similar rush, spattering and splashing into the concrete already in the forms, with a crater, or envelope of air visible about the descending materials. And in Fig. 15f are shown the heavier, segregated materials, separated from the sand and cement either in the receiving hopper or in the chutes, dribbling slowly along, although the chute is at an unusually steep pitch. Do these practices produce the best concrete obtainable, or even the best that may be produced at the present price paid for such work? Few, if any of the many

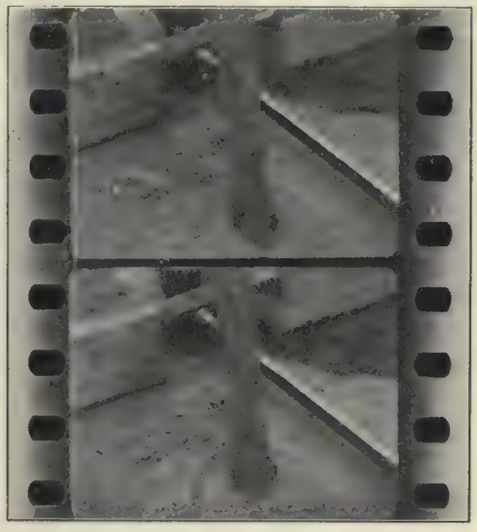


FIG. 15E—SPLASH INTO FORMS, WITH SEGREGATION AND IMPOUNDING OF AIR

able engineers directing concrete work would acknowledge this to be the case.

The foregoing series of photographs were made on a job using a medium wet concrete. The concreting was also well ahead of the other work so that quantity output was not a prime essential, and, furthermore, the inclination of the spouting was steep, so that slow delivery and a relatively dry mix were permissible. Yet, even in this concrete, segregation is evident; and the dribbling of the heavier materials through the chutes which brings about part of the demand for wetter concrete is illustrated with clearness.

The tendency toward the use of excess water is thus seen to be natural, as meeting most easily an economic demand for low placing cost per yard, brought about primarily by keen, competitive bidding. But



FIG. 15F—SLOW DRIBBLE OF HEAVY MATERIALS SEPARATED FROM CEMENT IN SPOUT

if it is granted that such consistency and violent handlings are productive of inferior results, is not this lower unit cost false economy? And are over-wet concretes and kinetic or gravity segregations inseparable from spouting operations? The determining factor in rapid, effective spouting is lubricated flow. It would seem either that a harmless lubricant might be added, or else that through a rational development of mechanical mixing processes, this lubricant might be produced from the inherently capable cement and water, so that the desirable features of spouting might be retained with the disadvantages eliminated. More experiment is needed to prove conclusively the commercial feasibility of these improvements, but enough is already known to give encouragement for their early realization.

Sliding vs. Rolling in Chutes

Not a little controversy has been waged over the method of transit of materials through the chutes themselves, insistence being placed by many upon a sliding, as opposed to a rolling of the aggregates. Viewed in the light of motion picture studies, with consideration given to the excess wetness and the inevitable gravity segregation common not only to spouting, but



FIG. 16—SPLASHING DISCHARGE OF CONCRETE FROM BOTTOM-DUMPING BUCKET USED TO DEPOSIT FOUNDATION COURSE FOR ROAD

to other placing operations as well, does not such a debate savor of that other reputed to have once waged so hotly in regard to which end of an egg, the big end or the little end, was the proper end to open? Compared to excess water, or to a splashing delivery into a skip bucket, or to segregation in the chutes, with attempted recombination by splash boards at the section joints, or to pounding, splashing delivery from a height, or to kinetic and gravity segregation in the forms, is not this question of very minor importance? And compared to the importance of that initial operation of mixing, the basic function of



FIG. 17—STEEL REINFORCEMENT IS OFTEN TOO CROWDED FOR BOND WITH CONCRETE

which is a proper production of the gluing, or cementing substance designed to hold the inert, incoherent materials together, are not such questions insignificant? If proper mixing and, partly through the enablement of such proper mixing, proper consistency were once secured, there would be little need to worry about rolling, or sliding, or splashing, or segregation, for the mass would be free-moving, sufficiently viscous not to separate, self-lubricated and probably unaerated as compared with present concretes.

Bottom-Dumping Buckets

Space does not permit of a close analysis of the delivery of concrete from bottom-dumping buckets, or from side-dumping, or bottom-dumping cars. In general features such operations closely resemble the dumping from wheelbarrows, save that in bottom dumping the stone is first and the more fluid portions last delivered, with perhaps something of advantage on this account, because of gravity penetration of the lighter, fluid materials into and between the heavier, solid portions below them.

An illustration of delivery of this character is given in Fig. 16, showing a paving mixer with boom bucket at the instant of dumping. Here again may be seen the splashing discharge from mixer to bucket, probably segregation in the bucket and dumping in a heap, with drainage of the lighter and more fluid materials. But perhaps of more serious consequence to the roadway than the influence of these factors of handling is the regrettable fact that few precautions are taken, in far too many cases, to secure a properly drained and bedded foundation for the concrete top. The necessity for committees to determine and prescribe the quantity of steel reinforcement to be put in concrete roads, which should carry no beam stresses, to prevent the concrete from cracking is no compliment to a material which should be sufficient of itself and most excellent for the purpose.

Bond Between Steel and Concrete

But another phase of the manufacture of concrete must be considered, in addition to those dealing only with the composite material itself. A relatively small portion of concrete work is without steel reinforcement, this reinforcement being designed to act, when surrounded by concrete, as an integral part of the mass and to bear virtually all tensile stress. But in order that it may so act, close contact must be had between concrete, mortar and steel. Further, the steel must occupy a definite, predeterminated position in the mass, or else its proper functioning is prevented, possibly to the extent of uselessness.

The use of sloppy-wet concretes to bring about close contact between cement and steel is common, but there seems to be no more cause of such a concrete to bind closely to steel after loss of water than there is for it to closely contact with its sand and stone, which it is known not to do. And if to such qualities of the concrete are added misplacement of the reinforcing steel or, as is shown in Fig. 17, the crowding together of many large steel bars in a narrow beam with scarcely a knife-blade crack between, virtually cutting off the beam at the steel and preventing any proper surrounding by the cement, a result below standard is inevitable.

What the Future Holds

The more carefully concrete is studied the more does the conviction grow that its qualities to-day are far below those which it should possess, and that its present field of usefulness will be extended many-fold in the not distant future. Much yet remains to be accomplished, but day by day and little by little the work is being done and the difficulties removed. Whether the ultimate outcome will be an economic readjustment, permitting a higher rate of payment for a superior product, or whether it will be mechanical refinements of apparatus and methods, producing these desirable results at the same price, or whether it will be a compromise of the two, does not yet permit of accurate determination. Judging, however, from the history of all industry and from the known crudities of to-day's manufacture the highest development will be reached through mechanical refinements, with an even greater economy of human energy and a corresponding contribution to the safety of the public.

[*This concludes Mr. Johnson's series on common abuses in mixing and placing concrete. He has stated the facts. It remains for engineers, contractors, and manufacturers of equipment to evolve improvements in current practice. If this occurs the series will have started a real constructive movement.*—EDITOR.]

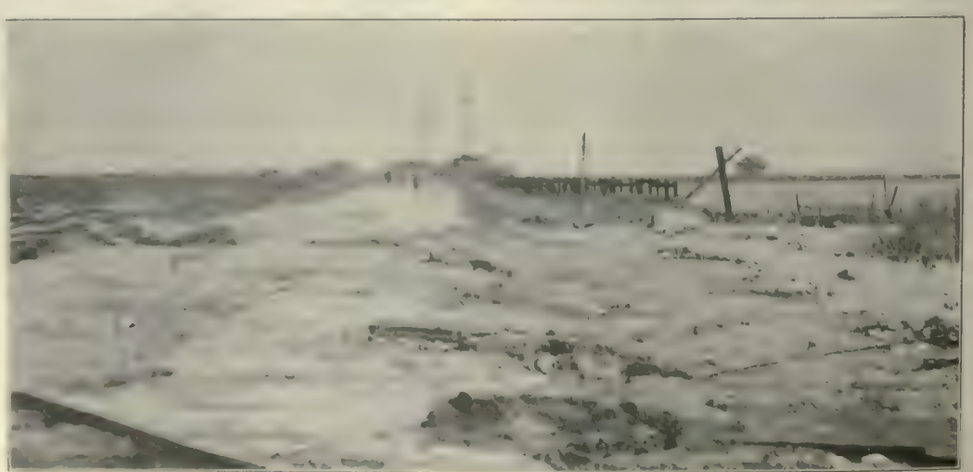
How Louisville & Nashville Repaired Storm Damage Along Gulf of Mexico

Emergency Work Following Hurricane of Sept. 29 Included Restoration of Embankments, Pile Trestles and Short-Span Bridges

DAMAGE done by the storm of Sept. 29 to the main line of the Louisville & Nashville Railroad between Pascagoula, Miss., and New Orleans, where the road skirts the Gulf of Mexico, was so extensive as to put the section of the road between Henderson Point, Miss., and Chef Menteur, La., completely out of commission. From the first warning by the U. S. Weather Bureau of the impending advent of a tropical hurricane, however, the railroad bent every effort to preparing for trouble and repairing the damage as rapidly as possible. Consequently, although hundreds of feet of pile trestles and short-span steel bridges were swept away and miles of embankment were wholly or partly washed out, the section worst affected being 35 miles long, and although the absence of other rail lines reaching this section made it virtually necessary for the repair forces to work in from the ends, the whole line was in shape Oct. 24 for the very slow passage of trains. Revenue freight trains resumed movement over the whole division on Oct. 27, and passenger trains on Oct. 28.

Preparations Made in Advance

Previous to the storm the railroad's general offices at Louisville received advice through the U. S. Weather Bureau that a tropical hurricane would probably strike the coast between Mobile and New Orleans. Telegraphic orders were issued at once to the superintendents of other divisions than the New Orleans division to have men in readiness to move in boarding cars to the seat of the trouble, and to accumulate such materials for making repairs as was in stock. Under these instructions large quantities of cross ties and a very considerable amount of heavy timber were loaded for blocking, and both trackmen and bridgemen were held in readiness to move. Immediately after the storm the division organization made such repairs as were prac-



ROADBED NEARLY OBLITERATED AT SITE OF RIGOLETS STATION—NOTE SCHOONER ACROSS RIGHT-OF-WAY IN DISTANCE

ticable, but on account of the magnitude of the damage they could not accomplish much. The wisdom of calling in advance on the other divisions for help was amply demonstrated, both the men and the material being put to good use.

Working in from the east end after the storm, the first serious trouble was encountered at Bay St. Louis, Miss., which was reached by the main repair forces Oct. 1, about 30 hr. after the storm. Prior to that the division forces had repaired minor damages to embankment at Pascagoula Bay and at Biloxi Bay.

Righting a Dislocated Drawbridge

Bay St. Louis is crossed by a creosoted pile trestle 9837 ft. long, in which there is a steel through truss drawbridge 192 ft. long. Parts of the trestle deck were carried away, although little damage was done to the bents. The anchor bolts attaching the drawbridge to the center pier were sheared off, and the whole bridge was shifted laterally about 6 ft. Only the lodging of the balance wheels on the extreme edge of the concrete pier prevented the draw from going into the bay. As the draw stood after the storm, the south truss was about 5 ft. higher than the north, the whole span having been tilted over.

A large barge was placed under each arm of the draw. In order to do this it was necessary to fill them partly with water, and after they were placed in position to pump the water out, and then wait for the rising tide to assist in taking the dead weight of the draw. The draw span, however, was lifted to a level position and shoved over laterally to its proper center mainly by the use of jacks. No damage was done to the trusses, and very little to the floor, but a considerable amount of damage was done to the turning mechanism and to the balance wheels and wedges which support the draw when in position for trains.

Night and day forces of bridgemen worked on the trestle and the draw, and this work was carried on continuously, notwithstanding the very heavy rains which prevailed during the earlier part of the work. Sufficient repairs were made to permit the passage of trains over the structure at 1 p. m. Oct. 4.

Beyond Bay St. Louis the roadbed was very badly cut at intervals, especially beyond Pearl River, 16 miles from Bay St. Louis. In many places the embankment was cut out to the tide level, while at one point both main track and side track were swept from the embankment and turned over into the canal alongside the tracks.

After getting over Bay St. Louis both bridgemen and trackmen devoted themselves to blocking up the track and putting it in condition to pass work trains, and on Oct. 14, Rigolets Bridge was reached.

Rigolets Bridge Repaired in Ten Days

Rigolets Bridge, which is in Louisiana, crosses one of the outlets of Lake Pontchartrain. The bridge is 2508 ft. long, consisting of 2272 ft. of short steel girder spans and a 236-ft. draw span together with a pile approach trestle at the north end. Thirteen 55-ft. deck girder spans and two 60-ft. through girder spans were carried away by the storm, with their supporting piers. In addition, one 55-ft. deck girder span at the other end of the bridge was so badly damaged by collision with a steel coal barge that it had to be removed, and 944 lin. ft. of the approach trestle were destroyed.

Three floating pile drivers, which were brought by water, and two heavy steel track pile drivers were used in driving a heavy trestle across the breaks in this bridge. A large stock of very long piles had been accumulated before the forces could reach the structure, as well as a quantity of stringers, cross ties and bracing. A large outfit of tugs, barges and motor boats was provided for handling material and men. At one time there were on the job nine barges, each having carrying capacity of 150,000 ft. b.m. of lumber, four tugs and three gasoline motor boats.

Roadbed Restored Under Difficulties

The track equipment still had to work from the east end only, on account of the large amount of damage done west of Rigolets and the difficulties attending the repair work. At Chef Menteur, the other outlet of Lake Pontchartrain, 11 miles from Rigolets and about 20 miles from New Orleans, 330 lin. ft. of girder spans with their supporting piers were destroyed. The intervening roadbed was damaged more than that at any other point. Here the road lies through a salt marsh, the general level of which is 1 or 2 ft. above mean tide, the tidal range being only about 1 ft. The railroad embankment itself is only about 4½ ft. above the level of the marsh.

Work train equipment was sent to Chef Menteur from New Orleans via other lines of railroad, and while a temporary trestle was being thrown across the break, forces were put to work restoring the roadbed between the two bridges. The conditions were very unfavorable, however, to rapid work. There was but a meager population in the salt marsh, and most of the houses were destroyed by the storm. Consequently prior to the opening up of the trestle across Chef Menteur it was necessary to transport the track forces from New Orleans and return each day by boat. As soon as Chef Menteur bridge was passed a long string of boarding cars for the men, with ample supply of water in tank cars for the locomotive engines, followed behind the gangs as fast as they could put the track in rough shape for work trains. It was on the morning of Oct. 24, however, ten days after the arrival of the forces from the east, that a third track pile driver reached Rigolets Bridge from the New Orleans end, and at 6.30 p. m. that evening trains were passed over the structure.

In order to put the track in shape for regular operation in the shortest possible time, large quantities of blast furnace slag were hauled by train from the vicinity of Birmingham, Ala., a distance of about 300 miles. Up to Dec. 1 about 80,000 cu. yd. of this slag had been used for surfacing the track.

The maximum force engaged on this repair work was probably nearly 1000 men. It was carried out under the direction of W. H. Courtenay, chief engineer, and Thomas Maney, general roadmaster.





DAMAGED TRACK AT RIGOLETS, AND RESTORED TRACK AT DUNBAR—IN RIGHT-HAND VIEW OLD TRACK IS IN CANAL



BAY ST. LOUIS DRAW SPAN TILTED OVER EDGE OF PIER

EXPANDED METAL POLES are used on the right-of-way of the Elgin, Joliet & Eastern Railway near East Chicago, Ind., for carrying the 11,000-volt transmission line of the Northern Indiana Gas & Electric Company, and also telephone and telegraph lines. About 1 mile of 35-ft. poles have been installed. Steel angles are used as cross arms, and the poles are set in the ground with portable concrete blocks, making concrete mixing at the site unnecessary.

Engineers' Technical File Should Be Small, Up-to-Date and Easily Kept

Elaborate Subject System Undesirable—A Restricted Loose-Leaf Notebook and a Vertical File Should Supplement Relatively Few Bound Volumes

By LOUISE B. KRAUSE
Librarian, H. M. Byllesby & Company, Chicago

EVERY ENGINEER has important printed or manuscript material in his possession which he wishes to preserve for future reference in the practice of his profession. The problem, therefore, which confronts him is to ascertain what is the best method for filing his material so that he can know not only what information he has on a subject, but also how it is filed, so that he can put his hand upon it immediately, without loss of time. The writer believes that the best solution lies in a bookcase of a few bound volumes covering the engineer's specialty, a loose-leaf notebook and a vertical file for matter not adaptable to the notebook. Both the loose-leaf matter and that in the vertical file should be inserted and numbered consecutively as obtained, rather than by an elaborate subject system. It should also be restricted, and obsolete data should be weeded out from time to time.

OBJECTIONS TO SUBJECT FILING

Readers of technical periodicals for the past few years have seen a number of articles written by engineers on the methods which they have individually worked out for filing their technical information. The majority of these articles recommend the expansion of the Dewey decimal classification to suit the need of the particular branch of engineering in which each engineer is most interested. In brief they recommend making a subject classification covering all the details of a particular subject, arranged in logical order, or to quote from an article recently published in a technical periodical, "An original classification drawn up to conform with the individual's need and viewpoint will prove the most satisfactory in the end. In such a classification the headings should be arranged in a sequence logical enough so that the position of every heading can be readily recalled."

Taking it for granted that the Dewey decimal classification does not cover engineering subjects with as great detail as is desired, there are, however, serious objections to the recommendations which advocate the drawing up of original classifications by engineers to suit their individual needs. The objections briefly stated are as follows:

1. The average engineer has not the time to work out an original classification, and even if he did have time it could be spent to greater advantage in study and reading along the lines of his profession than in devoting the many hours which would be necessary to working out an original scheme for filing.

2. The average engineer would not be successful in working out an original classification unless he had some instruction in the principles underlying the subject; for classification making is one of the most difficult branches of library science.

3. Although subject classification according to the decimal system is, without doubt, the best method yet devised for filing information, there are simpler methods of filing technical material which require no time or study to put into operation and which are quite satisfactory in keeping up an individual file.

Methods of Filing

Technical material exists in practically three forms (books and periodicals, manuscript data and clippings) and must be filed according to the form of the material in one of the three following ways:

BOOKCASE

1. A bookcase. In his bookcase, which need not be a large one, the engineer will keep his few worth-while books. They will not be many, because the best works on any particular branch of engineering are in reality few. This fact is also true of technical periodicals, and the engineer specializing in some specific branch of engineering will find that two or three periodicals are all that he needs in addition to the publications of the particular national engineering association which represents his line of work.

The arguments in favor of an engineer binding instead of clipping the few journals of particular interest to him have been stated by the writer in the Engineering Record, April 27, 1914, page 479. In addition to these reasons it may be stated also that one of the chief arguments against binding periodicals, namely, that they take up too much room, is negligible, when one considers that three feet of shelving will hold twelve volumes of a periodical the size of the Engineering Record.

The practice of clipping everything has almost become a fad since the widespread adoption of the vertical filing system. But the vertical file, valuable as it is, should never supplant for the engineer the time honored bookcase containing a small but up-to-date collection of volumes which are most helpful to him and the possession of which is one of the marks which designate him as a worthy member of his profession.

LOOSE-LEAF NOTEBOOK

2. A loose-leaf notebook. An engineer's notebook should contain original notes collected in his practice, also manuscript data collected from various sources. As far as possible all especially useful data should be put in this notebook so that they can be readily carried by the engineer wherever he goes. It is worth while for this reason to have copies made of working data of particular value, and put into the notebook, even though they may be found elsewhere. The best notebook for this purpose is a ring binder, size 9 x 11 in., with a flexible leather cover. All notes should be put on standard-size sheets and numbered consecutively when they are inserted, like the pages of a book. The notebook should contain index sheets, a sheet for each letter of the alphabet, and on these sheets should be recorded the subjects of the various data put into the book with the page number showing where it can be found.

Care should be exercised in making this subject index to be consistent and uniform in the use of subject names, and also to provide cross references where necessary. Each piece of data should be indexed under its most specific subject heading and not under a broad term which includes several definite divisions of a general subject. It should be indexed not under one subject only, but also under any other subjects on which it gives useful information. Cross references should be made from synonymous terms not used to the term under which the entry is made.

The objection to consecutive numbering in filing data is, of course, that it is more logical to have all data on a subject stand together, but when one considers that often the same piece of data may bear equally on two subjects, and unless it were duplicated can be filed only in one place, one finds the objection to consecutive numbering for a personal file to a large extent theoretical rather than practical. It is certainly much easier for a busy man not trained in the intricacies of subject classification to use a consecutive numbering system with a subject index, than to endeavor to work out an individual subject classification to cover all of his material.

VERTICAL FILE

3. A vertical file. In the vertical file is placed printed or manuscript information which is excluded by reason of its form from a bookcase or a notebook. Each piece of information that is put into the vertical file is numbered consecutively beginning with 1, on the same plan as the arrangement of the notebook, and the reason for so doing is the same. A subject card index is made on the same plan as the subject index to the notebook. As a vertical file and its contents cannot be carried about like a notebook, an index on cards is preferable to an index on sheets, which is used for the notebook data.

It is advantageous to include in the card index to the vertical file any subject references to periodical articles of personal value to be found in the volumes of periodicals. This is particularly important because with few exceptions the individual volumes of technical periodicals are badly indexed and are poor helps in locating a special article in a hurry. It may be profitably noted in this connection that the *Industrial Arts Index*, a cumulative bi-monthly, published by H. W. Wilson & Company, White Plains, N. Y., is an excellent subject index to the more important technical periodicals, and is to a large extent solving the problem of how to use effectively bound volumes of periodicals whose individual indexes are poor.

Both the notebook and the vertical-file plan for filing and indexing as outlined in this article have been used for a number of years by an engineer of high standing and have been found to amply take care of his personal material. The scheme presents a simple and satisfactory solution of the filing problem for a busy man with a minimum of time to devote to keeping his collected data in working order.

RESTRICTION OF MATERIAL

Another aspect of the general topic under discussion may be noted as follows: It is important to keep personal files down to as small a compass as possible, and the engineer will be wise if he adopts the plan of systematically discarding data his experience has outgrown, or which has been superseded by other material. If he is employed by a large company, maintaining a

well organized filing department and a library, his personal file can be kept quite small because of the organized service at his disposal. If he is building up a business of his own, and his personal file is beginning to partake of the interests of an organization, he will need to put the material into the hands of some one capable of administering it on a larger plan than is required for purely personal needs. If the latter condition be the case and there be definite need for an expansion of the Dewey decimal classification at certain points, the following list of existing extensions to the Dewey decimal classification may be of interest:

EXTENSIONS OF THE DECIMAL CLASSIFICATION

University of Illinois Engineering Experiment Station Bulletin 9, Revised edition, 1912.
"Extension of the Dewey Decimal System of Classification Applied to the Engineering Industries," by L. B. Breckenridge and G. A. Goodenough.
"Extension of Dewey Decimal System of Classification to Cover Municipal Engineering," by R. De L. French, in *Canadian Engineer*, Nov. 12, 1914.
"Extension of the Dewey Decimal System of Classification to the Gas Industry," by D. S. Knauss, American Gas Institute, October, 1914.
"Extension of the Dewey System of Classification Applied to Metallurgy, Metallography and Assaying," by R. M. Keeny, Colorado School of Mines, quarterly, Golden, Col., April, 1911.

In conclusion it might be well to state that this article is written, not to minimize the importance of subject classification, but to point out a simple and practical way of filing by which the busy man can avoid the serious difficulties which subject classification is bound to entail, especially when undertaken by the uninitiated.

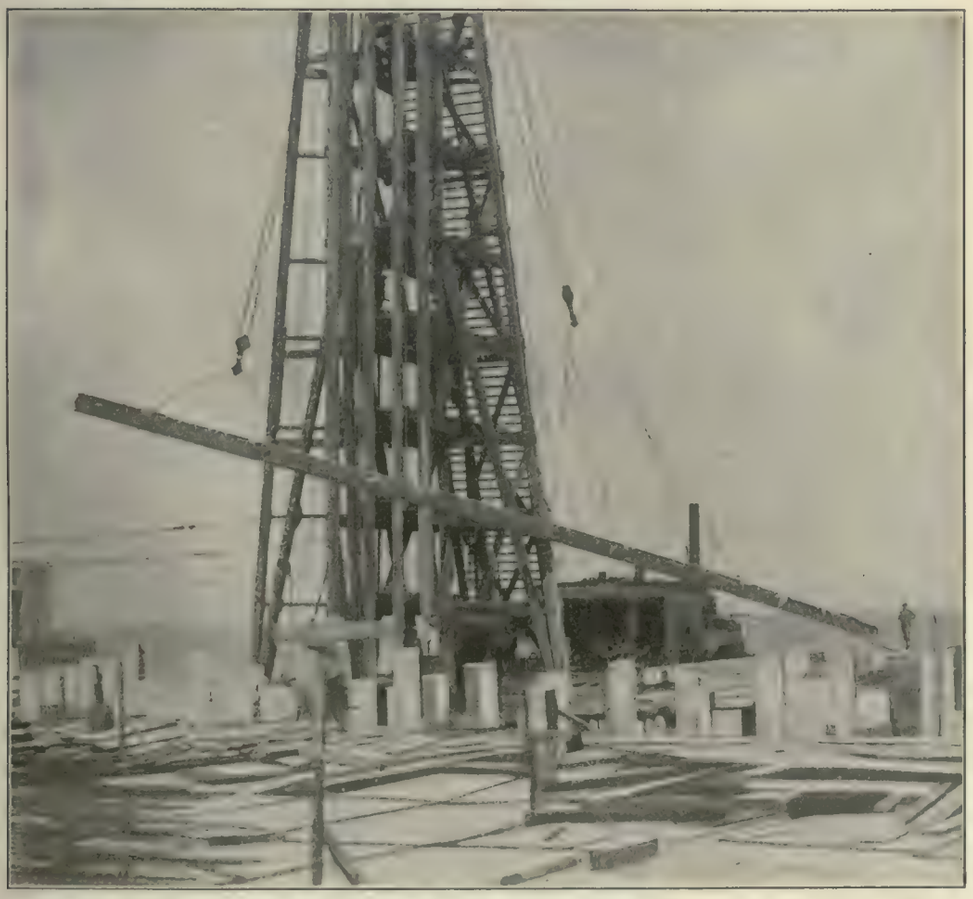
Driving 106-Foot Concrete Piles in San Francisco Piers

PIER CONSTRUCTION in San Francisco Bay has called for concrete piles of unusual length because a considerable depth of soft mud and ooze overlies the solid bottom in many places where all-concrete structures have been built. The engineering department of the State Harbor Commission has designed and built longer and longer piles as the work has progressed, until on the outer end of Pier 35 it was deemed advisable to use piles up to 106 ft. in length in the last few bents. The accompanying photograph shows one of the 106-ft. piles being raised to the driver.

The longest piles were 20 in. square at the butt with wedge-shaped tips 10 x 20 in. in cross-section. The reinforcing consisted of eight 1-in. bars with continuous hooping of No. 3 wire wound on 3-in. centers, except for 4 ft. at either end, where the winding was on 2-in. centers. The harbor commission's standard concrete mix was used, consisting of one part of cement and five parts of aggregate proportioned for maximum density. Thus far only two piles have been lost, it is reported, on account of breakage in driving.

The piles are cast at a point from which they could be conveniently skidded upon barges, which were towed to the driver, so that there was no unnecessary handling between casting yard and pier. In lifting piles more than 80 ft. in length it is the custom to sling each unit from lines attached at four points, as shown in the accompanying illustration. A three-drum hoisting engine is used, the third drum being used to operate the steam hammer. The concrete structure, or the pier proper, is protected by a fender line of creosoted piles with triple car-spring buffers between fender-line stringers and concrete beam. The creosoted piles are protected by green timber sheathing.

The piles have been designed under the direction of Jerome Newman, chief engineer, State Harbor Commission.



HANDLING A 106-FOOT CONCRETE PILE ON SAN FRANCISCO PIER WORK—NOTE METHOD OF SWINGING, WITH TWO FALLS AT FOUR POINTS OF ATTACHMENT

Supreme Court Upholds Missouri Drainage-District Law

Contention Is Dismissed That Tax Laid Level and Not According to Benefits Confiscates Property

ON Nov. 29, 1915, the U. S. Supreme Court handed down a decision affirming the constitutionality of the law under which drainage districts are formed in Missouri. The case was that of certain landowners in the Little River Drainage District. The contention was that the law was unconstitutional because a tax of 25 cents per acre for preliminary expenses was laid without relation to benefits, but as a level tax, and thus, since the plaintiffs' lands would be less benefited than others, that the procedure was in the nature of taking property without due process of law and in violation of the Fourteenth Amendment of the Federal Constitution. The law had already been sustained by the Missouri courts.

On the main point in question, the opinion, delivered by Justice Hughes, is as follows:

"The ultimate contention is that the plaintiffs in error cannot be subjected to this preliminary tax of 25 cents an acre because their lands, as they insist, will not be benefited by the plan of drainage. In authorizing the tax, it is said, the Legislature has departed from the principle of benefits, and the tax is asserted to be *pro tanto* an uncompensated taking of their property for public use. But the power of taxation should not be confused with the power of eminent domain. Each is governed by its own principles. A tax is an enforced contribution for the payment of public expenses. It is laid by some rule of apportionment according to which the persons or property taxed share the public burden, and whether taxation operates upon all within the state, or upon those of a given class or locality, its essential nature is the same. The power of segregation for taxing purposes has every-day illustration in the experiences of local communities, the members of which, by reason of their membership, or the owners of property within the bounds of the political subdivision, are compelled to bear the burdens both of the successes and of the failures of local administration. When local improvements may be deemed to result in special benefits, a further classification may be made and special assessments imposed accordingly, but even in such case there is no requirement of the Federal Constitution that for every payment there must be an equal benefit. The state in its discretion may lay such assessments in proportion to position, frontage, area, market value, or to benefits estimated by commissioners. And, as we have said, unless the exaction is a flagrant abuse, and by reason of its arbitrary character is mere confiscation of particular property, it cannot be maintained that the state has exceeded its taxing power. We find no such arbitrary action here. It was not necessary to base the preliminary tax upon special benefits accruing from a completed plan. . . . Whether the expense of ascertaining the best method of reclamation should subsequently be reimbursed when final assessments were laid according to benefits ascertained to result from the execution of the final plan presents a question of policy and not of power."

Elastic Curves and Influence Lines Simplify Analysis of Beams

Graphical Diagrams for Deflections and Reactions of Cantilever, Simple, Fixed-Ended and Continuous Beams with Variable Moments of Inertia

By J. P. J. WILLIAMS
Associate Editor, Engineering Record

THE usual analysis for the statically indeterminate reactions of fixed-ended and continuous beams is based upon the assumption that the moment of inertia is constant throughout the length of the beams. For ordinary draw spans such an assumption varies widely from actual conditions; in fact, all well-designed continuous beams have widely varying moments of inertia. The graphical methods to be developed herewith make possible a fairly rapid and accurate analysis, which not only

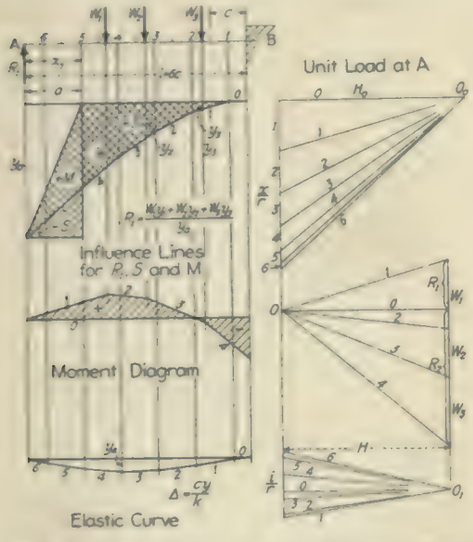


FIG. 1—DEFLECTION OF CANTILEVER BEAM

includes the effects of variable moment of inertia, but gives a clear idea of the variation in reactions, shears and bending moments by the use of easily constructed influence lines. In addition, formulas for the reactions produced by unequal settlement of supports will be given.

For all cases of beams in buildings in which plastered ceilings are used and the limit of allowable deflection specified, the actual deflections of beams of various types are of importance in design. Formulas for deflection in common use are based upon the assumption of constant moment of inertia. A more exact analysis for deflection, based upon the simple construction of an elastic curve, will be developed and applications to several cases considered in detail. The methods are applicable either to steel or to reinforced-concrete beams with variable moment of inertia, and will be explained in connection with the following examples: Cantilever beams, simple beams, beams fixed at one end, beams fixed at both ends, continuous beams of two spans and continuous beams of three spans. While the details of the treatment are original, the fundamental methods are those already discussed by D. B. Steinman and C. S. Whitney in the articles in the Engineering Record in the issues of Aug. 28, page 258, Sept. 11, page 324, and Oct. 16, page 486.

FUNDAMENTAL RELATIONS AND EQUATIONS

The familiar force polygons, moment diagrams, or funicular polygons, and influence lines are the graphical methods used. The fundamental basis of the theoretical relations is the following equation for vertical deflection $\triangle$, from the tangent to the neutral curve, as given in standard texts:

$$\triangle = \int \frac{Mx\,dx}{EI}$$

Either of two procedures can be adopted to simplify this computation and transform it for use as a graphical summation when the moment of inertia is variable. The length of beam, l, can be divided into such variable short lengths, dx, as will make the value of dx/EI constant so that it can be removed from the integral and the latter changed to a finite summation. Let $dx/EI = C$, then

$$\triangle = C \Sigma Mx$$

Or, a value I_1 for the moment of inertia of one section can be divided into the other values of I to obtain the ratio r equals I/I_1 as a variable, and the short lengths, dx, made constant, c, and selected according to the accuracy desired and their relation to the sections of constant moment of inertia. The resulting form is

$$\triangle = \frac{c}{EI_1} \sum \frac{M}{r} x$$

Owing to the greater control and flexibility of the second method, its simplicity and accuracy in application, it has been adopted in the analysis which follows. It is seen to differ in the summation term only in the fact that M/r replaces M as the multiplier of the variable, x.

To obtain the deflection, $\triangle$, by graphical construction, if i is the intercept of the moment diagram drawn with a pole distance, H, then $M = Hi$, Fig. 1. Substituting this in the equation for deflection, there results:

$$\triangle = \frac{cH}{EI_1} \sum \frac{i}{r} x$$

By then plotting the values of i/r as a load line, a second polygon with pole O_1 and pole distance H can be constructed to give the summation graphically. Then

$$\sum \frac{i}{r} x = H_1 y$$

can be substituted, and there is obtained

$$\triangle = \frac{cHH_1 y}{EI_1}$$

Let $k = EI_1/HH_1$. Then $\triangle = cy/k$.

In general measure the vertical intercepts to the same scale as the load line, and pole distance to the space or length scale of the diagram. To get the deflection in inches, all units should be inches, or if H, H_1 and c are in feet, $\triangle = 1728cy/k$. If convenient, H_1 can be made equal to H, then $k = EI_1/H^2$.

ADVANTAGES OF GRAPHICAL CONSTRUCTION

The great advantage of graphical construction is in the fact that relative deflections of different points are thus obtained and the vertical deflections of the points of the beam with respect to each other are indicated, when the deflections with respect to one tangent, found by the construction, are known. Hence when the relative deflections of certain points are known, the position of the base line of reference for the elastic curve is easily determined. The exact values of the deflection can then be computed by the above equations from the intercepts, y, of the elastic curve.

The ease with which influence lines for reactions, shears and bending moments can be related to elastic curves makes the analysis on this basis quite effective, especially in view of the advantages of influence lines for all cases of moving loads, or for many loads in various positions.

The number of divisions used in the graphical construction directly affects the accuracy. In general, the length c should not exceed one-fifth to one-tenth of the total length. The number has been made relatively low in the examples here used to avoid confusing the diagrams. The true elastic curves have not been shown on these diagrams; they are curving lines drawn tangent to the polygons which have been called elastic curves.

DEFLECTION OF CANTILEVER BEAM

The simple and fundamental case of a cantilever beam loaded with a uniform load w lb. per foot throughout and concentrated loads W_1 and W_2 is shown in Fig. 1, and the elastic curve for deflection below the fixed end B is directly obtained. The force polygon and moment diagram require no explanation. Note that negative forces and

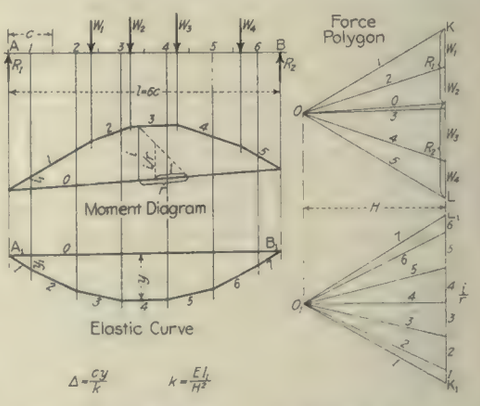


FIG. 2—DEFLECTION OF SIMPLE BEAM

bending moments are always plotted downward. Having plotted the moment diagram, either scale off the intercepts i and divide by the ratio r by slide rule, or use the graphical method indicated on the figure when the same scale is used to plot the i/r load line, K_1L_1, the values being transferred by dividers. The value of r can be laid off to any convenient scale on either side of the ordinate i.

The accuracy of the figures, of course, depends upon the scales used and the care with which the intersections are determined. Steep inclinations and the resulting indefinite intersections should be avoided by a proper selection of the pole.

DEFLECTION OF SIMPLE BEAM

The usual case of a simple beam supported at the ends is treated in Fig. 2, concentrated loads only being used in order to simplify the construction. The pole O is selected opposite assumed values of the reaction to give a nearly horizontal closing line. After plotting the values of i/r, the pole O_1 is similarly selected on an assumed horizontal ray, in this case ray 4, in order to give a closing line, A_1B_1, representing the original unstrained position of the beam, in a nearly horizontal position.

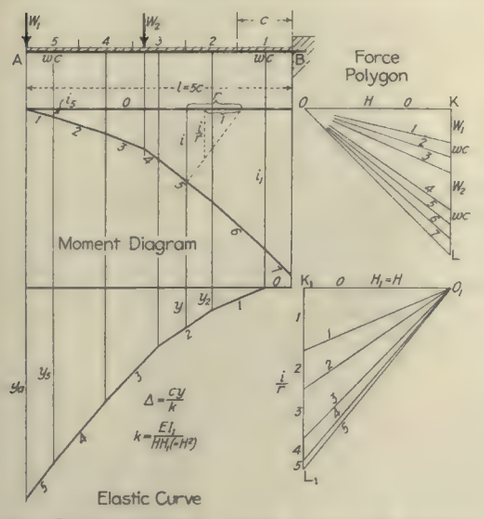


FIG. 3—INFLUENCE LINES AND DEFLECTION FOR BEAM FIXED AT ONE END

It should be noted that in all cases the values of i are assumed to represent the average for the length c considered. When sharp breaks occur at concentrated loads, the resulting error in using this average i may be large. It can be reduced by assuming a slight correction in plotting to make the plotted value more nearly represent the average for the division. The true elastic curve is, of course, a curving line tangent to the polygon shown in the diagram, and the deflection at any point is computed from the corresponding ordinate y as noted.

Beam Fixed at One End

The reactions in this case are statically indeterminate and can be obtained accurately only after a preliminary design, as in the case of all such structures. The general principles applied in the articles above mentioned are used in this case by considering the reaction R_1 at the supported end A, Fig. 3, to be the unknown, applying a unit load at A, and plotting the elastic curve for that load acting on a cantilever fixed at B. Since the bending moment is then the distance, x, from the end A, the bending moment diagram is not drawn, but values of x/r are computed and plotted on the load line as shown. Using the arbitrary pole O_o and pole distance H_o, the elastic curve for unit load at A is drawn.

This curve is the influence line for the reaction R_1. Since deflections vary directly with the loads, and since, by Maxwell's principle, any load W at any point x produces the same deflection at A as is produced at the point x by a load W at A, which would be Wy, the reaction R_1 necessary to cause zero deflection at A will be

$$R_1 = Wy/y_a$$

The unit-load elastic curve is therefore the unit-load influence line for the reaction R_1, which can be computed in the usual manner, indicated on the figure.

The deflection under the given loading is found by the elastic curve drawn parallel to the rays with pole distance O_1 and load line i/r. The intercepts i are obtained from the moment diagram constructed graphically after computing the value of the reaction R_1. The elastic curve should check by showing zero deflection at the supported end, and the value of the deflection can be computed.

The influence lines for shear, S, and bending moment, M, at any section are easily drawn on the reaction influence line as a base, as shown on the figure, noting that this curving base replaces the usual straight horizontal base line.

Effects of Settlement—Moment of Inertia

If the support at A should settle downward more than the fixed-end B, the reaction at A would decrease. Calling s the relative settlement of the support, positive if B settles more than A, and negative if A settles more than B, the reaction, R_1, due to settlement is

$$R_1 = s/\triangle_a = sk/cy_a$$

This value is independent of the loading and is added algebraically to the reaction due to loads, which is obtained by the influence line. The effects upon shear and bending moment at any section can easily be computed.

In computing the moment of inertia for built-up steel beams, deduction should be made for rivet holes in the usual manner, and since many sections will be subjected to negative bending moments, it is best to allow for the holes in both top and bottom flanges. For the case of reinforced-concrete beams, care must be taken to approximate to the action of concrete in tension, and all sections at which the maximum tensile unit stress in the concrete is less than its ultimate strength should be considered with the concrete acting and full moment of inertia used. For other sections only compression concrete and tensile steel should be included in the computation.

Beam Fixed at Both Ends

The relatively simple graphical construction shown in Fig. 4 for a beam fixed at both ends enables the unknowns R_1 and M_1 to be computed from the influence lines as noted. The theory is based upon the fundamental equations for vertical deflections and for change in angle of slope of the end tangents to the neutral curve. Assuming fixed ends and no vertical settlement of supports, the total relative deflection, $\triangle$, between the ends should equal zero and the total change in angle, φ, should equal zero. Using the equation for vertical deflection and noting that, for a single load W,

$$M = M_1 + R_1x - Wx^1$$

there results:

$$\triangle = \int_A^B \frac{Mx\,dx}{EI} = \int_A^B (M_1 + R_1x - Wx^1)\frac{x\,dx}{EI} = 0$$

Since M_1 is constant, the first term can be eliminated by shifting the origin for x to the center of gravity of the values dx/r, which will practically always be at the center line of the span, since then

$$\int_A^B \frac{dx}{r}\,x = 0, \text{ and } \int_A^B M_1\frac{x\,dx}{EI} = \frac{M_1}{EI_1}\int_A^B \frac{dx}{r}\,x = 0$$

The value of R_1 can then be obtained by solving the first equation, and the usual substitutions made to give summations, whence

$$R_1 = \sum W\frac{x}{r}x^1 \Big/ \sum_A^B \frac{x}{r}\,x$$

These products and summations can be obtained graphically by plotting x/r as a load line, noting that x^1 is zero for all points to the left of the load, and therefore the summation in the numerator is only carried up to the load, as given by the graphical construction. Hence, choose the pole O_o with a convenient pole distance H_o, and lay off x/r as a load line. It is convenient to begin the polygon at the center line and make ray 3 horizontal as shown, then check by symmetry. Note that x is measured from the center line or center of gravity of the values dx/r. The resulting polygon gives the influence line for R_1, since by graphical summation the numerator of the equation for R_1 becomes WyH_o, and the denominator becomes y_aH_a, therefore, using the summation sign to include all loads on the span, the reaction is:

$$R_1 = \Sigma Wy/y_a$$

A relative settlement, s, of the support A above B would induce a reaction R_1 found by equating the fundamental deflection equation to s. By substitution and reduction, there results

$$R_1 = sEI_1/c\sum_A^B \frac{x}{r}x = \frac{sEI_1}{cy_aH_o}$$

To obtain the unknown fixing moment M_1 use the second condition that

$$\varphi = \int_A^B \frac{M\,dx}{EI} = \int_A^B (M_1 + R_1x - Wx^1)\frac{dx}{EI} = 0$$

With the origin at the center line and the constant R_1, the second term containing R_1 will vanish, since

$$\int_A^B R_1x\,\frac{dx}{EI} = \frac{R_1}{EI_1}\int_A^B \frac{dx}{r}x = 0$$

The value of M_1, however, must be replaced by M_1^1, such that

$$M_1 = M_1^1 - R_1l/2$$

to allow for the shifting of the origin of co-ordinates to the center of gravity. Solving for M_1^1, after substituting $dx = c$ and $I = rI_1$, there is found

$$M_1^1 = \sum W\frac{i}{r}x^1 \Big/ \sum_A^B \frac{i}{r}$$

The second polygon with i/r as a load line is drawn as shown with pole at O_m, and pole

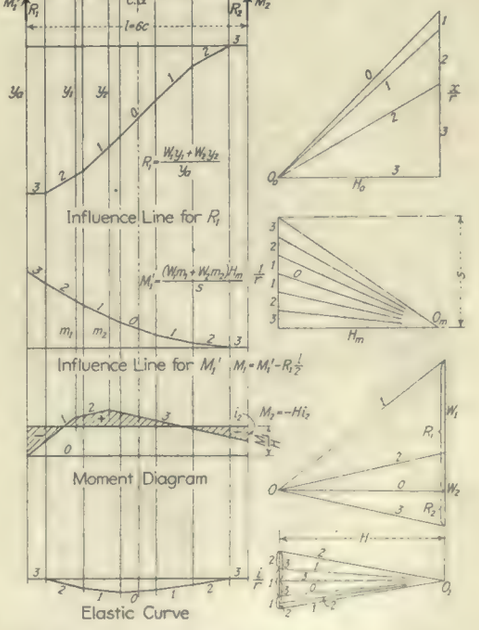


FIG. 4—DEFLECTION OF BEAM FIXED AT BOTH ENDS

distance H_m. Then, calling m the intercept, and S the summation of i/r, the general value for M_1' is:

$$M_1' = \Sigma W m H_m \; S$$

for all loads on the span. Then M_1 can be computed from the formula given above.

The bending moment diagram for any given loading can be drawn, as indicated by the third pair of diagrams, Fig. 4, after R_1 and M_1 are computed from the influence lines. The value of M_2 should be computed analytically for a check, and compared with the graphical value, Hi_2. The elastic curve is then drawn as already described, and the deflections, which are seen to be relatively small, can be computed as before.

CONTINUOUS BEAM OF TWO SPANS

The influence line for reaction R_1, shear S and bending moment M for a continuous beam of two spans with variable moment of inertia has been drawn in Fig. 5. This example is the same as that used in Vol. 2, page 39, of "Modern Framed Structures" and in a paper by the writer in the Transactions of the American Society of Civil Engineers, Vol. 76, page 785. The elastic curves for unit load at R_1, drawn as in the preceding cases on the assumption that the beam is supported only at R_2 and R_3 as a cantilever, is the influence line for the reaction R_1, as proved in discussing the beam fixed at one end. The values for M/r have been computed, the values of M being so easily obtained for this case. The base line for the ordinates y of this curve is located by connecting the points B and C, giving the closing line representing the original position of the straight beam, since the supports at R_2 and R_3 are assumed to be rigid, and therefore no deflections occur at these points. Although the scales used in the diagram are not large, the results check within 1 per cent the values obtained for uniform loading in the analyses above referred to.

A good check of the graphical construction for all cases of beams symmetrical about the center support B can be obtained by joining A_2 and B by a straight line and measuring ordinates from this line to the influence line. They should check the symmetrical ordinates for negative reaction R_1 on the right of B. This is due to the fact that the straight line BA_2 is the influence line for the reaction of a simple beam AB, and this reaction is too large by the value of the negative reaction produced by the effect of the negative bending moment at B, and this negative reaction is given by the ordinates on the right when the beam is symmetrical.

The deflection at any point for any given loading can be obtained from the elastic curve, constructed as already explained. The diagram gives this curve for the assumed case of two concentrated loads W_1 and W_2 on the left span. The load line is plotted, using R_1 as computed from the influence line and selecting the pole O on the horizontal ray 0. The unknown reactions R_2 and R_3 are obtained by ray 4 parallel to the closing line 4 of the moment diagram. The values i/r are then computed, or obtained graphically, and plotted as a load line, negative values downward, the pole O_1 selected with the same pole distance as before, and such that ray and side 4 on the right are horizontal (assumed) in order to give an approximately horizontal closing line $A_1B_1C_1$. A conclusive check is obtained for the graphical construction by noting that points A_1, B_1 and C_1 should be on the same straight line representing the original position of the unstrained beam.

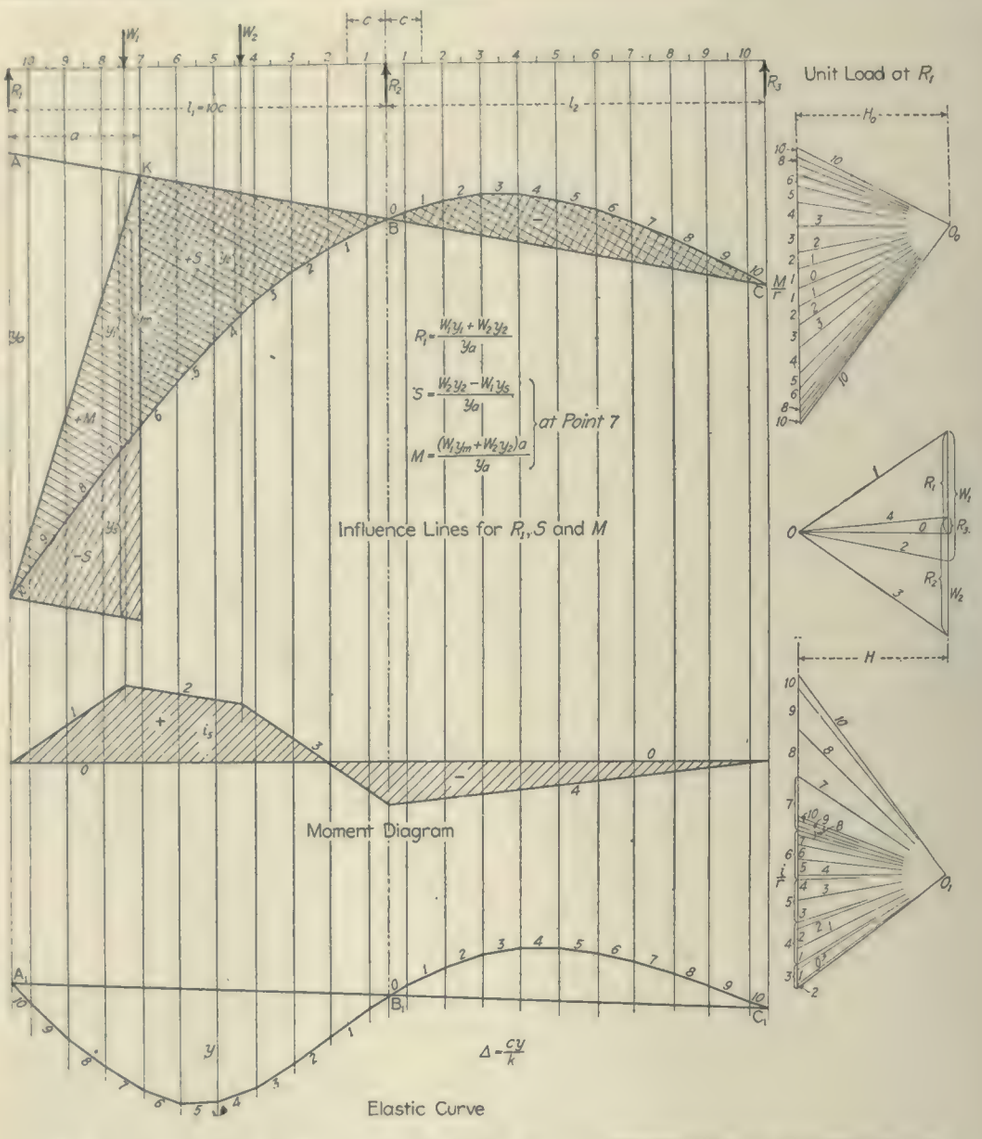


FIG. 5—INFLUENCE LINES AND DEFLECTION FOR CONTINUOUS BEAM OF TWO SPANS

If the support at R_1 should settle a distance s_1 with respect to the supports at R_2 and R_3, negative if downward, the resulting reaction would be

$$R_1 = s_1/\Delta_a = s_1 k/cy_a$$

Similarly, if the support at R_2 settles the distance s_2 with respect to that at R_3, negative if downward, the induced reaction is

$$R_1 = s_2 l_1/l_2 \Delta_a = s_2 l_1 k/l_2 c y_a$$

The influence lines for shear, S, and bending moment, M, at any given section can be drawn in the usual manner, noting that the reaction influence line really corresponds to the base line of the usual construction. For example, the shear influence line for point 7 is found by the line drawn through A_2 parallel to the straight closing line A_1B_1 and the value of S for the loading shown is as given. The bending moment influence line for this point, which is located a ft. from the end, is drawn by connecting A_2 and K, and its value is given by the formula in the figure. It is generally easier to use equivalent uniform loads and the area under the influence line; the total area for the reaction R_1 is first obtained and the triangular areas easily deducted for the computation of the bending moment.

CONTINUOUS BEAM OF THREE SPANS

The influence line for the reactions R_1 and R_2 of a continuous beam of three spans are drawn in Fig. 6. This construction is made by first drawing the elastic curve A_1B_1CD for a unit load at R_1 in the usual way, as indicated by the polygon drawn with pole O_0. In drawing these polygons great care must be used, and large scales are preferable. In order to decrease the inclinations, the pole is assumed on a horizontal ray, 0, between the two points or values 1. This line is drawn first, and the polygon continued each way from the point C. A relatively short pole distance should be used in order to give larger intercepts.

The beam is assumed to be a cantilever supported at R_2 and R_3, and the moments and values of M/r easily computed. The closing line through the points D and C represents the original position of the unstrained beam and the ordinate y under any given load W, is measured from it. The distance AA_1 is y_1 and BB_1 is y_2. The theory upon which the succeeding construction is based is as follows: A second elastic curve can be drawn for a unit load at R_2, using the same pole distance. Let y' be the resulting ordinate under the load W, y_2' the ordinate at R_2, and y_1' that at R_1. Then, by the fundamental relation between deflections at these points, using Maxwell's principle, the total deflections at A and B under the action of the given load W and the reactions R_1 and R_2 must be zero, and there can be written

$$Wy - R_1 y_1 - R_2 y_2 = 0$$
$$Wy' - R_1 y_1' - R_2 y_2' = 0$$

These two equations can be solved for the

unknown reactions, which are found to be

$$R_1 = \frac{yy_2' - y'y_2}{y_1y_2' - y_1'y_2} W$$

$$R_2 = \frac{y'y_1 - yy_1'}{y_1y_2' - y_1'y_2} W$$

The construction could be made on this basis and values for the reactions computed. A beam of any number of spans could be treated similarly.

To draw influence lines, however, it is possible to simplify these expressions. For the case of reaction R_1 make the construction such that $y_2 = y_2'$, and the equation reduces to

$$R_1 = \frac{y - y'}{y_1 - y_1'} W = \frac{y - y'}{y_a} W$$

or, the difference of the ordinates represents the influence line, as shown in Fig. 6. Similarly for R_2, by making $y_1 = y_1'$ there results

$$R_2 = \frac{y - y'}{y_b} W$$

and the influence line can be directly obtained, as shown.

In order to make $y_2 = y_2'$, it is necessary to pass the second polygon through the three points B_1, C and D. This is done by graphical construction, using the trial pole O_t. The closing lines of the polygons $B_2C_2D_2$ locate the points e and e_1, which then give the desired pole O_1 by the lines parallel to the true closing lines B_1C and CD. A careful construction of the polygons is necessary, and, of course, a check results when the final polygon is drawn—it must pass through the three given points. The difference between the ordinates of the two polygons, as shown hatched, then gives the influence line for the reaction R_1, which can be computed as indicated.

A similar construction, unit load at R_2, and the polygon passing through the points A_1, C and D gives the influence line for the reaction R_2, the polygon being drawn with pole O_2 found as before, using the closing line A_1C_2 to locate e_2.

Influence lines for shear and bending moment at sections in the span l_1 can be drawn on the reaction influence area for R_1 exactly as in the previous case of a two-span beam. For sections in the span l_2, however, it is best to compute the values of R_1 and R_2 from the influence lines, and the corresponding values for shear and bending moment, and plot the results.

If the deflections are desired, they can be obtained exactly as previously described for the two-span continuous beam, the bending moment diagram being plotted graphically, and the unknown reactions R_3 and R_4 found by a closing line in the moment diagram, as in the previous case.

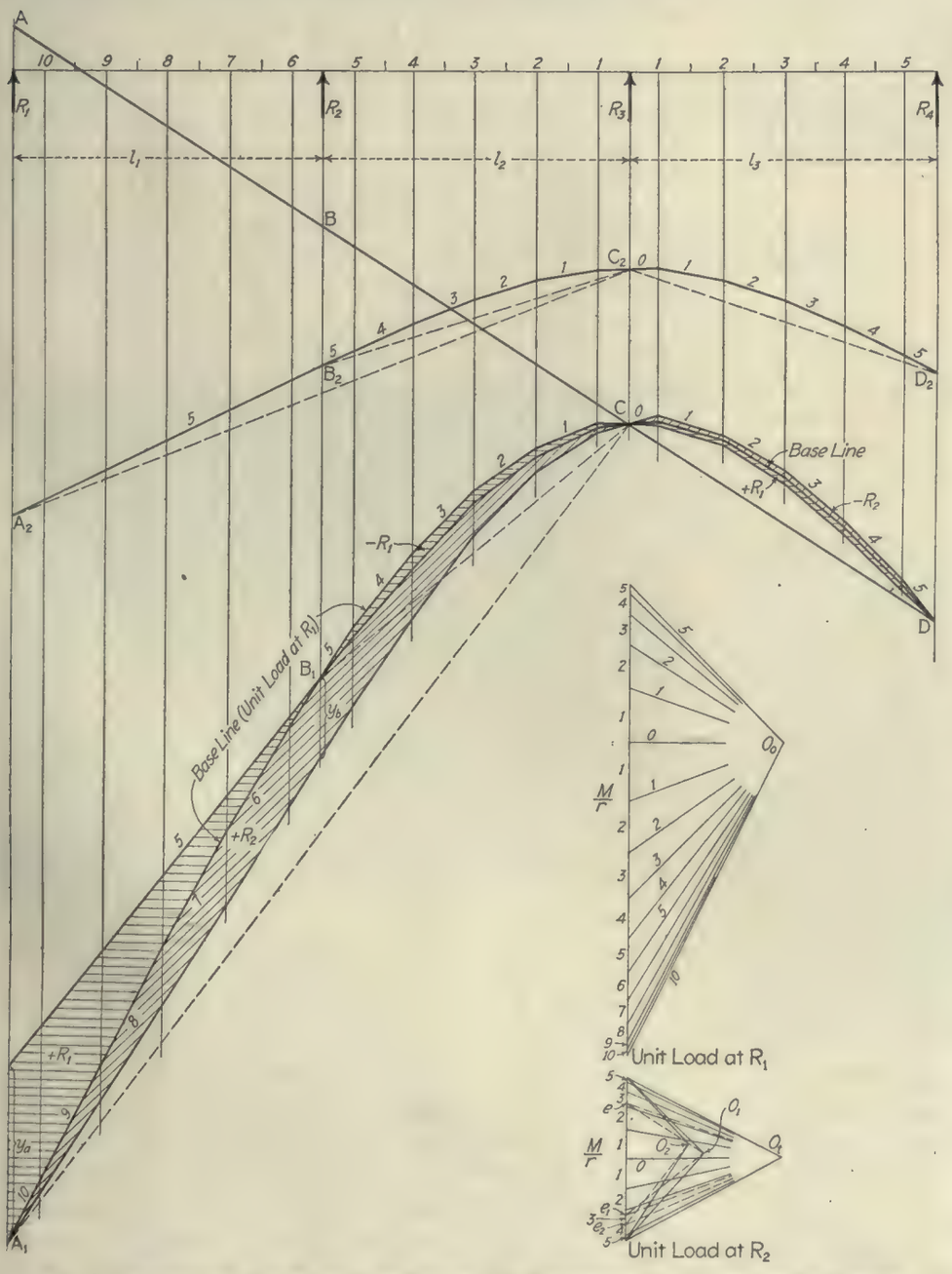


FIG. 6—INFLUENCE LINES FOR REACTIONS OF CONTINUOUS BEAM OF THREE SPANS

Electric Trucks Save Money at Panama Terminal

Twelve Have Proved So Effective in Four Months of Operation That the Panama Railroad Will Order Twelve More

TWELVE electric trucks in operation by the Panama Railroad on the piers of its Atlantic terminal have so far justified themselves that specifications are being prepared for twelve more. The performances of the trucks are described in a recent issue of the *Canal Record*. The change has effected a great reduction not only in cost, but also in time of handling cargoes. They are used not only on the piers, but between them and in the streets.

Before the electric trucks were placed in use the handling of cargo at the terminals was done entirely by means of two-wheeled push trucks for pieces weighing up to 500 lb., with locomotive cranes and flat cars for the unusually large and heavy pieces. At times there were as many as 1200 trucks and truckers employed, and the average was about 500. With wages of 90 cents a day for each trucker this meant about $450 per day.

Each Truck Can Save $19 per Day

Each of the electric trucks has been found to take the place of at least twelve men, or in a day-and-night shift operation to supplant about twenty-five men. The cost of operating the trucks during the 24-hr. day is approximately $3.50, of which $2 is for the operators, one to a shift, $1 for charging the storage batteries, and 50 cents for the interest on the investment and the wear and tear on the machine. In a double-shift day each truck thus effects a saving of about $19. The trucks are employed constantly, and the fluctuations in cargo are met by variations in the employment of the push trucks.

The electric trucks handle from 4000 to 6600 lb. per trip, and move at speeds varying from 8 to 12 miles per hour. Three types are in use. Four use trailers and haul 6600 lb. at 8 miles per hour. Three carry 4000 lb. and make 10 miles. Five carry 4400 lb. and make 12 miles.

The relatively great capacity and speed of the trucks allow them to be used to a large extent in place of railway cars for handling cargo between piers. Where cargo is transferred from a vessel at dock 10, for instance, to one at pier 8, the goods may be loaded on trucks, which will make the run of approximately 2000 ft. in three or four minutes, and handle the cargo more quickly than it could be handled by train. This eliminates much switching, with the delays incident to waiting for cars and engines, and saves a great deal of rehandling. Frequently cargo can be delivered to a truck in the sling into which it was loaded in the hold of the ship, hauled to some other point at the terminal and swung from the truck into another vessel in the same sling. When refrigerated goods for the commissary branch are unloaded the trucks can carry them direct to the cold-storage plant.

The trucks run very satisfactorily on the streets.

In connection with the use of the trucks, states the *Canal Record*, new short cuts for efficiency are being originated almost every day in meeting the various transfer problems. When the Panama Railroad vessels from the United States bring mail the trucks go to the ship's side and handle the packages quickly to the several cars of a special train. Goods for the line commissary are handled from the ship to cars designated for various towns; it is not necessary to take them first to the general warehouse. Local cargo for Colon is handled as unloaded direct to the land end of the pier, whence it can be taken by cartmen with a minimum of delay and confusion.

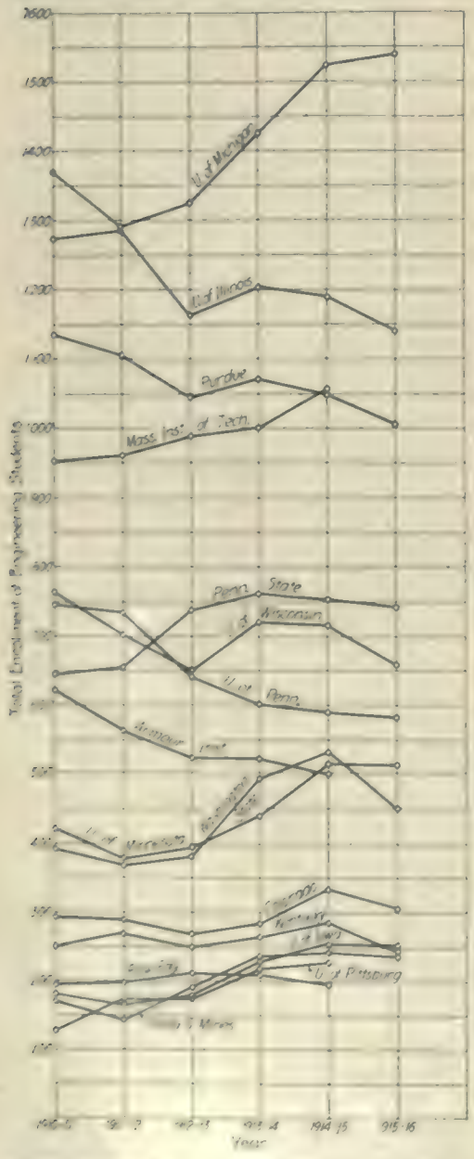
In many ways the trucks allow the substitution of a relatively few speedy units of large capacity for many units slow in their movements interfering with one another by their very numbers, and in need of constant supervision and speeding up.

Registration in Civil Engineering Is Decreasing

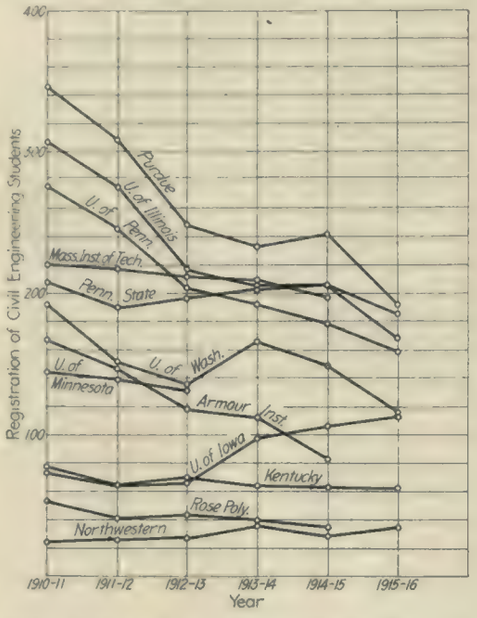
Statistics Indicate That Condition Is Not Local—East and West Show Similar Decline

FOR some years professors of civil engineering have been noting, in the Middle West particularly, the apparent decline in interest in engineering. The measure of this decline has been the decrease in the number of students in the engineering courses. Just how serious the decrease has been is evident from the curves presented herewith.

Taking first the curve of enrollment of all engineering students, it is apparent that while, in the sum, the decrease is considerable, there are good growths in some of the institutions. The downward trend of the curves for Illinois, Purdue, University of



ENROLLMENT OF ALL ENGINEERING STUDENTS SHOWS NO GENERAL DOWNWARD TENDENCY



ENROLLMENT OF ALL STUDENTS IN CIVIL ENGINEERING SHOWS SHARP AND PERSISTENT DECLINE

Pennsylvania and Armour Institute are counterbalanced by the very surprising curve for the University of Michigan, and the good growths of Massachusetts Institute of Technology, Pennsylvania State, Washington State, Minnesota and the 200-300 enrollment group. The sharp falling off in this year's registration is general, except for Michigan and Massachusetts Tech, though the figure for the latter is not plotted.

Civil Engineering Registration

When the curves of registration in civil engineering are taken up, however, the conditions appear to be more serious. Considering the curve for total registration of civil engineering students, for example, it will be noted that, with the exception of the University of Iowa, there has been a general decline, most serious in the Middle West, though, as in the previous diagram, experience at the University of Pennsylvania is similar to that in the Mississippi Valley.

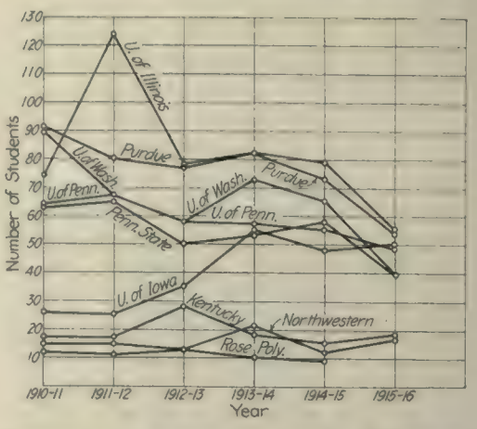
The final set of curves, that of the registration of freshman civil engineers, is the most serious of the three. The preceding diagram still shows in the figures for 1915-16, the fairly good freshman registration of 1912-13. Should the present trend persist the small registration of freshmen in 1915-16 presages very sharp declines in total registration two, three and four years hence. This is a serious matter for colleges equipped and manned for double the number of students that are in prospect.

Discussion Invited

The matter is giving serious concern to professors of engineering throughout the country. So far no one has proposed an explanation that is entirely satisfying to others studying the problem. The Engineering Record therefore, invites discussion from its readers, both in the colleges and in practice, on these points:

1. What is the cause or causes of the decline?
2. What is the remedy?
3. While the situation is alarming from the point of view of the colleges, is it so from the point of view of the practitioner? In other words, is the field oversaturated and will the profession be benefited by reduction in the supply of young engineers?

Some views on the matter will be found in the editorial pages of this issue.



NUMBER OF FRESHMAN CIVIL ENGINEERS PRESENTS MOST SERIOUS CONDITION, PRESAGING STILL SMALLER TOTAL ENROLLMENT IN NEAR FUTURE

Burn Typical Office Equipment in Test Room

Forest Products Laboratory, in Fire-Test House, Investigates Temperatures and Inflammability of Treated and Untreated Wood

FIRE tests on a typical office room with its usual complement of equipment have recently been carried out at the Forest Products Laboratory at Madison, Wis., as part of an investigation of the fire-resisting properties of treated and untreated wood. These tests have been in progress for two years, the first data being obtained on the relative burning points of treated and untreated wood. The fire-test house consists of a room constructed of cinder concrete and furnished with wood floor, trim, furniture, window casings and doors. It measures 12 x 16 ft. in plan, in side dimensions, and 10 ft. high. Books and papers were scattered around the room in exposed places, and one book case was filled with books.

Waste Paper Basket Would Not Start Fire After Four Attempts

In the first series of tests all the wood in the interior of the room was untreated but was given a coat of varnish. A fire was started in a waste paper basket so placed that it would communicate with a desk. Four attempts were made to burn the contents of the room by means of burning up the waste paper basket. In each case the basket burned out without igniting the furniture or destroying any of the contents of the room. During these four attempts various conditions of air control were obtained by conducting the test first with the

windows and doors closed and later partly or entirely opened.

It was found necessary in order to destroy the contents of the room to supply heat from the outside. A furnace was built adjacent to one of the windows and arranged to admit air highly heated by means of two crude oil burners. This air



OIL FURNACE SUPPLIED HEAT FOR FIRE-TEST HOUSE

was admitted to the room for 18 min. with door and window closed. It was found necessary to open the door and admit fresh air before combustion would take place. With the admission of fresh air the room immediately burst into flames. Within less than an hour after the first flame was noted the contents of the room were totally destroyed.



FOUR ATTEMPTS TO START FIRE FROM BASKET FAIL

Try Ammonia Salts As Fire Retardant

The room was then refitted in exactly the same manner, but with wood which had been treated with ammonium phosphate and ammonium sulphate to render it fire retardant. One small table and a chair of untreated wood were included to make certain that the conditions were such that untreated wood would burn. The test was repeated as in the above case. After about 15 min. of exposure to the heated air from the crude oil burners the door was thrown open to admit fresh air. This did not cause the contents to ignite, however, and the door was closed for another 15 min. It was then opened, and the untreated table and waste paper basket ignited and burned vigorously. All of the papers on the desk and the untreated table and untreated chair were very soon destroyed. The treated wood which was in contact with large masses of burning papers and books, such as the desk and the bookcase, was also gradually destroyed, but not until long after the untreated portions were consumed. After 3 hours the room was entered and photographs taken showing its condition after the test.

The test showed that the treated wood carbonized and gradually burned up when in contact with burning papers. Treated wood not in contact with combustible material did not support combustion, but was carbonized. The mass of carbonized material in the lower right-hand corner is what remains of the books and bookcase. This debris fell around the treated chair without destroying it. Accurate temperature measurements were taken at several points in the room at frequent intervals. The results are now being analyzed and will be reported on later.



ALL UNTREATED WOOD IN THE TEST ROOM BURNED



AMMONIA SALTS SAVE ALL BUT DESK AND BOOKCASE

September Railroad Operating Income Shows Marked Increase

GROSS operating revenues for September on the large steam railroads of the United States, according to a bulletin issued by the Bureau of Railway Economics, were $1,251 per mile, showing an increase of $66 or 5.6 per cent as compared with September, 1914. Operating expenses were $774, a decrease of $9 or 1.1 per cent. Net operating revenue, therefore, was $477—an increase of $75 or 18.6 per cent, and operating income was $426—an increase of $74 or 20.9 per cent. The Southern district was the chief beneficiary of the marked increase in net returns, its increase in operating income being 48 per cent. September, 1914, however, was the lowest September in the South for the last six years. The operating ratio for the whole country was 61.8 per cent, as compared with 66.0 per cent in September, 1914, and 69.6 in September, 1913. Considering the three main districts, the respective ratios for September, 1915, and September, 1914, were as follows: Eastern district, 62.5 and 67.9; Southern, 66.7 and 74.6; Western, 59.5 and 61.4.

A Chlorination Plant at Sacramento, Cal., was installed in the water-supply system early in 1915. After several months of use the local typhoid cases reported were found to be 73 per cent less than for the corresponding period of 1914.



TWO-LEVEL ARCHED VIADUCT OF MASONRY CROSSING THE TET RIVER IN FRANCE

High Masonry Arch Viaduct in France Designed as a Two-Level Structure

Fontpedrouse Viaduct for Electric Railway Contains Central Pier Supported on Crown of Lower Arch Spanning Deep Ravine of Tet River

A MODERN VIADUCT of granite masonry designed with remarkable architectural effects to conform to the rock profile and the natural beauty of the site is the new Fontpedrouse structure over the Tet River in France. Its masonry arches are supported on high piers, one of which is itself carried on the crown of a pointed arch below. A description of this structure, which was designed by Professor Sejourne, is given by A. Dumas in *Le Genie Civil* for Nov. 6, 1915. The photograph and general elevation here reproduced show the extraordinary character of this modern construction and its resemblance to the old Roman aqueducts.

The bridge is one of two structures, the other a steel suspension bridge, which carry across the Tet River the electric railway which was recently built from Villefranche-de-Conflent to Bourg-Madame. It is notable in two principal features—the designer has spanned the lower narrow ravine by a 98½-ft. pointed arch upon the keystone of which a high intermediate pier of the main arch viaduct is supported, and he has decreased the cost of the main arches by reducing their width to the minimum compatible with the lateral stability and the general magnitude of the structure by carrying the walkways on an overhanging reinforced-concrete floor slab supported on cantilever beams.

The number and span length of the masonry arches composing the main high-level viaduct are shown on the general elevation. The height of base of rail above the river is nearly 225 ft. High, massive towers with battlemented tops serve to divide the main structure from the arch approach at each end. All four of the main arches are of the same clear span, about 56 ft., with full-centered circular intrados. Spandrel arches are used in the solid rubble masonry, spandrel filling for both the upper and lower arches, as shown, and a continuous walkway provided at the lower level, with openings in the main intermediate piers. The viaduct is on a grade of 6 per cent, and the approaches consist of circular arch spans, about 29½ ft. clear between piers, two on one side and ten on the other.

The four main arches are 8.2 ft. wide at the top, which is sufficient to carry the narrow-gage electric track and provide for the walkways about 2.5 ft. wide on each side by cantilever brackets, as shown in the cross-section herewith. This total width of arches and piers increases at a constant batter to 13.65 ft. at the bottom of the high pier over the lower arch. This lower pointed arch is 17.3 ft. wide at the crown and 22.15 ft. wide at the springing line, with a thickness of 8.2 ft. at the crown and 11.5 ft. at the springing line.

Maximum Stresses

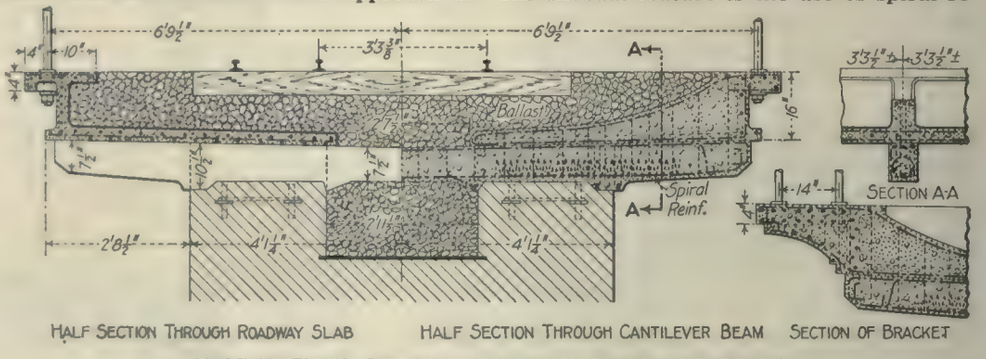
The maximum stress at the time of striking centers for the lower pointed arch was computed to be about 206 lb. per square inch. This decreases under service conditions to 175 lb. per square inch at the springing line and 142 lb. at the crown. These figures increase to nearly 200 lb. and 242 lb. respectively when the temperature rises 10 deg., and decrease slightly when the temperature decreases.

In the four main 56-ft. arches the maximum pressure is nearly 370 lb. per square inch at the springing and 440 lb. at the crown. These high figures are admissible because of the excellent granite used, and the exceptional quality of the construction work.

Reinforced-Concrete Details

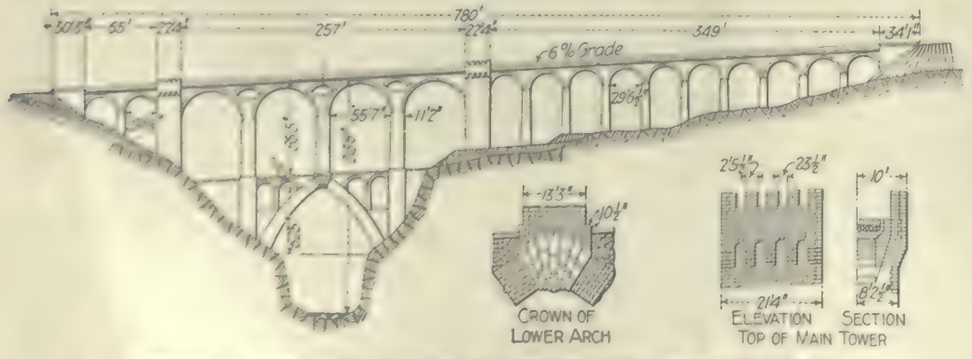
Ballast for the railway track is carried by the overhanging reinforced-concrete slabs shown in the accompanying sections. An unusual feature is the use of spiral reinforcement in the lower sections of the cantilever beams. These beams are spaced about 3.3 ft. apart, and at intervals are extended about 14 in. farther out to form refuges for pedestrians. A detail of these longer brackets is drawn. The third, or conductor, rail is shown on one side of the track and the walkways are protected by an iron railing on the outside. Steel anchor plates are inserted in the upper courses of masonry near the outside of the arch to tie effectively the edges.

The designer of the structure, Professor Sejourne of l'Ecole des Ponts et Chaussees, always lays great stress upon the architectural appearance of his bridges. The temperature stresses were computed by Professor Pegeaud, also connected with the same institution, of Paris, France.



HALF-SECTIONS THROUGH ROADWAY SLABS AND BEAMS

Spiral reinforcement used in lower sections of cantilever beams.



GENERAL ELEVATION—DETAILS OF TOWER AND ARCH KEYSTONE

ACTIVATED SLUDGE EXPERIMENTS will soon be carried on intensively by the Sanitary District of Chicago with stockyards sewage, $10,000 having recently been appropriated by the trustees for that purpose.

HINTS FOR THE CONTRACTOR

Details Which Save Time and Labor on Construction Work

Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

[*Contributions to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

Inverted Steam Hammer Pulls 35-Ft. Piles in 90 Seconds Each

AN INVERTED steam hammer has recently made the remarkable record of pulling in 90 sec. apiece 35-ft. steel sheet piling which was used in cofferdams for constructing the foundations of the Pittsburgh & Lake Erie Railroad's new warehouse in Pittsburgh. Mass concrete for the footings, 5 ft. thick, was poured directly against the sheeting with no attempt to prevent a bond, and the cofferdams were backfilled to the top before any pulling was done. Nevertheless, a majority of the piles were started and drawn in one minute less than the average driving time on each pile.



HOW STEAM HAMMER WAS RIGGED



PILES SHOWN AT RIGHT ARE NOT NEW—EVERY ONE OF THEM HAS BEEN DRIVEN AND PULLED

The rigging, plainly shown in the photographs, consisted of a wire-rope sling suspended from the crane hook supporting the inverted hammer. Over the anvil block of the latter passed a heavy strap of steel, shackled at the lower end to pulling straps pinned to the pile. The hammer, a No. 6 McKiernan-Terry, is rated at 275 blows a minute with an 8¾-in. stroke. It was supplied with steam from the crane.

This method of pulling piles, originated by Robert Melvin about a year ago in pulling sheeting for Arthur McMullen & Hoff on the Harlem River section of the new Lexington Avenue subway in New York City, is rapidly finding favor with contractors, because the piles pulled are in practically perfect condition. Mr. McKelvey of the McKelvey-Hine Company, which is carrying out the Pittsburgh & Lake Erie contract, was of the opinion that the piles would not have paid for the trouble of pulling them by other methods. Out of several car loads drawn with the hammer at Pittsburgh, however, practically every pile was in condition for immediate redriving.

Well-Pumping Difficulties Solved by Double Casings Filled with Gravel

By E. C. EATON

Superintendent of Filtration Plant, Panama-Pacific International Exposition

SAND caused a good deal of trouble in the five deep wells sunk to depths of about 80 ft. for supplying water to the filtration plant of the Panama-Pacific International Exposition at San Francisco, described in detail on page 748 of this issue. With well 1 not much difficulty was encountered, but the experiences with wells 2, 3, 4 and 5 were discouraging. It was found with all the wells that the foot-valve at first installed was an unmitigated evil. Sand in the water would gradually collect on this valve until sufficient had been deposited to hold the valve shut. The valves were accordingly removed.

A discharge of about 50 gal. per minute could be obtained from these wells for a period of a week. At this rate an appreciable amount of sand was pumped and, apparently, formed an open space around the well casing below the water line. This would hold up for several days and then suddenly break down, the ground about the well for a radius of 5 ft. dropping down or caving in when walked on. Unless carefully watched the pump would freeze up and throw the belt. Each of these four wells was sand-pumped, on an average, every 10 to 15 days, and the space around the casing where the caving occurred was kept filled with coarse sand in the hope that eventually this would collect around the outside of the casing and hold back the fine material.

As it would have been expensive to withdraw the pump and replace it for sand pumping and as there was a 2-in. space available between the pump and the casing an air lift was employed to remove the sand. An idea of the difficulty in keeping the sand from the wells may be gained when it is stated that on some occasions, when a plugging of the air lift discharge pipe occurred and a pressure of 100 lb. was put on the air pipe, the plug would suddenly clear, with a consequent rush of air through the bottom of the air lift, producing a certain amount of agitation of the water which would be sufficient to cause the sand to flow in through the casing and fill the well again to a depth of 2 ft. or more.

TEST GRAVEL AND PLATES

After nearly three months' trial the wells showed no improvement, and it was decided to drill a new well. Experiments were made with various mixtures of sand and gravel and different perforations in the well points. It was found that a naturally graded beach gravel, having an effective size of 0.42 mm. and a uniformity coefficient of 2.18, in conjunction with a perforation not over 1/32-in. wide, held back the fine material when the velocity through the perforations was as high as 0.75 ft. per second. This was considered a safe value.

Under contract the old wells cost $7.50 per foot of depth, so it was decided that a new well could be put down more cheaply by the Exposition Company, using a hydraulic ejector. Two concentric casings were sunk and the space between filled with the gravel chosen by the test above mentioned. In case of trouble due to clogging a 3-in. space between the casings was allowed, thus facilitating the removal of the sand for washing. Five days were required

TABLE 1—TEST OF NEW WELL

Discharge G.P.M.	Drawdown feet	G.P.M. per foot drawdown
5	1.5	3.3
20	3.25	6.15
35	4.33	8.10
60	5.91	10.15
110	8.43	10.50
125	11.90	10.50
155	13.40	11.56
175	15.00	11.62
200	16.40	12.20

to complete this well. A test gave the following results shown in Table 1.

No sand was discharged by the well, and it was determined to overhaul the old wells and reconstruct in a similar manner. There was a 2-in. space between the inner and outer casings, filled with pea-size gravel, and an attempt was made unsuccessfully to draw the inner casing. As it was necessary to get these wells in working order in a short time, it was decided to put down a third casing inside the inner casing, having a 1-in. space between them to be filled with sand of the same grade as that used in No. 6 well.

A test of one of these reconstructed wells gave the results in Table 2.

TABLE 2—TEST OF RECONSTRUCTED WELL

G.P.M.	Water levels in feet	Drop in feet	G.P.M. per foot drawdown
00	13.33	....	....
10	17.08	3.75	2.67
45	20.25	6.92	7.07
92	25.41	12.08	7.62
140	30.66	17.33	8.07
202	37.16	23.83	8.45
243	40.93	27.6	8.80

No sand was discharged at any time. The results of the experiments indicate that by an analysis of the soil in the particular district chosen it is not difficult to construct a well consisting of two casings with a sand filling at a cost of not over $4 per foot up to 100-ft. depth, in a district similar to this, and capable of delivering at least 200 gal. per minute continuously.

Inspecting and Calking Dredge Hulls Without Drydocking

A VERY simple device has been used on the fleet of dredges of the California Development Company to inspect and calk their hulls without drydocking. The company, operated by W. H. Holabird as receiver, owns and maintains the main system of canals supplying water to the Imperial Valley in southern California and in the northern end of the Mexican province of Lower California. The box, shown in the accompanying illustration, is built of 4 by 12-in. timbers and thoroughly calked. As is plain from the photograph, the long end is pushed beneath the dredge hull, the vertical leg being long enough to project above the water surface. To the edges touching the sides and bottom of the hull is nailed suitable rubber packing so as to make a water-tight seal. Once in place the inside of the box is pumped out. The water pressure against the bottom of the box clamps it so tight to the hull as to prevent any leakage. The clear dimensions inside and also the height of the vertical leg and the length of the horizontal section vary with the size and type of dredge. As a rule, however, only sufficient space is provided to give a fair amount of working room. The height of the vertical leg is determined, of course, by the draft of the dredge, while the horizontal length is determined by the beam of the boat. By the use of the device drydocking of the boats has been unnecessary, and they have been continuously maintained in service for years.



WATER PRESSURE CLAMPS MOVABLE "COFFERDAM" TIGHT AGAINST HULL

In connection with the calking of the hulls, using this device, it was found at the start that the cement placed over the calking would not hold. The scheme was hit upon therefore of tacking a light cleat over the seam as soon as the cement had been placed. This has proved effective and satisfactory.

Motor Truck Tears Up Half a Mile of Railroad a Day

THE accompanying photograph shows a portable derrick used recently by C. C. Parsons & Co. of Cleveland to tear up half a mile of track a day in removing an abandoned interurban line. The derrick, which was rigged on a White truck, was operated by the motor through a winch geared to the transmission. Where the ties were rotted, the rails and spikes were easily pulled by simply hooking on the tongs. Where the ties were still sound, the whole track came up at once when this was tried. It was found cheaper to pull the spikes first than to keep the trucks tied up while the ties were knocked loose after the track had been raised by the crane. The derrick loaded the rails on a second truck as they were pulled. It was also used to take down the old poles and cross arms.

The electric railway torn up was about 24 miles long, and was formerly operated between Chagrin Falls and Garrettsville, Ohio.

IN DRIVING CONCRETE PILES IN PIER WORK at San Francisco, the best cushion found was a coil of manila rope placed on three thicknesses of 2-in. fir plank. A single-acting steam hammer whose moving parts weighed 5000 lb. was used with a 1200-lb. follower block.



160 TO 170 RAILS A DAY WERE TORN UP AND LOADED BY THIS RIG

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

State Highway Officials Will Not Attend Two Annual Meetings

Take Steps to Bring Harmony Between Leading Organizations in Highway Field—Urge Officials Not to Appoint Delegates to Meetings Held Before Next December

The holding of two national road congresses each year was severely condemned at the meeting of the American Association of State Highway Officials in Chicago, Dec. 7 and 8. Resolutions were adopted expressing the sense of the meeting that it was opposed to the holding of any national road congress prior to Dec. 1, 1916, and binding the members of the association not to participate in any manner in any national congress held prior to that date. It was further determined that the members of the association would urge upon the executives of their States and also upon municipal officials that no delegates be appointed to any congress held prior to the date set. For the good of the road movement the association believes that the American Road Builders' Association and the American Highway Association should amalgamate into one organization or should at least arrange to hold jointly one annual road congress. If these two associations fail to arrange prior to Aug. 1, 1916, for such a joint congress to be held in December, 1916, or early in 1917, the executive committee of the highway officials' association was authorized to designate the date and place of its next meeting and to notify the above associations of the same, requesting them to hold a joint meeting at that time and place. The association stands pledged to give its hearty support and co-operation in case there is amalgamation or a joint meeting. Copies of the resolution will be sent to manufacturers, urging them to approve of the position and to co-operate in bringing about the single meeting advocated.

Resolutions were also adopted supporting the proposed federal-aid road law, which would make available Government funds each year to the extent of $25,000,000. A committee composed of George P. Coleman, highway commissioner of Virginia; E. A. Stevens, highway commissioner of New Jersey, and Henry G. Shirley, chief engineer of the Maryland State Roads Commission, was appointed to bring the proposed law to the attention of members of both branches of Congress.

The officers elected for the ensuing year were: President, Henry G. Shirley, chief engineer of the Maryland State Roads Commission; vice-president, A. B. Fletcher, California State highway engineer; secretary, J. H. Pratt, State geologist of North Carolina; treasurer, F. F. Rogers, Michigan highway commissioner. George P. Coleman of Virginia was re-elected for five years chairman of the executive committee. W. D. Sohier of Massachusetts, T. H. McDonald of Iowa, E. A. Stevens of New Jersey and Lamar Cobb of Arizona were elected members of the executive committee. S. E. Bradt of Illinois was elected chairman of the finance committee, with W. S. Keller of Alabama, P. D. Sargent of Maine and W. S. Gearhart of Kansas as members.

Would Submit Wharton Tract Purchase to Voters a Second Time

By a unanimous vote the New Jersey State Department of Conservation and Development decided Dec. 1 to recommend that the proposed purchase of the Wharton tract be again submitted to the voters of the State at the election next fall.

Water Power Bills Again in Congress

The Adamson and Ferris water-power bills were reintroduced in Congress at the opening session of that body. The former is intended to govern the construction of dams on navigable waters other than those on public lands, and has the approval of the Secretary of War and the chief of engineers of the Army. The bill has been slightly amended from the manner in which it came from the committee last year, but it will not be printed, nor will many other bills offered in Congress for a while, owing to the great number of bills introduced. The Ferris bill, which is intended to control dams on public lands, is the one which had the support of the Secretary of the Interior.

Representative Adamson said in Washington during the week that he expects to pass the measure to which his name is attached at the present session of Congress. To do so he will rely for support in large measure on the statements made at last year's hearings by Hugh L. Cooper, of New York, who was largely identified with the building of the Keokuk dam. Representative Ferris also announced that he intends to push his bill at this session of Congress.

Want Mississippi River Considered Apart from River and Harbor Bill

A resolution was adopted to request all members of Congress interested in the improvement of the Mississippi River and the prevention of floods in its valley to co-operate in the preparation of a bill designed to make of such work a separate and independent project, just as was done in the case of the Panama Canal, at a conference of senators and congressmen from the riparian States with members of the Mississippi River Commission and the presidents of local levee boards, held at Memphis, Tenn., Oct. 25. Such a bill would make such improvements a matter apart from the regular River and Harbor Bill.

Important Philadelphia City Departments to Be Headed by Well-Known Engineers

George S. Webster and George E. Datesman Chief Engineer and Principal Assistant Engineer Respectively of the Bureau of Surveys Are Promoted to Important Posts

As briefly noted in this journal last week, George S. Webster, chief engineer of the Bureau of Surveys, Philadelphia, has been appointed director of the Department of Wharves, Docks and Ferries, and his assistant, George E. Datesman, has been made director of public works. The appointments have been highly praised in Philadelphia, for both engineers have proved by long service their grasp of Philadelphia's needs and their ability to execute important works in a successful manner.

Philadelphia Engineers Made Heads of Important City Departments



GEORGE S. WEBSTER — GEORGE E. DATESMAN

George S. Webster

Mr. Webster has been chief engineer of the Bureau of Surveys for nearly twenty-three years. He was born in Philadelphia, and educated in the Friends' Select School and the University of Pennsylvania, being graduated from the latter with the degree of civil engineer in 1875.

His first work was as an assistant in laying out the grounds of the Centennial Exposition. Later he served for a brief time in the United States Coast and Geodetic Survey, and in 1877 entered the employ of the Bureau of Surveys as assistant engineer. His progress was rapid, for in 1880 he was made surveyor and regulator of the tenth survey district, a position similar to that of city engineer of a smaller town. His responsibilities for the municipal engineering work in that district being successfully discharged, he was promoted to the position of principal assistant engineer in 1892, and in 1893 became head of the bureau, which office carries with it the presidency of the Board of Surveyors, an organization having large authority and control over the surveying and engineering activities of the city.

The work of public improvement that has

been under the supervision of Mr. Webster during his long incumbency of the office he now leaves has included the establishment and extension of the street and park systems, the design and construction of all sewers and bridges, the design of a new system of sewage disposal and its inauguration by the construction of the Pennypack Creek sewage disposal plant, and the abolishment of grade crossings. Some of the principal achievements along these lines have been the construction of the great concrete arch bridge carrying Walnut Lane across the Wissahickon Ravine, the Falls, Grays Ferry and Passyunk Avenue bridges across the Schuylkill River and a large number of concrete bridges of fine design in various parts of the city. Under his charge has been the abolishment of grade crossings along the Pennsylvania and the Philadelphia & Reading railways, the development of the South Philadelphia Improvement project, covering the comprehensive replanning of 5000 acres in the southern section of the city for commercial, industrial and residential purposes; the widening of Delaware Avenue; the construction of concrete bulkheads and three large municipal piers along the Delaware River front; the dredging of the Delaware River from the city to Marcus Hook before the department of which he now becomes director was created and the laying out and opening of many important streets, parkways and parks. In 1905 and 1906, in addition to his other duties, he was acting chief of the Bureau of Filtration and directed the work then in progress for the improvement and filtration of the water supply of the city.

George E. Datesman

Mr. Datesman was graduated in civil engineering from Lafayette College and began professional work in architectural lines in Des Moines, Iowa. He spent one year subsequently in mining work and then entered the service of the City of Philadelphia as draftsman. For three years, until 1888, he continued with the city and then for three years more was in private practice in Germantown. He returned to the Bureau of Surveys as chief draftsman in 1891 and has been with the office ever since.

He has been associated with his chief, Mr. Webster, in the important work carried on in the department since his connection therewith. He has given special attention, however, to sewer design and sewage disposal, making a trip to Europe in the interests of the city. On that trip, too, he studied general municipal problems, such as boulevard and parkway development, urban transportation systems, especially subways; foreign street extension and pavement methods, and the financing of municipal improvements. With his wide experience he comes to the headship of the Department of Public Works with excellent preparation. He will, after the first of January, have direct charge not only of the works with which he has been associated, for the Bureau of Surveys is a sub-department of the Department of Public Works, but will also have supervision over other engineering activities of the city, including the work of the highways bureau.

Million Acre-Feet Added to Reclamation Service Storage Capacity

More than 1,000,000 acre-feet were added to the capacity of its storage reservoirs by the U. S. Reclamation Service during the past year. Four large and interesting dams were brought practically to completion, namely: The Arrowrock, the highest in the world; the Elephant Butte, which impounds the largest quantity of water of any artificial reservoir in the world except Gatun Lake; the Grand River, which is the longest roller-crest dam in the United States, and the Lahontan. Water was furnished to irrigate more than 750,000 acres of land and to grow crops worth $16,500,000. The total expenditure during the year for building dams and other irrigation works was $15,000,000. Construction completed included 753 miles of canals, 284 miles of waste-water ditches and open drains, 60 miles of irrigation and drainage pipe lines, 747 bridges, 1079 culverts, 311 flumes, 51 miles of roads and 178 miles of telephone lines. Irrigation canals were lined with concrete to a total length of 54 miles. The excavation of earth and rock amounted to 17,000,000 cu. yd. and 750,000 cu. yd. of concrete were placed.

Combine Novelty with Utility in Design of Steel Water Tank

A novelty in the way of steel tank design resulted from the decision of the City Dairy Company of Toronto, Canada, to combine advertising with utility in a steel water tank to be erected at its plant for fire protection purposes. The tank has a capacity of 25,000 gal. and is modeled after one of the company's standard quart bottles. It is 13 ft. in diameter and 35 2/3 ft. high, with its bottom at an elevation of 70 ft. above the ground, and is painted a pure white. The steel plate construction of the big bottle is similar to that of the standard water tanks of the manufacturer, the Canadian-Chicago Bridge & Iron Works of Bridgeburg, Ontario and Chicago, by whom it was designed and erected. The 4-post tower on which it is mounted is also of standard construction, designed to meet the requirements of the Canadian Board of Fire Underwriters.



TANK HAS 25,000-GALLON CAPACITY

St. Paul Electric Locomotives Perform Well in Test Run

The first actual tests on the Chicago, Milwaukee & St. Paul Railway's newly electrified mountain divisions in Montana were made Dec. 8 by officials and directors of the system, accompanied by officials of the General Electric Company. The completed sections of the electrified district were toured in three special cars drawn by one of the new 260-ton 3000-volt electric locomotives. Passenger-train tests were made at speeds up to 70 miles per hour, after which the same locomotives were used in tonnage tests of passenger trains, pulling 2500 tons at a uniform speed of 16 miles per hour. At the conclusion of the tests the president and other officials who witnessed them expressed gratification at their complete success.

The regenerative braking device included in the equipment of the 3000-volt locomotives proved under the actual tests to be entirely successful. It was seen that the use of the air-brakes had been practically done away with except for station stops and emergency uses, and that an enormous saving could be expected in the lessening of wear and tear on track and equipment. The constant grinding of brake shoes on wheels is nearly eliminated.

Among those who accompanied the test "special" were A. J. Earling, president of the railway; C. A. Goodnow, assistant to the president, who has had charge of the electrification, and A. H. Armstrong, of the General Electric Company.

It is expected that the all-steel transcontinental trains of the railway will be operated electrically over the Continental Divide shortly after the first of the year.

Silver Rivet Supersedes Time Honored Cornerstone

Instead of the customary cornerstone setting, a silver rivet was driven into the steel work of a 26-story building being erected at Madison Avenue and Forty-second Street, New York City, by August Heckscher. When the building is completed the rivet will be exposed in a silver lined recess in the main entrance lobby.

Would Skirt Border of Country with Military Road

A bill has been introduced in Congress that provides for a national highway system, extending from coast to coast, to cost not more than $100,000,000, as a means of defence. The sale of long-term 3 per cent notes is proposed to raise the funds for the purpose.

The bill provides that the highway shall be constructed by army engineers and its construction and use shall be under such regulation as the President may prescribe. It would begin at Los Angeles, Cal., and proceed by a practical route to Jacksonville, Fla., then northward to New York and Portland, Me. At New York the westward route would start for Chicago and go from there via Minneapolis, the Dakotas, Montana and Idaho to Washington, then down the Pacific Slope to San Francisco, Los Angeles and San Diego.

First Span Placed on Columbia River Interstate Bridge

The first span of the Columbia River interstate bridge, connecting Portland, Ore., and Vancouver, Wash., was placed in position Dec. 6. The span is 265 ft. long and weighs 468 tons. It was loaded on four barges, which were towed by tugs up the river, and placed in position in approximately three hours.

Secretary of War Condemns General Dam Act—Advocates New Law

In his annual report the Secretary of War, Mr. Garrison, points out that the general dam act has prevented the development of water power on navigable streams and characterizes the law as a "makeshift which effectually prevents all development." Continuing he says:

"On the one hand it [the general dam act] does not offer the rightful and necessary inducement for an economical and profitable development, nor on the other hand would it adequately protect the interests of the public if development were possible under it. Even were it sufficient in these regards it has been demonstrated that it would be unworkable in another. It is a general dam act in name only; while purporting to lay down general conditions to cover development in all cases, it nevertheless requires in each case the further special authorization of Congress, an inconsistency which invites a disregard of the general conditions, makes of each application an independent legislative proposition, and subjects each project to the delay and hazard of congressional action."

In the next paragraph the Secretary points out that the usual use of electric power, in cities and in factories, is not the only outlet at the present time for hydroelectric energy. He points out that the fixation of atmospheric nitrogen, through the use of the electric furnace, offers a tremendous field for the use of cheap power—a matter of particular importance at the present time when nitrogen is so important a factor in military effectiveness. He therefore urges that Congress enact suitable legislation along the lines of that which failed to pass in the last Congress.

Hopes to Open East Half of Barge Canal in Another Year

Only one more season is needed to finish the Champlain Canal of the New York State Barge Canal system, and also a channel from the Hudson River to Lake Ontario via the Erie and Oswego branches, states Frank M. Williams, State engineer and surveyor, in the November Barge Canal *Bulletin*. On each of these units there is a single unfinished and unawarded contract. The approval by popular vote last election day of the bond issue for the completion of the whole improvement makes it possible to push the work on these two contracts, together with that on the few others not quite completed, provided the Legislature takes steps for the immediate issuing of the bonds. Mr. Williams points out that this should be one of the first acts of the Legislature.

The Erie Canal west of the Oswego junction contains several uncompleted parts. Legal complications are here largely responsible for the unfinished condition. There are numerous railroad crossings, causing delays both in coming to agreements with the railroads and in performing the work so as not to interrupt traffic. Because of the amount of work still to be done and the number of crossings still to be made, Mr. Williams thinks two seasons will be required to complete the western half of the canal.

Popularize Results of Geological Survey Scientific Investigations

Four guide books of the West, plainly written in the effort to make the geologic description of the country traversed readily understood by the average traveler, were published by the U. S. Geological Survey during the past year. This is the beginning of a definite movement to popularize the results of the scientific investigations of the Survey. Other results attained during the year, according to the annual report of the Secretary of the Interior, were the completion of geologic and topographic surveys in the United States, Alaska and Hawaii, aggregating nearly 112,000 square miles, the classification of about 23,000,000 acres of public lands and the publication of scientific, economic and statistical reports, aggregating 23,574 pages. In addition, special bulletins were prepared to meet the demand for authoritative information concerning possible sources of mineral products hitherto imported, and an extensive correspondence was conducted to bring producers and consumers together. This service was rendered, the report points out, with the purpose of making America more independent industrially.

Work Started on $5,000,000 Additions to Inland Steel Company Plant

Work has been started on additions to the Inland Steel Company plant, Chicago, which will cost $5,000,000. Eighteen open-hearth furnaces will be constructed, increasing the output by 1,000,000 tons. The work is being done by company forces and, it is expected, will be completed by next fall. The excavation has been started and concrete work will continue throughout the winter.

Want Commission to Study Methods and Results of Land Settlement

Believing that conditions have arisen in certain sections of the country which are retarding rural development and making it difficult for farmers of small capital to become owners of the land they cultivate, the National Conference on Marketing and Rural Credits, held Nov. 30-Dec. 2, adopted the following resolutions:

"We believe that the remedy for these conditions existing in the irrigation sections is to be found in legislation by the states, or by the nation and the states, which will provide money to be loaned settlers to aid in the preparation of public land for cultivation and to the purchase of such privately owned land to be resold to settlers under methods and conditions similar to those now in successful operation in Australia, New Zealand and other countries.

"As such legislation would involve a radical departure from past methods and policies and as the systems of other countries would have to be modified to conform to our needs and conditions, the first step toward the inauguration of such legislation should be a comprehensive investigation of the subject.

"The conference, therefore, favors and recommends to Congress the appointment of a commission of five members to investigate the methods and results of land settlement in the West and other parts of this country where settlement of cut-over lands, drainage of swamp land and irrigation must be undertaken, as well as the causes and results of tenant farming in the entire country, and to prepare a report with recommendations as to the measures needed to remove the obstacles to acquiring farmers and the modifications needed in the successful land settlement system of other countries to insure their effective operation here."

California Railroad Commission Reports on Activities

In a letter of transmittal accompanying the annual report of the California Railroad Commission which appears in print this month, the following figures are given: During the fiscal year ending June 30, 1915, 675 formal applications and 241 formal cases were decided. Valuations made by the commission included the following: Railroad, $97,509,514.10; water, $37,100,086.00; electric, $30,851,929.93; telephone, $8,493,177.72; gas, $6,961,543.22; wharf and warehouse, $434,394.76; total, $181,350,645.73. In 99 per cent of the formal proceedings decided by the commission its orders have become effective without litigation, while the commission has won all of the last eleven successive cases decided by the court.

High-Grade Men for Factory Executives in Demand

According to the report of Arthur Keisel, secretary of the American Association of Engineers, 29 S. La Salle Street, Chicago, there is a call for high grade men as factory executives, and the supply of men in the civil engineering field is about equal to the demand. The association has attained a membership of 260, and, through its service clearing house, one hundred engineers have been put in touch with positions in the last two months, although not all of them have been placed. Of these only forty were members. No one belonging to the association is out of employment, so it is necessary to go outside to fill many of the openings.

National Employment Exchange Placed 3894 During Year

During the fiscal year ending Sept. 30, the National Employment Exchange, 30 Church Street, New York City, placed 3894 workers in positions. The general mercantile branch placed 2354 of these and the manual labor branch 1540. The first listed 3289 orders and the second 2202. In the latter part of the year extensive orders were received for gangs of laborers, mechanics and similar classifications, which the exchange was unable to fill due to a scarcity of applicants. The placements included only 70 laborers. Operations for the year showed a net loss of $2,084, as compared to a loss of $4,898 for the previous year.

News of Engineering Societies

The Pennsylvania State College will give a short course in the latest developments of highway engineering Dec. 27-31.

The National Society for the Promotion of Industrial Education will hold its annual convention at Minneapolis Jan. 20-22, 1916.

The Louisiana Engineering Society heard Burrus D. Wood speak on "Modern Diving and Wrecking Methods on the Mississippi" at a meeting held in New Orleans Dec. 13.

The Southern California Association of Members of the American Society of Civil Engineers held a dinner at the Hotel Clark, Los Angeles, on Dec. 8, at which Capt. Charles T. Leeds presided. Following the dinner the Big Creek power project of the Pacific Light & Power Corporation was discussed by R. C. Starr, hydraulic engineer. About fifty members and guests attended.

The Indiana Engineering Society and the Indiana Sanitary and Water Supply Association will hold their annual meetings simultaneously, Feb. 2-5, 1916, at the Claypool Hotel, Indianapolis. Major-General W. C. Gorgas, U. S. A., will be the principal speaker at the meeting of the latter organization. The programs of both meetings will be so arranged that delegates to each may attend the other, and the subjects discussed will be such as to be of interest to both.

The Iowa Section of the American Waterworks Association held its first annual meeting at the State University of Iowa, Iowa City, Dec. 3-4. Dr. Edward Bartow of the State Water Survey of Illinois spoke on the activated sludge process of sewage purification. The following officers were elected: Chairman, Robert N. Kinnaird, chief engineer of the Des Moines Water Company; vice-president, C. H. Streeter, superintendent of the Cedar Falls water and electric plant; secretary, J. J. Hinman, Jr., senior water bacteriologist and chemist, State Board of Health Laboratory; directors, William Molis, superintendent of the Muscatine City Waterworks, and J. P. Berry, superintendent of the Waterloo Waterworks.

The New York Section of the American Waterworks Association held its December meeting at the Manhattan Hotel, New York City, Dec. 15. A paper by G. E. Willcomb on "Resanding Problems at Albany" was read

and F. E. Hale and Edgar M. Hoopes, Jr., city engineer of Wilmington, presented papers on "Iron Removal by Rapid Sand Filtration" and "Airbound Difficulties." Mr. Hale's paper was based on experiences of the New York City Department of Water Supply, Gas & Electricity in dealing with Long Island well water. Mr. Hoope's paper was based on experiences at the Wilmington plant. Short papers were also delivered by F. W. Green, G. R. Spalding, E. G. Manahan, S. M. Van Loan and A. A. Tolson.

The University of Illinois will give a short course in highway engineering Jan. 10-21, 1916. Arrangements have been made for one or more addresses by the state highway engineers of Wisconsin, Iowa and Kansas. Other prominent highway engineers will participate. Papers will be presented by members of the staff of the department of civil engineering and by other members of the University faculty. Several county superintendents of highways have agreed to deliver addresses upon subjects for which they are peculiarly fitted and others have consented to lead in the discussion of the formal papers. The addresses, discussions and demonstrations will be such as to be of interest to highway engineers, to township highway commissioners and to contractors engaged in bridge and road construction.

Personal Notes

L. P. SCOTT, assistant engineer with the Illinois State Highway Department, who has been on leave of absence for the past year acting as county superintendent of highways for Carroll County, Illinois, will return to the State Highway Department Jan. 1 in the capacity of chief draftsman in the road department.

S. C. CAMPBELL has resigned his position with the Illinois State Highway Department to accept appointment as county superintendent of highways of Carrol County, Ill., to be effective Jan. 1.

ROBERT B. MARSHALL, chief geographer of the U. S. Geological Survey, has been appointed general superintendent of national parks, succeeding Mark Daniels, whose resignation is noted elsewhere in these columns. Mr. Marshall entered the service of the Geological Survey in 1889 as field assistant. In 1893, as topographer he began a survey of Yosemite Park and, in 1904, he served as a member of the commission constituted to consider changing the boundaries of that park. He was appointed chief geographer of the Geological Survey in 1908, and, in that capacity, made exhaustive studies of all the national parks.

B. H. BURRELL, senior highway engineer, U. S. Office of Public Roads and Rural Engineering, has been directed to make an investigation of the proposed highway from San Diego, Cal., to Washington by way of El Paso, Tex. Mr. Burrell studied engineering at the California Military Academy and was with the California Bridge Company from 1890 to 1897. For the next four years he was engaged in private practice, with the exception of about six months spent in the office of the city engineer of Oakland, Cal. In 1901 he went to the Philippine Islands as chief draftsman with the city engineer of Manila. He became superintendent of sanitation in that city the following year, and provincial supervisor of La Union Province in 1903. From 1906 to 1907 he was district engineer in charge of Engineering District 12 and, from the latter year until 1909, engineer in charge of contract for the Philippine Government in Manila Harbor. He returned to the United States in 1910 and, after a few months spent in architectural work in Oakland, Cal., was appointed civil engineer and superintendent of construction for the U. S. Quartermaster's Department. He entered the service of the U. S. Office of Public Roads in 1911.

CARL H. REEVES, formerly assistant engineer with the Public Service Commission of Washington, and, previous to that, civil engineer with the Stone & Webster Engineering Corporation, has opened offices in the Henry Building, Seattle, Wash., to engage in practice as consulting engineer, specializing in municipal and highway work. He was graduated from the University of Washington in 1901. His first service, after graduation, was as transitman for the Spring Valley Water Company at Port Townsend, Wash. From this work he went to the office of the city engineer of Seattle, where he remained until 1906, when he became assistant engineer of outside work for the Seattle Electric Company. In 1911 he was appointed bridge and field engineer for the Stone & Webster corporation, with which company he continued until March of the present year, attaining the grade of civil engineer in 1914. While with the Public Service Commission of Washington he had charge of street and interurban railway track, roadway and bridge appraisals.

J. NORMAN JENSEN, architectural engineer in the Chicago building department, has been restored to office by court order, following his suspension in April on charges of the building commissioner. The charges were not proved and on May 27 his name was put back on the eligible list, another man being named for his position. The courts have now ruled that Mr. Jensen must be put back on the pay roll.

J. KAPPEYNE, formerly connected with the valuation of the utilities in the District of Columbia, has been appointed engineer to the Public Utilities Commission of the District of Columbia. He was born in Holland in 1882 and received his professional education at the Polytechnical School of Zurich in Switzerland. His first practical experience was obtained in the United States on the design and installation of the equipment of the subaqueous tunnels of the Hudson & Manhattan Railway Company and of the New York City subways now in the course of construction. Previous to going to Washington he was engaged on the valuation of the street railways of Greater New York for the Public Service Commission, First District.

EDWIN JENNINGS, formerly connected with the Department of Bridges, New York City, has resumed practice as consulting engineer at 835 Broadway, New York City.

J. FRANKLIN DIGGS, JR., formerly resident engineer of the southern division of the bureau of sanitary engineering of the Maryland Department of Health, has been transferred to the western division, with offices at Hagerstown, in a similar capacity.

MARK DANIELS has resigned from the position of general superintendent of national parks. He occupied the office for somewhat over a year, during which time, among other works, he designed a complete road and trail system for five of the national parks.

J. B. LIPPINCOTT, consulting hydraulic engineer, of Los Angeles, has been retained by the city of Santa Monica, Cal., to report on the plans for the storm water drainage system proposed for that city.

CHARLES F. PLACE, formerly city engineer of Hayward, Wis., has been appointed prospect engineer on a 10,000-acre irrigation project at Clearmont, Wyo. The work will result in the adapting of a large cattle ranch to sugar beet growing.

CLINTON R. GOODRICH, formerly construction superintendent with James Stewart & Company, Inc., is now associated with the Dale Engineering Company, general contractors, of Utica, N. Y. He was graduated from Cornell University in 1905 and for the past six years has been in charge of building work for the Stewart company, principally in the Southwest, but for the past year on the development of the Ilion plant of the Remington Arms & Ammunition Company.

E. F. CYKLER, formerly assistant engineer to H. J. Brunnier at Berkeley, Cal., has been appointed chief engineer for the Lord-Young Engineering Company, Ltd., on pier construction and dredging contracts at Honolulu, T. H.

OSCAR S. STRAUS, formerly secretary of the Department of Commerce and Labor and Ambassador to Turkey, has been named chairman of the Public Service Commission of the First District, New York, succeeding Edward E. McCall, removed.

H. GILBERT KARGES has been appointed superintendent on the construction of a $500,000 hotel at Evanston, Ind. He was graduated from the University of Illinois in 1914.

DR. D. S. JACOBUS, advisory engineer for the Babcock & Wilcox Company, manufacturer of steam boilers, superheaters and mechanical stokers, of New York City, and special lecturer in experimental engineering at Stevens Institute of Technology, was elected president of the American Society of Mechanical Engineers at the annual meeting of that society, held in New York City, Dec. 7.

M. M. O'SHAUGHNESSY, city engineer of San Francisco, expects to attend the hearing before Secretary of the Interior Lane, at Washington, D. C., Jan. 26, 1916, on the John Hays Hammond claims for water and power rights in the Poopenaut Valley, which are said to conflict with the Hetch Hetchy grant to San Francisco. The hearing was originally set for Dec. 13, but was later postponed.

THOMAS W. RANSOM, consulting mechanical engineer in the office of the city engineer of San Francisco for a number of years, has tendered his resignation to take effect Jan. 1. Mr. Ransom retires to take up private practice, and has opened engineering offices in the Mills Building, San Francisco.

Obituary Notes

FRANK BAILIE, of the H. K. Porter Company, manufacturer of steam and compressed air locomotives, of Pittsburgh, died Dec. 14.

W. W. RAMSEY, president of the Ramsey Engineering Company, of Chicago, died Dec. 3 at the age of 69. He was one of the early pioneers in the field of reinforced concrete and in the development of expanded metal. The business of the firm will be continued by W. E. Ramsey, his son.

EMORY A. ELLSWORTH, for four terms city engineer of Holyoke, Mass., and a well-known architect and engineer of that city, died at his residence on Dec. 8. He was senior member of the firm of Ellsworth & Howes. Mr. Ellsworth had been in practice in Holyoke for forty years and was sixty-two years of age. He was the designer of many public and private buildings, including some of the plant of the Massachusetts Agricultural College at Amherst.

SALEM D. CHARLES, chairman of the Boston Board of Street Commissioners, died at the Worcester City Hospital on Dec. 9. Mr. Charles had been in poor health for over a year. He was elected to the board in 1899 and later succeeded the late John P. Dore as chairman.

LIEUT.-COL. CHARLES S. BROMWELL, Corps of Engineers, U. S. A., died at Honolulu, Hawaii, Dec. 10. He was graduated from West Point in 1890. At the time of his death he was in charge of defense work in Honolulu and Pearl harbors and of the improvement of Hilo, Honolulu and Kohului harbors. Previous to that he was in charge of the Cleveland engineering district. For several years he served as military aide to President Roosevelt.

B. F. Affleck Heads Cement Manufacturers' Association

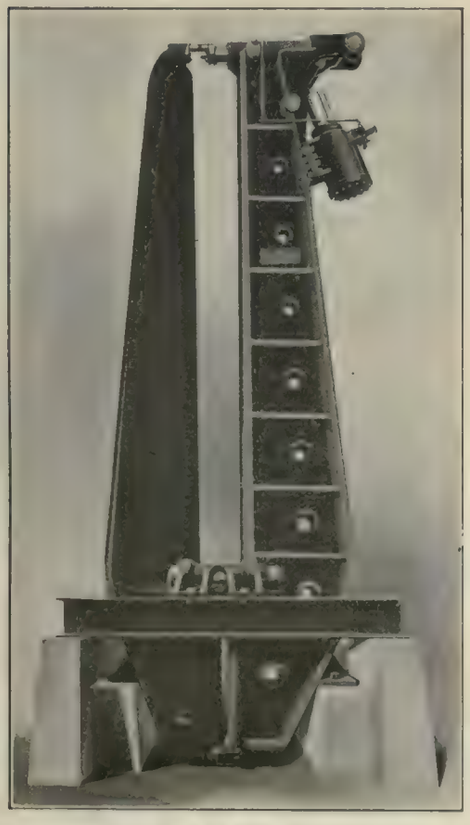
At the annual meeting of the Association of American Portland Cement Manufacturers, in New York, Dec. 13 to 16, B. F. Affleck, of Chicago, president of the Universal Portland Cement Company, was elected president of the association, succeeding John B. Lober, of Philadelphia, president of the Vulcanite Portland Cement Company. Mr. Lober retired after a service, not continuous, however, of nine years as president of the association and received an ovation upon the presentation to him at the annual dinner of an exquisite silver punch service. Not content with this evidence of their esteem and affection, his colleagues presented him with a phonograph and a record cabinet of regal proportions, that his leisure might be filled, as Mr. Sinclair said in the presentation speech, with the best that opera, or perchance vaudeville, might afford.

Enlarged plans for the association's activities were considered and adopted.

Largest Pneumatic Riveter Has Pressure of 100 Tons

The big riveter shown herewith has a wide opening with toggle-joint motion and gradually increasing pressure until the rivet is gripped, after which a simple lever motion under maximum pressure for a considerable space drives the rivet up tight. This combination, once adjusted for a given length and grip of rivet, needs no further manipulation to drive "steam-tight" rivets for heavy pressure, regardless of ordinary variations in the length of rivets, size of holes or thickness of plates. Such variations have prevented ordinary pneumatic riveters from being used on work of this sort, although a hydro-pneumatic type of riveter has been developed and is preferred by a few for this work to the hydraulic machines usually employed.

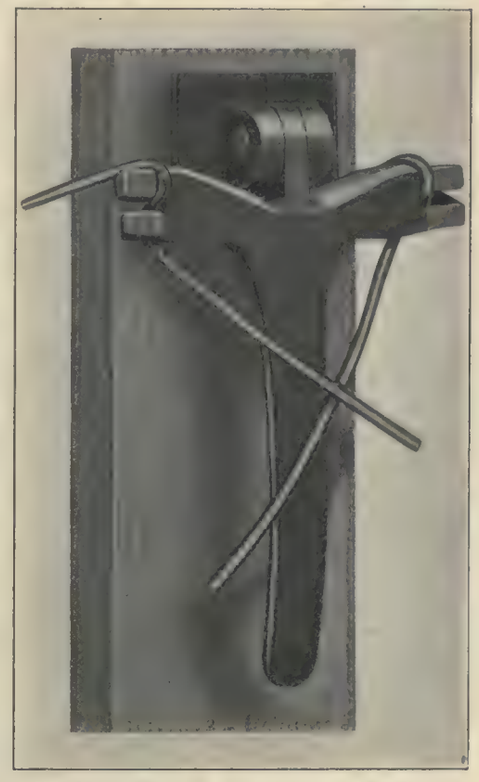
Two of these riveters, with a reach of 21 ft. and capable of exerting a pressure of 100 tons on the rivet die with 100 lb. air pressure, have just been built by the Hanna Engineering Works of Chicago, for which the Vulcan Engineering Sales Company is agent. They are said to be the largest pneumatic riveters ever constructed. This type is said to avoid the drawbacks of the hydraulic and hydro-pneumatic types of riveters, and to have besides many advantages of its own.



RIVETER HAS TWO MOTIONS

You Can Put This Form Clamp On in Ten Seconds

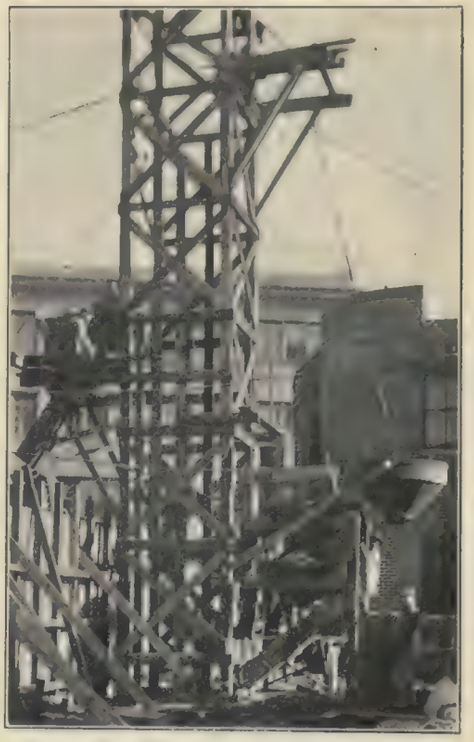
A wire form clamp, which can be placed on the wire, pushed against the form and locked in ten seconds, has been placed on the market for the first time. It can also be removed as quickly as applied without cutting the wires. A toggle lock, which insures a positive automatic locking action, is used. Wooden wedges, twisting the wires and boring holes in the forms are all eliminated. The new clamp, as shown in the accompanying photograph, is a one-piece device, weighs 24 oz. and will handle up to 3/16-in. wire. Only one clamp is necessary for a complete tie. The Universal Form Clamp Company, Chicago, are the manufacturers.



FORM CLAMP OF EFFICIENT OPERATION

Lever Elevator Attached to Tower Feeds Mixer

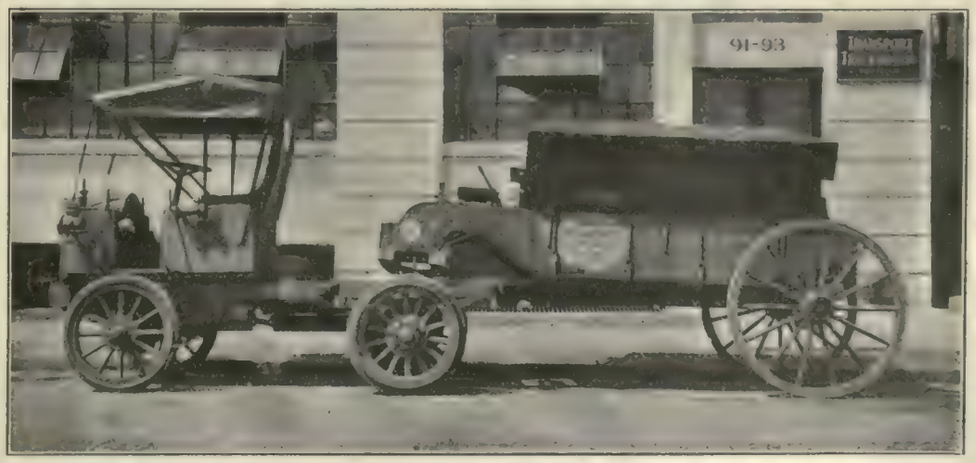
An elevator consisting of a charging hopper pivoted at the outer ends of two levers hinged to the hoisting tower has been designed by the Automatic Concrete Mixer Company, Inc., at Providence, R. I., and used with success in tower installations where Haines mixers are employed. It enables the mixer to be set above ground without requiring any inclined runways for charging it. The hopper is hoisted by the regular tower engine, and dumped by opening its lower gate. When being charged, the top of the hopper is level with the ground. Its rim is supported by wood blocks at a sufficient height to prevent the gate handle from striking the bottom of the pit dug to receive it.



LEVER ELEVATOR IN USE

Five-Ton Tractor Can Be Used Economically for Two-Ton Loads

A 5-ton gasoline tractor has been placed on the market which can be used economically, its manufacturer claims, for loads as small as 2 tons. It is built to haul loads either by means of a patented device furnished with the tractor or on specially built trailers. The advantages claimed for it are small initial investment and economy in fuel, tires and repairs. A 25-hp. engine is used, working through a massive worm driven axle with an especially large gear reduction. All working parts are protected from mud and water. The tractor is illustrated in the accompanying cut. It is manufactured by the Transport Tractor Company of Long Island City, N. Y.



TRACTOR BUILT TO HAUL LOADS EITHER BY MEANS OF A PATENTED DEVICE OR ON SPECIALLY BUILT TRAILERS

High Freight Rates Bar Cement from South America

With a tariff preference of 20 per cent in their favor, American cement manufacturers are not doing well in the Brazilian markets in competition with European exporters, according to an official statement of the Department of Commerce. European firms have been given an advantage in freight rates that more than offsets the preferential tariff. The freight rate from England to Pernambuco, for example, is $9 per ton, while the rate from New York is $12.

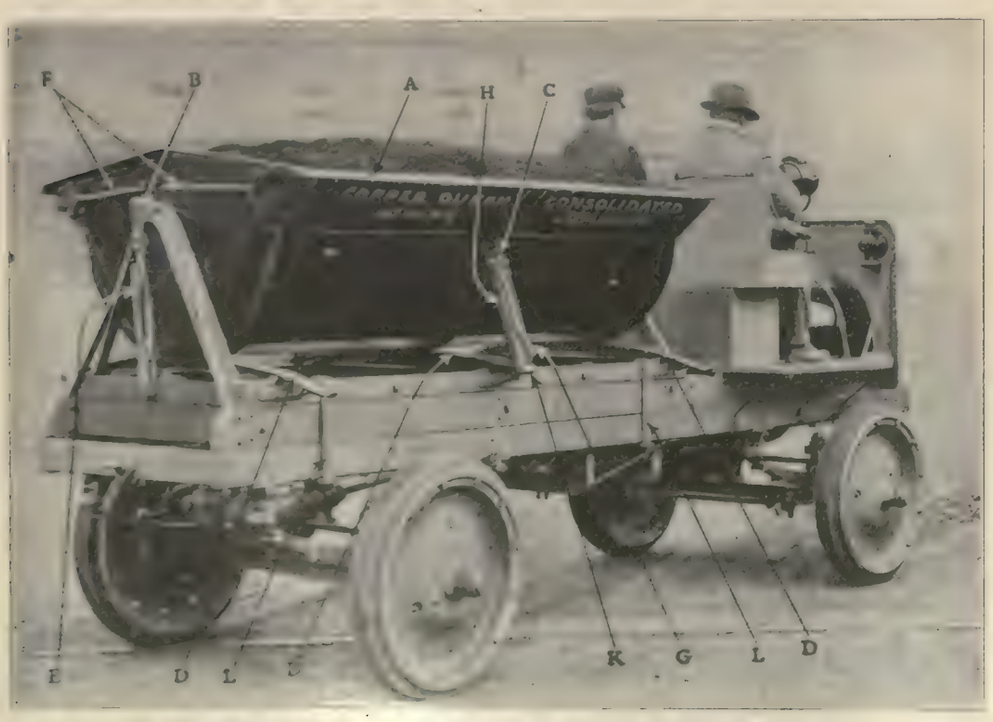
According to statistics furnished by the Bureau of Foreign and Domestic Commerce, the imports of cement into Brazil have grown to important proportions in recent years. In 1913, the latest year for which statistics are available, the total imports for the country were valued at more than $7,000,000. This was an increase of approximately $2,000,000 in a year's time. Of the 1913 imports, $3,000,000 worth came from Germany, $2,000,000 worth from England, $900,000 worth from Belgium and $750,000 from the United States, other countries furnishing smaller amounts.

Two-Way Side Dump Motor Truck Makes Unloading Possible

By means of the new Lee two-way side dump body the whole operation of unloading a motor truck for bulk materials has been made possible, it is claimed, for the average driver in ½ minute. An expert can do it in from 20 to 25 seconds.

The act of dumping is performed as follows: A handle (G) in the middle of the body is raised, thus releasing an eccentric stop (C). The support (H) is then free to move outward, so the operator now pulls the handle (G) toward him and allows the support (H) to hang downward from the hinge (K). He then grasps another handle (E) and pulls it sideways, one way or the other, thus releasing the catch (B) and a similar catch in front, to which it is connected by a longitudinal rod. The body is then ready to be dumped, which is done by pulling out one of the handles (F) and pressing on it easily until the body rolls on its rails (D), the distance through which it rolls being governed by the length of restraining chains under the body. The operator dumps and rolls back the body with the same motion. The support (H) and the catch (B) are then replaced, both front and rear catches being operated at the same time by either the handle at the rear or the similar one at the front of the body.

The body was designed and is made especially for Jeffery Quad truck, manufactured by the Thomas B. Jeffery Company, Kenosha, Wis.



TRUCK CAN BE UNLOADED IN ONE-HALF MINUTE BY AVERAGE OPERATOR

Only One Man Needed to Operate This Back Filler

With its scraper swung from a 25-ft. boom the latest back filler to be placed on the market requires only one man for its operation. The boom is 15 ft. long in its regular size, but by the adjustment of a 10-ft. extra section the 25-ft. length is obtained. The machine is equipped with a 10-hp. Novo engine. The operating levers are located at the rear of the machine and are so grouped that they can be reached by the operator from his seat. A self-acting scraper, 4 ft. wide, built up of steel angles and oak planks, is provided for handling the dirt. The back filler, which it is claimed has made four swings per minute, is manufactured by the Pawling & Harnischfeger Company, Milwaukee.



NEW TYPE OF BACK FILLER IN ACTION

Business Notes.

E. F. Houghton & Company of Philadelphia have purchased outright the American Regulator Company, manufacturer of the American regulator system of temperature control for large buildings, and will enlarge their plant to accommodate the new acquisition. Mr. Bonnet, formerly president of the Regulator Company, will manage the department.

The Syndicate Club, composed of executives of the Garford Motor Truck Company of Lima, Ohio, and officials of parts and material companies, recently held its annual convention at Orchard Island, near Lima. The club was formed to bring together the Garford Company and those affiliated with it in a business way, and it is believed to be the first organization making for a greater spirit of co-operation between the motor truck builder and material manufacturers ever established in the industry.

The Chicago Bridge and Iron Works has moved its general sales office from Washington Heights to the Old Colony Building, 37 W. Van Buren Street, Chicago.

Blaine S. Smith, general sales manager of the Universal Portland Cement Company of Chicago, was elected general secretary of the Chicago Association of Commerce at its annual meeting, held Dec. 8. He has served the association actively for several years as chairman of the Illinois committee and, until now, as chairman of the Ways and Means Committee Council. He was appointed general sales manager of the cement company early this year.

The H. M. Byllesby Company, engineers and constructors, Chicago, have organized the Byllesby Mercantile Corporation, to engage in a general exporting and importing business between this country and Central and South America.

Trade Publications

Southwark Foundry & Machine Company, Philadelphia. Catalog, 8¼ x 11 in., 40 pages, illustrated. The description covers every feature of the Southwark-Rateau centrifugal pump. Appended are instructions for installing, starting, stopping and maintaining centrifugal pumps.

Keuffel & Esser Company, New York City. Pocket handbook, 3 x 5¾ in., 39 pages. Gives solar ephemeris for each day of the year 1916, together with tables of latitude coefficients, mean refraction corrections and other data useful in field astronomy and surveying. Interspersed with the tables are testimonials relative to the company's make of instruments.

Engineering Record

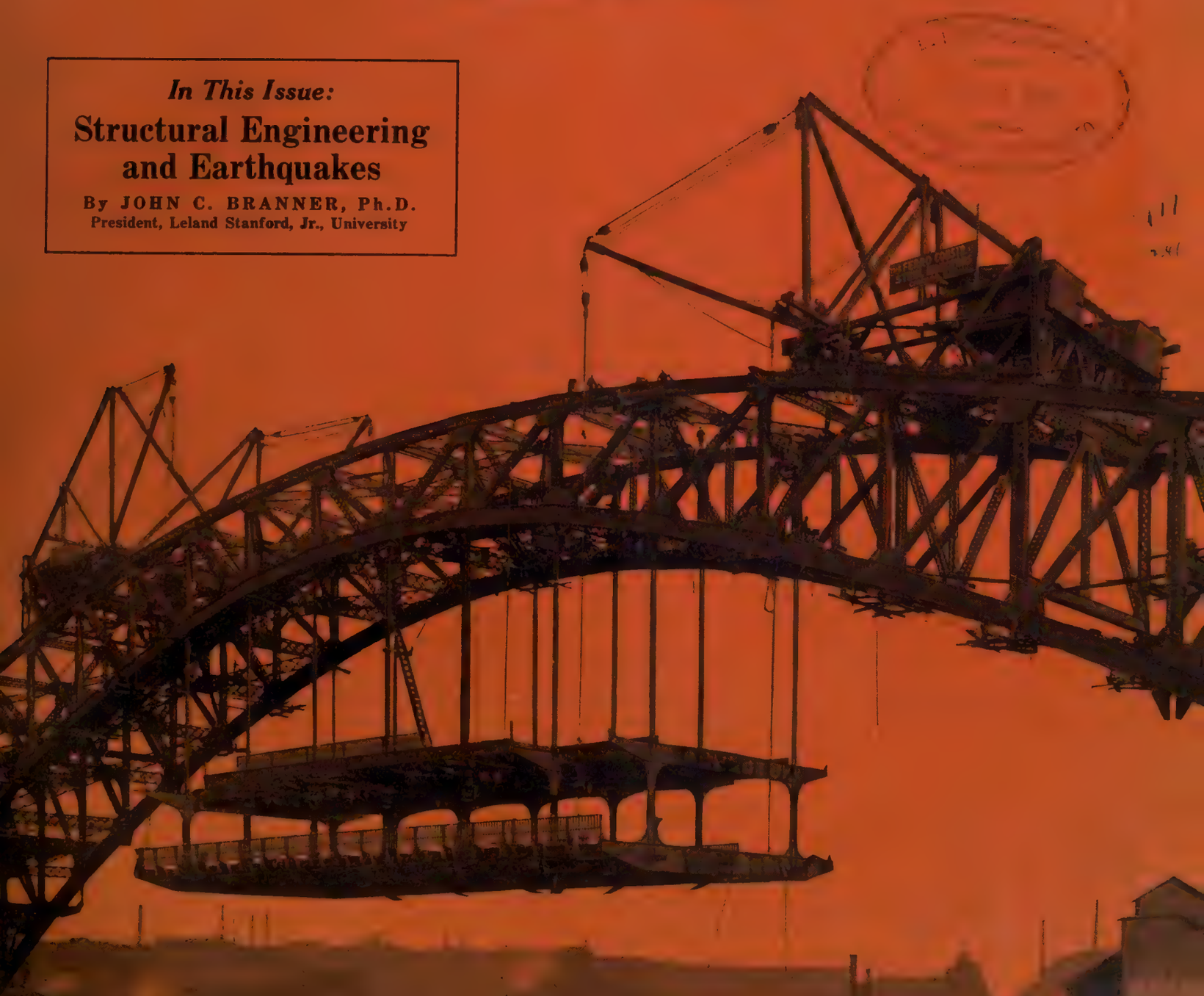
Circulation 20,000 Copies. McGraw Publishing Company, Inc.

December 25, 1915

In This Issue:

Structural Engineering and Earthquakes

By JOHN C. BRANNER, Ph.D.
President, Leland Stanford, Jr., University



Newest Link in Cleveland's Traffic System Nears Completion

After 591-Foot Detroit-Superior Arch — Third Longest in the United States – Was Closed October 8, Work Was Started on Suspended Double-Deck Roadway with Separate Levels for Street Car and Vehicular Traffic Crossing Cuyahoga River.



Architects: Bonfoey and Elliott, Tampa, Florida
General Contractors: McGucken and Hyer, Tampa, Florida
Roofers: Eagle Roofing and Art Metal Works, Tampa, Florida

On Tampa's New City Hall—

TAMPA is building this fine, new city hall at a cost of several hundred thousand dollars. The plans were open to competition and this interesting design was the winner. The size and nature of the contract naturally attracted the ablest architects and as the first-class architects of the country appreciate the superiority of Barrett Specification Roofs, this type was selected to cover the Tampa City Hall.

This is a cycle of reasoning which has become increasingly familiar during the last few years. If it is a large or first-class building it attracts first-class architects and engineers, and the preference of such men is almost always for Barrett Specification Roofs.

That is why you can select at random any large, important, public or commercial building anywhere in the United States that has been built within the past ten years and find, almost invariably, that it has a Barrett Specification Roof.

Such a roof is the lowest priced of all permanent roofs. It requires no care or maintenance expense and is good for upwards of twenty years without repairs. It takes the base rate of fire insurance and is approved by the Underwriters' Laboratories.

You can have a roof exactly like that on the Tampa City Hall by writing The Barrett Specification in full into your building plans.

Hydronon
The Damp-proofing Paint

Especially recommended for use above the ground level on the interior of stone, brick or concrete walls to exclude dampness.
Has superior covering capacity and is vastly superior to other paints in its permanence and resistance to dampness. Booklet on request.

Tar-Rok Sub Floors

This construction provides the most suitable surface on which to bed plank (without the use of sleepers) where a wooden lower floor is desired in factory, machine shop, storehouse, etc., effecting a maximum of strength, rigidity and protection against dry rot, decay or fire, at a nominal cost. Booklet on request.

A copy of The Barrett Specifications, with roofing diagrams, free on request.

BARRETT MANUFACTURING COMPANY

New York Chicago Philadelphia Boston St. Louis Cleveland Cincinnati Pittsburgh
Detroit Birmingham Kansas City Minneapolis Salt Lake City Seattle Peoria
THE PATERSON MFG. CO., LIMITED: Montreal Toronto Winnipeg Vancouver
St. John, N. B. Halifax, N. S. Sydney, N. S.

TRADE B MARK

Engineering Record

A Weekly Journal Devoted to Civil Engineering and Contracting

Published by McGraw Publishing Company, Inc.

Volume 72 NEW YORK, SATURDAY, DECEMBER 25, 1915 Number 26

777

Greetings!

CHRISTMAS GREETINGS from a magazine to its readers are likely to appeal to the recipient as cold and formal. Yet the Engineering Record feels that it may occupy in its readers' minds a somewhat different position—that to them it is invested with a distinct personality which make its greetings welcome. And it entertains that belief because of the friendly comments with which each step in its progress has been received. Readers from the four points of the compass have expressed their views, now commending a departure, now criticising another, but always in a constructive way. Therefore, most heartily do the editors extend to the readers of the Engineering Record their wishes for a Happy Christmas. May the New Year hold for each a full measure of peace and happiness, as well as of material prosperity.

Passenger-Rate Decision

MUCH ENCOURAGEMENT for the railroads is to be found in the award of the Interstate Commerce Commission in the Western passenger-rate case. The commission has come near to granting all that the railroads asked, especially to the roads of the northern group, where the 2½ cents sought for interstate business was reduced only to 2.4 cents. In the southern group the grant was 2.6 cents in lieu of the 3 cents sought. Rates for mileage books for the two groups are raised from 2 to 2¼ and 2½ cents respectively. As the increases are expected to bring the railroads from $30,000,000 to $40,000,000 annually, there is no need to quibble over the exact figures of the award. The significant feature is that the commission, despite the usual army of state commissioners seeking to discredit the railroads' statistics, has reached such a decision with but one dissenting vote.

Single Highway Convention

IN THE ISSUE of Nov. 20 this journal expressed the opinion that it would be impossible to effect a permanent arrangement whereby the American Highway Association and the American Road Builders' Association would hold a joint meeting annually. It was pointed out then that engineers and manufacturers had not adhered to their determination expressed time and again to attend only one national meeting each year. It appears now, however, that there is a new determination to bring the two associations together—to force them together, if need be. The American Association of State Highway Officials at its meeting in Chicago week before last pledged its members not to attend any national meeting before Dec. 1, 1916, while the manufacturers of road materials and equipment reached the same conclusion at a meeting in Worcester last week. If both classes will stick to their determination, there is promise that the present absurdity of attempting to hold two national congresses, in which ideas and papers are very largely duplicated, may be forced into the realms of highway history.

"Cubic Performance"

IN LAST WEEK'S issue, page 751, Leslie C. Frank, sanitary engineer of the U. S. Public Health Service, defined "cubic performance," a term suggested by him to make easy a comparison of the performance of sewage or water-treatment plants. Cubic performance, as explained by Mr. Frank, is the number of unit volumes of liquid treated per unit volume of device in a unit of time. It is, therefore, essentially a means of making operating comparisons. Sanitary engineers will be quick to appreciate its value. It offers a convenient method of comparing one plant with another, even though the two be of dissimilar type. In the past this has been well nigh impossible, for it involved a mental co-ordination of half a dozen different terms. Every engineer realizes that until recently it has been far more difficult to compare water or sewage plants in terms of operation than in terms of design. In fact, until a committee of the New England Waterworks Association began work a few years ago, operating statistics for water purification plants in the United States were in a condition little short of chaotic. Each operator was telling his story, figuratively, in a different language, and translation was arduous and unsatisfactory. From this statistical babel there was evolved a uniform method of reporting analytical results that allows of intelligent comparison of different plants. The proposal of the term "cubic performance" is further evidence of this effort to simplify the interpretation of operating data. It should prove of great value in the study of the volume performance of sewage and water-treatment plants.

"Special Availability" Value

VALUE for "special availability" of certain lands for reservoir, railroad location and other sites has been a subject frequently discussed among engineers. The matter has been before the Supreme Court of the United States on at least two occasions, but apparently the issue was not clearly enough joined to convince lawyers and the judges of inferior courts as to the attitude which the supreme bench would take. Early in November the court handed down a decision in favor of the city in the case of the City of New York vs. William Sage, Jr., in which $7,600 had been allowed for land and buildings in the Ashokan reservoir site and $4,300 for "reservoir availability." The city contested the award but lost in the U. S. Circuit Court and in the Circuit Court of Appeals. The Supreme Court reverses the inferior courts and declares that no allowance should have been made for "reservoir availability." The court says, "What the owner is entitled to is the value of the property taken, and that means what it fairly may be believed that a purchaser in fair market conditions would have given for it in fact—not what a tribunal at a later date may think a purchaser would have been wise to give, nor a proportion of the advance due to its union with other lots. The city is not to be made to pay for any part of what it has added to the land by thus uniting it with other lots, if that union would not have been practicable or been attempted except by the intervention of eminent domain. Any rise in value before the taking, not caused by the expectation of that event, is to be allowed, but, we repeat, it must be a rise in what a purchaser might be expected to give." The decision naturally is one of very great importance to municipalities and public service corporations.

The Newlands' Resolution

SENATOR NEWLANDS has offered a resolution providing for the appointment of a joint committee to investigate the present status of the railroads. This solution is in accordance with the suggestion made by the President in his recent annual message to Congress. Five Senators and five members of the House of Representatives would compose the committee. The object, as stated in the preamble to the resolution, is to safeguard adequately the interests of the public while "securing the establishment and maintenance of transportation facilities adequate to the needs of a growing and expanding commerce, and assuring to private owners and the investing public just consideration and protection of legitimate rights of property." One must view the resolution with conflicting emotions. If the committee be fair, great good will be done to the country at large by its investigation. If it conduct its studies in a prejudiced attitude, the condition of the carriers is likely to be worse after the investigation than it is now. By and large, however, it seems impossible to pick ten men from Congress and

not secure at least a modicum of those who appreciate that the prosperity of the country is intimately related to the prosperity of its transportation systems. While much will depend upon the personnel, therefore, the chances are at least even that the salient facts in the present unsatisfactory condition of our railroads will be brought out. The resolution, therefore, should prevail.

Making Effective Reports

IN ANOTHER week the year's work will end and the preparation of the annual report will be in order. Considering the thousands of state, city, town and county engineering departments throughout the United States, the aggregate amount of labor which will be expended on these documents will be stupendous, and yet most of the effort will be wasted—or at least it will be if the 1915 crop of reports resembles its predecessors. It is not too late, however, for engineers to cast aside precedents and produce reports which taxpayers will understand and will want to read. If ever this effort were neded it is now. During the year now nearly past the war held up many urgent public improvements. Contract work dwindled to a mere shadow of its normal volume, and engineers were idle. The dawn of a new activity is at hand and engineers must indicate what improvements are needed and get the backing of the public for these works. The annual report, therefore, should bring before the people a clear picture of the improvements urgently needed. The report should deal with vital matters. The trivialities—tiresome tables of valve and hydrant locations, personnel of the stenographic and clerical forces, inventory of equipment, etc.—should be omitted. The report should be readable—a message of engineering achievement and a prospectus of the work needed. Finally it should be issued as soon as possible, the broad facts being given to the newspapers just as soon as possible.

All Construction Will Be Hampered

MUCH comment has been received by this journal with reference to the editorials it has been publishing on the need for letting next year's contracts as early as possible. Among the commendatory letters are some that indicate that the writers are under the impression that only construction in which steel is used in large quantities—such as in steel bridges and buildings—will the pinch be felt. This is not the case—and for two reasons. In the first place, the prices of all materials are going up, on account of the better demand, while the higher wages in all the producing centers will certainly be passed along to the consumers. In the second place, manufacturers of contractors' equipment are having difficulty in securing the necessary supplies. Consequently contractors' plant will cost more and this cost necessarily will appear in the unit figures in next year's bids. Instances have been cited in recent editorials of increases in manufacturers' prices. At this writing there is a letter at hand from a large manufacturer of road-building machinery in which, after agreeing to accept orders until Jan. 1 on this year's prices, the prediction is made that equipment bought next year will cost from 25 to 50 per cent more than at present. This manufacturer's view bears out what the Engineering Record has learned from other equipment makers, except that most of them feel that the increased cost may go above 150 per cent of this year's figures. Moreover, many manufacturers will not, after the first spring rush, be able to accept orders except for late summer delivery. This journal, therefore, repeats its former warnings to engineers throughout the country. There is a serious obligation on them, to act quickly, to have their contracts, whether requiring steel or not, let as soon as possible.

Influence of Liability Insurance

LIABILITY insurance probably has done more than any other factor to convince the contractor that the provision of safe working conditions is a paying investment. As long as the matter of compensation was left to the courts, the contractor took chances. Little was done to prevent accidents, as courts could take no action until after the fact. Educational efforts were needed to show contractors as a class that unsafe working conditions were not necessary, that accidents were just as bad for the contractor as for the victim and the public, and that safe conditions paid many times over for their trifling cost.

The large insurance companies, notably the Travelers, which was one of the first to write contractors' liability insurance, have taken up this educational work in a thorough and efficient manner. The results have been great, and must be gratifying to those who had the vision and the courage to carry out the campaign. A most powerful lever was in the hands of these men in the shape of the premiums charged. Contractors soon recognized that such insurance was cheap at any price. They also learned that if they followed the suggestions of the insurance companies and carried out their work in a safe manner, their rating would improve and their premiums decrease. Soon the Travelers was in so strong a position that it could require and receive immediate co-operation from the contractors insured with it. Its force of inspectors now visit at frequent intervals the contracts on which it has written policies. They are given every facility by the contractor's forces and the strictest heed is paid to suggestions as to improving the working conditions. The company, however, does not stop here. It maintains an engineering force which investigates working condtions to the end that it may develop and codify good practice. It publishes literature on safety precautions and circulates it as widely as possible. The latest work of its engineering staff, a comprehensive summary of the best American scaffold practice, is reviewed on another page of this issue.

Until the state insurance funds take up the subject with a similar broad vision, it is difficult to understand how they can fill the place of the private companies, or how they can be of the same service to the country in the most important phase of the liability question—that of actually reducing the number of accidents.

Will Pacific Coast Engineers and Corporations Help?

ELSEWHERE in this issue is an authoritative article by Dr. John C. Branner on the relation between earthquake faults and the design of engineering work. It carries an appeal which in the past has fallen on deaf ears, but which ought to find a ready response among engineers, contractors and large corporations on the Pacific Coast.

Dr. Branner points out that earthquakes generally are not dangerous, and that there are hundreds of shocks of no importance as far as damage is concerned. The least of these shocks, however, if proper data were gathered about it becomes important in a scientific way, for the data would help in the location of the active faults, where earthquakes originate and whence they spread.

Severe damage, when there is such, is due to the fact that structures are built across these faults. If the location of the faults can be determined with exactness, engineers will avoid them when possible. If it is necessary, however, to carry an aqueduct across a fault line or even to build a dam in a faulted valley, the type of structure will be chosen that will be least damaged by a shock, and suitable repair materials will be held available at the points of crossing.

It is necessary for the integrity of many engineering structures in earthquake zones that the active faults be accurately located. Manifestly the gathering of such information by the maintenance of a large and scattered corps of scientific investigators, equipped with seismographs, is out of the question. Fortunately, however, data that any layman can record are sufficient to aid in the location of the active faults. If he will but record the time of the shock and describe the extent of the disturbance—whether building frames creaked and dishes were rattled, whether chimneys were thrown down or buildings destroyed—his note together with those of hundreds or thousands of other observers in the earthquake zone, will help to locate the responsible fault.

Manifestly this is a work in which individuals can help, but the greatest assistance can be rendered by the public service corporations—telegraph, telephone, power and railway companies—which have employees scattered over wide areas on the Coast. These men are obliged to report to headquarters daily, and if the good-will exists, the corporations can at little or no expense gather observations from the entire territory affected. The work deserves the hearty support of every engineer, contractor and corporation on the Pacific Coast.

Supply of Explosives

ONE instinctively wonders as the colossal war progresses how the necessary supply of explosives is kept up. One answer to the question is that it has not been kept up until recently, so that the Allies, in particular, may have been somewhat hampered by lack not only of shells, but also of explosives with which to fill them. Probably the mere mechanical difficulty of getting the requisite number of shells is now overcome, but a bombardment extending almost inch by inch over miles of trenches requires an amount of high explosives that staggers the imagination.

In the good old times the use of firearms depended on a plentiful supply of "villainous saltpeter," and the nation bereft of it was hard pressed for ammunition. Indeed it was not many years ago when one could with some justice fancy that if the niter beds from which practically the sole supply was derived became exhausted, bellicose mankind might have been forced back on pike and long bow to gratify his blood-letting inclination. But the advance of science has changed all that, and while the shift of scene has not been so swift as in the case of the fine old Japanese colonel, mentioned by Ashmead Bartlett, who in his youth fought in chain mail and with a battleaxe, and lived to survive desperate wounds from machine-gun fire in the capture of 203-Meter Hill, yet the time has come when niter is almost a non-essential, because the engineer can rob the atmosphere to procure the nitric acid which is the fundamental requisite for all modern explosives. Characteristically enough the center of the nitrogen-fixation industry is in Germany and Scandinavia, so that if natural resources should run short artificial ones will still be at hand. Plants of this kind were several years ago turning out nitric acid at the rate of as high as three-quarters of a ton per kilowatt-year, and it is well understood that this yield has now been considerably increased so that peace by exhaustion of the nitric acid supply is a hopeless dream.

Turning now to the other materials for which the world is calling in the war, practically all military explosives are obtained by the nitration or the treatment by nitric acid of one of three groups of materials: cellulose, the essential constituent of plant fibers; glycerine, and the group of hydrocarbons best known by its two familiar members, benzol and toluol, both obtained from coal tar. With the first two of these group products the United States is peculiarly well provided—in its enormous cotton crop and ample supply of hog fat. Moreover, there is extreme activity in obtaining from gas works and coke furnaces the coal tar which is the basis of the third. Germany is peculiarly rich, as everybody knows, in coal-tar resources, but is a little short of the other things necessary, hence the fervent calls for cotton supply.

There has been considerable discussion as to the reason for the demand for cotton by powder makers when other sources of cellulose are found plentifully in every vegetable material. A full answer to this question would lead into intricate technicalities, but in a broad way the facts are as follows:

All the smokeless explosives used for firearms are made, substantially, of nitro-cellulose, although some of them are strengthened with nitro-glycerine to the extent of from 10 to 40 per cent. Nitro-cellulose means a great many things, according to the point to which the nitration is carried. If pushed to the limit it results in gun cotton, quite too violent for successful use, although the Austrians tried it for artillery service more than a half-century ago. If the process of nitration is carried less far milder compounds result, some of which make excellent propellants. But there is quite a series of these, and to get the right ones in the right proportions for use as gunpowder is a rather troublesome chemical problem, the solution of which requires a very high degree of technical skill and also favorable material on which to operate. The same nominal process carried out on cellulose derived from different sources does not yield the same results, and perhaps cannot be made to yield them. Even with the purest raw cotton as the basis it is a notorious fact that two batches of powder produced by the same process may vary considerably in propelling force. If one tries nitrating other varieties of cellulose the result may be a powder too strong, too weak, or too unstable. Explosives of a sort can be obtained by nitrating all sorts of vegetable material, even starch and sugar. But working a purely chemical process is not at all so simple a thing as grinding up and treating in a systematic manner the weighed quantities of niter, charcoal and sulphur from which black gunpowder was made. It has been reported recently that the Germans are making smokeless powder out of wood pulp, as was done with modest success in this country more than twenty years ago, but there is no doubt that lack of cotton, the easiest and most uniform material to work with in powder manufacture, must prove a great inconvenience, to say the least. Little wonder that England tries to hold up the cotton supply when every pound of it means several hundred rounds of small-arms ammunition for her enemies.

The nitro-glycerine compounds are not used as propellants save in the limited way just mentioned, and they are too sensitive to be fired in ordinary shells, although they doubtless might be excellently utilized by air craft. The extensive quest for glycerine material in this country must therefore be charged to the use of the nitro-compound as accelerator in smokeless powders. In fact, such accelerated powders have been standard in several foreign services, notably the British. So long as the supply of fats holds out there will be no lack of glycerine, which is a large constituent of all of them, and can be freed by easy means. In Germany, reports say, fats are not so plentiful as in the early stages of the war. The lack of fats for cooking is predicated likely on the consumption for ammunition making. In this country and among the Allies adequate supply of powder for propelling purposes becomes merely a matter of building factories on a big scale, whether the explosives are to be made of nitro-cellulose alone or be accelerated with nitro-glycerine.

As to the third class of high explosives, derived from benzol and allied substances, the case is altogether different. A plentiful supply of raw material demands almost the building up of a new industry, the importance of which turns on the fact that all the enormous quantities of high-explosive shells, used literally by the million, are charged with this particular class of explosives which cannot be replaced by anything yet discovered. Their unique advantage lies, first, in the fact that they are stable enough to endure the shock of firing in shells, and, second, that they, so to speak, pack well in the shell, thereby increasing the quantity which can be charged and, necessarily, the violence of the explosion. Everyone remembers the somewhat futile attempts to develop dynamite-throwing guns fifteen or twenty years ago. Dynamite is far too tender for throwing over long ranges at high velocity. The two explosives now practically in universal use are the much-talked-of picric acid and trinitrotoluol, the first of which is widely used under the names of mélenite in the French service and lyddite in the British. Picric acid is nothing but a nitrated carbolic acid, the latter substance being a very simple derivative of benzol with coal tar as a source, while trinitrotoluol results from the nitration of toluol, a very close analogue of benzol and from the same source. About 2 per cent each of benzol and toluol can be taken out of coal tar by careful treatment, and it is on this meager product of the distillation of coal that the high-explosive campaign turns. It is no wonder that the price of carbolic acid shot up with the very beginning of hostilities. Both of the resulting explosives are of nearly the same power, weight for weight, as gun cotton, but as they can with proper precautions be safely melted and poured into the shells in a solid mass, a considerable weight can be got into the shell cavity, and a correspondingly powerful explosion obtained. Before a really liberal supply of them can be produced, plants for the direct or incidental production of coal tar must be multiplied and every precaution taken to save the tar now produced as a by-product. Heretofore much of it has been wasted or used merely as tar, except in Germany, where the color industry has conserved these valuable resources.

The explosive industry, if it does nothing else for us in this country, will check a little of our characteristic wastefulness. Meanwhile Germany, having learned to waste nothing, has far and away the best facilities for turning out these destructive products, which seem indispensable for the purpose of rooting the defenders out of their trenches and blowing the most carefully prepared fortifications off the face of the landscape.

To sum up the situation, an indefinitely great amount of propelling explosives, sufficient for even a world at war, can be turned out from the cotton crop and the easily enlarged nitric-acid-producing capacity. The high explosive demand can only be met by the organization of new industries, now rapidly going on, but far from complete accomplishment.

Structural Engineering and Earthquakes

Dangers Are Mitigated by Exact Location of Active Faults—Engineers, Large Corporations and Interested Individuals Can Easily Help to Gather Needed Information

By JOHN C. BRANNER, Ph.D.
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[*Dr. Branner points out that earthquakes generally are not dangerous, and that what danger does attend severe shocks can be mitigated, so far as structural damage is concerned, by determining the exact location of active faults. He points out how simple the collection of the desired data is, though it requires co-operation from many individuals over a wide area. He urges engineers, large corporations and others in earthquake zones to co-operate with the Seismological Society of America in gathering the needed information.*—EDITOR.]

OVER most of our country earthquakes are so infrequent that they are not taken into consideration by structural engineers. There is, however, a broad zone lying between the Rocky Mountains and the Pacific Ocean in which earthquakes are locally more or less frequent. Most of the shocks felt even there are quite harmless, to be sure, but occasionally there is one that makes our engineers feel a bit uncomfortable, while at long intervals there are shocks that do, or are capable of doing, serious damage to bridges, railways, dams, water mains, tall chimneys, and other costly structures.

NEGLECT OF THE SUBJECT

Hitherto architects, engineers, and contractors have paid but little attention to the risks from earthquakes. The reason for this lack of attention is due partly to the fact that many of the engineers who have charge of works in the earthquake zone of our country have grown up and been educated in the East, where such phenomena are negligible, or they are accustomed to see earthquakes ignored even in the earthquake zone itself.

The California earthquake of 1906, however, offers a lesson to our Western engineers that they cannot afford to neglect. Unfortunately most of them *are* forgetting that lesson as rapidly and as completely as possible.

The following letter received some years ago shows that some of our engineers are looking to the future as every conscientious engineer should do:

"The ——— Company, of which I am the chief engineer, proposes to build several reservoir dams in the States of ——— and ———. If the Seismological Society of America can give me or refer me to information about the frequency and character of the earthquakes in those States it will enable me to determine the types of structures indicated."

Owing to the fact that no such information is in existence, my reply to this letter was short and disappointing both to the engineer and to me. The question is a perfectly reasonable one, however, and every structural engineer who has to do work west of the Rocky Mountains ought to be able to lay his hands on the kind of information this man asked for.

Why is it that such data are not available? It is because up to the beginning of the publication of the "Bulletin" of the Seismological Society of America in March, 1911, there was no systematic collecting and publication of such data in this country. There were indeed several seismologic stations in operation before that time, and the stations established by the Jesuit Fathers were especially active, but the data collected were confined to records made by seismographs, and were hardly available to the public.

Efforts were made from time to time to have the scope of the work of the U. S. Weather Bureau so enlarged as to include records of earthquakes, but for some reason that the public is not acquainted with this reasonable recommendation was not approved until about a year ago. In time the records of the Weather Bureau will be available for engineers, and there is every reason to expect that they will eventually be of great value.

ORDINARY SHOCKS NOT DANGEROUS

But much more is needed. The co-operation of intelligent people all over the country is necessary; but for two reasons it is difficult to get that co-operation.

First, the frequency of light earthquake shocks on the west coast is, in itself, a difficulty, for the very reason that most people are accustomed to them, and there is therefore nothing either alarming or impressive about them—outside opinion to the contrary notwithstanding. In a region where earthquakes are common it is a frequent experience to hear a remark like this in the middle of a conversation: "By the way, did you feel that earthquake last night?" and after a yes or no, the conversation goes on without further interruption. The general result of this attitude of mind is that most people think too little of the matter to formally report the time and intensity of the shock; it does not really seem to be worth while. And indeed, if the observations of any single individual be taken alone, they are not worth while; it is only when a large number of observations by different persons are brought together that they mean something and become valuable.

SUPPRESSION OF INFORMATION

A second and more serious obstacle is the attitude of many persons, organizations, and commercial interests toward earthquakes in general. The idea back of this false position—for it is a false one—is that earthquakes are detrimental to the good repute of the west coast, and that they are likely, if reported, to keep away business and capital, and therefore the less said about them the better.

This theory has led to the deliberate suppression of news about earthquakes, and even of the simple mention of them. Shortly after the earthquake of April, 1906, there was a general disposition that almost amounted to concerted action for the purpose of suppressing all mention of it. When efforts were made by a few geologists to interest people in the collection of information in regard to it, we were advised, and even urged over and over again, to gather no such information, and above all not to publish it. To people interested in science and accustomed to the methods of science, it is not necessary to say that such an attitude is false and untenable, and can only lead, sooner or later, to confusion and disaster.

STRUCTURES MUST AVOID FAULT LINES

The only way we know of to deal successfully with any natural phenomenon is to get acquainted with it, to find out all we can about it, and thus to meet it on its own grounds. That is the way mankind has succeeded thus far, and it is safe to conclude that it is the only way it ever will succeed.

In the first place, the great majority of earthquakes experienced in the earthquake zone are not dangerous in any sense whatever; while the suppression of information regarding them leads those who live elsewhere to the entirely natural but erroneous conclusion that they are all dangerous. On the other hand, if there are places so liable to destructive earthquakes that houses, dams, bridges, and other structures should not be built in them, or, if built, must be specially constructed with a view to withstanding earthquakes, then we think engineers should know where those places are. If certain types of structures are dangerous, we think it ought to be known what they are. Certainly nothing is to be gained by shutting our eyes to genuine dangers, or by exaggerating or encouraging others to exaggerate perfectly harmless shocks into serious dangers.

DATA NEEDED

To meet the practical problems of earthquakes we must find out about them; and we certainly cannot find out about them if we are not informed, or if we are misled or misinformed. We are convinced, also, that the terrors that earthquakes have for mankind are largely attributable to our own ignorance. The more we know about them the less harm they can do us, and the less reason we shall have to fear them. So that, after all, we come down to this absolute necessity: In order to deal successfully with earthquakes, we must have trustworthy information in regard to the time, the place, and the character of them.

The Seismological Society of America was organized for the purpose of finding out all it can about earthquakes, and for studying their phenomena for the purpose of getting all the light it can on the subject.

It is not unusual to find the opinion that earthquakes are among the ills of life that we must put up with as they come along; that there is no preventing them, and that there is no relief to be had from them. Prevent them we cannot, but I am far from being an alarmist on the subject of earthquakes. Indeed, the more I know about them, the more confident I am that their dangers, if met intelligently, can be almost completely done away with.

But if those dangers are to be minimized, the earthquakes themselves must be studied and the remedies indicated must be applied.

Active and Inactive Faults

We already know that earthquakes are more frequent in some places than in others, and we know that some of them—perhaps most of them—are produced by movements or displacements of the rocks forming the crust of the earth. We know, too, that these lines of displacements, or fault lines as they are called in geology, are abundant in some parts of the globe and uncommon in others. The strains that accumulate in the rocks near the surface of the earth, on account of change of volume or for any other reason, are likely to be relieved along the fault lines, because it is there that movement is easiest.

It is evident, however, that some faults yield under strain much more readily than others, and it therefore comes about that, in earthquake regions, some of the faults are what may be called active, while others are sealed up and are active no longer.

Locate the Active Faults

The region spoken of above as an earthquake zone is one full of faults, though most of them are not active. Geologists can work out the locations of the faults readily enough as a rule, but they cannot so readily distinguish between active faults and those that have ceased to be active. And in order to serve mankind it is especially important that we should be able to ascertain which of the faults are active.

Geologists are acquainted with certain features about faults that suggest their recent activity, but such features furnish contributory evidence rather than direct evidence of activity. If we could have thousands or even hundreds of seismographs installed and carefully maintained all over the country, the active faults might, in time, be located. But on account of its expense such a method is not practicable. The only way that seems to be available for determining them is to locate by personal observations the epicenters of earthquakes as the shocks occur. This method has been used in California since 1911, and, so far as can be judged, it promises to enable us eventually to recognize the planes or centers at which the serious earthquakes originate. But it will require many years of patient recording, reporting, and publishing of the results before there will be data enough available to be of considerable service to engineers.

Many Personal Observations Needed

In brief, the plan is, whenever an earthquake occurs, to determine the distribution of its severity or intensities from personal observations, in connection with seismographic records, and thus to locate its point or line of emergence at the surface, or the center from which the shock radiated. Judging from what we know or suspect, it will eventually appear that these centers of disturbance are more or less fixed, and that, over and over again, the earthquakes will occur in the same places, or will emerge at points along certain fault lines. Thus it will be possible in time to know which faults are active, and this knowledge will enable engineers to avoid locations that are dangerous, or if they cannot be avoided to otherwise provide against disaster.

Some months ago I had occasion to tell one of our leading engineers that a large water main, to be constructed under his direction, would be obliged to cross an active fault line, and that, soon or late, the main would be broken by a dislocation that could not possibly be avoided or resisted. The engineer asked to know the precise location of the fault, and on its being pointed out, he said that it would be easy enough to so provide for such a break that it would do the least possible damage, and could be promptly repaired.

This particular case shows how simple the problem becomes, once the location of a dangerous fault is really known. But this is an exceptional case, for while this one fault is known to be active, there are evidently others that are not known as active faults, and the only way to know them is to gather information about them.

Lack of Co-operation

The efforts of the Seismological Society to bring such information together have thus far met with only partial success, owing to the lack of co-operation over wide areas and on the part of a large number of people, including the engineers themselves.

There are many important enterprises in the West that are liable at any time to be seriously damaged by earthquakes, and neither the corporations nor their engineers appear to give a moment's thought to what earthquakes are liable to do to their structures any day.

In the collection of earthquake data the Seismological Society has the co-operation of just one large corporation. The others are trusting to luck, and engineers know whether luck is a thing they can depend upon comfortably.

If we could have the prompt co-operation of the large power, water, railway, and telegraph and telephone companies that operate in the western earthquake zone, we should soon have the active faults located, and should be in a position to refer engineers and contractors to information of the greatest value in connection with the location and character of their proposed structures.

What the Individual Can Do

The information wanted in regard to earthquakes is anything that will give an idea of the severity or intensity of a shock every time one is felt. The observer only needs to tell where he was when it was felt, the time as nearly as an ordinary watch or clock will give it, and what happened—that is, whether dishes, windows and doors were rattled, whether furniture and other things were upset, plaster cracked, or chimneys thrown down.

Some very valuable suggestions have occasionally been obtained from persons using the telephone at the time of an earthquake, by one of the parties observing the shock after the other one mentioned its occurrence at the opposite end of the line. A note that can be written inside of two minutes is often of great value when taken in connection with other similar notes.

No one needs apologize for any fact he sends in. To our requests for information about earthquakes we are frequently told that "I don't know anything about earthquakes." There is but one reply to be made to such remarks, and that is that "we know precious little about them ourselves; we are just now trying to find out, and we want your help."

[The address of the secretary of the Seismological Society of America, to whom notes of eathquakes should be sent, is Stanford University, Cal. The annual subscription to the quarterly "Bulletin" is $2. The secretary is Dr. S. D. Townley.]

Concrete and Fine Earth Form Core Wall in Rock-Fill Dam

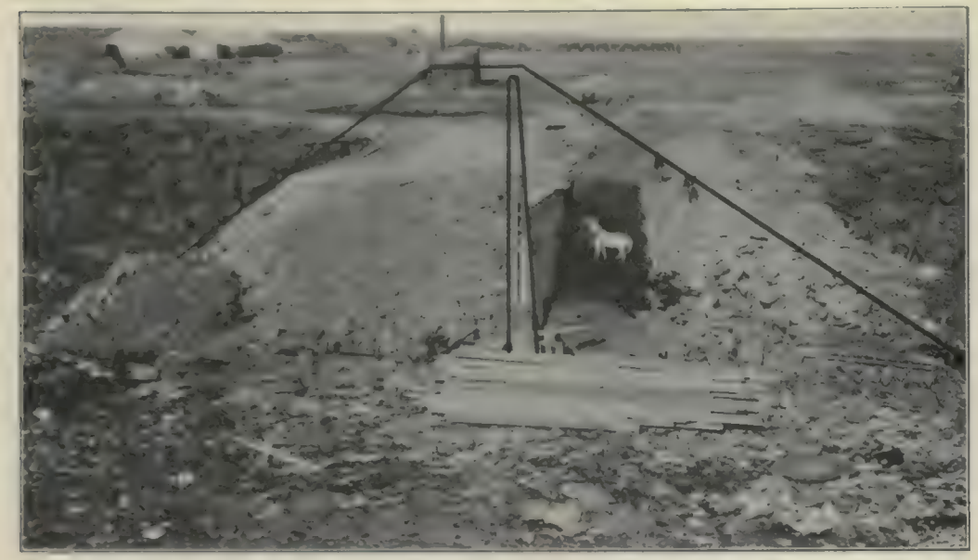
Irrigation Reservoir Dam in Seamy Volcanic Canyon Where Earth Was Scarce Rendered Tight by Special Treatment

THE Smith rock fill dam on volcanic rock in the San Luis valley, Colorado, was rendered watertight by the use of a core wall of concrete backed up with selected earth. The structure, which was completed in 1914 to irrigate a portion of the 60,000-acre Trinchera Irrigation District, impounds 5000 acre-ft. of water and required a special type of construction to satisfy local conditions. The site is in a canyon 40 ft. deep and 200 ft. wide. The abutment walls and bottom consist of layers of volcanic rock containing many small seams of clay material which borings showed extended for a distance of at least 50 ft. below the surface of bed rock across the canyon.

The dam extends to a height of 43 ft. above the present bed of the stream, and economy of construction made it necessary that all the material forming the fill be taken from the spillway, which was designed of such dimensions that the excava-



FLUME FROM ROCK-FILL DAM TRAVERSES VOLCANIC ROCK COUNTRY



HORSE AIDS MEN IN TAMPING EARTH BLANKET NEXT TO CONCRETE CORE WALL

tion made would balance the fill required.

A watertight diaphragm was constructed by excavating a trench from 10 to 15 ft. below the surface of bed rock across the canyon and for about an equal distance into the abutment walls of the canyon. This trench was entirely filled with 1 to 5 gravel concrete containing about 35 per cent of plums. The core wall was located just inside the top of the slope on the water face of the embankment. At the surface of bed rock it was narrowed to 5 ft. in width and continued to within 18 in. of the crest of the dam, where the thickness uniformly diminished to only 18 in.

EARTH BLANKET BACKS CONCRETE

On the water face of this core wall was placed a blanket of selected earth, tightly compacted, 8 ft. wide on the high water line of the reservoir and 16 ft. wide at the foundation of the embankment. At the back of the core wall was constructed a loose rock drain 3 ft. wide extending over the whole face of the core wall and connected with a similar drain in the stream bed leading to the lower toe of the embankment.

The fill on the downstream side of the dam is from the borrow-pit run from the spillway excavation, except that for the lower toe, which consists of large boulders placed to prevent wave wash during the operation of the spillway. On the upstream side beyond the earth blanket was placed borrow-pit run from the spillway excavation, except the outer 10 ft., which is formed of large selected rock, hand placed to provide a substantial riprap.

OUTLET PIPE VALVED AT BOTH ENDS

The outlet is constructed of one 48⅜-in. steel pipe incased in not less than 9 in. of concrete, and placed in a trench in solid rock extending for the entire length of the culvert to at least the center of the line of pipe. The discharge is controlled by a Ludlow sluice gate on the upper end of the outlet, which is operated by a stem extending up the slope of the embankment. The downstream end is fitted with a 48-in. single gate valve.

Those in charge report that the operation of this reservoir during the past season has shown this type of construction to be efficient for the existing conditions. There has been no seepage through or under the embankment with the reservoir practically filled, and only about 0.1 sec.-ft. of seepage through crevices in the abutment walls of the canyon beyond the lines of the core wall. There has been practically no settlement of the structure.

SEQUENCE OF CONSTRUCTION

To obtain the deserved degree of watertightness and to make sure that the diaphragm would be placed to the best advantage the specification clearly defined the sequence of construction. The entire cut-off trench across the base of the dam between the abutment walls was completely excavated and during the prosecution of this work the culvert trench was excavated and prepared for placing the outlet culvert. The preparation of the foundation for the embankment was carried on at such time as not to interfere with the placing of embankment as the construction progressed. The work as a whole was so prosecuted as to carry up the rising embankment and concrete facing wall to such an elevation as to divert the water through the outlet culvert at the earliest time practicable. Excavation of the spillway was completed in time to provide safety for the embankment immediately on its completion. The spillway dike was constructed at such times during the prosecution of the work as was most convenient to the contractor.

The conduit from this reservoir extends more than a mile through the canyon to its lower end and consists of No. 132 Lennon galvanized flume mounted on standard trestle bents spaced on 16-ft. centers on tangents and on 8-ft. centers on curves. All bents are founded on concrete pedestals.

The Phillips Construction Co. & O'Gara, of Denver, were the contractors, for whom J. M. Scott was superintendent, and O. E. Shelbourne and C. H. W. Smith, respectively, were engineers in charge of the construction of the dam and the flume line. George M. Bull, consulting engineer, Denver, designed the structures and supervised the construction as engineer for the Trinchera Irrigation District.

Rock Temperatures in Deep Tunnels Recorded

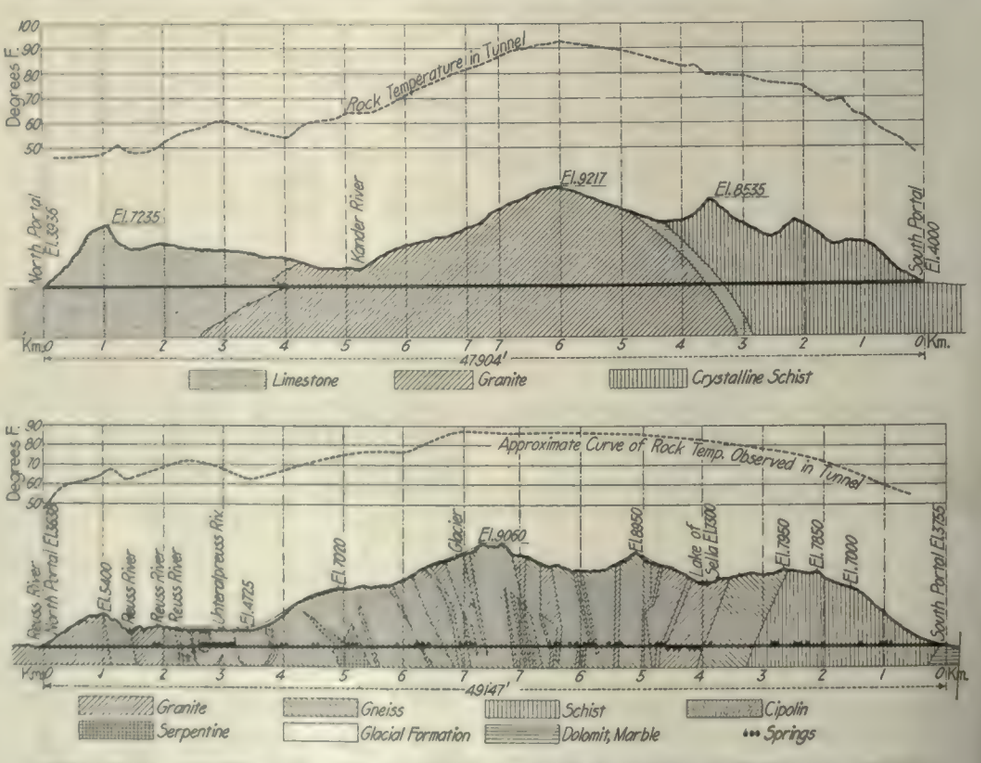
Observations of Underground Temperatures at the Lœtschberg and the St. Gothard Tunnels Show Influence of Local Conditions

By EUGENE LAUCHLI

Civil and Hydraulic Engineer, New York City

OBSERVATIONS on underground temperature made by the engineers in charge of driving the lately completed Lœtschberg tunnel have added valuable information to similar observations made in connection with long and deeply overlaid tunnels previously driven.

The maximum elevation of the range penetrated by the Lœtschberg tunnel is 9217 ft. and the maximum depth overlying the tunnel, about 6 kilometers from the south portal, is 4887 ft., as shown in the diagram. The materials penetrated consist chiefly of limestone on the north side, and of crystalline schists on the south side, the



GEOLOGICAL PROFILE AND AVERAGE TEMPERATURES FOR THE LŒTSCHBERG TUNNEL (ABOVE) AND THE ST. GOTHARD TUNNEL (BELOW)

center of the range consisting of the so-called Gastern granite.

Observations of the rock temperature in the tunnel were made in bore holes from 4 to 6 ft. deep, at stations about 165 ft. apart, and permanent stations were established at each kilometer. Stations established at the north and south portals gave average yearly air temperatures of 42 deg. Fahr. and 44.2 deg. Fahr. respectively. Three readings were taken daily at these stations during six years.

The ground temperature at the surface above the tunnel was obtained from observations as made during the construction periods of the Simplon and St. Gothard tunnels. The elevation of both portals of the Lœtschberg tunnel is about 4000 ft. above sea level, and the average corrected air temperature at this elevation was found to be 42.2 deg. Fahr. At an elevation of 6986 ft. the air temperature was 32 deg. Fahr., thus making the air gradient 297 ft. per degree Fahr. The temperature of the ground corresponding to an air temperature of 42.2 deg. Fahr. was found to be 44.4 deg. and that corresponding to an air temperature of 32 deg. was about 38.3 deg. As shown in the figure, a maximum rock temperature of 93.2 deg. Fahr. was recorded, very near to the point of maximum covering, the geothermic gradient at this station being 83.3 ft. per degree Fahr.

Geothermic Gradient

According to the material penetrated, the geothermic gradient was found to vary, being 69 ft. per degree Fahr. in granite, 67 ft. in schist, and 90 ft. in limestone. From the north portal up to kilometer 2 the rock temperature was low, owing to the fact that the Kander River flows about parallel to and almost above the tunnel, thereby cooling off the surrounding rock. On the south side the steepness of the strata greatly increased the conductivity of the rock, also permitting surface water to find access to the tunnel.

Unlike the Simplon and St. Gothard tunnels, where, in the former, large underground springs were tapped at intervals, and in the latter small springs were distributed uniformly all along the tunnel, as shown in the figure, the Lœtschberg tunnel was relatively dry except near the portals. The average depth overlying the St. Gothard tunnel was greater than that overlying the Lœtschberg tunnel, and yet the rock temperature did not exceed 89 deg. Fahr. in the former bore, as the steeply inclined strata, together with the uniform distribution of underground water, helped to keep down the temperature underground.

Readings taken during and after the construction of the Lœtschberg tunnel indicated that, owing to the powerful ventilation used, the rock surrounding the bore was cooling off very rapidly. In general this cooling took place at the rate of 0.3 deg. Fahr. per month.



INTERIOR OF MAIN WAITING ROOM, LOOKING NORTH—TICKET OFFICE ON LEFT

New Los Angeles Station Provides Unusual Conveniences for Passengers

Ramps Instead of Stairways Lead from Subway to Train Platforms—Ticket-Office Innovations—Special Yard for Private Cars

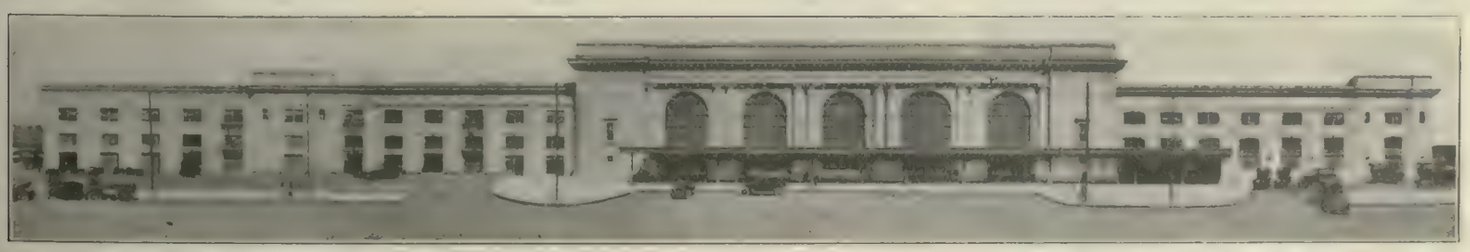
THE OLD Arcade Depot of the Southern Pacific Company in Los Angeles, built in 1888 as the largest passenger station at that time existing on the Pacific Coast, has recently been replaced by a modern station in which the following features govern the design: (1) Separation of pedestrian grade and track grade, (2) separation of incoming and outgoing passengers, (3) adequate conveniences for waiting passengers, (4) modern baggage-handling facilities for the enormous tourist traffic and (5) a ticket office of maximum selling efficiency and an information bureau for arriving as well as departing passengers. The construction of the new station began in April, 1914, and the structure was dedicated last spring in time for the accommodation of Exposition visitors.

General Features and Dimensions

The building is on concrete foundations with a concrete basement. The walls are of brick, plastered to carry out the modern renaissance design. The main waiting room, about 208 x 70 ft., is in the central part. To the north is a 225 x 60-ft. wing containing the baggage room on the first and second floors, connected by freight elevators and a chute for returning the baggage to the lower floor. The third floor contains office quarters for the local division organizations.

To the south a wing 136 x 70 ft. contains the exit concourse, and the head of the exit inclines from the underground passage leading from the train platforms. This concourse is 45 x 60 ft., and is joined on the south by the large dining and lunch room. The second floor of this wing corresponds in height with the third floor of the north wing, and is provided with plumbing for future subdivision and held as reserve office space.

Under the north wing two large vaults for the storage of records are provided. Under the south wing the men's toilet room occupies the space under the exit concourse, and is reached by a stairway from the main waiting room. It is lighted by prisms in the exit concourse floor. The mechanical plant of the building and yards lies to the south of this toilet room, on three levels. All machinery is on the upper level, the boilers are on the intermediate level, while the fuel-oil storage tanks are in a fireproof vault of special design, opening from an area on the track side of the boiler room. Ventilating fans for toilets in the north and in the south wings are mounted



EXTERIOR VIEW OF LOS ANGELES STATION—BAGGAGE ROOM ON LEFT, DINING ROOM AND AUTOMOBILE PARK ON RIGHT



INCLINE LEADS TO TRAIN PLATFORMS

Suction-tread finish of cement surface to prevent slipping; butterfly type of umbrella sheds and details of columns can be seen above.

in penthouses on the roof of each wing.

Outgoing passengers are passed by gatemen through doors in the east wall of the waiting room to an inclosure on the same level, from which a ramp on a 15-per cent grade leads down parallel with the building to the level of the subway, which is at right angles to the direction of the building and the tracks and passes under all the station tracks, ten in number. A chain-and-post fence makes a subdivision of this passage, the ends of the fence being altered from time to time to make a direct inclosed aisle to any train platform for which any waiting-room door or doors may be used for train loading.

The first two tracks are service and baggage loading tracks, making the third the first passenger track. Between this and the fourth track is the first passenger platform, 18 ft. wide. A 7-ft. ramp leads up from each side of the subway on a 15-per cent grade for access to and from each platform. The subway, 32 ft. wide, is divided in the center by a line of steel posts supporting the roof and track floor with a high ornamental iron fence in which directing gates are placed opposite each ramp.

The south side of the subway is used for arriving passengers and leads by a ramp directly to the floor of the exit concourse in the building, whence access to a wide, covered sidewalk is gained by nine doors in the west wall or Central Avenue side. Taxicabs and street cars are conveniently near. The dining room on the south and the main waiting room on the north are immediately adjacent. Steel trough-floor construction carries the tracks over the subway, as shown in the accompanying cross-section.

The train platforms are covered for 750 ft. by specially designed reinforced-concrete butterfly sheds 18 ft. wide. The foundations were cast in place. The post units and the two longitudinal roof slab units of the 20-ft. panels were poured, lifted, seasoned and loaded at a point about three blocks away from the site, the unit system of reinforced concrete being applied by the contractors.

The 35-ft. space between the building and the first track is covered by a cantilever marquise making a covered baggageway. All wiring is underground and in conduits, no poles being used in the entire yard. The steam, air and gas piping is grouped, gated and branched so that any part may be shut off for repairs or additions.

OPEN TICKET OFFICE

The ticket office presents a new departure in that no grille is used, the counter being designed for free business intercourse between purchaser and seller. The arrangement of ticket cases is unique, all coupon forms being in drawers under the counter, and all card tickets being held in two horizontal revolving cases set into the counter and having a capacity of 720 forms, all of which the ticket agent reaches without turning away from a purchaser or stepping aside. Normally one case serves two ticket sellers, one on either side. An inclosure behind the main ticket office has two tables with chairs where passengers requiring special or extended attention may be seated.

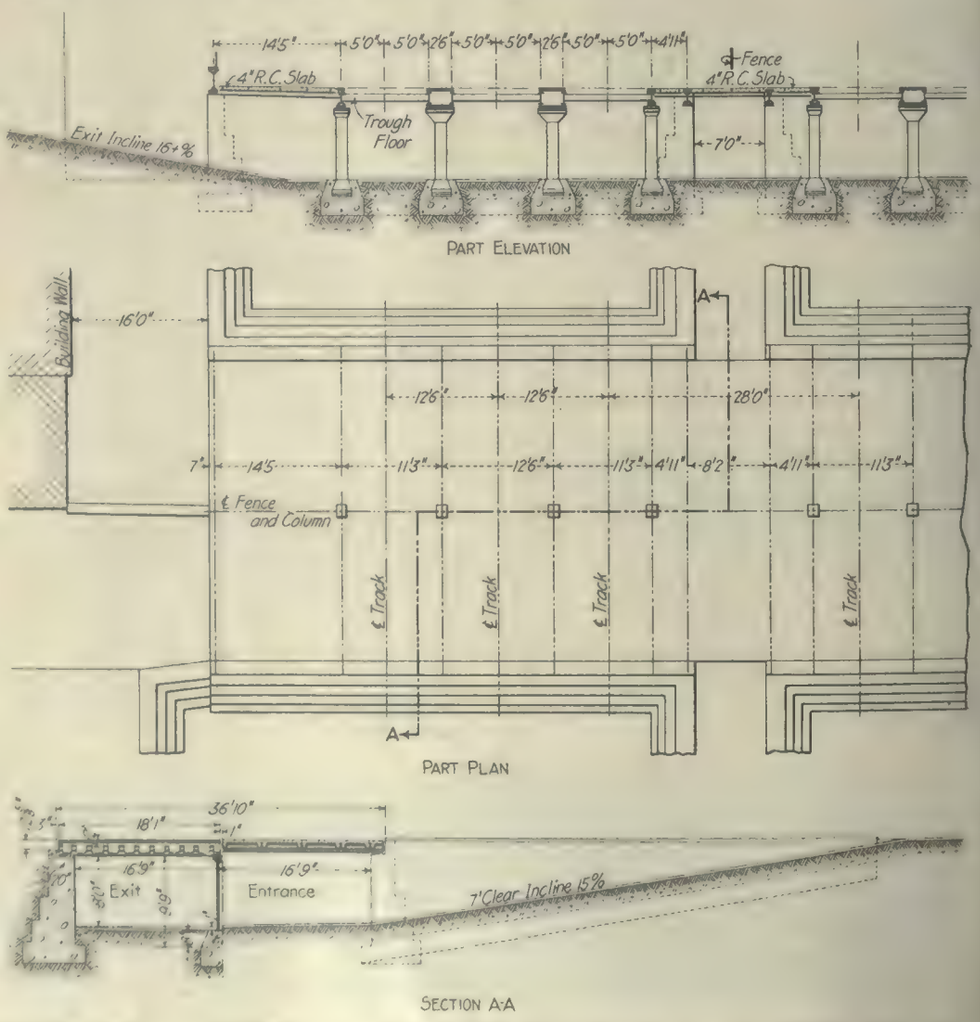
Practically no commuters are handled at this station, but 6000 people per day were accommodated to and from through trains, with no noticeable effort, during the Exposition rush of this past summer. Fifty-four scheduled trains per day and many special and extra trains are handled, Los Angeles and environs probably being visited by almost every visitor to California.

PRIVATE-CAR YARD

A feature of the station layout is a private-car yard for accommodating the many private parties coming to Los Angeles in the tourist season. The private-car yard has steam, gas, storage-battery charging plugs, and water and air connections, and is also provided with hand city telephones for use in the cars. Asphalt walks, flower beds, running water in car-drainage gutters, a private automobile entrance and ample lighting at night make the yard unusually attractive and useful.

John Parkinson and Edwin Bergstrom, of Los Angeles, were the architects for the building proper, their work and all other work being carried out under the direction of J. Q. Barlow, assistant chief engineer of the Southern Pacific Company. The Alta Planing Mill Company, of Los Angeles, was the contractor for the building proper, and the Van Sant-Houghton Company for the subway and butterfly sheds.

AN ERROR IN PLACING THE DRAWINGS was made in the article on "Elastic Curves and Influence Lines" in last week's issue. The drawings for Fig. 1 on page 762 and for Fig. 3 on page 763 should be transposed. Typographical errors were made in the last equation in the third column on page 763, for M'_a, and also in the next four lines of the text—i/r should be $1/r$. On page 764 the letter A_2 should be placed at the left end of the influence lines so that $AA_2 = y_a$, and in the fifteenth line from the bottom of the second column "line A_1B_1" should read "line AB."



PART PLAN / D ELEVATIONS OF SUBWAY CONSTRUCTION LEADING TO PLATFORMS



CLOSING BREACH IN COFFERDAM CAUSED BY SUDDEN 2-FOOT RISE IN RIVER

Improving Navigation on the Upper Mississippi near Le Claire, Iowa

Construction of 3½-Mile Canal, 6 Feet Deep and 250 Feet in Medium Width, Together with Lock and Closing Dam at Lower End, Part of Government Program

IMPROVEMENT of the upper Mississippi River, near Le Claire, Iowa, by the construction of a canal which will provide a 6-ft. channel, 250 ft. wide, along the upper 3 or 4 miles of the Rock Island Rapids, is being vigorously carried out by the federal government. Years ago a commission of government engineer officers appointed to investigate the improvement of the Rock Island Rapids reported that a canal was feasible along the Illinois shore. While their idea in the main is being carried out, the present engineers in charge decided to use the Iowa shore because of its adaptability for creating a wide channel.

As may be seen in the accompanying general plan, Smith's Island, which lies at the lower end of the canal, has comparatively deep water behind it. A lock of 80 x 350-ft. chamber dimensions with about 8 ft. of water over the sills will be constructed between Smith's Island and the Iowa shore with a closing dam between the lock and the island.

In order to permit the unwatering of the canal prism so that about 150,000 cu. yd. of bedrock may be removed by the dry method, a box cofferdam approximately 9700 ft. long had to be built, of which 8000 ft. has been constructed. The size of the canal to be excavated in the bedrock will be 250 ft. wide by 7 ft. deep below low water at the head of the canal. The actual water surface will vary from 300 to 700 ft. in width. A longitudinal dam which will be superimposed on the cofferdam is to be built from the upper point of Smith's Island to the head of the rapids at Le Claire. For the larger part, it will be erected to such a height as to be overflowed at stages of the river above 6½ ft.

COFFERDAM CONSTRUCTION

Points projecting from Smith's Island and the Iowa shore will be cut off to improve the channel leading to the lock. Subaqueous methods are being employed for removing isolated patches of rock above and below the canal. Another phase of the work will be the construction of a levee along the inner edge of Smith's Island.

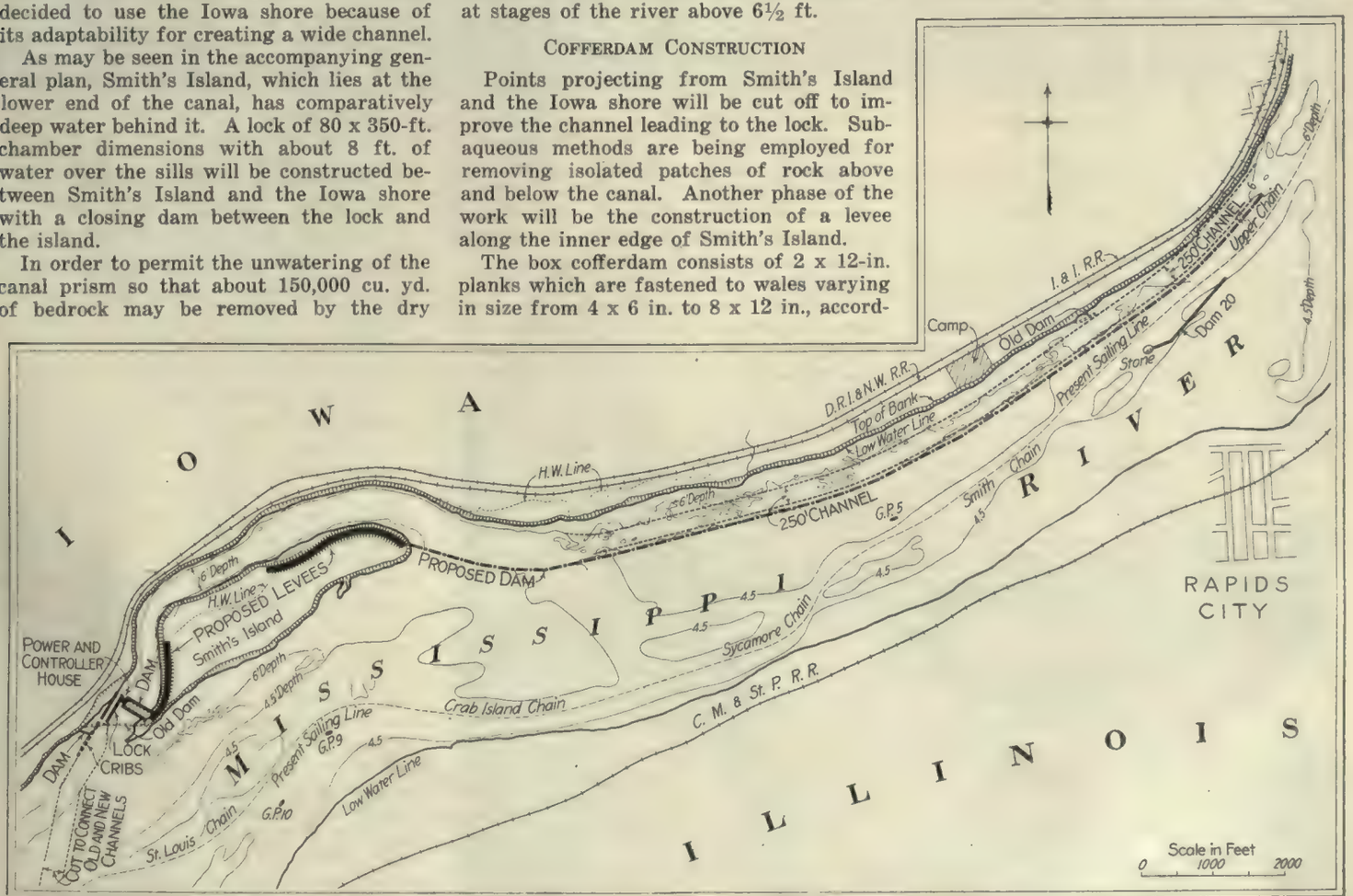
The box cofferdam consists of 2 x 12-in. planks which are fastened to wales varying in size from 4 x 6 in. to 8 x 12 in., according to the depth of water. The wales, which are mitered at 16-ft. intervals, are fastened at each sink plank by rods proportioned to the load filling to be carried. The rods are run through both wales and sink plank to a similar terminus on the opposite side of the cofferdam. Where depressions occur, a deeper section of the cofferdam had to be built and the wales were increased in number, the ends of extra lines of waling being left free after spanning any depression.

One of the accompanying photographs shows how work on the cofferdam was carried out. The lumber storage pile was floated on barges adjacent to the pontoons from which the carpenters worked. The small jib cranes, which can be seen erected on the pontoons in the foreground, are used for holding up floating sections of waling which are waiting to be attached. The gravel and silt fill for the cofferdam was obtained, by means of a dipper dredge, from bars near the Illinois shore, and were brought to the work in barges. Two types of equipment are used for removing filling from the barges to the cofferdam, one a clamshell and the other a Page dragline bucket, both operated by derrick boats.

REPAIRING A BREAK

The width of the cofferdam varies proportionately with its depth. About 80,000 cu. yd. of filling was placed at an average cost of 22 cents per cubic yard. The timber construction, material and labor, cost about $46.50 per 1000 ft. b.m. The total cost of the cofferdam was approximately $72,000.

On Sept. 23 a section 100 ft. long was washed out, owing to insufficient filling and a sudden 2-ft. rise of the river. This was



GENERAL SITUATION MAP OF THE ROCK ISLAND RAPIDS, SHOWING PROPOSED AND COMPLETED WORK



VIEW ALONG COFFERDAM

repaired in about a week by floating barges on each side of the breach. The barges were held in position by steel cables secured to the rock bottom of the river by means of ring bolts. One of the views shows the positions of the barges. Although there was a 2½-ft. fall through the opening, the closure was made without serious difficulty.

LAYOUT OF CONSTRUCTION CAMP

About 1¼ miles from the upper end of the canal and about 100 ft. from shore is located the construction camp. This consists of three barracks, each housing thirty-two men, a mess hall, a warehouse, a roundhouse and shop, two wash houses and an office building. This camp is also the terminus and storage yard for the railroad which is to be built down into the unwatered area for hauling out rock. The ladder track running diagonally through the camp now extends to the river front and will be the main line into the pit.

The laborers are mostly native-born Americans. The good food, shower baths, hot and cold running water and clean, healthy sleeping quarters are all factors employed in making the men contented and eliminating illness.

Work on the cofferdam, which was completed recently, was started in May. The entire project will, it is estimated, take six years for completion.

H. E. Reeves is the resident engineer, reporting to J. B. Bassett, assistant engineer in charge of the work, who in turn reports to Major C. M. Hoffman, Corps of Engineers, U. S. A., under whose direction the plans of the work were prepared.

Legislation Needed to Control Use of Ground Water

Charles H. Lee Points Out Need of Administrative Machinery for Making Rules Laid Down by California Courts Effective

THAT a natural ground-water supply is a common benefit for the use of all lands having access to it and that each owner is entitled to a reasonable use from the common supply upon his own land in conjunction with a similar equal use of all other land owners are established rules in California and so recognized by the courts, according to a paper read before the California State Water Problems Conference by Charles H. Lee of Los Angeles. Furthermore, where there is a surplus the supply may be used for distant lands. What is lacking, however, is the administrative machinery to put the rules laid down by the courts into effect. Following is an abstract of Mr. Lee's contentions:

Because surface-water supplies are so intimately related to ground-water supplies it would be necessary, in order completely to regulate the one, to provide a similar control of the other. The time for such regulation is the present. The use of ground-water resources is in the development stage and rapidly increasing. If users are accustomed to control from the beginning much needless litigation will be avoided later.

In some sections the use of the available supply has already exceeded the safe yield. The only means of preventing an overdraft is by appeal to the courts, which in many cases is beyond the means of the individual.

Water levels are being drawn down in many underground reservoirs by wastefully leaving artesian wells uncapped when the water is not being used. The State laws provide penalties for this, but the laws are not always enforced.

There is need for a systematic collection and careful analysis of data relative to ground-water resources. The gathering of such information requires knowledge of conditions over large areas and extensive periods of time, and the co-operation of local people. It can be best undertaken by a disinterested party.

The State Water Commission should be given power to control the use of both surface and ground water. In addition it should be authorized to maintain a technical organization to conduct investigations of ground-water supplies and their relation to surface waters, either independently or in co-operation with federal investigations, and be provided with funds for the purpose.

Wheel Tax Would Provide Road Maintenance Funds

FOR the maintenance of roads in North Carolina Joseph Hyde Pratt, secretary of the State Highway Commission, has recently advocated the imposition of a "wheel tax," based upon tire widths and the amount of damage to highway surfaces caused by individual vehicles. All funds thus collected would be used exclusively for maintenance work. Under the suggested wheel tax a wagon capable of carrying 4000 lb. and with wheels having tires 2 to 2½ in. in width would pay a much greater tax than the same capacity wagon whose wheels have tires 6 in. wide. If the front wheel of such a wagon should not have the same tread as the rear wheels the tax would be still lower. The heavier the load the wagon will hold, the higher, proportionately, will be the wheel tax, and the wider the tire, the lower the wheel tax. With automobiles the horsepower and weight of machine will determine the wheel tax. An equitable scale of the wheel tax can be devised, Dr. Pratt believes, which will not work a hardship on any one and the revenue derived from it will maintain the roads.

In West Virginia lumber wagons have been doing a great deal of damage to the public roads and the county engineers are now putting in force an act recently passed at the extraordinary session of the last legislature, which is as follows:

Persons, firms, etc., making continuous use of any piece of the country road or driving thereon any wagon and by such use causing more than the usual wear, may be compelled to put thereon a section man or men and keep or assist in keeping said road in such repair as the court may order. Any person disobeying or refusing such orders shall be adjudged guilty of a misdemeanor, and upon conviction thereof fined not to exceed $50, or imprisonment, or both.

This action of the West Virginia Legislature, Dr. Pratt thinks, is a move in the right direction, but he is still of the opinion that the wheel tax method of furnishing a maintenance fund and of controlling the damage that vehicles do to roads, is by far the more practical and effective one.



HOW THE TIMBER IS PLACED FOR COFFERDAM—NOTE JIB CRANES ON PONTOONS

SAND AND GRAVEL valued at $23,846,999 was produced in the United States during 1914, according to the U. S. Geological Survey. This represents a total of 79,281 tons, slightly less than the production in 1913, owing to the decline in building, but still 11 per cent greater than the production in 1910, the largest previous output. Of this total, 85 per cent was sand and gravel used in construction work, the largest tonnages produced being classified under gravel 39,212,858 tons, and building sand, 24,003,962 tons. Material classed under these heads also represents about 75 per cent of the total value of sand and gravel produced, though the highest average price was recorded for glass sand, the 1,619,649 tons of which produced brought $1,568,030. Building sand brought an average price of 32 cents per ton, a fraction of a cent more than the price in 1913. Gravel rose in average price from 23 cents a ton in 1913 to 24 cents in 1914.

Pressure Chamber Equalizes Wash-Water Distribution at Miraflores Filters

False Bottom, with Feed Pipes to Filter Bed, Replaces Usual Underdrainage System Involving Ridge Blocks and Pipe Manifolds

By GEORGE C. BUNKER
Physiologist in Charge of Canal Zone Water Purification

UNIFORMITY in the distribution of wash water and rate of filtration, low maintenance costs and a minimum amount of strainer trouble and loss of sand have been made possible at the Miraflores rapid filtration plant in the Canal Zone at Panama by incorporating as the main feature of the design of the underdrainage system a false bottom or pressure chamber in place of the usual ridge block and pipe systems. Water under a pressure of 28 lb. per square inch is carried into the filters through feed pipes with their upper ends deflected 180 deg. so that the flow of wash water is deflected downward upon the filter floor or gravel bed. While these feed pipes have been fitted with strainers, test results have convinced the writer that in this type of underdrainage system strainers are unnecessary. The filter plant was placed in operation March 14, 1915, and since that date has supplied filtered and sterilized water to a population of 70,000 in Paraiso, Pedro Miguel, Corozal, Ancon, Balboa and Panama. It was designed under the direction of George M. Wells, resident engineer, and its operation is controlled by the division of municipal engineering, of which D. E. Wright is municipal engineer.

Character of Raw Water

The original source of supply for the new water works was an arm of Miraflores Lake. The rapid increase in the chlorine content of this water, due to the lockages through the Miraflores locks, necessitated the selection of the present source, the Chagres River arm of Gatun Lake at Gamboa. This river is approximately 65 miles long with a drainage basin of 559 square miles. Gatun Lake backs up the river for about 10 miles so that a mixture of the two waters forms the raw water supply of the filter plant. Under certain conditions the more turbid and polluted water from Gaillard Cut flows back to the intake. Ordinarily the turbidity of the raw water is low, but after heavy rains on the watershed of the river it is increased to a few hundred parts per million.

Table 1 shows the physical and chemical characteristics of the raw water during the months of April, May and June of this year.

Table 2 shows the variation in bacteria in the raw water during the month of June.

Aeration Reduces Odors

On account of decided odors, present intermittently, the raw water is first discharged into an aeration basin through 105 nozzles which are arranged in seven batteries of 15 each. During the months of April, May and June the dissolved oxygen in the raw water was increased from an average of 65.8 to 88.7 per cent of saturation. During the same period the free carbonic acid was reduced from an average of 2.6 to 0.5 parts per million.

The aerated water flows over three weirs into three concrete mixing chambers, located in the basement of the head house. Each chamber, 37 ft. long, 15 ft. wide and 8 ft. deep, is divided transversely into eight compartments by 6-in. walls which form baffles, so arranged that the water flows vertically down and under the first, then rises and passes over the top of the second, and so on. The alum solution is added to the aerated water as it enters the first compartments of the mixing chambers. During the months of April, May and June the alum averaged 192 lb. per million gallons, varying from a minimum of 101 to a maximum of 471 lb. per million gallons.

After passing through the mixing chambers the raw water discharges into three cross-connected parallel concrete sedimentation basins. The length of each basin is 300 ft., the combined width of the three is 125 ft., the depth at the floor valleys is 17.75 ft. and that at the summits 16.5 ft. At the present time an average sedimentation period of 12 hours is obtained.

Each basin is divided into three compartments by two pressure baffle walls, which are provided with five rectangular openings, 1.5 ft. wide by 6 ft. long, placed 3.5 ft. below the water level. Extending across these baffle walls in front of the openings there are concrete skimming troughs which reach to within about a foot of the normal water level. Between the pressure walls there are two light baffle walls which contain four openings, 6 ft. wide, extending from within 2.5 ft. of the top to 3 ft. from the bottom of the basin. In addition to the baffling effect they prevent wave action which would otherwise result due to the strong winds which prevail at times. All of the valves on the underdrainage system of the basins are hydraulically operated gate valves controlled from an operating table located in the head house.

At the filter building end of the basin the settled water enters a receiving box from which it passes upon the filters through two 30-in. cast iron pipes. There are fourteen rapid sand gravity filters, constructed of reinforced concrete, measuring 19.75 x 21.5 ft. and 11 ft. deep to the floor in which the underdrainage system is placed. They

Table 1—Characteristics of Raw Water, April, May and June, 1915

	Maximum	Minimum
Odor	4 v	2 v
Taste	4 v	2 v
	Parts per million	
Turbidity	120	2
Color:		
Apparent	100	17
True	15	0
Alkalinity	52	30
Free carbonic acid	4.5	Trace
Total iron	2.6	0.10
Hardness, soap	32	26
Oxygen consumed	3.05	1.8
Chlorine	11.5	7.8
Dissolved oxygen, per cent saturation	72	59
Solids:		
Total	118	84
Fixed	86	39

Table 2—Variation in Bacteria, June, 1915

	Bacteria per c.c. at 38°C.		
	Average	Maximum	Minimum
Nutrient agar	688	5,400	85
Litmus lactose agar:			
Total	99	660	4
Acid formers	1	10	0
Gas formers	*	2	0

*Five samples contained a total of six; 25 samples were free from gas forming colonies.

	Presumptive tests for colon group — lactose peptone bile at 40° C.		
	0.1 c.c.	1 c.c.	10 c.c.
Number of samples	30	30	30
Positive tests	7	21	30



MIRAFLORES RAPID FILTER PLANT SERVES POPULATION OF 70,000 IN PANAMA CANAL ZONE



EACH FILTER IS OPERATED BY HYDRAULIC VALVES CONTROLLED FROM A SLATE OPERATING TABLE



THE THREE LONG CROSS-CONNECTED SEDIMENTATION BASINS ARE WELL BAFFLED

are arranged in two rows of seven units each, with the operating floor and pipe gallery between. Each unit has a sand area of 425 sq. ft. or 0.00975 of an acre, making a total of 5950 sq. ft. If operated at a rate of 125,000,000 gal. per acre per day each unit will deliver 1,220,000 gal. per 24 hours.

Pressure Chamber Unique Feature

The differential feature of the Miraflores plant is the design of the filters. In place of the usual ridge block and pipe systems of underdrainage there is a reinforced concrete false bottom, 12 in. thick, which forms the top of a pressure chamber 2 ft. deep. In the false bottom there are placed 1677 vertical ⅜-in. brass feed pipes, spaced 6 in. center to center. The ends of the pipes projecting above the false bottom are bent 180 deg., so that the wash water, instead of discharging upwards, is deflected directly upon the floor or gravel. On the ends of these pipes are screwed brass strainers, leaving a space of about 1¼ in. between the latter and the floor or top of the false bottom. The strainer is a slightly buckled circular plate ⅞ in. in diameter, pierced with twenty-five 1/16-in. holes and swedged into a hexagonal base ending in a ⅜-in. threaded sleeve for screwing over the ⅜-in. brass feed pipe from the pressure chamber. The relation between the area of the strainer openings and that of the sand surface of a filter is 1 to 475 or 0.21 per cent.

In each filter there are 24 in. of Chagres River gravel arranged in three layers, as follows:

Layer	Thickness, inches	Size
Bottom...	8	Passed by 1¾-in. square mesh Retained on 1-in. square mesh
Middle...	12	Passed by 1-in. square mesh Retained on 7/16-in. square mesh
Top	4	Between 7/16 and 3/16 in. diameter

Thirty inches of Chame beach sand, with an average effective size and uniformity coefficient of 0.40 and 1.9 respectively, complete the filtering material. An independent air system is placed between the small and medium grades of gravel. This will be used only in case hard spots and mud patches develop.

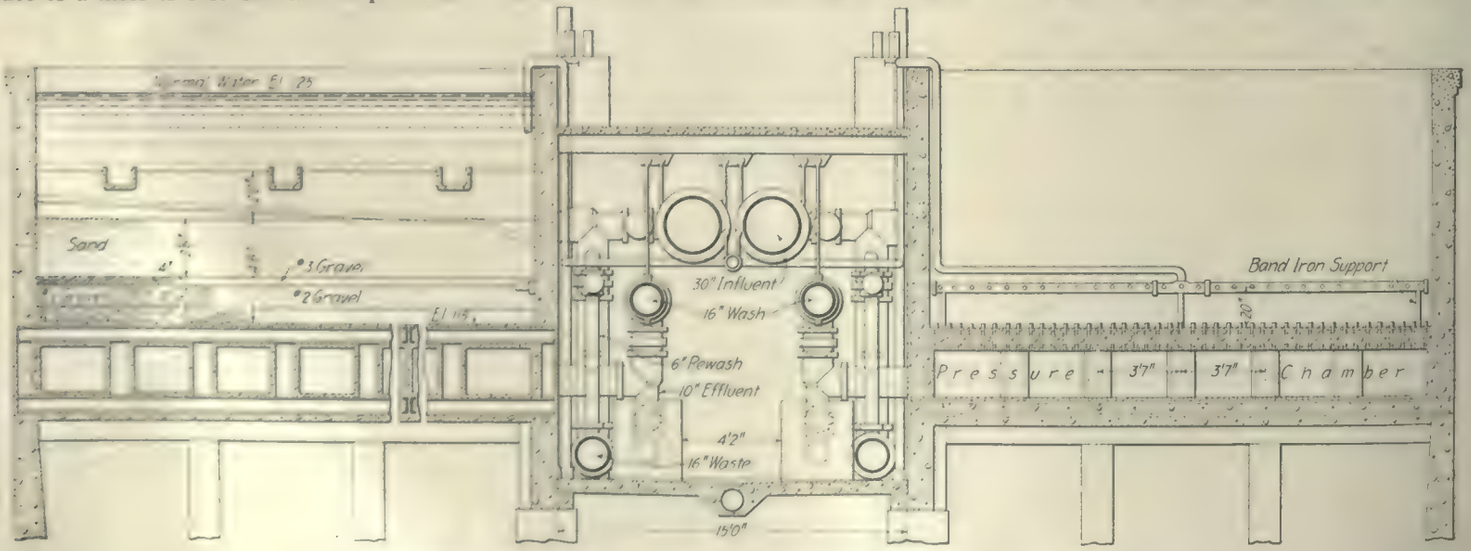
The pressure chambers were built to withstand a maximum pressure of 28 lb. per square inch. When a filter is washed at a rate of 6400 gal. per minute, or 15 gal. per square foot of sand surface, equivalent to a 24-in. rise of wash water per minute, a pressure of about 16 lb. per square inch is developed on the false bottom. Under these conditions an excellent distribution of wash water results and the sand bed is raised 8¼ in. above its normal elevation or to within 12½ in. of the weirs of the wash-water troughs.

Tests on Strainers

In order to determine by comparison whether or not the strainers are essential in this type of filter they were not placed on the feed pipes in three of the filters. When washed at the same rate as the filters equipped with strainers a pressure of 11 lb. per square inch is developed on the false bottom. The distribution of wash water is equally as good and the sand bed is floated to the same height above its normal level. It is the opinion of the writer that in this type of underdrainage system strainers are unnecessary.

One central and six lateral concrete troughs effectively remove the wash water. Weirs are cut in the troughs so that the maximum travel of suspended particles is limited to 2.5 ft. When washing at the rate mentioned above the depth of water over the weirs is 1¾ in. and there is sufficient current at the filter wall ends of the lateral troughs to prevent the settling out of suspended particles.

While false bottoms have been used in filters built prior to these they have been designed for low pressures and rates of flow of wash water. As far as the writer knows these filters are the only ones embodying concrete false bottoms which will withstand a maximum pressure of 28 lb. per square inch and allow a vertical rise of wash water of 2 ft. per minute with an ample margin of safety. This type of filter construction insures a uniform distribution of wash water and rate of filtration, a low maintenance cost, minimized strainer trouble and a minimum loss of sand.



PRESSURE CHAMBER OR FALSE BOTTOM IS UNIQUE FEATURE OF UNDERDRAINAGE SYSTEM

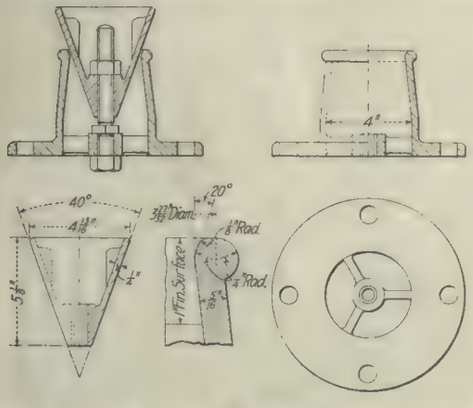
Its object is to create uniform distribution of wash water through feed pipes and equalize rate of filtration.

During the first ten days of operation, starting March 15, the percentage of wash water averaged 8.08, dropping, however, to 2.35 during the remaining seven days of the month. For the months of April, May and June the percentages were 2.7, 3.6 and 3.75 respectively. The results of microscopic examinations made during these three months indicate that the micro-organisms in the raw water will control the length of the filter runs and consequently the amount of wash water. This conclusion is confirmed by the writer's experience in the operation of the rapid sand filter plants at Mt. Hope and Agua Clara, where the micro-organisms in the reservoir supplies introduce serious difficulties. Table 3 shows the variation in the length of the filter runs.

TABLE 3—VARIATION IN LENGTH OF FILTER RUNS

Month	Filter runs in hours—Maximum	Minimum	Average	Per cent of wash water
April	46.2	15.2	26.5	2.7
May	46.3	7.2	16.5	3.6
June	29.7	5.5	13.1	3.75

In May the shortest runs occurred, with a total of 900 standard units of micro-organisms, of which 690 were Nitzchia. Immediately after the period of short runs



RAW WATER IS AERATED, TO REDUCE ODORS, BY 105 NOZZLES

heavy rains on the watershed of the Chagres River reduced the micro-organisms and Nitzchia to 303 and 164 standard units respectively. This resulted in the lengthening of the runs to a maximum of 46.3 hours.

Each filter is operated by hydraulic valves controlled from a slate operating table, each of which, in addition to the usual equipment, is provided with small 10-watt green and red lamps so connected that the former burns when the filter is in operation and the latter starts to burn when the loss of head reaches a fixed point.

The discharge of filtered water from each filter is regulated by a controller which consists of a simple round open-top concrete box, approximately 2.5 ft. in diameter and 3.5 ft. deep, cast on the floor of the pipe gallery; an adjustable circular bronze orifice cast in the floor and opening into the clear-water basin; a copper float 2.25 ft. in diameter carrying a stem which will operate a small vertical piston valve, and a 10-in. hydraulic valve placed on the effluent line leading into the controller box.

It has been found necessary to use 20 lb. of hypochlorite of lime per million gallons of water, equivalent to 0.80 parts per million of available chlorine, in order to prevent the development of "after-growths" in the distribution reservoirs and pipe lines. This is the maximum amount of bleach which may be used without producing an odor and taste. It reduces the bacteria in the sterilized water, as it leaves the filter plant, to an average of 7 per cubic centimeter at 38 deg. C. on nutrient agar and eliminates the members of the colon group as determined by production of gas in lactose bile.

E. J. Tucker is superintendent of the filter plant. F. H. Waring and H. F. Schmidt are his assistants.

Rural Credits Necessary if Irrigation Enterprises Are to Succeed

Irrigators Have Insufficient Capital, Which Is Absorbed in Breaking Land, Leaving Little for Stock and Equipment

By EDWARD GILLETTE
Sheridan, Wyoming

SUCCESS in farming depends mainly upon the methods used. This applies in the greatest degree to irrigation districts, as the money invested and work required are greater than in so-called dry farming. This, however, is only in degree, as the results achieved by all farmers depend upon the skill employed in making use of the land. Few people realize the initial cost in taking up a raw piece of land and getting it into condition to produce enough to support a family.

FAILURES IN IRRIGATION FARMING

Nearly all irrigation projects, whether built by the government or by companies or individuals, are more or less failures on account of not giving proper aid, or realizing the great cost of improvements required, in the early stages of making a farm. The poor showing made on government projects has been caused by simply building irrigation works and not following this up by extending advice and aid so that it is possible for the settler to make a success. Foreign countries, Italy, Denmark, Australia and others, recognized this condition long ago and have put in force measures which have made irrigation successful in every case.

On the reclamation projects in Wyoming and Montana, according to the testimony of over five hundred settlers, the cost of improvements, including reasonable buildings, fencing, breaking up land and smoothing it for irrigation, constructing laterals, and purchasing farm machinery and necessary live stock to run a small farm, has cost an average of $60 per acre. This means no greater investment than is actually required to put the farm in condition to produce enough to support a small family. We must add to the above the cost of the land and water in order to come to a realization of what this business requires. Then the fact dawns upon us that a large investment and skill are necessary to make the business pay.

AID IN OTHER COUNTRIES

Foreign countries, realizing these conditions, assist the farmer in getting started, where necessary. Experts are employed to advise the settler; he is furnished needed money for improvements and live stock; he is instructed in irrigation and in farming generally and ultimately becomes independent of aid. At first thought it seems as though the government might be a great loser by this method, but experience has demonstrated the fact that loss is sustained by not following out this method instead of doing so. Of course, these loans are secured on the land and live stock and limited to a proper amount. Care is also taken to aid those who are willing to work and have reasonable capacity.

In an Australian state where money had been loaned to settlers on government irrigation projects, there were due in 1912 over seven thousand repayments; only ten farmers were in arrears and these arrears amounted to only $468. Between two and three hundred million dollars has been loaned to these Australian farmers, and there is no one of the 777 members who compose the eight Parliaments who is not a strong supporter of the system.

BANKERS CANNOT EXTEND AID

It costs the public nothing, as the same interest is received on these loans as on government bonds, with the added benefit of creating thousands of productive farms and homes for people who otherwise could not get them, and starting a movement away from already over-crowded cities. Bankers on our reclamation projects would gladly welcome the loaning of funds and giving expert advice to farmers by the state and government, as the wonderful increase in production of the farms increases all business, theirs especially, and betters the security of loans. It is a work impossible for the banks to perform. The purpose of the loans is to assist the farmers over the first few years, until the farms are on a good working basis and the annual payments for water can be easily made. The water payments extend over a long period, making the yearly instalments small. All objections to this method of loaning money have been overcome in other countries, and it would be strange indeed if our country could not do the same.

On our reclamation projects, as a rule, farmers are in debt as far as it is possible for them to borrow, the amount varying from one to two thousand dollars. This would not be serious if all the land were in cultivation, and there was enough stock to consume the feed raised. Such is not the case, and there appears no hope for the future; the farmer is about at the "end of his string" and something has to be done or he will lose what time and money he has put into the business. Where a farmer has enough stock to consume what feed he can raise, he is doing a good business besides keeping up the fertility of the soil.

The object should be to make a farm sufficiently productive the first year to support a family. The second year all the land should be made productive and a permanent and successful business established thereafter.

The only possible way to make our irrigation projects successful is to make state and national government loans to the farmers, and the quicker it is done the better for the country at large.

COST OF ONE-FAMILY FARM

The average value of a farm which will support a family is from five thousand to ten thousand dollars. There is the greatest demand for farms of this size. Near cities where truck farming is practised, a few acres is worth this amount; where sugar beets and alfalfa are raised 40 to 60 acres are worth the same; where straight alfalfa and grain are produced, 80 to 160 acres are required; in dry-farming from half to a whole section is necessary to be

worth this amount. We always come to this fact that a farm sufficiently large to support a family is worth about $7,500. A good idea is thus obtained of the work a settler has to perform, or the financial resources he must have.

THE OBJECTION OF PATERNALISM

If objection is made to national aid on government projects and state aid elsewhere on account of paternalism, the answer is that it is worse than paternalism for the government to construct these irrigation projects, get settlers on the land and have conditions prevail which make it impossible to succeed unless private capital and enterprise supply the needed advice and aid. In some districts sugar factories have come to the rescue.

If a thorough investigation of this subject were made by the government, the fact would be revealed that it is the duty not only of Congress but of the states as well to give the relief and protection needed by our struggling settlers. In addition to being a duty, it would be found the greatest opportunity to add to our national wealth and stability.

Although a small matter comparatively, it also would enable the government to get back the money expended on irrigation, which, under the present scheme, is impossible.

GREATER WINNIPEG'S ELECTRIC POWER consumption per capita exceeds that of nineteen other cities in the United States and Canada for which the Water-Power Branch of the Dominion Department of the Interior has secured statistics. The records show that the per capita output in kilowatt hours generated is 740 in Winnipeg. The nearest cities in Canada are Vancouver with 668 kw.-hr., Toronto with 535 and Montreal with 520. The records for the cities in the United States tabulated by the bureau show 730 kw.-hr. for Atlanta, 660 for Buffalo, 565 for Detroit, and 553 for Pittsburgh. Philadelphia shows the surprisingly low figure of 165 kw.-hr. The statistics are published in a report on the water-power of the Winnipeg River, prepared by H. E. M. Kensit under the direction of J. B. Challies, superintendent of the bureau.

Detroit-Superior 591-Foot Steel Arch Successfully Swung by Toggle Adjustment

Timber Travelers with Stiffleg Derricks Erect Three-Hinged Arch Span and Double-Deck Floor in Cleveland Bridge

SATISFACTORY progress was made in the erection of the new Detroit-Superior high-level bridge at Cleveland during the past season by the use of relatively simple and inexpensive erection devices. The 591-ft. three-hinged arch span, now completed, holds third place in span length in this country, being exceeded only by the Hell Gate arch and the Niagara arch. The steel for the arch span was erected between July 29 and Nov. 5, including the placing of the double-deck floor. A description of the design and details of this span will be found in the Engineering Record of Nov. 28, 1914, page 591, and that of Dec. 12, 1914, page 640.

On top of the erection tower, shown in one of the photographs, is a beam runway for the traveler frame, which cantilevers over the tower. The horizontal steel struts are part of the tower, as can be seen in the photograph. They transmit the component from the anchorage at the adjacent pier to the main pier, thus eliminating any horizontal thrust due to cantilever erection. The maximum stress in each backstay, including wind, was 2,230,000 lb., and the area was 143 sq. in. The backstay consists of a line of eyebars supported by the tower and containing the framed toggle arrangement clearly shown in one of the views.



TRAVELER ON STEEL TOWER ERECTED END PANEL OF ARCH

Heavy end lower chords erected first on false-work by use of sheer-legs on face of pier. Note rods connecting vertical posts to backstay, necessary because backstay could not be connected until end panel was erected and end top chord pin driven.



TOGGLE IN BACKSTAY—SCREW IN TENSION TO LOWER ARCH

Power applied through rope sheave seen in center on connecting shaft between the two toggles, insuring uniform movement.

The closure of the main arch was made on Oct. 8, using screw toggles in the backstays for adjustment, in a manner similar to the closure operations for the Hell Gate arch, with telephone communication, as described in the Engineering Record of Oct. 9, 1915, page 438. The essential difference in the two operations was in the use of toggles for adjustment of the Cleveland structure and screw jacks upon the vertical posts of the backstays in the Hell Gate arch. Cantilever erection using backstays was the fundamental method in each case, but the Detroit-Superior arch erection was started at each end from a high tower on which the traveler was assembled, and the backstays could be carried to the next adjacent pier to develop the uplift.

STEEL ERECTION TOWERS

At each end of the main arch span, just behind the abutment piers, a 90-ft. steel tower was first erected by means of a 115-ft. ginpole. This ginpole was used from the ground to erect the lower section of the tower, then raised to the level of the pier and supported on the tower section already erected, and finally raised another panel for the purpose of erecting the top-chord traveler and two stiffleg derricks.

The toggle was designed to put the adjusting screws in tension, and these screws were turned by a shaft connecting them, as shown, in order to insure uniform movement of both arches. The power for turning was obtained from a single-drum hoisting engine on the ground below, connected to a sheave wheel on the center of the shaft. One turn of the toggle screw at the beginning was computed to cause a vertical downward movement at the crown of the arch of 2⅜ in., and thirteen turns of the shaft were required for one turn of the screw. The total stress in the eyebars at the toggle was 2,530,000 lb., including wind, and the maximum component carried by the screw was 517,000 lb. tension. The screw is 9¾ in. in diameter, with 1¾-in. pitch.

The top-chord traveler was a timber framework consisting essentially of 12 x 12-in. horizontal chords with 4 x 12-in. bracing, and two transverse struts of braced timbers. In order to allow for the changing slope of the top-chord runway and keep the lower sills of the derrick horizontal, adjustment was provided by a line of holes in the two 15-in. channels to which the built-up shoe at the rear of the derrick was bolted. Two 25-ton stiffleg derricks



TOP CHORD TRAVELERS LIFT STEEL FROM SCOWS DURING CANTILEVER ERECTION

Progress photograph taken Sept. 29; arch closure made on Oct. 8. Steel struts seen back of main piers connect to backstays and prevent any horizontal thrust during erection.

were mounted on the frame, the transverse legs being spliced at their intersection.

Erection Progress and Closure

The erection of the steel arch was begun on the east side July 29, and on the west side Aug. 26. The delay on the west side was due to awaiting the completion of the main pier, and the erection progress was fixed by the west cantilever. The travelers were supported on the steel I-beam stringers of the span, temporarily used on timber bents above the top chord for the first four panels, as seen in the photograph. In beginning the erection of the end panel, the end lower chord, which is the heaviest member in the bridge and weighs 30 tons, could not be handled by the derricks without special equipment. As connection of the backstay to the end of the top chord could not be made until the panel was erected, falsework bents were used for the end panels. A pair of sheer-legs on the face of the pier, with tackle attachment, made it possible to use the derricks for hoisting the end chord.

The actual working time on the west side for erecting the arches and bracing was 32 days of 8 hr. each. In this time about 1250 tons of steel was placed on the west half. All truss members up to the four center panels, except the bottom chords, were riveted up, the other joints being bolted until after closure.

Closure—Special Erection Struts

The closure of the arch was successfully accomplished Oct. 8. The two halves of the arch lined up within ⅛ in., easily adjusted by a cable, and were within 22 in. of bearing when the lowering operation was begun about 10.30 a. m. By 2.23 in the afternoon, with a 2-hr. intermission, the arch closure was completed. Telephones were used at each hoisting engine turning the toggle screws, and at the center where the superintendent of the erection company controlled the operation. A total vertical motion at the center of about 22½ in. brought the arch to a bearing.

Owing to the fact that the adjacent concrete arch spans cannot be placed until after the main steel arch span is erected and the backstays and towers are removed, the main abutment piers are subjected to excess unbalanced thrust until these arches are in place. To provide for this thrust two concrete struts 5 x 7 ft. in section were placed between the bases of the abutment pier and the adjacent pier where the next arch had been placed and was thus available for resistance.

Erection of Floor

The double-deck floor system, with six trolley tracks on the lower level and a highway floor and sidewalks on the upper level, was erected from the center toward the ends by the travelers on the top chords. As in the case of the main arches, the material was hoisted from scows in the river. It was placed by the following sequence of operations: First, the 8 x 1⅜-in. nickel-steel hangers were placed in the arch chord, then the pin-connected floorbeams of the upper level and the built-up hangers for the lower level were erected. The lower-level floorbeams were then placed and the riveted connections to the hangers made. Stringers and bracing could then be erected.

By Nov. 5 all steel, about 4200 tons, had been placed. Nickel steel was used for the main members and carbon steel for the bracing and floor system. The concrete arches of the approaches are all placed except the two adjacent to the main arch. The west approach is now completed, and also the lower decks on many of the spans of the east approach.

The contractor for the fabrication and erection of the steel arch was the King Bridge Company. Harry Fuller, chief engineer, was in charge of the design and construction of the erection material. The erection, however, was let as a subcontract to the Ferro Construction Company, of Chicago, of which F. C. Fisher is president, and F. F. Buck, superintendent of construction. The contractor for the concrete arch approaches is the Hunkin-Conkey Construction Company, with Harold E. Ketchum, superintendent of construction, and H. L. Hilton, engineer. The structure is being constructed for Cuyahoga County, under the direction of W. A. Stinchcomb, county engineer, A. W. Zesiger, bridge engineer, and K. D. Cowen, engineer of construction.

U. S. Reclamation Service Projects, under way or completed, embrace approximately 3,000,000 acres of irrigable land, divided into about 60,000 farms of from 10 to 160 acres each. During the present year water was available from Government ditches for 1,450,407 acres on 29,017 farms.



ARCH CLOSED AND DOUBLE-DECK FLOOR STEEL PLACED BY RETURNING TRAVELERS

Progress photograph taken Nov. 1. Amount of movement of toggles can be seen by comparison with other photograph.

Seattle Utilities Pay City for Subsurface Maps

Taxpayers Relieved from Expense of Underground Surveys by Charging Cost to Companies Owning Underground Structures

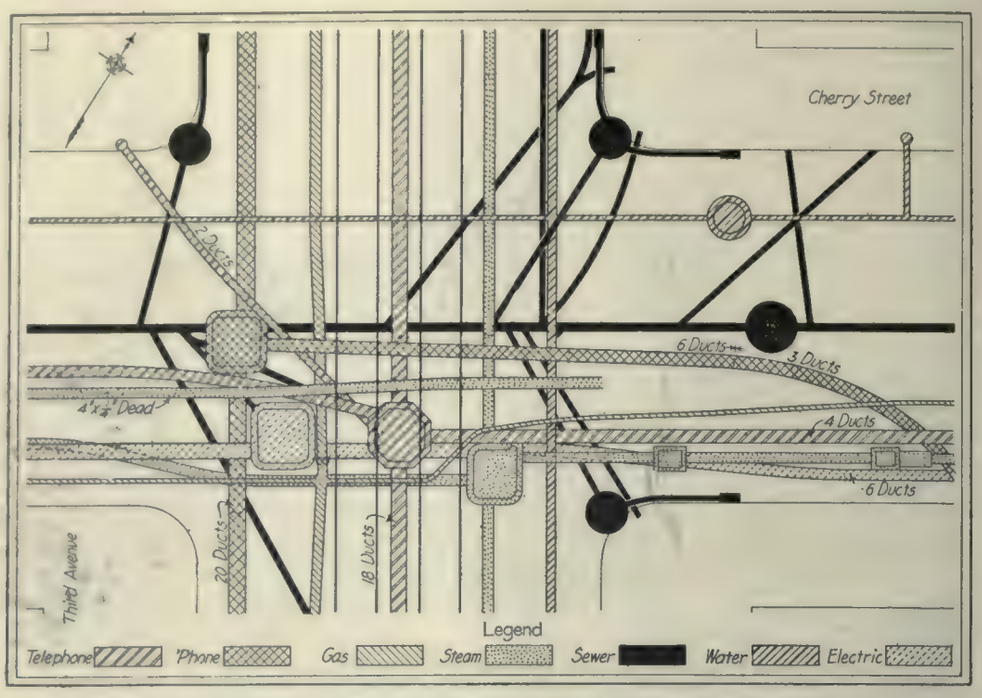
By A. L. VALENTINE
Superintendent of Public Utilities, Seattle

THE Engineering Record of Jan. 9 contains an interesting article by O. E. Carr on the underground survey of the city of Cincinnati. This article states that early in 1912 the city council of Cincinnati set aside $125,000 for the purpose of surveying and mapping the sewers and other utilities beneath the surface of the streets. The article gives in detail the plan of organization of field parties and the manner of making the survey and keeping notes. The first field party began on April 27, 1912, and the force was gradually increased until there were eight parties in the field, the last party being disbanded Nov. 22, 1913.

The initial plan required the field parties to locate objects in the streets with reference to curb lines; locate sewer manholes; determine size of sewers; depth and elevation of invert at manholes; location of inlet valves, as well as street car tracks. Water pipes were located; gas mains were located and compared with existing records. Locations of width of telephone conduits were obtained from the telephone companies and these plats checked with figures obtained by the survey of the manholes.

Work Takes 19 Months

It will be noted that it took this large force 19 months to do the necessary field work, after which, of course, the notes were mapped by the office force. An idea of this part of the work may be obtained when it is observed that it was necessary to have a tracing made of the entire city from records of the county auditor's office, complete copies of plats in the office of the gas company, tracings from the records of the waterworks department, as well as complete information from the telephone company showing size and location of conduits.



HOW SEATTLE SHOWS ACTUAL LOCATIONS OF ITS SUBSURFACE STRUCTURES
In the original maps the various lines are differentiated by colors which it is impossible to reproduce here

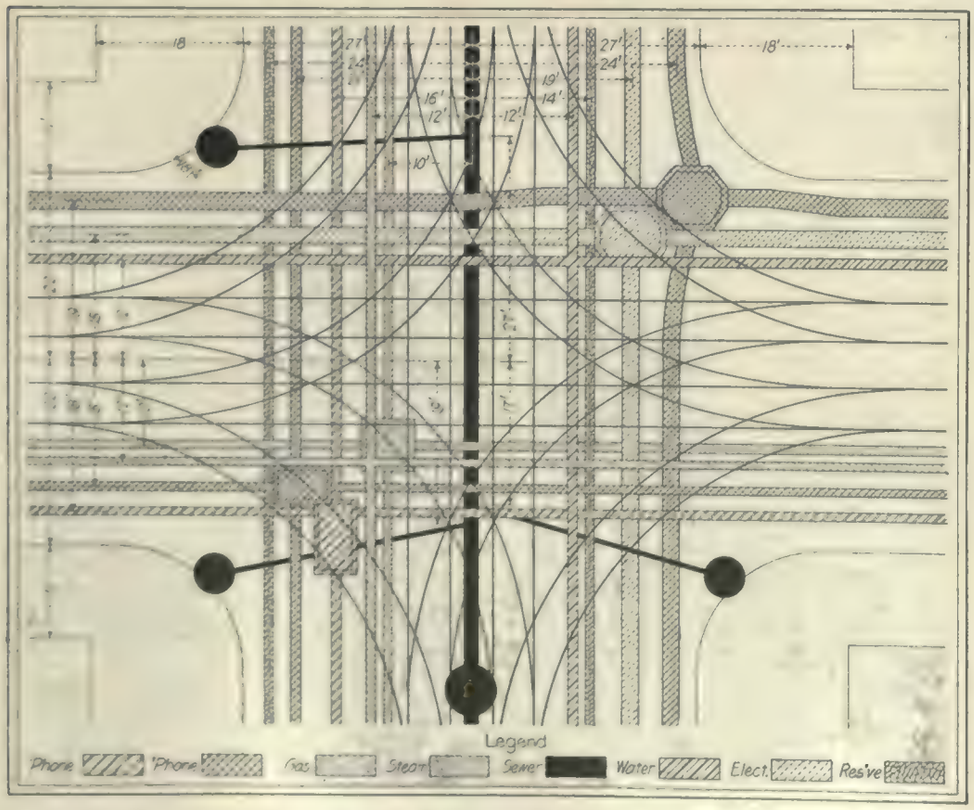
Plans Prove Useful

The article is closed with the following statement: "The usefulness of these plans has been clearly demonstrated during the past year. Demands for information contained in them are constantly being made by the water and highway departments, the city solicitor and other officials. The plans should be the first step in the creation of a substantial, important and self-supporting department. The perfecting of this system of records cannot fail to be of inestimable value to Cincinnati."

When we compare an expenditure of $125,000, in which all taxpayers were compelled to joint, as was the case in Cincinnati, with the expense of the Public Utilities Department of Seattle, a relatively small cost is readily seen. The following is the plan adopted in Seattle: The records of the department showing everything beneath the surface of the streets are platted on unsensitized cloth, on a scale of 10 ft. to the inch. The company desiring to install a utility or make an extension to an existing utility makes application through the Public Utilities Department to the Board of Public Works for permission to do the work. These applications cover various classes of work—the mere setting of a telephone pole, the laying of electric ducts, telephone conduits or steam-main extensions, the installation of a crossover for street-railway track, a spur track from a steam road or main-line steam or street railway track construction.

Space for Each Utility

Each utility is assigned a certain space under the street, all in an orderly arrangement, and inspectors of the department see that the work is carefully done and a record made of the installation in a note book provided for that purpose. These notes are then placed upon the permanent records by the draftsmen. The time spent by the inspectors in securing this information, as well as the time of the draftsmen in platting it on the records, is billed against the utility company doing the work, so that, in Seattle, instead of a large expenditure of money, taken from the taxpayer to pay for the records, the value of which cannot be as great as those secured at the time of construction, the department secures records that are absolutely correct, cost the taxpayer nothing at all and are of inestimable value. They are in constant use by the city light department, city water department, city engineer's department, streets and sewers department, public utility companies and contractors for municipal improvements of all kinds.



STANDARD LOCATIONS OF UNDERGROUND CONDUITS AS LAID OUT BY THE DEPARTMENT OF PUBLIC UTILITIES

Chief of Engineers Suggests Military Reading Course

Civilian Engineers Are Given List of Forty-Nine Sources of Military Information of an Engineering Nature

A READING COURSE on military subjects for civilian engineers has recently been suggested in a bulletin issued by the office of the chief of engineers of the War Department in response to frequent requests. The references were selected, first, with a view to giving to engineers unfamiliar with the art of war a general survey of that subject—an understanding of the first essential to insure successful application of engineering knowledge and resources to military purposes; and, second, with a view to setting forth, as far as practicable, the ways in which engineering is applied to military purposes and the means provided therefor.

The bulletin explains that both military art and military engineering are progressive, and a considerable part of the latest and most detailed information published is available only in service journals of our own and foreign armies. This is particularly true of technical details of sea-coast defense (including submarine mining), field artillery, military aviation and the influence of these on military engineering. It is believed, however, that the fundamentals of each subject are well covered by the references given in this list. While the list is long, the relative importance of the various works is indicated, and suitable comments on each are included, so that persons using the lists of references may be able to select those which particularly interest them. Suggestions looking to an improvement of the list, which contains books on military policy, conduct of war and military history, permanent fortifications, organization, equipment and duties of the engineer troops and field engineering will be gladly received.

Military field engineering at the front differs from ordinary engineering work in the field in being generally simpler, of a rough-and-ready character, and especially because of the limited equipment which can be taken along with the advance of an army, and because of the necessity of working in strict subordination to the military situation. In the rear of the army, on the contrary, conditions are very similar to those governing ordinary engineering operations, and civilian organization is suitable, subject to directions by the higher military staff. Little attempt is made in works on military field engineering to treat of general engineering methods.

Cost Per Square Foot of Floor Read from Charts

Useful Diagrams for Obtaining Unit Cost for Any Construction Composed of Fixed Quantities at Variable Prices Explained

A USEFUL METHOD for finding graphically the unit cost of any construction in terms of variable unit costs of its fixed component parts is shown by the accompanying charts. The first gives the cost per square foot of a typical mill-building floor composed of 4 in. of broken stone, 1 in. of sand and tar, 3 in. of hemlock and a ⅞-in. tongue-and-groove maple finish. The second gives the cost per square foot for the material in a 4-in. concrete slab for three different mixes. The construction of the first chart will be explained, as the method of procedure is applicable to any other case where the unit costs of the component parts are variable and a fixed amount of each enters into the final unit, the cost of which is desired.

PREPARATION OF CHART

To prepare the chart shown in Fig. 1, four combination costs for the stone and sand at the limiting values of the costs assumed for these quantities per cubic yard are first computed in cents per square foot of floor, knowing the quantities of each. Selecting a convenient scale and direction, called scale X on the diagram, these combination values are plotted, and four parallel lines, AA_1, BB_1, CC_1 and DD_1, are drawn through the plotted points. The point A is selected arbitrarily and the point C chosen to give sufficient length AC for the sand scale and at the same time a convenient diagonal direction AC for locating the stone scale. The latter is found between the

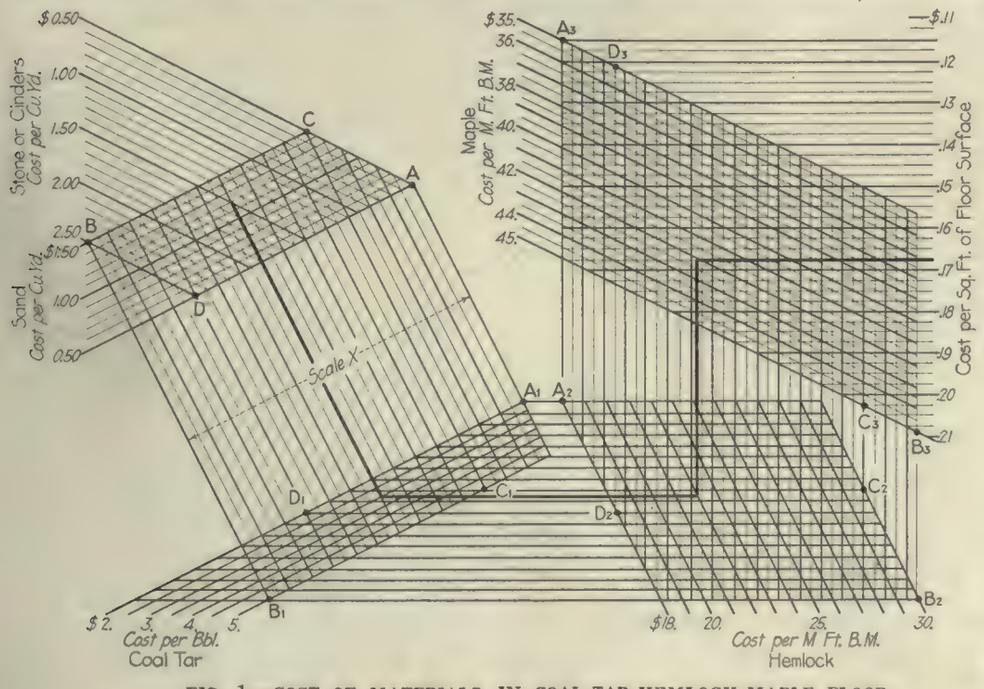


FIG. 1—COST OF MATERIALS IN COAL-TAR-HEMLOCK-MAPLE FLOOR

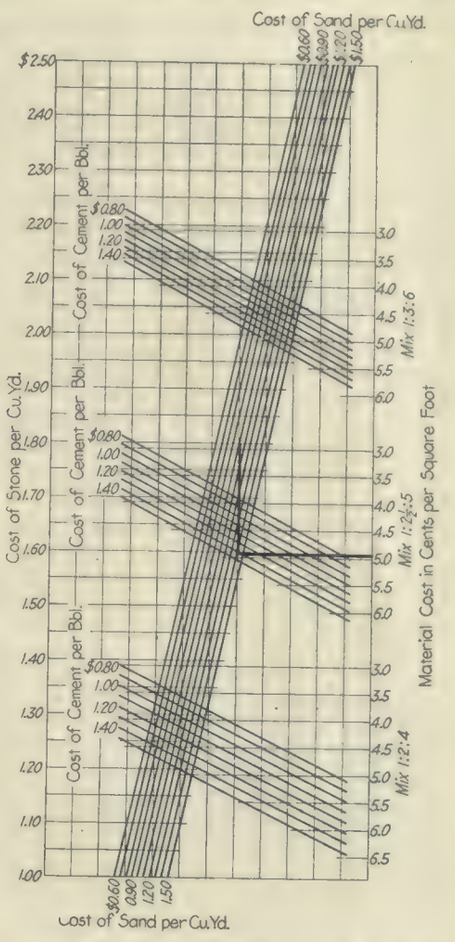


FIG. 2—COST OF MATERIALS IN 4-INCH CONCRETE SLAB FLOOR

diagonal sides AC and DB of the parallelogram $ABCD$, the sides AD and BC in this case being conveniently made parallel to the assumed direction of the combination scale X. The lines AD and AC are easily divided into the desired number of parts by the use of any convenient diagonal line and scale.

Using the previous four combination costs for the first two items, a second set of four combination costs including the cost of the tar used per square foot is computed. The amount of tar is based on an assumption of 1 gal. of tar to 5½ sq. ft. for the stone and 1 gal. to 10 sq. ft. for the sand, with 3 per cent waste. The four costs are then plotted to a convenient scale in a vertical direction, beginning at any selected point A_1, and the four horizontal lines A_1A_2, B_1B_2, C_1C_2 and D_1D_2 are drawn through them. The lines A_1D_1 and C_1B_1 through the resulting intersection points then give the direction of the scale for the coal tar as shown. This can be divided into the desired number of parts in the usual manner.

CONTINUING THE DIAGRAM

Similarly, the four combination costs per square foot, including the 3-in. hemlock flooring at limiting prices, with 12 per cent added for waste and 0.02 cents for nails, are computed. These are plotted horizontally to an assumed convenient scale, beginning at the point A_2. The resulting intersections A_2, B_2, C_2 and D_2 where the vertical lines cut the preceding horizontal lines determine the slopes A_2D_2 and C_2B_2 for the hemlock scale.

The final costs, including the ⅞-in. maple floor faced from 1-in. material and allowing 25 per cent for the tongue and groove with 0.1 cent for nails, are then computed for

the four limiting prices and plotted in the final vertical scale shown, giving points of intersection A_2, B_2, C_2 and D_2, and fixing the scale for maple cost by the lines A_2D_3 and B_2C_3. Any number of variables can be included by continuing the process of right-angled turns between the scales used for combination costs.

The use of the diagram is explained in the chart, Fig. 1, by the heavy lines which indicate the successive steps in reading for the case of stone or cinders at $1.50 per cubic yard, sand at $1.20 per cubic yard, coal tar at $3 per barrel, hemlock at $22 per thousand and maple at $42 per thousand, giving a final total cost of 16¾ cents per square foot.

The second chart, Fig. 2, is constructed and used in a similar manner, noting that the quantity of sand and of stone for the given mixes is practically constant. The heavy lines indicate the solution for the case of stone at $1.80, sand at $1 and cement at $1.45 for a 1 : 2½ : 5 mix, giving a total cost of nearly 5 cents per square foot for the materials.

This and similar charts have been prepared by A. Pearson Hoover, engineer with John W. Ferguson Company, engineers and building contractors, Paterson, N. J.

Experiment with Natural Water Softening Zeolite

R. N. Kinniard Tells Iowa Section of American Waterworks Association of Tests on Des Moines and University of Illinois Water

EXPERIMENTING with a natural hydrous aluminum silicate in combination with calcium, which is capable of exchange with sodium in the raw state at a high rate and to at least as high a capacity as the synthetic product, R. N. Kinniard, chief engineer of the Des Moines Water Company, has succeeded in evolving a method of measurement of the rates of exchange in both directions of the reaction. He gave the following results to the Iowa Section of the American Waterworks Association, Dec. 3. Des Moines city water, which has a total carbonate and sulphate hardness of more than 300 parts per million, has been softened in experimental filters. In the laboratory of Dr. Edward Bartow of the Illinois State Water Survey these Des Moines experiments have been duplicated with University of Illinois water having a total carbonate hardness of 300 parts per million. With a filter layer 2 ft. thick, rates of filtration of 2 gal. per minute per square foot and upward have been obtained with water of 300 parts per million hardness. This is equal to the rapid sand filtration rates and suggests the substitution of this natural medium either in gravity or pressure filters for municipal use.

Requirements for Containers

The requirements for containers and drainage and washing systems would not be unlike the arrangement for rapid sand filtration. More idle time would be involved in the regenerating process than is at present consumed in washing the filters, which would increase somewhat the bulk of the equipment. The cost per unit capacity would therefore be somewhat more than the cost of rapid sand filters. The other items of expense would be in the cost of the medium as compared with sand, its life and the cost of salt for regeneration.

It is not unlikely that the medium can be produced very cheaply, as compared with a synthetic product. The material with which Mr. Kinniard has experimented requires some refining and hardening to give it mechanical form. The process is not involved and if handled in large quantities can be made to meet a heavy demand at an easily practicable figure.

Quantities and Costs

Present information indicates that 4 lb. of salt can be counted on to convert completely 1 lb. of equivalent calcium carbonate to sodium carbonate, and Mr. Kinniard feels justified in saying that the indications are that this can be reduced. Assuming a ratio of four to one, and 300 parts per million hardness, 10 lb. of salt would be required to treat 1000 gal. of water. Salt is marketed in carload lots at $3 or more per ton. Assuming $5 per ton, the chemical cost would be 2½ cents per 1000 gal., which figure can easily compete with lime and soda. The two processes, however, are not strictly comparable. The zeolite process gives a completely softened water without reducing the total solids. The lime process reduces the hardness by the amount of bicarbonates, while the soda process is only useful in that it converts calcium and magnesium sulphates to the sodium sulphates, which is exactly the same chemical substitution as is made by the zeolite.

Either alone or in combination with lime, Mr. Kinniard states, the zeolite process will be a most valuable finishing process. For waters harder or softer than 300 parts per million the cost figures would vary about in proportion to the hardness. Complete softening would probably be neither necessary nor desirable for municipal use, which would reduce the cost proportionately. For harder waters the depth of the medium layer could be somewhat increased, sufficient probably to maintain rates of flow nearer the usual rates, without increasing the equipment except as to depth of the containers.

Hydraulic Fill Method Used to Throw Temporary Dam Across Wide Stream

Structure Across Colorado River at Imperial Heading Diverted Entire Flow at Low Water Into Imperial Valley

FOR NOT QUITE a month, from Sept. 20 to Oct. 3, the entire flow of the Colorado River was diverted into the canal system of the Imperial Valley by a hydraulic fill dam, about 6 miles below Yuma. The unusual features of the work were the deposition of the dam-building material in the running water of the stream, and the fact that the material was obtained locally in a country notorious for the friable and unstable character of its soil—a soil commonly likened to sugar in its action when in contact with running water. However, the dam-building material was not this light alluvium, brought down by the ruddy Colorado, but heavier deposits pumped from below the present level of the stream bed.

Reasons for the Work

Water for the irrigation of the valley, located in Southern California and the northern part of Lower California (Mexican territory) is taken from the Colorado River just above the international boundary line. The flow of the stream seldom falls below 7000 sec. ft., being ample normally for the needs of the irrigated lands, which in the period when low water is to be expected require from 3500 to 4000 sec. ft. In the height of the irrigating season, when water is usually plentiful, the maximum demand is about 5500 sec. ft. This year, however, the flow of the stream fell below the 7000 average minimum, endangering the supply to the valley. The California Development Company (operated by W. H. Holabird as receiver), which owns the main canals in the valley and sells water to the mutual distributing companies, in order to save the crops determined to throw a dam across the stream just below its heading, thus diverting the entire flow into its canal, and wasting such water into the Salton Sea as might be in excess of its needs.

Limitations to Design

For various reasons it was not possible, or at least not advisable, to put a permanent structure across the stream. The river is considered navigable by the War Department, and the cost of a permanent structure was out of the question because of the present financial condition of the California Development Company. Furthermore, immediate relief was needed. It, therefore, was a problem of putting in a temporary structure, using such materials as were locally available.

While there is at the heading a good quarry, furnishing ample rock, previous ruling of the War Department, requiring a rock-filled trestle across the stream to be removed, barred such construction from consideration. Furthermore, a dam of that sort would have been costly, for experience in closing breaks in the Colorado has disclosed endless difficulties in building a pile trestle, the current washing the soft alluvium away from the piles with great rapidity.

Hydraulic Fill Adopted

Attention, therefore, was directed to some type of earth fill structure. Dry-earth handling methods were barred, because with them only the light alluvium could be economically secured. This is an unsuitable dam-building material because even the slowest current carries it away. Hydraulic-carriage methods were therefore resorted to, and were feasible only because beneath the present stream bed a considerable amount of heavier materials is to be found. These consist of stones up to 6 in. in maximum size and, principally, of a mixture of clay, alluvium and gravel, which when wet has considerable strength, and comes through a 10-in. dredge discharge pipe in lumps as large as 6 or 8 in. The theory was that these heavier materials discharged along the center line of the dam would build up a fairly good current-resistive core, the lighter materials being carried off by the separating action of the water to the upstream and downstream toes. Much of this material would be lost, but the larger particles and lumps would not be carried away by low current veloci-

ties. For the closure, which it was recognized would be the difficult part of the work, it was planned to make use of brush and sacks of earth.

PROCEDURE

With the plan formulated, a 10-in. suction dredge, with a ladder and suction pipe long enough to reach to a depth of 15 ft. below the present stream bed, was put to work Aug. 12, 1915. The river at this point is about 900 ft. wide, and the dam makes an angle of about 10 deg. with a line normal to the stream flow, the trend of the dam being downstream toward the right bank. The dredge in fourteen days carried the dam to an elevation of 12 in. above water level, extending from the Arizona shore to within 250 ft. of the California shore. As the fill rose light poles were jetted into it and quantities of willow and cottonwood brush piled against them to form a fence. There were two such lines, about 30 ft. apart, within which space materials were pumped to raise the crown of the dam rapidly. Three subsequent runs across the stream raised the dam to an elevation of 5 ft. above water level. With the type of construction described there resulted a base width of about 150 ft. and a crown of 30 ft., the depth of water being 6 to 7 ft. When the work was started the velocity of the current was from 2 to 3 ft. per second. As the channel cross-section was decreased the velocity naturally increased and at closure was about 6 ft.

Since the stream is subject to rapid rises and it was undesirable to take more than about 5000 sec. ft. through the Imperial Valley canals, arrangements were made during the construction of the dam to cut it at two places. The ends of the dam, on either side of the point of final closures, were built as abutments, with brush and stick fences strengthened with sacks of earth, the lines being winged back along the toes. The same type of construction was used at another point in the dam, thus making it possible by using light blasts to quickly create two 150-ft. channels.

CLOSURE

Before beginning the final closure the bottom was carefully lined with about 10,000 sacks filled with heavy material pumped by the dredge. The closure, which was made in a velocity of about 6 ft. per second, and at the very last instant in a depth of water of about 22 ft., was effected with the aid of cottonwood and willow brush obtained on the river banks. The brush consisted of young trees, 6 to 10 in. in diameter at the butt, and 20 to 30 ft. long. These were piled on a barge moored upstream at the point of closure. Another barge was loaded with earth-filled sacks, while the dredge was in operation with its discharge line at the closure point. Two 1¼-in. steel cables were stretched from the California shore to the end of the dam beyond the closure point. The procedure was to throw the brush into the stream, butts pointing downstream, and so to guide them that the butts would come to rest against the cables. Bundles of brush weighted with sacks were thrown from the barge and, with the current, immediately brought pressure to bear on the brush, quickly bending the poles until at the steel cables they were pointed vertically upward. The strain on them was relieved by turning the discharge of the hydraulic dredge onto them. In this way progress was slowly made across the channel. Closure was effected on Sept. 20, when there was a head of about 6 ft. of water against the dam.

The structure remained intact from its completion until Oct. 3, when a rise of the stream, telegraphed ahead from Needles, 300 miles up the river, made it advisable to blow up the closure section. This was done by a charge of dynamite. During the time of complete closure the discharge went as low as 2700 sec. ft., and on most of the days was about 3500 sec. ft., all of which was needed in the valley. This was an exceptionally low stage of the river, particularly for a protracted period, though a minimum of 3000 sec. ft. had previously been recorded.

YARDAGE AND COSTS

Yardage measurements of the prism indicate that there were 30,000 cu. yd. of material in the dam, though the pumping records, combined with observation of the percentage of material carried, indicated that 40,000 cu. yd. were pumped. The two figures are not inconsistent, because it is known that much of the fine material was washed to the toes and there lost. The costs for the pumping alone were as follows:

Labor	$578.38
Fuel oil (13,000 gal.)	416.00
Other oil, and supplies	100.00
	$1,094.38

On the basis of 40,000 cu. yd. pumped this would give a cost of 2.7 cents per yard. The dredge was immediately upstream from the dam side, so that the length of pumping line was in no case greater than 500 ft.

For the final closure 450 cords of brush, at 0.73 cents a cord; 21,300 sacks, at a total cost of $1,140, and 1000 ft. of second-hand ¾-in. and 1¼-in. cable, at a cost of $100, were used. No timber or piling was bought, poles and brush being secured on the banks.

The total cost of the work figured out as follows:

Earthwork (dredge)	$1,100.00
Brush and poles	333.00
Sacks	1,140.00
Wire	32.00
Cable and clamps	100.00
All labor	2,000.00
	$4,705.00
Add 10 per cent for supervision	470.00
	$5,175.00

As against this cost should be set the increased revenue of from $700 to $1200 per day from the sale of the water.

Since low flows are to be expected and are likely annually to embarrass the irrigation district, the California Development Company plans to lengthen the ladder on its dredge in order to get deeper than at present. By so doing still heavier material will be secured and will enable a structure stable under even higher velocities than were experienced this summer to be built. It is expected that the present structure will in part be carried out by high water, but that a considerable base will be left as a foundation for a similar structure next year, should that prove necessary. The dredge, of course, has excavated a deep and extensive hole which, it is expected, will be filled with heavy material brought down in the freshets of the next high-water season.

The work described was carried out under the direction of J. C. Allison of Calexico, Cal., chief engineer and assistant general manager for W. H. Holabird, receiver of the California Development Company.



EARTH DAM BUILT ACROSS COLORADO RIVER BY HYDRAULIC METHODS—INTAKE OF IMPERIAL CANAL AT EXTREME RIGHT OF PICTURE

TWO NEW CIRCULAR COMMUNICATIONS have been issued to the chairmen of the railroad valuation committees by Thomas W. Hulme, general secretary of the Presidents' Conference Committee. They have to do with the inclusion in the inventory of property used but not owned by the carrier, and with "condition per cent." The substance of the former is that the carrier's pilots should be prepared to point out all property used by the carrier, whatever the ownership; that the carrier should seek to have property used but not owned recorded in detail in the inventory and not merely referred to; and that exceptions should be taken if this is not done. The circular on "condition per cent," pointing out the difference between the government's and the carriers' views as to what constitutes depreciation, urges the pilots to cooperate with the government in the ascertaining of facts regarding age and probable date of renewal of parts of each individual unit, but not to commit themselves as to the life or condition per cent of the whole unit. The pilots are especially urged not to agree to life tables.

Literature

For the Civil Engineer and Contractor

New Publications

WATER-SUPPLY PAPERS. U. S. GEOLOGICAL SURVEY. Paper, 6 x 9 in. Washington, Government Printing Office.

PROFILE SURVEYS IN CHELAN AND METHOW RIVER BASINS, WASHINGTON. Prepared under the direction of R. B. Marshall, chief geographer. Paper No. 376; 8 pages, 5 plates.

SURFACE WATER SUPPLY OF OREGON, 1878-1910. By F. F. Henshaw and H. J. Dean, in co-operation with John H. Lewis, State Engineer of Oregon. Paper No. 370; 829 pages; illustrated.

PROFILE SURVEYS IN SPOKANE RIVER BASIN, WASHINGTON AND JOHN DAY RIVER BASIN, OREGON. Prepared under the direction of R. B. Marshall, chief geographer. Paper No. 377; 7 pages, 10 plates.

PROFILE SURVEYS IN 1914 IN UMPQUA RIVER BASIN, OREGON. Prepared under the direction of R. B. Marshall, chief geographer, in co-operation with John H. Lewis, State Engineer o Oregon. Paper No. 379, 7 pages; 13 plates.

PROFILE SURVEYS IN 1914 ON MIDDLE FORK OF WILLAMETTE RIVER AND WHITE RIVER, OREGON. Prepared under the direction of R. B. Marshall, chief geographer, in co-operation with John H. Lewis, State Engineer of Oregon. Paper No. 378; 8 pages; 6 plates.

SURFACE WATER SUPPLY OF THE UNITED STATES, 1914. PART VIII, WESTERN GULF OF MEXICO BASINS. By Nathan C. Grover, chief hydraulic engineer, and Glenn A. Gray, district engineer. Paper No. 388; 124 pages, with list of previous publications; illustrated.

SURFACE WATER SUPPLY OF THE UNITED STATES, 1913. PART II, SOUTH ATLANTIC AND EASTERN GULF OF MEXICO BASINS. By Nathan C. Grover, chief hydraulic engineer, Guy C. Stevens and Warren E. Hall, district engineers. Paper No. 352; 84 pages, illustrated. PART V, HUDSON BAY BASINS AND UPPER MISSISSIPPI RIVER. By Nathan C. Grover, chief hydraulic engineer, W. A. Lamb and W. G. Hoyt, district engineers. Paper No. 335; 177 pages; illustrated.

TRIANGULATION ALONG THE COLUMBIA RIVER AND THE COASTS OF OREGON AND NORTHERN CALIFORNIA. By Charles A. Mourhess, computer. Special publication No. 31, U. S. Coast and Geodetic Survey. Paper, 9 x 11½ in.; 149 pages; illustrated. Washington, Government Printing Office.

TRIANGULATION IN WEST VIRGINIA, OHIO, KENTUCKY, INDIANA, ILLINOIS AND MISSOURI. By A. L. Baldwin, assistant inspector of geodetic work. Special Publication 30, U. S. Coast and Geodetic Survey. Paper, 9 x 11½ in.; 67 pages; illustrated. Washington, Government Printing Office.

THE BUILDING ESTIMATOR'S REFERENCE BOOK. By Frank R. Wallace. Limp leather; 4½ x 6½ in.; 612 pages; illustrated. Chicago, published by the author, 30 Michigan Avenue. $10.

WATER POWER ENGINEERING. The Theory, Investigation and Development of Water Powers. By Daniel W. Mead, professor of hydraulic and sanitary engineering, University of Wisconsin. Second edition. Cloth, 6 x 9 in.; 843 pages; illustrated. New York, McGraw-Hill Book Company, Inc. $5 net.

DISTRIBUTION OF THE MAGNETIC DECLINATION IN THE UNITED STATES FOR JAN. 1, 1915. By Daniel L. Hazard, assistant inspector of magnetic work. Special publication No. 33, U. S. Coast and Geodetic Survey. Paper 6 x 9 in.; 16 pages, isogonic chart and secular change tables. Washington, Government Printing Office.

LAND DRAINAGE BY MEANS OF PUMPS. By S. M. Woodward, drainage engineer. Revised with special reference to the Upper Mississippi Valley by C. W. Okey, senior drainage engineer. Bulletin 304, U. S. Department of Agriculture, Office of Public Roads. Paper, 6 x 9 in.; 60 pages; illustrated. Washington, Government Printing Office.

BEITRAG ZUR BERECHNUNG VON MASTFUNDAMENTEN. By Dr.-Ing. H. Frohlich. Paper, 7 x 10½ in., 60 pages; illustrated. Berlin, Germany, Wilhelm Ernst & Sohn. 2.60 marks.

Records the results of experimental tests of ten full-size concrete foundations for transmission line poles in ordinary soil, and discusses results. Theoretical analysis is given, and formulas are derived. Diagrams are plotted for design purposes, and examples solved.

A TREATISE ON SAFETY ENGINEERING AS APPLIED TO SCAFFOLDS. Cloth, 6 x 9 in.; 354 pages; illustrated. Hartford, Conn., Travelers Insurance Company. $1.

An exceptionally well-illustrated volume treating the subject of safe scaffolding in very comprehensive form, and including both American and European practice. Based upon results of experience and observation, it has been worked up by the engineering department of the Travelers Insurance Company. Reviewed on page 801.

INVENTIONS AND PATENTS. By Philip E. Edelman. Cloth, 7 x 8 in., 248 pages, illustrated. New York, D. Van Nostrand Company. $1.50 net.

Explains the methods of patent procedure for the information of all persons interested in patents, either as inventors, investors or manufacturers. Contains chapters on steps necessary to secure a patent, patentability and practicability, protecting an invention, disposing of patent rights, infringements, foreign patents and the present status of inventions.

AN OPEN LETTER TO THE FEDERAL TRADE COMMISSION. By the Port of Seattle Commission. Bulletin 5. Paper, 6¼ x 9¼ in.; 96 pages; illustrated. Seattle, Wash. H. C. Piggott Printing Company.

A report reviewing the recent wharf and terminal improvements at Seattle, and covering the facilities at that port for storing and shipping various kinds of freight. It explains the need and purpose of the several structures that have been completed for handling and storing freight, outlines the plans for the proposed belt-line railway and accounts for the commission's expenditure of about $5,000,000 in port improvements. The half-mile pier, the grain elevator, the cold-storage plant and several others among the more important structures each receives attention in a separate chapter. An explanation is also made of the policy and the advantages of municipally owned terminal facilities.

MAINTENANCE OF WAY AND STRUCTURES. By William C. Willard, assistant professor of railway engineering, McGill University. Cloth, 6 x 9 in.; 451 pages; illustrated. New York, McGraw-Hill Book Company, Inc. $4 net.

SCIENTIFIC MANAGEMENT AND LABOR. By Robert Franklin Hoxie, associate professor of political economy, University of Chicago. Cloth, 5 x 7½ in.; 302 pages. New York and London, D. Appleton & Company. $1.50 net.

A SURVEY OF THE PUBLIC HEALTH SITUATION IN ITHACA, NEW YORK, 1914. By Franz Schneider, Jr., sanitarian, Russel Sage Foundation. Paper, 6 x 9 in.; 33 pages; illustrated. Ithaca, N. Y., Central Committee for Ithaca Survey.

BEITRÄGE ZUR GESCHICHTE DER TECHNIK UND INDUSTRIE. Jahrbuch des Vereines Deutscher Ingenieure. Vol. 6, 1914-15. By Conrad Matschoss. Paper, 8 x 11 in.; 187 pages; illustrated. Berlin, Julius Springer.

The following is the table of contents of this volume:

Schmiedemachinen. By Prof. Hermann Fischer.
Leuchttürme. By Dr. Richard Hennig.
Der Bickfordsche Sicherheitszünderfabrik in Deutschland. By Prof. Hugo Fischer.
James B. Francis. Zur hundertsten Wiederkehr seines Geburtstages. By Dr. Karl Keller.
Peter Ritter von Tunner und seine Schule. By Hofrat Josef Gängl v. Ehrenwerth.
Ein Beitrag zur Geschichte der Grossgasmachine. By Dr. Wilhelm von Oechelhaeser.
Die Lokomotiven der vormaligen Braunschweigischen Eisenbahn, unter Mitberücksichtigung gleichartiger Lokomotiven bei anderen Bahnverwaltungen. By W. Nolte.

Especial mention should be made of the 16-page tribute to the memory of James B. Francis on the occasion of the hundredth anniversary of his birth. The author, Dr. Keller, has paid this American hydraulic engineer unusual compliments throughout the description of his work and inventions.

Books Reviewed

Irrigation Practice and Engineering—Volume II

Author, B. A. Etcheverry, head of the Department of Irrigation, University of California. Cloth, 6½ x 9½ in.; 364 pages, 82 illustrations. New York, McGraw-Hill Book Company, Inc. $3.50.

Reviewed by F. H. Newell

Professor of Civil Engineering, University of Illinois, Urbana.

The second volume, just issued, of Etcheverry's "Irrigation Practice and Engineering," justifies the expectations raised by the appearance of Vol. I of the series. Vol. II is devoted primarily to the conveyance of water, but also contains introductory chapters relating to irrigation engineering as a whole. The treatment of the subject renders the book valuable not merely for the purpose of instruction, but, more than this, for reference by practising engineers. Not only are the discussions excellent, but the illustrations command special attention from their completeness and attractive appearance.

The subjects included under the head of conveyance of water, after the introductory chapters on surveys, examinations, planning and computations are considered, deal with the silt problems, the loss of water in canals, the design of the canal, cross-section, tunnels, flumes, pipe and inverted siphons and special devices of this nature. The book is characterized as a whole by simplicity and clearness of statement and by logical arrangement and presentation of the salient facts. It brings together in concise form the important features of the topics above mentioned, and gives in addition many references to original sources of information.

The Corrosion of Iron

Author, L. C. Wilson, Cloth, 5 x 7½ in.; 178 pages. New York, Engineering Magazine Company, $2.

Reviewed by Allerton S. Cushman, Ph.D.

Director, Institute of Industrial Research, Washington, D. C.

According to the claims made in its preface, this little volume is an attempt to put in simple form some of the more important facts connected with corrosion tests and protection of iron. The author states that he hopes to reach the busy engineer who has not time to consult the original authors.

Since this is the avowed intention of the book, it is to be regretted that the author has seen fit to espouse one side in several important metallurgical controversies over subjects of great importance to engineers, and to quite ignore the data and arguments that have been presented in rebuttal. In respect to the claims that have been advanced as to the excellence and rust-resistance of the commercially pure irons as well as for the types of ordinary steels alloyed with a quarter of one per cent or less of copper, the so-called "copper-bearing steels," the author of this volume has undertaken to decide the question in favor of the latter product, quite ignoring the evidence that has been advanced in favor of the purer open-hearth irons. It would seem as though the partisanship of the author is clearly disclosed by his quoting in full the tests and arguments of the proponents of copper-bearing steels without making reference to the arguments of those who believe in pure iron, although the latter have been widely disseminated in the literature of corrosion studies. In referring to the results of a series of private tests made in the interest of one side of this controversy, the author states on page 147:

"The low carbon and manganese material, American ingot iron, was in rather bad shape, and after about 18 months of exposure had disappeared entirely, although all of the copper-bearing sheets were still in place."

It does not seem to be ethically correct for a book which purports to be written for the dissemination of knowledge among engineers to undertake to belittle the product of any one manufacturer by reference to the material manufactured under his copyrighted brand name. The discussion of the excellence of various types of material is, of course, permissible. An author is well within his rights in expressing an opinion either in favor of or against any particular type which is offered for sale. In the interest of fairness, however, it would be just to refer to the fact that the matter was in controversy and required further investigation before it could be finally settled. It is unlikely that any engineer in charge of construction work would wish to accept as proved on present evidence that sheets of

any well made open-hearth metal of from 27 to 16 gage, whether it be called iron or steel, could be made to entirely disappear under atmospheric corrosion in from 9 to 18 months, provided the conditions of the test were fair, open and unbiased. However good certain brands of open-hearth copper-bearing steels or irons may have appeared in the tests that have already been published, the counter claims advanced for the excellence of pure iron cannot be ignored with fairness or justice.

The author includes a considerable amount of discussion on the characteristic dark color of the adherent rust which usually is a sign of durability, and advances the claim that this is always characteristic of the copper-bearing steels, whereas the other purer metals, he alleges, rust with a lighter, loosely adherent rust which causes the sheets to quickly waste away. These contentions have been denied by some authorities who believe in the purer irons and who have advanced the claim that the dark, adherent, close-grained rust is characteristic of carefully made basic open-hearth metal, quite independent of the copper content. These conflicting contentions must be investigated in an unbiased manner, and the fact that the American Society for Testing Materials is planning systematic and comprehensive tests on these mooted questions is sufficient proof that the society considers them as yet unanswered. This fact the author has not seen fit to refer to.

In another important controversy on the comparative durability of wrought iron and steel pipe which has been carried on for a number of years past, the author chooses to select all the evidence available in favor of steel, quite ignoring the evidence that has been advanced in favor of iron. In the summary of his seventh chapter the author attempts to finally settle this controversy in a few words which, as far as brevity and succinctness are concerned, are above criticism. As the author puts it:

"All conclusions negative to superiority of iron over steel as to corrodibility, and tendency to pitting somewhat greater in the case of wrought iron."

It is probable that most engineers will wish to examine evidence on both sides of these controversial matters before coming to a final conclusion, and they will probably not lose sight of the fact that after all neither steels nor irons are standard substances. Before specifying steel as against iron it is necessary to consider that a given type of steel may or may not be durable under the conditions of service to which it is to be exposed.

The first five chapters of the book consist of a condensed review of the work published by a number of students of corrosion problems and set forth the various theories which have been held to account for the corrosion and protection of iron and steel. The wording of these chapters is to a considerable degree reminiscent of that of the original authorities which the author consulted. The volume could have been improved from an ethical standpoint by a more liberal use of quotation marks, which are mainly conspicuous by their absence throughout the book. Chapter III discusses protective measures and discusses at length various methods for estimating the weight of coating on galvanized material. A great deal is made of the old-fashioned Preece or copper-sulphate test, now almost abandoned. The newer and more useful basic lead acetate test is not even mentioned. In this and many other respects the book is neither accurate nor up to date. Those who believe in the statement made by the author on page 10, that extremely pure iron corrodes about as readily as ordinary commercial grades of steel, and those who further believe that steel is better and cheaper than iron for all purposes, will undoubtedly be pleased with this volume. Those, however, who are seeking fair information on this important topic will probably not be satisfied with a volume which presents only one side of several important controversies.

General Specifications for Concrete Work as Applied to Building Construction

Author, Wilbur J. Watson. Second edition. Paper, 8¼ x 11 in.; 56 pages; illustrated. New York, McGraw-Hill Book Company, Inc. $1 net.

The great progress made in the art of reinforced-concrete design and construction in the seven years which have elapsed since the first edition of the specifications by this author was published in 1908 has made it necessary to make radical revisions to bring them up to date. The present form of these specifications is highly satisfactory. Much of the matter will be found to conform closely to standard practice and to recent rulings by the building departments of large cities. The notation used in the formulas and many allowable unit stresses are the same as given by the Joint Committee on Concrete and Reinforced Concrete.

In the section on computing and designing, the usual assumptions of straight-line stress variation in beams and neglect of tensile stress in concrete are made, and T-beam limiting dimensions are specified. Vertical stirrups are allowed 10,000 lb, unit stress instead of the 12,000 lb. permitted in diagonal bars. A new provision is a specification for coefficient of contraction or shrinkage of concrete set in air, which is given in terms of the mix used, and must be provided for in the details of the design.

An approximate method for T-beam design is described and a table included to facilitate its application. The tests for quality of cement are those of the American Society for Testing Materials, with some modifications. The tests required for sand and coarse aggregate are of unusual completeness and definiteness. Decreases in allowable unit stresses of 33 1/3 and 50 per cent are specified for concrete placed under water, depending on the method used. The dropping of concrete from a height greater than 10 ft. is not permitted. The importance of limiting the time for removal of forms is recognized, and too early removal is properly provided against. Eight different methods for finishing the concrete surface are described in detail. Complete descriptions of waterproofing methods are given under the four principal classes.

The rules for computing flat-slab floors are the same as those in the Chicago Building Code, with a few exceptions. In the four-way system the positive bending-moment coefficient for Strip A is made 1/50 instead of 1/40. The bending moments for wall panels are increased by 10 per cent if supported on concrete columns and girders, and 20 per cent if on bearing walls, and for all wall panels the amount of reinforcement at right angles to the wall is increased an additional 10 per cent. These, though arbitrary, appear to be much more logical requirements than those in the Chicago code. Another difference is in the increase from 5 per cent to 10 per cent as the amount by which the length of rectangular panels is allowed to exceed the breadth in classifying for the two different methods of design. Furthermore, in making tests for acceptance, the specified loading is twice the live load only, under which load the deflection must not exceed 1/500 of the panel length.

Under the title "Unit Systems" it is provided that the usual assumption of T-beams may be used when proper provision is made for bonding unit slabs into unit beams or girders, and that when a jarring machine is used in making units the unit stresses may be increased proportionately to the increased strength. The final section contains a few tables and data useful in design.

American Sewerage Practice—Volume III

Authors, Leonard Metcalf and Harrison P. Eddy. Cloth, 6 x 9¼ in.; 851 pages, 230 illustrations. New York, McGraw-Hill Book Company, Inc. $6 net.

Reviewed by George W. Fuller

Consulting Engineer, New York City.

Vol. III of "American Sewerage Practice" by Metcalf and Eddy deals with the disposal of sewage and reaches the high plane of excellence of the two earlier volumes. Its purpose is stated by the authors to be twofold: First, to explain in a simple nontechnical way the nature of sewage and the changes that take place in it when subjected to different conditions; second, to describe the structures designed to produce various conditions in order to modify as desired the character of the sewage before it finds its way into some body of water.

Chapters 1 to 6, inclusive, covering 240 pages, and including what might be called the theoretical portion of the book, are devoted to a description, as free from technical expressions as practicable, of the nature of sewage and its behavior under various conditions and processes. Chapter 1 deals with progressive steps in sewage treatment, and Chapter 6 describes the theories of sewage disposal and treatment. They are carefully and comprehensively prepared and give a good historical synopsis of the past and present status of this subject. Chapters 2, 3 and 4 are devoted to an explanation of the chemical, bacterial and plankton aspects of sewage and sewage-polluted waters. Chapter 5 contains records of the composition of sewage from various sources, both in this country and abroad, including references to the effect of trade wastes.

The remainder of the volume, more than 600 pages, is devoted essentially to the details of methods of sewage disposal. It is provided with an abundance of good illustrations and an ample supply of representative data to aid designing engineers and the operators of treatment plants.

The book has been intentionally kept free, as the authors state, of highly technical discussions of data and theory upon which there is not yet full accord on the part of special workers in this field. The intent has been, in the absence of adequately precise data, to record the practical experience of to-day with as definite inferences as are justifiable from general information. The

authors speak of this viewpoint with special reference to the subjects of screening, the use of contact beds in America, aeration as related to oxidation of sewage and the disposal of sludge. On these topics the authors have gathered comprehensive valuable data not only from this country but from England, France and Germany.

Sewage disposal by dilution is treated in a chapter of about fifty pages. The more important investigations are tersely summarized and a concise description is given of the significance of various leading factors bearing on this topic. The effect of winds, tides, temperature conditions and stratification are fully discussed.

Grit chambers and sedimentation are discussed adequately as to theory. Full records are given of typical structures, and attention is given in particular to data to record the efficiency of representative devices. The same comment applies to the chapter of about fifty-three pages on tanks for sludge digestion. The chapter on chemical precipitation is characterized by its practical viewpoint in dealing with the behavior of various available chemicals and especially a description of their manufacture, storage, application, mixing and control, under conditions of practice. Sludge data are well presented.

The chapters on trickling filters and intermittent sand filters cover more than 100 pages, and are carefully prepared with abundant illustrations of suggestive value to the designer and of points of practical aid to the operator. A separate chapter of thirty-seven pages is devoted exclusively to apparatus for the automatic control of filter dosing.

Chapter 17 deals with irrigation and the utilization of sewage and sludge as fertilizers. Data from the Royal Commission on Sewage Disposal are summarized at length, and European experiences at the larger sewage farms are stated tersely, as is the historical development of sewage irrigation in America.

The last two chapters of the book deal with the disinfection of sewage and sewage effluents, and with the disposal of sewage from residences and institutions. The former chapter is unusually complete in its historical development, although it does not lead the reader far into recent experiences in the use of liquid chlorine. The last chapter, on isolated plants of various types and sizes coming under the general heading of residential and institutional plants, contains many helpful suggestions.

This book is a monumental contribution to American literature on sewage disposal, with judicious references to the more important developments abroad. Its preparation has been impressively thorough. It should and doubtless will be a welcome addition to the library of all those who are interested directly or indirectly in this important and rapidly developing branch of sanitation. Coming at a time when the state of the art is changing more rapidly perhaps than ever before, and when more communities than previously are interested in securing efficient disposal of sewage at least cost, its appearance is more than ordinarily welcome.

METERING THE IOWA FALLS (IOWA) WATER SERVICES reduced the hours of pumping from 15 to 7½ hr. per day. The city compels the consumer to buy meters, but the city buys the meters in quantity and retails them to the consumers at actual cost.

Letters to the Editor

Comment on matters of interest to engineers and contractors will be welcomed

Chicago's Water Supply Situation Controlled by Pins

SIR: I have read with interest your article in the Engineering Record of Dec. 11, page 714, on paving work in Philadelphia controlled by a handful of pins.

It may interest your readers to know that for several years the undersigned has used this method in controlling the water-supply situation in Chicago. On a map of Chicago, hanging on the wall in the city engineer's office, some sixty circles, properly numbered, are shown. Each circle represents the location of a water pressure gage. These gages are read daily and the pressures indicated reported to the city engineer's office. Pins of different colors, each representing a certain range of pressures, are used for these various locations, so that one can see at a glance the various pressures all over the city area.

Adjacent to this map are nine cards, representing the nine major water pumping stations in the city. The pumping engines in operation at each station are designated by black pins set in the first vertical columns on these cards. Pumps being repaired are indicated by pins placed in the second columns, and pumps held in reserve by pins in the third columns. In this manner the situation is shown at a glance, and the method has proved to be of great value.

JOHN ERICSON,
Chicago. City Engineer.

Graphical Analysis of Arches

SIR: The writer wishes to call attention to an error made in redrawing for publication Fig. 3 of his article "Graphical Analysis of Arches with Fixed Ends Greatly Simplified" in the Engineering Record of Sept. 11, 1915, page 325. The value z_A'' should be the ordinate under A at the extreme left-hand end of funicular polygon 4 instead of the corresponding ordinate of polygon 5 as shown.

It should be of interest to note that the funicular polygons 3, 4 and 5 are the elastic curves of the arch when acted upon by H, V and M' respectively. Consider that the arch is fixed at the right end and free at the left end, and that a lever is attached to the left end so that a horizontal force may be applied to the left end with its line of action passing through the "center of gravity," C.G., of the arch. This horizontal force H will then produce a horizontal displacement only of the left end, and no vertical or angular displacement. Polygon 3 is the resulting elastic curve, z_K' giving the vertical displacement of the point K.

Since z_K' is the vertical displacement of the point K produced by a horizontal force at the left end, by Maxwell's theorem it is also the horizontal displacement of the left end produced by an equal vertical force at K. The value z_1 gives the horizontal displacement of the point A for the same load, and the actual value of H of the fixed arch for any load P is therefore equal to Pz_K'/z_1.

In the same way polygon 4 is the elastic curve for the arch when acted upon by a vertical force through C.G., there then being no horizontal or angular displacement of the left end. Polygon 5 is the elastic curve when a moment is applied to the left end.

The writer has prepared two elementary articles which explain the application of the graphical method to straight beams and two-hinged arches. These will be published in the January and February issues of the Cornell *Civil Engineer*.

C. S. WHITNEY.
New York City.

The Taxpayer and the Engineer

SIR: I have read with great interest your editorial on "The Taxpayer and the Engineer" appearing in the Engineering Record of Dec. 11, page 712. Much credit is due you for calling attention in the manner that you have to the serious loss to the taxpayers in American cities, resulting from the errors committed by politicians, which might have been corrected in time by engineers. The fault, in my opinion, lies with the existing political conditions rather than with any lack of interest or co-operation on the part of engineers. There are many engineers in this city who are fully aware of the many millions that this city could save, were strict business and engineering principles applied to every branch of its government, but for this knowledge to effect any saving would require less interference from politics than now exists.

Your comments make more evident the advisability of having an engineer with executive ability on the membership of each of our public service commissions. The executive heads of many of our railroads and other public service corporations have received their fundamental training as engineers, and the great progress which has been brought about in this country in recent years is mainly a result of the co-operation that such engineers have received from boards of directors and stockholders. Similar co-operation does not exist today in our "great municipal corporations."

In December, 1911, I called the attention of several members of the New York Board of Estimate to the saving that would result to the city if the material excavated for the subways were disposed of for the filling in of the Riverside Drive extension and various other properties belonging to the city, whose value could thereby be enhanced. I then estimated that the total excavated material that could be obtained from the subways and the water-supply tunnels would have amounted to more than 2,700,000 cu. yd. The fill required for the improvements above mentioned would have amounted to about 2,400,000 cu. yd. Nothing has been done in this direction since that date, except that recent subway contracts in Brooklyn stipulate that the material excavated from the subway should be disposed of with the co-operation of the Commissioner of Parks.

On Jan. 18, 1915, I wrote an exhaustive report giving reasons why the Queensboro tunnels at Sixtieth Street should be con-

structed instead of operating the trains over the Queensboro Bridge. Copies of this report were sent to every member of the Board of Estimate and to several local civic organizations. The tunnel proposition was officially approved by the Board of Estimate, but the contract has not yet been awarded for this work. As you have mentioned in your editorial, the cost of these tunnels will be very much increased owing to the rise in cost of materials during the past year, of all of which city officials were at that time fully aware. I cannot find any other reason for this delay than the one of politics. I am informed that the delay in referring the matter to the Sinking Fund Commission by the Public Service Commission is what caused the loss to the city of the New York Dock Company's proposition at the foot of Montague Street, Brooklyn.

Aside from the increase in cost of construction there is a greater loss to the city that will result by reason of the fact that all of the subways in Manhattan and the Bronx will be completed before the Queensboro tunnels are ready for operation. These various flagrant losses to the taxpayers of this city constitute a criminal waste of its resources, which might have been employed to meet many other crying needs at the present time.

Such matters, it seems to me, ought to be taken up by engineering organizations in a manner similar to that in which the Merchants' Association, Chamber of Commerce, City Club and others actively interest themselves in important city problems. On matters which involve special engineering knowledge as well as public necessity, engineering organizations are in a better position than other associations to do exceptional public service. The same applies to our technical journals. In this respect your weekly editorials on matters of public interest deserve the co-operation and interest of the entire public.

MAURICE DEUTSCH,
Consulting Engineer.

New York City.

Critical Velocity in Hydraulic Turbine Intakes

SIR:—I have read with much interest the article on hydraulic power developments by A. G. Hillberg, which appeared in your paper Oct. 2, 1915, but regret to find that Mr. Hillberg did not give the formulas covering the critical velocity of water at which air will be drawn down in penstocks to turbine wheels.

I allude particularly to that part of his article that appears near the lower right-hand corner of page 413 in the issue mentioned, and should be pleased to see in your columns a full description with formulas for these critical velocities.

F. W. SALMON,
Civil and Mechanical Engineer.

Birmingham, Ala.

[A copy of this letter was submitted to Mr. Hillberg, who replies as follows.—EDITOR.]

SIR:—An interesting point has been brought up for discussion in Mr. Salmon's letter. Generally engineers do not investigate scientifically every detail in a design; some of them are designed purely by guesswork, the engineer guiding himself by rough approximations based on his experience. But if experience is lacking the only way in which to proceed is to investigate the problem scientifically in order to make certain that the design is entirely on the safe side.

Intakes for waterwheels are generally closed by straight head gates, which in the upper position leave a clearance with the masonry (see Fig. 1), while no clearances are left on the sides. Furthermore, in some installations the air vent has been placed only a few feet back of the face of the masonry. This vent can be either straight or curved at its upper end. The latter shape

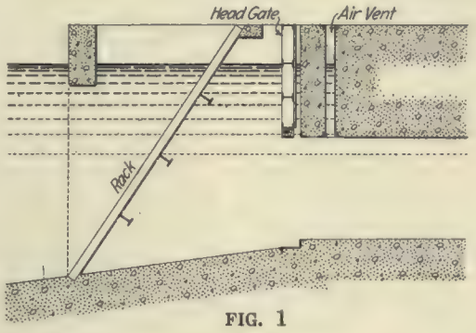


FIG. 1

has the advantage that should the vent be poorly designed or misplaced, and, therefore, under certain conditions subjected to violent surges, water will not be thrown up into the gatehouse, but discharged back of the head gate.

Another point of importance is the number of intake openings. There can be one, two, three or four openings. If the latter case is analyzed it is obvious that when all gates are open each of them carries about one-fourth of the discharge, but when one or more of them are closed, as, for instance, when the unit is being started or closed down, the quantity of water passing through

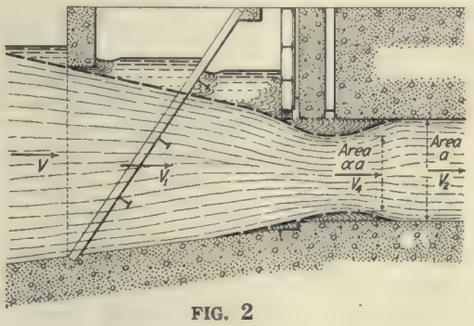


FIG. 2

that or those in the open condition is increased materially. As the friction losses in the passages and the turbine are about the same for all conditions (with the only exception of the comparatively small part located between the piers supporting the head gates and extending for some distance into the intake) it is evident that, when only one gate is open practically the full discharge is passed through it. Ordinarily the turbine gates are closed, and the discharge under such conditions would be from 10 to 15 per cent of that at 0.8 or full gate because of leakage. The designer, however, in order to be on the safe side, has to assume that something has gone wrong, and that, consequently, the unit is not in operating condition, and that, therefore, the full discharge passes through one opening.

If now the stream lines are plotted they will look about as illustrated in Fig. 2. As will be noticed, the oblique pressure of the water approaching the opening from various directions tends to cause a contraction of the stream some distance back of the opening. At this point the velocity reaches its maximum value, and is accompanied by a corresponding reduction in pressure. If now the pressure under normal conditions is too low an air pocket may form. As the downstream side of this pocket, theoretically, ends in a knife edge, the friction of the water against the pocket will cause the tearing off of this edge, so that a very efficient injection of the air will take place. This air is carried further in to the scroll case and liberated, thus forming another air pocket or pockets at points where the velocity is slower and the pressure correspondingly greater. After a while, when the accumulated air has reached a certain quantity, the pressure on it will force it to seek an outlet and in many cases it will rush toward the air vent near the intake. In a certain plant this air, carrying water with it, went up through the vent and nearly blew the roof off the gatehouse. In this plant the vent was later on rebuilt and turned toward the back of the gate.

As the water approaches the power house, the first loss in head takes places at the racks. Another loss is caused by the building up of the velocity, and then there is a loss due to the entrance. Consequently, the following equation can be established:

$$h = h_1 + h_2 + h_3 \qquad (1)$$

where h = total loss of head in feet; h_1, loss at the racks; h_2, velocity head, and h_3, loss due to entry.

The loss through the racks can closely enough be said to equal the head lost in changing the velocity. The rack bars obstruct the area; calling the net area A_1, the velocity is

$$v_1 = Q/A_1 \text{ and } h_1 = v_1^2/2g \qquad (2)$$

Between the racks and the opening a loss takes place equal to the change in velocity head, or

$$h_2 = (v_2^2 - v^2)/2g \qquad (3)$$

At the entrance the head lost is

$$h_3 = c(v_2^2/2g) \qquad (4)$$

where $c = 1/\beta^2 - 1$. Generally β is assumed at from 0.82 to 0.97, making $c = 0.50$ to 0.06. It is advisable to assume the higher value, because of the sharp edges of the intake.

There is, however, a more accurate way of figuring the loss due to entrance. As mentioned previously, a contraction takes place a certain distance inside the intake opening. The losses due to entrance are due to this contraction.

The head lost due to contraction is

$$h_3 = q(v_2^2/2g) \qquad (5)$$

In equation 5 q is a variable depending upon the prevailing conditions. Weisbach found that

$$q = \frac{0.0765}{\alpha^2} + \left(\frac{1}{\alpha} - 1\right)^2$$

where α depends upon the relation between the areas in front and inside the opening. Calling the areas A and a their relations would be a/A, and the following table can be established:

a/A	0.20	0.40	0.60	0.80	1.00
q	0.42	0.33	0.25	0.15	0.00
α	0.66	0.70	0.75	0.84	1.00

The smallest effective area is thus

$$a_1 = \alpha a$$

and the corresponding velocity

$$v_1 = Q/\alpha a$$

One point that should be observed is that generally the piers in front of the head gates form a bellmouth in plan. The contraction coefficient α is therefore somewhat

too small, the net area in fact being greater than a_0. In neglecting this fact the designer errs on the safe side.

Introducing the values of h_1, h_2 and h_3 in equation 1, the minimum permissible value of h is obtained. Careful designers, however, should add at least 6 in. to this theoretical value.

A. G. HILLBERG.

New York City.

Propose Series of Fire-Resistance Tests of Columns

SIR: The Associated Factory Mutual Fire Insurance Companies, the National Board of Fire Underwriters, and the National Bureau of Standards propose to carry out a series of tests on the ultimate fire resistance of loaded columns and the fire-resistive value of column protection. These tests are to be conducted at the Underwriters' Laboratories, in Chicago, with new apparatus designed especially for this purpose.

In view of the awakening interest in fire prevention and protection, and the necessity for more exact information on which to base specifications for fireproof construction, the importance of this investigation will be recognized.

A prospectus has been prepared covering the general plan of the present investigation, including a brief description of the first series of test samples, the apparatus, and the methods of testing that it is proposed to employ. [An abstract of the prospectus is printed below.] This prospectus is being sent to a number of prominent engineers, architects, building commissioners, manufacturers and underwriters for their criticisms and suggestions.

In order that the investigation may be made as comprehensive and complete as possible, your careful consideration and assistance, particularly with reference to the materials selected, the methods employed in their application, and the methods of testing, will be greatly appreciated. Replies may be sent to any of the undersigned or to the Underwriters' Laboratories, 207 E. Ohio Street, Chicago.

ASSOCIATED FACTORY MUTUAL FIRE INSURANCE COMPANIES,
NATIONAL BOARD OF FIRE UNDERWRITERS,
NATIONAL BUREAU OF STANDARDS,
UNDERWRITERS' LABORATORIES, INC., CHICAGO.

Prospectus of Fire-Resistance Tests

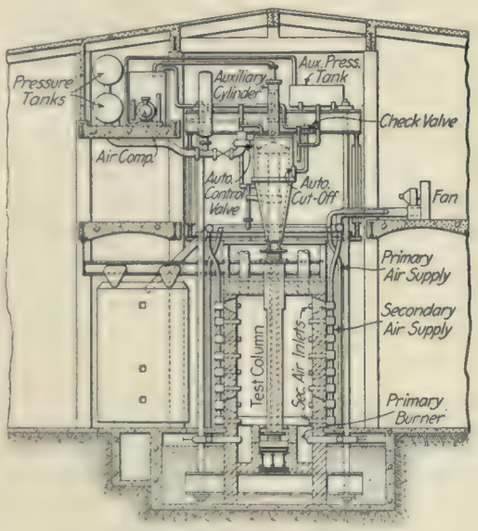
The object of the investigation in the first series of the proposed tests is to ascertain the ultimate fire resistance of centrally loaded columns under conditions approximating those of actual service in buildings; to obtain the fire retardant value of various commonly-used types of column protection with full and accurate data sufficient to allow classification of column protection for various classes of buildings; to furnish data for guidance in the determination of proper test conditions for heavier columns, and special tests to ascertain the effect of the application of fire streams to columns while in a highly heated condition.

Test columns specially designed for the test apparatus and for safe rated loads of about 50 tons have been secured. These columns, except one of each type, will each be protected by one of the various common fire-resistive materials and allowed to season for about six months before being tested. Supplementary standard tests will be made of the materials.

Each column is to be subjected to its safe rated load and to temperatures increasing at a predetermined rate until failure occurs, or until the column has withstood the high temperature for 8 hr. Observations at regular intervals during the tests will be made of the furnace temperatures, the temperatures at various points of the structural portion of the column near the middle, and the effects produced by the fire on both the column and the protective material during and after the test. Photographic records will be made before and after the test.

TYPES TO BE TESTED

The types of columns to be tested include rolled steel sections, built-up steel sections, round cast iron sections, steel pipe filled with concrete, vertically reinforced and hooped columns, and several wooden columns. At least one of each type is to be wholly unprotected. Others are to be partially protected by concrete and others fully protected by various thicknesses of concrete, clay tile, gypsum blocks and plaster on metal lath in accordance with the methods commonly employed in practice. The coverings for the same sections are, in general, to be placed in 2-in. and 4-in. thicknesses. The thickness outside of solid flanges varies from ¾ to 1 in. and outside of lattice bars and rounds from ½ to ⅝ in. All clay tile is to be in 12-in. widths and the mortar for coverings is to be 1:1:6 Portland cement, hydrated lime and fine bank sand. A No. 12 black annealed wire tie is to be placed around each course of tile.



ARRANGEMENT OF TEST APPARATUS

The tests will be made in a fireproof building specially designed for work of this character, and the apparatus consists essentially of a furnace heated by 6-in. blast burners, a hydraulic ram and restraining frame by means of which loads are applied to the columns, thermocouples for measuring the temperatures, and protected wires attached near the center of the columns to measure the deflection, all fully illustrated and described in the prospectus. Details of the methods of testing are also given, and a proposed time-temperature curve for application of heat is shown.

Effect of Salamanders in Concrete Construction

SIR: Some twelve or more years ago a six-story building covering a ground area about 150 ft. square was erected on Euclid Avenue in this city. The framework of this building was steel; the floors were the Roebling system of concrete floor arches between I-beams, cinder concrete being used, but of unknown mix. When the outside walls, floors and roof were in place, work was stopped and the building left in this unfinished condition and unoccupied for eight or ten years and, during this interval, the rain and snow had more or less free access to the several floors through the poorly protected window openings. At the end of this time the writer was engaged to make an examination of the building to ascertain the amount of deterioration, if any, when it was discovered that the concrete floor arches, near the outside or where they had been the most exposed to the weather, were sound and in good condition, but about the central part of the building nearly all of these floors had disintegrated and the concrete, in a large number of places, had fallen through, apparently from its own weight.

The cause of the above condition has been a mystery, and though we have asked a number of experienced concrete engineers regarding it, we have received no satisfactory explanation. Finally, a prominent contractor of the city, after searching his "memory files," stated that he felt confident that these particular floors were "run" during cold weather, that "salamanders" had been used to prevent freezing and that these had been placed near the central part of the floors and the hot air from them, impinging directly against the floor above, caused this to dry out too quickly for the proper curing of the concrete, which was probably of a "dry" mix. If this is the true solution, or even a partial one, it would be interesting to know the condition of other floors about the country which have been dried out in a similar manner. Of course, where "forms" have been used to support the wet concrete, these would protect it against the too rapid drying, but how about floors where "self-centering" has been used?

We would be pleased to have the opinion of some of your many readers on the cause of the above described detorioration; also as to whether the sulphur fumes, from the coke used in salamanders, would have been injurious or not.

THE WALTER P. RICE ENGINEERING COMPANY,
Per Charles F. Lewis.

Cleveland.

THE FOREST PRODUCTS LABORATORY at Portland, Ore., maintained by the U. S. Forest Service, has made approximately 20,000 tests on structural timber in the ten years since it was established. Attention has been devoted particularly to Western hemlock and Douglas fir, the majority of tests having been made on these two species in an endeavor to furnish the information that would create greater confidence in timber native to the Northwest. On account of the inferior quality of an Eastern hemlock, well known to Eastern lumbermen and builders, it has been necessary to combat skepticism, laboratory officials report, in introducing the Western timber of that name.

HINTS FOR THE CONTRACTOR

Details Which Save Time and Labor on Construction Work

Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

[*Contributions to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

All Scaffold Builders Should Read This Book

By H. D. HAMMOND
Associate Editor, Engineering Record

THERE IS much economic loss to this country and a large cash loss to its contractors annually from unsafe working conditions that could be remedied readily if good practice were standardized. In this respect scaffold work of all kinds has been a serious offender. Scaffold hazards arise from the fact that scaffolds support men and materials at heights from which a fall is dangerous. The scaffold may fall, the men may fall, or objects, such as tools, may fall on those below. At least one serious scaffold accident occurs every day on construction work in this country. Such accidents are preventable and have been largely prevented in Europe by uniform construction standards. Conforming to these standards makes scaffolds little or no more costly than those built in a haphazard way, and well-built scaffolds pay big dividends in increased efficiency by guaranteeing the safety of the workmen.

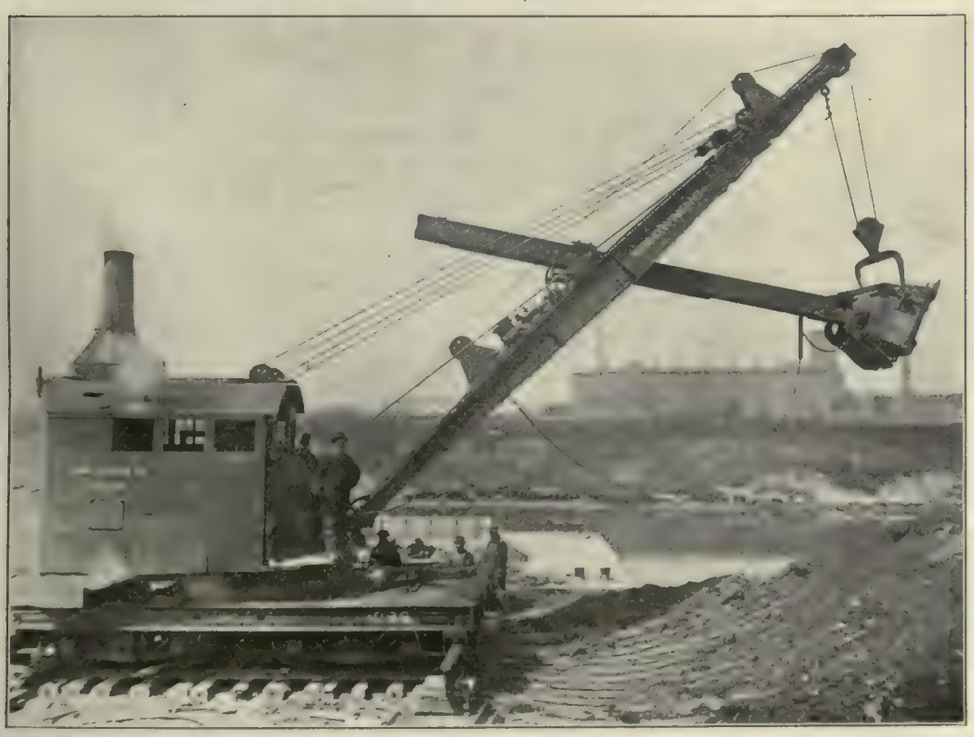
European scaffolds of the bricklayer's, independent pole and ladder types differ radically from American practice in using largely unsawn round poles, and the suspended scaffold used in this country for tall buildings is unknown abroad. We need, therefore, a standard practice of our own in scaffold construction. Up to the present nothing of this sort has existed. It was left for one of the great underwriting companies that take construction risks—the Travelers' Insurance Company of Hartford—to put its engineering force at work drafting a code of standard American scaffold practice which would detail correct methods of building and maintaining every common type of scaffold used in this country. The work is now published, and is listed under "New Publications" on another page of this issue.

Every one who builds scaffolds should study it. While it is written primarily from the viewpoint of the safety engineer, it describes in detail the most economical ways of building scaffolds so as to insure the efficiency of the working force by providing freedom of movement and freedom from apprehension of unnecessary risks. The cost of making a scaffold of a given type safe in this sense is scarcely more than that of building a similar structure on which the workmen will be in constant danger of injury. It is too well known to need further emphasis that the returns from safe working conditions in increased efficiency are much larger than the direct saving in decreased compensation and liability payments, which is itself an important item. Contractors needed only some standard summary of good practice to make a wide application of these principles to scaffold work. The summary is now at hand.

Locomotive Crane Put to Many Uses on One Job

THE LOCOMOTIVE crane shown rigged as a steam shovel in the accompanying photograph was also used on the same job to handle a clamshell bucket in unloading materials and for driving 1085 lin. ft. of sheeting and foundation piles. Used as a steam shovel, the crane dug and loaded onto scows between 700 and 850 cu. yd. of stiff clay per day. The scows used held about 500 yd., and a dumping board was rigged so that after one side of the scow was loaded material could be dumped on the board and spread to the other side without turning the scow around. The wood sheeting driven was 8 x 12 in., 18 ft. long. The round piles were 26 ft. long. The work was arranged so that this one machine did practically everything on the job that required hoisting.

The Nash-Dowdle Company, of Chicago, were contractors for the concrete dock on the collateral channel of the Sanitary District Drainage canal for the new Chicago municipal shops, where the crane was used.



RIGGING OF LOCOMOTIVE CRANE FOR STEAM SHOVEL WORK CLEARLY SHOWN

Guide Frame Used to Drive Piles in 22-Ft. Tide at Balboa

By ALEX. P. CRARY
Ancon, Canal Zone

A TIMBER FRAME set on the harbor floor was used recently with great success in driving batter piles for the quarantine station landing at Balboa, Canal Zone. The necessity for placing these piles with accuracy can be appreciated from the design of the pier, shown in the accompanying drawing. The difficulty of doing this by ordinary means where a 22-ft. tide had to be taken into consideration made the development of some special method necessary. The piles were made of 14-in. pipe with cast-iron points held on by 3 ft. of concrete deposited before driving. They were 56 to 64 ft. long, which would have required a very high floating driver. In addition the tidal currents were so strong as to make the use of such a driver impracticable. The panel length, averaging over 21 ft., was so great that to use a land driver of any size that could be readily provided would have meant driving intermediate bents of wood piles and wasting a great deal of time. Also, there was no way to guy a land driver, and much time would have been lost in cutting off the pipe piles as each bent was driven. Then, too, it would have been hard to make the proper connections to the pipe piles for a temporary floor system.

CONSTRUCTION OF FRAME

A derrick boat was available, however, and a steam-hammer already rigged for driving with it. The problem of holding the piles while driving them was solved by the frame shown in the accompanying photographs, which rested on the bottom and was handled from bent to bent by the derrick boat. This frame was made of 8 x 8-in. posts braced with 2-in. plank bolted on. It was built for driving both piles of a bent at one setting, being 12 ft. wide, 22 ft. long and 24 ft. high. The bottom was floored over and loaded with enough ballast to hold the frame solidly on the bottom. This ballast was left in place in moving. As the floor also made a wide base which kept the frame from sinking into the mud, the plank were secured against upward as well as downward pressure. The



PULLING A PILE DOWN WITH WEIGHT OF BOOM AND HAMMER



DERRICK BOAT LIFTS GUIDE FRAME CLEAR TO MOVE AHEAD

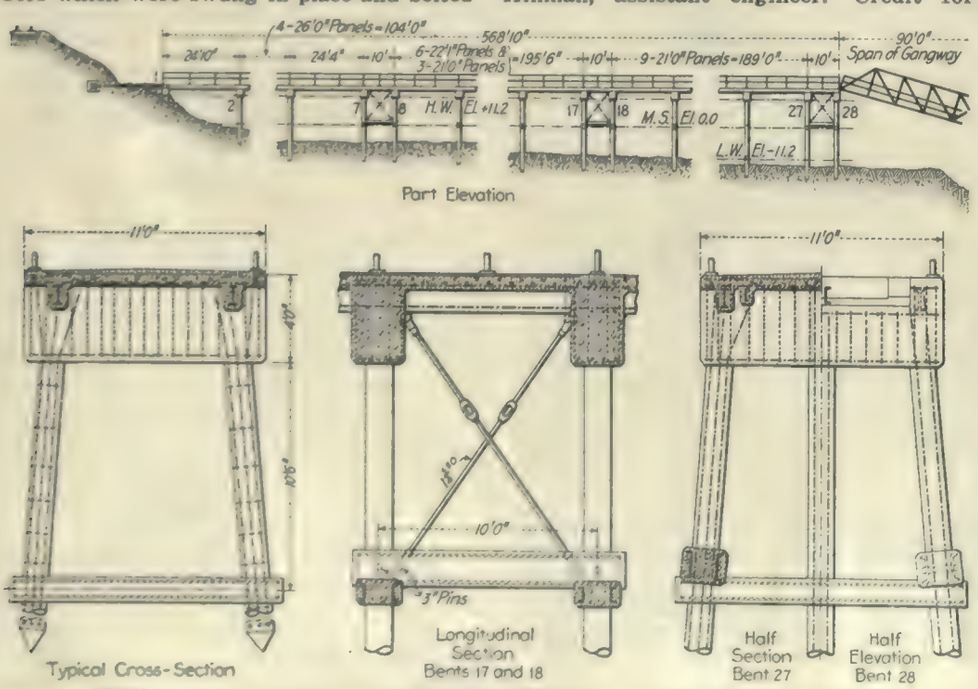
floor was designed for a pressure of 100 lb. per square foot, but it developed that the mud would easily sustain 150 lb., and that a load of 200 lb. would not have been dangerous. This floor was built on a slope corresponding to that at the bottom, which was nearly uniform. This enabled the frame to be set plumb.

There was a slot for the piles 30 in. wide along the center line of the floor. For guiding the piles a pair of horizontal 8 x 8-in. timbers 60 ft. long were secured crosswise to the top of the frame. To each were bolted two cross pieces, forming with the long timbers a pair of open slots into which the piles were set. The guide timbers were loose, so that they could be centered in both directions after the frame was set. They were then clamped down to other timbers on which they rested by fitting U-shaped irons over them, the tips of which were bent at right angles to the plane of the U so that they could catch under the supporting timber. These clamps were tightened with wedges.

A lower guide, made of a pair of 4 x 6-in. timbers set lengthways of the frame, was adjusted by plumb-bob to the batter after the upper guides were set. The lower guides had a pair of 4 x 6-in. hinged timbers which were swung in place and bolted after the piles were set, thus holding them on all sides. Line was taken from two pairs of range poles set on shore to a 1 in 12 batter in the plane of each row of piles.

In driving, the derrick boat loaded itself with piles at high tide, as many as 22 being carried at one time. The piles were set in the frame and dropped. If this did not bring them down low enough to set the hammer on, a line was hooked over the top of the pipe and the weight of the boom and hammer dropped on this line to pull the pile down. The hammer was then set on the pile, being centered by a cone-shaped lug which went down into the pipe, and the pile was driven down in the usual way.

Ten piles was the greatest number driven in one day, as work could only proceed at certain hours. At low tide there was no water at the shore end to float the derrick boat, while at high tide the lower guide on the frame was submerged when working at the outer end. The driving frame cost $167.43 and driving cost $3.90 per pile. The writer was contractor for the work, which was done under the direction of Rear Admiral H. H. Rousseau, engineer of terminal construction. The landing was designed by W. Rowland, assistant engineer, and its construction was in direct charge of H. D. Hinman, assistant engineer. Credit for many valuable suggestions is due J. W. Barningham, who had charge of the derrick boat.



DESIGN MADE ACCURATE PILE-DRIVING ESSENTIAL, TIDE MADE IT DIFFICULT

Forked Suction Used to Keep Water Low in Sumps

A CENTRIFUGAL pump may be made to keep the water very low in the sump where the flow is less than the capacity of the pump by putting a tee in the suction line and running one branch to the sump and the other to the river, according to a reader who was interested in the article by William G. Broadhurst on page 611 of the Engineering Record for Nov. 13. As used by this man in gravel mining where the water had to be kept low continuously, the double suction was made up with two valves, one below the tee and one next the stem of the tee. As the water ran lower in the sump, the valve in the line to the river was gradually opened and the valve below the tee closed until the point was reached where the pump was drawing enough water from the sump to balance the leakage and taking sufficient additional water from the river to keep it from losing its prime. After the valves were correctly set they did not require attention more than once or twice an hour to hold the sump practically dry. To break up whirlpools around the suction in the sump which caused the pump to draw air a board platform, several times the size of the strainer, was fitted around the suction so that it floated on the water. With either steam or gasoline drive, the engine could be governed so that very little water had to be pulled from the river.

A FLOATING DRYDOCK has just been placed in commission at Prince Rupert, B. C., the western terminus of the Grand Trunk Pacific Railroad. The drydock is built in three sections, each of which may be used independently. The two outside sections have a lifting capacity of 5000 tons, while the middle section has a capacity of 10,000 tons, making the combined capacity 20,000 tons. The drydock, which is estimated to have cost $2,500,000, has an overall length of 604 ft. and a clear width of 100 ft. The maximum length of ship that can be lifted, exclusive of overhang at bow and stern, is 600 ft. Ships with drafts up to 30 ft. can be handled. The equipment of the drydock includes twenty-four 12-in. centrifugal pumps.

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

Water Right Payments on Old Entry May Be Credited to New

The Secretary of the Interior on Dec. 20 approved a recommendation of the Reclamation Service, by which an entryman who takes advantage of the Act of March 4, 1915, which permits him to exchange the land which he has entered and which is found not to be irrigable to the extent therein prescribed, may receive credit on account of his new entry under the Reclamation Extension Act to the amount of his water right payments on the former water right application.

Starts Liberty Avenue Grade Separation at Pittsburgh

Work was started Sept. 1 on a $750,000 grade-crossing elimination improvement of the Baltimore & Ohio Railroad at Liberty Avenue, Pittsburgh, to be completed, it is expected, during 1916. The project involves the elevation of the main-line tracks for more than a mile. From 350 ft. east of the avenue to the Allegheny River the tracks will be carried on a steel viaduct 2100 ft. long, while the remaining 3800 ft. will be earth fill with retaining walls. Both viaduct and walls will be carried on concrete piles.

The work will involve about 50,000 cu. yd. of grading, 3000 tons of structural steel, 20,000 cu. yd. of concrete and 50,000 lin. ft. of concrete piling. Special pile-driving machines will have to be used under the old viaduct on Thirty-third Street, on account of the limited headroom. The concrete will be distributed by compressed air from central mixing plants.

Liberty Avenue is one of the main thoroughfares of the city, running from the downtown district to the Bloomfield and East End sections. It carries a double-track line of the Pittsburgh Railways Company. The double-track main line of the Baltimore & Ohio carries all through freight and passenger traffic. The average daily traffic over the crossing is 65 trains, 40 light engines, 4100 pedestrians, 1700 vehicles and 300 street cars (carrying probably nearly 11,000 passengers). Many difficulties are involved in maintaining and safeguarding this traffic during the carrying out of the improvement.

Improved Business Conditions Reflected in Forest Service Revenues

A larger revenue from all sources for the fiscal year 1916 as a result of the general improvement in business conditions throughout the country, is predicted for the federal Forest Service by the forester of the Department of Agriculture in his annual report. The increasing prosperity has already been felt in the National Forests, as is shown by an increase during the first three months of about $119,000 over the earnings of the same period last year.

During the fiscal year, the total revenues were $2,481,469.35, an increase of $43,759.14 over 1914. Of the $5,662,094.13 provided by the regular appropriation for the Forest Service, $5,281,000 was expended for protection, utilization and improvements; the cost of protection being increased by an extraordinarily severe fire season which necessitated emergency expenditures that were partly provided for by a deficiency appropriation of $349,243. An additional sum of about $196,000 was spent under the law which permits 10 per cent of the forest receipts to be employed in road development for the public benefit.

Baltimore Sewage Commission to Close Up Work Jan. 1

The Baltimore Sewerage Commission will close up its work and go out of existence Jan. 1, when the sewer system constructed under its jurisdiction will be turned over to the city. More than 40 engineering employees will leave the service with its termination.

Engineers to Study Chicago's Transportation Problem

Three engineers are to be appointed to study the transportation situation in Chicago. An ordinance passed Dec. 20 by the Chicago City Council authorizes the local transportation committee to secure the services of experts at once. The nominations of the committee are to be confirmed by the council, and it is stipulated that one man shall be a Chicago engineer, while the other two shall have had experience in working out the solution of the city transit problems of either New York, Philadelphia or Boston. The names and records of the engineers qualified to serve will be gathered for consideration of the committee by its chairman, Henry B. Capitain.

The questions to be settled in Chicago are whether to consolidate the street and elevated lines under one management to secure a unified transportation system and the advisability of constructing subways.

Antelope Creek Conduit Under Lincoln, Neb., Almost Completed

Work on the last section of the conduit which will carry Antelope Creek under the city of Lincoln, Neb., is almost completed. The entire conduit is more than a mile long and rectangular in section, 10 ft. high by 20 ft. wide. The total cost will be about $250,000.

Big Merger of Utilities in Northern Indiana Planned

A big merger of public utilities in northern Indiana is contemplated by a petition filed with the Public Service Commission of Indiana by the Northern Indiana Gas & Electric Company, which seeks to purchase all plants and property of the General Service Company and the Indiana Lighting Company. The proposed merger covers gasworks, electric and heating works and waterworks serving Fort Wayne, Lafayette, Logansport, Peru and numerous other cities and towns. The purchasing company, of which C. H. Geist is president, already controls the corresponding utilities of East Chicago, Hammond, Michigan City, South Bend, Mishawaka and other places.

Kentucky Will Use Convicts on Road Work

Kentucky voters in a recent election approved of an amendment to the constitution that permits State prisoners to work outside the prison walls, which will result in the convicts being used on State road work.

Since 1891 statutes of the State have forbidden taking prisoners outside the prison walls, this law having resulted from abuses which followed their employment by railroads and other private corporations. Two years ago an amendment to remove the ban was carried by a large majority, but declared unconstitutional, as the Secretary of State had failed to advertise it for a sufficient period of time.

New England Men Attend Worcester Road Congress

Nelson P. Lewis Discusses Highway Financing and W. H. Connell Explains Planning Board for Control of Work

Organized by the local Chamber of Commerce, the First International Road Congress at Worcester, Mass., Dec. 14 to 17, drew a large attendance from the New England states, the presence of W. A. McLean of Toronto, Canada, engineer of highways of the Provincial Department of Public Works of Ontario, adding to the meeting its international flavor. It was apparently upon the expectation of a sizable Canadian delegation that the gathering was styled international. While this designation was, perhaps, somewhat ambitious, the proceedings were well attended and among the papers were many of a high order of excellence. The registration exceeded 600.

Character of Attendance

The meeting was recruited to a large extent from the ranks of the small town or country road supervisor—the man from Maine, New Hampshire and Vermont, to whom a road congress is not an every-day event. The majority of the speakers, however, were men of national standing in the highway field—chief engineers, city and state highway department heads and men holding similar positions of responsibility. Several highway engineers of prominence and long convention experience expressed the opinion that the presence of the small-town road officials in such large numbers augured well for the future of the highway development in New England, as these men reap the largest profits from such a meeting. In giving these delegates an opportunity of learning from authoritative sources the principles of sound highway financing, organization, construction and maintenance, the Chamber of Commerce not only secured for Worcester the benefits accruing from the influx of delegates in large numbers, but also furthered the cause of good roads in the New England states in a substantial way. As was to have been expected, Massachusetts was well represented through members of the Massachusetts Highway Association, and there were delegations, also, from Connecticut and Rhole Island.

Although this was Worcester's first attempt at staging a road congress the meetings were well handled; the speakers, for the most part, had been selected with discrimination, and the service and general accommodations at the Hotel Bancroft were excellent. At all of the sessions the convention hall was well filled.

Exhibitors Discuss Future Policies

An exhibit of road building machinery and equipment, held in an auditorium a couple o blocks from the Hotel Bancroft, was participated in by about twenty-five concerns, and by the U. S. Office of Public Roads, which had on display models of various types of highway construction. The separation of the exhibit from the other convention activities, due to lack of space in the hotel, lessened the interest in the commercial features of the meeting.

At an informal meeting of representatives of the exhibiting companies at the Worcester congress the proposed convention of the American Road Builders' Association scheduled for next February was discussed. There appeared to be some doubt as to the advisability of participating in the exhibits of any convention held prior to December, 1916. This is in line with the action of the American Association of State Highway Officials taken in Chicago

early this month, as reported in the news section of the Engineering Record of Dec. 18. The interpretation of this action is, of course, a protest against the American Road Builders' Association in holding a meeting so soon after the joint convention of the two national highway associations at Oakland, Cal., last September.

At a meeting of the asphalt interests a proposal for starting a large-scale campaign to give publicity to the merits of asphalt paving was the chief topic. J. R. Draney, sales manager, of the U. S. Asphalt Refining Company, was delegated to draw up a tentative plan of action and submit it for approval at a later meeting of representatives of the companies concerned.

"Let Posterity Pay"

From the viewpoint of timeliness and real value one of the outstanding features of the meeting was the able enunciation of principles upon which sound highway financing must be based, made by Nelson P. Lewis, chief engineer of the Board of Estimate and Apportionment, New York City. He first considered the question of local assessments for highway improvements, pointing out that in the very small town the paving of Main Street, for example, is a general benefit and should be charged accordingly. But in the case of a large city where business is widely diffused the paving of certain streets benefits, not so much the community at large, as the abutting property owners. In cases of this kind the expense should be met, not from the general tax levy, but by special assessment.

Long-term bonds for short-lived structures, Mr. Lewis pointed out, are the most objectionable features of present-day highway financing, and are an improper use of a city's credit. "Let posterity pay" is a popular slogan, but a vicious one. He explained some of its results as evidenced by conditions in New York City, and then described in detail New York's new policy of pay-as-you-go. Mr. Lewis dwelt upon the merits of the short-term and serial bonds for highway improvements, characterizing them as one of the logical, sane methods of financing roads in rural communities.

Administrative and organization elements of the highway problem formed the subject of the address by William H. Connell, chief engineer of the Philadelphia Bureau of Highways. Mr. Connell dwelt at some length upon his planning board by which he is able to visualize the status of work on about 750 paving contracts by means of a large city map and various sizes and colors of pins, as described in detail in the Engineering Record of Dec. 11, page 714. Another valuable paper was one by J. R. Worcester, consulting engineer, of Boston, treating of the economic features in the selection of concrete or steel for bridges.

Logan Waller Page, of Washington, told of the work of the U. S. Office of Public Roads, and the highway policies of the Province of Ontario, Canada, were outlined by W. A. McLean. Mr. McLean made a plea for the elimination of politics in highway work and condemned the practice of resorting to the spoils system in filling positions requiring technical knowledge after each change of administration.

The merits of natural and refined asphalt roads was the subject of two papers, one by Clifford Richardson, consulting engineer of the Barber Asphalt Paving Company, and the other by LeRoy M. Law, chemist of the U. S. Asphalt Refining Company.

Disagree on Joint Filler

In George W. Tillson's paper on "City Pavements," which was read in Mr. Tillson's absence by Secretary Davison, the preference for the bituminous filler for stone block pavement did not meet with the universal approval of the convention. There were many advocates of cement grout, and the general opinion, as expressed from the floor, was that the cement grout filler was preferable even if it did make the pavement somewhat noisy. In speaking of conditions at Boston, Louis K. Rourke, formerly commissioner of the Department of Public Works, explained that in congested streets carrying many subsurface structures there was an advantage in the bituminous filler when pavements had to be opened and relaid.

Milwaukee's Concrete Roads

The practical side of concrete road-building was dealt with by H. J. Kuelling, who made the trip from Milwaukee, Wis., to be present at the Worcester meeting. All of Milwaukee's concrete road work is paid for by direct taxation—not by long-term bonds—and during 1915, 399,000 sq. yds. were laid. The county furnishes all of the cement directly to the contractor as an insurance against mixtures of improper proportions. There is a wide field, Mr. Kuelling believes, in investigating the advantages of hydrated lime as an ingredient in mixtures for concrete roads. Reinforcement, he believes, is needed only in exceptional cases where the subgrade is soft or spongy. The spout is the preferred method of distributing concrete to the roadbed in Milwaukee County, according to Mr. Kuelling. Felt and paper are preferred to metal strips at expansion joints, and the spacing of such joints has been increased recently from 25 to 50 ft.

William E. McClintock told of the history of highway development in Massachusetts and Dr. Ira N. Hollis, president of Worcester Polytechnic Institute, emphasized the necessity of highly trained engineers in highway construction. Dr. Joseph Hyde Pratt made the trip to Worcester from North Carolina in order to preside at one of the sessions and speak on the selection of materials for highway construction.

In selecting types of construction for city pavements G. Hanna, commissioner of street cleaning, Cleveland, O., pointed out that the cost of street cleaning is, in reality, a part of paving maintenance and is very seldom considered in this connection. The improvement of a street surface influences the cleaning cost to a very considerable extent, and is a factor which highway engineers should think of in addition to wearing qualities and first cost.

Among the exhibits the two which occupied the most prominent positions were those of the Federal Government and of the American Portland Cement Manufacturers' Association, which exhibited concrete road construction by means of full-scale models.

The four days of the meeting were organized under the following headings: Dec. 14, International Day; Dec. 15, Road-Builders' Day; Dec. 16, County and City Day; Dec. 17, Automobile Day.

Much of the interest at the early sessions was contributed by the presiding officer, Harold Parker, formerly chairman of the Massachusetts Highway Commission. Mr. Parker possessed a faculty of arousing interest in a speaker by a few well-chosen introductory remarks, and always endeavored to promote discussion by a terse summing up of a paper after the speaker had finished. The convention was unfortunate in opening its program on a day when a severe snow storm tied up railway traffic throughout New England and the Eastern states. In spite of this handicap, however, most of the speakers reached Worcester and the porgram was carried through with only a few revisions.

An entertainment feature which filled the convention hall to capacity was the 7000-ft. moving picture film of the Lincoln Highway, the new 3384-mile memorial route between New York and San Francisco.

American Society of Civil Engineers Redistricted

Country Divided Into Thirteen Instead of Seven Divisions—Canadian Provinces Placed with Adjacent U. S. Districts

Pursuant with the amendment to the constitution of the American Society of Civil Engineers adopted early this year, the country has been redivided into thirteen instead of seven districts. The recommendations of the redistricting committee, composed of J. Vipond Davies, Arthur S. Tuttle and Charles Warren Hunt, have been adopted by the board of direction and are therefore in force.



THESE ARE THE NEW GEOGRAPHICAL DISTRICTS OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS

States Split in Two Cases

In its report to the board, dated Nov. 5, the committee explains that its effort was to confine the boundaries of each district to the boundary lines of states. In two instances, however, it seemed advisable to make departures from this rule—in the cases of Pennsylvania and California.

Instead of putting the whole of Canada in one district as in the past, it is divided, provinces being placed with adjacent districts across the international boundary line.

The redistricting is based on the corporate membership of the Society as of Feb. 10, 1915. The total corporate membership on that date was 6683. Deducting 441 members resident outside of North America and 1223 corporate members within the metropolitan district, New York, there are left in North America outside of the resident district 5019 members. Dividing these among twelve districts would therefore make it desirable to have 418 members in each district. This was the object the committee had in mind.

The committee recommends that when the constitution is next amended all members of the Society not resident in North America be attached to District 1, without, however, paying any additional dues.

The new districts are shown on the map and the number of members in each district

in the detailed statement which follows. It will be noticed that the districts with the largest membership are those in which the large cities are located. In these the growth is expected to be smaller than in the other cities, so that what disparity was necessary in the present redistricting will likely be made up rapidly. Moreover, sectional community of interests was deemed more important than exact balancing of numbers.

The committee further recommends that when the constitution is again amended redistricting be placed in the hands of the board of direction with power to modify and rearrange as conditions indicate advisable.

The corporate membership in the new districts is as follows: District 1, 1223, or adding the 441 members not resident in North America, 1664; district 2, 541; district 3, 512; district 4, 499; district 5, 418; district 6, 484; district 7, 377; district 8, 469; district 9, 362; district 10, 315; district 11, 365; district 12, 310; district 13, 367; total, 6683.

Will Help Plant Seedling Miles on Lincoln Highway

The Lincoln Highway Association is prepared to furnish not more than 3000 bbl. of cement for the construction of a standard mile of road to any county along the route, under conditions which are now generally known. The location of these seedling miles will be governed by the following factors:

Due regard to the worst stretches requiring improvement and to the necessity of outside aid for the construction of hard-surfaced roads in each locality; the amount of co-operation to be expected from the locality; that it will be placed on sections of the highway where no question exists as to the final location of the road or as to the permanent right of way; that it will be placed on sections of the Lincoln Highway so marked and so named, or where proper assurance is given for such marking and naming before or immediately after construction, and that the future maintenance of the seedling mile must be assured either by the State or community.

Communities desiring to take advantage of the cement donation should take up the matter in the immediate future with the Lincoln Highway State, county or local consuls, from whom details may be obtained.

Hole Through 9000-Foot Sewer Under Newark Bay

On Dec. 8 the 9020-ft. pressure section of the Passaic sewer under Newark bay from Newark meadows to Bayonne, N. J., was holed through. This section of the tunnel will operate as an inverted syphon to carry the flow of the sewer under the bay. It was necessary to drive the tunnel at a depth of 250 ft. to keep it in solid rock where open tunneling methods could be used. At the Bayonne end the flow will rise 170 ft. in the shaft and continue east at that level to New York bay. The 75,000 cu. yd. of material removed from the lower tunnel consisted mainly of red sand stone and trap rock. One disintegrated stretch of trap required considerable timbering. The top-heading method of driving was used, and the tunnel was completed in seventeen months actual working time, during fifteen months of which headings from both the Newark and the Bayonne shafts were in progress. An average of 265 ft. per month was thus made in each heading while driving was in progress.



Courtesy Newark Evening News

TIMBERED SECTION OF SEWER TUNNEL WHOSE HEADINGS MET RECENTLY UNDER NEWARK BAY

About one-third of the concrete lining has been placed, mostly from the Bayonne shaft. Only part of the invert lining has so far been completed at the Newark end. The contract of the New York & New Jersey Construction Company, which is doing the work for the Passaic Valley Sewer Commission, includes also a connection chamber at the top of the Newark shaft and 2000 ft. of the tunnel at the higher level from the Bayonne shaft. This latter work is now practically complete. J. F. Shanley, Jr., is president of the contracting company, of which H. C. Sanford is vice-president and general manager and R. H. Keays engineer. R. E. Parker is superintendent and F. R. McDonnell engineer at the Newark shaft, and Walter Steenburg is superintendent and J. H. Fitzgerald engineer at the Bayonne shaft.

Engineers Selected to Advise on Cedar River Reservoir

William Mulholland, chief engineer, Department of Public Service, Los Angeles, Cal.; Frederick P. Stearns, consulting engineer, of Boston, and Reginald H. Thomson, consulting engineer, of Seattle, have been selected to advise with A. H. Dimock, city engineer of Seattle, Wash., on the Cedar River dam sealing.

Pennsylvania Highway Department Announces Promotions of Engineers

For the purposes of highway administration the State of Pennsylvania has been redistricted and a number of changes in personnel, recommended in the reorganization plan of William D. Uhler, chief engineer of the State Highway Depatment, have been approved. Two employees of the department, F. E. Winter and W. S. Hammaker, have been promoted to become acting assistant engineers in charge of districts. W. R. Wolfinger, who has been assistant engineer in charge of district 9, with headquarters at Chambersburg, is transferred to district 5, with headquarters at Allentown, succeeding John T. Gephart, Jr., engineer of construction, who has been temporarily in charge of that district. Mr. Gephart returns to the Harrisburg office to assume his duties as engineer of construction. Eleven new county superintendents, C. H. Orndorf, D. A. McCloskey, J. W. Frazier, W. B. Fleming, E. L. Clemmer, H. S. Wood and J. G. English, have been named All of the new positions were filled by promotion based on the merit system.

Appraisal of Plant of Indianapolis Water Company Begun

Work was begun this week on an appraisal, by the Public Service Commission of Indiana, of the plant and property of the Indianapolis Water Company. The purpose is to fix rates.

Will Be Five Research Fellowship Vacancies at Illinois

There will be five research fellowship vacancies to be filled in the Engineering Experiment Station of the University of Illinois, at the end of the current academic year.

Since 1907 the university has maintained ten such fellowships, for each of which there is an annual stipend of $500. They are open to graduates of approved American and foreign universities and technical schools. Appointments are made, and must be accepted, for two consecutive collegiate years, at the expiration of which period, if all requirements have been met, the Master's degree will be granted. Not more than half of the time of the research fellows is required in connection with the work of the department to which they are assigned, the remainder being available for graduate study.

Nominations to fellowships, accompanied by assignments to special departments of the Engineering Experiment Station, are made from applications received by the director of the station each year, not later than the first day of February. Appointments are made in March, and take effect the first day of the following September. The nominations are based upon the character, scholastic attainments and promise of success in the principal line of study or research to which the candidate proposes to devote himself. Preference is given those applicants who have had some practical engineering experience following their undergraduate work.

Pennsylvania Highway Department Makes Maintenance Record

Reports from the Pennsylvania State Highway Department for the working season just closed show that the department maintained over 8000 miles of the total of 10,200 miles in the state system. This is the greatest amount of maintenance work ever done by the state. Practically all of the work of the department this year was maintenance, which involved the resurfacing of about 400 miles. More than 6000 miles of earth roads were dragged or scraped and 1880 miles of stone or hard surfaced roads and 557.75 miles of flint, gravel and shale roads were dressed up. Most of the work done was of a semi-permanent character.

Personal Notes

CHARLES H. PAUL, formerly construction engineer for the U. S. Reclamation Service on the recently completed Arrowrock Dam, has resigned from the Government forces to become one of the principal assistants to Arthur E. Morgan on the Miami Conservatory District work. Mr. Paul received his professional education at Massachusetts Institute of Technology and has been actively engaged in engineering work for 21 years. He started as pipe inspector for the Rockport Water Company, and served for short periods with the Boston sewer department and the Massachusetts State Board of Health. In 1896 he was appointed rodman for the Metropolitan Water Board, in which service he continued until 1900, attaining the grade of engineer-inspector. For the next four years he was with the Bureau of Filtration of the city of Philadelphia. He joined the Reclamation Service in 1904 as field assistant on the Lower Yellowstone Project.

CHARLES W. KUTZ has been promoted from the rank of major in the Corps of Engineers, U. S. A., to that of lieutenant-colonel, to fill the vacancy caused by the death of Lieut.-Col. Charles S. Bromwell. Colonel Kutz was graduated from West Point in 1893. After a 3-year course in the post-graduate work, he was engaged for five years as assistant on river and harbor fortification work at Baltimore and Portland, Me. In 1903 he was appointed assistant to the chief of engineers and in 1906 he made an investigation of power development and water diversion at Niagara Falls. He served three years in the Philippines as chief engineer of that division. In January of the present year he was chosen chairman of the public utilities commission of the District of Columbia. At present he is engineer commissioner of the district.

MAJOR EDWARD N. JOHNSTON, Corps of Engineers, U. S. A., in charge of the Wilmington District, has been granted a leave of absence to take charge of some river and harbor improvements at Melbourne, Australia.

DOUGLAS MACARTHUR has been promoted from the rank of captain in the Corps of Engineers, U. S. A., to that of major, and relieved from duty as a member of the General Staff.

CAPT. JOHN J. KINGMAN, Corps of Engineers, U. S. A., has been appointed a member of the General Staff, succeeding Major Douglas MacArthur, relieved.

FRANK E. PRICE, president of the Monmouth Contracting Company of Red Bank, N. J., has returned to that city from New York State, where the company recently completed a 10-mile water main contract at Mount Morris and an 8-mile line at Hilton. The company has contracts for laying over 30 miles of gas mains, 4 miles of water mains and a 1½-mile sewer at Red Bank, work upon which will be started in the spring. Excavating machines may be used for the trenching.

OSCAR F. GAYTON, formerly assistant engineer in the office of Alvord & Burdick, consulting engineers, of Chicago, has been appointed valuation supervisor in the Department of Public Service, Chicago with office in the City Hall.

BION J. ARNOLD, consulting engineer, of Chicago, has been asked by the grade crossing commission of Syracuse to examine and advise upon the plans adopted for the elimination of grade crossings in that city.

GEORGE F. SWAIN, professor of civil engineering at Harvard University and consulting engineer, of Cambridge, Mass., has been selected by the city council of East Orange, N. J., to study the feasibility of the grade crossing elimination plans being considered by that city.

MAJOR R. E. WOOD, U. S. A., Retired, chief quartermaster at Panama and director of the Panama Railroad, has joined the staff of the Barber Asphalt Paving Company as assistant to the president, with headquarters at Philadelphia. Major Wood was graduated from West Point in 1900. He was connected with the building of the Canal from 1905 to 1915, and retired with the rank of major under the Panama Canal Act.

W. A. HITCHCOCK has resigned as engineer in charge of the track and roadway department of the valuation bureau, Public Utilities Commission, Washington, D. C., the work of the department having been completed. He is a graduate of the University of Pennsylvania, and, previous to his connection with the valuation work at Washington, served as construction engineer for W. F. Bear & Company in Virginia, as assistant engineer for the Fort Wayne & Wabash Valley Traction Company and as engineer for the Southern Michigan Railway Company. He was appointed to the position from which he had resigned in June, 1914.

H. C. GASS has completed contracts upon which he was engaged at San Antonio, Tex., and has started work on a new contract at Houston.

C. H. FOX, formerly assistant division engineer of the Canadian Pacific Railway, has been appointed resident engineer of district 2, Manitoba division.

WALTER T. MOODIE, formerly engineer maintenance-of-way of the Canadian Northern Railway at Winnipeg, has been appointed division engineer of the central division of that road. He was educated in Scotland and entered railway service in 1903 as assistant engineer on the Caledonian Railway in that country. From 1905 to 1908 he served as engineer on the location and construction of railways in South Africa. He went to Canada in the latter year as engineer in the construction department of the Canadian Northern and was appointed engineer maintenance-of-way at Winnipeg in 1911.

T. LUCAS, formerly engineer maintenance-of-way of the Canadian Northern Railway, west of Winnipeg, has been appointed lease engineer of the lines of that company west of Port Arthur.

A. T. FRASER, formerly district engineer for the Canadian Northern Railway at Edmonton, Alberta, has been appointed division engineer at that city.

ORLANDO K. MORGAN, office engineer of the Carolina, Clinchfield & Ohio Railway, at Johnson City, Tenn., has assumed the duties of the office of the chief engineer of that road, following the death of Ward Crosby, which is noted elsewhere in this issue.

FRED KIRKPATRICK has resigned as assistant engineer of Dodge City, Kan., to accept a position in the engineering department of the Anthony & Northern Railway at Pratt, Kan.

J. W. SHEPERDSON, formerly assistant general superintendent of the Central Iron & Steel Company of Harrisburg, Pa., has been appointed to a position on the forces of the Morgan Construction Company of Worcester, Mass.

GUSTAV FISK, formerly engineer for the Cambria Steel Company of Johnstown, Pa., has been appointed assistant general superintendent of the Central Iron & Steel Company of Harrisburg, Pa., succeeding J. W. Sheperdson, whose appointment to another position is noted elsewhere in these columns. Some years ago Mr. Fisk had charge of the construction of the plant of the Tata Steel Company in India.

H. M. BYLLESBY COMPANY, engineers, and constructors, Chicago, have acquired control of steamship lines to France, to Sweden and to Archangel, and are conducting a general shipping business.

PAUL A. VOLCKER, assistant engineer in the New York State Highway Department, has been appointed city engineer of Lebanon, Pa., to be effective, Jan. 3, 1916. Mr. Volcker was graduated from Rensselaer Polytechnic Institute in 1911, and has been with the highway department and the State engineer's office of New York state since last year.

OTTO E. GOLDSCHMIDT, consulting engineer, of New York City, has moved his offices to the Tilden Building, 105 West Fortieth Street.

W. EARL KELLAR, acting city engineer of Schenectady, has been appointed city engineer of Binghamton, N. Y., to go into office Jan. 1, 1916. Mr. Kellar was graduated from the civil engineering department of Union College in 1907. During his college course he engaged in a general surveying practice around Schenectady. In 1908 he entered the New York State Highway Department as a leveler on design and location work. Later he was stationed at the residency office on Barge Canal Residency 2. In 1910 he became deputy city engineer of Schenectady, which position he held for two years, going then to the office of the state engineer as assistant engineer. In 1914 he again entered the city engineer's office in Schenectady, and became acting city engineer in January of the present year. While in Schenectady he has had charge of the construction of pavements, sewers, a garbage disposal plant, a public market and schools. Under his direction a 20,000,000-gal. reservoir for the city was designed and the plans for the development of a park system were carried almost to completion.

JOHN A. BRASHEAR, past president of the American Society of Mechanical Engineers, has been elected an honorary member of the Engineers' Club, New York City.

PERCY H. WILSON, secretary for eight years of the Association of American Portland Cement Manufacturers, has tendered his resignation. During his term of office as secretary, the association was built up from a weak, struggling organization into one of the most effective manufacturers' associations in the country. Originally its functions related merely to the interchange of information among the member companies. The scope has rapidly widened until now the greater part of the $200,000 budget has been for promotional work of the very highest order. A large corps of trained inspectors—all of them graduate engineers—have been following concrete road work in the field, advising with engineers and contractors as to changes in specifications and methods. Educational booklets of excellent quality have been prepared and distributed, lecturers on concrete have appeared before hundreds of audiences, correspondence and manual training school courses have been prepared and given, and, in general, the association office made the recognized clearing house for information on cement and concrete. In all this work professional standards have been adhered to. In fact, the reason for the association's influence undoubtedly has been its scrupulous observance, even though professedly engaged in promotional work, of the highest ethical standards. For this development work chief credit is given by the association members to the retiring secretary. Mr. Wilson is a graduate of the University of Pennsylvania and before joining the cement association was engaged in foundation and general construction work.

Obituary Notes

WILLIAM W. COLE of the firm of Cole, Ives & Davidson, consulting engineers, New York City, died in Poughkeepsie, Dec. 20, as a result of internal injuries sustained in an accident a year ago. Mr. Cole was born in

Medford, Mass., in 1866, and was educated at Worcester Polytechnic Institute. He first engaged in engineering work in 1885 as assistant engineer for the New England Construction Company on the construction of waterworks at Newport, R. I.; Gloucester, Mass.; Frankfort, Ind., and Green Bay, Wis. In 1889 he served as assistant engineer and, later, as construction engineer of the Toledo, St. Louis & Kansas City Railroad. He was chief engineer and general manager on the construction of the Utica (N. Y.) Belt Line Street Railway in 1892 and, in 1893, designed and built the West Side Street Railway of Elmira, N. Y., and the waterworks of that city. During the following sixteen years he was associated with the public utility companies in Elmira, being instrumental in consolidating the street railways, electric light companies, natural and artificial gas companies, waterworks companies and park properties into one utility corporation. For a large part of this period he also acted as consulting engineer for the Chemung Canal Trust Company of Elmira, in connection with its various investments. In 1907 he left Elmira to become a member of the engineering firm of Day & Zimmerman of Philadelphia. The organization of the Pennsylvania Central Heat, Light & Power Company, which includes a number of electric light and gas properties, also the reorganization and reconstruction of the electric light and traction companies of Oil City and Franklin, Pa., were effected by Day & Zimmerman during Mr. Cole's management of their Public Utility Department. In January of the present year he formed a partnership with Arthur S. Ives and Rolland A. Davidson, who had previously been associated in engineering work, and has since been located at 61 Broadway, New York City, specializing in public utility engineering work and in financial reports for banking interests in New York. In addition he has acted as a consulting engineer for various financial interests in connection with appraisals, examinations and reports on gas, electric and traction properties, including, at various times, the utilities at Canandaigua, N. Y.; Hartford, Conn.; Lancaster, Pa.; Colorado Springs, Col.; Lockport, N. Y.; Topeka, Kan.; Terre Haute, Ind.; Denver, Col.; Baltimore, Md., and Beloit, Wis. He was the first president of the Empire State Gas & Electric Association of New York, and was vice-president of the New York Street Railway Association.

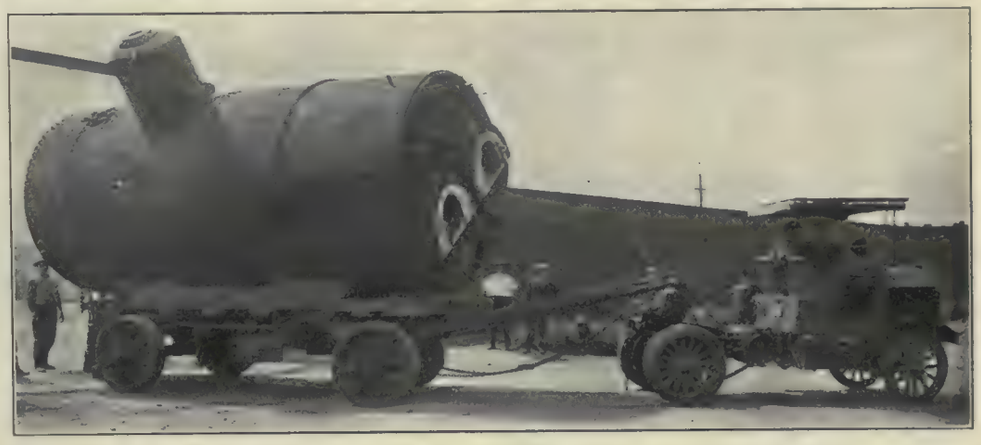
WARD CROSBY, chief engineer of the Carolina, Clinchfield & Ohio Railway, died at Johnson City, Tenn., Dec. 5. He was born in Canada in 1859 and entered railway service in 1880 on the Eastern Railroad, now a part of the Boston & Maine. In 1881 he went to Mexico on the location of the Mexican Central, and returned to this country later in the year as assistant engineer on the Boston & Lowell. Later he was with the Boston & Maine, the Barre Railroad, the Norfolk & Western and the Concord & Montreal. He entered the service of the Carolina, Clinchfield & Ohio in 1891 as assistant engineer. In 1905 he was appointed division engineer and principal assistant engineer. He attained the grade of chief engineer in 1911.

This Bucket Handles All Soil Conditions Without Change

Ability to work in any kind of soil, whether dry, hard, wet, sticky or stony, and a positive cleaning action for the bucket are features of the latest improvement to be made on the Pawling & Harnischfeger trenching machine. It is built up in the wheel type, with angles and a special cog rack. The cast steel bucket has a forged steel lip or cutting edge. The shape of the bucket and its fastening by a single pin between the angles forces its rear, or back, to the angles when cutting. Due to its pin fastening the bucket is easily raised when passing the cleaners. Stones cannot remain in the bucket and damage the cleaners.

Tractor with Rated Capacity of 15 Tons Hauls 41-Ton Load

Confronted with the task of moving a 33-ton boiler from a power plant, in Holmesburg, to the Philadelphia city power plant at Fairmont Park, the Henderson Company, contractors, of Philadelphia, after figuring that it would take 28 horses to do it, accepted the offer of a gasoline tractor company representative to use one of his machines on the job. Though the maximum rated capacity of the tractor was only 15 tons, and the total load, including the weight of the truck on which the boiler was hauled, was 41 tons, the start was made without difficulty and the journey without mishap.



33-TON BOILER MOVED LONG DISTANCE WITHOUT MISHAP BY GASOLINE TRACTOR

A Knox tractor, manufactured by the Knox Motors Associates of Springfield, Mass., was used.

Casing of Deepest Well in the United States Has Welded Joints

To do away with the use of upset ends, bolts and collars to hold the casing lengths together in a well for the People's Natural Gas Company near McDonald, Pa., and, in this manner, to permit the use of a larger diameter of casing, the various sections were welded together by oxy-acetylene apparatus. The well, which is said to be the deepest ever drilled in the United States, and the second deepest in the world—one in Galicia in Europe being 119 ft. deeper—reaches to a depth of 7181 ft. The diameter of the hole decreases from 13 in. at the top to 5 in. at the bottom. The weight of the welded casing is 45 tons.

In welding, the ends of the lengths were chamfered to 60 deg. to facilitate the making of a deep, wide weld, which in each case was built up to a ¼-in. reinforcement all around. The casing was in 22-ft. lengths.

Two sections were welded together in a yard, then hoisted into the derrick and lowered. Five feet of the upper end were kept above the floor, supported by steel wedges, placed between the casing and a steel block through which it was lowered. Then two more lengths, welded together, were hoisted and butted against the last casing and the process repeated. The weld was permitted to cool sufficiently to permit the placing of a hand upon it before the wedges were removed and the casing lowered. A plank with half of a circle cut in one side was placed across the top of the derrick against which the upper end could be held while the lower end was welded, thus insuring the alignment.

At the bottom of the well salt water was encountered, the pressure of which was estimated at about 3000 lb. In the first length of the casing lowered, an oak plug about 3 ft. long, soaked in water, was driven into the end for the purpose of using the water to buoy up the pipe and take off as much strain from the welds as possible. When about 2500 ft. of casing had been lowered the plug blew out with great force. In the next piece of tubing welded, another plug was put in with a small steel ring in back of it. After the entire 6321 ft. of casing was in place, this was drilled out.

Prior to putting in the welded casing, there was a string of heavy casing, with screw fittings, with upset ends, and, back of the upset parts, two collars fastened wth bolts, all of which was necessary to hold the casing together, as the screw fittings themselves would not suffice. These upset ends, bolts, etc., took up considerable room and did not permit of a casing with a large inside dimension. The advantage of the welded casing was the doing away of these outside fittings, thus permitting the use of a larger casing diameter.

The welding was done with Oxweld oxy-acetylene apparatus, manufactured by the Oxweld Acetylene Company, Thirty-sixth Street and Jasper Place, Chicago, under the direction of the representatives of that organization.

Trailer for Touring Cars Could Be Used to Advantage by Contractors

A light trailer for touring cars with a carrying capacity of 1260 lb. that will follow in the track of any touring car, around any corner or into an opening, and, which, it is claimed, will stand up at high speeds, has been placed on the market by the Troy Wagon Works Company of Troy, Ohio. The wheels are 36 in. in diameter and rubber tired. Axles are 1¼-in. square solid steel. The front springs are oil-tempered double semi-elliptic, and the rear springs oil-tempered full elliptical. The body is approximately 26 in. from the ground and is oak floored, with full paneled poplar and oak sides. Inside dimensions are 96 in. long by 35 in. wide and 10 in. deep, with 6-in. side flare boards. The trailer is provided with a full cushioned spring drawbar with draft off the front axle. An attachment is provided to fit any car.

National Foreign Trade Convention to Be Held, Jan. 27 to 29

The National Foreign Trade Conference will be held in New Orleans, Jan. 27-29, 1916. It is expected that representatives of practically every element in the foreign trade of the United States will participate.

The conference will seek to substitute national action for national conversation. The program will be devoted to practical application of sound business principles to the problems of further upbuilding of the American foreign-going merchant marine, the utilization of the tariff to encourage foreign trade and, particularly, to protect it from discrimination, ways and means for smaller manufacturers and merchants to engage in foreign trade, and the adaptation of commercial education to the needs of foreign commerce so that a steadily increasing army of young men,

equipped to become foreign traders, may be graduated from the schools and colleges.

Among the speakers will be: Frank A. Vanderlip, president of the National City Bank of New York; Fairfax Harrison, president of the Southern Railway; James A. Farrel, president of the United States Steel Corporation; Willard Straight, vice-president of the American International Corporation; Percival Farquhar, president of the Brazil Railway Company; Daniel Warren, of the American Trading Company; A. B. Johnson, president of the Baldwin Locomotive Works, and William Pigott, vice-president of the Seattle Car & Foundry Company.

Wood Preservers Will Convene in Chicago January 18-20

The effect of the European war on the American timber-treating industry will be one of the chief topics for discussion at the twelfth annual convention of the American Wood Preservers' Association, which will be held in Chicago, Jan. 18-20, 1916, at the Hotel Sherman. The domestic production of zinc chloride and other preservatives has largely increased in the face of a falling off of 22½ per cent in imports of creosote in the last fiscal year.

Pick Up and Remove Snow by 4-Yd. Wheel Scraper

A 4-yd. wheel scraper for snow, which amounts to a self-loading dump wagon has recently been added to the list of wheel scrapers of the "Maney" four-wheel type. The illustration shows one in the carrying position, loaded with snow on the way to the dump. On the far side of the scraper shown is a lever which throws out the spool clutches and allows the pan to drop to the loading position. Thrown in the opposite direction the pan may be stopped at any point. A chain-driven windlass actuated by the rear wheels winds up chains supporting the rear end of the pan to the carrying position. Dumping is accomplished by raising the end gate at the rear.

The scraper is made by the Baker Manufacturing Company, Springfield, Ill., and is to be used in conjunction with the company's



WHEEL SCRAPER HAULS AWAY FOUR YARDS OF SNOW AT ONE OPERATION

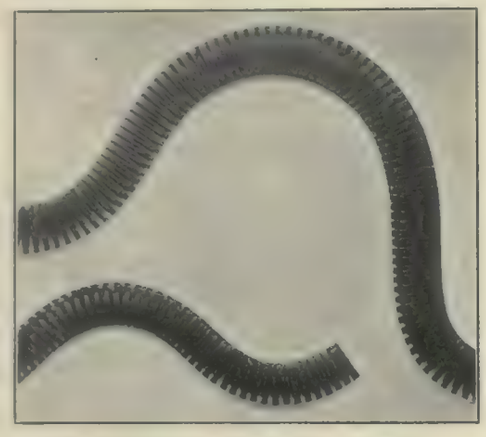
snow plows which may be attached to the front and rear of motor trucks to throw the snow into windrows. The street department of New York City is using one of the outfits.

No Electrolytic Action Between New Coating and Base Metal

A new coating for box annealed sheet iron has been developed that will protect it against rust and corrosion, it is claimed, for almost an indefinite length of time. Due to the fact that there is no electrolytic action between the base metal and the new "Ebonized" coating, the life of the metal is conserved also against that source of deterioration. The material is manufactured by the Dixie Culvert & Metal Company of Atlanta, Ga., for particular use on culvert pipe for road drainage purposes made from black iron. Tests covering several months have shown that it provides an absolute protective coating also against acid or alkali. In the manufacture of the culvert pipe only iron that is guaranteed to contain not more than 16/100 of 1 per cent impurities is used.

Notching from Opposite Edges Adds to Flexibility of New Curve Rule

A new flexible curve rule has been placed on the market, which is said to represent a new departure in such rules. The material is black xylonite, notched from opposite edges, thus,



SECTION OF RULE SHOWING NOTCHING

it is claimed, making it very flexible. On one edge is a ruling strip and on the other a metal wire for retaining the rule in any curve into which it might be bent. One extremity ends in a tangent. The rule is manufactured by the Keuffel & Esser Company, Hoboken, N. J.

New Glazing Construction for Skylights

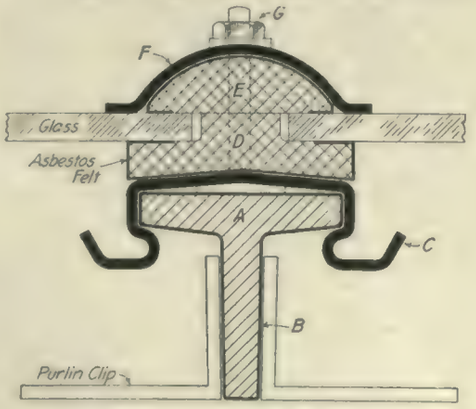
Waugh glazing construction, illustrated in the accompanying section, is fully described in Bulletin 56 just issued by the Asbestos Protected Metal Company of Pittsburgh. In the cross section shown the lettered parts are as follows:

A—Rolled steel T-beam, stiff enough to carry its load without deflection, thus preventing glass breakage.

B—Protective coating claimed to be acid, alkali and moisture-proof, heat and fire-resisting. Preserves steel from corrosion and resulting loss of stiffness.

C—Asbestos-protected metal gutter, not a part of the beam, and designed to collect condensation from the glass. It is claimed that it cannot corrode and never needs painting.

D—Asphaltic glass cushion, which provides



SECTION OF WAUGH GLAZING CONSTRUCTION

a non-absorbent, resilient and insulating bed for the glass, keeps it from contact with the hard bolts, etc., and gives it a broad continuous bearing, thus avoiding destructive strains.

E—Asphaltic cap filler which leaves no hollow spaces. It follows the contour of the glass surface and adheres to it, and thus excludes water.

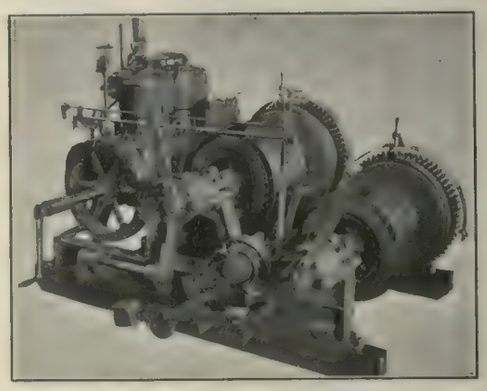
F—Cap to protect filler and distribute pressure evenly and continuously. Spring tension locks the cap nuts.

G—Cap bolt, which clamps the glass between the flexible cushion and filler to insure permanently water-proof joints. Can be used to support cleaner's bridge planks without straining glass.

This construction is used in sawtooth and continuous monitor sash, except that the condensation gutter, C, is omitted, and clamping clips substituted. The bulletin illustrates and describes many installations, and gives details and drawings in full.

This Gasoline Driven Hoist Develops High Power

A high power gasoline driven hoisting engine with a maximum speed of 600 r.p.m. and a speed of 150 ft. per minute with a 6500-lb. load has recently been developed. The engine is fitted with a governor which controls the maximum speed of the hoist, but below this speed it is hand-governed. The engine is connected through a band friction to the hoist proper. The manufacturer, the Minneapolis Steel & Machinery Company, has equipped it with a cone friction in the same manner as in its steam hoist, and other details are also approximately the same. In the accompanying photograph a 40-hp. hoist is shown equipped with a 45-hp. Twin City heavy duty



HIGH POWER FEATURE OF THIS GASOLINE HOIST

motor. The engines are furnished in four sizes, namely, 30, 40, 65, and 90 hp. with 1, 2, or 3 drums.

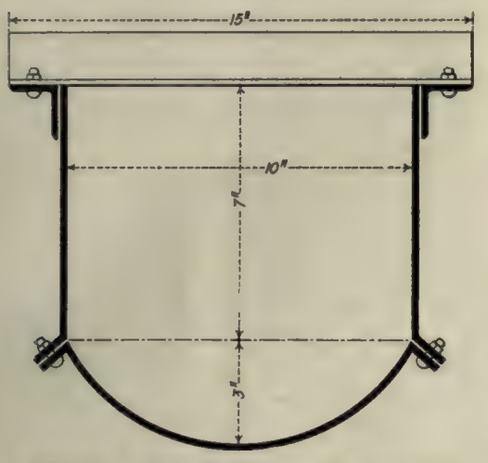
Business Notes.

Walter H. Kestin has been appointed sales manager for the concrete machinery department of the Northwestern Steel & Iron Works of Eau Claire, Wis. Thornton W. Rosholt, vice-president of the company, who has hitherto devoted a portion of his time to that work, will in the future devote himself more closely to work among the trade.

J. P. Beck, formerly publicity manager of the Universal Portland Cement Company, has been made general manager of the Association of American Portland Cement Manufacturers, and will have charge of the enlarged educational, promotional and publicity plans adopted at the meeting of the Association in New York last week. Mr. Beck was graduated from the University of Illinois in 1907, and immediately joined the staff of the Universal Portland Cement Company. He continued with that organization until early this year, when he resigned to become publicity manager of the Hagar Portland Cement Company. He left the latter corporation in order to make a study of the possibility of enlarging the scope of the cement association's work. As a result of his studies, he prepared an elaborate report, outlining the opportunities for expansion. The report was presented last week, the needed appropriations for the work voted and Mr. Beck engaged to put the plan into effect. Mr. Beck in 1914 won the $1000 prize offered by *Advertising and Selling* through the Associated Advertising Club of the World for the best plan for an advertising campaign.

Stiff Concrete Chute Has Removable Bottom

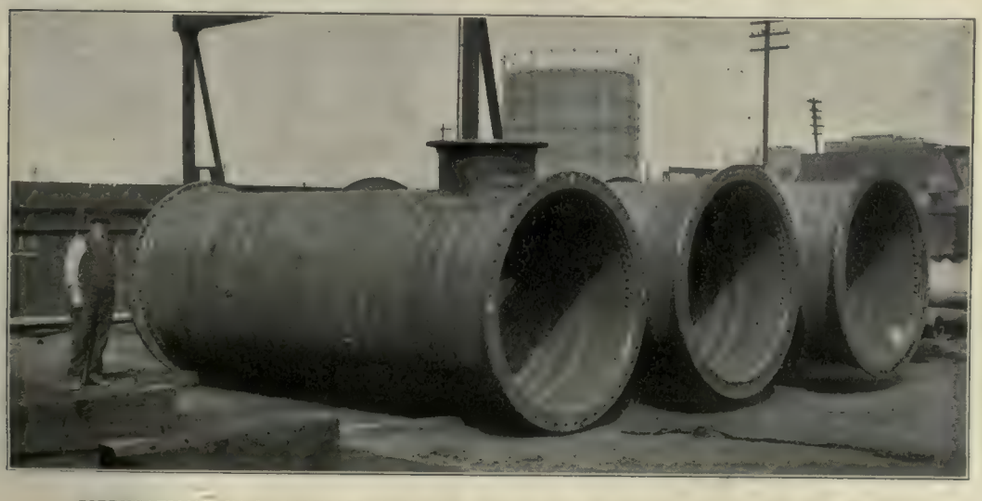
The concrete chute illustrated in the accompanying cut has a removable bottom which can be replaced when worn out, at slight expense, compared to buying a new chute. The chute is made of No. 14 blue annealed steel plate and 2 x 2-in. angles. The joints between the bottom and side plates further stiffen the section. Chutes are furnished in a number of lengths, either trussed, or to be supported from a cable. They are manufactured by the Automatic Concrete Mixer Company, of Providence, R. I.



BOTTOM OF THIS CHUTE CAN BE RENEWED

New Lap-Welded Pipe Is Stiffened by Corrugations

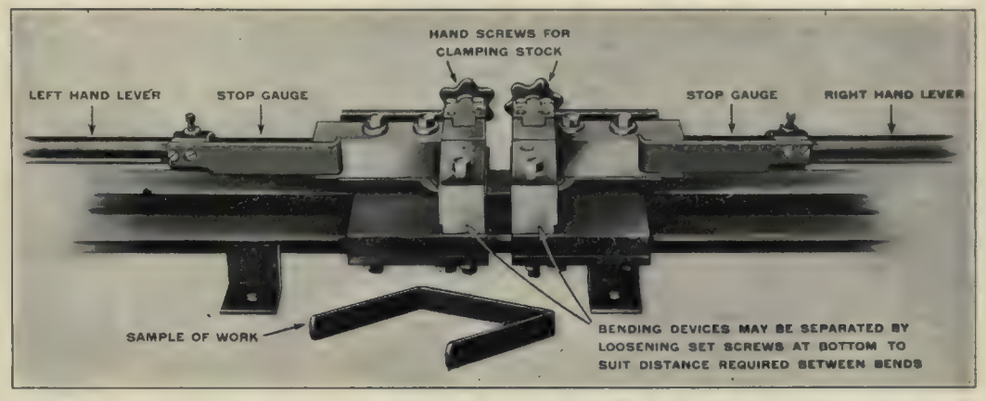
Large diameter lap-welded pipe with slight corrugations which, it is claimed, give an additional stiffness and greater factor of safety than plain pipe when under vacuum service, is the latest pipe product to be placed on the market. This pipe is designed to allow the use of lighter sections than have been available heretofore for vacuum service. The new pipe, shown herewith, is 66 in. in diameter, ⅜-in. thick, and has corrugations about 1 in. deep on 8-in. centers, with seamless forged steel flanges attached. It is manufactured by the American Spiral Pipe Works, Chicago.



CORRUGATIONS OF LAP-WELDED PIPE GIVE GREATER STIFFNESS IN VACUUM SERVICE

Tool Bends Reinforcing Bars in Two Places at One Setting

The reinforcing bender illustrated herewith makes a right-hand and a left-hand bend in reinforcing bars without re-setting the bending device or removing the stock. The machine consists of a right-hand and a left-hand bender mounted on a long base with means for adjusting them so that the distance between bends may be made of any desired length. Bends may also be made at any angle. The machines may be fitted with dies for bending flat stock edgewise, or with dies for making radius bends. The machine shown, known as the Wallace No. 1 double-lever bar bender, will bend ⅝-in. round or ½-in. square bars cold, and will bend ⅞-in. round or ¾-in. square bars hot. It is made by the Wallace Supplies Manufacturing Company, 420 Orleans Street, Chicago.



TOOL BENDS REINFORCING IN TWO PLACES AT ONE SETTING TO DESIRED ANGLE OR RADIUS

American Steel Export Company Is Incorporated

The American Steel Export Company was incorporated in Delaware June 29 with a capitalization of $200,000. It is reported that the Cambria Steel Company is back of the new concern, whose ostensible object is the promotion of the sale abroad, particularly in South America, of American steel products through specialization in foreign distribution. Several other independent steel concerns are also said to be interested in the new company.

Trade Publications

The following companies have recently issued trade literature:

Link-Belt Company, Chicago. Bulletin 221, 6 x 9 in., 4 pages, illustrated. A circular storage system that may be economically used in handling stone and gravel.

Troy Wagon Works Company, Troy, Ohio. Catalog, 5 x 7 in., 20 pages, illustrated. Deals with Troy truck trailers. It is shown that the total capacity of a motor truck can be multiplied five times by the use of trailers. General information and specifications of several types of machines are included.

The National Lead Company, 111 Broadway, New York, is offering for distribution reprints of the paper by Frederic H. Fay, on "Protection of Metal Structures," printed in the "Proceedings" of the Engineer's Society of Western Pennsylvania. Striking examples of serious corrosion of bridges in Boston are illustrated, and a complete bibliography on metal corrosion and protection is included. Many methods for protection are advocated, and the importance of proper maintenance emphasized. Dr. A. H. Sabin gives a good discussion of the best painting practice.

Layne & Bowler Company, Box 805, Kansas City, Mo. Catalog, 8 x 11 in., 238 pages, illustrated. Complete description of well-pumps, drilling outfits, shutter screens for large irrigation wells, and other accessories. Contains a discussion of the general subject of pumping and irrigation with valuable information for the prospective user of equipment for handling water from underground sources.

Harold L. Bond Company, 383 Atlantic Avenue, Boston. Catalog E, 7¼ x 10 in., cloth-bound cover and 318 pages, illustrated. Covers in a most complete manner a full line of contractors' equipment, varying from timber derricks, derrick fittings, hoists, buckets, engines, pumps, cars, concrete mixers, etc., to all sorts of tools, barrows and machines used for general contracting purposes. Each machine, fitting or outfit is classified in its particular section of the catalog and, in most instances, is illustrated. Complete data as to its size, make, weight, price, etc., are given. An index in the front of the edition classifies alphabetically the entire line shown, so that it is an easy matter to locate what one wants and then learn what is necessary to know the particular line that this company carries.

The Redwood Manufacturers Company, Hobart Building, San Francisco. "Wood-Stave Pipe." Pocket book, 6 x 4 in., 70 pages, illustrated. A very useful book, furnishing general information regarding the construction, advantage and uses of wood-stave pipe. Space is given to a description of the products made by this company, to information as to the quality of materials that should enter into its construction, the construction itself, limits of pressure, durability, longitudinal strength, weight of parts, tightness, carrying capacity, fixtures and uses. The illustrations show sections of pipe, methods of construction and some of its varied applications. About half of the book is devoted to tables of flow for sizes from 10 up to 120 in., values of C in Kutter's Formula, pressures of water and hydraulic weights and measures.

Trussed Concrete Steel Company, Youngstown, Ohio.—Thirteenth edition of Hy-Rib Handbook, 5¼ x 7¾ in., 142 pages, illustrated. This new edition of the handbook on hy-rib and metal lath embraces all the information and copious illustrations of the previous edition, and includes additions and revisions. Specifications and descriptions have been completely revised to include the latest developments and improvements. Illustrations and information on pressed-steel studs and Kahn pressed-steel construction and on Floretyle construction have been added. The book is well prepared, contains results of tests of slabs under load and fire, formulas and tables for safe loads on floors and roofs, and clear descriptions of wall, siding, partition and conduit construction in addition to many other uses of less interest to the engineer.

New Construction Activities

New York City's $71,000,000 bond issue, bearing 4½ per cent interest, brought the price of 101¼, which is a little below that of the large issues sold in 1914. Unloading American bonds on the New York market by British subjects to enable them to subscribe to the new British war loan has affected the domestic bond market. In view of this fact, and the present general conditions, the price obtained by the city, as well as the fact that the bids received three times over-subscribed the issue, is entirely satisfactory.

The advances in steel prices, actual and prospective, have increased domestic inquiries materially, especially in the structural steel line. It is becoming evident that the great volume of export business is making the mills independent of domestic business, and prices are expected to remain firm. This month the output of the industry is expected to approach 95 per cent of the capacity.

Buildings

The Pennsylvania Railroad closed a $4,000,000 contract for its new freight terminal in Chicago on June 25. An order for 13,200 tons of steel for this building has been placed in Pittsburgh. It is reported that the contract for the Oklahoma State capitol, noted last week, has been awarded. The college building noted recently at Middlebury, Vt., has been awarded at $110,000. A $200,000 building contract has been awarded in Cleveland, and another building contract awarded in St. Louis for $400,000. A number of school-building projects costing in the neighborhood of $100,000 are noted, both awarded and prospective. Bids are desired for a building of this class to cost $200,000 at Grand Forks, N. D. The Board of Education of Newark, N. J., has approved a budget including $1,500,000 for new school buildings. Two buildings are planned at Pittsburgh, one to cost $200,000 and the other $300,000. A $200,000 building is planned in Kansas City, and plans have been completed for a $400,000 bank building at Grand Rapids, Mich. Plans have been filed in New York City for a $400,000 store and loft building, and for a $350,000 warehouse. The American Tobacco Company will build a $750,000 factory in Brooklyn, according to reports. Permits have been issued for a $500,000 extension to the Westinghouse plant in Cleveland.

Bridges and Roads

An $88,000 contract for a concrete bridge has been awarded at Bryson City, N. C. A $115,000 concrete viaduct has been contracted for at Kansas City, Kan. A bridge over the Miami River at Hamilton, Ohio, contracted for last week will cost $96,000, and a steel highway bridge over the Colorado River at Topeck, Ariz., was awarded at $74,000. Bids are desired on a number of small steel and reinforced-concrete bridges throughout the country. A $250,000 bridge is being planned at New Haven, Conn. Plans have also been prepared for a $300,000 bridge at Dayton, Ohio. It is reported that a $225,000 highway bridge will be built over the Allegheny River at Natrona, Pa.

A paving contract amounting to $106,000 has been awarded at Troy, N. Y. The lowest bid on paving work for the borough of the Bronx, New York City, opened June 24, was $85,000. A paving contract amounting to $310,000 has been awarded at Philadelphia. The lowest bid for paving opened June 21 at Baton Rouge, La., was $153,746. A contract for paving awarded at Wellington, Kan., totaled $76,500. The lowest bids opened for paving work at Fort Dodge, Iowa, totaled $92,400. Bids are desired on paving work in Long Island City, and the State of California will let 30 miles of concrete and earth roads on July 6. Plans for road work to cost $163,000 have been completed at Lowville, N. Y. Petitions for 17 miles of road work have been approved at Pittsburgh. Toledo has sold paving bonds in the sum of $200,000. Ordinances for paving work that will cost $150,000 have been passed at Laurel, Miss. It is reported that New Orleans will let paving work totaling $1,500,000 within the next two months. It is reported that roads to be built at Arcadia, Fla., will cost $210,000. Lake City, Fla., has voted a $400,000 highway bond issue, and a $600,000 issue of the same character has been voted at Owensboro, Ky.

Waterworks and Sewers

A water-main contract has been awarded at Cincinnati for $23,735. Bids are desired at Paris, Ill., and at Maryville, Tenn., for constructing filter plants. Bids are also desired for constructing a $70,000 filter plant at Cheyenne, Wyo. Bids are desired on a 2,000,000-gal. concrete reservoir at West Lynn, Ore., and for waterworks extensions, including a dam, intake chamber, and 3½ miles of pipe line, at Ilion, N. Y. Plans have been completed for the new pipe line to supplement Jersey City's water supply, and the work will be let soon in two contracts. Plans are being completed for a $625,000 water supply for Watervliet, N. Y. Dayton, Ohio, will offer $135,000 water bonds for sale July 27. The spending of $430,000 for rebuilding the Compton Hill reservoir at St. Louis is comtemplated. It is reported that Malvern, Ark., will spend $90,000 for waterworks.

A $67,000 sewer contract has been awarded at Rochester, N. Y. The lowest bid opened June 24 on the Chicago sewer work previously noted was $195,583. The Clark Drive sewer in Vancouver, B. C., has been contracted for for $70,000. Bids are desired for constructing a sewer tunnel under Forty-first Street, New York City. It is reported that Port Washington, Long Island, will construct a $125,000 sewer system. The construction, subject to the sale of bonds, of sewers which will cost $141,000 has been authorized at Minneapolis. Sewer work totaling $149,000 has been recommended at St. Louis. It is reported that the last four of seven units for the Dallas (Tex.) sewage-disposal plant will be let soon.

Miscellaneous

The lowest bid opened June 23 for a breakwater at Oswego, N. Y., was $78,000. A contract for building a dam at Felts Mills, N. Y., has been awarded. Another dam contract for $120,000 has been awarded at Apalachee, Ga. Levee work amounting to $94,800 has been awarded at Vicksburg, Miss. It is reported from Philadelphia that two sections of the New York Connecting Railroad on Long Island have been awarded. A small railroad contract has also been awarded at Harlan, Ky. Bids are desired on 1,400,000 cu. yd. additional levee work at Vicksburg. Bids are desired on considerable irrigation work by the United States Government at Great Falls, Mont. It is reported that construction will soon begin on a $1,500,000 railway near Johnstown, Pa. Plans have been completed for irrigation work to cost $1,120,000 near Lindsay, Okla. Bids are desired both for construction and bonds on a $600,000 irrigation system at Connelly, Wash.

WATERWORKS

PROPOSED WORK.

Watervliet, N. Y.—Water Board (John G. Clute, Pres.) reported completing plans for the Normanskill water supply system. Cost reported to be about $625,000.

Jersey City, N. J.—Plans are completed for new pipe line to supplement water supply for Jersey City, and it is expected that contracts will soon be advertised. There will be two contracts, the first for an 11-mile 72-in. steel pipe line extending from Jersey City, across the meadows and over the hills to Brookdale, and the second for a double line of 48-in. c.-i. pipe under both the Hackensack and Passaic Rivers, about 2000 ft. of single pipe. The Chief Engineer of Jersey City is Chas. A. Van Keuren and the Consulting Engineer for this work is J. Byers Holbrook, 52 Vanderbilt Avenue, New York.

Wenonah, N. J.—About $8,000 will be spent for water works improvements.

Pennsylvania.—Following is list of permits relative to water works issued by State Dept. of Health, Harrisburg, May 15 to June 15:

Honesdale, Honesdale Water Co., extensions to distributing system.

Johnstown, Johnstown Water Co., temporary disinfection apparatus.

Mount Carmel, to Bear Gap Water Co., extensions to distributing system.

Jersey Shore, Jersey Shore Water Co., rapid sand filtration plant.

Langhorne, Langhorne Spring Water Co., rapid sand filtration plant.

Littlestown, to Littlestown Water Co., extensions to distributing system.

Stroudsburg, Stroudsburg Water Supply Co., temporary disinfection apparatus.

Oil City, extensions to distributing system.

Connellsville, Connellsville Water Co., remodel filter plant.

Nicholls, Ga.—City Council reported to have granted Mr. Byck of Waycross a franchise for construction of water works and electric light plant.

St. Petersburg, Fla.—City Comrs. considering issue of $146,000 bonds for water works improvements, new sewers and improvements to water front.

Orrville, Ala.—City considering construction of water works.

Dayton, Ohio.—Bonds for $135,000 for water works extension and improvements will be sold July 27 by Hugh E. Wall, City Accountant.

Kenosha, Wis.—All bids opened June 14 by Bd. Water Comrs. for furnishing material and constructing a 42-in. c. i. intake pipe about 10,000 ft. in length, a submerged intake crib and a concrete intake well, have been rejected, and it was voted to install a gravity filtration plant. B. C. Brennan, City Engr.

Fromberg, Mont.—Citizens reported to have voted $17,500 bonds for construction of water works, to include a pumping system, cement reservoir and concrete pump house.

Whitehall, Mont.—Proposed water works will cost $16,000 and will include 2 miles c.-i. pipe, 14 hydrants; to pump water from tubular wells to elevated tank. Bids for bonds to be received in August. Geo. E. Baker, City Engr.

St. Louis, Mo.—Bd. of Public Service reported to have authorized an ordinance prepared, providing for an appropriation of $430,000 for rebuilding Compton Hill reservoir.

Malvern, Ark.—W. L. Collie, City Recorder, writes it is proposed to construct water works, from plans of Engineer Cook of Little Rock; cost $90,000.

Marlin, Tex.—Citizens voted $15,000 for water works improvements.

Seattle, Wash.—Bd. of Works adopted resolution to make needed repairs and reconstruct a portion of old timber dam at Cedar Lake, to cost $10,000.

Bd. Pub. Wks. (L. B. Young, Chmn.) approved plans for water mains in 37th Ave. N. E.; cost $12,000.

Seattle, Wash.—Local press reports state that Bd. of Pub. Wks. will soon let contract for sealing Cedar River impounding basin back of the new masonry dam; cost not to exceed $300,000.

Davis, Cal.—Davis Water Co. (T. G. Schmeiser, Pres.) contemplate installing a new pump and motor in well; capacity 6000 to 10,000 gal. per min.; pump must be centrifugal, capable of pumping against a 125-ft. total head.

Oceanside, Cal.—City Trus. considering calling election to vote $12,000 for water works improvements and $8,000 for reconstructing municipal pier.

BIDS DESIRED.

Albany, N. Y.—Until July 6 by Isidore Wachsman, Secy. Bd. Contract and Supply, for chemical and bacteriological examination of water supply.

Binghamton, N. Y.—Until July 23 by Bd. Water Comrs. (John D. Davidson, Secy.) for constructing covered reservoir, 750,000 gal., advertised in Engineering Record. Fredk. E. Beck, Engr.

Brooklyn, N. Y.—Until July 12 by William Williams, Comr. Water Supply, Gas and Electricity, Municipal Bldg., New York, for alterations and improvements at New Utrecht Pumping Station, Avenue V and E. Fourteenth Street, and converting same into a distributing station.

Hilton, N. Y.—Until July 15 by Myron Roberts, Chmn. Village Trus., for constructing water works, advertised in Engineering Record. Engineer, H. C. Kittredge, Rochester.

Contracting News

Of Special Interest to Engineers, Contractors, Builders and Manufacturers of Engineering and Building Supplies

Ilion, N. Y.—Until July 9 by Bd. Water Comrs. (Geo. R. Russell, Secy.), for furnishing about 3½ miles 10-in. cl-i. pipe and constructing a concrete diverting dam, intake chamber and gate house, advertised in Engineering Record. J. D. Ringwood, City Engr.

New York, N. Y.—Until July 12 by William Williams, Comr. Water Supply, Gas and Electricity for furnishing and laying water mains and appurtenances, for connections between distribution system and various shafts of city tunnel Catskill Aqueduct, Section I, borough of the Bronx, security $20,000; Section II, borough of Manhattan, security $35,000, and Section III, between distribution system and Shaft 22, and Brooklyn Conduit, in borough of Brooklyn, security $8,000. Also separate bids for furnishing and delivering lead lined elbows, nipples and pipe.

Totowa, Passaic County, N. J.—Until July 19 by Borough Council for construction of water works, according to local press reports.

Baltimore, Md.—Until July 14 (extension of date from June 30) by Bd. of Awards, in care of City Register, for a 20,000,000 gal. centrifugal pump and electric power equipment for Eastern pumping station, Water Dept., advertised in Engineering Record. Ezra B. Whitman, Consulting Engr.

Clayton, Del.—Until July 15 by Town Council for water supply sewerage system and disposal plant, advertised in Engineering Record. Herbert W. Hatton, Consulting Engr., Equitable Bldg., Wilmington.

Washington, D. C.—Until July 19 by Comrs. D. C. (Oliver P. Newman, Chmn.) for furnishing and delivering c.-i. coated water pipe and specials for use of the Water Dept.

Pensacola, Fla.—Reported desired until July 6 by T. H. Johnson, Comr. Pub. Wks., for constructing a pumping station.

Maryville, Tenn.—Until July 7 by Mayor and Bd. Aldermen for constructing water works, including approx. 10 miles 4, 6, 8 and 10 in. ci. pipe, hydrants, valves and boxes, 125,000 gal. steel tank and tower, filtration plant, 1,000,000 gal. daily capacity, brick pumping station, including pumps, boilers and auxiliaries (alternate bids will be considered for electrically driven units), one or more deep wells, concrete dam and intake, etc. R. C. Huston & Co., Engrs., 1028 Falls Bldg., Memphis. W. A. McTeer, City Recorder.

Berwyn, Ill.—Until July 6 by Bd. Local Improv. (Oscar N. Lindahl, Secy.), for water supply pipe in Ogden and other streets. Special Assessment No. 82; cost, $17,444.

Chicago, Ill.—Until July 8 by W. R. Moorehouse, Comr. Pub. Wks., for Central Avenue Pumping Station, 5 water-tube boilers with superheaters, furnaces, and mechanical stokers.

Until July 9, for 2 boiler feed pumps with accessories and appurtenances complete at Roseland Pumping Station, also separate bids for approximately 250 tons reinforcing steel for Mayfair Pumping Station.

Paris, Ill.—Until July 22 by City Council (Simon Risser, Comr. Pub. Property), for constructing rapid sand filter plant 1,500,000 gals. capacity, advertised in Engineering Record. Engrs., Fleming Babbitt & Enger, Urbana.

Viola, Ill.—Until July 19 by B. D. Baxter, Pres. Bd. Local Improv., for water supply well, advertised in Engineering Record. Engineers, Terhune & Horton, Century National Bank Bldg., Peoria.

Fond Du Lac, Wis.—Reported desired until July 8 by J. F. Hohensee, City Clk., for approximately 13,900 ft. 4 to 14 in. c.-i. water mains.

Lowden, Iowa.—Until July 8 by Richard Parr, Town Clk., for constructing system including 12,240 lin. ft. 4, 6 and 8 in. c.-i. pipe, hydrants, valves, specials, pump house, elevated tank and tower, deep well pump and motor. J. G. Thorne, Consulting Engr., 317 Howes Blk., Clinton.

Cheyenne, Wyo.—Reported desired until July 6 by J. J. Showalter, City Clk., for constructing proposed rapid sand filter plant at Round Top reservoir, capacity 6,000,000 gals.; cost, $70,000.

St. Louis, Mo.—Until July 9 by E. R. Kinsey, Pres. Bd. Pub. Service for two 350 h.p. Heine type boilers at High Service Pumping Station No. 2, Bissell's Point.

West Lynn, Ore.—Reported desired until July 20 by L. L. Porter, Secy. West Lynn Water Comn., for constructing system including 12,000 ft. 10 in. and 6 miles 4 and 6 in. pipe, concrete lined reservoir, 2,000,000 gal. capacity, concrete standpipe.

Phoenix, Ariz.—Until July 7 by Robert A. Craig, City Mgr., for 12-in. water mains, gate valves and hydrants on portions of Ninth and McKinley Streets.

Guelph, Ont.—Until July 6 by Water Comrs. (A. H. Foster, Mgr.), for constructing a reinforced concrete reservoir, also 5500 ft. conduit line.

PRICES AND LETTINGS.

★Indicates award of contract.

★Cincinnati, Ohio.—Contract awarded by Dept. Pub. Safety (Edward P. Durr, Secy.) to M. J. McCarthy, Cincinnati, at $23,735, to lay c. i. pipe, special castings and valves and other miscellaneous work for high-pressure fire system in Eighth St., Bway. and Reading Rd. (bids opened June 18). Other bids: Kirchner Sons Co., $26,090; H. V. Crumley, $29,100; M. F. Quill, $28,370; Thomas P. Strack, $32,245 (bidders all of Cincinnati).

★Cleveland, O.—Contract awarded by Bd. of Control to Sanford Riley Stoker Co., Ltd., Worcester, Mass., for stokers for Division Ave. pumping station, at $19,000.

★Aurora, Minn.—Contract awarded by Village Council to Sharp & McQuire for drilling 10-in. water well at $5 per ft and $1.20 per ft. for extra casing, and to Michael Boylan of Virginia, Minn., for laying water mains in Jackson St. and connecting water system with new well at $9,480.

★Sidney, Mont. — Contract reported awarded by City Council for c.-i. pipe line in Special Improv. Dist. No. 1, to Bendon, Jones & Reed of Sidney at $17,414.

★Temple, Tex.—Contract to construct concrete dam and spillway at water works pumping station, reported awarded to P. G. Burns, Houston, at $16,460.

★Seattle, Wash. — Contract reported awarded by Bd. Pub. Wks. for construction of water mains in 5th Avenue to G. Argentieri & Co., 989 Rainier Avenue, Seattle, at $10,000.

★Pasadena, Cal. — Contract reported awarded to Theo. L. Syvertson, Pasadena, to construct Linda Vista water system, at $19,617.

★Peterboro, Ont.—Contract awarded by Utilities Comn. to De Laval Dairy Supply Co., Peterboro, to furnish and install pumping unit of 6,000,000 gals. capacity. William Kennedy, Jr., Engr., 364 University St., Montreal Que.

SEWERAGE AND SEWAGE DISPOSAL

PROPOSED WORK.

Derry, N. H.—Citizens voted June 25 to install a sewer system in West Derry to cost $25,000. James Coburn, Chmn. Bd. Selectmen. Dudley & Sawyer, Engrs., Manchester.

Kenmore, N. Y.—Bonds for $20,000 for storm sewers will be sold on July 7. E. W. Johnson, Village Clk.

Kenmore, N. Y.—Village Trus, will sell bonds July 7 for constructing surface and storm water sewers.

Port Washington, L. I., N. Y.—Town Board reported to have decided to construct sewer system, to cost $125,000. Henry Seaman, Chmn. Sewer Comn.

Bogota, N. J.—Borough Council considering extension of sewer system.

Prospect Park, Passaic County, N. J.—H. J. Harder, City Engr., of Paterson, preparing preliminary plans for a system of swers and disposal works for Prospect Park borough.

Greensburg, Pa.—Saml. G. Dixon, State Comr. of Health, at Harrisburg, has approved plans for extension of sewer system of Greensburg, southwest Greensburg, south Greensburg and Youngwood. It is recommended that the four boroughs unite on one project for construction of a joint sewage disposal plant.

Pennsylvania.—Following is list of permits relative to sewers issued by State Dept. of Health, Harrisburg, May 15 to June 15:

Monongahela City—Lateral sewer extensions.
North East—Sewage treatment works.
Philadelphia — Lateral sewer extensions.
Freeport—Sewage treatment works.
Washington—Lateral sewer extensions.
Greenville—Relocation of sewage treatment works.

Clayton, Del.—See "Water Works."

St. Petersburg, Fla. — See "Water Works."

Lexington, Ky.—Solomon-Norcross Co., Atlanta, Ga., engaged to prepare plans for proposed sewage disposal plant.

Chardon, Ohio.—Bonds for $70,000 for constructing a sewerage system and treatment plant will be sold July 6 by Robert S. Parks, Village Clk.

Middletown, Ohio.—Question of paving and sewering Third Street at a cost of $75,000 reported being considered.

Portsmouth, O.—City Engineer reported preparing plans for sewers in Sunnyside Dist.

Lenox, Ia.—City Council considering sewer improvements to consist of outlet sewer and disposal plant, and about 3800 lin. ft. 12-in.; 4200 lin. ft. 10-in.; 2300 lin. ft. 8-in. and 1300 lin. ft. 6-in sewer, cuts ranging from 4 to 20 ft Theo. S. DeLay, Engr., Creston.

Minneapolis, Minn. — New lateral sewers, estimated to cost $141,085 have been authorized by Sewer Com. for construction this season, subject to the sale of bonds. Carl Illstrup, City Sewer Engr.

Wymore, Neb.—City reported considering construction of sewer system.

St. Louis, Mo.—Bd. Public Service recommended to Bd. of Aldermen for passage, an ordinance, providing for construction of sewers as follows: Des Peres Sewer Dist. No. 3, estimated cost $2,000; Baden sewer. Dist. 2, $49,000; Ferry Street, Joint Dist. sewer, $71,000; Harlem Creek sewer, Dist. No. 12, $7,900; Harlem Creek sewer, Dist. No. 13, $11,400; Penrose Joint Dist. sewer, $7,600.

Austin, Tex.—M. C. Welborn, City Eng., writes citizens June 9 voted $50,000 bonds for sanitary sewer construction, (not $500,000 as recently reported). Also voted same day in favor of the following: For construction of bridges and storm sewers, $225,000; for street paving, $200,000, and construction of school buildings, $250,000. According to reports, bonds will be sold on July 7.

Dallas, Tex.—Local press reports state contracts will soon be let by the City Comn. for the last 4 units of the proposed sewage disposal plant. Total cost of the 7 units is $550,000. Three of units are now under construction. Jas. Fuertes, Consulting Engr., New York.

Tulsa, Okla.—Citizens voted $100,000 bonds for sewers.

Seattle, Wash.—City Engineer A. H. Dimock estimates cost of constructing sewers in Fairmont Avenue at $50,000.

Eugene, Ore.—Sewer Com. of City Council preparing plans for construction of sewers near river, to cost about $15,000.

Forest Grove, Ore.—City Council engaged R. E. Koon, Bd. of Trade Bldg., Portland, to prepare plans and specifications for sewer system; cost about $20,000.

Mt. Angel, Ore.—Louis C. Kelsey, Selling Bldg., Portland, preparing plans for sewer system and septic tank, to cost $10,000.

Marysville, Cal.—Plans reported completed by W. M. Meek, City Engr., for extending sewer and fill in part of Ellis Lake; cost $20,000.

BIDS DESIRED.

Portland, Me.—Until July 6 by Bion Bradbury, Jr., Comr. Pub. Wks. for about 3710 lin. ft. 8, 10 and 12-in. sewer in Washington Avenue.

Boston, Mass.—Until July 7 by Patrick O'Hearn, Acting Comr. Pub. Wks., for pipe sewers and drains in Condor Street, East Boston.

New York, N. Y.—Until July 9 by Marcus M. Marks, Pres. Manhattan Boro., for constructing tunnel relief sewer in portions of E. 41st St. and Madison Ave.; security $75,000.

Maywood, N. J.—Until July 26 by Borough Council (Charles Stass, Clk.) for constructing sanitary sewer system, advertised in Engineering Record, Alex. Potter, Engr., 50 Church St., New York.

Takoma Park, Md.—Until July 6 by Ben G. Davis, Town Clk., for laying terra cotta pipe sewers, constructing cement sidewalks and cement curbs and macadamizing roadways.

Clayton, Del.—See "Water Works."

Washington, D. C.—Until July 7 by Comrs. D. C. (Oliver P. Newman, Chmn.), for constructing 6000 ft. 10 and 12-in. pipe sewers, advertised in Engineering Record.

Paducah, Ky.—Until Aug. 3 by L. A. Washington, Comr. Pub. Wks., for outfall sewer, Dist. No. 3, Contract No. 1, advertised in Engineering Record.

Cincinnati, Ohio.—Until July 9 by Philip Fosdick, Dir. Pub. Service, for constructing sewers and drains in Seitz, Dorsey and Goethe Streets.

Brazil, Ind.—Reported desired until July 20 by F. De Aroney, Clk. Bd. Pub. Wks., for sanitary sewer in West End, about 2843 lin. ft. 10-in. and 3801 lin. ft. 8-in. vitr. pipe, Y's, etc. F. C. Wilson, City Engr.

Berwyn, Ill.—Until July 6 by Bd. Local Improv. (Oscar N. Lindahl, Secy.) for constructing sewer in Ogden Avenue and other streets Special Assessment No. 81, cost $24,607; also sewer in alley south of Twelfth Street, cost $3,994.

Chicago, Ill.—Until July 8 by Bd. Trus. Sanitary Dist., Chicago (John McGillen, Clk.), for two 500-horsepower water tube boilers, complete, for Thirty-ninth Street Pumping Station, advertised in Engineering Record.

Cicero, Ill.—Reported desired until July 12 by Bd. Local Improv. for vitr. tile pipe sewer in W. 18th and W. 58th Sts.

Clinton, Iowa.—Until July 13 by Frank W. Leedham, City Clk., for a sewer cleaning machine capable of cleaning sewers ranging in size from 8 in. to 36 in.

Sanborn, Iowa.—Reported desired until July 9 by J. H. McNeil, Mayor, for about 4 miles of sewers and disposal plant. P. A. Edquist, Engr., 856 Omaha Natl. Bank Bldg., Omaha, Neb.

Eveleth, Minn.—Reported desired until July 20 by C. H. Williams, City Clk., for constructing sewage disposal plant. Cost, $40,000. C. M. Dorway, City Engr.

Red Lake Falls, Minn.—Reported desired until July 6 by Joseph Perrault, City Clk., for constructing sewers during year 1915.

St. Paul, Minn.—Reported desired until July 6 by August Hohenstein, Purchasing Agt., for constructing sewers in several streets.

Clyde, Kan.—Until July 15 by J. A. Hawkinson, Mayor, for sewer system including 23,864 ft. 8, 10 and 12 in. vitr. tile pipe, sludge pump and engine, disposal plant, etc. E. T. Archer, Consulting Engrs., New England Bldg., Kansas City, Mo.

Pratt, Kan.—Until July 7 by M. P. Jones, City Clk., for constructing sanitary sewers in Dist. No. 3, consisting of about 4 miles of pipe, 21 flush tanks and 48 manholes. G. W. Ellis, Engr., Pratt.

Grand Island, Neb.—Reported desired until July 7 by H. E. Clifford, City Clk., for constructing storm and sanitary sewers.

Choteau, Mont.—Reported desired until July 9 by A. L. Powers, City Clk., for sanitary sewers, including 5176 lin. ft. 8 and 9-in. vitr. sewer pipe.

Port Angeles, Wash.—Reported desired until July 6 by J. L. Beam, City Clk., for constructing salt glazed vitr. clay or cement pipe sanitary sewers in portions of three alleys; cost reported at $12,000.

Mount Angel, Ore.—Reported desired until July 13 by P. N. Smith, City Recorder, for furnishing cement, sand, gravel and sewer pipe for constructing sewer; cost $15,000.

Alameda, Cal.—Reported desired until July 6 by R. E. Bosshard, City Clk., for sewer construction.

Los Angeles, Cal.—Reported desired until July 6 by H. B. Ferris, Secy. Bd. Pub. Wks., for constructing pump house and installing machinery for sewage-disposal plant.

Moscow, Idaho.—Reported desired until July 12 by J. R. Strong, City Clk., for storm-sewer improvements.

PRICES AND LETTINGS.

★Indicates award of contract.

★Boston, Mass.—Contract awarded to West Roxbury Trap Rock Co. for Mattapan Brook sewer, Dorchester, at $24,428 (bids opened June 16).

Long Island City, L. I., N. Y.—Lowest bid opened June 23 for constructing sewer in Polk Ave., Borough Queens, submitted by Clancy & Van Alst, Long Island City, as follows: 1991 lin. ft. 4-ft. 3-in. reinforced concrete sewer, $7.40; 285 lin. ft. 4-ft. concrete sewer, $6.20; 255 lin. ft. 3-ft. 9-in., $6.15; 255 lin. ft. 3-ft. 6-in., $6; 239 lin. ft. 3-ft. 3-in., $6; 24 lin. ft. 18-in. vitr. salt-glazed pipe sewer, $1; 62 lin. ft. 15-in., $1.40; 153 lin. ft. 12-in., $1.30; 27 manholes, ea., $51; 1 cleaning shaft, $92; 12 single receiving basins, ea., $120; 7 double receiving basins, ea., $185; 410 lin. ft. 12-in. pipe for basin connections, $1.25; 140 lin. ft. 10-in., $1; 193 spurs, 6-in., on concrete sewers, 24 in. long, 50 cts.; 975 lin. ft. 6-in. pipe for house connection drains, 70 cts.; 1 chamber in Fifty-first St., $230; 1 junction chamber at Polk Ave. and Fifty-first St., $340; 180 M. ft. timber, 1 ct.; 25 cu. yds. extra concrete Class A, 1 ct.; 2000 lbs. reinforcing steel (extra), 1 ct.; total $27,570. Next three lowest bids: Chris. Nally, 710 Columbus Ave., New York, $31,555; Angelo Paine, Brooklyn, $32,190; Stanhope Contr. Co., Brooklyn, $34,653.

★Rochester, N. Y.—Contract awarded by Bd. Contract and Supply June 15 to John Petrossi Co., for sewers in Hollenbeck and other streets at $67,367.

New Orleans, La.—Following are totals of 4 lowest bids opened June 14 by Bd. Port Comn., for installing sewerage at new cotton warehouses: L. M. Dalgarn, $15,936; Jefferson Constr. Co., $16,464; Blum & McNamara, $22,456; Reynolds & Co., $22,500.

★Bexley, O.—Contract awarded for constructing sanitary sewers in portions of Park View, Drexel and Columbia Aves., and Town St. to R. G. Howell, and West Side Sewer to Excavating Co., both of Columbus.

★Frankfort, Ind.—Contract awarded for constructing sewer pipe to C. C. Huffine & Co., Frankfort, at $7,026 (bids opened June 17). R. H. Boynton, City Engr.

★Kewaunee, Wis.—Contract awarded by Bd. Pub. Wks. (Emil T. Seidenglanz, Chmn.) for 12 blocks of sewers, to Grey, Robinson Constr. Co., Manitowoc (bids opened June 18).

★Sidney, Mont.—Contract reported awarded by City Council to Bendon, Reeds & Jones, Sidney, for constructing main sewer at $14,537, and lateral sewers in Special Improv. Dist. 3, at $9,707.

★**Chicago, Ill.**—Following are bids opened June 24 by Sanitary Dist. of Chicago for Contract 2 of Calumet intercepting sewer: (a) Byrne Bros. Dredging & Eng. Co., $[illegible] (awarded contract); (b) Nash-Dowdle Co., $265,596; (c) Henry C. Ulen, $235,476; (d) Marquette Constr. Co., $247,283; Nash Bros., $264,990; John W. Farley, $307,206 (bidders all of Chicago).

Unit prices of (a), (b), (c) and (d):

	*(a)	(b)	(c)	(d)
4,370 lin. ft. sewer, 11-ft. concrete	$34.50	$35.90	$39.00	$45.00
7 manholes on concrete sewer	50.00	40.00	29.00	30.00
3,200 lin. ft. 12-in. vitr. tile pipe	1.00	1.60	1.50	1.50
350 lin. ft. 9-in. vitr. tile pipe	1.00	1.00	1.00	1.00
32 manholes on tile sewer, without covers	30.00	35.00	54.00	25.00
15 standard c.-i. manhole covers and frames	10.00	8.50	13.00	9.00
Rebuild sewer at Ninety-seventh Street and Houston Avenue (lump sum)	1,000.00	500.00	5,200.00	1,700.00
Crossing Commercial Avenue at Ninety-seventh Street (lump sum)	1,400.00	250.00	2,800.00	1,200.00
Crossing C. & W. I. R.R. and C., R. I. & P. R.R. tracks (lump sum)	1,500.00	3,000.00	2,400.00	1,500.00
88 M ft. plank road along Torrence Avenue	40.00	40.00	34.00	25.00
1,700 lin. ft. relay water service pipes	1.00	2.00	0.70	0.50
140 lin. ft. relay 6-in. sewer house connections	0.50	1.00	0.70	0.50
1,200,000 lb. reinforcing steel	0.02½	0.02½	0.03½	0.03
Additional Work:				
500 lin. ft. piling furnished	0.20	0.25	0.35	0.20
500 lin. ft. piling driven	0.20	0.50	0.85	0.50
5 M ft. cribwork on piling	40.00	42.50	55.00	50.00
5 M ft. plank foundations	25.00	25.00	25.00	25.00
5 cu. yd. excav., earth	0.75	0.75	0.75	0.75
1 cu. yd. excav., rock	3.00	3.00	3.00	3.00
5 cu. yd. concrete, Class A	8.00	8.00	8.00	8.00
5 cu. yd. concrete, Class B	7.50	7.50	7.50	7.50
1 cu. yd. brickwork	9.00	9.00	9.00	9.00

★**Chicago, Ill.**—Following are bids opened June 24 by Sanitary Dist. of Chicago for Contract 3 of Calumet intercepting sewer: (a) Byrne Bros. Dredging & Eng. Co., $331,583 (awarded contract); (b) Henry C. Ulen, $342,184; (c) Nash-Dowdle Co., $348,602; (d) John W. Farley, $380,561; Marquette Constr. Co., $381,348; Nash Bros., $451,401 (bidders all of Chicago).

Unit prices of (a), (b), (c) and (d):

	*(a)	(b)	(c)	(d)
7,700 lin. ft. concrete sewer, 13 ft. diameter	$40.25	$40.00	$42.25	$44.40
12 manholes on concrete sewer	50.00	30.00	40.00	40.00
Connection at 100th Street (lump sum)	500.00	2,340.00	300.00	300.00
Crossing under C. & W. I. R.R., etc. (lump sum)	2,000.00	5,500.00	3,600.00	2,000.00
35 M ft. plank roadway on Torrence Avenue	40.00	34.00	40.00	35.00
634,000 lb. reinforcing steel	0.02½	0.03½	0.02½	0.05
37 connections tile pipe, 18 in.	2.00	14.00	3.00	5.00
5 connections tile pipe, 24 in.	3.50	14.00	4.00	5.00
Additional Work:				
5 cu. yd. excav., earth	0.75	0.75	0.75	0.75
5 cu. yd. excav., rock	3.00	3.00	3.00	3.00
5 cu. yd. concrete, Class A	8.00	8.00	8.00	8.00
5 cu. yd. concrete, Class B	7.50	7.50	7.50	7.50
5 cu. yd. brickwork	9.00	9.00	9.00	9.00
5 M ft. plank foundations	25.00	25.00	25.00	25.00

★**Laurel, Mont.**—Contract for constructing sewer system reported awarded to Security Bridge Co., Lewiston, Idaho, at $14,093.

★**Sisseton, S. D.**—Contract for constructing sewers (bids opened June 15) awarded to E. M. Schoflow of Elgin, Ill., at $24,804. C. Kennedy, Mayor.

★**Italy, Tex.**—Contract reported awarded to E. L. Daleon, of Dallas, for constructing sewer system, at $12,625.

★**Port Angeles, Wash.**—Contract for constructing sewers on North Side reported awarded to H. A. Cotton of Port Angeles, at $38,464 (bids opened June 29).

★**Phoenix, Ariz.**—Contract awarded to Geo. Tisdale, Phoenix, for addition to sewage disposal works at about $10,000. J. B. Girand, City Engr.

★**Vancouver, B. C.**—Contract awarded by Vancouver and Districts Joint Sewerage and Drainage Bd. to construct Clark Drive sewer system to H. P. Peterson, 207 Holden Building, at $70,055, using tunnel method.

BRIDGES

PROPOSED WORK.

Bridgeport, Conn.—Alfred H. Terry, City Engr., writes the proposed bridge to be constructed at Grand St. will cost about $220,000; and the bridge at E. Washington St., $130,000.

New Haven, Conn.—Plans reported being completed by F. L. Ford, City Engr., for constructing new bridge to replace Tomlinson Bridge; cost $250,000.

New York, N. Y.—U. S. Government has given its consent to construction of rapid transit bridge over Bronx River at Westchester Avenue to carry tracks of Pelham Bay Park branch of Lexington Avenue subway, which at this point runs on elevated structure. Plans call for permanent bridge with clearance of 61 ft. above mean high water, so that all except tall masted vessels will be able to pass underneath.

Lock Haven, Pa.—Public Service Comm. reported to have approved plans of Pennsylvania R. R. Co. for a bridge to be constructed over its tracks at Fourth Street.

Natrona, Pa.—Allegheny County at Pittsburgh and Westmoreland Counties contemplates constructing bridge over Alleghany River from Natrona to Braeburn, probable cost $225,000.

Phoenixville, Pa.—Comrs. Montgomery County at Norristown and Chester Counties voted to rebuild intercounty bridge recently destroyed. To be concrete with 30-ft. roadway and 5-ft. sidewalks.

York, Pa.—State Water Supply Comm. granted permission to Comr. of York County, to construct 5 bridges as follows: Reinforced concrete bridge across Stony Run from Dillsburg to Rossville; across south branch of Muddy Creek on Muddy Creek-Gatcheville Road; reinforced concrete bridge across Codorus Creek in Glen Rock; reinforced concrete bridge across Beaver Creek on East Berlin Spring Grove Road; across Red Run on Mulberry Kralltown Road.

Birmingham, Ala.—It is reported that Julian Kendrick, City Engr., has been asked to make examination of city bridges with a view to gradual substitution of concrete for all wooden bridges.

Dayton, Ohio.—Plans prepared by Morgan Engineering Co., Dayton, for bridges to be erected at Keowee, Fifth and Webster Sts. by city, at cost of about $300,000.

Troy, Ohio.—Reported bonds for $19,000 for completing rebuilding of bridges destroyed by flood will be sold July 10 by Co. Commissioners.

Hammond, Ind.—County Comrs. at Crown Point about to let contract for lift bridge over Grand Calumet River in Hammond. Harper L. Grove, Bridge Engr., Hammond. Address, County Auditor, Crown Point.

Quincy, Ill.—County Supervisors appropriated $25,755 for new bridge and bridge repair work.

Rockford, Ill.—Bonds for $24,000 for bridge improvement will be sold July 15 by E. A. Wettergren, City Clk.

Hardin, Mont.—Bonds for $28,500 for constructing bridge over Big Horn River will be sold July 12 by R. P. Ross, Co. Clk.

Austin, Tex.—See "Sewerage and Sewage Disposal."

Davenport, Wash.—About $50,000 has been appropriated for bridge work in Lincoln County this year, includes 50 bridges and culverts. Guy H. Harvey, Co. Engr.

Alameda, Cal.—Construction of bascule bridge connecting Alameda and Bay Farm Island is contemplated by county; cost, about $20,000.

Challis, Idaho. — Citizens of Custer County reported to have voted $35,000 bonds for constructing five bridges; the State Highway Comm. will contribute an additional $6,000.

BIDS DESIRED.

Boston, Mass.—Until July 9 for work on Spring Street Bridge, over Charles River between Dedham and Boston, and to be delivered at Room 602 City Hall Annex, Boston, to be received on three different sections as follows: Widening Bridge, by Spring Street Bridge Comm. (John F. Merrill, Chmn.); Boston Approach, by Patrick O'Hearn, Acting Comr. Pub. Wks.; and for Dedham approach by Selectman of Dedham (John A. Hurschm, Chm.).

Minetto, N. Y.—Until July 21 by Concrete Steel Eng. Co., Consulting Engrs., Park Row Bldg., New York, for constructing concrete steel bridge at Minetto.

Belvidere, N. J.—Until July 6 by Bd. Freeholders (J. R. Thatcher, Dir.), for constructing two I-beam bridges.

Freehold, N. J.—Until July 12 by J. M. Corlies, Dir. Bd. Chosen Freeholders, for replanking bridge over North Shrewsbury River, known as Oceanic Bridge; also Mott Street Bridge, borough of Keyport. Geo. D. Cooper, Co. Engr., Red Bank.

New Brunswick, N. J.—Reported desired until July 12 by A. B. Fox, Co. Engr., Perth Amboy, for constructing reinforced concrete bridge.

Doylestown, Pa.—Until July 12 by Co. Comrs. (Watson Davis, Chmn.) for concrete bridge over Walters Run, New Britain Township, on road from Chalfont to Line Lexington.

Easton, Pa.—Until July 16 by George F. P. Young, Co. Compt., for constructing reinforced concrete County Bridge No. 179 over Oughoughton Creek, Washington Township.

Philadelphia, Pa.—Plans for bridges to be constructed at Fifth and Third Streets and Fisher Avenue, bids to be opened July 8 by M. L. Cooke, Dir. Dept. Pub. Wks., are on file at office of Engineering Record, 239 W. Thirty-ninth Street, New York.

Pittsburgh, Pa.—Until July 16 by Hyatt M. Cribbs, Co. Compt., for constructing 2 reinforced concrete elliptical arches—Bridge No. 3 over Deer Creek, West Branch in Richland Township; Bridge No. 4, Flaughertys-Run in Moon Township; extension of arch Bridge No. 1, Kilbuck Run, Glenfield Boro., and for diversion of Pine Creek, Eliminating county bridges Nos. 17 and 18 over Pine Creek, Shaler Township.

Huntington, W. Va.—Until July 6 by R. S. Douthat, Clk. County Court for furnishing steel work and all other materials and building superstructure of bridge over Chesapeake & Ohio Ry. Co.'s right of way to connect Mud River Bridge near Milton. Oliver & Maupin, Engrs., Court House Bldg., Huntington.

Rainelle, W. Va.—Reported desired until July 6 by County Court, Lewisburg, for constructing 3 steel or reinforced concrete bridges, one 25 ft. and two each 20 ft. with 16-ft. roadways. J. S. Crawford, Clk of Court.

Guyton, Ga.—Reported desired until July 6 by City Comrs. for constructing steel bridge over Ogeechee River; cost about $4,500. Address J. D. Knight, Mayor.

Clearwater, Fla.—Reported desired until July 5 by E. W. Parker, Contractor, Tampa, for draw bridge.

Montgomery, Ala.—Reported desired until July 12 by Co. Comrs. for constructing steel bridge over Pinlala creek, on Hayneville Road. Thomas H. Edwards, Co. Engr.

Ironton, Ohio.—Reported desired until July 8 by Co. Comrs. for constructing steel or concrete bridge over Ice Creek, 113 ft. long, 20-ft. roadway.

Newark, Ohio.—Until July 24 by Co. Comrs. for constructing Dry Creek Bridge over Dry Creek at Newark and Mount Vernon Road, Newton Township, consisting of substructure, extending and repairing present wings and abutments and superstructure, one steel span 104 ft. c. to c., 18-ft. roadway, concrete floor. J. W. Hursey, Co. Aud.; John C. Swartz, Co. Surv.

Portsmouth, Ohio.—Until July 19 by Thomas C. Patterson, Co. Aud., for through girder skew span bridge, reinforced concrete floor and macadam roadway over Cockrell's Run, Valley Township, 41-ft. span; two through girder 40-ft. span bridges, reinforced concrete floor and macadam roadway, one over Dever's Run, Rush Township, and one over Bear Creek, Union Township, 44 ft. 3 in. riveted pony truss skew span bridge over Bear Creek, Union Township; 23 ft. 6 in. I-beam bridge, Arnold and Higgins Turnpike, Rush Township; 123-ft. riveted high truss span bridge over Brush Creek, Union Township; two 18-ft. reinforced concrete arch spans in Rush Township.

Wauseon, Ohio.—Reported desired until July 6 by Co. Comrs. for two 18-ft. span bridges and one retaining wall 320 ft. long.

Bloomington, Ind.—Reported desired until July 6 by Co. Comrs. for constructing Willard Farr steel bridge in Bloomington Township. W. F. Kinser, Co. Aud.

Logansport, Ind.—Reported desired until July 6 by Co. Comrs. for a reinforced concrete culvert over Ulerick Ditch. A. P. Flynn, Co. Aud.

Shelbyville, Ind.—Reported desired until July 7 by Co. Comrs. for a 110-ft. span steel girder bridge, with reinforced concrete abutments over Little Blue River in Union Township, and a 150-ft. span steel truss bridge with reinforced concrete abutments over Big Springs Creek west of Boggstown, Sugar Creek Township. Frank W. Fagel, Co. Aud.

Illinois—By County Clerk for constructing bridges as follows under supervision of State Highway Comm.:

Until July 6 at Troy—Longenwalter Bridge, reinforced concrete 28-ft. span; cost $1,355. W. E. Howden, Co. Supt. Highways, Edwardsville.

Until July 7 at Toulon, Wilson Bridge, span 75-ft. steel on reinforced concrete abutments; cost $4,070. W. E. Nixon, Co. Clk.

Aitkin, Minn.—Reported desired until July 12 by H. C. Beecher, Co. Aud., for concrete culvert on Road No. 3.

Austin, Minn.—Reported desired until July 12 by O. J. Simmons, Co. Aud., for 2 reinforced concrete bridges.

Faribault, Minn.—Reported desired until July 12 by Edward F. Kelly, City Recorder, for bridge on Division Street.

Waseca, Minn.—Until July 12 by Theodore Peterson, Co. Aud., for constructing three reinforced concrete culverts and a 16-ft. bridge.

West Brook, Minn.—Reported desired until July 8 by I. O. Iverson, Town Clk., for steel and concrete bridges.

Beloit, Kan.—Reported desired until July 8 by Co. Comrs. for constructing county bridges Nos. 810,201 and 86,141. T. H. McCall, Co. Clk.

Holton, Kan.—New bids desired until July 25 by Co. Comrs. for constructing one 50, one 60 and one 70-ft. steel bridge. William H. Webster, Co. Clk.

Olathe, Kan.—Reported desired until July 7 by Co. Comrs. for constructing steel and concrete bridge in Good Mission Township.

Osborne, Kan.—Reported desired until July 8 by J. Doane, Co. Clk., for constructing a 90-ft. low-water bridge with concrete floor.

Arlington, Neb.—Reported desired until July 13 by Ove T. Anderson, Co. Clk., for 14-ft. reinforced concrete arch culvert over Moore's Creek, and for grading and filling a grade and roadway over said culvert creek and ditch.

Drayton, N. D.—Reported desired until July 6 by August Low, County Clk., for steel and concrete county bridges.

Williston, N. D.—Until July 15 by M. H. Aaon, Co. Aud., for constructing bridges for period of 1 year, advertised in Engineering Record.

Watertown, S. D.—Reported desired until July 20 by Co. Comrs. for 3 steel bridges. M. A. Hockman, Co. Bridge Superv.

Hardin, Mont.—Until July 21 by R. P. Ross, Co. Clk., for constructing following bridges: Hardin Bridge, three-span, 160-ft., 16-ft. roadway, riveted steel, concrete foundation, F. M. Murray, Engr., Billings; Sarpy Bridge, one 160-ft. span, 16-ft. roadway, riveted span, concrete foundation, F. M. Murray, Billings, Engr.; Wyola Bridge, 80-ft. span, 16-ft. roadway, steel joists, concrete abutments.

Kansas City, Mo.—Until July 7 by Allen C. Southern, Co. Surv. and Highway Engr., Kansas City, for constructing reinforced concrete viaduct at separation of grades on Blue Ave. and Chicago & Alton R.R., 2 miles east of corporate limits of city, about 1146 cu. yds. concrete, 139,000 lbs. reinforcing metal, 8700 cu. yds. embankt., etc.

Until July 13 by Allen C. Southern, Co. Surv., for 6 ft. concrete arch culvert, 10 ft. concrete arch in Sect. 30, Range 29 W., Township 47; and a steel girder bridge with concrete floor in Sect. 7, Township 47, Range 29 W.

Pawnee, Okla.—Reported desired until July 6 by Co. Comrs. for Cimarron River Bridge, consisting of four 150-ft. spans with 16-ft. roadway, with 4 combination concrete piers.

Tecumseh, Okla.—Reported desired until July 21 by Co. Comrs. for 70 ft. steel highway bridge over North Canadian River at Beard St.; also separate bids for following steel highway bridges: four 30-ft. bridges, one 24-ft. and eight 50-ft., all 16-ft. roadway. R. C. Greene, Co. Clk.

Seattle, Wash.—Reported desired until July 20 by C. Comrs. for constructing the Duwamish Bridge, steel on concrete piers; cost $30,000. A. P. Denton, Co. Engr.

Coquille, Ore.—Reported desired until July 8 by Robert R. Watson, Co. Clk., for constructing Howe Truss steel bridge across east fork of Coquille River; cost $12,000.

Gold Beach, Ore.—Reported desired until July 7 by J. M. Caughell, Co. Engr., for reconstructing Elk River Bridge.

Hanford, Cal.—Reported desired until July 6 by Clk. Bd. Superv. for constructing reinforced concrete bridge.

San José, Cal.—Until July 12 by Henry A. Pfister, Clk. Bd. Superv., for constructing a reinforced concrete bridge on Quito and Pollard Roads over Wildcat and San Tomas Aquino Creeks.

San Luis Obispo, Cal.—Reported desired until July 8 by Bd. Superv. for a reinforced I-beam bridge, 21 ft. wide, 20 ft. span, over Sulphur Creek on State Highway about 4 miles from San Luis Obispo; also a bridge consisting of 108 ft. riveted steel truss and 17 34-ft. concrete spans across San Luis Obispo Creek at Miles Station, about 7 miles from San Luis Obispo. A. F. Parsons, Co. Surv.

Baker, Ore.—Reported desired until July 9 by A. B. Combs, Jr., Co. Aud., for constructing 2 steel bridges.

St. Charles de Bellechasse, Que.—Reported desired until July 11 by Joseph Lapointe, Secy.-Treas., for constructing concrete pillars, embankments, approaches,, etc., and superstructure of iron bridge on stream at Moulin Bouchard.

Moorefield, Ont.—Until July 24 by G. H. Dickson, R. R. No. 1, Moorefield, for constructing a 25-ft. concrete beam bridge between Perth and Wellington Counties. Bowman & Connor, Engrs., 31 Queen Street W., Toronto.

PRICES AND LETTINGS.

★Indicates award of contract.

★Grove City, Pa.—Contract awarded June 21 by County Comrs., at Mercer (H. C. Comstock, Clk.) to construct Pine Ave. bridge over Wolf Creek, to Penn Bridge Co., Beaver Falls, at $6,150. Other bids: Farris Bridge Co., Pittsburgh, $7,541; F. S. Wilson, Kittaning, $7,874; Canton Bridge Co., Canton, Ohio, $7,987; T. F. Hungiville, Smethport, $8,120. Lewis E. Burnside, Co. Engr.

★Bryson City, N. C.—Contract reported awarded to C. W. Roquarth Co., Charlotte, for constructing reinforced concrete bridge over Tuckaseegee River near Bryson City; it will be 4 spans, 325 ft. in length; cost about $88,000.

★Ashland, Ohio.—Contract for constructing Semple Ditch Bridge, Joe Sheets and Iceman bridges in Montgomery Township, and John Snyder Bridge in Mohican awarded by Bd. County Comrs. to Central Constr. Co., Wooster, at $5,199.

★Hamilton, Ohio.—Contract reported awarded by Co. Comrs. to A. Yawger Co., Indianapolis, Ind., to construct Columbia bridge over Miami River, at $96,000; it will be of concrete, 730 ft. long, and have 7 piers.

Illinois. — Following are lowest bids opened June 23 by State Highway Dept. for bridges:

Macoupin County, Sect. B, 236.4 yard concrete, Zastrow-Lashmet, Jacksonville, Ill., $2,564.

McDonough County, Electric Wheel Co., Quincy, Sect. A, 323.4 yds. concrete, $3,760; Sect. B, 273.1 yds., $3,498; Sect. C, 330.5 yds. concrete, $3,910, and Sect. D, 179.5 yds., Central States Bridge Co., Indianapolis, Ind., $3,836.

★Kansas City, Kan.—Contract reported awarded by City Comrs. to American Steel Co. to construct reinforced concrete viaduct over tracks of the Union Pacific and Chicago, Rock Island & Pacific Railway tracks at Eighteenth Street, at $115,801; it will be a third of a mile long, 30 ft. wide, and will be paid for by the Union Pacific and Rock Island Railway companies and the Metropolitan Street Ry Co. and is a gift to city; it will connect Argentine district on south side of Kansas City, Kan., with Quindaro district on north.

★Dallas, Tex. — Contract reported awarded by Co. Comrs. to Missouri Valley Bridge & Iron Co., to complete Trinity Heights Bridge.

★Raton, N. M.—Contract to construct steel riveted bridge with concrete abutments over Sugarite Creek, southeast of Raton, 100-ft. span, reported awarded to Levy Constr. Co. of Denver, Col., at $6,150, with $20 a cu. yd. above water and $22 per cu. yd. beneath water and floor.

★Washington.—Contract for constructing Mayfield Bridge over Cowlitz River awarded by State Highway Comn. at Olympia to Beers Bldg. Co., Portland, Ore., at about $28,888. To be steel superstructure with concrete piers and abutments, 468 ft. long.

★Albany, Ore.—Contract to construct steel bridge over Santiam River awarded by Co. Comrs. to Pacific Iron Wks., Portland, at $13,461. Next 3 lowest bids: Portland Bridge Co., Portland, $14,200; Beers Bldg. Co., Portland, $14,776; Illinois Steel Bridge Co., Spokane, Wash., $15,380. R. M. Russell Clk.

★Eureka, Cal.—Contract to construct cable suspension bridge, main span 750 ft., also for steel bridge two 324-ft. spans over Eel River, at Scotia, awarded to Macer-Fraser Co. of Eureka, at $55,160. Fred M. Kay, Co. Clk.

★Salinas, Cal. — Contract reported awarded by County Bd. of Supervisors to construct Neponset bridge across Salinas River, to Peterson & Griar, at $32,329, and for bridge over Nacimiento River to W. L. Gillim, at $27,730.

★Topock, Ariz.—Bids were opened June 19 by Cato Sells, Comr. Indian Affairs, Dept. Interior, Washington, D. C., for constructing steel highway bridge across Colorado River near Topock, and contract awarded to Kansas City Structural Steel Co., Kansas City, Mo., at $74,450, concrete added or omitted $12 per cu. yd. Next three lowest bids: Virginia Bridge & Iron Co., Roanoke, Va., $80,900; Missouri Valley Bridge & Iron Co., Leavenworth, Kan., $82,500; Security Constr. Co., Los Angeles, Cal., $82,597.

PAVING AND ROADS

PROPOSED WORK.

Lawrence, Mass.—City Council voted to spend $31,337 for street improvements.

Lowville, N. Y.—Bd. of Supervisors approved plans and specifications for 3 county highways as follows: Shady Avenue to E. State Street, Lowville, cost $30,000; the Barnes Corners to West Lowville Road, cost $109,600; the Kosterville to Lyons Falls Road, cost $23,800. Cost to be divided between County and State.

Rochester, N. Y.—Common Council voted to pave Pitkin Street with asphalt and Woodlawn Street with brick; cost, $13,700.

East Orange, N. J.—City to pave Harrison St. with wood block, granite block, asphalt block or concrete; also city and county to pave Central Ave. with bitulithic under supervision of County Engineer Fred A. Reimer. Contract for construction to be let in August. W. D. Williger od, City Engr. L. E. Rowley, City Clk.

Pittsburgh, Pa.—Petitions presented by County Comrs. for improvement of 9 roads have been approved by grand jury as follows: Scotia Hollow road in Jefferson Township, 1.74 miles ; Emsworth and Haysville road, Emsworth, 1,073 ft.; Painters Run road in Mount Lebanon and Upper St. Clair Townships, 4.15 miles; Gibsonia road, Pine and Richland Townships, 4.03 miles; Mattern road in Scott and Union Townships and Greentree borough, 1.07 miles; Snake Hollow road, Versailles Township, 1.92 miles; Elkhorn and Monongahela City road, 2.7 miles; Troy Hill extension No. 3 road, Ross Township, 0.68 mile; Perrysville improved road, Sect. 1; Thornburg and Cambells Run connecting road in Robinson Township, 1.47 miles.

Uniontown, Pa.—Contract about to be let by City Council for repaving with brick Pittsburgh Street, from Crawford Avenue to Peach Street, about 5 blocks.

Alexandria, Va.—City Council considering paving roads as follows: Road from stone bridge to city line, Patrick Street, Mount Vernon Avenue, and road from King Street to Janney's Lane; cost, $41,300.

Fairmont, W. Va.—Fairmont Dist. reported to have voted an additional $100,000 bonds to be used to complete highway improvement.

Macon, Ga.—See "Sewerage and Sewage Disposal."

Arcadia, Fla.—Reported about $210,000 is to be spent by County in district road improvements, which will include brick paving on Bowling Green and Arcadia Roads, about 10 miles.

Fort Myers, Fla.—Bonds for $177,500 for road and bridge Dist. No. 1 will be sold July 5 by H. A. Hendry, Clk. Co. Comrs.

Lake City, Fla.—Citizens voted $400,000 bonds for brick highways to connect with that of St. Johns County and run through Volusia and New Smyrna.

Melbourne, Fla.—Citizens of Brevard County reported to have voted $150,000 bonds for good roads.

New Orleans, La.—Local press reports state that the Commission Council will within next 60 days award contracts for paving, which will probably amount to $1,500,000. Creosoted long leaf yellow pine wood block as a paving material is said to be in favor here.

Laurel, Miss.—Final ordinances for paving 20 additional streets and avenues in residence districts of city have been adopted by city. Cost about $150,000.

Meridian, Miss.—About 30,000 sq. yds. macadam will be laid on Fifth and Eighth Sts., to include 12,000 lin. ft. concrete curb. County will do paving and city will do drainage, curb and gutter work. J. T. Pinkston, County Engr. J. C. Watts, City Engr.

Crossville, Tenn.—Bonds for $100,000 for road improvements will be sold July 12 by C. G. Black, Secy. Co. Comrs.

Waverly, Tenn.—Bonds for $250,000 for road construction work will be sold July 3 by James T. Anderson, Chmn. Highway Comn.

Frankfort, Ky.—The $250,000 road bond issue of Whitley County reported to have been declared valid by Court of Appeals.

Owensboro, Ky.—Citizens reported to have voted (by a majority) $600,000 bonds to build 100 miles of rock roads.

Shepherdsville, Ky.—Fiscal Court of Bullitt County reported to have adopted plans of Wm. Speed of Louisville for reconstruction of northern end of Louisville and Shepherdsville pike, known as Preston Street pike.

Akron, O.—Paving work contemplated includes 8.67 miles city streets, comprising 92,885 cu. yd. earth excav., 130,717 sq. yd. brick pavt. on 4-in. concrete base, 2-in. sand cushion tax expansion along curb, 78,180 lin. ft. stone curb, 5100 lin. ft. combined curb, 375,125 sq. ft. cement sidewalk.

Chardon, Ohio.—Bonds for $30,000 for Huntsburg Township Road Dist. will be sold July 10 by A. D. Williams, Clk. Township.

Cincinnati, Ohio.—Plans and specifications reported approved by County Comrs. for road improvements as follows: Lees Creek Road, cost of $13,139; widening and macadamizing Plainfield Road, $8,126, and concrete culvert on Strimple Road, $3,084.

Dayton, Ohio.—Bonds for $72,900 for improving portion of Inter County Highway No. 19 will be sold July 26 by Walter H. Aszling, Clk. Co. Comrs.

Findlay, Ohio.—City Council considering issue of $85,000 bonds for repaving Main Street this summer.

Massillon, Ohio.—City reported to have sold $25,000 street improvement bonds.

Toledo, Ohio. — Park and boulevard bonds amounting to $200,000 were sold by Finance Committee.

Wapakoneta, Ohio.—Bonds for $23,000 for Rapp Pike improvement will be sold July 16 by F. W. Langhorst, Co. Aud.

Youngstown, Ohio.—Bonds for $31,140 for street paving will be sold July 26 by Daniel J. Jones, City Aud.

Marion, Ind.—County road improvement bonds for $25,000 reported sold.

Rockford, Ill.—County Comrs. considering purchase of a road roller, a crusher and other road apparatus for road building.

West Allis, Wis.—Proposed to pave National and Greenfield Avenues and Mitchell Street, about 30,000 yard, with asphalt, brick, concrete, creosoted block, and about 8000 ft. concrete curb and gutter on 6-in. concrete foundation. E. G. Orbert, City Engr.

Burlington, Iowa.—Contract about to be let for paving Division Street from Third to Eighth Street.

Valley Junction, Iowa.—City Council voted to pave 21 blocks, including Fourth, Fifth and Maple Streets.

St. Paul, Minn.—Council passed ordinance providing for repaving University Avenue, from Rice to Dale Street, with spot test creosote blocks at an estimated cost of $57,514, or $6.12 per ft.

Willmar, Minn.—Saml. Nelson, Co. Aud., writes no bids were received June 25 for constructing State road Nos. 3 and 7.

Kalispell, Mont.—City Council voted to construct cement sidewalks and cross walks in Dists. No. 166 and 167, estimated cost $30,850.

Austin, Tex.—See "Sewerage and Sewage Disposal."

Denison, Tex.—Julian C. Field, Field Building, Denison, engaged by Co. Comrs., acting in conjunction with the citizens' Advisory Com., to design and supervise construction of highway system provided for by the $900,000 bond issue recently voted.

Tulsa, Okla.—Citizens voted $100,000 bonds for parks and boulevards.

Seattle, Wash.—Contract will soon be let by Bd. Pub. Wks. for paving as follows: East side Thirty-fifth Avenue, s. w., cost $66,000; Market and W. Fifty-fifth Street, cost $26,000.

Bd. of Pub. Wks. adopted resolution providing for paving with brick blocks Utah Avenue from Massachusetts Street to Stacey St.

Seattle, Wash.—Chas. R. Case, Supt. of Streets(recommended to City Council repaving First Avenue, bet. Pike Street and Denny Way, including renewal of brick gutters, to cost about $10,000.

Tacoma, Wash.—Section of Pacific Highway between Center St. and South Tacoma will be paved this summer, jointly by city and county; total cost $39,000. W. C. Raleigh, City Engr.

Tacoma, Wash.—City Council voted to pave M Street with asphalt on concrete base.

San Francisco, Cal.—Bd. Supervs. San Mateo County appropriated $48,000 for constructing highways.

Phoenix, Ariz.—Council considering paving 17 blocks 3½-in. asphaltic concrete with 1½-in. bitulithic top, curb, etc. J. B. Girand, City Engr.

BIDS DESIRED.

Boston, Mass.—Until July 6 by Patrick O'Hearn, Acting Comr. Pub. Wks. for edgestones and brick sidewalks in Wait Street, bitulithic pavt. on Lingard Street, Dorchester, and bituminous macadam roadway in Pelton Street, West Roxbury.

Albany, N. Y.—Until July 6 by Isidore Waschman, Secy. Bd. Contract & Supply, for repaving with asphalt portions of State and Slingerland Streets and Northern Boulevard, and with vitr. shale blocks Robin and N. First Streets.

Boonville, N. Y.—Until July 22 by J. A. Bateman, Village Clk., for 3700 sq. yd. brick paving and 1776 lin. ft. concrete curbing, advertised in Engineering Record.

Cohoes, N. Y.—Reported desired until July 9 by Bd. Estimate and Apportionment for paving with brick on Bowery Street; cost $22,000.

Long Island City, L. I., N. Y.—Until July 8 by Maurice E. Connolly, Pres. Queens Borough, for regulating and grading Van Alst Ave., about 140,000 cu. yds. embankment (in excess of excav.), 25 M ft. spruce timber in drains, 6000 lin. ft. guard rail, 3500 lin. ft. spruce piles for drains, etc.; also for furnishing Bureau of Highways 62,000 asphalt paving blocks, as directed in the Borough.

Niagara Falls, N. Y.—Until July 6 by Thos. H. Hogan, City Clk., for paving a portion of Whitney Ave., known as Paving Contract 187. F. S. Parkhurst, Jr., City Engr.

Bayonne, N. J.—Until July 6 by William P. Lee, City Clk., for improving Twenty-ninth Street, from Avenue E to Avenue A, including 8900 sq. yds. asphalt pavt., 4600 lin. ft. new bluestone curb, 5600 sq. ft. new bluestone flag, etc.

Freehold, N. J.—Until July 12 by Bd. Chosen Freeholders (J. M. Corlies, Dir.) for repairing portion of Red Bank-Middletown Road, in Township of Middletown. Geo. D. Cooper, Co. Engr., Red Bank.

Hackensack, N. J.—Until July 16 by County Road Com. Bd. Chosen Freeholders (A. V. Morrison, Chmn.) for improving 4 sections of Kinderkamack Road, Piermont Road and Grand Avenue.

Newark, N. J.—Until July 15 by Bd. Street & Water Comrs. (Morris R. Sherrerd, Ch. Engr.) for repaving S. Orange Street with asphalt block on 6-in. concrete.

Summit, N. J.—Until 8 p. m. July 6 by Common Council (Fred C. Kents, City Clk.), for paving Pine Grove Avenue, telford foundation and macadam surface and cobble gutter, etc., advertised in Engineering Record. Alexander Blair, City Engr.

Clarion, Pa.—Until July 15 by F. M. Arnold, Jr., Secy. Boro. Council, for brick and concrete paving, etc., advertised in Engineering Record.

Franklin, Pa.—Reported desired until July 6 by Campbell & Curry, Engrs., First Natl. Bank Bldg., Johnstown, for approximately 9000 sq. yds. brick or concrete paving.

Millvale, Pa.—Until July 6 by H. H. Dixon, Boro. Clk., 320 Grant Avenue, for paving with vitr. block portion of Ohio Street.

Philadelphia, Pa.—Until July 7 by M. L. Cooke, Dir. Dept. Pub. Wks., for laying or repairing Neuchatel or asphalt pavt., granolithic pavt., fountain basins, steps, coping, curbs, etc., repairing sidewalks and coping and placing granite curb bounding Bainbridge Street plots known as "Shippen Plaza" from Third to Fifth Streets in Fourth Ward.

Cumberland, Md.—Until July 7 by Mayor and City Council for grading, recurbing and repaving Baltimore Street, approximately 6000 sq. yds. creosoted wood block pavt. James P. Gaffney, City Engr.

Upper Marlboro, Md.—Until July 6 by Henry St. J. L. Briscoe, Chmn. Co. Comrs. for building a section of State Aid Highway along Riggs Road, a distance of about 1.59 miles.

Huntington, W. Va.—Reported desired until July 20 by R. S. Douthat, Clk., Co. Comrs., for grading, masonry and culverts on Ohio River Road about 6 miles. Oliver & Maupin, Engrs., Court House, Huntington.

Jackson, N. C.—Until July 10 by Bd. Road Comrs. Jackson Township (G. A. Moore, Secy.), for constructing 8 or 10 miles of clay-gravel and sand-clay roads.

Pinellas Park, Fla.—Until July 6 by T. J. DeHaas, Town Clk. for curbing and paving with brick streets and avenues.

Wauchula, Fla.—Reported desired until July 12 by City Clerk for paving with brick about 1 mile on Main Street and also Fifth Avenue, including ground around depot.

New Orleans, La.—Until July 27 by A. G. Ricks, Comr. Dept. Pub. Finances, for constructing highway connecting with existing Chef Menteur Road in vicinity of Chef Menteur.

Canton, Miss.—Reported desired until July 8 by Bd. Superv. Dist. No. 1 (J. F. Flournoy, Jr., Chmn.), for improving roads including gravel or navaculite for finishing surface, including concrete bridges and culverts. Xavier A. Kramer, Engr., Magnolia and Canton.

Crystal Springs, Miss.—Reported desired until July 6 by D. H. Miller, Secy., surfacing with gravel roads in Superv. Dist. No. 5. Xavier A. Kramer, Engr., Magnolia.

Hazlehurst, Miss.—Reported desired until July 5 by Xavier A. Kramer, Engr., Magnolia, for constructing gravel roads; cost, $160,000.

Meridian, Miss.—Until July 9 by J. O. Wise, Secy. Good Road Comrs., for about 45,000 sq. yds. macadam. J. T. Pinkston, Highway Engr.

Danville, Ky.—Until July 13 by W. P. Caldwell, City Road Engr., for furnishing 300 cu. yds. gravel and 1000 cu. yds. crushed stone for various pikes in the county.

Cincinnati, Ohio.—Until July 8 by Alter Boulevard Clk. Co. Comrs., for widening and resurfacing Plainfield Road in Columbia Township. Specification No. 1.

Until July 12 by Percy Fendick, Dir. Pub. Service, for grading, setting curb and paving with granite blocks section of Warsaw Avenue and Glenway Avenue.

Coshocton, Ohio.—Bonds for $11,000 for paving Seventh Street will be sold July 10 by Hugh Gamble, City Aud.

Lakewood, Ohio.—Until July 12 by Director of Public Works, for paving following streets with brick on bituminous concrete or sheet asphalt: Dewey Street, 4122 sq. yds.; Norton Avenue, 2412 sq. yds.; French Avenue, 3665 sq. yds.; Virginia Avenue, 4424 sq. yds.; also surfacing the pavements with bituminous concrete or sheet asphalt or bituminize on Lake Avenue, 25,000 sq. yds. E. A. Fisher, City Engr.

Lorain, Ohio.—Until July 7 by L. B. Jeannette, Clk. Bd. Pub. Service, for paving with vitr. brick or asphalt portion of 19th St., about 1450 sq. yds., 2200 lin. ft. curb, cost $11,000. C. M. Osborn, City Engr.

Mansfield, Ohio.—Until July 15 by Co. Comrs. (J. H. Dawson, Chmn.) for repaving portions of N. Main Street Road, Park Avenue East Road and Marion Avenue Road.

Newark, Ohio.—Until July 12 by City Clerk for paving Clay and Bonita Vista St., 1450 sq. yd. with tar macadam, mixed method and brick.

Ravenna, Ohio.—Until July 12 by John S. Malmsbee, Dir. Service for paving with vitr. block portions of Lake Avenue, Prospect and Chestnut Streets, about 3390 sq. yds. paving, 4000 lin. ft. curb.

St. Clairsville, Ohio.—Reported desired until July 5 by Emerson Campbell, Co. Aud. for resurfacing 9000 ft. High Ridge Road.

Tiffin, Ohio.—Until July 12 by Wm. Heller, Dir. Pub. Service, for paving with vitr. brick or block on crushed stone or concrete foundation, or with asphalt block on concrete foundation, E. Market, W. Davis and Wentz Sts., in all about 15,690 sq. yds. and 9730 sq. yds. vitr. brick or block pavt. on Coe St.

Ionia, Mich.—Reported desired until July 6 by Donald M. Steele, City Clk., for paving with brick N. Second and N. Third Streets. Edward H. Christ, Engr., 7 Norris Bldg., Grand Rapids.

Chicago, Ill.—Until July 7 by W. R. Moorehouse, Comr. Pub. Wks., for 2100 sq. yds. 3½ in. creosoted tamarack hexagonal paving blocks for bridges over river at North Western Avenue and Diversey Avenue and a viaduct at N. State Street.

Peoria, Ill.—Until July 6 by Bd. Local Improv. (Sheman W. Eckley, Pres.), for repaving with asphaltic cement portion of Callender Avenue, about 5800 sq. yds.

Davenport, Iowa.—Until July 6 by J. W. Crowley, Chmn. Bd. Pub. Wks., for paving portions of Mueller Ave. and Forest Rd., about 3250 sq. yds. asphaltic concrete, 2160 sq. yds. sheet asphalt on 16th St., and 1422 sq. yds. concrete pavt. on an alley.

St. Paul, Minn.—Reported desired until July 6 by August Hoberstorfer, Purchasing Agent, for grading and curbing various streets; also for concrete sand and coarse asphalt sand for paving Dayton Avenue; also for 1000 yds. clean gravel (or crushed rock) and 1500 bbls. Portland cement; separate bids for 110 bbls. cement for curbing Shields Avenue.

Virginia, Minn.—Reported desired until July 12 by Albert E. Bergford, City Clk., for paving with creosoted blocks, bitulithic, ganitoid, donnelite, asphaltum, etc., and for cement curb and gutters on various streets.

Fort Scott, Kan.—Reported desired until Aug. 2 by N. J. Rose, Co. Clk., for 3 miles macadam on Coleman Road. E. E. Toles, Co. Engr.

Grand Island, Neb.—Reported desired until July 7 by City Engr., for street paving to cost $35,000.

White Sulphur Springs, Mont.—Reported desired until July 6 by George Wallwork, City Clk., for 42,000 ft. walks, 4000 sq. ft. cross walks, etc.

Kansas City, Mo.—See "Miscellaneous."

Kaufman, Tex.—Reported desired until July 12 by James A. Conley, County Judge, for constructing county roads and bridges in Prect. No. 8, including Crandall. About $150,000 available. Charles Chappell, Highway Engr.

Longview, Tex.—Until July 14 by Co. Comrs. for grading and surfacing with stone and gravel 15 miles of Dallas-Shreveport Highway. D. K. Caldwell, Co. Engr.

San Antonio, Tex.—Until July 15 by Fred Pfeiffer, City Clk., for approximately 12,000 sq. yd. paving, advertised in Engineering Record.

Conconully, Wash.—Reported desired until July 6 by F. A. Grainger, Co. Aud., for constructing Permanent Highway No. 8, between Omak and Okanogan.

Seattle, Wash.—Until July 20 by Co. Comrs. for constructing Bond Road No. 9 (Snoqualmie-Franklin Road); cost $50,000. A. P. Denton, Co. Engr.

Washington.—Reported desired until July 19 by State Highway Bd., Olympia, for clearing, grading and surfacing following roads:

3½ miles of State Road No. 23, between Mead and Newport, Spokane and Pend Oreille Counties.

23½ miles Pacific Highway, between Chester and Enterprise, Whatcom County.

Bakersfield, Cal.—Until July 7 by Bd. Superv. (F. E. Smith, Clk.), for grading and constructing culverts on Div. 5, Sect. 3, Bakersfield-McKittrick Road, approximate 1.4 miles.

California.—Until July 6 by State Highway Comn., Forum Bldg., Sacramento, for sections of following State roads:

Tehama County, Div. 3, Route 3, Sect. C, about 12.7 miles grading.

Glenn County, Div. 3, Route 7, Sect. B, about 9.4 miles paving.

Contra Costa County, Div. 4, Route 14, Sect. B, 3½ miles grading.

Tulare County, Div. 4, Route 4, Sect. D, and Route 10, Sect. A, about 6.4 miles concrete paving, and Div. 6, Route 10, Sect. A, 3.9 miles concrete paving.

Manhattan Beach, Cal.—Until 7.30 p. m. July 7, for improvement of Ninth, Tenth, Eleventh and Alleys to include 57,996 sq. ft. 5-in. concrete pavt., oil and screenings top, 4647 sq. ft. cement sidewalk, 13,186 sq. ft. center walk, 25 ornamental concrete lighting posts with conduit and globes, etc. M. M. Murray, City Engr.

Redwood City, Cal.—Reported desired until July 12 by Co. Superv. for constructing first link of the highway into the Big Basin, leading from Pescadero to the Santa Cruz County line.

Ingersoll, Ont.—Until July 5 by W. R. Smith, Town Clk., for approximately 7175 sq. yds. vitr. brick pavt., on concrete base, with 3500 ft. combined curb and gutter.

Toronto, Ont.—Until July 5 for creosoted wood block floor on Summerville Bridge on Dundas Street, between York and Peel Counties. Frank Barber, Engr., 57 Adelaide Street, E., Toronto.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Buffalo, N. Y.**—Contract for paving with asphalt awarded by Bd. Pub. Wks. to German Rock Asphalt & Cement Co., Buffalo, Bailey Ave. at $20,180, Rejtan Street at $10,350, Krakow, Matejko and Kopernik Streets at $16,160.

★**Herkimer, N. Y.**—Contract reported awarded by Village Trus. to Warren Bros. Co., Boston, Mass., for paving W. Smith Street, Dewey Avenue, William and George Streets, at a total of $18,300.

New York, N. Y.—Following are unit prices of 4 lowest bids opened June 24 by President, Borough of Bronx, for paving with granite block and sheet asphalt on concrete foundation Fordham Road from Webster Ave. to Harlem River Terrace and setting curb: (a) Asphalt Constr. Co.; (b) W. J. Scanlon Contr. Co.; (c) J. Leopold; (d) Uvalde Contr. Co.:

	(a)	(b)	(c)	(d)
12,456 sq. yds. sheet asphalt pvt. (heavy traffic mixture) ..	$1.02	$0.78	$0.85	$0.82
19,206 sq. yds. granite block pvt. outside railroad area	2.56	2.51	2.47	2.60
1,600 sq. yds. granite block pvt. in railroad area	2.56	2.51	2.47	2.75
5,850 sq. yds. Class B concrete	3.25	3.96	4.50	4.35
100 lin. ft. new curb..	.75	.79	1.10	1.00
200 lin. ft. old curb	.20	.23	1.10	.50
Totals	$85,094	$85,230	$88,613	$90,176

★**Rochester, N. Y.**—Contract awarded by Bd. of Contract and Supply June 16 to Robertson Holter Co. for paving Norton St. with asphalt at $64,197.

★**Troy, N. Y.**—Contract for repaving Fourth Street with Hassam awarded by Bd. Contract & Supply to Hassam Paving Co., Worcester, Mass., at $22,948.

★**Utica, N. Y.**—Contract Awarded by Bd. Contract to Harry W. Roberts & Co., for paving Park Place and Holland Avenue with bitulithic and artificial curb, and resurfacing Burrstoff Avenue and Huntington Street with bitulithic.

Pittsburgh, Pa.—Contract for furnishing 15,000 tons asphalt mixture for road improvement awarded by County Comrs. to Booth & Flynn Co., Pittsburgh, at from $7.45 to $8.30 per ton.

★**Philadelphia, Pa.**—Contract awarded by Dept. Pub. Wks., Bureau of Highways (W. H. Connell, Ch. Engr.), to McNichol Paving & Constr. Co., Philadelphia, for improvement of the Northeast Boule. and branches from Rhawn St. at following bid:

232,605 cu. yds. grading.....	$0.28
58,457 sq. yds. bituminous pavement.	.47
9450 cu. yds. concrete base (4-in. or 5-in.)	4.43
58,457 sq. yds. asphalt paint coat....	.02
58,457 sq. yds. asphalt seal coat.....	.04
9220 sq. yds. vitr. block gutter paving	1.46
17,490 lin. ft. armored concrete curbing (8-in.)	.54
10,915 sq. yds. concrete footways....	1.36
71,820 sq. yds. topsoil (5 in. thick)..	.25
75,307 sq. yds. grass seeding.....	.01
3000 lin. ft. 4-way electrical conduit	.86
Total	$310,000.00

Alexandria, Va.—Following bids were opened by Chief Clerk, Dept. of Agriculture, Washington, D. C., June 22, for constructing experimental road on Russel Road, in Alexandria County: William P. McDonald, Constr. Co., New York, $18,363; L. M. Johnson, Arlington, $20,935; G. B. Mullen Constr. Co., Washington, D. C., $18,574.

★**Lincolnton, N. C.**—Contract for 20,000 sq. yd. asphaltic concrete pavement awarded by Bd. Aldermen to Noll Constr. Co., Chattanooga, Tenn.

★**Anniston, Ala.**—Contract for constructing 6½ miles highway between Jacksonville and Piedmont awarded to Goodrich Constr. Co.

Baton Rouge, La.—Following are 4 lowest bids opened June 21, for 158,000 sq. yd. bituminous gravel pavement: G. W. Prutsman, Baton Rouge, $153,746; E. J. Wetherstrom, Kansas City, Mo., $168,073; P. J. Haernon, St. Louis, Mo., $175,555; Hauick, Quarry & Constr. Co., St. Louis, Mo., $181,248. John J. Mundinger, City Engr.

★**Cincinnati, Ohio**—Contract for improving Winton Rd. in Springfield Township awarded to Goph & Holden, Harrison, at $11,434 (bids opened June 18). Other bids: Van Camp Bros., 3312 E. Side Hyde Park, Cincinnati, $12,190; John Ruebel Contr. Co., Cincinnati, $12,481; Wm. P. Flynn, 1252 Chase Ave., Cincinnati, $14,718. Albert Reinhardt, Clk. Co. Comrs.

★**Findlay, Ohio.**—Contract Reported awarded to Haskell & Battles, Painesville, for paving E. Sandusky Street, at $9,856.

★**Lakewood, Ohio.**—Contracts awarded for paving (bids opened June 14) to Cleveland Trinidad Paving Co., Cleveland, at following bid: Matthews Avenue and Park Road, 4-in. brick on 6-in. concrete, 6825 sq. yd., $16,450; Clifton, Forest and W. Forest Roads, 2-in. bitulithic on 4-in. concrete, on old macadam, 19,700 sq. yd., $50,523. E. A. Fisher, City Engr.

★**Utica, Ohio.**—Contract awarded by Village Council (Edw. Ottman, Clk.) for improving four streets with brick on concrete foundation, concrete curb and drainage sewers, about 15,600 sq. yd., to Henderson Bros., Coshocton. Swaitz & Irwin, Engrs., Newark.

★**Indianapolis, Ind.**—Contract for constructing a road on boundary line between Franklin and Perry Townships awarded by Bd. County Comrs. to McKinsey & Jenkins at $14,957.

★**Fort Wayne, Ind.**—Contracts for paving awarded by Bd. Works as follows: McCormick Avenue and Oak Street with asphalt, to R. E. M. Constr. Co. at $1.65 per sq. yd.; Chandler, Baker, Wilson Avenues, Fourth, Cherry and Delaware Streets with asphalt, to Reichert & Stinchfield, $1.65 per sq. yd.; Ingle Street with Dolarway, to Lamasco Constr. Co., at $1.40 per sq. yd.

★**Sault Ste. Marie, Mich.**—Contract for constructing 6 miles Class E stone roads, awarded by County to W. B. Hutchinson, of Michigan City, Ind., at $34,200 (bids opened June 18). D. F. Boley & Co., Crystal Falls, bid for this work, $53,659.

★**Cairo, Ill.**—Contract awarded by Bd. Local Improv. (W. H. Wood, Pres.) for paving in Dist. No. 2, including 4727 cu. yds. excav. and grading, 24,162 sq. yds. gravel macadam pavt., 17,950 lin. ft. combination concrete curb and gutter, etc., to Reppert Constr. Co., of Melrose Park, at 61 cts. per lin. ft. (bids opened June 21).

Ft. Dodge, Iowa.—Lowest bids opened by City Comrs. June 8 for paving First, Second and Third Dists., submitted by Bryant Asphalt Co.: First Dist., brick paving at $47,306, or asphaltic concrete, $39,902; Second Dist., brick, $12,440; Third Dist., asphaltic concrete, $32,718.

★Contract for paving 25,000 yd. with Texaco asphalt awarded by City Council to McGarry & Co., Chicago, Ill., at $1.60 to $1.65 per sq. yd.

★**Mankato, Minn.**—Contract for paving with creosoted blocks N. and S. Front Street awarded by City Council to Widell Co., Mankato, at $37,667.

★**Pipestone, Minn.**—Contract for paving 34 blocks with concrete awarded by City Council to Widell Co., Mankato, at about $60,000.

★**Wellington, Kan.**—Contract for paving (bids opened June 2) awarded to Kaw Paving Co., Topeka, at following bid: 29,740 sq. yds. asphaltic concrete 4-in. base, $1.25; 12,468 sq. yds. asphaltic concrete 5-in. base, $1.35; 10,500 cu. yds. excav., 35 cts.; 22,799 lin. ft. combined curb and gutter, 46 cts.; 7500 lin. ft. storm water sever, $10,417; total, $76,506. J. W. Mavity, City Engr.

Bethany, Mo.—Lowest bid opened by city June 21 for 11,500 sq. yds. concrete paving submitted by Universal Concrete Co., St. Joseph, at $1.18 and $1.15 per sq. yd.; 7500 lin. ft. curb, 39 cts. J. R. McClure, City Clk.

★**Kansas City, Mo.**—Contract for paving Twelfth Street awarded by Bd. Public Works to A. R. Mense at $21,921.

★**St. Louis, Mo.**—Contracts awarded by Bd. Pub. Service for paving as follows: Dalton and Berthold Streets and Grand View Place to Frank A. Stiers, at $23,710; Marcus, Columbia and Marquette Streets, to Timothy E. Cavanagh, $22,604.

★**Fort Collins, Colo.**—Contract awarded by Co. Comrs. for 3 miles of Fall River-Grand Lake Highway to F. C. Dreher, Denver, at following bid: Earth excav., 35 cts. per cu. yd.; loose rock, 64½ cts.; solid rock, 94½ cts.; clearing, $400 per mile; total, $16,255.

★**Olympia, Wash.**—Contract for paving E. Fourth Street awarded by City Clerk to Independent Asphalt Paving Co., Northern Bank Bldg., Seattle, at about $22,000.

★**Port Townsend, Wash.**—Contract for improving streets in Local Improvement Dist. No. 8 awarded by City Council to Nettleton, Bruce & Eachbach, American Bank Bldg., Seattle, at $15,190.

★**Burlingame, Cal.**—Contract reported awarded by City Trus. to Raisch Improv. Co., for paving Cypress, Barriollet and Occidental Avenues, at $10,309.

★**California.**—Contracts for State Highway work awarded by State Highway Comn., Sacramento, June 22, as follows:

Colusa County, Div. 3, Route 7, Sect. C, awarded to L. F. Gerdetz, 443 Rialto Bldg., San Francisco, at $40,052. (Bids opened June 1).

Kings County, Div 6, Route 10, Sect. A, awarded to George S. Benson & Sons, 521 Stimson Bldg., Los Angeles, at $50,212. (Bids opened May 24).

★**Salinas, Cal.** — Contract reported awarded by County Superv. to Granite Rock Co., to construct roads between Salinas and Hilltown, and also for the Salinas and Armomas Roads; cost about $12,000.

★**San Francisco, Cal.**—Contract for paving Pier No. 2 with wood block pavements awarded by Bd. Harbor Comrs. to Rolph-Mills & Co.

Sandpoint, Idaho.—C. J. Chaffins, Co. Surveyor, writes bids were opened June 15 for paving Cedar St., First and Second Aves., about 20,000 sq. yds., and lowest bid was submitted by Mitchell & Payne, for bitumass 4-in. base, $1.35 per sq. yd.; total, $28,590; or 5-in. base, $1.45 per sq. yd.; total, $30,190.

★**Sandwich, Ont.** — Contract reported awarded to Chick Contr. Co., for paving Mill St. and Askin Avenue and the Cadwell Sand & Gravel Co., for Sandwich and Church Streets; total cost about $27,000.

STREET CLEANING AND GARBAGE DISPOSAL

PROPOSED WORK.

Madison, Wis.—G. R. Bascom, Univ. of Wisconsin, Madison, engaged by Bd. of Commerce to report on garbage disposal system for Madison.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Detroit, Mich.—Lowest bid opened June 24 by Dept. Pub. Wks. (Geo. H. Fenkell, Comr.) for erecting reduction plant on north side of Detroit Terminal R.R., between Shoemaker and Harper Aves., submitted by Smith, Hinchman & Grylls, Detroit, at $180,788.

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS

PROPOSED WORK.

Harbor—Providence, R. I.—The State Harbor Improv. Comn. accepted plan submitted by its chief engineer, William D. Bullock, for development and improvement of general harbor conditions in Providence and along Seekonk River.

Drainage—Savannah, Ga.—Council considering completion of drainage system; cost about $400,000.

Drainage—Hastings, Fla.—Judge Hilburn has signed order providing for construction of drainage system east of boulevard, embracing about 5000 acres.

Improve Water Front—St. Petersburg, Fla.—See "Water Works."

Drainage—White Castle, La.—Citizens voted $60,000 bonds June 22 to construct drainage system, from plans of Daney & Waddill of New Orleans. S. M. Levy, Secy. and Treas. Drainage Dist.

Hydroelectric Plant—Hampton, Tenn.—O. W. Richardson of Hampton, Supt. Laurel Fork R.R. Co., reported interested in construction of a dam for the Hydroelectric Co.

Ditch—Canton, Ohio.—County Comrs. reported to have accepted plans for Domer ditch.

Ditch Bonds—Sidney, Ohio.—Bonds for $24,200 for ditch improvements will be sold July 6 by George P. Staley, Co. Aud.

City Dock—St. Louis, Mo.—Preliminary plans for building first of contemplated chain of municipal docks on Mississippi River being prepared by Dept. Public Utilities. This dock will be built by the Water Division for handling coal for water works. Above dock will be of concrete construction, 2000 ft. long and 160 ft. wide. Chas. S. Butts, Asst. Engr.

Wharf—Beaumont, Tex.—Plans being completed by Hugh McL. Harding, for wharf units, to cost about $100,000. Frank Keith, Chmn. Wharf & Dock Comn.

Drainage—Corpus Christi, Tex.—Citizens of Robstown Drainage Dist. reported to have voted $158,000 bonds for drainage for district, comprising 96,000 acres. Work includes building roads and constructing 500 concrete culverts.

Dock and Warehouse—Seattle, Wash.—The Harbor Island Dock & Terminal Co., White Bldg., reported to have decided to construct dock and warehouse on Harbor Island, to cost about $500,000. O. D. Fisher, of Fisher Flouring Mills Co., White Bldg., and Schwager-Nettleton Mill Co., White Bldg., are reported interested.

Irrigation—Lindsay, Cal.—Stephen E. Kieffer of Oakland reported to have completed plans for irrigation of 15,000 acres of orange lands in Lindsay-Strathmore Irrigation Dist.; probable cost $1,120,000.

Pier-Oceanside, Cal. — See "Water Works."

BIDS DESIRED.

Dredging—Brooklyn, N. Y.—Until July 12 by R. A. C. Smith, Comr. Docks, Pier A., New York, for dredging in Mill Basin, Jamaica Bay, Boro. Brooklyn, Contract No. 1463.

Dredging—Port Chester, N. Y.—Until July 30 by U. S. Engineer's Office, New York, for dredging in Port Chester Harbor, N. Y., advertised in Engineering Record.

Riprap — Tompkinsville, N. Y.—Until July 14 by J. T. Yates, Inspector Third Lighthouse Dist., for furnishing and placing riprap at Coney Island Light Station, N. Y.

Dredging — Wilmington, Del. — Until July 24 by U. S. Engineer for dredging Tuckerton and Absecon Creeks, N. J.

Irrigation Work—Washington, D. C.—Until July 20 by U. S. Reclamation Service, Washington, D. C., for furnishing material for outlet structures for Keechelus Reservoir, Yakima Project, Wash., and Sherburne Reservoir, Milk River Project, Mont., consisting of six 3 ft. x 7 ft. slide gates for 100-ft. head, c.-i. piers, 2 cast steel columns and other accessory parts for each reservoir, advertised in Engineering Record.

Elkton, Fla.—Until July 6 by W. W. Snow, Clk. of County Court, for constructing canal 4½ miles long, 24 ft. wide and 3 ft. deep; cost about $10,000. Engineer, Peter Kendrick of St. Augustine.

Levee Work—Vicksburg, Miss.—Until July 12 by Third Mississippi River Dist. P. O. Box 404, for constructing about 1,415,000 cu. yds. levee work.

Ditch—Canton, Ohio.—Until July 21 by C. L. Stoner, Co. Clk., for constructing Domer Ditch in Canton Township, main ditch 9793 cu. yds., laterals 2129 cu. yds.

Bulkhead—Cleveland, Ohio.—Until July 14 by E. G. Krause, Clk. Co. Comrs. for constructing reinforced concrete and steel-pipe bulkhead as per Report 3537. W. A. Stinchcomb, Co. Surv.

Revetment Wall—Columbus, Ohio.—Until July 12 by John I. Miller, State Supt. Pub. Wks., for constructing concrete revetment wall along south shore of Indian Lake near the bulkhead, Russells Point, Ohio, advertised in Engineering Record.

Breakwater — Conneaut, Ohio. — Until July 30 by U. S. Engineer's Office, Cleveland, for constructing pier head, and rubble mound breakwater at Conneaut Harbor, Ohio, advertised in Engineering Record.

Defiance, Ohio.—Bonds for $17,500 for constructing Dry Creek Ditch, No. 434, will be sold July 19 by Roger Daoust, Co. Aud.

Ditch—Monticello, Ind.—Until July 8 by Paul Ford, Drainage Comr. for constructing Ernest Scipio Ditch.

Levee Work—Alton, Ill.—Reported desired until July 12 by East Side Levee and Sanitary Dist. Bd. for completing the levee front along Mississippi River, about 800,000 cu. yds. material.

Levee Work—East St. Louis, Ill.—Reported desired until July 12 by Bd. Trus. East Side Levee and Sanitary Dist. Sexton Bldg. (G. L. Barton, Pres.), for constructing earth levee, requiring 80,000 cu. yds. earth embankment, 230 cu. yds. reinforced concrete, two hand gates and two automatic flood gates.

Pumping Plant, Etc.—Quincy, Ill.—Until July 21 by Bd. Superv. of Fabius River Drainage Dist. at office of John H. Best, Illinois State Bank of Quincy, for a steam driven pumping plant, containing 2 42-in. centrifugal pumps, normal capacity 46,000 gal. per minute each, against a maximum static pumping head of 15 ft.; also for a reinforced concrete sluiceway, advertised in Engineering Record. Harman Engr. Co., Engrs., Peoria, Ill.

Kenosha, Wis.—Until July 9 by Street Assessment Com. (M. J. Shcoley, Chmn.) for constructing about 375 ft. dock protection along harbor line on Washington Island.

Irrigation Work—Babb, Mont.—Until July 7 by U. S. Reclamation Service Babb (Camp 9), for excav. and backfilling around about 1300 lin. ft. St. Mary crossing pressure pipe, about 6000 cu. yds. back fill and excav. Work is situated in Blackfeet Indiana Reservation about 38 miles northwest of Browning.

Irrigation Work—Great Falls, Mont.—Until July 30 by U. S. Reclamation Service, Great Falls, for constructing canals and structures for Sun River Irrigation Project, including 455,000 cu. yds. excav., placing 4290 cu. yds. reinforced concrete, manufacture and placing of 4560 ft. concrete pipe and 265 M ft. lumber.

Irrigation Work—Conconully, Wash.—Reported desired until July 6 by F. A. Grainger, Co. Aud., for constructing irrigation system to water 12,000 acres in Okanogan Valley. Reported bonds for $600,000 for this improvement will be sold on the same date.

Sluice Gates for Locks—Seattle, Wash.—Reported desired until July 12 by U. S. Engineer's Office, Burke Bldg., for rectangular sluice gate for opening 7 x 5 ft. for use in locks Lake Washington Canal.

Retaining Wall—Seattle, Wash.—About July 13 for constructing concrete retaining wall along Railroad Avenue; approximate cost, $92,083. A. H. Dimock, City Engr.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Dredging—Boston, Mass.—Lowest bid opened by U. S. Engineer June 21 for dredging in Chelsea Creek and in channel between Nixes Mate and Long Island, Boston Harbor, submitted by Coastwise Dredging Co., Norfolk, at 15.49 cts. per cu. yd.

★**Dredging — Gloucester, Mass.** — Contract awarded by Bd. of Harbor and Land Comrs., Boston, for dredging channel Mill River, Gloucester, to Bay State Dredging Co., Ltd., 247 Atlantic Ave., Boston, at 29.5 cts. per cu. yd. and $9 per cu. yd. respectively.

★**Sea Wall—Woods Hole, Mass.**—Contract for rebuilding wharves and building new sea wall and coal house at U. S. Weather Bureau fisheries station Woods Hole awarded to T. A. Scott Co., New London, Conn., at $29,482 (bids opened July 12).

★**Dam—Felts Mills, N. Y.**—Contract awarded to Stewart Eng. Cor., 17 Battery Pl., New York, for general contract of constructing gravity section concrete dam at Felts Mills. This dam impounds waters of Black River, generating power to operate the pulp and paper mill of Taggart Paper Co.

Oswego, N. Y.—Following are bids opened June 23 by U. S. Engineer's Office, Buffalo, for concrete superstructure on outer breakwater at Oswego Harbor: (a) H. S. Kerbaugh, Inc., Buffalo, $78,606; (b) Great Lakes Dredge & Dock Co., Buffalo, $92,685; (c) George F. Hodgson, Fulton, $94,662; (d) T. A. Gillespie Co., Pittsburgh, Pa. $88,946; (e) Lake Shore Contr. Co., Cleveland, Ohio, $102,485:

	(a)	(b)	(c)	(d)	(e)
900 lin. ft. removing old superstructure	$12.00	$14.00	$12.00	$11.00	$12.75
45 M. ft. new timber	80.00	100.00	80.00	70.00	90.00
1100 cu. yd. concrete blocks ..	10.00	10.00	10.00	8.24	12.00
9175 cu. yd. mass concrete.	5.75	7.00	7.50	7.24	8.00
9 mooring posts ea.	50.00	40.00	50.00	45.00	40.00

★**Dam—Lock Haven, Pa.**—Following are the unit prices of Charles Dugan, Williamsport, successful bidder, for constructing portion of storage Dam No. 1 on McElhattan Run, Wayne Township, bids opened June 14 by Allen Sterner, Supt. of Parks and Public Property (H. P. Shoemaker, City, Engr.):

10,014 cu. yds. general earth excav.	$0.46
122 cu. yds. trench earth excav. for core wall	1.35
173.7 cu. yds. trench earth excav. for lowering pipe.....	1.55
530 cu. yds. rubble concrete, 1:3:6..	5.50
30 cu. yds. plain concrete, 1:3:6....	6.85
150 sq. yds. riprap, 1 ft. deep.....	1.00
1 24-in. "Darling" Double D. H. end valve, 14.5-ft. stem-set.....	130.00
106 sq. yds. Laitance picking from old concrete	0.12
1218 lin. ft. twisted ¾ reinforcing steel, placed, per lin, ft.....	0.20
100 lin. ft. 8-in. vitr. pipe open drain, in core wall trench, laying only	0.05
15 cu. yds. broken stone, placed....	0.95

Cranes—Norfolk, Va.—Following bids opened June 12 at Bureau Yards and Docks, Navy Dept., Washington, D. C. (H. R. Stanford, Ch.), for Spec. 2160—shipbuilding cranes at Navy Yard: Brown Hoisting Machinery Co., Cleveland, $49,700; for mounting each crane on wheels, add $3,700; McMyler Interstate Co., Bedford, O., $19,800; Terry & Tench Co., New York, $23,000; Lawrence D. Weaning, 1277 E. 40th St., Cleveland, O., $20,600.

★**Apalachee, Ga.** — Contract reported awarded to C. W. Roquarth Co., Charlotte, N. C., for constructing reinforced concrete dam over Apalachee River, at $120,000.

Levee—New Orleans, La.—Lowest bid opened June 15 by Bd. State Engrs. for Scott Levee, Riverside enlargement; approximate contents, 210,000 yds.; submited by B. Hearin & Son, at 11.22 per cu. yd.

★**Levee Work—Vicksburg, Miss.**—Contract awarded by U. S. Engineer at Vicksburg for 660,000 cu. yds. levee enlargement to Walter H. Dennison, Memphis, Tenn., at $94,842 (bids opened June 5).

★**Power House—Ashland, Ky.**—Contract awarded by U. S. Engineer to Geo. W. Ward & Son of Ashland, Ky., for building power house at dam No. 29, Ohio River, near Ashland, at $18,770.

Drainage District Work—Chicago, Ill.—Following are bids opened June 24 by Sanitary Dist. (John McGillen, Clk.) for excavating side slopes and constructing pile and timber protection on North Shore Channel of Sanitary Dist. in Evanston and Wilmette—(a) 150,000 cu. yds. excav., (b) 9500 lin. ft. piles, (c) 40 M ft. timber: Byrne Bros. Dredging & Eng. Co., (a) 59 cts., (b) 47 cts., (c) $75; Great Lakes Dredge & Dock Co., (a) 59 cts., (b) 50 cts., (c) $78.

★**Pumping Plant for Drainage — Oquawka, Ill.**—Bids were opened June 19 by Comrs. Henderson, County Drainage Dist. No. 3 (R. B. Parsons, Secy.) to construct complete pumping plant capable of discharging 6000 gal. of water per minute against a total pumping head of 16 ft. and contracts were awarded to J. T. Rudesell & Co., East St. Louis, and Murray Iron Works, Burlington, Ia. M. E. Bannon, Dist. Engr., Ft. Madison.

★**Ditches, etc.—Eureka, Mont.**—Contract reported awarded by Comrs. of Glen Lake Irrigation Project, for construction of ditches, laterals, siphons, etc., to Boomer & Hughes, of Spokane, Wash., at about $100,000.

★**Irrigation — Imperial, Cal.** — Contract for constructing 41,809 sq. ft. of floor lining with reinforced wire mesh in connection with irrigation system, awarded to W. J. Bathrick of Imperial at 11⅞ cts. per sq. ft. and 50 cts. per cu. ft.

★**Aprons on Ferry Slips—San Francisco, Cal.**—Contract reported awarded by Harbor Comrs. to Healy-Tibbitts Constr. Co., for side aprons on ferry slips No. 6, 7 and 8 at $13,000.

ELECTRIC RAILWAYS

PROPOSED WORK.

Boston, Mass.—Boston Elevated Ry. Co. contemplates considerable construction in Boston and suburbs; it will build several loops at ends of long runs.

Brooklyn, N. Y.—See "Private Buildings."

Farrell, Pa.—Farrell & Mercer Ry. Co. has received franchise from City Council to construct an electric railway in Mercer. This is part of plan to construct an electric railway from Farrell to Mercer and New Castle.

Washington, Pa.—Easton & Washington Traction Co. plans to construct an electric railway between Washington and Hackettstown, N. J., extending along Lake Hopatcong 19 miles.

Jacksonville, Fla.—Jacksonville Traction Co. authorized to build extension along King Road.

Pontiac, Mich. — Detroit, Pontiac & Owosso Ry. Co. petitioned Council for a franchise to build a railway in Pontiac. This is part of plan to construct railway, from Owosso to Detroit. Geo. H. Lau, Detroit, reported interested.

Belpre, Ohio.—Marietta-Parkersburg Interurban Ry. Co. of Marietta petitioned Council for franchise to construct railway in Belpre in connection with proposed railway from Parkersburg to Marietta.

Peoria, Ill.—Work is about to begin on constructing an electric railway between Chillicothe and Peoria. Cost about $500,000. E. F. Hunter, Peoria, is interested.

Ogden, Utah.—Ogden, Logan & Idaho Ry. Co. will erect 2 substations, one at Utah Hot Springs and one at Deweyville, to cost about $35,000 each with equipment.

BIDS DESIRED.

Brooklyn, N. Y.—Reported desired until July 16 by Bd. Public Service, 154 Nassau Street, New York, for open hearth rails to be used to equip new rapid transit lines of the dual system, approximtely 37,800 tons open hearth track rails and about 2400 tons open hearth guard rails.

New York, N. Y.—Until July 20 by Pub. Service Comn. for First Dist. for construction of Sect. 1 of Route 49, a part of Culver rapid transit railroad. This is a 3-track elevated railroad, which will connect Fourth Avenue subway through Thirty-eighth Street and Gravesend Avenue with Coney Island. Sect. 1 extends from a point in Thirty-seventh Street, 246 ft. southeast of Tenth Avenue, under private property and intersecting streets to Gravesend Avenue and over Gravesend Avenue to point about 525 ft. south of Bay Parkway (Twenty-second Avenue) produced, advertised in Engineering Record.

RAILROADS

PROPOSED WORK.

Rochester, N. Y.—Rochester Connecting R.R. Co., represented by Alfred W. Grey of Niagara Falls, reported to have petitioned Public Service Comn. for permission to build and operate standard gage railroad from Rochester to Niagara Falls; capital $200,000. Plan is to connect eastern terminal of Buffalo, Rochester & Lockport R.R. with Pennsylvania R.R. at Rochester.

Johnstown, Pa.—Reported that R. S. Wilbur and F. O. Keller, of Somerset, Supt. and Ch. Engr. respectively of the Johnstown-Rockwood R. R. Co., reported to have announced that work is about to begin on construction of railroad from Johnstown to Kelso, Davidsville, Holsopple, Jerome, Pilltown, Boswell, Jenner, Accosta, Belmont, Harrison, Somerset, Milford and Rockwood; cost about $1,500,000.

Topeka, Kan.—Reports state the Atchison, Topeka & Santa Fé R.R. Co. (R. A. Rutledge, Ch. Engr., Topeka) has petitioned State Railroad Comn. for permission to issue $10,808,000 bonds, proceeds to be used for extension and improvements to its system in western Texas. It is said plans provide for filling the 125-mile gap that exists between the Stering City and the Lamesa branches. Route of the proposed new line is via Big Springs, on the Texas and Pacific.

Turner, Ark.—Boyd Mayo of Turner and J. F. Watkins of Postelle reported interested in construction of a railroad from Turner to Postelle.

Athabasca Landing, Alta. — Reported that Athabasca & Fort Vermillion Ry. Co. about to begin surveys at Athabasca preliminary to construction of a railroad from Athabasca to Fort Vermillion, a distance of 300 miles.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Long Island.**—Contracts for construction of 2 sections of the New York Connecting Railroad, between Bowery Bay Road and Long Island Railroad at Fresh Pond Junction, have been awarded by Pennsylvania R.R. Co. (A. C. Shand, Ch. Engr., Philadelphia, Pa.) to the Wilson & English Constr. Co. of New York and to P. McManus, Inc., of Philadelphia. This portion of the New York Connecting line will be used for movement of through freight traffic between the Pennsylvania and New Haven system.

★**Harlan, Ky.** — Contract reported awarded to Grant Mason of Pineville for constructing extension of the Martins Fork line of Louisville & Nashville R. R. to Grays Branch.

★**Chicago, Ill.**—Contract awarded to P. T. Clifford & Son, Valparaiso, Ind., for filling, in connection with track elevation of N. Y. C. & St. L.

★**Roby, Tex.**—Contract reported awarded by Roby & Northern R. R. Co., to Baker Mfg. Co., Sweetwater, to build railroad from Roby, in a northerly direction to connection with the Texas Central at North Roby, a distance of five miles. J. C. McWhirter, of Roby, is one of the directors.

PUBLIC BUILDINGS AND SCHOOLS

PROPOSED WORK.

Lexington, Mass.—At recent town meeting $45,000 was appropriated for school in North Lexington.

Buffalo, N. Y.—Plans prepared by Howard L. Beck, City Archt., Municipal Bldg., for library and social building, brick, steel and concrete, to be erected at Grant and Amherst Sts., cost $50,000.

Newark, N. J.—Bd. Educ. approved tentative 1915 construction budget, including $2,519,000 for new construction. Among buildings to be improved are 22 classroom and combination auditorium and gymnasium to Ann, 10th and Charlton St. schools; 18 room addition to Madison school; 24 room addition to S. Market St. and 15th Ave. schools.

Philadelphia, Pa.—See "Miscellaneous."

Austin, Tex.—See "Sewerage and Sewage Disposal."

Clarksburg, W. Va.—Plans completed for 4-story building to be erected on Water and Mechanic Sts. to replace present Kessler Hospital, cost, $75,000. Selma M. Mason, Gen. Mgr.

Parkersburg, W. Va.—Site on Dudley Ave. selected on which to erect high school.

Pittsburgh, Pa.—Plans prepared for 1-story fireproof addition to boiler house of the Bureau of Mines, cost $40,000.

Cedarville, Ohio—Site selected for $75,000 school.

East Cleveland, Ohio.—Bonds for $150,000 for high school will be sold July 10 by Charles Ammerman, Clk. Bd. Educ.

Kilbourne, Ohio.—Bonds for $35,000 for school building will be sold July 23 by W. Ott, Clk. Bd. Educ. Brown Township, Rural School Dist., Kilbourne.

Toledo, Ohio.—Bonds for $100,000 for school improvements will be sold July 10 by L. L. Bomat, Clk. Bd. Educ.

Xenia, Ohio—Bonds for $75,000 for school building sold.

Bloomington, Ind.—Contract soon to be let by Library Bd. for erecting $40,000 Carnegie Library.

Evansville, Ind.—Bonds for $150,000 will be sold July 6 by Bd. Educ. (A. L. Fisher, Clk.) for erecting school.

Peoria, Ill.—Bd. of County Supervisors will sell $100,000 bonds July 15 to be used for erecting jail. Architect to be selected in September.

Depere, Wis.—Building cost $60,000 to be erected at St. Norbert College.

Jefferson, Wis.—Building costing $50,000 to be erected at St. Coletta Inst. for Feeble Minded Children.

Kenosha, Wis.—Bd. Educ. intends erecting $100,000 school.

Charter Oak, Iowa.—Citizens voted $50,000 school improvement bonds.

Washington, Iowa.—Plans for high school to be prepared by Eckland & DeArment, Trust Bldg., Rockford, Ill.; cost, $100,000.

Ortonville, Minn.—Edwin F. Bromhall, Duluth, preparing plans for school; cost, $35,000.

Wheaton, Minn.—Plans being prepared by Edwin F. Bromhall, Duluth, for $35,000 school.

Kansas City, Mo.—Plans for 6-story fireproof brick and terra cotta St. Joseph Hospital to be erected on Linwood Boule. and Prospect Ave. have been approved.

Johnson City, Tex.—Citizens voted $25,000 court house bonds.

Martin, Tex.—Citizens voted $50,000 for schools.

Tulsa, Okla.—Citizens voted $125,000 bonds for city hall.

Victorville, Cal.—Citizens voted $25,000 high school building bonds.

BIDS DESIRED.

Springfield, Mass.—Until July 12 by Fire Comrs. (William W. Tapley, Secy.), for alterations and additions to Winchester Square Fire Station, including heating, plumbing, etc. B. Hammett Seabury, Archt., 21 Bosse Place.

Newport, R. I.—Proposals desired until July 8 by F. N. Fullerton, City Clk., for erecting the John Clarke School on Mary St., separate bids for heating, plumbing, etc.

Albany, N. Y.—Until July 27 by Trustees Public Bldgs., Capitol, for alterations and additions to State House, advertised in Engineering Record. Lewis F. Pilcher, State Archt.

Buffalo, N. Y.—Reported desired until July 9 by Trus. Tuberculosis Hospital for erecting administration building on West Farm site.

Orchard Park, N. Y.—Reported desired until July 6 by Bd. Educ. for erecting 2-story school, cost $40,000. Robt. North, Archt., Prudential Bldg., Buffalo.

New York, N. Y.—Until July 12 by C. B. J. Snyder, Supt. School Bldgs., Bd. Educ. for general construction, plumbing, etc., School No. 3, Grove and Hudson Streets, Boro. Manhattan.

Utica, N. Y.—Until July 13 by Dennis J. Kelly, Clk. Bd. School Comrs., for erecting Kernan School. Gouge & Ames, Archts., Utica.

Fort Hancock, N. J.—Until July 23 by Quartermaster for repairs to hospital stewards' quarters, hospital and annex.

Jersey City, N. J.—Until July 28 by Bd. Chosen Freeholders for erecting county jail.

Newark, N. J.—Until July 7 by R. D. Argue, Secy. Bd. Educ., for waterproofing Newark Normal School and for repairs to Barringer High School.

Harrisburg, Pa.—Until July 15 by Samuel B. Rambo, Supt. Pub. Grounds & Bldgs., Capitol Bldg., for completion of new fireproof main building on State Arsenal grounds at Eighteenth and Herr Streets, advertised in Engineering Record.

Philadelphia, Pa.—Until July 9 by William Dick, Secy. Com. on Property Bd. Pub. Education, for school on Limekiln Pike and 65th Ave. and 2d St. Pike and Sanger St., and addition to McClure School; also miscellaneous repairs to various schools.

Wilmington, Del.—Reported desired until July 12 by H. J. Guthrie, Secy. Bd. Educ., for erecting annex to high school. W. E. Hance, Archt., 204 W. 24th St.

Washington, D. C.—Until Aug. 2 by Bureau of Standards for erecting chemical laboratory building, on Connecticut Ave., advertised in Engineering Record. Donn & Deming, Archts., 808 17th St., N. W.

Weston, W. Va.—Until July 27 by State Bd. of Control, Charleston (J. S. Lakin, Pres.), for erecting congregate dining hall, kitchen, etc., at Weston State Hospital, advertised in Engineering Record. H. Rus Warne, Archt., Charleston.

Bessemer, Ala.—Reported desired until July 7 by Bd. Educ. for erecting additions to Clarendon Avenue School and Roberts School. Cost $25,000.

Bardwell, Ky.—Until July 6 by County Bldg. Comrs. (R. O. Willingham, Secy.), for erecting county jail.

Barlow, Ohio.—Until July 6 by Bd. Educ., Barlow Rural School Dist. (W. H. Cunningham, Clk.), for erecting high school. E. S. Matheny, Archt., 710 Harrison Bldg., Columbus.

Columbiana, Ohio.—Until July 10 (readvertisement), by Vincent C. Basinger, Clk. Bd. Educ., Fairfield Township, for erecting fireproof 8-room school, including auditorium and gymnasium. E. Rufus Thompson, Archt., Youngstown.

Fayetteville, Ohio.—Until July 24 by W. H. Johnson, Clk. Bd. Educ. for erecting school in Sub-Dist. No. 15.

Freedom, Ohio.—Until July 17 by M. E. Parker, Clk. Bd. Educ. Freedom Township School Dist., for erecting central school including heating and ventilating. C. F. Owsley, Archt., Mahoning Bank Bldg., Youngstown.

Hamilton, Ohio.—Until July 15 by E. O. Roll, Clk. Bd. Educ., Hanover Township, R. R. No. 5, Hamilton, for erecting school house, barn and outbuildings. Geo. W. Barkman, Archt., Hamilton.

Hilliard, Ohio.—Until July 19, by Bd. Educ. Brown Township, Rural School Dist. (George C. Renner, Clk., R. F. D. No. 3, Hilliard), for erecting elementary grade and high school. Frank L. Packard, Archt., Columbus.

Lisbon, Ohio.—Until July 15 by James T. Kennedy, Co. Clk., for erecting high school; cost, $70,000. Frank L. Packard, Archt., Columbus.

Lowell, O.—Official reports state until July 24 by Bd. Educ. (F. F. Young, Clk.) for erecting grade and high school, including heating and plumbing. F. S. Rusk and Cree Sheets, Archts., 146 N. High Street, Columbus.

Mount Vernon, Ohio.—Reported desired until July 6 by Bd. Educ. (Carl N. Lorey, Clk.), for erecting fireproof school. Walter S. Anderson and W. H. Tremaine, Archts., Stauffer Bldg.

New Bloomington, Ohio.—Until July 27 by Bd. Educ. new Bloomington Village School Dist., care of J. W. Haruff, Clk., Agosta, for erecting fireproof high and grade school, including heating, plumbing, etc. Howard & Merriam, Archts., 8 E. Broad Street, Columbus.

Metz, Ind.—Reported desired until July 15 by School Trus. Richland and York Townships, care of Ellwood & Ellwood, Archts., S. Main St., Elkhart, for erecting one and two story centralized school; cost $36,000.

Muncie, Ind.—Until July 31 by F. M. Williams, Co. Aud., for erecting building for the county infirmary.

Detroit, Mich.—Until July 8 by George H. Fenkell, Comr. Pub. Wks., for erecting warehouse in Eastern Yard, Dept. Pub. Wks. Smith, Hinchman & Grylls, Detroit, Archts.

Maywood, Ill.—Reported desired until July 8 by A. J. Busscher, Pres. Bd. Educ. Proviso Township, Maywood, for erecting 2-story and basement high school; cost $80,000. E. E. Roberts, Archt., 82 W. Washington Street, Chicago.

Rock Island, Ill.—Until July 5, by Bd. Educ. for erecting Irving School on 12th Ave. Olof Z. Cervin, Archt., Rock Island.

Fort Atkinson, Wis.—Until Aug. 2 by James A. Wetmore, Acting Superv. Archt., Treas. Dept., Washington, D. C., for construction complete of U. S. Post Office, including mechanical equipment, lighting fixtures and approaches.

Roland, Iowa.—Until July 21 by Bd. Educ. (M. M. Eggland, Secy.) for erecting 2-story and basement high and grade school, including heating and plumbing. W. F. Gernandt, Archt., State Bank Bldg., Omaha, Neb.

Detroit, Minn.—Until July 19 by E. J. Bestick, City Clk., for erecting 2-story brick city hall and fire station, separate bids for heating and plumbing.

Felton, Minn.—Until July 14 by A. V. Specht, Clk. School Dist. No. 75 for erecting 6-room consolidated brick school. A. H. Foss, Archt., Elbow Lake.

St. Paul, Minn.—Reported desired until July 8 by August Hohenstein, Purchasing Agent, for reinforcing steel for Gaultier School Addition.

Bloomfield, Neb.—Reported desired until July 6 by W. R. Hoyt, City Clk., for erecting city hall and jail.

Lincoln, Neb.—Reported desired until July 5 by Leo Mathews, Secy. Bd. Control, for erecting 4-story and basement home for dependent children; cost $30,000. Joseph W. Salmon, Archt., 416 First Natl. Bank Bldg.

Seward, Neb.—Reported desired until July 6 by J. R. Roberts, Co. Clk., for erecting county jail and sheriff's residence.

Fessenden, N. D.—Reported desired until July 19 by Haxby & Gillespie, Archts., Fargo, for erecting brick school.

Grand Forks, N. D.—Reported desired until July 6 (readvertisement), by Bd. Educ. for erecting school: cost, $200,000.

Tabor, N. D.—Until July 14 by J. J. Kudrna, Clk Dist. No. 58, for erecting 2-story brick school, also heating. Goets Co., Archts, Yankton.

Chamberlain, S. D.—Reported desired until July 12 by George Issenhuth, Archt., Hudron, for erecting 2-story brick school.

Custer, S. D.—Reported desired until July 15 by Co. Comrs. for erecting addition to court house. Eisentraut & Bartholz, Archts., Rapid City.

Watertown, S. D.—Reported desired until July 20 by Co. Comrs. for erecting 2-story and basement reinforced concrete and brick poor asylum, including heating and plumbing.

Warrensburg, Mo.—Until July 7 by C. E. Hoover, Registrar of Missouri State Normal School, for erecting science hall, including heating, plumbing, etc. Smith, Rea & Lovitt, Archts., Finance Bldg., Kansas City.

Newport, Wash.—Reported desired until July 8 by Co. Comrs. for erecting court house; cost $50,000. H. H. Mirray, Co. Aud.

Raymond, Wash.—Reported desired until July 7 by W. W. Downing, Chancery Clk., Jackson, for erecting reinforced concrete jail. Emmett J. Hull, Archt., Daniel Bldg., Jackson.

Salem, Ore.—Until July 21 by Cato Sells, Comr. Indian Affairs, Washington, D. C., for addition to brick assembly hall at Salem School.

Hyde Park, Cal.—Until July 12 by Bd. School Trus. (L. Wilhelm, Clk., for group of grade school buildings at 4th Ave. and 53d St. Thomas Franklin Power, Archt., 424 Higgins Bldg., Los Angeles.

Los Angeles, Cal.—Until July 8 by Bd. Educ. (William A. Sheldon, Secy.) for erecting school on 24th St. and school on Annandale tract.

Duncan, Ariz.—Until July 6 by Clerk Bd. Educ. for erecting 2-story brick school 68 x 120 ft., cost $25,000. Lescher & Kibbey, Archts., Phoenix.

Ottawa, Ont.—Until July 9 by G. J. Desbarats, Deputy Minister Naval Service, Dept. Naval Service, for constructing new buildings for Life Saving Station at Point Pelee on Lake Erie, Ont.

The Pas, Man.—Reported desired until July 10 by G. N. Taylor, Archt., for erecting 8-room brick school.

Guantanamo, Cuba.—Until July 31 by H. R. Sanford, Chm. Bureau Yards and Docks, Nevy Dept., Washington, D. C., for marine barracks and four quarters for civilian employees of frame construction with corrugated steel roofs and a recreation building, frame construction tile roof, at the Naval Station.

PRICES AND LETTINGS.

★Indicates award of contract.

★**Middlebury, Vt.**—Contracts awarded to T. W. Rogers, of Brandon, and A. Calhoun & Son, Middlebury, Vt., for erecting dormitory and commons building for Middlebury College; cost $110,000. Architects, Rossiter & Miller, 15 West Thirty-ninth Street, New York.

★**Brooklyn, N. Y.**—Contracts awarded by Bd. of Health (S. S. Goldwater, Pres., New York) for erecting, general contract, plumbing and gas fitting pavilion on grounds of Kingston Ave. Hospital, Boro. Brooklyn, as follows: General contract, F. G. Fearon Co., 32 Bway., New York, $66,972; plumbing, John J. Kenny Co., 236 W. 20th St., New York, $4,795; steam heating, William J. Olvany, 177 Christopher St., New York, $4,200.

★**Fort H. G. Wright, N. Y.**—Contract for erecting annex to hospital awarded Connecticut Eng. & Contr. Co., at $23,898.

★**Conneautville, Pa.**—Contract for erecting school awarded as follows: Kratt & Agnew, Lorain, general construction, $47,988; McGinnis Co., Pittsburgh, heating, $6,275; E. R. Lumsden & Co., Indiana, plumbing, electric wiring, etc., $5,708.

Kingston, Pa.—Following four lowest bids opened by School Bd. for erecting school on Cuba St., 4th Ward: John Curtis & Co., $32,260; E. Francis Mellin, $32,500; M. L. Roth, $32,637, and W. B. Richards, $33,187. Lowest bid for ventilating and heating was from Jos. H. Slovlin, $4,273.

★**Sugar Notch, Pa.**—Contracts for erecting high school awarded as follows: Construction, E. J. Donohue, $28,015; heating and plumbing, T. A. Curley, $5,217.

Beverly, Ohio.—Following are bids opened June 23 for erecting school: E. Mast, Zanesville, $23,375; J. W. Showers, Zanesville, $25,600; Shoman & Taylor, Crooksville, $25,777; Farescion & Putnan, Marietta, $26,574; Harris & Spindle, Wheeling, W. Va., $30,900. Harry E. Meyer, Archt., Zanesville.

★**Canton, Ohio.**—Contract for erecting Crystal Park School awarded Melbourne Bros., Canton, at $74,900; heating and plumbing, F. E. Geisler & Co., Pittsburgh, Pa., $10,200; C. C. & A. L. Thayer, Archts., New Castle, Pa. Contract for reinforced floors for new high school awarded F. E. Downs Constr. Co., Canton, at $6,500. Geo. F. Hammond, Archt., Cleveland.

★**Toledo, Ohio**—Contract for additions to Chase and Wayne schools awarded as follows: General contract to Walls, Bock & Kuhlman, at $103,000; heating, Shaw, Kendall Co., $25,434; plumbing, Robert Raitz Co., $8,200 for Chase addition and $8,500 for Wayne.

★**Urbana, Ohio.**—Contract for erecting high school awarded to E. E. Becket, Columbus, at $27,903 (bids opened June 14). Robert G. Duncan, Clk. Bd. Educ.

★**La Salle, Ill.**—Contract for erecting U. S. Post Office awarded Charles W. Gindele, Chicago, at $67,000.

★**Plover, Iowa.**—Contract for erecting school from plans of James S. Cox, Estherville, awarded to B. Y. Constr. Co. of Dows (bids opened June 4). P. J. Shaw, Dist. Secy.

Sheldon, Iowa—Lowest bid opened for erecting court house was from Bankers' Realty Investment Co., Omaha, Neb., at $114,995.

★**Chillicothe, Mo.**—Contract for erecting U. S. Post Office awarded W. H. Fissell & Co., New York, at $87,700.

★**Excelsior Springs, Mo.**—Contract for remodeling high school awarded to John E. Anderson & Son, Kansas City, Kan. (bids opened June 14). J. H. Felt & Co., Kansas City, Mo.

★**Warrensburg, Mo.**—Contract for rebuilding training school for Missouri State Normal School, awarded to Jefferson Planing Mills Co., Jefferson City. Smith, Rea & Lovitt, Archts., Finance Bldg., Kansas City.

★**Dallas, Tex.**—Contract for erecting high school awarded as follows: General work—E. C. Gerhard Co., St. Louis, Mo., $257,994; heating and ventilating O'Connor Bros., Muskogee, $33,900; plumbing, Sanguinet Bros., Dallas, $11,507; electric work, F. E. Newberry Co., St. Louis, $5,280. William B. Ittner, Archt., St. Louis, Mo.

★**Oklahoma City, Okla.**—Contract for erecting capitol building reported awarded Jas. Stewart & Co. Cost, $1,500,000.

PRIVATE BUILDINGS

PROPOSED WORK.

Brooklyn, N. Y.—Plans filed by Shampan & Shampan, 772 Bway., Brooklyn, for 6-story brick and limestone apartment house to be erected at Bedford Ave. and S. 10th St. at a cost of $75,000.

Plans filed for following for following buildings: Two 4-story brick tenements

at E. Sixteenth Street and Foster Avenue and a 4-story brick tenement at Foster Avenue and E. Seventeenth Street for Louisville Realty Co., cost $175,000, W. McCarthy, Archt., 16 Court Street; two 4-story brick tenements at Butler Pl. and Plaza Street for Alto Holding Co., cost $140,000, Worthman & Braun, Archts., 114 E. Twenty-eighth Street.

Brooklyn, N. Y.—Public Service Comn. has approved form of contract submitted by the New York Municipal Ry. Cor. for construction of 8 elevated railroad stations on the Broadway, Brooklyn, elevated railroad, required in connection with third-tracking of line between Havemeyer Street and East New York. Stations are at Hewes Street, Lorimer Street, Flushing Avenue, Myrtle Avenue-Bway., Kosciusko Street, Gates Avenue, Halsey Street and Chauncey Street.

New York, N. Y.—Plans filed by Wm. H. Birkmire, 1133 Bwry., for 16-story store and loft building which Michael Coleman intends erecting on site of Eden Musee.

New York, N. Y.—Plans filed for following buildings: Two 5-story brick apartment house at Academy Street and Post Avenue for Post Investment Co., cost $98,000, Andrew J. Thomas, Archt., 2526 Webster Avenue; two 5-story brick stores and apartment house at 207th Street and Vermilyea Avenue, for Gustave L. Lawrence, cost $90,000, John Hauser, Archt., 360 W. 125th Street; 8-story fireproof tenement at 79 Washington Pl. for Fogliasso Clement Bldg. Co., cost $50,000, Frank C. Vitolo, Archt., 16 E. Twenty-third Street; 12-story fireproof light manufacturing building at 35 W. Thirty-seventh Street for Louis E. and Maria L. Frith, cost $180,000, Herman Lee Meader, Archt., 2 W. Thirty-third Street; 11-story fireproof warehouse at 267 Fifth Avenue for Frank V., John H. and Crawford Burton, cost $350,000, Starrett & Van Vleck, Archts., 8 W. Fortieth Street; 16-story fireproof store and loft building at 53 W. Twenty-third Street for Nameloc Co., cost $400,000, William H. Birkmire, Archt., 1133 Broadway; 5-story brick tenement at Broadway and 238th Street for Charles Housle Realty Co., cost $50,000, Moore & Landsiedel, Third Avenue and 148th Street, Archts.; 1-story brick sub-station and power house at White Plains Road and 211th Street for Interborough Rapid Transit Co., cost $50,000; George H. Pegram, 165 Broadway, Archt.

Rochester, N. Y.—William P. Brackett, Archt., Powers Bldg., writes plans not yet completed for 3-story and basement steel, stone, terra cotta and brick Labor Temple for the Labor Temple Assoc. Cost reported to be $90,000.

Rochester, N. Y.—Plans prepared by Leon Stern, Chamber Commerce Bldg., for group of brick buildings to be erected on Genesee Street and Elmwood Avenue for Jewish Orphan Asylum; cost, $45,000.

Jersey City, N. J.—Plans completed by R. W. Sailer, 70 Montgomery St., for fireproof concrete bakery and garage for National Grocery Co.; cost, $75,000.

Allentown, Pa.—Plans being prepared by Louis E. Jallade, 37 Liberty Street, New York, for 6-story brick terra cotta and steel Y. M. C. A. building.

Pittsburgh, Pa.—R. Maurice Trimble, Ferguson Bldg., to prepare plans for the community building for the First United Presbyterian Church; cost $200,000.

Pittsburgh, Pa.—Plans being prepared by E. B. Lee, 307 4th Ave., for 10 or 12-story brick and steel store and loft building to be erected at Smithfield St. and 7th Ave. for Henry W. Oliver estate; cost, $300,000.

South Bethlemen, Pa.—The Roman Catholic Church of the Holy Ghost will erect in Bethlehem West Side, a church and orphanage costing $50,000.

Washington, D. C. — Federal City Constr. Co. incorporated for purpose of erecting 9-story steel frame, fireproof brick, limestone and terra cotta office building at D and E Sts. and 13th and 13½ Sts. N. W. Cost, $1,000,000. Archts., Milburn, Heister & Co., Washington.

Spartanburg, S. C.—Southern Ry. Co. (B. Herman, Ch. Engr., M. W. and Structures, Washington, D. C.), intends erecting freight terminal facilities; cost, $100,000.

Macon, Ga.—Plans being prepared by Feilheimer & Long, 7 E. 42d St., New York, for union passenger station to be erected at 5th and Cherry Sts. for Central Georgia Ry.

Louisville, Ky.—Plans being prepared by Joseph & Joseph, Louisville, for $50,000 building to be erected on Market St. for Western Union Telegraph Co.

Richmond, Ky.—A $25,000 business block and lodge building is to be erected at Third and Main Streets by the Elks.

Avondale, Ohio—Plans prepared for church and parsonage to be erected for St. Andrews R. C. Church on Reading Road; cost, $100,000.

Dayton, Ohio — Plans completed by Frank Hill Smith, Main and 2d Sts., for 4-story reinforced concrete fireproof building which Houston Lowe will erect on St. Clair St.

Warren, Ohio.—Loyal Order of Moose reported considering erecting 4-story lodge building.

Adrian, Mich.—Preliminary plans are being received by the Masonic Society for a temple to cost $50,000. Chas. M. Dibble is in charge.

Detroit, Mich.—Plans completed by C. Howard Crane, 2323 Dime Bank Bldg., for fireproof theater to be erected on Greenwood and Grand River Aves.

Grand Rapids, Mich.—Plans completed by Osgood & Osgood, Grand Rapids, for 13-story granite building for Grand Rapids Savings Bank to be erected on Monroe Avenue. Cost, $400,000. Contract for steel work has been awarded to Toledo Bridge & Steel Co.

Chicago, Ill.—Plans being prepared by Ralph C. Harris, Stock Exchange Bldg., for 3-story hotel which Kusel & Harris will erect at 944 Eastwood Avenue. Cost, $75,000.

Plans being prepared for brick, Bedford stone and terra cotta church and Sunday school building to be erected at Sixty-second and Woodlawn Avenues for Ninth Church of Christ (Scientist). Cost, $100,000.

Plans prepared by Paul Gerhardt, Schiller Bldg., for 7-story reinforced concrete warehouse to be erected in Kingsbury Street Dist.; cost $140,000.

Milwaukee, Wis.—Plans approved for moving picture theater to be erected on Belleview Pl. and Downer Ave. for Neacy Realty Co.; cost, $55,000.

Havre, Mont.—Plans for school and church for Roman Catholic Church approved; cost $60,000. Rev. P. J. Mahoney, Pastor.

Kansas City, Mo.—Plans about completed by Smith, Rea & Lovitt, Finance Bldg., for 7-story office building to replace Ridge Bldg. at 908 Walnut Street. Cost, $200,000.

Kansas City, Mo.—St. Michael R. C. Church will erect a stone edifice at 5000 E. Twenty-fourth Street to cost $35,000.

Seattle, Wash.—See "Hydraulic Construction and River Improvement."

Tacoma, Wash.—Dave Goss, Tacoma Hotel, plans to erect at 9th and Market Sts. a 6-story fireproof hotel; cost, $100,000.

Oakland, Cal.—Directors Southern Pacific R. R. have approved plans for the $1,000,000 terminal depot. W. Hood, Ch. Engr., San Francisco.

BIDS DESIRED.

Olneyville, R. I.—Reported desired until July 6 by John F. O'Malley, Archt., 75 Westminster Street, Providence, for erecting a concrete brick and stone school for St. Anthony Parish; cost, $25,000.

Cleveland, Ohio.—Reported desired until July 22 by Emil Ulrich, Archt., 1900 Euclid Avenue, for erecting 2-story and basement parochial school for Nativity Slovak R. C. Church; cost $35,000.

Dayton, O.—Until July 14 by Bldg. Com. (William J. Tancred, Secy.) for erecting a 2-story and basement lodge building on S. Main Street for Fraternal Order of Eagles. Albert Pretzinger and Edw. P. Musselman, Archts., Reibold Annex.

Detroit, Mich.—Reported desired until July 12 by B. P. O. E., Lodge No. 34, (Harmon Hunt, Chmn. Bldg. Com., Elks Temple), for erecting 3-story and basement club house; cost reported $250,000. Van Leyen & Schilling and H. J. Keough, Archts., 1117 Union Trust Bldg.

Sesser, Ill.—Until July 15 by Thos. Ogilvie, Secy. U. M. W. of A., No. 1237, for erecting 2-story lodge building. R. Z. Gill, Archt., Murphysboro.

Superior, Wis.—Reported desired until July 12 by Emil Ulrich, 705 Euclid Bldg., Cleveland, Ohio, and John Bach, Newton Bldg., Superior, Wis., Assoc. Archts., for erecting 3-story and basement St. Joseph Orphan Asylum; cost $80,000.

Duluth, Minn.—Until July 12 by Rev. J. M. Koudelka, 628 Bay Street, for erecting St. Joseph Orphan Home.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Buffalo, N. Y.**—Contract awarded Chas. Berricks Sons Co., 1151 Main St., for brick and terra cotta and cement club house at Elmwood Ave. and Summer St. for Buffalo Tennis Club.

★**Pittsburgh, Pa.**—Contract for structural steel for Liberty Theater awarded to Cambria Steel Co., Johnstown.

★**Mount Sterling, Ky.**—Contract for erecting loose leaf warehouse (150,000 lb. daily capacity), on Sycamore Street, for Kirkpatrick & Clay, awarded Edward L. Williams.

★**Cleveland, Ohio**—Contract for erecting Euclid-Forty-Sixth Market on Euclid Ave. awarded to F. B. Marks Constr. Co., and for steel work to Massillon Bridge Co. Cost, $200,000.

★**Toledo, Ohio.**—Contract for erecting storage warehouse for Scheiwe Storage Co., awarded to Theodore Starrett Co., Detroit, Mich., at $50,000. M. M. Stophelt, Archt., Nasby Bldg.

★**Van Wert, Ohio.**—Contract for erecting Y. M. C. A. Building awarded Larson-Danielson Constr. Co., Laporte; cost, about $100,000.

★**Battle Creek, Mich.**—Contract awarded Michigan Engr. Co., Kalamazoo, for erecting concrete, brick and steel combination freight house and car barn on River Street, for railway connecting Grand Rapids and Battle Creek; cost, $100,000. W. G. Fargo, Archt., Jackson.

★**Chicago, Ill.**—Contract for furnishing and erecting structural steel work for proposed new freight house at Polk Street awarded June 25 to Thompson-Starrett Co., Chicago. R. Trimble, Ch. Engr., M. of W., Pennsylvania Lines west of Pittsburgh, Pittsburgh, Pa.

★**Ames, Iowa.**—Contract for erecting 4-story hotel awarded W. D. Lewis Co., at about $110,000.

★**Manhattan, Kan.**—Contract for erecting First Presbyterian Church awarded M. E. Brady, of Beliot, at about $50,000.

★**St. Louis, Mo.**—Contract for erecting 6-story fireproof steel frame, brick and terra cotta office building at Bway. and Locust St. awarded Jas. Stewart & Co., Inc., Bank of Commerce Bldg., by Ranier Realty Co.; cost, $400,000. Eames & Young, Archts., Wright Bldg.

NEW INDUSTRIAL PLANTS

PROPOSED WORK.

Amsterdam, N. Y.—H. W. Grieme, Amsterdam, prepared plans for 1-story steel and brick addition, 75 x 55 ft., to plant of Amsterdam Silk Mills.

Brooklyn, N. Y.—Plans being prepared by Francisco & Jacobus, 200 Fifth Avenue, New York, for cigarette factory to be erected at Park and Nostrand Avenues for American Tobacco Co.; cost $500,000.

Brooklyn, N. Y.—American Tobacco Co. will erect at Park and Nostrand Aves. factory costing $750,000.

Reading, Pa.—Carpenter Steel Wks. will erect an annealing building, 65 x 175 ft.; cost, $40,000.

Laurinburg, N. C.—R. E. Lee, Laurinburg, reported organizing company for purpose of erecting cotton mill, brick construction, equipped with 15,000 spindles, electric power, etc.

Cleveland, Ohio—Permit issued for additions and alterations to plant of Westinghouse Electric & Mfg. Co., 1220 W. 58th St. Other improvements also contemplated, total cost $500,000.

Detroit, Mich.—Permit issued to Albert Kahn, Archt., Detroit, for 5-story reinforced concrete factory on Concord Avenue and the Boulevard for Packard Motor Car Co.; cost $175,000.

BIDS DESIRED.

Grand Rapids, Mich.—Reported desired until July 12 by Wernette-Bradfield Meade, Archts., Grand Rapids, for erecting power house for Imperial Furniture Co.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Amsterdam, N. Y.**—Contract awarded to H. C. Grieme Co., Amsterdam, for erecting 2-story, 40 x 80 ft., foundry for Inman Fdry. Co.

★Contract awarded to H. C. Grieme Co., Amsterdam, for 1-story, 40 x 90 ft., foundry for Edw. L. Smith Foundry Co.

★**Binghamton, N. Y.**—Contract awarded to J. L. Lewis, Wall St., for erecting 2 additional stories to cigar factory of Barnes-Smith Co.

Contract awarded to J. L. Lewis, Wall St., for erecting mill, 35 x 11 ft., for Ballard Silk Co.

★**Buffalo, N. Y.**—Contract awarded by Pierce-Arrow Motor Car Co. to Aberthaw Constr. Co., Boston, Mass., for erecting 4-story, 200 x 400 ft., steel and reinforced concrete addition to plant at Elwood Ave. and N. Y. Central R. R. Belt Line; cost, $200,000.

★**Lockport, N. Y.**—Contract for addition to plant of Covert Motor Vehicle Co. at Grand and Green Streets awarded Manien Bros., Rochester; cost $30,000.

★**Syracuse, N. Y.**—Contract awarded to Taylor-Hornsby Constr. Co., Post-Standard Bldg., for erecting 2-story machinery shop, 56 x 123 ft., on N. Franklin St. for Merrill Soule Co.

★**Philadelphia, Pa.**—Contract awarded to Smith Hardican Co., 1608 Cherry St., for erecting 4-story reinforced concrete and brick factory for Berg Distilling Co. Sauer & Hahn, Archts., 1112 Chestnut St.

★**Philadelphia, Pa.**—Contract awarded Turner Concrete Steel Co., Philadelphia, for erecting 8-story reinforced concrete factory at Eleventh and Brandywine Streets for Edwin J. Schoettle Mfg. Co.; cost $150,000.

MISCELLANEOUS

PROPOSED WORK.

Park Bonds—Camden, N. J.—Finance Com. of City Council has sold $50,000 bonds for park improvements.

Plant for Sand Dredging, etc.—Philadelphia, Pa.—John G. Brown, Witherspoon Bldg., Philadelphia, has been engaged to design and build plant for mining, pumping, screening, washing and drying of sand for the Norcross & Edmunds Sand Co. of Philadelphia.

BIDS DESIRED.

Cement, Sand Rock, Etc.—New York, N. Y.—Until July 9 by Departments of Bridges, Docks and Ferries, Public Charities, Water Supply, Gas and Electricity and Fire Department, Room 1230, Municipal Bldg., for furnishing and delivering lime, cement, sand rock, fire clay and fire brick.

Piles and Lumber—New York, N. Y.—Until July 12 by R. A. C. Smith, Comr. Docks, for furnishing according to Contract 1460, lumber and piles.

Hydro-Electric Plant—Spring Hope, N. C.—It is reported that Eastern Carolina Light & Power Co., Spring Hope, will construct hydro-electric plant on Tar River near Spring Hope, and electric transmission systems to several towns; will ultimately develop 2000 hp., the first instalment to be 250 hp. unit.

Tank—Key West, Fla.—Until July 17 by H. R. Stanford, Ch. Bureau Yards and Docks, Navy Dept., Washington, D. C., for one 50,000 gal. fuel-oil storage tank at Naval Station.

Power Plant Machinery—Greencastle, Ind.—Until July 21 by Bd. Trus. Indiana State Farm, for machinery and equipment for power plant, advertised in Engineering Record. C. E. Talkington, Supt. Indiana State Farm.

Facing Bricks and Timber—Chicago, Ill.—Until July 7 by W. R. Moorehouse, Comr. Pub. Wks. for furnishing and delivering f.o.b. cars city's side track at Marshall Boule. Municipal Plant, 180,000 wire cut vitr. brick, also same time and place for 64.2 M ft. creosoted yellow pine and 6.5 M ft. creosoted plank for Western and Diversey Bridges.

Dumb Waiters—Springfield, Ill.—Reported desired until July 12 by Bd. Administration Capitol (Frank D. Whipp, Fiscal Superv.) for furnishing and installing automatic push button election dumb waiters in administration buildings at Alson State Hospital Upper Alton, State Colony for Epileptics, Dixon, and Chicago State Hospital, Dunning. James B. Dibelka, State Archt., 130 N. Fifth Street, Chicago.

Dam—Duluth, Minn.—Reported desired until July 6 by Co. Comrs. Duluth, for constructing dam at Vermilion Falls.

Subway—Kansas City, Mo.—Until July 7 by Allen C. Southern, Co. Surv. and Highway Engr., for constructing approaches to subway at separation of grades on Blue Ave. and Missouri Pacific Ry. tracks, about 2½ miles east of corporate limits of city. Work includes 33,000 cu. yds. earth excav., 35,000 equiv. yds. overhaul, 950 cu. yds. reinforced concrete retaining wall, 8880 sq. yds. asphaltic macadam pavt., etc.

Lumber—Galveston, Tex.—Until July 7 by Lighthouse Inspector, New Orleans, La., for funishing long leaf yellow pine lumber delivered at Galveston.

Cement—Santa Ana, Cal.—Reported desired until July 7 by Bd. Superv. for furnishing between 50,000 and 80,000 barrels Portland cement f.o.b. cars at place of manufacture at rate of 100 to 500 barrels daily.

Lumber, Etc.—Panama.—Until July 9 by Major F. C. Boggs, Corps Engrs., U. S. A., General Purchasing Officer, The Panama Canal, Washington, D. C., for furnishing according to Circular 941—maple and mahogany lumber, pig iron, etc.

Galvanized Steel, Cypress Lumber, etc.—Panama.—Until July 16 by Maj. F. C. Boggs, Corps Engrs., U. S. A., General Purchasing Officer, The Panama Canal, Washington, D. C., for furnishing according to Circular 943, galvanized steel, cypress lumber, etc.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Swimming Pool—Philadelphia, Pa.**—Contracts awarded by Board of Recreation, City Hall, for building swimming and wading pool at Waterview Recreation Park as follows (bids opened June 17): Building, F. W. Van Loon, $87,971; plumbing, Powers & Magee, $5,846; heating, Bulman Bros., $4,267; electrical work, Walker & Kepler, $2,705. Contractors all of Philadelphia.

★**Conduit — Boston, Mass.** — Contract awarded by Bd. Pub. Wks. (Patrick O'Hearn, Comr.) for constructing Maltapan Brook conduit in Delhi St., Dorchester, to West Roxbury Trap Rock Co., Grave and Centre Sts., West Roxbury, at $24,428.

★Cement—Wilmington, N. C.—Contract awarded to Carter Portland Cement Co., Charleston, S. C., to furnish about 22,000 bbls. Portland cement at $2.80 per bbls. (award May 26 by U. S. Engineer at Wilmington).

Proposals

For Proposals Advertised, see Pages 54, 55 and 56.

WATERWORKS.

Bids Close.			See Eng. Record.
July	6.	Waterworks, Thief River Falls, Minn.	Jun. 26
July	6.	Water Works, Powell, Wyo.	Jun. 26
July	6.	Filter Plant, Cheyenne, Wyo.	July 3
July	6.	Reservoir, Etc., Guelph, Ont.	July 3
July	6.	Pipe, Berwyn, Ill.	July 3
July	6.	Examination of Supply, Albany, N. Y.	July 3
July	6.	Pumping Station, Pensacola, Fla.	July 3
July	7.	Rack, shutters, etc., Contract 149, New York, N. Y. Adv. Jun. 19, 26.	Jun. 19
July	7.	Contract 140, New York, N. Y.	Jun 26
July	7.	Reservoir and Filtration Plant, Port Henry, N. Y. Adv. Jun. 26.	Jun. 26
July	7.	System, Canova, S. D.	Jun. 26
July	7.	Water Works, Marysville, Tenn.	July 3
July	7.	Mains, Phoenix, Ariz.	July 3
July	8.	Pipe, Covington, Ky.	Jun. 19
July	8.	Generator Equipment, Chicago, Ill.	Jun. 26
July	8.	System, Lowden, Iowa.	July 3
July	8.	Mains, Fond du Lac, Wis.	July 3
July	8.	Boilers, Etc., Chicago, Ill.	July 3
July	9.	Standpipe, San Juan, P. R.	Jun 19
July	9.	Water Wks. Extension, Ilion, N. Y. Adv. July 3.	July 3
July	9.	Boiler Feed Pumps and Steel, Chicago, Ill.	July 3
July	9.	Boilers, St. Louis, Mo.	July 3
July	12.	Improvements, Covington, Va. Adv. Jun. 19, 26.	Jun. 19
July	12.	Turbines, Hyde, New South Wales	Jun. 19
July	12.	Pump, Saltsburg, Pa.	Jun. 26
July	12.	Mains, Etc., New York, N. Y.	July 3
July	12.	Improv. Pump Station, Brooklyn, N. Y.	July 3
July	14.	Improvement, Beaumont, Tex.	Jun. 26
July	14.	Pumps, Baltimore, Md. Adv. July 3.	July 3
July	15.	System, Clayton, Del. Adv. July 3.	July 3
July	15.	Water Works, Hilton, N. Y. Adv. July 3.	July 3
July	19.	Well, Venn, Ill. Adv. July 3.	July 3
July	19.	Water Wks., Totowa, N. J.	July 3
July	19.	Pipe, Washington, D. C.	July 3
July	20.	Systems, West Linn, Ore.	July 3
July	22.	Bridges, Paris, Ill. Adv. July 3.	July 3
July	23.	Reservoir, Binghamton, N. Y. Adv. July 3.	July 3

SEWERAGE AND SEWAGE DISPOSAL.

July	6.	Elroy, Wis.	Jun. 26
July	6.	Portland, Me.	Jun. 26
July	6.	Los Angeles, Cal.	July 2
July	6.	Pt. Coal, Ohio	July 3
July	6.	Alameda, Cal.	July 3
July	6.	Takoma Park, Md.	July 3
July	6.	Berwyn, Ill.	July 3
July	6.	Port Angeles, Wash.	July 3
July	6.	Portland, Me.	July 3
July	7.	East St. Louis, Ill.	Jun. 26
July	7.	Cleveland, O. Adv. Jun. 26, July 3.	Jun. 26
July	7.	Grand Island, Neb.	July 3
July	7.	Washington, D. C. Adv. July 3.	July 3
July	7.	Depot, Kan.	July 3
July	7.	Boston, Mass.	July 3
July	8.	Chicago, Ill. Adv. July 3.	July 3
July	9.	New York, N. Y.	July 3
July	9.	Syracuse, Iowa	July 3
July	9.	Cincinnati, Ohio	July 3
July	9.	Choteau, Mont.	July 3
July	12.	Avalon, N. J. Adv. Jun. 26, July 3.	Jun 26
July	12.	Peoria, Ill. Adv. Jun. 26, July 3.	Jun. 26
July	12.	Syracuse, N. Y.	Jun 26
July	12.	Moscow, Idaho	July 3
July	12.	Canton, Ill.	July 3
July	15.	Clyde, Kan.	July 3
July	15.	Chester, Ind. Adv. July 3.	July 3
July	20.	Brazil, Ind.	July 3
July	20.	Eyota, Minn.	July 3
July	26.	Maywood, N. J. Adv. July 3.	July 3
Aug.	3.	Paducah, Ky. Adv. Aug. 3.	July 3

BRIDGES.

Bids Close.			See Eng. Record.
July	6.	Orange, Cal.	Jun. 19
July	6.	Hankinson, N. D.	Jun. 19
July	6.	Colfax, Wash.	Jun. 19
July	6.	San Jose, Cal.	Jun. 26
July	6.	Lewisburg, W. Va.	Jun. 26
July	6.	Milton, Va.	Jun. 26
July	6.	Laguna, Colo.	Jun. 26
July	6.	Frankfort, Ky.	Jun. 26
July	6.	Norwalk, O.	Jun. 26
July	6.	Indiana	Jun. 26
July	6.	Wauseon, Ohio	July 3
July	6.	Hanford, Cal.	July 3
July	6.	Bellville, W. Va.	July 3
July	6.	Pawnee, Okla.	July 3
July	6.	Guyton, Ga.	July 3
July	6.	Bloomington, Ind.	July 3
July	6.	Logansport, Ind.	July 3
July	6.	Drayton, N. D.	July 3
July	6.	Belvidere, N. J.	July 3
July	6.	Troy, Ill.	July 3
July	6.	Huntington, W. Va.	July 3
July	7.	Washington	Jun. 19
July	7.	Canton, O.	Jun. 19
July	7.	Kansas City, Mo.	July 3
July	7.	Illinois	July 3
July	7.	Gold Beach, Ore.	July 3
July	7.	Olathe, Kan.	July 3
July	7.	Ashbyville, Ind.	July 3
July	8.	Bismarck, N. D.	Jun. 26
July	8.	Jamestown, N. D.	Jun. 26
July	8.	Springfield, Mass. Adv. Jun. 26.	Jun. 26
July	8.	Philadelphia, Pa. Adv. Jun. 26.	Jun. 26
July	8.	Beloit, Kan.	July 3
July	8.	Ironton, Ohio	July 3
July	8.	San Luis Obispo, Cal.	July 3
July	8.	Osborne, Kan.	July 3
July	8.	Coquille, Ore.	July 3
July	8.	West Brook, Minn.	July 3
July	9.	Cincinnati O.	Jun. 19
July	9.	Lansing, Mich.	Jun. 26
July	9.	Baker, Ore.	July 3
July	9.	Boston, Mass.	July 3
July	11.	St. Charles de Bellechasse, Que.	July 3
July	12.	Lebanon, O. Adv. Jun. 26.	Jun. 19
July	12.	Hartland, Minn.	Jun. 26
July	12.	Seattle, Wash.	Jun. 26
July	12.	North Timiskaming, Que.	Jun. 26
July	12.	Doylestown, Pa.	July 3
July	12.	Montgomery, Ala.	July 3
July	12.	New Brunswick, N. J.	July 3
July	12.	Austin, Minn.	July 3
July	12.	Aitkin, Minn.	July 3
July	12.	Waseca, Minn.	July 3
July	12.	Faribault, Minn.	July 3
July	13.	Arlington, Neb.	July 3
July	12.	Freehold, N. J.	July 3
July	12.	San José, Cal.	July 3
July	13.	Kansas City, Mo.	July 3
July	15.	Williston, N. D.	Jun. 26
July	16.	Easton, Pa.	July 3
July	16.	Pittsburgh, Pa.	July 3
July	19.	Portsmouth, Ohio	July 3
July	20.	Watertown, S. C.	July 3
July	20.	Seattle, Wash.	July 3
July	21.	Minotto, N. Y.	July 3
July	21.	Hardin, Mont.	July 3
July	23.	Seattle, Wash. Adv. Jun. 19 to July 3.	Jun. 19
July	24.	Moorefield, Ont.	July 3
July	24.	Newark, Ohio	July 3
July	25.	Holton, Kan.	July 3

PAVING AND ROADS.

July	6.	Mansfield, La. Adv. June 12.	Jun. 12
July	6.	Hopkins, Minn.	Jun. 19
July	6.	Lockland, O.	Jun. 19
July	6.	Trenton, Ga.	Jun. 19
July	6.	Corsicanna, Tex.	Jun. 26
July	6.	Cathlamet, Wash.	Jun. 26
July	6.	Seattle, Wash.	Jun. 26
July	6.	Kearney, Neb.	Jun. 26
July	6.	Niagara Falls, N. Y.	Jun. 26
July	6.	Wenatchee, Wash.	Jun. 26
July	6.	Indiana	Jun. 26
July	6.	Davenport, Iowa	July 3
July	6.	Pinellas Park, Fla.	July 3
July	6.	Crystal Springs, Miss.	July 3
July	6.	California	July 3
July	6.	Upper Marlboro, Md.	July 3
July	6.	Peoria, Ill.	July 3
July	6.	Albany, N. Y.	July 3
July	6.	Franklin, Pa.	July 3
July	6.	Summitt, N. J. Adv. July 3.	July 3
July	6.	Conconully, Wash.	July 3
July	6.	Millvale, Pa.	July 3
July	6.	Ionia, Mich.	July 3
July	6.	Bayonne, N. J.	July 3
July	6.	St. Paul, Minn.	July 3
July	6.	White Sulphur Springs, Mont.	July 3
July	6.	Niagara Falls, N. Y.	July 3
July	6.	Benton, Mass.	July 3
July	7.	Albany, N. Y. Adv. Jun. 19 to July 3.	Jun. 19
July	7.	Mt. Vernon, Wash.	Jun. 26
July	7.	Cumberland, Md.	July 3
July	7.	Grand Island, Neb.	July 3
July	7.	Lorain, Ohio	July 3
July	7.	Bakersfield, Cal.	July 3
July	7.	Chicago, Ill.	July 3
July	7.	Manhattan Beach, Cal.	July 3
July	7.	Philadelphia, Pa.	July 3
July	8.	Pittsburgh, Pa.	Jun. 26
July	8.	Indiana	Jun. 26
July	8.	Clearwater, Fla.	Jun. 26
July	8.	Canton, Miss.	July 3
July	8.	Long Island City, L. I., N. Y.	July 3
July	9.	Cincinnati, O.	Jun. 19
July	9.	Chattanooga, Tenn. Adv. Jun. 26.	Jun. 26
July	9.	Meridan, Miss.	July 3
July	9.	Cincinnati, Ohio	July 3
July	9.	Corona, N. Y.	July 3
July	10.	Jackson, N. C.	July 3
July	12.	Washington	Jun. 19
July	12.	Moscow, Idaho	Jun. 26
July	12.	Seattle, Wash.	Jun. 26
July	12.	Tiffin, Ohio.	July 3
July	12.	Ravenna, Ohio	July 3
July	12.	Lakewood, Ohio	July 3
July	12.	Wauchula, Fla.	July 3
July	12.	Newark, Ohio	July 3
July	12.	Cincinnati, Ohio	July 3
July	12.	Redwood City, Cal.	July 3
July	13.	Alabama	Jun. 19
July	13.	Chestertown, Md.	Jun. 26
July	13.	Albany, N. Y. Adv. Jun. 26, July 3.	Jun. 26
July	13.	Kaufman, Tex.	July 3
July	13.	Danville, Ky.	July 3
July	13.	Virginia, Minn.	July 3
July	14.	Youngstown, O.	Jun. 26
July	14.	Long View, Tex.	July 3
July	15.	Albany, N. Y. Adv. Jun. 26, July 3.	Jun. 26
July	15.	Newark, N. J.	July 3
July	15.	Mansfield, Ohio	July 3
July	15.	Clarion, Pa. Adv. July 3.	July 3
July	15.	San Antonio, Tex. Adv. July 3.	July 3
July	15.	Williston, N. D. Adv. July 3.	July 3
July	16.	Hackensack, N. J.	July 3
July	19.	Washington	Jun. 19
July	20.	Oelwein, Ia.	Jun. 19
July	20.	Huntington, W. Va.	July 3
July	20.	Seattle, Wash.	July 3
July	22.	Booneville, N. Y. Adv. July 3.	July 3
July	24.	Spencer, Ia.	Jun. 26
July	25.	Tiffin, O.	Jun. 26
July	27.	New Orleans, La.	July 3
Aug.	2.	Fort Scott, Kan.	July 3

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS.

July	6.	Irrigation Work, Conconully, Wash.	July 3
July	6.	Canal, Elkton, Fla.	July 3
July	7.	Drainage Work, West Lake, La.	Jun. 26
July	7.	Irrigation Work, Babb, Mont.	July 3
July	8.	Riprap, Philadelphia, Pa. Adv. Jun. 19 to July 3.	Jun. 19
July	8.	Ditch, Monticello, Ind.	July 3
July	9.	Drainage Work, Selmer, Tenn.	Jun. 26
July	9.	Wall, Kenosha, Wis.	July 3
July	12.	Repairs to wharves, Portland, Ore. Adv. Jun. 19, 26.	Jun. 19
July	12.	Dredging, Philadelphia, Pa.	Jun. 19
July	12.	Irrigation Work, Grand Junction, Colo. Adv. Jun. 19.	Jun. 19
July	12.	Shed, Panama	Jun. 19
July	12.	Repair wharves, Portland, Ore. Adv. Jun. 19 to July 3.	Jun. 19
July	12.	Retaining Wall, Columbus, Ohio Adv. July 3.	July 3
July	12.	Levee, Vicksburg, Miss.	July 3
July	12.	Levee Work, East St. Louis, Ill.	July 3
July	12.	Sluice Gates for Locks, Seattle, Wash.	July 3
July	12.	Levee Work, Alton, Ill.	July 3
July	12.	Dredging, Brooklyn, N. Y.	July 3
July	13.	Steel Doors on Pier, Panama Adv. Jun. 26.	Jun. 26
July	14.	Bulkhead, Cleveland, Ohio	July 3
July	14.	Riprap, Tompkinsville, N. Y.	July 3
July	15.	Timber Wharf, Charleston, S. C.	Jun. 19
July	15.	Irrigation Work, Goshen, Utah	Jun. 19
July	15.	Dredging, New York, N. Y. Adv. Jun. 19 to July 3.	Jun. 19
July	19.	Steel Gates, Wilmington, N. C. Adv. Jun. 19 to July 3.	Jun. 19
July	20.	Irrigation Work, Washington, D. C. Adv. July 3.	July 3
July	21.	Ditch Improvement, Canton, Ohio	July 3
July	21.	Pumping Plant, Etc., Quincy, Ill. Adv. July 3.	July 3
July	30.	Irrigation Work, Great Falls, Mont.	July 3
July	30.	Dredging, Port Chester, N. Y. Adv. July 3.	July 3
July	30.	Breakwater, Conneaut, Ohio Adv. July 3.	July 3
July	31.	Dredging, Pearl Harbor, Hawaii	Jun. 19
Aug.	24.	Dredger, Adelaide, Australia	Jun. 19
July	24.	Dredging, Jacksonville, Fla. Adv. Jun. 19 to July 3.	Jun. 26
Aug.	15.	Dredge Work, Rosseau, Minn.	Jun. 26
		State Canal Work, Mechanicsville, N. Y. Adv. Jun. 19, 26.	Jun. 19

PUBLIC BUILDINGS AND SCHOOLS.

July	5.	Mountain Home, Idaho. Adv. Jun. 26, July 3.	Jun. 26
July	6.	Savannah, Ga.	Jun. 12
July	6.	Douglas, Wyo.	Jun. 19
July	6.	Cherokee, Ia.	Jun. 19
July	6.	Hamden, O.	Jun. 26
July	6.	Bloomfield, Neb.	Jun. 26
July	6.	Hardin, Mont.	Jun. 26
July	6.	Barlow, Ohio	July 3
July	6.	Bardwell, Ky.	July 3
July	6.	Grand Forks, N. D.	July 3
July	6.	Bloomfield, Neb.	July 3
July	6.	St. Paul, Minn.	July 3
July	6.	St. Marys, Ohio	July 3
July	6.	Seward, Neb.	July 3
July	7.	San Francisco, Cal.	Jun. 5
July	6.	Duncan, Ariz.	July 3
July	7.	Brandywine, Md.	Jun. 19
July	7.	Indianapolis, Ind.	Jun. 19
July	7.	Kellerton, Ia.	Jun. 19
July	7.	Chico, Cal.	Jun. 19
July	7.	Jackson, Miss.	Jun. 26
July	7.	Woodward, Ia.	Jun. 26
July	7.	Allentown, Pa.	Jun. 26
July	7.	Delhi, N. Y.	Jun. 26
July	7.	Raymond, Wash.	July 3
July	7.	Orchard Park, N. Y.	July 3
July	7.	Newark, N. J.	July 3
July	7.	Warrensburg, Mo.	July 3
July	8.	Des Moines, Ia.	Jun. 5
July	8.	Fultonham, O.	Jun. 19
July	8.	Canton, O.	Jun. 26
July	8.	Maywood, Ill.	July 3
July	8.	Detroit, Mich.	July 3
July	8.	Newport, Wash.	July 3
July	8.	Newport, R. I.	July 3
July	8.	Los Angeles, Cal.	July 3
July	9.	Cleveland, O.	Jun. 19
July	9.	Beardstown, Ill.	Jun. 5
July	9.	Torrington, Wyo.	Jun. 19
July	9.	Tompkinsville, N. Y.	Jun. 26
July	9.	Ottawa, Ont.	Jun. 26
July	9.	Buffalo, N. Y.	July 3
July	9.	Philadelphia, Pa.	July 3
July	9.	Ottawa, Ont.	July 3
July	10.	Swanton, O.	Jun. 19
July	10.	The Pas, Man.	July 3
July	10.	Columbiana, Ohio	July 3
July	12.	Wanamie, Pa.	Jun. 26
July	12.	Springfield, Mass.	July 3
July	12.	Chamberlain, S. D.	July 3
July	12.	New York, N. Y.	July 3
July	12.	Hyde Park, Cal.	July 3
July	12.	Wilmington, Del.	July 3
July	13.	Washington, D. C.	May 22
July	13.	Utica, N. Y.	July 3
July	14.	Galveston, Tex.	Jun. 19
July	14.	Fulton, Minn.	July 3
July	14.	Tavor, N. D.	July 3
July	15.	Minneapolis, Minn.	Jun. 26
July	15.	Harrisburg, Pa. Adv. July 3.	July 3
July	15.	Metz, Ind.	July 3
July	15.	Lisbon, Ohio	July 3
July	15.	Custer, S. D.	July 3
July	15.	Hamilton, Ohio	July 3
July	17.	Washington, D. C.	Jun. 26
July	17.	Freedom, Ohio	July 3
July	19.	Hilliard, Ohio	July 3
July	19.	Detroit, Minn.	July 3
July	20.	Indianapolis, Ind.	Jun. 12
July	20.	Watertown, S. D.	July 3
July	21.	New Orleans, La. Adv. Jun. 19 to July 3.	Jun. 19
July	21.	Roland, Iowa	July 3
July	21.	Salem, Ore.	July 3
July	22.	Cleveland, Ohio	July 3
July	23.	Fort Hancock, N. J.	July 3
July	24.	San Diego, Cal.	Jun. 26
July	24.	Lowell, Ohio	July 3
July	24.	Fayetteville, Ohio	July 3
July	26.	Webb City, Mo.	Jun. 19
July	27.	Weston, W. Va. Adv. July 3.	July 3
July	27.	New Bloomington, Ohio.	July 3
July	27.	Albany, N. Y. Adv. July 3.	July 3
July	28.	Jersey City, N. J.	July 3
July	29.	Quitman, Ga.	Jun. 26
July	30.	Albion, Mich.	Jun. 26
July	31.	Guantanamo, Cuba	July 3
July	31.	Muncie, Ind.	July 3
Aug.	1.	Seattle, Wash.	Jun. 5
Aug.	2.	Fort Atkinson, Wis.	July 3
Aug.	2.	Washington, D. C. Adv. July 3.	July 3
Aug.	16.	Baltimore, Md. Adv. Jun. 26 to July 3.	Jun. 26

PRIVATE BUILDINGS.

July	6.	Olneyville, R. I.	July 3
July	10.	Minot, N. D.	Jun. 19
July	12.	Emporia, Kan.	Jun. 26
July	12.	Marceline, Mo.	Jun. 26
July	12.	Superior, Wis.	July 3
July	13.	Detroit, Mich.	July 3
July	12.	Duluth, Minn.	July 3
July	14.	Dayton, Ohio	July 3
July	15.	Vancouver, B. C.	Jun. 12
July	15.	Sesser, Ill.	July 3

MISCELLANEOUS.

July	6.	Dam, Duluth, Minn.	July 3
July	7.	Laundry equipment, Sonyea, N. Y. Adv. Jun. 19, 26.	Jun. 19
July	7.	Cement, Sand Rock, Etc., New York, N. Y.	July 3
July	7.	Subway, Kansas City, Mo.	July 3
July	7.	Facing Brick and Timber, Chicago, Ill.	July 3
July	7.	Lumber, Galveston, Tex.	July 3
July	7.	Cement, Santa Ana, Cal.	July 3
July	9.	El. Rys., Brooklyn, N. Y. Adv. Jun. 26, July 3.	Jun. 26
July	9.	Lumber, Etc., Panama.	Jun. 26
July	9.	Lumber, Panama	July 3
July	10.	Sprinkling System, Boston, Mass.	Jun. 26
July	12.	Tunnel, Pittsburgh, Pa. Adv. Jun. 5 to July 3.	Jun. 5
July	12.	Dumb Waiter, Springfield, Ill.	July 3
July	12.	Piles and Lumber, New York, N. Y.	July 3
July	14.	Elevators, Baltimore, Md.	Jun. 26
July	15.	Lift, Washington, D. C.	Jun. 26
July	16.	Steel, Etc., Panama	July 3
July	16.	El. Rys. Rails, Brooklyn, N. Y.	July 3
July	17.	Tank, Key West, Fla.	July 3
July	21.	Elevator, Port Townsend, Wash.	Jun. 26
July	21.	Power Plant Machinery, Greencastle, Ind. Adv. July 3.	July 3
July	31.	Timber, Detroit, Mich. Adv. Jun. 26.	Jun. 26
Aug.	16.	Towing Locomotives, etc., Panama.	Jun. 26

New Construction Activities

The steady improvement in the steel trade during the past week has strengthened the opinion that the outlook is more encouraging. A decline in the price of the common stock of the United States Steel Corporation induced the belief that hard-pressed foreign share holders could not afford to wait to realize on the improved conditions and caused no uneasiness. The mills in the Pittsburgh district operated at 80 per cent capacity during the past month, which was marked by more rapid progress toward the restoring of normal conditions than any previous month this year. The pig iron business seems to continue to drag, but pig iron producers still maintain confidence in the outlook. The business during the past week consisted mainly of small lots of from 2,000 to 5,000 tons, though one order, at least, was for as much as 10,000 tons. Railroad earnings were more satisfactory.

Buildings

Private building work continued very slow during the past week, though 657 permits to a value of $631,045 were issued in Seattle, Wash., one for a fireproof structure to cost about $200,000, three for semi-fireproof structures aggregating $34,500 and 273 for frame structures aggregating $308,790. Plans are being prepared for a four-story reinforced concrete administration building and other buildings for the Los Angeles County Hospital at San Bernardino, Cal., to cost about $150,000. Preliminary plans have been prepared for a two-story brick and concrete school in Los Angeles to cost $100,000. A ten-story reinforced concrete and brick building also to cost $100,000 is being planned at Atlanta, Ga. A $200,000 group of buildings of granite, limestone, brick, reinforced concrete and steel are to be erected at Willoughby, Ohio. Contract for building a $100,000 church is to be let soon at Wheeling, W. Va. The lowest bid for erecting a brick school at Washington, D. C., was $261,000. The State Board of Education of Iowa expects to erect several buildings costing from $20,000 up to $175,000 as soon as possible. $178,500 was the lowest bid received for the erection of an administration building and four cottages at the State Industrial Home for Women at Muncie, Pa. Plans are about completed for a City Hall to be constructed of brick and stone at a cost of $100,000 at Little Falls, N. Y. The erection of a $200,000 court house has been authorized at Boone, Iowa, and plans are being prepared for a 4-story warehouse to cost $200,000 at Houston, Texas. The citizens of Gastonia, N. C., voted $100,000 in bonds for city schools. Three buildings are to be erected, one of which is now under construction. Plans are being prepared for a factory to cost $200,000 at San Francisco. Improvements are contemplated to a sanitarium at Dallas, Texas, to cost $400,000. It is reported that the Oregon-Washington Railway & Navigation Company, of Portland, will soon ask for bids for erecting terminal buildings at The Dalles and Private Rock junction to cost $400,000. A contract for a $111,750 high school annex has been awarded at Butte, Mont.

Bridges and Roads

The county commissioners at Dedham, Mass., are contemplating the erection of a bridge over Charles River to cost about $75,000. In general, about the same amount of bridge work is being called for as in the past few weeks, though the jobs are generally of small magnitude. No large paving jobs are in evidence in the Eastern States, but plans have been prepared in Seattle, Wash., for pavements to cost over $300,000. Bids for about 9700 square yards of bituminous concrete paving are being asked for in the Borough of the Bronx, New York City, and bids are desired for about five miles of highways in various counties of New York State. The City of Philadelphia will receive bids until July 13 for paving to the amount of several hundred thousand dollars. It is reported that bids are desired in Xenia, Ohio, for about 17,200 square yards of wood block, brick, sheet asphalt, asphaltic concrete, waterbound and tarbound macadam pavements. Contracts have been awarded in Columbus, Ohio, for paving amounting to almost $300,000. Bonds for $100,000 for highway improvements will be sold in August at Johnstown, Pa. Bids are desired until July 14 for 24,635 square yards of asphalt paving in the Borough of Brooklyn, New York City.

Waterworks and Sewers

Bids will be received until Aug. 1 by the city clerk at Ottawa, Ont., for constructing an overland pipe line system to cost about $460,000, including high lift pumps and motors, transformers, switches and equipment. The citizens of Clarksdale, Miss., voted $150,000 in bonds for water and sewer extension, school buildings and City Hall. Plans are being prepared for waterworks system at Watervliet, N. Y., to cost about $650,000. City Council at Coshocton, Ohio, passed an ordinance providing for an issue of bonds for the construction of a 3,000,000-gal. reservoir. The City Council at Cincinnati is considering bond ordinance for $210,000 to be used for erecting water tanks. Bonds will be sold by Verdun, Quebec, for $400,000 for improvements, including waterworks, paving, roads, sidewalks and public markets. Bonds were sold at Ocala, Fla., for $150,000 to be used for waterworks and sewerage improvement. Bids will be received by Langhorne, Pa., for a filter plant of about 300,000 gallons daily capacity. Bids are desired by Gallitzin, Pa., for the construction of a storage reservoir. A $500,000 trunk intersecting sewer has been authorized at Philadelphia. Construction of a storm water sewer to cost about $100,000 has been approved at Baltimore. Bids are desired for constructing sewers in various streets in the Borough of the Bronx, New York City, until July 15. Bids were opened in Indianapolis for an $80,000 sewer. Contract for a $275,000 sewer was awarded at Okalona, Miss. The Sanitary District of Chicago expects to announce sewer contracts to the amount of $3,500,000 within the next three months.

Miscellaneous

Bids are desired until July 15 by the Boroughs of the Bronx, Brooklyn and Manhattan, New York City, for the removal of snow and ice during the coming winter. The lowest bid opened for erecting reduction plant at Detroit, Mich., amounted to $181,000. The Board of Estimate, New York City, authorized an issue of about $900,000 in corporate stock for constructing a new fire alarm system in Manhattan. Bids are desired in August for pier construction at Philadelphia. The U. S. Engineer Office desires bids for constructing a breakwater at Chicago Harbor, Ill. Contract for constructing a $200,000 pier at Brooklyn, N. Y., has been awarded. The U. S. Engineer Office at Norfolk, Va., desires bids for dredging in inland waterway from Norfolk, Va., to Beaufort Inlet and in Hempstead and Huntington Harbors. Fairmont, W. Va., is considering building a 300-ft. causeway to cost $145,000. An issue of $100,000 in bonds for docks at Beaumont, Texas, has been approved. Contract for 45 miles of levee, requiring the removal of 326,000 cubic yards of earth at Port Lavaca, Texas, has been awarded. Bids are desired until July 15 by the Dock Department of New York City for the construction of a new pier in Brooklyn. Bids are desired at Poplar Bluff, Mo., for constructing nine drainage ditches about 189,967 feet long and totalling about 721,608 cubic yards of excavation, also for 28 steel bridges across such ditches. Bids are desired in Philadelphia for the construction of a section of subway.

WATERWORKS

PROPOSED WORK

Holyoke, Mass.—Engineers J. L. Tighe and Lucey have submitted to Bd. of Water Comrs. plans for construction of intake reservoir to be situated on Mahan Brook, about ⅛ mile above present Fomer intake; it will be connected by pipe line with present pipe line from Fomer and will increase supply of water at Ashley and high service reservoirs.

Lenox, Mass. — Local press reports state that Lenox Water Co. has indefinitely postponed question of constructing reservoir.

Pittsfield, Mass.—See "Sewerage and Sewage Disposal."

South Hadley Falls, Mass.—State Bd. of Health has recommended that town secure a new water supply in place of Buttery Brook and Leaping well sources now in use or filter the water from these reservoirs.

Warren, Mass.—Recent town meeting voted to install water works, to cost $100,000. Joseph S. Hastings, Chmn. Water Comrs.

Watervliet, N. Y.—John G. Clute, Pres. Water Bd., writes plans being prepared by Solomon, Norcross & Keis, Watervliet, for constructing proposed water works, will be completed about July 15; cost $625,000.

Youngsville, N. Y.—Citizens reported to have voted $28,000 bonds for construction of water works.

Pittsburgh, Pa.—Contract will soon be let by Dept. Pub. Wks. for erection and completion of 2 gate houses and appurtenances at the North Side Reservoir.

Clarksburg, W. Va.—City will within next 3 months install one 6,000,000-gal. high lift pump and one 6,000,000-gal. low lift pump; estimated cost $20,000. Scotland G. Highland, Secy. and Gen. Supt. City Water Works.

Ocala, Fla.—Bonds for $155,000 reported sold, to be used for water works and sewerage improvements, from plans of Twombly & Henney, 55 Liberty St., New York

Covington, Ky.—The Dixie Water Co. reported formed to furnish Fort Mitchell with water from the Covington mains.

Clarksdale, Miss.—Citizens June 23 voted $150,000 bonds for water and sewer extensions, school buildings and city hall. W. S. Bobo, City Engr.

Erlanger, Ky.—Erlanger Improv. Assoc. reported interested in extending water mains from Fort Mitchell to Erlanger; estimated cost $30,000.

Harlan, Ky.—D. H. Goss, City Clk., writes plans being prepared for water works (private ownership); cost $75,000.

Ashtabula, Ohio. — Ashtabula Water Supply Co. have engaged Chester & Fleming, Pittsburgh, Pa., to prepare plans and specifications for a 10-in. pipe line crossing under Ashtabula River.

Cincinnati, Ohio.—Council considering bond ordinance of $210,000 to be used for erecting water tanks in Kennedy Heights to replace present Mount Auburn tanks.

Columbus, Ohio.—Lowest bid opened June 29 by Geo. A. Borden, Dir. Pub. Service for converting septic tanks into settling tanks of Imhoff type and constructing new sludge drying beds at Sewage Treatment Wks., adjacent to Scioto River, Franklin Township, Contract 28, submitted by D. W. McGrath & Son, at $197,996.

Coshocton, Ohio.—Council has passed ordinance providing for issue of bonds for constructing 3,000,000-gal. reservoir. L. N. Staats, Mayor. Chester & Fleming, Consulting Engrs., Pittsburgh, Pa.

Youngstown, Ohio.—Bd. of Control will soon let contract for raising foundations for engines at filter plant above high water level, for steam pipe fitting for new pumping station and for the coal bins and overhead trestle from the B. & O. tracks to pumping station.

Wittenberg, Wis.—Plans being prepared by W. G. Kirchoffer, 22 N. Carroll Street, Madison, for water works; cost $12,000.

Hettinger, N. D.—Citizens voted $75,000 bonds for construction of waterworks, from plans of Engineer Green of Spokane, Wash.

Sydney, Mont.—Gerharz-Jaqueth Eng. Co., Great Falls, will have charge of sewer construction, laying water mains, constructing concrete sidewalks and curb; work to cost $60,000.

Wibaux, Mont.—Bonds for $27,000 for waterworks will be sold July 10 by J. R. Quammel, Town Clk.

Contracting News

Of Special Interest to Engineers, Contractors, Builders and Manufacturers of Engineering and Building Supplies

Benton, Ark.—J. B. McCrary, Atlanta, Ga., and Little Rock, contracted with the Comrs. of Benton Improv. Dist. to install water and sewerage systems, contract price $80,000.

Chandler, Okla.—Citizens voted $5,000 bonds June 11 for laying water mains. City will do the work. J. B. Foster, City Clk.

Jones City, Okla.—Bd. of Trus will soon vote bonds for municipal waterworks and electric light plant and have retained Benham Eng. Co., Colcord Bldg., Oklahoma City, to prepare plans, specifications and estimates.

Enumclaw, Wash.—City Council voted to take option on a spring and 20 acres of land owned by George Forler 3½ miles from Enumclaw pumping station, pipe lines and distributing system will be constructed.

Seattle, Wash.—City Council has passed ordinances calling for construction of water mains in N. Eighty-second, Bradner Place, Twenty-ninth Avenue; cost about $35,000. L. B. Young, Chmn. Bd. Pub Wks.

Coquille, Ore.—City Council will soon let contract for 3000 ft. redwood water pipe.

Eastside, Ore.—S. B. Cathcart, City Engr., estimates cost of constructing water works, including goodon or lead pipe, at $25,000, or $40,000 using c. i. pipe.

Wellston, Ore. — Benham Eng. Co., Oklahoma City, engaged to prepare plans and supervise construction of municipal water works, cost $20,000.

Phoenix, Ariz.—City Commission instructed city to investigate and make complete report on installation of pure water supply for city. J. B. Girand, City Engr.

Vernal, Utah.—Reported that city proposes extending supply line of water system 5 miles.

Verdun, Que.—Bonds for $400,000 for improvements, including water works, paving, roads, sidewalks, parks, public market, increased fire protection, will be sold July 14 by G. A. Ward, Secy.-Treas.

BIDS DESIRED.

Hilton, N. Y.—Until July 16 (extension of date from July 15) by Myron Roberts, Chmn. Village Trus., for constructing water works, advertised in Engineering Record of July 3. Engineer, H. C. Kittredge, German Insurance Bldg., Rochester.

New Brighton, S. I., N. Y.—Until July 14 by William Williams, Commissioner Water Supply, Gas and Electricity, Municipal Building, New York, for furnishing and laying water mains in Beach, Broad, John and Prince Streets, Maple, New York, Osgood, Prospect, Richmond and St. Mary's Avenues and in Bway., Borough Richmond.

Totowa, Passaic County, N. J.—Official reports state until July 19 for constructing distributing system, including 11 miles 4 to 10-in. bell and spigot mains, 75 fire hydrants, 150 gate valves and boxes, etc. Wm. Ferguson, Jr., Engr., United Bank Bldg., Paterson; L. Redman, Boro. Clk.

Altoona, Pa.—Allegheny Water Co. is taking bids on plans prepared by Chester & Fleming, Pittsburgh, Pa., for an auxiliary pumping station.

Gallitzin, Pa.—Until July 24 by Harry F. Conrad, Boro. Secy., for constructing a storage reservoir on Gum Tree Run, advertised in Engineering Record. D. W. Lockman, Engr., 47 Altoona Trust Bldg., Altoona.

Langhorne, Pa.—About July 20 by H. J. Briggs, Secy. Langhorne Spring Water Co., for filter plant of 300,000 gal. daily capacity. Engineer, William H. Boardman, 426 Walnut Street, Philadelphia.

Bedford, Ohio.—Until July 19 by H. T. Hubbell, Village Clk., for furnishing material and constructing water mains in portions of Tarbell and Ennis Avenues, Jefferson and Harriman Streets.

Shadyside, Ohio.—Later reports state bids opened until July 15 by F. McComb, Clk. Bd. Trus. Public Affairs, Shadyside Bank Bldg., for a water supply system; probable cost $45,000. A. J. Harbaugh, City Engr.

Chicago, Ill.—Until July 12 by Edward J. Glackin, Secy. Bd. Local Improv., for constructing water supply pipes in S. Francisco Avenue, Justine, S. Kolin, Mansfield and other streets and avenues; also until July 14 for rubber hydrant valves and gaskets and for iron body brass mounted gate valves.

Chicago Heights, Ill.—Reported desired until July 19 by Orb W. Ritter, City Clk., for a deep well centrifugal pump.

Kenosha, Wis.—Local press reports state bids desired state July 26 by Bd. Water Comrs. for an intake to be extended into the lake for a distance of 4700 ft. with a submerged crib in connection with it. Also a 24-in. main to be laid under the Kenosha River at foot of Main Street. Probable cost of intake is $75,000 and main about $8,000. B. C. Brennan, City Engr.

Grinnell, Iowa.—Until July 17 by City Clk. A. C. Harriman for water works extensions, requiring 3 miles 6 to 4-in. water mains. Bids desired as a whole or separately for labor and material. Charles P. Chase, Engr., Clinton.

Keota, Iowa.—Until July 20 by Town Clk for constructing water works, consisting of an 8-ft. well, 100 ft. deep, pumping station, deep well engine, 80,000 gal. steel tank and 6 miles mains. Bids desired as a whole or in sections. Charles P. Chase, Engr., Clinton.

Marshalltown, Iowa.—Until 9 a. m. July 12 by City Comrs. (J. J. Wilson, Clk.) for water pipe, hydrants, valves, etc., advertised in Engineering Record.

Riverside, Iowa.—Until July 15 by Town Clk., for constructing water works, to consist of deep well, 50,000 gal. tower and tank, pumping station and machinery and about 3 miles 4 to 8-in. mains. Bids desired as a whole or in sections. Charles P. Chase, Engr., Clinton.

Lakefield, Minn.—Until July 28 by E. C. Andersen, Village Recorder, for furnishing material, construction of additions and improvements to water works and electric light plant. Earle D. Jackson, Engr., St. Paul.

Larned, Kan.—Until July 19 by L. D. Burgess, City Clk., for improvements to water works system, including furnishing, erecting and testing motor driven pumps at well; test boilers, steam and exhaust piping, and auxiliary boiler room equipment, furnishing and erect stack, etc.

Sioux Falls, S. D.—Until July 26 by Walter C. Leyse, City Aud., for a 1,200,000 gal. reinforced concrete covered reservoir, 350,000 gal. elevated tank, and for alternative installation of pumping machinery, etc., advertised in Engineering Record. John Mundt, Comr. Water Wks. Dabney H. Maury, Consulting Engr., 1137 Monadnock Blk., Chicago, Ill.

Galveston, Tex.—Until July 15 by Bd. City Comrs. (John D. Kelley, Secy.) for furnishing f.o.b. Galveston 200 tons 6-in., 150 tons 8-in. c.-i. water pipe, Class C.

Ottawa, Ont.—Until Aug. 3 by City Clk. for constructing overland pipe line system, to cost about $460,000, to include the following: high lift pumps and motors, transformers, switches and equipment, pipe and putting of same together, trench, cartage and lay pipe, bridge construction, pump house and substation. J. B. McRea, Consulting Engr., Ottawa.

PRICES AND LETTINGS.

★Indicates award of contract.

★Schenectady, N. Y.—Press reports state that the general contractors of the proposed $222,000 Bevis Hill reservoir have decided to assign their contract to Brown & Lowe of Schenectady, providing the city will approve.

★Youngstown, Ohio.—Contract reported awarded by Bd. of Control to William Henderson for rebuilding filter beds, at $54,975. Contract for condensers at water plant awarded to Engineering Equipment Co., Pittsburgh, Pa., at $1600.

SEWERAGE AND SEWAGE DISPOSAL

PROPOSED WORK

Pittsfield, Mass.—Mayor Faulkner reported to have signed orders appropriating $6500 for water mains to Coltsville; $40,000 for additional filter beds at sewage plant; $25,000 for sewer in South Street, and $10,000 for lateral sewer extension.

Rockland, Mass. — Question of constructing sewer system, reported under consideration.

College Hill, Pa.—Borough Council reported to have decided to construct sanitary sewer system.

Lebanon, Pa.—City Council approved specifications for disposal plant submitted by City Engineer T. R. Crowell. James M. Fuertes, Consulting Engr., New York.

Philadelphia, Pa.—Council has authorized construction of Frankford Creek intercepting sewer; appropriation available $500,000.

Baltimore, Md.—Board of Awards has approved specifications for construction of storm water sewer to drain into Jenkins run, to cost about $100,000. Work to be done under direction of Sewerage Comn.

Wilmington, Del.—Edgar M. Hoopes, Jr., Ch. Engr. of Water Dept., favors construction of sewer connecting Henry Clay and Rising Sun sections with city sewer system; cost about $60,000.

Macon, Ga.—J. J. Gaillard, City Engr., reported to be preparing plans for Vineville sewer.

Ocala, Fla.—See "Water Works."

Clarksdale, Miss.—See "Water Works."

Meridian, Miss.—City Council passed ordinance providing for issue of $10,000 bonds for sanitary sewers.

Neshoba, Miss.—See "Water Works."

Harlan, Ky.—D. H. Goss, City Clk., writes plans being prepared for sewer system; cost $75,000.

Chicago, Ill.—The Sanitary Dist. will within the next 3 months let contracts to the amount of $3,500,000.

Quincy, Ill.—Bd. Local Improv. considering construction of pipe sewers in Eleventh Street, between Spring and Elm Streets; also in territory between Thirteenth and Twenty-fourth, Oak and Spruce Sts. Contract will not be let for about a month. Fred L. Hancock, City Engr.

Maysville, Wis.—Question of constructing sewer system reported under consideration.

Ottumwa, Iowa.—City to construct 4000 to 5000 ft. 8 to 15-in. pipe sewers. F. T. Lynch, City Clk.

Breckenridge, Minn. — Citizens voted $18,000 bonds for constructing sewers, from plans of Engineer Baker of Wahpeton, N. D.

St. Paul, Minn.—All bids opened June 14 by August Hohenstein, City Purchasing Agent, for constructing sewers in Glenham, Maplewood, Medford and Otto Avenue, have been rejected, being above Engineer's estimate; cost about $20,000.

Virginia, Minn.—Council reported to have decided to construct storm sewers; cost $35,000.

Salina, Kan.—About ½-mile 10 and 12-in. pipe sewers contemplated. P. G. Wakenhut, City Engr.

Benton, Ark.—See "Water Works."

Marlin, Tex.—Citizens voted $45,000 bonds for sewers.

Sydney, Mont.—See "Water Works."

Roslyn, Wash.—Council passed resolution creating Local Improvement Dist. No. 1 and L. I. D. No. 2, providing for 6, 8, 10 and 12-in. vitr. pipe sewers in Pacific and Alaska Avenues and other streets. George T. Wake, City Clk.

San Diego, Cal.—Proposed to construct a 12-in. and 16-in. sewer, to serve the northeastern portion of San Diego and the whole of East San Diego, the expense to be apportioned between the two cities.

Victoria, B. C.—City Council authorized expenditure of about $50,000 in construction of sewers, surface drains, etc.

BIDS DESIRED.

Brooklyn, N. Y.—Until July 14 by L. H. Pounds, Pres. borough of Brooklyn, for a mechanical plant in Twenty-sixth Ward Disposal Works, Hendrix Street and Vandalia Avenue.

New York, N. Y.—Until July 15 by Douglas Mathewson, Pres. borough of the Bronx, for constructing sewers in portions of various streets, including W. 175th and W. 176th Streets, Davidson and Grand Avenues. Work includes 18,450 cu. yd. earth excav., 21,500 cu. yd. rock excav. above subgrade of streets, 5425 cu. yd. rock excav in trenches, 12,800 cu. yd. filling, 31,500 sq. ft. concrete sidewalk, 5623 lin. ft. 12 to 30-in. vitr. pipe, 7 M ft. timber sheeting, etc. Security $44,000; in Randall Avenue and Bronx River Avenue, concrete sewer as follows: 514 ft. 6 ft. 9 in. x 6 ft., 557 ft. 6 ft. 6 in. x 6 ft., 312 ft. 5 ft. 9 in. x 6 ft., 312 ft. 5 ft. 6 in. x 6 ft., 1516 lin. ft. 5 ft. 3 in. x 6 ft., 448 lin. ft. 12 to 20-in. vitr. pipe sewer, 1200 cu. yd. rock excav., 60,000 lb. steel reinforcement bars, 50 M ft. timber, 5 M ft. timber sheeting, 68,000 lin. ft. piles, etc. Security $40,000; sewers in Spencer Avenue, St. Raymond Avenue, Herschell Street, about 2454 lin. ft. 12 to 24-in. vitr. pipe, 260 lin. ft. 42 in. x 56 in. and 528 lin. ft. 29 in. x 40-in. concrete sewer, etc. Security $9,500.

Until July 15 by Marcus M. Marks, Pres. Manhattan Borough, for constructing sewers in Thirty-second Street, about 759 lin. ft. 3-ft. 6-in. x 2-ft. 4-in. brick sewer, 44 M. ft. timber and planking for bracing and sheeting, etc.

Newark, N. J.—Until Aug. 31 by Passaic Valley Sewerage Comrs. (Joseph H. Quigg, Clk) for constructing superstructure and appurtenances for Newark Bay Pumping Station, Part of Sect. 5 of Passaic Valley Sewerage Wks. William M. Brown, Ch. Engr.

Philadelphia, Pa.—Until July 13 by A. M. Taylor, Dir. Dept. City Transit, for reconstruction and relocation of sewer in Buttonwood Street from Thirteenth to Broad Street, and work appurtenant thereto.

Baltimore, Md.—Until July 21 by Bd. Awards, at office of City Register, for building Sect. No. 1 of the Jenkins Run Trunk Drain Storm Water Contract No. 45. Approximate quantities: Masonry drain, 945 lin. ft. 138 in. x 99 in., 1495 lin. ft. 84 in., 635 lin. ft. 78 in., 750 lin. ft. 72 in. and 125 lin. ft. 30 in. x 36 in., 1430 lin. ft. 18 in. to 24 in. vitr. pipe drain, 600 lin. ft. 12 to 15 in. inlet connections, 24 manholes. Harry W. Rodgers, Secy. Sewerage Comn.

Ocean City, Md.—Until July 26 by Mayor and Council (J. M. Mumford, Secy.), for constructing sewage pumping station, clarification tank, intercepting and branch sewers, advertised in Engineering Record. Pugh & Hubbard, Engrs., 731 Witherspoon Bldg., Philadelphia, Pa.

Cloverdale, Ala.—Until July 27 by W. R. McDade, Town Clk., for constructing sanitary and storm sewers and concrete curb and gutters. Smith & Carter, Engrs., Montgomery.

Bedford, Ohio.—Until July 19 by H. T. Hubbell, Village Clk., for furnishing material and constructing sewers in portions of Jefferson, Leonard and Harriman Streets, Tarbell and Ennis Avenues.

Cleveland, Ohio.—Until July 7 by Commissioner Purchases and Supplies, for constructing under two contracts in tunnel, approximately 7500 lin. ft. 6-ft. circular brick sewer.

Westerville, Ohio.—Until July 16 by R. D. Bennett, Village Clk., for furnishing material and extending sanitary sewers in Glenwood Drive, State, E. Park and West Sts.

Escanaba, Mich.—Until July 15 by Bd. Pub. Wks. for constructing trunk line sewer, advertised in Engineering Record; cost $50,000.

Saginaw, Mich.—Reported desired until July 15 by Emil Roethke, Drainage Comr., for constructing 9 miles of drains.

Chicago, Ill.—Until July 12 by Edward J. Glackin, Secy. Bd. Local Improv., for constructing tile pipe sewers in various streets, including S. Fairfield Avenue, N. Kilbourne Avenue and other streets, also for drains in Rice, W. Sixty-second, W. Thirty-first Streets and other streets and avenues.

Wenona, Ill.—F. H. Ong, City Clk., writes bids will be opened first week in August for 5 miles of sewers, 8 to 24 in.; cost $23,000. Engineers, Mellinish & Broyhill, of Bloomington.

Milwaukee, Wis.—Until July 22 by Sewerage Comn. (John H. Fowles, Secy.), for constructing a plant for treating a part of sewage advertised in Engineering Rec. ord.

Tillamook, Ore.—Until July 14 by John Aschim, City Recorder, for constructing sewers, drains, etc., in a portion of Fifth Street; cost $10,000.

Bathurst, N. B.—See "Water Works."

PRICES AND LETTINGS.

★Indicates award of contract.

★Boston, Mass.—Contract awarded by Patk. O'Hearn, Acting Comr. Pub. Wks., for sewers in Temple, Hillcrest, Lorette and Elgin Streets, and outlets, West Roxbury, to Antony Cafalo, 316 Belgrade Avenue, Rosendale, Mass., at $70,526.

★Scarsdale, N. Y.—Bids were opened June 24 for sewer extensions, Divisions A, B and C, from plans of Waring, Chapman & Farquhar, 874 Bway., New York, and contracts were awarded as follows:

★Division A—Awarded to Fred. E. Gross & Son, Yonkers, at $8,426. Unit prices as follows:

10-in. Vitr. Sewer:	
100 ft. 6 to 8 ft. deep	$0.80
450 ft. 8 to 10 ft. deep	0.94
8-in. Vitr. Sewer:	
340 ft. 6 ft. deep or less	0.56
400 ft. 6 to 8 ft. deep	0.69
1,300 ft. 8 to 10 ft. deep	0.80
600 ft. 10 to 12 ft. deep	1.10
100 ft. 12 to 14 ft. deep	1.65
10 ft. 14 to 16 ft. deep	2.30
20 Ys on 10-in. sewer	0.55
90 Ys on 8-in. sewer	0.45
6 Y-extensions	1.90
5 additional 2-ft. pieces 6-in. pipe	0.28
12 ft. 10-in. iron pipe sewer	0.90
36 ft. 8-in. iron pipe sewer	0.70
1 manhole, 6 ft. deep or less	38.00
9 manholes, 6 to 8 ft. deep	45.00
22 ft. manholes, depth over 8 ft. (necks)	3.50
2 spurs in manholes, 6 in.	0.60
2 sewer drop connections, 8 in.	7.00
1 lamphole on 8-in. sewer	8.00
1 flushtank, inc. lampholes	80.00
800 yds. rock excav.	2.25

★Division B—Awarded to Fred. E. Gross & Son, Yonkers, at $6,713. Unit prices as follows:

8-in. Vitr. Sewer:	
100 ft. 6 ft. or less	$0.56
2,200 ft. 6 to 8 ft. deep	0.69
1,400 ft. 8 to 10 ft. deep	0.80
50 ft. 10 to 12 ft. deep	1.10
250 Ys on 8-in. sewer	0.45
12 ft. 8-in. iron pipe sewer	0.70
2 manholes, 6 ft. deep or less	38.00
8 manholes 6 to 8 ft. deep	45.00
6 ft. manholes, depth over 8 ft. (necks)	3.50
2 spurs in manholes, 6 in.	0.60
1 sewer drop connection, 8 in.	7.00
1 lamphole on 8-in. sewer	8.00
4 flushtanks, inc. lampholes	80.00
1,200 yd. rock excav.	2.25

★Division C—Awarded to Daly & Merritt, Port Chester, at $31,965. Unit prices as follows:

10-in. Vitr. Sewer:	
1,800 ft. 6 ft. deep or less	$0.50
1,200 ft. 6 to 8 ft. deep	0.55
560 ft. 8 to 10 ft. deep	0.60
350 ft. 10 to 12 ft. deep	1.00
300 ft. 12 to 14 ft. deep	1.10
150 ft. 14 to 16 ft. deep	1.25
200 ft. 16 to 18 ft. deep	1.50
150 ft. 18 to 20 ft. deep	1.75
250 ft. 20 to 22 ft. deep	1.90

250 ft.	22 to 24 ft. deep	2.50
100 ft.	24 to 26 ft. deep	2.75
60 ft.	26 to 28 ft. deep	3.00
10 ft.	28 to 30 ft. deep	3.50
	8-in. Vitr. Sewer:	
600 ft.	6 ft. deep or less	0.47
3,500 ft.	6 to 8 ft. deep	0.53
5,000 ft.	8 to 10 ft. deep	0.55
800 ft.	10 to 12 ft. deep	0.75
250 ft.	12 to 14 ft. deep	0.99
80 ft.	14 to 16 ft. deep	1.21
10 ft.	16 to 18 ft. deep	1.51
200 Ys	on 10-in. sewer	0.90
500 Ys	on 8-in. sewer	0.70
60	Y-extensions	1.00
90	additional 2-ft. pcs. 6-in. pipe	0.40
72 ft.	10-in. iron pipe sewer	2.00
24 ft.	8-in. iron pipe sewer	1.75
7	manholes, 6 ft. deep or less	40.00
41	manholes, 6 to 8 ft. deep	45.00
110 ft.	manholes, depth over 8 ft (necks)	5.00
24 ft.	manholes, depth below 16 ft. (13-in. walls)	7.00
10	spuds in manholes, 6 in.	1.00
3	sewer drop connections, 8 in.	25.00
1	lamphole on 8-in. sewer	50.00
8	flushtanks, inc. lampholes	100.00
5,000 yd.	rock excav.	3.00

★**Okolona, Miss.**—Contract for constructing sewer system reported awarded to Sullivan, Long & Haggerty of Bessemer, Ala., at $275,100. Work includes: 11,550 cu. yds. earth and 9592 cu. yds. rock excav., 39,200 ft. 8 to 12-in. pipe, 54 manholes, 25 flush tanks, etc. J. H. Davis, City Clk.; Frank L. Wilcox, Engr., Syndicate Trust Bldg., St. Louis, Mo.

★**Delphos, Ohio.** — Contract reported awarded to Summers & Hardin of Lima for sewage diluting plant, at $9766.

Indianapolis, Ind.—Bids were opened June 25 by Bd. Pub. Wks. for constructing sewers as follows (Chas. A. Brown, Engr. of Sewers):

★Central Avenue, to include 13,340 ft. block sewer, 6 ft. to 2 ft. 6 in., 13,180 lin. ft. vitr. pipe sewer 20 to 12 in., double strength, 25,080 lin. ft. house connections, 57 oval manholes, 20 circular manholes, 1 inlet, etc., awarded to McLaughlin Contr. Co., Pittsburgh, Pa., at $5.43 per lin. ft.; Amco segment block being selected. Other bidders on this class of block (per lin. ft.): J. H. Cahill, Louisville, Ky., $5.44; Foulkes Contr. Co., Terre Haute, $5.81; American Constr. Co., Indianapolis, $5.60; John B. McLane, Cincinnati, Ohio, $5.65.

★Thirty-eighth Street overflow, to include 4345 ft. 8 ft. 6 in. vitr. brick or concrete drain, awarded to Marion County Constr. Co., Indianapolis, at $18 per lin. ft. of monolithic concrete (price includes all items and appurtenances), average cut about 19 ft., gravel excav., some water; total cost $78,210. Other bidders (per lin. ft.)—(a) Amco block, (b) Natso block, (c) concrete: Columbia Contr. Co., (a) $18.43, (b) $18.40; J. H. Cahill, (a) $19.67, (b) $18.24; Foulkes Contr. Co., (c) $20.45; John B. McLane, (a) $19.95.

★**Council Bluffs, Iowa.**—Contract awarded by City Council to E. A. Wickham of Council Bluffs for constructing 12½ miles of sewer in Sewer Dist. No. 1, west end of city, at $62,573.

★**Toronto, Ont.**—Contract for sewer in Weston Road from St. Clair Avenue to city limits awarded to Orpen Co., Ltd., at $23,868.

BRIDGES

PROPOSED WORK

Manchester, N. H.—Construction of steel and concrete bridge at Elm Street contemplated by city.

Winnisquam, N. H.—Plans being prepared by Storrs & Storrs of Concord for a steel highway bridge over outlet of Lake Winnisquam at Winnisquam, to be about 150 ft. long, with concrete slab floor; estimated cost $40,000, to be proportioned $20,000 to State Higway Dept., $10,000 to town of Tilton and $10,000 to town of Belmont.

Dedham, Mass.—County Comrs. contemplate constructing bridge over Charles River at Spring Street; cost about $75,000.

Lowell, Mass.—Luten Engineering Co., Springfield, selected to supervise construction and prepare plans for steel work for Pawtuckettville Bridge; cost about $80,000.

Buffalo, N. Y.—All bids opened for constructing Chicago St. Viaduct rejected. According to report new bids will be received by Comr. Pub. Wks.; estimated cost $184,000.

Buffalo, N. Y.—See "Railroads."

Kingston, N. Y.—Construction of viaduct in Kingston is contemplated by city, Ontario & Western R.R., Ulster & Delaware R.R. Co. and State; estimated cost $97,489.

La Salle, N. Y.—Construction of a viaduct over railroad tracks at Hamilton Avenue is contemplated by Village Bd.; probable cost $15,000.

Sea Isle City, N. J.—Cape May County Freeholders, at Cape May C. H., contemplate constructing steel bridge over Ludlam's Thorofare at Sea Isle City.

Beaver, Pa.—The County Comrs. reported to be preparing plans for construction of two bridges of concrete girder type, one over Mellon's Run on the Meilon Farm, New Sewickley Township, the other across north branch of Big Sewickley Creek on the Nordheim Farm.

Mercer, Pa.—County Comrs. reported considering construction of steel or concrete bridge on State Street.

Washington, D. C.—National Memorial Bridge Assoc. incorporated to construct bridge between Washington and National Cemetery at Arlington. Among incorporators: Brainard H. Warner, Ellen S. Mussey and others.

Meridian, Miss.—City Council authorized issue of $15,000 bonds for concrete bridge and drainage.

Ashtabula, Ohio. — Question of constructing bridge at Prospect Street under consideration. Lewis A. Amsden, City Engr.

Lewiston, Ill.—Bernadotte bridge in Fulton County is to be replaced with a steel structure.

Sioux City, Iowa.—City Council reported to be considering construction of bridge across Floyd River at Thirty-seventh Street.

Kansas.—About $1,000,000 will be spent by Republic, Cloud, Clay, Geary, Riley, Wabaunsee, Pottawatomie, Shawnee, Jefferson, Jackson, Douglas, Leavenworth, Marshall, Washington, Mitchell and Ottawa Counties for replacing bridges recently destroyed by floods in Kaw Valley.

Topeka, Kan.—A 3-span concrete bridge is to be constructed over Shunganunga Creek, south of Twentieth Street by city and Topeka Ry. Co.; cost about $18,000.

Chickasha, Okla.—About 23 bridges have been destroyed by floods in Grady County. J. A. Robinson, County Comr.

Portland, Ore.—Geo. S. Edmonstone, City Hall, preparing plans for bridge on earth foundation over Traudale branch of O. W. R.R. & Navigation Co.; it will be of concrete, have 9 spans, and cost about $52,000. Philip H. Dater, City Engr.

Toronto, Ont.—At recent meeting of York County Council, Engr. A. E. James submitted report on proposed building of new high level bridge over little Rouge River at Locust Hill, and estimates cost of a bridge 560 ft. in length at $18,000; if concrete, cost about $20,000.

BIDS DESIRED.

Pine Brook, N. J.—Reported desired until July 13 (readvertisement) by Bd. Freeholders, Morris and Essex Counties, at Court House, Morristown, for rebuilding bridge over Passaic River at Pine Brook, between the two counties. William E. King, Engr., Morris County.

South Amboy, N. J.—Until Aug. 4 by Bd. Chosen Freeholders, Freehold (J. M. Corlies, Dir.), for constructing Strauss bascule trunnion bridge over Matawan Creek on road from South Amboy to Keyport. C. E. Close, Clk. Bd., 41 Main St., Matawan. G. D. Cooper, Co. Engr., 60 Broad St., Red Bank.

Philadelphia, Pa.—Until July 13 by Dept. Pub. Wks., Bureau of Highways, for Schedule L, repairs to bridges; cost $10,000. Wm. H. Connell, Ch. of Bureau, City Hall.

York, Pa.—Until July 19 by F. S. Bartenschlager, Co. Compt., for structural steel bridge over Red Run, Washington Township, one span 80 ft. 6 in., 14-ft. roadway; reinforced concrete arch bridge over Cabin Creek, near East Prospect, Lower Windsor Township, 40-ft. span, 14-ft. roadway.

Moundsville, W. Va.—Reported desired until July 22 by County Clerk for constructing steel or concrete bridge.

Pineville, Ky.—Until July 17 by County Comrs. for constructing bridge over Cumberland River, consisting of two 150 ft. spans and one 50 ft. span. Address Commissioner Public Roads.

Mansfield, Ohio.—Until July 28 by John A. Dalton, Co. Aud., for constructing Orange St. Bridge. Charles L. Bushey, Co. Engr.

Youngstown, Ohio.—Until July 21 by Frank H. Vogan, Co. Clk., for building bridge on road east from Greenford in Green Township.

La Harpe, Ill.—Until July 16 by William Burgner, Co. Supt. Highways, at the Town Hall, La Harpe, for constructing a reinforced concrete bridge between Durham and La Harpe Townships, known as Mealey Bridge, 50 ft. span, 16 ft. roadway; cost $2,330.

Colville, Wash.—Until July 19 by Co. Comrs. for constructing a steel truss highway bridge near Kettle Falls; cost $16,000. R. B. Thomas, Co. Engr., A. B. Sansburn, Co. Aud.

Eugene, Ore.—Reported desired until July 19 by Stacy N. Russell, Co. Clk., for constructing a 20-ft. reinforced concrete bridge, 20-ft. roadway across slough on County Road No. 200; also separate bids for piers and superstructure of a wood Howe truss bridge, three spans, across Coast Fork of Willamette River.

California.—Until July 19 by State Highway Comn., Forum Bldg., Sacramento, for following bridges:

Shasta County, across Pit River south of Baird, a reinforced concrete bridge 395 ft. long with one arch of 242 ft. clear span and 2 girder approaches of about 37 ft. clear span; across Boulder Creek and Shotgun Creek, two reinforced concrete girder spans of 35 ft. each, at Boulder Creek and two reinforced concrete girder spans of 40 ft. each at Shotgun Creek.

Siskiyou County, across Sacramento River, near Dunsmuir, reinforced concrete bridge 532 ft. long with one arch 180 ft. clear span and two arches of about 114 ft. clear span.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Grafton, W. Va.**—Contract awarded by County Court to Luten Bridge Co., Grafton, for constructing reinforced concrete arch bridge across Tygarts Valley River at St. Mary's Street, Grafton; length 560 ft., 18-ft. roadway, one 7-ft. walk.

★**Marshall, N. C.**—Contract for building bridge across French Broad River at Marshall awarded to Southern Bridge Co., Birmingham, Ala., as follows: Substructure, 353 cu. yd. concrete, $7.98; 3000 lb. steel for reinforcing, $2.05; superstructure, complete (lump sum), $13,996; total $16,875. Totals of other bids: Nashville Bridge Co., Nashville, Tenn., $17,895; Vincennes Bridge Co., Vincennes, Ind., $19,113; Virginia Bridge & Iron Co., Roanoke, Va., $20,110.

★**Bucyrus, Ohio.**—Contract for superstructure of Parcher Bridge (bids opened June 12) awarded to Elkhart Bridge & Iron Co., Elkhart, Ind., at $5,658. H. A. Biebighauser, Co. Aud.

★**Cincinnati, Ohio.**—Contract for constructing culvert in Cincinnati Ave. (bids opened June 25) awarded to Cleary White Contr. Co., care of A. J. Brehm, Cincinnati, at $5542. Next 3 lowest bidders: J. J. Foley, Cleveland, $5471; William Nickoson, Sayler Park, $6360; R. E. Baisley, Cincinnati, $6742. Albert Reinhardt, Clk. Co. Comrs.

Marion, Ohio.—Contract for constructing superstructure and fill for Parcher Bridge improvement awarded by County Comrs. to Brady O'Connell & Molloy, Marion, at $8,544.

★**Illinois.** — Following are contracts awarded by State Highway Comn. on bids opened June 30 for road and bridge work:

Cumberland County, Section A—Bridge, to Candy & McElroy, Robinson, at $2,075.

Cumberland County, Section B—Bridge, to Candy & McElroy, Robinson, at $2,240.

Du Page County, Section B—Concrete road, to Thomas H. Cutler, Gary, Ind., $4,480.

Fulton County, Section D—Bridge, to Central States Bridge Co., Indianapolis, Ind., at $2,588.

Fulton County, Section E—Bridge, to M. R. Van Houten, Canton, at $1,902.50.

Greene County, Section A—Bridge, to C. M. Hanes, Jerseyville, at $5,150.

Hamilton County, Section A—Bridge, to W. T. Bland, Cairo, at $4,005.

Hamilton County, Section B—Bridge, to W. T. Bland, Cairo, at $4,114.90.

Jackson County, Section B—Macadam shoulders, to Meyer & Thomas Constr. Co., E. St. Louis, at $1,725.

Jersey County, Section B—Bridge, to Herrick Constr. Co., Carlinville, at $984.

Jo Daviess County, Sections A and B—Concrete road, to Empire Constr. Co., Des Moines, at $9,989.

La Salle County, Section B—brick road, to F. E. Ball, Hampshire, at $8,800.

La Salle County, Section D—Brick road, to W. J. Brennan, La Salle, at $9,027.

Mercer County, Section C—Bridge, to Connelly & Dunning, Chicago, at $4,548.

Mercer County, Section D—Bridge, to Porter-McCully Constr. Co., Mackinaw, at $7,740.

Mercer County, Section E—Bridge, to Porter-McCully Constr. Co., Mackinaw, at $4,510.

Montgomery County, Section A—Bridge, to Herrick Constr. Co., Carlinville, at $4,547.

Montgomery County, Section B—Bridge, to Herrick Constr. Co., Carlinville, at $4,497.

Ogle County, Section B—Bituminous surfacing, to E. F. Davis, Oregon, at $1,500.

Perry County, Section A—Bridge, to Renkel Constr. Co., St. Louis, at $4,950.

Putnam County, Section A—Bridge, to Renkel Constr. Co., St. Louis, at $3,311.

Putnam County, Section B—Bridge, to Renkel Constr. Co., St. Louis, at $3,104.

Saline County, Section A—Bridge, to J. L. Dorris Constr. Co., Harrisburg, at $1,720.

Stark County, Section B—Bridge, to Connelly & Dunning, Chicago, at $6,280.

Stark County, Section C—Bridge, to Connelly & Dunning, Chicago, at $5,910.

Stephenson County, Section B—Bridge, to W. H. Shons, Freeport, $2,088.

Vermilion County, Section B—Earth work and culverts, to Cameron, Joyce & Co., Keokuk, Iowa, at $7,063.78.

Washington County, Section A—Bridge, to H. E. Haun, Richview, at $3,194.

Wayne County, Section A—Bridge, to Wayne Co. Concrete Constr. Co., Fairfield, at $3,657.88.

Wayne County, Section B—Bridge, to Wayne Co. Concrete Constr. Co., Fairfield, at $4,072.35.

White County, Section A—Gravel road, to Morgan, Morgan & Massberger, Carmi, at $13,600.

Woodford County, Section B—Bridge, to Davis & Widmer, Deer Park, at $1,520.

★**Wellington, Kan.**—Contract awarded to Topeka Bridge & Iron Co., Topeka, for one reinforced flat top concrete bridge 40 ft. long, 52 ft. wide, at $3,000, and one reinforced concrete arch bridge 25 ft. long, 52 ft. wide, at $2,470 (bids opened June 21). J. W. Mavity, City Engr.

★**Laredo, Tex.**—Contract for constructing 2 concrete bridges over Arroyos Chacon and Zacate awarded by Street and Bridge Com. City Council to A. G. Ramey, San Antonio, at about $12,000.

★**Portland, Tex.** — Contract reported awarded by Comrs. Co. Road Dist. to W. T. Montgomery, San Antonio, for concrete bridge and culverts from Sap depot to north line of district, at $8,761.

★**Ribera, N. M.**—Contract for constructing 14-ft. steel bridge over Pecos River at Ribera awarded by County Comrs. at Las Vegas to Missouri Valley Bridge Co., Leavenworth, Kan., at $5,500.

★**Lebanon, Ore.** — Contract for constructing 320-ft. steel bridge over South Santiam River awarded by County Court of Linn County to Pacific Iron Wks., Portland, at $13,461.

★**Burlingame, Cal.**—Contract reported awarded by City Trus. to Eaton & Smith to construct 8 bridges, at $20,072.

★**Santa Barbara, Cal.**—Contract reported awarded to Boardman Constr. Co., 1107 Story Bldg., Los Angeles, to construct reinforced concrete bridge across Mission Creek, at Haley and De la Vina Streets, at $6,760.

★**San Francisco, Cal.**—Contract awarded by Bd. Pub. Wks. (F. S. Churchill, Secy.) to construct Strauss Trunnion bascule bridge across Channel Street waterway to Thomson Bridge Co., 103 Main Street, at $84,287; it will have a span of 90 ft., 40-ft. roadway, with double street railway track in center. Next 3 lowest bids: Tibbitts-Pacific Co., $92,877; Healy-Tibbitts Contr. Co., $94,421; California Contr. Co., $102,833.

PAVING AND ROADS

PROPOSED WORK

Buffalo, N. Y.—City Council voted to pave Austin, Bridgeman and May Streets with asphalt, and Clio and Lakewood Streets and Sunnyside Place with shale brick.

Phelps, N. Y.—Citizens voted June 22 to spend balance of $55,000 Main Street paving fund for improving Church Street. P. V. Keefe, Village Clk.

Vailsburg, N. J.—Bd. Freeholders, at Newark voted to pave S. Orange Avenue, Vailsburg.

Allentown, Pa.—About $90,000 will be spent by city for street improvements.

Johnstown, Pa.—Bonds for $100,000 for highway improvements will be sold Aug. 5 by Harry W. Slick, City Treas.

Pittsburgh, Pa.—Bonds amounting to $500,000 for road improvements in Allegheny County were sold by County Comrs.

Sewickley, Pa.—The Borough Council approved plans for constructing 4-mile boulevard.

Cheraw, S. C.—Bonds for $25,000 for road improvement will be sold July 15 by Bd. Pub. Wks. (G. A. Sherrill, Chmn.)

Jefferson, S. C.—Citizens of Jefferson Township reported to have voted $25,000 to build and maintain good roads.

New Orleans, La.—City Council is considering constructing a plant to manufacture creosoted wood block pavements.

Augusta, Ky.—Later reports state citizens of Bracken County defeated proposition to issue $40,000 bonds to repair turnpikes.

Cleveland, Ohio.—Bonds for $23,582 for Chagrin Falls-Greenville Road improvement will be sold July 21 by E. G. Krause, Clk. Co. Comrs.

Steubenville, Ohio.—Bonds for $53,000 for constructing Irondale and Yellow Creek Free Turnpike road will be sold July 13 by John L. Means, Co. Aud.

Havana, Ill.—City Council contemplates paving 20 blocks.

Shawano, Wis.—D. E. Westcott, City Clk., writes all bids opened June 27 for 9233 sq. yd. macadam pavt. and 3763 lin. ft. combined curb and gutter have been rejected, and work will be done by Comr. of Streets and Sidewalks.

Iola, Kan.—F. R. Bartlett, City Engr., writes contract about to be let for paving Bway., State, Elm and Chestnut Streets, about 38,400 sq. yd., with Optional brick or National pavement, on concrete 22,000 ft. curb.

Anaconda, Mont.—City Council contemplates paving and constructing sidewalks on Jackson and Main Streets and repairing Artesenia Road.

Bozeman, Mont.—City Council adopted resolutions calling for improvement of Dickerson and E. Main Sts. by grading, paving, curbing, sidewalks, etc. Paving to be of standard bitulithic on concrete base, asphaltic concrete, asphalt macadam or light standard bitulithic pavt.; estimated cost $14,657.

Missoula, Mont.—City Council voted to pave and construct cement sidewalks in Improv. Dist. No. 35, cost $48,360.

Austin, Tex.—City Comm. contemplates paving Rio Grande, Red River, First Streets and West Avenue.

Dallas, Tex.—Bryan Parkway will be paved by city at a cost of about $10,000.

Denison, Tex.—A. B. Clenny, City Engr., will soon let contract for paving W. Sears St., 12,000 sq. yd., with concrete or asphaltic concrete.

Rockwall, Tex.—Citizens voted $25,000 bonds for constructing roads.

Olympia, Wash.—No bids received by State Highway Comm. June 28 for constructing section of Pacific Highway from La Center north in Clarke County; work will be done by day labor.

Contract about to be let by County Comrs. for constructing 3 miles road from Mason County line toward Olympia, to be gravel surfaced.

Seattle, Wash.—Bd. Pub. Wks. approved plans for paving streets as follows: E. Marginal Way, cost $300,000; Market and W. Fifty-fifth Streets, cost $25,000; Thirty-fifth Avenue S. W., cost $66,000; Meridian Avenue and Ferdinand Street, cost $6,200.

City Council voted to construct concrete walks and curbs on Lowman Drive, California Avenue, Thirty-ninth Avenue S. W., W. Holden Street, Stroud Avenue.

Contracts are about to be let by Bd. Pub. Wks. for paving Fifth Avenue N., and constructing concrete sidewalks on Franklin Avenue and Burwell Streets.

Tacoma, Wash.—County Comrs. voted to construct Pacific Highway south from Tacoma Country Club, 5 miles.

City Council contemplates constructing cement concrete sidewalks on N. Thirty-eighth, Thirty-ninth, Forty-first, Gove, Mullen, Ferdinand and Huson Streets.

Walla Walla, Wash.—City Council voted to pave First, Newell and Thorne Streets, cost about $12,000.

San Francisco, Cal.—Bd. of Wks. has adopted plans for a scenic boulevard 40 ft. wide, to be constructed around Twin Peaks, to be paved with asphalt, at a width of 25 ft.

Vacaville, Cal.—Citizens voted $12,000 bonds for paving Main Street.

Lewiston, Idaho.—About $60,000 will be spent for highway improvements in Upper Tammany Dist.

Verdun, Que.—See "Water Works."

Fort Erie, Ont.—City will at once pave 2400 yds. concrete and about 1 mile macadam; cost $10,000. Engineer, George Rass of Welland. William Simmons, City Clk.

BIDS DESIRED.

Massachusetts.—Until July 13 by State Highway Comm., Boston (F. I. Bieler, Secy.), for constructing macadam road in Amherst, about 8000 ft. in length.

Walpole, Mass.—Until 7.30 p. m. July 12 by Bd. Selectmen for grading and surfacing about 10,000 ft. streets.

Providence, R. I.—Until 2.15 July 12 by Bd. Contract and Supply, for paving with wood block Fountain and Empire Sts.

Albany, N. Y.—Until July 26 by State Comm. of Highways (Edwin Duffey, Comr.), for constructing highways in various counties, advertised in Engineering Record.

Brooklyn, N. Y.—Until July 14 by L. H. Pounds, Borough Pres., for regulating, grading and laying sidewalks on portions of Bay Nineteenth, W. Fifteenth and W. Seventy-second Streets and Seventh Avenue, asphalt pavt. on various streets, including E. Ninth, E. Nineteenth, E. Thirty-fourth and other streets, in all about 56,580 sq. ft. cement sidewalks, 24,635 sq. yd. asphalt pavt. (5-yr. guarantee, etc.).

New York, N. Y.—Until July 15 by Thomas Matsumoto, The Bronx Borough, for regulating, grading, laying sidewalks, etc., at portions of Wood, Glover Streets and Boston Avenue, about 5470 sq. ft. new bluestone flagging, 25,000 sq. ft. concrete walk (1 Yr. Maintenance), etc.; also paving with bituminous concrete on E. 174th and E. 176th Streets and Albany Crescent, about 9700 sq. yds.

Until July 15 by Marcus M. Marks, Pres. Borough of Manhattan, for repaving with asphalt pavement of W. Fourth and E. Sixty-eighth Streets, about 9860 sq. yd.; improving Market Place, under Williamsburgh Bridge, 17,216 sq. ft. concrete sidewalk, and furnishing and delivering 16,000 granite paving blocks, and 160,000 wood paving blocks.

Burlington, N. J.—Until July 26 by F. W. Parrott, Co. Aud., for grading, tiling and laying concrete pavt. on 1 mile of road, advertised in Engineering Record.

Guttenberg, N. J.—Until July 19 by Town Council for regulating and paving Bergenline Avenue with trap rock blocks. Robert Gaw, City Engr.

Hackensack, N. J.—Until July 12 by Bd. Chosen Freeholders for repair of Blue Ridge Road, Chestnut Ridge Road, Ridge Road, also repair of Passaic Avenue, asphalt pavt.

Keyport, N. J.—Borough Clerk writes bids will be received about Sept. 1 for paving Broad Street with concrete about 10,000 sq. yd.; cost $12,000. Engineer, George D. Cooper, Red Bank.

Newark, N. J.—About Aug. 5 by Bd. of Street and Water Comrs., for paving following streets: S. Munn Avenue, with asphalt; Sunset Avenue, asphalt; Chelsea Avenue, asphalt; N. Sixth Street, asphalt or brick; Eckert Avenue, asphalt; Belleville Avenue, granite; Sussex Avenue, 3-in. asphalt block; Bridge Street, granite; all to be laid on 6-in. concrete.

Until July 22 by Bd. Street & Water Comrs. (Morris Sherrerd, Ch. Engr.) for paving with bitulithic on 6-in. concrete found., Conklin and Shadwick Avenues.

S. Orange Avenue, bids for which are to be opened July 15, will require about 10,000 sq. yd. of 3-in. asphalt block pavt. on 6-in. concrete and 4700 lin. ft. 20 to 6-in. granite curb, set in concrete, etc.

Philadelphia, Pa.—Until July 13 by Dept. Public Works, Bureau Highways, for paving street improvements as follows (William H. Connell, Ch. of Bureau, City Hall):

Schedule	Character of Work	Estimated Cost
A	Grading	$56,000
B	Paving with asphalt	135,000
C	Paving with vitrified block	23,000
D	Repaving with asphalt	121,000
E	Repaving with vitrified block	50,000
F	Repaving with wood block	137,000
G	Repaving with granite block	30,000
H	Resurfacing with asphalt	21,000
I	Resurfacing with asphalt (Heater method)	5,000
J	Surfacing with waterbound macadam	36,000
K	Resurfacing with bituminous pavement	11,000

Hagerstown, Md.—Until July 13 by County Comrs., Hagerstown (Barry M. Hartle, Clk.), for constructing a section of State aid highway between Chewsville and Old Forge Road, about 1⅛ miles; also a mile of road on Old Forge Road through town of Fiddlesburg.

Dayton, Va.—Until July 15 at County Clerk's Office, Harrisonburg, for constructing 6 miles macadam road between Dayton and Ottobine.

Parkersburg, W. Va.—Until July 14 by Frank Good, City Clk., for furnishing material and paving portions of Green, 8th, 18th and Avery Sts. with vitr. brick.

Brooksville, Fla.—Until July 17 by Co. Comrs. for furnishing approximately 200 tons asphalt, 3 asphalt kettles. H. S. Jaudon Eng. Co., Engrs., Savannah, Ga.

Sarasota, Fla.—Until July 24 by City Council for approximately 14,000 sq. yd. paving on Palm and Strawberry Aves., brick, asphaltic concrete, modified asphalt and fibered asphalt will be considered. Fitch P. Wright, C. Engr., Comr. Pub. Wks.

Laurel, Miss.—Until July 20 by D. F. Gardiner, City Clk., for street improvements, including 27,753 sq. yd. asphalt, 10,073 sq. yd. wood block, 23,098 sq. yd. gravel pavt. and 35,200 sq. ft. concrete sidewalks. H. W. Bell, City Engr.

Louisville, Ky.—Reported desired until July 14 by Bd. Pub. Wks. (Roger G. McGrath, Secy.) for improving portions of Parker Avenue, Thirty-fourth, Walnut and Thirty-fifth Streets.

Cuyahoga Falls, Ohio.—Until July 28 by W. F. Williston, Village Clk., for grading, curbing and paving with brick and block stone Portage Street.

Cincinnati, Ohio.—Until July 14 by Philip Fosdick, Dir. Pub. Service, for improving Southern Avenue, including setting granite curbs, paving roadway with brick and constructing necessary drains and inlets and retaining walls.

Euclid, Ohio.—Until July 12 by H. S. Dunlop, Village Clk., 804 Marshall Bldg., Cleveland, for furnishing material and repairing Euclid and Chardon Roads. F. A. Pease, Village Engr., Marshall Bldg., Cleveland.

Jefferson, Ohio.—Until July 12 by A. V. Hillyer, Clk. Co. Comrs., for surface treatment of the New Lyme-Brownville macadam road as per Report 76.

New Philadelphia, Ohio.—Until July 19 by Edw. Stingel, Co. Engr., for 1 mile of brick road.

Oak Hill, Ohio.—Until July 17 by D. Spurge Parry, Village Clk., for grading, curbing and paving with brick a portion of W. Main Street and with macadam Water Street.

Upper Sandusky, O.—Reported desired until July 14 by George M. Fleck, Village Clk., for paving with vitr. brick or block, shale brick or block, on a concrete foundation, asphalt block on a concrete foundation, or other material, portions of Eighth and South Streets, requiring 9994 sq. yd. paving, etc. William Martin, Village Engr.

West Jefferson, Ohio.—Until July 26 for paving Main Street with asphalt macadam on concrete foundation; cost $42,000. Address, City Clerk.

Xenia, Ohio.—Reported desired until July 20 by Dir. Pub. Service for about 17,200 sq. yd. wood block, brick, sheet asphalt, asphaltic concrete, waterbound or tar bound macadam paving, etc. J. P. Shumaker, City Engr.

Brockton, Ill.—Reported desired until July 12 by Comrs. Highways, Embarrass Township, for constructing combination rock and gravel roads on 4 highways.

Chicago, Ill.—Until July 14 by Bd. Local Improv. (Edward J. Glackin, Secy.) for paving portions of Calumet Avenue, Junior Terrace, Byron, Le Moyne and a number of other streets. Bids desired on vitr. brick, asphalt, etc.

Janesville, Wis.—Until July 27 by Bd. Pub. Wks. (James A. Fathers, Chmn.) for furnishing material and paving with asphalt Wisconsin and S. Bluff Streets, in all 6444 sq. yd. paving and 195 sq. yd. resurfacing; also with brick Milton Avenue, requiring 5963 sq. yd. paving, etc.

Blue Earth, Minn.—Until July 15 by Easton Floe, City Clk., for 18,000 sq. yd. paving and 8000 ft. curbing, advertised in Engineering Record.

Brainerd, Minn.—Reported desired until July 12 by C. W. Mahlum, Co. Aud., for constructing 1 mile of state road.

Tonganoxie, Kan.—Until July 12 at office of City Clerk, for constructing about 9892 sq. yds. concrete pavement, 2748 lin. ft. combined concrete curb and gutter, etc.

Norfolk, Neb.—Reported desired until July 19 by P. F. Stafford, City Clk., for 30,000 yd. concrete paving and 16,000 ft. concrete curb. H. H. Tracy, City Engr.

Butte, Mont.—Until Aug. 4 by City Clerk for paving work, Broadway from Montana to Emmet Street, 17,000 sq. yd. with bitulithic or asphaltic concrete, curb 8100 ft., gutters 2800 ft., concrete base, fill to be loam for parking; cost $50,000. J. J. Armstrong, City Engr.

Until Aug. 7 by City Clerk for paving with bitulithic, asphaltic or wood block Main Street, Platinum to Aluminum Street, about 6000 sq. yds. on concrete foundation; cost $15,000.

Laurel, Mont.—Reported desired until July 16 by O. H. Bundy, City Clk., for laying approximately 14,500 sq. yd. bitulithic pavement, etc., in Special Improvement Dist. No. 15.

Sydney, Mont.—See "Water Works."

Kansas City, Mo.—Until July 13 by Bd. Pub. Wks. (Edward F. Webster, Acting Secy.) for improving portions of Brookside Boulevard, Indiana and Montgall Avenues, Oak and Twenty-ninth Streets. Bids desired on sheet asphalt, asphalt macadam and Portland cement concrete pavement; also repairing and maintaining macadam pavement on Oak Street and Wornall Road.

Sapulpa, Okla.—Reported desired until July 15 by R. M. Whittlsey, City Engr., for 16,000 yd. concrete pavt., 4200 yd. excav. and curbing and gutter.

Seattle, Wash.—Until July 27 by F. W. Allen, Deputy Co. Engr., for paving Duwamish River and Renton Junction Roads with crushed rock, later brick; cost $100,000. F. W. Allen, Deputy Co. Engr.

Spokane, Wash.—Reported desired until July 23 by Alfred T. Anderson, Co. Aud., for constructing 4½ miles Permanent Road No. 13-A. between Dennison and Deer Park. Bids desired on asphaltic macadam, asphaltic concrete on concrete base, asphaltic concrete on macadam base, one course concrete, two course concrete, Warrenite and Warrenite and asphaltic macadam, requiring in all 29,000 cu. yd. excav., 38,000 sq. yd. paving and 1200 ft. corrugated pipe culverts. J. W. Strack, Co. Engr.

Walla Walla, Wash.—Reported desired until July 16 by County Comrs. for constructing Permanent Highway No. 9 by hardsurfacing. Grover Cookerly, Co. Engr.

Astoria, Ore.—About July 15 for paving Twelfth, Eleventh and other streets, about 11,000 sq. yd. with asphaltic concrete and Hillside brick on 5-in. concrete foundation. G. T. McClean, City Engr.

Tillamook, Ore.—Until July 14 by John Aschin, City Recorder, for paving with concrete a portion of Fifth Street and with concrete, asphalt wearing surface Second Avenue E. and another portion of Fifth Street.

California.—Until July 19 by State Highway Comm., Forum Bldg., Sacramento, for following sections of State Highways, paved with Portland cement concrete.

Alameda County, from Livermore to Santa Rita, 5.8 miles.

Santa Clara County, from Los Gatos, to San Jose, 8.9 miles.

Los Angeles County, from Rancho Tujunga to La Canada, 4.9 miles.

San Bernardino, Cal.—Reported desired until July 13 by Bd. Superv. for paving with concrete 2.038 miles of county highway Etiwanda Avenue, Road 17, Div. A, from San Bernardino Avenue to Highland Avenue, and 1.986 miles of Magnolia Avenue, Road 34, from Colton Avenue to Perris Avenue.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Brookline, Mass.**—Contract awarded for laying wood block pavement on Washington Street to Simpson Bros. Cor., Boston, at $33,240 (bids opened June 14).

★**Massachusetts.** — Contract awarded June 29 by Massachusetts Highway Comm. (F. I. Bieler, Secy.) for 3700 ft. asphalt macadam road in Danvers to D. Linehan & Son, Beverly, at $8,976. Next 2 lowest bids: Alco Contr. Co., $9,361; Perini Constr. Co., $9,624.

★**Meriden, Conn.**—Bids were opened June 29 by Bd. Pub. Wks. for paving E. and W. Main Streets as follows—(a) E. Main Street, including 6100 sq. yd. wood block, 13,398 sq. yd. brick, 13,210 sq. yd. reinforced concrete, set curb, etc.; (b) W. Main St., including 10,820 sq. yd. wood block, 6475 sq. yd. brick, set curb, etc.: H. L. & W. Limmich, Meriden, (a) $83,503, (b) $56,371; Thos. Kearney, Meriden, (a) $79,158, (b) $53,791 (awarded contract); Leonard Suzio, Meriden, $77,656 (awarded contract), (b) $54,148. W. S. Clark, City Engr.

★**Albany, N. Y.**—Contracts for paving awarded by Bd. Contract and Supply as follows: Broadway, to Wm. F. Campion, at $142,245; Willett Street and a road in Beaver Park between Eagle Street and Park Avenue with asphalt, to Gleason & Davitt, at $38,767; Main Avenue with asphaltic concrete, to Langan Constr. Co., at $84,461.

Batavia, N. Y.—Following are lowest bids opened June 16 by Council for paving: Dellingler and Tracy Aves., with bituminous macadam, W. H. Ripton, Rochester, $7,285 and $9,014 respectively; Washington Ave., bituminous macadam, H. W. Roberts, Utica, $25,230; Swan St., with bitulithic, Warren Bros. Co., Boston, Mass. (only bidder), $14,221.

★**Geneva, N. Y.**—Contract for paving Exchange Street with asphalt and brick awarded by Bd. Pub. Wks. to Warner, Quinlan Co., Syracuse.

★**New York, N. Y.**—Following repaving contracts were let June 28 by President borough of Manhattan: Amsterdam Avenue from Sixty-third to Sixty-eighth Street, Thirty-sixth Street from Tenth to Eleventh Avenue and West End Avenue from Ninety-first to Ninety-sixth Street and from Bway. to West End Avenue, all to Asphalt Constr. Co., at 208 Bway., at $33,999, $12,017 and $17,923 respectively; Sixty-second Street from Columbus to Amsterdam Avenue and Thirty-eighth Street from Madison to Park Avenue, both to Aztec Asphalt Co., 90 West Street, $6364 and $3288 respectively.

★**Troy, N. Y.**—Contract for repaving Hoosick St. with Hassam awarded by Bd. Contract and Supply to Hassam Pavement Co., Worcester, Mass., at $51,226.

★**Belvidere, N. J.**—Contract awarded July 2 by Bd. Chosen Freeholders (J. R. Thatcher, Dir.), for surface treatment of 194,000 sq. yd. of county highways, also for repairs to the macadam road leading from Hackettstown to Allamuchy, to Salmon Bros. of Netcong.

Millburn, N. J.—Lowest bid opened June 14 by Bd. Freeholders, Newark, for paving Springfield Ave., Millburn, about 8800 sq. yds. with type known as Roman road, submitted by Franklin Contr. Co., New York, at $1.54 per sq. yd. Other bidders: Central Constr. Co., Boston, Mass., $1.58½ per sq. yd., and Allen Eng. Co., Newark, lump sum bid of $17,500. Specifications for the Roman pavt. call for 6-in. concrete, smoothed off at top with cement, over this is placed ½-in. surfacing of a patented bitumen mixture. This is applied in a semi-liquid form which hardens to about consistency of asphalt.

★Contracts for waterfound macadam with cobble gutters in Wyoming and Short Hills sections of Millburn awarded by Township Com. June 21 to John Dorer, Irvington, at about $30,000.

★**Newark, N. J.**—Contract for paving with asphalt Richard, Oraton Streets and Ferry Avenue, awarded to Continental Public Works Co., New York, at $6609, $5929 and $11,796 respectively, and for paving Ferry Street with wood block to Glenfield Constr. Co., Newark.

Trenton, N. J.—Lowest bids opened June 25 for paving with asphaltic concrete on 5-in. concrete foundation, Ardmore, S. Clinton and Whittaker Avenues, Cooper, Fulton and Lamberton Streets, 26,075 sq. yd. submitted by Newton Paving Co., Trenton, at $1.24 and $1.29 per sq. yd.; total $43,479. Abram Swan, Jr., Engr. of Streets, Municipal Bldg.)

★**Washington, D. C.**—Contract awarded for 7700 sq. yd. granite block roadway to R. J. Beall Constr. Co., Washington (bids opened by Comrs. D. C., June 22).

★**Waycross, Ga.**—Contract for paving with brick Gilmore and Tebeau Streets awarded by City Council to Georgia Engineering Co., at 98½ cents sq. yd.

★**St. Augustine, Fla.**—Contract awarded by J. Clifford R. Foster, State Arsenal, for constructing approximately 10,000 sq. yd. No. 2 vitr. brick roadway with 4-in. x 10-in. concrete curb within State Camp Grounds at Black Point, to Wilson Constr. Co., Clark Bldg., Jacksonville, at $1.17 per sq. yd.

★**Selma, Ala.**—Contracts awarded by Bd. Co. Revenue for grading and gravel-ing roads as follows (bids opened June 21): Barkersville Road, 10 miles, to Central Alabama Constr. Co., Luverne; Blacock and Uniontown Road, 3½ miles, to D. R. Cook & Co., Montgomery.

★**Columbus, Tenn.**—Contract for about 24,000 sq. yd. paving on concrete base (bids opened July 2) awarded to Southern Asphalt & Constr. Co., at 81 cts. per sq. yd.; maintenance 8 cts. Next lowest bidder: Murray Constr. Co., Knoxville, Tenn., 88 cts. per sq. yd.; maintenance, 5 cts. W. P. Erwin, City Recorder.

★**Berlin Heights, Ohio.**—Contract for paving Ceylon Rd. (bids opened June 21) awarded to Kennedy-Warner Co., Medina, at $11,900. T. M. Elson, Township Clk.

★**Columbus, Ohio.**—Contracts for paving awarded by Bd. Pub. Service June 29 as follows: To Cleveland Trinidad Paving Co., for paving Long and Main Streets with asphalt at $75,017 and $53,945 respectively, and Northwood Avenue, $8,615; to Andrews Asphalt Paving Co., for paving with asphalt W. Broad Street from Sandusky Street to Shady Lane, at $102,-047, and Souder Avenue, $5,372; to S. T. Knight for asphalt paving on Ohio Avenue, at $9,704; Gibbard Avenue, at $21,400, and Fairwood Avenue, $28,231; to W. M. Graham for asphalt on Markison Avenue, at $5,840; to George Geigle & Son, brick paving, at $48,625.

★**Findlay, Ohio.** — Contract for constructing Base Line Road awarded by County Comrs. to Col. Edington, at $12,890.

★**Medina, Ohio.**—Contract for paving Angling Road in Hartland and Clarksfield Townships awarded by County Comrs. June 25 to Modern Constr. Co., Fremont, at $38,165.

★**Middletown, Ohio.**—Contract for 66,750 sq. ft. cement sidewalks (bids opened June 22) awarded to Arpp Simpson Co., Middletown, at $14,797. Other bids: A. U. Johns, Trenton, $15,501; Alexander Paul, Middletown, $18,672; Strudtbeck Bros., Middletown, $16,267. John Kemz, Clk. City Comn.

★**Polk, Ohio.**—Contract awarded by Bd. Trus., Jackson Township (Fred Hartsel, Clk.) for improving and paving 10 miles or roadway to E. F. Downs, Toledo, at $38,968. R. T. Scantlebury, Co. Engr., Ashland.

★**Salem, Ohio.**—Contract awarded by city for repaving McKinley Avenue to Kent Constr. Co., Kent, at $1.07 per sq. yd.; total cost $22,470.

★**Struthers, Ohio.**—Contract awarded for grading and macadamizing Cemetery Hill Rd., Poland Township, to Walters & Russell, West Austintown, at $11,110 (bids opened June 22). Other bids: L. H. Young Contr. Co., West Austintown, $12,335; Campbell Bros., Youngstown, $15,000.

★**Youngstown, Ohio.**—Contract awarded by City Bd. of Control to R. C. Shook, Youngstown, for grading and improving Fredericksburg Road at Milton, at $36,-284.

Lowest bids opened by Green Township Trus. for constructing north, south, east and west roads through Greenford, 3.65 miles of macadam pavement: Smith Constr. Co., Youngstown, at $32,245, and from second section of east and west road, 1.32 miles, L. H. Young Co., Youngstown, at $10,171.

Bloomington, Ind.—Lowest bid opened by City Council for paving S. College Avenue with bituminous concrete submitted by Indiana Asphalt Co., Indianapolis, at $19,306.

★**Elgin, Ill.**—Contract awarded on bids opened June 26 by City Council for paving portion of N. State Street to Logan & Giertz Constr. Co., Elgin, as follows: 12,062 sq. yd. brick pavement (Purington block), $1.75; 3593 lin. ft. curb and gutter, 50 cts.; 2895 lin. ft. curb, 30 cts.; 298 lin. ft. concrete headers, 20 cts.; 16 crosswalk headers, $2; 16 gutter plates, $3; 9 catch basins, $30; 270 lin. ft. 8-in. sewer, 50 cts.; adjusting M. H. & C. B.; total $24,360. Other bids: Illinois Hyd. Stone & Constr. Co., Elgin, $25,310; H. G. Goelitz, Oak Park, $25,240. Engineer's estimate, $26,673. Morgan H. Brightman, City Engr.

Illinois.—See "Bridges."

★**Milwaukee, Wis.**—Contract for paving Third Street with sandstone awarded by Public Wks. Dept. to George Czerwinski, at $26,000.

Des Moines, Iowa.—Lowest bids opened by City Council for paving Court Avenue are as follows: Des Moines Asphalt Co., with asphalt, at $1.94¼ per sq. yd., and Wagner & Co., with brick, at $1.98 per sq. yd.

★**Mason City, Iowa.** — Contract for 10,600 sq. yds. concrete pavement (bids opened June 21) awarded to Shugart & Munson, Nevada, at $1.565 per sq. yd.; Moore, Seig Constr. Co., Waterloo, bid $1.62. F. P. Wilson, City Engr.

Leavenworth, Kan. — Following bids opened by City Comn. for paving with brick 2d Ave.: E. W. Geiger Constr. Co., $17,461, and D. W. Bodding Co., Kansas City, at $18,536.

★**Helena, Mont.**—Contract for filling and paving 11 blocks on Perry St. with bitulithic awarded by city to Southern Bitulithic Co., Nashville, Tenn., at $41,000.

★**Clarksville, Tex.**—Contract awarded for 13,531 sq. yds. brick, 7,230 sq. yds. asphalt macadam pavement, to McCallum & Dalton, 210 First National Bank Bldg., Fort Worth, at $52,023 (bids opened June 21).

★**Portland, Tex.** — Contract reported awarded by Comrs. Road Dist. 1 of San Patricio County, to W. T. Montgomery of San Antonio, for causeway and approach and road from Nueces Bay to the San Antonio and Aransas Pass depot at $23,853. The road is to be of mud-shell construction, trap-rock facing, and tarvia treated.

Everett, Wash.—Lowest bid opened by County Comrs. for constructing Permanent Highway No. 18 submitted by Ward & Templeton, Everett, at $13,694.

Contract for constructing Permanent Highway No. 17 awarded by County Comrs. to Ward & Templeton, Everett, at $9509.

★**Goldendale, Wash.**—Contract for constructing Permanent Highway No. 4 awarded to Transfer & Livery Co., Hood River, Ore., at $20,950.

★**Mount Vernon, Wash.**—Contract for paving Cleveland Avenue and Section Street awarded by City Council to M. E. Morris, Burlington, at $10,469.

★**Seattle, Wash.**—Contract for constructing Woodinville-Duval Road awarded by King County Comrs. to Booker, Kiel & Whippel, Central Bldg., at $45,215.

★Contract for constructing Permanent Highway No. 9 (Wight Road) awarded by County Comrs. Geo. Banderet, Renton, at $16,498.

★**Oregon.**—Contracts awarded by State Highway Comn., Salem, for furnishing 5000 bbl. cement and 10,000 cu. yd. crushed rock for constructing concrete paving on Siskiyou Mountain Div. Pacific Highway. Standard Portland Cement Cor., San Francisco, at $2.51 per bbl. for cement, and Medford Concrete Constr. Co., Medford, for crushed rock, at $1.73 to $1.85 per cu. yd.

★**Palo Alto, Cal.**—Contract awarded to Federal Constr. Co., Sharon Bldg., San Francisco, for paving as follows: 7544 yd. grading, 50 cts.; 12,354 ft. concrete curb, 30 cts.; 441,682 sq. ft. 5-in. concrete pavt., 10. 24cts. J. T. Byxbee, Jr., City Engr.

Ogden, Utah.—Lowest bid opened by City Comn. for paving Madison Street submitted by P. J. Moran, Salt Lake City, at $28,280.

★**Walkersville, Ont.**—Contract for 17,500 sq. yd. bitulithic or asphalt concrete pavement, etc., awarded to Chick Constr. Co., Windsor. (Bids opened June 24). Cecil H. Robinson, Town Clk.

STREET CLEANING AND GARBAGE DISPOSAL

PROPOSED WORK

Glen Ridge, N. J.—Town Council considering construction of garbage disposal plant. L. H. Davey is one of committee.

Newark, N. J.—Bd. of Works (Morris R. Sherrerd, Ch. Engr.) is said to favor letting contract to lowest bidder for collecting garbage for another 3 years, improvements to be made to present system.

Farrell, Pa.—Citizens reported to have voted to issue bonds for constructing incinerating plant.

BIDS DESIRED.

New York, N. Y.—Until July 16 by J. T. Fetherston, Comr. Street Cleaning, Municipal Building, for furnishing material and equipment for removal of snow and ice during winter season of 1915-1916 as follows: Borough of Manhattan, $100,-000 security; Borough Bronx, $25,000 security; Borough Brooklyn, $100,000 security; Borough of Manhattan divided into 3 snow removal districts, security $40,000 each district; Borough Brooklyn divided into 4 snow removal districts, security $25,000 each district.

Asbury Park, N. J.—Until July 13 by Bd. Comrs. for collection, removal and disposal of garbage, rubbish, ashes and dead animals; also separate bids for collection and operation of a disposal plant for collecting and transporting for garbage, rubbish, ashes and dead animals. Howard D. LeRoy, Comr. Pub. Wks.

East Chicago, Ind.—Reported desired until July 16 by City Clerk for constructing garbage disposal plant.

Rock Island, Ill.—Frank Flasch and Albert E. Kerr, representing Flasch Co. of Chicago, holders of contract for erection of 12-ton garbage incinerator to cost $16,000, are in this city and about to let sub-contracts for erection of plant.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Detroit, Mich.—Later reports state that following are totals of bids opened June 24 by Dept. Pub. Wks. (Geo. H. Fenkell, Comr.) for erecting reduction plant from plans of Smith, Hinchman & Grylls, Detroit: F. H. Goddard, Inc., Detroit, $180,-788; H. L. Van der Horst, Kalamazoo, $184,000; Geo. D. Nutt Co., $185,740; C. A. Fuller Co., $186,433; John H. Parker Co., $194,877; Corrick Bros., $201,000.

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS

PROPOSED WORK

Olean, N. Y.—E. W. Fitzgerald has been appointed by Mayor Simpson, Chmn. Flood Abatement Comn., to have charge of flood abatement work, for which $150,000 bonds were recently authorized.

Causeway—Fairmont, W. Va.—Bd. City Affairs reported considering building a 300-ft. causeway across Coal Run ravine to connect Main Street and Fairmont Avenue; cost about $135,000.

Bank Protection—Savannah, Ga.—Following are totals of bids opened June 21 by Col. W. G. Langfitt, Corps Engrs., U. S. A., for repairs to bank protection of Savannah River: Simons-Mayrant Co., Charleston, S. C., $17,275 recommended for award); A. J. Twigys & Son, Augusta, $20,325.

Drainage—Woodstock, Ill.—Hearing will he held July 12 at County Court, Woodstock, for establishment of Coon Creek Drainage Dist. of Boone and McHenry Counties. Work comprises 16 miles of tile 6 to 27-in. and 6 miles open ditch; main ditch 30 to 40-ft. bottom and over 260,000 cu. yds. excav. Arthur L. Webster, Drainage Engr. of Wheaton,

Drainage—Atlantic, Iowa.—Preliminary surveys being made by J. H. Mayne, Council Bluffs, for drainage of Indian Creek, about 100,000 cu. yd. Address County Aud.

Drainage—Logan, Iowa.—Surveys being made by Engineer Price for drainage. Address County Aud.

Wharves—Beaumont, Tex.—State Attorney General has approved issue of $100,000 bonds for wharves and docks, plans for which are being prepared by Hugh McL. Harding, 52 Vanderbilt Avenue, New York.

Levee—Fort Worth, Tex.—Mayor Tyra is said to favor construction of levee at Holly plant; cost about $16,500.

Dry Dock — Galveston, Tex. — City Comrs. granted J. P. McDonough a 50-yr. lease covering a site on Pelican Spit for a dry dock and marine ways project. Charles N. Crowell, Naval Archt., East Boston, Mass., reported to have been engaged by J. P. McDonough to prepare plans and supervise proposed marine railway, dredging and bulkheading, etc.

Power Plant—Eugene, Ore.—City reported to be considering installation of a 1250-kw. steam electric power plant as an auxiliary to existing municipal plant of two 700-kw. generators on McKenzie River.

Dredge Improvement—Portland, Ore.—Port of Portland Comn. will soon let contract for installing ladder, cutting machinery and other equipment necessary to fit out dredge the new Columbia. E. W. Wright, Port Mgr., estimates cost of equipping dredge at $22,500.

E. W. Wright, Mgr. Port of Portland Comn., reported to have recommended removal of dyke at head of Haydens Island, so that there would be a current through slough, or build dyke to such a height that freshets carrying sediment would not go over it; the latter to cost about $100,000. He also estimates cost of dredging slough as follows: For 20 x 200-ft. channel, $26,263; for 25x300-ft. channel, $107,811, and for a 30 x 300-ft. channel, $278,302.

BIDS DESIRED.

Pier—Brooklyn, N. Y.—Until July 15 by R. A. C. Smith, Comr. Docks and Ferries, Pier A, New York, for building new pier at foot of Thirty-fifth Street, borough of Brooklyn; security $136,000.

Dredging—Brooklyn, N. Y.—Until July 16 (extension of date from July 12) by R. A. C. Smith, Comr. Docks, Pier A., New York, for dredging in Mill Basin, Jamaica Bay, Boro. Brooklyn, Contract No. 1463.

Dredging—New York, N. Y.—Until Aug. 2 by U. S. Engineer's Office, Army Bldg., 39 Whitehall Street, for dredging in Hempstead and Huntington Harbors, N. Y., advertised in Engineering Record.

Dredging—Philadelphia, Pa.—Until Aug. 9 by U. S. Engineer's Office, Philadelphia, for dredging in Delaware River on Bellevue and Cherry Island Lighthouse ranges, advertised in Engineering Record.

Pier—Philadelphia, Pa.—Until Aug. 9 by John Meigs, Dir. Pub. Wharves, Docks & Ferries, 555 Bourse Bldg., for pier construction in Delaware River, between McKeon Street and Snyder Avenue, advertised in Engineering Record.

Dredging—Norfolk, Va.—Until Aug. 4 by U. S. Engineer's Office, Custom House, for dredging in Inland Waterway from Norfolk, Va., to Beaumont, N. C., advertised in Engineering Record.

Pier—Augusta, Ga.—Until July 22 by City Council for furnishing material and constructing a reinforced concrete pier and steel warehouse, as advertised in Engineering Record. Nisbet Wingfield, City Engr.

Dredging—Grand Marais, Mich.—Until July 15 by U. S. Engineer's Office, Duluth, Minn., for dredging.

Breakwater—Chicago, Ill.—Until Aug. 3 by U. S. Engineer's Office, 508 Federal Bldg., for constructing rubble mound breakwater at Chicago Harbor. Ill., advertised in Engineering Record.

Dams and Shore Protection — Rock Island, Ill.—Until July 31 by U. S. Engineer, P. O. Building, for construction and repair of dams and shore protection between Buena Vista and Spechts Ferry, Iowa; between Montpelier and Fairport, Iowa; between Quincy, Ill., and Hannibal, Mo., and between Cap au Gris, Mo., and Grafton, Ill., advertised in Engineering Record.

Drainage Ditches—Poplar Bluffs, Mo.—Until July 19 by J. P. Chambers, Clk. Co. Court, for constructing 9 drainage ditches, about 189,567 ft. long, and totaling about 1,021,608 cu. yd.; also for 28 steel bridges across said ditches. John H. Greason, Engr., Drainage Dist. N. 10.

Levee—Caldwell, Tex.—Until July 31 (readvertisement) for constructing about 360,000 cu. yds. in earthwork in levees and a small amount in drain ditches. Address R. S. Newsom, Chmn. Comrs. Burleson Co. Improv. Dist. No. 1, at office of County Clerk, Caldwell. J. C. Nagle, Improvement Engr., Austin.

Dredging — Bremerton, Wash. — Until Aug. 14 by H. R. Sanford, Ch. Bureau Yards & Docks, Navy Dept., Washington, D. C., for dredging at Navy Yard, Puget Sound, Wash., both sides of Piers 6 and 7, according to Specification No. 2177; amount available $15,000.

Piers—Pearl City, T. H.—Until Sept. 18 at Bureau Yards and Docks, Navy Dept., Washington, D. C. (H. R. Stanford, Ch.), for Spec. 2169—Reinforced concrete torpedo boat piers at Naval Station, Pearl Harbor.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Pier — Brooklyn, N. Y.** — Contract awarded by Dept. of Docks and Ferries, New York, for constructing new pier at foot of Thirtieth Street, borough of Brooklyn, known as Thirtieth Street pier (bids opened June 18), to W. P. Seaver, Inc., Grand Central Terminal, New York, at $196,263.

Dredging—New York, N. Y.—Following are the bids opened June 28 at U. S. Engineer's Office, Army Building, for dredging in Newtown Creek: (price given per cu. yd. scow meas.): P. Sanford Ross, Inc., 277 Washington Street, Jersey City, N. J., 26 1-3 cts.; Maryland Dredging & Contr. Co., Baltimore, Md., 27 cts.; John A. Seeley, 30 Church Street, New York, 27½ cts.; Coastwise Dredging Co., Norfolk, Va., 29¼ cts.; Morris & Cuming Dredging Co., 17 State Street, New York, 32 cts.; R. G. Packard Co., Bayonne, N. J., 38 cts.; amount available, $25,000.

Dredging—Trenton, N. J.—Following are bids recently opened for dredging First Section of channel connecting head of Barnegat Bay (price given per cu. yd.): Rickards Dredging Co., Philadelphia, Pa., 18 cts.; Hill Dredging Co., Atlantic City, 19 cts.; Bay Dredging Co., Brooklyn, N. Y., 22 cts.

Jetty Work—Wilmington, Del.—Following are bids opened June 28 by U. S. Engineer, Wilmington, for repairs to north jetty and placing fender piles on Christania River, Del.: Richard Parrott, Newburgh, N. Y., $8340; Jones Constr. Co., Wilmington, $9828; C. R. Simpson, New York, $8207; J. E. Brenneman, Philadelphia, Pa., $9849.

★**Drain—Salisbury, N. C.**—Contract for removing 331,591 yd. material and other work necessary to drain Withrow Creek awarded to L. O. White of Statesville, at $14,500 (bids opened June 21). G. A. Brown, Chmn. Drainage Comn., Box 564.

Levee Work—New Orleans, La.—Following are lowest bids opened June 22 for levee work: Aurora Levee, 5th Dist., right bank, H. W. Bond Bros., $38,812; new levee, Southern Pacific Railroad terminal to the U. S. Naval Station, Hampton Reynolds, 17.48 cts. per cu. yd.; Upper station river side enlargement, 5th Dist., Lower Coast Constr. Co., 13.6 cts. per cu. yd.; filling barrow pits from U. S. government depot to lower side of Audubon Park, Lower Coast Co., 14.7 cts. per cu. yd.

★**Steel Lock Gates, Etc.—Vicksburg, Miss.**—Contract awarded by U. S. Engineer, Vicksburg, Miss., for furnishing steel locks, valves, 1 orea trestle, operating machinery, etc., about 450,000 lb., to Independent Bridge Co., Vicksburg, at $17,718 (bids opened June 15).

★**Levee Enlargement—Vicksburg, Miss.**—Bids were opened June 26 at office at Third Mississippi River Dist., P. O. Box 404, for constructing about 519,000 cu. yd. levee enlargement and contract awarded to N. C. Williamson & Co., Milliken, La., at 14.4 cts., 14.9 cts., 14.87 cts. and 15.98 cts per cu yd.; total $77,175. Totals of next 4 lowest bids: W. T. & E. M. Lowrance & Co., Memphis, Tenn., $83,040; Roach, Stansell, Lowrance Bros. & Co., Memphis, Tenn., $86,964; Francis T. Constant, Alexandria, La., $85,116; R. T. Clark & Co., Natchez, $85,116.

★**Ditch—Roseau, Minn.**—Contract for constructing Ditch No. 21, about 29 miles (bids opened June 29) awarded to National Constr. Co., Alexandria, at 12.37 cts per cu yd. Other bids: Northern Drainage Co., Thief River Falls, 14.85 cts.; Constructing Co., Duluth, 12.37 cts.; S. G. Berglund Co. Aud.

★**Ditch—Port Lavaca, Tex.**—Contract for 45 miles ditches, requiring 326,000 cu. yds. earth excav. awarded to Howard Kenyon, Houston, at 12.95 cts. for (earth) dredging, fences, clearing, at cost plus 20 per cent.

★**Dredging — Los Angeles, Cal.** — Contract reported awarded to Standard American Dredging Co., 325 Central Bldg., for dredging in Los Angeles Harbor about 115,000 cu. yd., at $37,869.

★**Canal Excavation — Payson City, Utah.**—Contract awarded by U. S. Reclamation Service, Provo, for construction, involving about 25,000 cu. yd. canal excavation and about 2600 cu. yd. reinforced concrete near Payson City, to Heuser & Sim, Salt Lake City, $35,500 (bids opened June 16).

★**Transformer Station—Owen Sound, Ont.**—Contract awarded to Grier & Lethbridge by Hydroelectric Comn., for constructing hydroelectric transformer station.

ELECTRIC RAILWAYS

PROPOSED WORK

Poughkeepsie, N. Y. — Poughkeepsie City & Wappingers Falls Electric Ry. Co. plans to spend about $150,000 for improvements to tracks.

Wheeling, W. Va.—Plans being considered to construct an electric railway from Wheeling, W. Va., to Baltimore, Md., via Fairmont and Grafton. Pennsylvania Electric & Lighting Co., Valley Falls, is interested.

Rutherfordton, N. C.—Plans are being considered to build a railway from Rutherfordton to Columbus, distance 15 miles. L. D. Miller, Rutherfordton, is interested.

Florence, Ala.—Lauderdale Power Co. incorporated to construct an electric railway between Florence and Huntsville, 75 miles. Alan Jemmison, Birmingham, Pres.

Kenton, Ohio.—Plans being considered by Toledo, Bowling Green & Southern Traction Co. to extend line from Findlay to Kenton. R. N. Hamlin, Gen. Supt., Findlay.

Little Rock, Ark.—Intercity Terminal Ry. Co. incorporated to construct a railway in Little Rock and Argenta. C. C. Kavanaugh, Pres.; F. L. Schmutz, Secy.

Toronto, Ont.—Ontario Hydro Electric Power Com. has completed surveys for construction of railway from Toronto to Montreal and Ottawa. Plans have also been prepared for constructing radial railway to extend 60 miles north and west of London, Ont.

BIDS DESIRED.

Philadelphia, Pa.—Until Aug. 16 by A. M. Taylor, Director Dept. City Transit, 754 Bourse Bldg., for construction of City Hall Section of Broad Street subway under City Hall and the Market Street subway and work appurtenant thereto known as Contract No. 101. This section is 700 ft. long and will include the underpinning of the west side of City Hall and the Market Street subway. Expect to invite bids for the steel superstructure of the same stretch one month later. Appropriation for subway work is $2,800,000 and for elevated work $1,200,000. Henry H. Quimby, Ch. Engr. of City Transit.

San Francisco, Cal.—Reported Bd. Pub. Wks. will let contract about July 14 for steel rails and other material for constructing the Church Street Municipal Railway; cost for materials, $20,000.

PRICES AND LETTINGS.

★**Manchester, Ky.**—Contract for constructing 3-mile section of Cumberland & Manchester R.R., from Manchester to Barbourville, awarded to T. J. Vermillion & Son, Barbourville. M. E. S. Posey, Barbourville, Ch. Engr.

RAILROADS

PROPOSED WORK

Buffalo, N. Y.—Finance Com. of Aldermen favor bond issue of $273,010 for grade crossing work and work of terminal commission, to include Bailey Avenue viaduct over Pennsylvania, Lackawanna and Lehigh tracks, $95,000; Delavan Avenue grade crossing, $21,225; Box Avenue and French Street grade crossing improvement, $52,594; viaduct over Pennsylvania tracks at Lord and Smith Streets.

Bluefield, W. Va.—Virginia R.R. Co. reported considering construction of trunk line from point near Bluefield through coalfields of Buchanan and Dickenson Counties, Va., entering Kentucky and passing through Pike and Letcher Counties, terminating at a point on Elkhorn Creek, in Elkhorn coalfields, a distance of about 80 miles.

Summersville, W. Va.—George W. and Harry B. Curtin are reported interested in the construction of a railroad from Summersville to Charleston, a distance of 23 miles.

Hagerstown, Md.—Cumberland Valley R.R. Co. (T. B. Kennedy, Engr., Chambersburg, Pa.) proposes building large yards and a new engine house in southern section of city.

Cotton Plant, Ark.—Cotton Plant & Southwestern Ry. Co. reported formed by W. R. Satterfield, Helena; T. R. Yarbrough, Cotton Plant, and others, to construct a railroad to Gramer, 25 miles in length, to be used by the Chicago Mill & Lumber Co.

Dallas, Tex.—Missouri, Kansas & Texas Railroad Co. (L. F. Lonnbladh, Dallas, Engr. M. of W.) will spend about $200,000 on track improvement work in Texas during the next few months.

San Antonio, Tex.—Plans being prepared in City Engineer's Office, for culvert bridges required as part of franchise contract between city and San Antonio Belt & Terminal Ry. for its right-of-way up San Pedro Creek. If plans meet approval of railway engineers in Dallas, it is said that work will be started at once; cost of proposed work said to be about $1,200,000.

Portland, Ore.—Reported the Silver Falls Timber Co., Northwestern Bank Bldg., has increased capital $400,000, to be used in extending logging railroad 7 miles.

Riverside, Ore.—Reported that the Oregon-Washington Railroad & Navigation Co. (J. R. Holman, Ch. Engr., Portland) will extend the Oregon Eastern R.R. 30 miles west from Riverside to Crane Creek Gap; estimated cost $750,000.

Lewiston, Idaho.—The Camas Prairie R.R. Co. (F. N. Finch, Mgr., Lewiston) has increased capital from $50,000 to $100,000; reported extension will be made.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Ridgewood, N. J.**—Contract reported awarded for improvements around Erie station at Ridgewood as follows: For excavating, concrete work and grading to Arthur Mullen, New York, and erection of new station to Corning Building Co., Corning, N. Y. Estimated cost of abolishing the 4-track grade crossings at Godwin and Franklin Avenues, constructing subway for foot travel, making undergrade crossing for vehicular travel at East Franklin Ave. and building station, $160,000.

PUBLIC BUILDINGS AND SCHOOLS

PROPOSED WORK

Little Falls, N. Y.—W. Neil Smith, 101 Park Avenue, New York, completing plans for city hall, to be 3 stories, of stone and brick, 96 x 100 ft., and cost $100,000.

Watertown, N. Y.—Bd. of Educ. writes bids will be called for in about 2 weeks for erecting proposed Arsenal St. school, to be of brick, 146 x 73 ft.; cost, $50,000. Architect, A. F. Lansing, of Watertown.

Bayonne, N. J.—Proposed to erect 2 elementary schools and addition to high school. No appropriation yet. W. J. Tomlin, Secy. Bd. Educ.

Oil City, Pa.—School Board has approved plans for school prepared by E. E. Joralemon of Buffalo to cost $110,000. J. N. Mark, Secy. Bd. Educ.

Keyser, W. Va.—Bonds for $30,000 for school improvements will be sold July 10 by C. N. Finnell, Pres. School Bd.

Gastonia, N. C.—Citizens voted $100,000 bonds for city schools. Three buildings to be erected, one under construction.

Tallapoosa, Ga.—Citizens voted $25,000 bonds for erecting school.

Seabreeze, Fla. — Marks & Sheftall, Jacksonville, are architects for the 2-story fireproof reinforced concrete grammar and high school; cost $40,000.

Henderson, Ky.—Plans being prepared by Gilbert, Fabran & Brenato, Evansville, Ind., for erection of city hospital. A. B. Jarvis, Chmn. Bldg. Com.

Cleveland, Ohio.—Plans being prepared by William S. Lougee, Marshall Bldg., for remodeling and erecting additions to County Juvenile Detention Home on Franklin Avenue N. W.; cost, $65,000.

McArthur, Ohio.—J. A. Newson, Clk. High School Com., writes all bids opened June 26 for erecting brick high school have been rejected; new bids will be received in about 30 days. Charles F. Wright, Archt., New Natl. Bank Building, Columbus.

Albion, Mich.—Physical laboratory is to be erected at Albion College; cost, $40,000.

Marquette, Mich.—James D. Reilly, Secy. Bd. Educ., writes bids for erecting fireproof high school will not be received until about Sept. 1; cost reported to be $110,000.

Rockford, Ill.—Bd. Superv. authorized plans prepared for 4-story addition to the jail; cost $200,000.

Ames, Iowa.—Plans being prepared for a women's dormitory, cost $60,000; and hospital, cost $35,000, to be erected at Iowa State College. Address State Bd. Educ., Des Moines.

Boone, Iowa.—Bd. Superv. has been authorized to erect $200,000 court house.

Cherokee, Iowa. — William Shardlow, Secy. Bd. Directors, Independent School Dist. of New Cherokee, writes that date of opening of bids for erecting new high school has been postponed from July 6; will be readvertised later.

Iowa.—Iowa State Bd. Educ. (W. H. Gemmill, Secy., Des Moines) expects to erect as soon as possible buildings at State institutions as follows: Dental Building, at State University, Iowa City; cost $175,000. Detention Hospital, at State University, Iowa City; cost $30,000. Dormitory for Women, at Iowa State College, Ames; cost $60,000. Science Building, at Iowa State College, Ames; cost $65,000. Hospital, at Iowa State College, Ames; cost $35,000. Dairy Barn, at Iowa State College, Ames; cost $20,000.

Chatfield, Minn.—Citizens voted June 15 to issue $45,000 bonds, including erection of a school. E. J. Sutherland, Secy. Bd. Educ.

Houston, Tex.—Plans being prepared for 4-story warehouse to cost $200,000. Address Mayor.

Bellingham, Wash.—Plans being prepared by T. F. Doan, Sunset Blk., for an annex to North Side High School; cost $95,000. Address Bd. Educ.

Portland, Ore.—Plans being prepared by John V. Bennes, Archt., for a training school for teachers at State Normal School; it will be 3 stories, of mill construction, 127 x 82 ft., and cost $50,000.

Los Angeles, Cal.—Preliminary plans prepared by Morgan, Walls & Morgan, 1136 Van Nuys Bldg., for 2-story brick and concrete school on 7th St.; cost $100,000.

Plans being prepared by W. J. Bliesner, 1102 Van Nuys Bldg., for brick and concrete gymnasium to be erected at Polytechnic High School; cost $40,000.

San Bernardino, Cal.—Plans being prepared by Lyman Farwell, 617 Story Bldg., Los Angeles, for erecting buildings for county hospital including 4-story reinforced concrete administration building, with 2 wings, a tuberculosis patients' building, cottages for aged dependents, building for insane and home for children; cost $150,000.

Taft, Cal.—Plans being prepared for a $45,000 school.

Verdun, Que.—See "Water Works."

BIDS DESIRED.

Gardiner, Me.—Until Aug. 13 by James A. Wetmore, Acting Superv. Archt., Washington, D. C., for construction complete (including mechanical equipment, lighting fixtures and approaches) of 1-story and basement brick faced U. S. Post Office.

Boston, Mass.—Until July 27 by State House Bldg. Comn., Boston (John F. Kelliher, Chmn.), for erecting an addition on the westerly side of the State House.

North Attleboro, Mass.—Until Aug. 12 by James A. Wetmore, Acting Superv. Archt., Washington, D. C., for construction complete (including mechanical equipment and approaches, except lighting fixtures) of a 1-story and basement brick and stone U. S. Post Office.

New York, N. Y.—Until July 13 by Robert Adamson, Fire Comr., for repairs and alterations to quarters of various companies.

Caldwell, N. J.—Until July 16 by Bd. Educ. for furnishing material and erecting a school on Crane Street. Holmes & Winslow, Archts., 103 Park Avenue, New York City. George W. Pulis, Dist. Clk.

Harrisburg, Pa.—Until July 16 by D. D. Hammelbaugh, Secy. Bd. School Directors, 121 Chestnut Street, for erecting 12-room school at Fifth and Mahantongo Streets. C. Howard Lloyd, Archt., Telegraph Bldg.

McCutcheonville, Pa.—Reported desired until July 14 by Albert Pretzinger and Edward P. Musselman, Archts., Reibold Bldg., Dayton, for erecting 2-story school; cost $75,000.

Wellsburg, W. Va.—Until Aug. 11 by James A. Wetmore, Acting Superv. Archt., Washington, D. C., for construction complete (including mechanical equipment, lighting fixtures and approaches) of U. S. Post Office.

Augusta, Ga.—See "Hydraulic."

Cincinnati, Ohio.—Until July 13 by Philip Fosdick, Dir. Pub. Service, for excavation and grading cut stone work and tiling and mosaic work for brick and concrete bathhouse at Spring and E. 13th Streets. Lewis G. Dittoe, Archt., 617 Provident Bank Bldg.

Until July 30 by Albert Reinhardt, Clk. Co. Comrs., for alterations to north wing of the City Work House, known as "Women's Cell House," on Colerain Avenue.

Cleveland, Ohio.—Reported desired until July 20 by W. S. Lougee, Archt., Marshall Bldg., for additions and alterations to Meckes Homestead on Franklin Avenue N. W.; cost $65,000. Building is to be used as county juvenile detention home.

Vinton, Ohio.—Until July 16 (readvertisement) by Bd. Educ., care T. M. Glenn, Vinton, for erecting 2-story high school. Charles F. Wright, Archt., New First Natl. Bank Bldg., Columbus.

Coldwater, Mich.—Until July 14 by Bd. Control, Michigan State Public School (J. B. Montgomery, Supt.) for erecting a brick building for dependent crippled children, including plumbing, heating and electric wiring. Edwyn A. Bowd, Archt., Lansing.

Cicero, Ill.—Until 8:30 p.m., July 12, by Bd. Educ., School Dist. No. 99 (F. W. Zuchowski, Secy.) for furnishing material and erecting an addition to Cicero School, Forty-ninth Avenue and Twenty-third Street. Ashby, Ashby & Schulze, Archts., 178 W. Jackson Boulevard, Chicago.

Galesburg, Ill.—Until July 15 by Sixth Infantry Comn., I. N. G., at office of Jas. B. Dibelka, State Archt., 130 N. Fifth Avenue, Chicago, for erecting an armory for the Sixth Infantry, I. N. G., at Galesburg.

Springfield, Ill.—Until July 26 by State Bd. of Administration, Springfield (F. D. Whipp, Fiscal Superv.) for erecting 2 power houses, one at Chicago State Hospital, Dunning, and one at Elgin State Hospital, Elgin. James B. Dibelka, State Archt., 130 N. Fifth Avenue, Chicago.

Kenosha, Wis.—Until July 20 by Bd. Educ. for erecting Collins Street School. Howard H. Hahn, Archt., Isermann Bldg.

Stevens Point, Wis.—Until July 31 by Bd. Regents of Normal Schools (William Kittle, Secy.) at office of Van Ryn & De Gelleke, Archts., Caswell Blk., Milwaukee, for furnishing material and erecting a 3-story and basement dormitory building for State Normal School, Stevens Point.

Woodward, Ia.—Until July 14 (extension of date from July 7) by Bd. Control of State Inst., Des Moines (F. S. Treat, Secy.) for erecting at State Hospital and Colony for Epileptics at Woodward, medical group—one 2-story and 9 one-story structures, a power plant, radial brick smokestack, 175 ft. high and 7 ft. top, and 1-story laundry. H. F. Liebbe, State Archt., Des Moines. Proudfoot, Bird & Rawson, Consulting Archts., Des Moines.

Kinbrae, Minn.—Until July 21 by J. J. Fury, Clk. School Bd., for furnishing material and erecting school. H. Edw. Walker, Archt., Lumber Exchange, Minneapolis.

Lake Park, Minn.—Until July 15 by State Bd. Control, St. Paul, for erecting a tuberculosis sanatorium at Lake Park, including mechanical equipment and deep well. Sund & Dunham, Essex Bldg., Minneapolis, and A. J. Fridlund, Assoc. Archts.; Rose & Harris, Engrs., Minneapolis.

Milaca, Minn.—Until July 20 by Bd. of Educ. (H. P. Bacon, Clk.) for erecting school, from plans of Chas. F. Pillsbury of Minneapolis; cost $22,000.

Wisner, Neb.—Until Sept. 1 by R. H. Morse, School Dist. 30, for erecting 2-story brick school, 105 x 84 ft., to cost $35,000. Architect, John Latenser, Omaha.

Hayti, S. D.—Until July 28 by County Comrs. (David Sour, Cchmn.) for erecting courthouse, including heating.

Tabor, S. D.—Until July 24 by J. J. Kudrna, Clk. School Dist. No. 58, for furnishing material and erecting a 2-story brick school. Goetz Co., Archts., Yankton.

Appleton City, Mo.—Until July 14 by Bd. Educ. for erecting high school, including heating, plumbing, etc. J. H. Felt & Co., Archts., Kansas City.

Okmulgee, Okla.—Until July 12 by A. F. Boone, Clk., Bd. Educ., for erecting high school, including gymnasium and shop building, heating, plumbing, etc. Smith, Rea & Lovitt, Archts., Finance Bldg., Kansas City, Mo.

Ottawa, Ont.—Reported desired until July 15 by Duncan C. Scott, deputy Supt.-General of Indian Affairs, Dept. Indian Affairs, Ottawa, for erecting office building at File Hills Agency, Sask.

Toronto, Ont.—Until July 13 by W. C. Wilkinson, Secy.-Treas. for enlargement of McMurrich School, Ossington Avenue and St. Clair Street.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Boston, Mass.**—Contract for erecting superintendent's quarters at Boston City Hospital awarded D. R. McKillop at $22,456.

★**Fort Plain, N. Y.**—Contracts for erecting school awarded F. A. Caswell, Syracuse, at $51,986, and plumbing, Burns Bros., Syracuse, $3,467.

Newark, N. J.—See "Miscellaneous."

West New York, N. J.—Contract for erecting School No. 6 awarded Fred. Hearter, West New York, at about $110,435; plumbing, Louis Menegaux, at $6,900; Teran, Mahoney & Monroe will probably secure heating, at $16,133.

Muncy, Pa.—Following are four lowest bids opened June 30 by Dept. State Bd. Charities, Harrisburg, for erecting an administration building and 4 cottages at the State Industrial Home for Women: Metzger & Fisher, Philadelphia, $178,500; Edw. Fay & Son, Philadelphia, $183,930; Conners Bros. Co., Lowell, Mass., $194,450, and George A. Fuller Co., Philadelphia, $199,150.

★**Baltimore, Md.**—Contract for erecting School 101 and 111 awarded D. M. Andrews, Baltimore, at $87,000.

★**Washington, D. C.**—Following are four lowest bids opened June 30 by Commissioners D. C. for erecting brick school No. 174 on 1st and N. Sts.: (Bidders of Washington, D. C.) P. F. Gormley Co., $260,767, Washington (awarded contract); Wells Bros. Co., New York and Washington, $267,000; George A. Fuller Co., New York and Washington, $267,700; George E. Wyne, Washington, $274,900. Heating, Driggs, Distern & Stringer, Baltimore, Md. (lowest), $61,317; plumbing, Standard Eng. Co., Washington, $12,100 (lowest). Brick chimney and stack, Heine Chimney Co., Chicago, Ill., $1,786; electric work, Standard Eng. Co., $7,350.

★**Atlanta, Ga.**—Contract for erecting 4-story brick and concrete school on S. Pryor Street awarded to T. J. & Albert L. Day at $40,000.

★**Tampa, Fla.**—Contracts for erecting two Junior High Schools, one in Hyde Park and the other in Tampa Heights, awarded Logan Bros., of West Tampa, at $73,992.

Clarksdale, Miss.—See "Water Works."

★**Lawrenceburg, Ky.**—Contracts awarded by J. S. O'Dell, Chmn. Fiscal Court, for erecting 2-story and basement court house, from plans of Joseph & Joseph, Louisville. General construction, A. J. Starr, Knoxville, Tenn., $34,722; heating, A. J. Anderson Co., Louisville, $2175.

★**Cincinnati, Ohio.**—Contract for mill work in women's dormitory awarded by Trus. Univ. Cincinnati, to Cullen & Vaughn Co., Hamilton.

Mt. Vernon, Ohio.—Following are four lowest bids opened June 24 by Supervising Architect, Washington, D. C., for erecting U. S. Post Office; (a) limestone, (b) sandstone: J. S. Rogers Co., Moorestown, N. Y. (b), $102,700; Westchester Eng. & Constr. Co., White Plains (a), $96,500; George T. Kelly, Yonkers (a), $96,588; William J. Morgan, Mt. Vernon (b), $99,000; Jos. di Benedetto, New York (a), $87,737; (b), $95,737; John T. Brady & Co., New York (a), $94,510; (b) $97,510.

★**Lafayette, Ind.**—Contract awarded to W. P. Jungclaws Co., Indianapolis, for general construction of 3-story brick and stone veterinary science building at Purdue University, at $40,000. Architects, R. P. Daggett & Co., Indianapolis.

★**Grand Rapids, Mich.**—Contracts for erecting Sheldon School awarded as follows: General contract to A. W. Morgan, $51,979; plumbing, Muir Plumb. Co., 142 Fulton Street, E., $6,170; steam heating Knee Heating Co., $6,034. (Contractors all of Grand Rapids.)

★**Hastings, Mich.**—Contract for erecting high school awarded Thomas Crocker of Allegan, at $67,334.

★**Sandusky, Mich.**—Contract to erect court house from plans of Joseph E. Mills & Son, 1305 Kresge Bldg., Detroit, awarded to Covell Constr. Co., Ionia, at $74,528.

★**Herrin, Ill.**—Contract awarded by Bd. Educ. (W. L. Smith, Secy.) to furnish material and erect school (bids opened June 21) to Herrin Constr. Co. N. S. Spencer & Son, Archts., Champaign.

★**Crookston, Minn.**—State Bd. Control, St. Paul, awarded contract at $28,284, to James Peterson, Minneapolis, for erecting tuberculosis sanitarium for Polk and Norman Counties at Crookston.

★**Butte, Mont.**—Contract awarded by School Bd. for erecting high school annex to Montana Constr. Co., Missoula, at $111,750 (bids opened June 27). Wilson & Cutting, Archts., Butte.

Cuero, Tex.—Following are four lowest bids opened June 21 by Superv. Archt., Washington, D. C., for erecting U. S. Post Office—(a) limestone, (b) sandstone: Texas Constr. Co., San Antonio, (a) $52,500, (b) $55,300; Richardson Eng. & Constr. Co., Bainbridge, Ga., (a) $53,470, (b) $54,470; George A. Shaul, Seneca, Kan., (a) $53,510; R. P. Farnsworth & Co., Fayetteville, Tenn., (a) $56,470, (b) $59,000; Potters Lumber Co., East Liverpool, Ohio, (b) $60,800.

★**Long View, Tex.**—Contract for erecting U. S. Post Office awarded V. E. Taylor, Ennis, at $36,250.

★**Los Angeles, Cal.**—General contract for erecting 2-story and basement brick and concrete school at 2147 Clifford Street, Edendale, awarded Somers-Lund Co., 1415 Baker-Detwiler Bldg., at $37,868. Lowest bid opened recently for erecting South Park School, 2 stories, brick and concrete, was submitted by Cresmer Mfg. Co., Riverside Street, at $45,000.

★Contract for erecting 2-story brick and concrete schools awarded as follows: Forty-second Street School, to Merchants' Realty & Investment Co., Van Nuys Bldg., at $22,855; Twentieth Street School, M. N. Yesberg, 1650 Morton Avenue, $41,860; Macy Street School, Alta Planing Mill Co., 1812 Industrial Street, $134,616; Rowan Avenue School, Huntsberger-Reed Co., Van Nuys Bldg., $42,496; 2-story brick addition to Western Avenue School, Alex. G. Grant, Builders' Exchange, $31,275.

PRIVATE BUILDINGS

PROPOSED WORK

Boston, Mass.—Plans being prepared by H. S. Demoorjian, State Mutual Bldg., Worcester, for brick office building which Y. Kayajian, Jamaica Plains, Mass., will erect; cost $50,000.

Plans about completed by Clarence H. Blackall, Archt., 20 Beacon Street, for 12-story steel and stone building for Pelham Trust Co., to be erected on Tremont and Boylston Streets.

Brooklyn, N. Y.—Plans being prepared by Charles L. Seifert, 110 W. Fortieth Street, New York City, for 6-story apartment house to be erected on north side of Eastern Parkway opposite Brooklyn Institute of Arts and Sciences. Taggart Bldg. Co., 1405 Carroll Street, Owners.

Plans filed for 6-story brick store and tenement to be erected at Bedford Avenue and Tenth Street for Ross Land Co., cost $65,000, Shampan & Shampan, Archts., 772 Broadway, Brooklyn, and for 1-story brick theater to be erected at Flatbush and Canarsie Avenues for Hertz Constr. Co., cost $50,000, R. T. Short, Archt., 370 Macon Street.

New York, N. Y.—Plans filed for following buildings: Brick tenement at 207th Street and Broadway for Seeman Constr. Co., 612 W. 207th Street, cost $55,000, Moore & Landsiedel, Archts., 148th Street and Third Avenue; 12-story brick tenement at West End Avenue and Seventy-fifth Street for Charmion Constr. Co., cost $600,000, Neville & Bagge, Archts., 105 W. Fortieth Street; 6-story brick tenement at 264 W. Nineteenth Street for Rekcansie Realty Co., cost $55,000, Sam K. Hasbrouck, Archt., 245 W. Eighteenth Street; 5-story brick tenement at Edgecombe Avenue and 138th Street for 114th St. and 7th Ave. Constr. Co., cost $65,000, Gronenberg & Leuchtag, Archts., 303 Fifth Avenue; two 5-story brick tenements at Clinton Avenue and 180th Street for Advance Constr. Co., cost $135,000 all, Charles B. Meyers, Archt., 1 Union Square; two 5-story brick tenements at Woodycrest Avenue and 165th Street for Woodycrest Bldg. Corp., cost $80,000, Thomas F. Dunn, Archt., 953 Woodycrest Avenue; 5-story brick tenement at 184th Street and Valentine Avenue for Nista Constr. Co., cost $75,000, M. W. Del Gaudio, Archt., 401 Tremont Avenue; 5-story brick tenement at Hull Avenue and 205th Street for W. A. J. Bldg. Corp., cost $45,000, John P. Boyland, Archt., 2526 Webster Avenue.

Plans being prepared by Schwartz, Gross & Marcus, 347 Fifth Avenue, for 12-story fireproof apartment house to be erected by Schuyler Square Realty Co. at West End Avenue and 106th Street.

★**Rochester, N. Y.**—Plans being prepared by Eldridge Comes & Kauzor, 316 Cutter Bldg., for church and parish house to be erected at Lexington Avenue and Finch Street for Holy Rosary R. C. Church; cost $60,000. Rev. Arthur H. Hughes, Pastor.

Brookville, Pa.—Plans being prepared by H. E. Kennedy Co., Home Trust Bldg., for brick, cement and plaster auditorium to be erected for Brookville Park Assoc. Dome to be of concrete 80 ft. in diam.

Wheeling, W. Va.—Bd. Trus. Scottish Rite Cathedral, will soon let contract for erecting fireproof building to replace temple destroyed by fire; cost $100,000. Fred. F. Faris, Archt., Schmelbach Bldg.

Atlanta, Ga.—Tentative plans being prepared by W. T. Downing, Grant Bldg., for a 10-story reinforced concrete and brick building which Frank Hawkins will erect on Walton and Fairlie Streets; cost $100,000.

Birmingham, Ala.—Plans being prepared by Miller & Martin, Title Guarantee Bldg., for a 2-story terra cotta mercantile building on Twentieth Street by Jamison Real Estate Co.

Alexandria, La.—Plans completed by W. S. Stevens, New Orleans, for picture theater to be erected by Sawnger Amusement Co.; cost, $75,000.

Chattanooga, Tenn.—Plans prepared by W. M. DeKalb, Chattanooga, have been accepted for the Shinn Memorial Church, brick, terra cotta and marble, which Universalists will erect on Main and Hickory Streets.

Louisville, Ky.—A brick and stone building is to be erected at Fourth and Market Streets for Western Union Telegraph Co.; cost, $45,000.

Burkettsville, Ohio—Plans being prepared for 1½-story brick and stone fireproof church for St. Bernard Congregation; cost, $65,000.

Cleveland, Ohio.—Plans being prepared by Izant & Frink, Illuminating Bldg., for dancing academy to be erected on Euclid Avenue for H. O. Oster; cost, $50,000.

Plans about completed by E. J. Schneider, Cuyahoga Bldg., for 3-story brick, reinforced concrete and sandstone auditorium, school and social building to be erected by St. Stephen's German Catholic Church at a cost of $90,000. Rev. Casimir Reichlin, Pastor.

Contract soon to be let by B. B. Given, Syracuse, N. Y., for erecting 2-story brick and terra cotta building in the East End, according to plans by S. H. Weis, Scofield Bldg., Cleveland.

Willoughby, Ohio.—Andrews Inst. for Girls (A. H. Van Gorder, Pres.) will erect a group of buildings; cost $200,000; granite, limestone, brick, reinforced concrete and steel will be used in construction.

Detroit, Mich.—R. E. Rasman, Penobscot Bldg., is architect for 4-story fireproof glazed terra cotta building to be erected at Woodward Ave. and John R. St. for Schloss Bros., 48 Bates St.

Dallas, Tex.—The Baptists propose making improvements to Baptist Memorial Sanitarium and Baylor Medical School, both in Dallas; cost $400,000.

Aberdeen, Wash.—Ralph L. Philbrick reported interested in business building to be erected on Eighth and J Streets; cost $150,000.

Seattle, Wash.—Plans being prepared by J. F. Everett, Boston Blk., for a 4-story reinforced concrete, steel and terra cotta hotel; also a 3-story fireproof apartment house; both buildings to be erected at Fourth Avenue and Marion Street; cost $125,000 and $100,000 respectively. West & Wheeler, Colman Bldg., agents for both buildings.

The Dalles, Ore.—Reported Oregon-Washington R.R. & Navigation Co. of Portland (T. W. Saul, Div. Engr., Portland) will soon ask bids for erecting terminal buildings at The Dalles and Pilot Rock Junction; cost $400,000.

Tillamook, Ore.—City Recorder writes plans being prepared by Chas. H. Burgraff, of Albany, for 2-story brick city hall, 52½ x 105 ft.; cost $20,000, and $18,500 for equipment, to include steam heating plant, etc.

Vancouver, B. C.—Canadian Northern R.R. (R. W. Graham, Supt. Bldgs., Vancouver), it is reported, will erect a 5-stall roundhouse at Boston Bar and a 10-stall roundhouse at Kamloops; also erecting new stations at Langley, Matsqui, Rosedale and Lytton.

BIDS DESIRED.

Lewistown, Pa.—Until July 15 by Bldg. Com., Fraternal Order of Eagles (W. M. Baker, Chmn.), for erecting a 3-story brick business building.

Harrodsburg, Ky.—Reported desired until July 15 by Bldgs. Com., United Presbyterian Church (N. L. Curry, Chmn.), for erecting an addition and remodeling edifice; probable cost $30,000. Samuel Hannaford & Sons, Archts., Hulbert Bldg., Cincinnati, Ohio.

Devils Lake, N. D.—Until July 15 by A. V. Haig for erecting a Masonic temple. J. A. Shannon, Archt., Devils Lake.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Springfield, Mass.**—Contract awarded to Fred T. Ley & Co., Inc., 307 Main St., for erecting 2-story brick and stone building for Springfield Daily News. H. L. Sprague, Archt., 310 Main St.

★**Meriden, Conn.**—Contract for erecting addition to the Elks Lodge building awarded H. Wales Lines Co., Meriden; cost $30,000.

★**Brooklyn, N. Y.**—Contract awarded Turner Constr. Co., 11 Bway., New York, for erecting 3-story reinforced concrete warehouse at E. Eighty-fourth Street and Ditmars Avenue for W. Beckers Aniline & Chemical Wks., Inc. Benj. Driesler, 153 Remsen Street, Archt.

★**Canajoharie, N. Y.**—Contract for erecting Methodist Church awarded Hallinan & Snyder, Little Falls, at $24,460.

★**New Brighton, S. I., N. Y.**—Contract for erecting 4-story brick school at Richmond Terrace and Church Street awarded John Fallon, 225 Fifth Avenue, New York; cost $100,000. Walter Schumm, Archt., 225 Fifth Avenue, New York.

★**New York, N. Y.**—Contract awarded to Whitney Co., 1 Liberty Street, for erecting the Central Club for Nurses, at 132 E. Forty-fifth Street, for Y. W. C. A.; cost $400,000; Parish & Shroeder, Archts., 12 W. Thirty-first Street; also contract for central Y. W. C. A. building at Lexington Avenue and Fifty-third Street, to be 10 stories and cost $350,000; Donn Barber, Archt., 101 Park Avenue.

★**Fairchance, Pa.**—Contract awarded by School Bd. (Owen R. Brownfield, Secy.) to erect 2-story brick high school to John L. Darby, of Fairchance. John H. Harman, Archt., 632 First Natl. Bank Bldg., Uniontown.

★**Johnstown, Pa.**—Contract for Simplex concrete piling for Pennsylvania R.R. passenger station awarded Cranford Constr. Co., 609 Gerke Bldg., Cincinnati, Ohio, and also for Simplex concrete piling for bridge foundations at Delaware Avenue for Pennsylvania R.R.

★**Pittsburgh, Pa.**—Contract for erecting brick and stone residence, also a garage on Woodland Road for Edw. Pitcairn, awarded Patterson & Shaw, 30 E. Robinson St.; cost $50,000. Janssen & Abbott, Archts., 9th and Liberty Ave.

★**Washington, D. C.**—Contract for erecting brick and terra cotta and concrete edifice for St. Andrews Episcopal Church awarded to W. E. Mooney, Evans Bldg., Washington. Architects, Chas. Bolton & Sons, Witherspoon Bldg., Philadelphia, Pa.

★**Springfield, Ohio.**—Contract for power and heating plant at Ohio Masonic Home awarded Cullen & Vaughn Co., Hamilton.

★**Hastings, Neb.**—Contract for erecting Methodist Church at Seventh Street and Hastings Avenue awarded C. D. Richey, at $48,380.

★**Monticello, Ark.**—Contract for erecting brick Citizens Bank building awarded F. W. Johnson, Monticello; cost, $25,000.

★**Albuquerque, N. M.**—Contract for erecting Y. M. C. A. Building awarded John W. McQuade, of Albuquerque, at $57,000.

★**Seattle, Wash.**—Contract for erecting 3-story brick veneered apartment house at Summit Ave. and Marion St., reported awarded Johnson & Odin, Mutual Life Bldg.; cost $65,000. J. A. Creutzer, Archt., N. Y. Blk.

★**Portland, Ore.**—Contract awarded to Thomas Muir, Abington Bldg., for erecting 3-story addition to 4-story warehouse at Fifteenth and Kearney Streets; cost, $50,000. McNaughton & Raymond, Archts., Title & Trust Bldg.

★**Los Angeles, Cal.**—Contract awarded Alta Planing Mill Co., 830 McGarry St., at $53,000, for erecting 3-story brick warehouse at Palmetto and Alameda Sts. for Rudger Merle Co.

★**Vancouver, B. C.**—Contract awarded to Purdy & Henderson, Henry Bldg., Seattle, Wash., for erecting 3-story reinforced concrete and steel bank building for Merchants Bank of Canada, at Pender and Granville Sts; cost $150,000. Somervell & Putnam, Archts., White Bldg., Seattle, Wash.

NEW INDUSTRIAL PLANTS

PROPOSED WORK

Athens, Ga.—Southern Cotton Oil Co. intends erecting steel and brick factory to replace building recently destroyed by fire; cost $50,000.

Birmingham, Ala.—Birmingham Stove & Range Co. (Sam. Jones, Pres., Atlanta, Ga.), it is reported, will erect a plant in North Birmingham; cost $100,000.

Texarkana, Ark.—M. Reinboldt, Fort Smith, reported interested in erection of factory for manufacture of store fixtures and refrigerators.

Tacoma, Wash. — Reported Tacoma Smelting & Refining Co. (W. R. Rust, Pres.) will erect a power house, an additional fine copper furnace and install new machinery in the smelting plant.

San Francisco, Cal.—Plans being prepared for factory to be erected by Wallace Egg Carrier Corporation, 507 Mission Street; cost $200,000.

BIDS DESIRED.

Cleveland, Minn.—Until July 13 by Farmers' Elevator Co., for erecting a grain elevator.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Watervliet, N. Y.**—Contract for erecting 3-story factory here for J. B. Carr Chain Co. of Troy awarded C. B. Boland Co., Troy; cost $40,000.

★**Toledo, Ohio.**—Contract for enlarging factory of Toledo Cement Co. awarded Stellinger Bros., 216 City Park Avenue. Metz, Reeves Bellman & Nordhoff, Archts., Toledo.

★**Bay City, Mich.**—Contract awarded to Bay City Steam Co., Bay City, for erecting wood working plant for Bigelow Cooper Co.

MISCELLANEOUS

PROPOSED WORK

Fire Alarm System—New York, N. Y.—Bd. of Estimate has authorized issue of $879,583 corporate stock for constructing a new fire alarm system in Manhattan Borough.

Parkway and Boulevard System—Ann Arbor, Mich.—University of Michigan has engaged Frank Law Olmstead to act in an advisory capacity with landscape design department of university on plans for parkway and boulevard system along Huron River. Cities of Ann Arbor and Ypsilanti, with Eastern Michigan Edison Co., Ann Arbor Civic Assoc., Merchants' Credit Assoc. of Ann Arbor and Business Men's Assoc. of Ypsilanti, are reported interested.

Tunnel—Seattle, Wash.—City Council and County Comrs. reported to have decided to construct tunnel to connect with basement of new county courthouse. Daniel Huntington, City Archt., will prepare plans, cost about $16,000.

BIDS DESIRED.

Grading, Etc., Beaver Park.—Albany, N. Y.—Until July 12 by Isidore Wachman, Secy. Bd. Contract & Supply, for grading a portion of the easterly section of Beaver Park, including an athletic field approximate 8½ acres in area, an embankment about 10 ft. high surrounding the athletic field, roads, paths and slopes, where directed, an open air swimming pool about 60,000 sq. ft. in area and constructing receiving basins, laying sewer connections, reconstructing and rebuilding manholes, etc.

Street Signs—New York, N. Y.—Until July 15 by Marcus M. Marks, President Boro. Manhattan, for 500 street signs contractor furnish each frame to contain two enamel street signs at various locations Borough Manhattan

Steel Beams—Washington, D. C.—Until July 20 at Bureau Supplies and Accounts, Navy Dept., Washington, D. C., for delivering steel "T" beams at Navy Yard, Washington.

Piling, Etc.—New Orleans, La.—Reported desired until July 14 by Ernest M. Loeb, Pres. Bd. Port Comrs. for furnishing creosoted piling, creosoted lumber, and creosoted sheet piling required for constructing Julian St. Wharf.

Steel Barges—Vicksburg, Miss.—Until Aug. 12 by Third Mississippi River Dist., P. O. Box 466 for constructing and delivering 5 steel barges, advertised in Engineering Record.

Marine Railway—Pearl Harbor, Hawaii.—Until Sept. 18 by H. R. Stanford, Ch. Bureau Yards & Docks, Navy Dept., Washington, D. C., for constructing a marine railway at the Naval Station, Pearl Harbor, according to Specification No. 2172 appropriation $94,000

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Massachusetts.**—Contract for furnishing about 7500 bbls. Portland cement awarded by Massachusetts Highway Comrs., Boston, to A. S. Fields, Southampton Street, Boston, at $1.58 per bbl. Bids opened June 26.

★**Park Building and Grandstand—Newark, N. J.**—Contracts for administration building for Essex County Park Comm. to be erected in Branch Brook Park, awarded as follows: General construction, E. M. Waldron Co., $62,271; plumbing, James McCullough, New York, $4025; heating, A. M. Pearson, $2644; electrical equipment, H. R. Jackson, $1000.

★Contracts for grandstand in Weequahic Park awarded as follows: Steel work, Lawrence & Garrigues, $21,500; masonry, New Jersey Cement Co., $3,502; carpenter work, H. N. Doremus & Co., $3987; roof and sheet metal work, Jacob Steinberg, $1495; and plumbing, Jacob Rau Jr., $2048.

★**Riprap Stone—Memphis, Tenn.**—Bids were opened June 30 by Maj. E. M. Markham, Corps Engrs., U. S. A., for riprap stone, and it was recommended that Arnold Stone Co., Neelys Landing, Mo., be awarded contract for 100,000 cu. yd. at 52 cts. per cu. yd., and C. C. Huthmacher, Grand Tower, Ill., for 11,000 cu. yd. at 84 cts.

★**Snow Sheds—Ladner, B. C.**—Contract reported awarded for construction of snow sheds for the joint Kettle Valley & Vancouver, Victoria and Eastern Ry. to Coquihalla Pass, to Gutzke-Mellquist Co., of Portland, Ore. Included in work is a concrete and steel bridge over Lander's Creek, 285 ft. high of 9 spans.

Proposals

For Proposals Advertised, see Pages 46, 47 and 48.

WATERWORKS.

Bids Close.		See Eng. Record.
July 12.	Improvements, Covington, Va. ..... Adv. Jun. 19, 26.	Jun. 19
July 12.	Water Pipe, Etc., Marshalltown, Iowa ..... Adv. July 10.	July 10
July 14.	Improvement, Beaumont, Tex.	Jun. 26
July 14.	Pumps, Baltimore, Md... Adv. July 3.	July 3
July 14.	Main, New Brighton, S. I., N. Y.	July 10
July 14	Valves, Chicago, Ill.....	July 10
July 15.	System, Clayton, Del.... Adv. July 3, 10.	July 3
July 15.	Pipe, Galveston, Tex....	July 10
July 15.	System, Shadyside, Ohio.	July 10
July 15.	System, Riverside, Iowa.	July 10
July 16.	Water Works, Hilton, N. Y. ..... Adv. July 3.	July 3
July 17.	Water Wks., Grinnell, Iowa	July 10
July 19.	Well, Viola, Ill. ..... Adv. July 3, 10.	July 3
July 19.	Water Wks., Totowa, N. J.	July 3
July 19.	Pipe, Washington, D. C..	July 3
July 19.	Pumps, Chicago Heights, Ill.	July 10
July 19.	System, Larned, Kan. ...	July 10
July 19.	Mains, Bedford, Ohio ...	July 10
July 20.	System, West Lynn, Ore.	July 3
July 20.	Intake, Etc., Kenosha, Wis.	July 10
July 20.	System, Keota, Iowa.....	July 10
July 22.	Filters, Paris, Ill..... Adv. July 3, 10.	July 3
July 22.	Reservoir, Mifflinburg, Pa. Adv. July 10.	July 10
July 23.	Reservoir, Binghamton, N. Y. ..... Adv. July 3, 10.	July 3
July 24.	Reservoir, Gallitzin, Pa.. Adv. July 10.	July 10
July 26.	Reservoir, etc., Sioux Falls, S. D..... Adv. July 10.	July 10
July 28.	Water Wks. Improv., Lake Field, Minn.....	July 10
Aug. 2.	Dam, Contract 10, Hartford, Conn. ..... Adv. July 10.	July 10

SEWERAGE AND SEWAGE DISPOSAL.

July 12.	Avalon, N. J..... Adv. Jun. 26, July 3	Jun. 26
July 12.	Peoria, Ill. ..... Adv. Jun. 26, July 3.	Jun. 26
July 13.	Philadelphia, Pa.	July 10
July 14.	Tillamook, Ore.	July 10
July 14.	Brooklyn, N. Y.....	July 10
July 15.	Clyde, Kan.	July 3
July 15.	Clayton, Del. ..... Adv. July 3, 10.	July 3
July 15.	Saginaw, Mich.	July 10
July 15.	Escanaba, Mich. ..... Adv. July 10.	July 10
July 15.	New York, N. Y.....	July 10
July 16.	Westerville, Ohio.	July 10
July 19.	Bedford, Ohio	July 10
July 20.	Brazil, Ind.	July 3
July 20.	Eveleth, Minn.	July 3
July 21.	Baltimore, Md.	July 10
July 22.	Milwaukee, Wis. ..... Adv. July 10.	July 10
July 26.	Maywood, N. J. ..... Adv. July 3, 10.	July 3
July 26.	Ocean City, Md..... Adv. July 10.	July 10
July 27.	Cloverdale, Ala.	July 10
July 28.	Cuyahoga Falls, Ohio....	July 10
Aug. 3.	Paducah, Ky. ..... Adv. July 3, 10.	July 3
Aug. 31.	Newark, N. J.....	July 10

BRIDGES.

July 12.	Lebanon, O. ..... Adv. Jun. 26.	Jun. 19
July 13.	Arlington, Neb.	July 3
July 13.	Kansas City, Mo.....	July 3
July 13.	Pine Brook, N. J.....	July 10
July 15.	Williston, N. D..... Adv. July 3.	Jun. 26
July 16.	Easton, Pa.	July 3
July 16.	Pittsburgh, Pa.	July 3
July 16.	La Harpe, Ill.....	July 10
July 17.	Pineville, Ky.	July 10
July 19.	Portsmouth, Ohio	July 3
July 19.	Eugene, Ore.	July 10
July 19.	York, Pa.	July 10
July 19.	Colville, Wash.	July 10
July 19.	California	July 10
July 20.	Watertown, S. C.....	July 3
July 20.	Seattle, Wash.	July 3
July 21.	Minetto, N. Y.....	July 3
July 21	Hardin, Mont.	July 3
July 21.	Youngstown, Ohio	July 10
July 22.	Moundsville, W. Va.....	July 10
July 23.	Seattle, Wash. ..... Adv. Jun. 19 to July 10.	Jun. 19
July 24.	Mansfield, Ont.	July 3
July 24	Newark, Ohio	July 3
July 25.	Helton, Kan.	July 3
July 28.	Mansfield, Ohio	July 10
Aug. 4	South Amboy, N. J.....	July 10

PAVING AND ROADS.

July 13.	Alabama	Jun. 19
July 13.	Chestertown, Md.	Jun. 26
July 13.	Albany, N. Y..... Adv. Jun. 26 to July 10.	Jun. 26
July 13.	Kaufman, Tex.	July 3
July 13.	Danville, Ky.	July 3
July 13.	Virginia, Minn.	July 3
July 13.	Kansas City, Mo.....	July 10
July 13.	Massachusetts	July 10
July 13.	Hagerstown, Md.	July 10
July 14.	Youngstown, O.	Jun. 26
July 14.	Long View, Tex.....	July 3
July 14.	Cincinnati, Ohio	July 10
July 14.	Tillamook, Ore.	July 10
July 14.	Louisville, Ky.	July 10
July 14.	Upper Sandusky, Ohio...	July 10
July 14.	Chicago, Ill.	July 10
July 14.	Parkersburg, Va.	July 10
July 15.	Albany, N. Y..... Adv. Jun. 26 to July 10.	Jun. 26
July 15.	Newark, N. J.....	July 3
July 15.	Mansfield, Ohio	July 3
July 15.	Clarion, Pa. ..... Adv. July 3.	July 3
July 15.	San Antonio, Tex. ..... Adv. July 3.	July 3
July 15.	Williston, N. D..... Adv. July 3.	July 3
July 15.	Sapulpa, Okla.	July 10
July 15.	New York, N. Y.....	July 10
July 15.	Dayton, Va.	July 10
July 15.	Blue Earth, Minn..... Adv. July 10.	July 10
July 16.	Hackensack, N. J.....	July 3
July 16.	Laurel, Mont.	July 10
July 16.	Walla Walla, Wash.....	July 10
July 17.	Brooksville, Fla.	July 10
July 17.	Oak Hill, Ohio.....	July 10
July 19.	Washington	July 3
July 19.	California	July 10
July 19.	New Philadelphia, Ohio..	July 10
July 19.	Guttenberg, N. J.....	July 10
July 19.	Norfolk, Neb.	July 10
July 20.	Oelwein, Ia.	Jun. 19
July 20.	Huntington, W. Va.....	July 3
July 20.	Seattle, Wash.	July 3
July 20.	Laurel, Miss.	July 10
July 20.	Xenia, Ohio	July 10
July 22.	Boonville, N. Y..... Adv. July 3.	July 3
July 22.	Newark, N. J.....	July 10
July 23.	Spokane, Wash.	July 10
July 24.	Spencer, Ia.	Jun. 26
July 24.	Sarasota, Fla.	July 10
July 25.	Tiffin, O.	Jun. 26
July 26.	Albany, N. Y..... Adv. July 10.	July 10
July 26.	Burlington, N. J..... Adv. July 10.	July 10
July 26.	West Jefferson, Ohio....	July 10
July 27.	New Orleans, La.	July 3
July 27.	Seattle, Wash.	July 10
July 27.	Janesville, Wis.	July 10
July 28.	Cuyahoga Falls, Ohio....	July 10
Aug. 2.	Fort Scott, Kan.....	July 3
Aug. 4.	Butte, Mont.	July 10
Aug. 7.	Butte, Mont.	July 10

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS.

July 13.	Steel Doors on Pier, Panama ..... Adv. Jun. 26.	Jun. 26
July 14.	Bulkhead, Cleveland, Ohio	July 3
July 14.	Riprap, Tompkinsville, N. Y.	July 3
July 15.	Timber Wharf, Charleston, S. C.....	Jun. 19
July 15.	Irrigation Work, Goshen, Utah	Jun. 19
July 15	Dredging, New York, N. Y. ..... Adv. Jun. 19 to July 10.	Jun. 19
July 15.	Pier, Brooklyn, N. Y.....	July 10
July 15.	Dredging, Grand Marais, Mich.	July 10
July 16.	Dredging, Brooklyn, N. Y.	July 10
July. 19.	Steel Gates, Wilmington, N. C. ..... Adv. Jun. 19 to July 10.	Jun. 19
July 19.	Drainage Ditches, Foplar Bluffs, Mo.	July 10
July 20.	Irrigation Work, Washington, D. C..... Adv. July 3.	July 3
July 21.	Ditch Improvement, Canton, Ohio	July 3
July 21.	Pumping Plant, Etc., Quincy, Ill. ..... Adv. July 3, 10.	July 3
July 22.	Pier, Augusta, Ga..... Adv. July 10.	July 10
July 24.	Dredging, Jacksonville, Fla. ..... Adv. Jun. 10 to July 10.	Jun. 26
July 30.	Irrigation Work, Great Falls, Mont.	July 3
July 30.	Dredging, Port Chester, N. Y. ..... Adv. July 3, 10.	July 3
July 30.	Breakwater, Conneaut, Ohio ..... Adv. July 3, 10.	July 3
July 31.	Dredging, Pearl Harbor, Hawaii	Jun. 19
July 31.	Dam and Shore Protection, Rock Island, Ill.... Adv. July 10.	July 10
July 31.	Levee, Caldwell, Tex....	July 10
Aug. 2.	Dredging, New York, N. Y. ..... Adv. July 10.	July 10
Aug. 3.	Breakwater, Chicago, Ill.	July 10
Aug. 4.	Dredging, Norfolk, Va... Adv. July 10.	July 10
Aug. 9.	Pier, Philadelphia, Pa... Adv. July 10.	July 10
Aug. 9.	Dredging, Philadelphia, Pa. ..... Adv. July 10.	July 10
Aug. 14.	Dredging, Bremerton, Wash.	July 10

Bids Close.		See Eng. Record.
Aug. 15.	Dredge Work, Rosseau, Minn.	Jun. 26
Aug. 24.	Dredger, Adelaide, Australia	Jun. 19
Sep. 18.	Pier, Pearl City, T. H....	July 10

PUBLIC BUILDINGS AND SCHOOLS.

July 13.	Washington, D. C.....	May 22
July 13.	Utica, N. Y.....	July 3
July 13.	Toronto, Ont.	July 10
July 13.	New York, N. Y.....	July 10
July 13.	Cincinnati, Ohio	July 10
July 14.	Galveston, Tex.	Jun. 19
July 14.	Fulton, Minn.	July 3
July 14.	Tavor, N. D.....	July 3
July 14.	Appleton City, Mo.....	July 10
July 14.	McCutchenville, Pa.	July 10
July 14.	Coldwater, Mich.	July 10
July 14.	Woodward, Iowa	July 10
July 15.	Minneapolis, Minn.	Jun. 26
July 15.	Harrisburg, Pa. ..... Adv. July 3, 10.	July 3
July 15.	Metz, Ind.	July 3
July 15.	Lisbon, Ohio	July 3
July 15.	Custer, S. D.....	July 3
July 15.	Hamilton, Ohio	July 3
July 15.	Ottawa, Ont.	July 10
July 15.	Galesburg, Ill.	July 10
July 15.	Lake Park, Minn.....	July 10
July 16.	Harrisburg, Pa.	July 10
July 16.	Vinton, Ohio	July 10
July 16.	Caldwell, N. J.....	July 10
July 17.	Washington, D. C.....	Jun. 26
July 17.	Freedom, Ohio	July 3
July 19.	Hilliard, Ohio	July 3
July 19.	Detroit, Minn.	July 3
July 20.	Indianapolis, Ind.	Jun. 12
July 20.	Watertown, S. D.....	July 3
July 20.	Cleveland, Ohio	July 10
July 20.	Milaca, Minn.	July 10
July 21.	New Orleans, La. ..... Adv. June 19 to July 10.	Jun. 19
July 21.	Roland, Iowa	July 3
July 21.	Salem, Ore.	July 3
July 21.	Kinbrae, Minn.	July 10
July 22.	Cleveland, Ohio	July 3
July 23.	Fort Hancock, N. J.....	July 3
July 24.	San Diego, Cal.	Jun. 26
July 24.	Lowell, Ohio	July 3
July 24.	Fayetteville, Ohio	July 3
July 24.	Tabor, S. D.....	July 10
July 26.	Webb City, Mo.	Jun. 19
July 26.	Springfield, Ill.	July 10
July 27.	Weston, W. Va..... Adv. July 3,	July 3
July 27.	New Bloomington, Ohio..	July 3
July 27.	Albany, N. Y. ..... Adv. July 3, 10.	July 3
July 27.	Boston, Mass.	July 10
July 28.	Jersey City, N. J.....	July 3
July 28.	Hayti, S. D.....	July 10
July 29.	Quitman, Ga.	Jun. 26
July 30.	Albion, Mich.	Jun. 26
July 30.	Cincinnati, Ohio	July 10
July 30.	Kenosha, Wis.	July 10
July 31.	Guantanamo, Cuba	July 3
July 31.	Muncie, Ind.	July 3
July 31.	Stevens Point, Wis.....	July 10
Aug. 1.	Seattle, Wash.	Jun. 5
Aug. 2.	Fort Atkinson, Wis.....	July 3
Aug. 2.	Washington, D. C..... Adv. July 3, 10.	July 3
Aug. 11.	Wellsburg, W. Va.....	July 10
Aug. 12.	North Attleboro, Mass...	July 10
Aug. 13.	Gardiner, Me.	July 10
Aug. 16.	Baltimore, Md. ..... Adv. Jun. 26 to July 3.	Jun. 26
Sep. 1.	Wisner, Neb.	July 10

PRIVATE BUILDINGS.

July 14.	Dayton, Ohio	July 3
July 16	Vancouver, B. C.....	Jun. 12
July 15.	Sesser, Ill.	July 3
July 15.	Harrodsburg, Ky.	July 10
July 15.	Lewistown, Pa.	July 10

NEW INDUSTRIAL PLANTS.

July 13.	Cleveland, Minn.	July 10

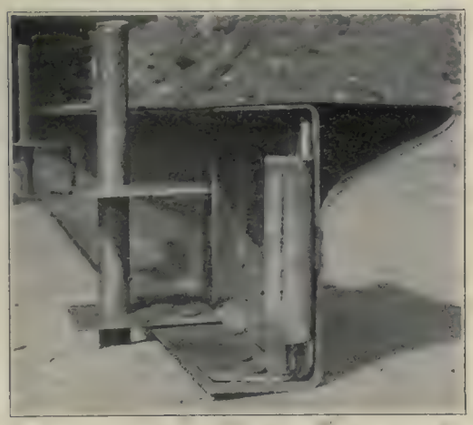
MISCELLANEOUS.

July 12.	Tunnel, Pittsburgh, Pa... Adv. Jun. 5 to July 3.	Jun. 5
July 13.	Garbage Disposal, Asbury Park, N. J.....	July 10
July 14.	Elevators, Baltimore, Md.	Jun. 26
July 14.	Piling, Etc., New Orleans, La.	July 10
July 14.	Rails for El. Ry., San Francisco, Cal.	July 10
July 15.	Lift, Washington, D. C...	Jun. 26
July 15.	Street Signs, New York, N. Y.	July 10
July 16.	Steel, Etc., Panama.....	July 3
July 16.	El. Rys. Rails, Brooklyn, N. Y.	July 3
July 16.	Garbage Disposal, East Chicago, Ind.	July 10
July 16.	Garbage Disposal, New York, N. Y.....	July 10
July 17.	Tank, Key West, Fla....	July 3
July 20.	El. Ry., Brooklyn, N. Y.. Adv. July 3, 10.	July 3
July 20.	Steel Beams, Washington, D. C.....	July 10
July 21.	Elevator, Port Townsend, Wash.	Jun. 26
July 21.	Power Plant Machinery, Greencastle, Ind. ..... Adv. July 3.	July 3
July 31.	Timber, Detroit, Mich... Adv. Jun. 26, July 10.	Jun. 26
Aug. 12.	Steel Barges, Vicksburg, Miss. ..... Adv. July 10.	July 10
Aug. 16.	Towing Locomotives, etc., Panama.	Jun. 26
Aug. 16.	Subway Work, Philadelphia, Pa.	July 10
Sep. 18.	Ry. at Naval Station, Pearl Harbor, Hawaii..	July 10

New Forms for Concrete Road Work

One of the concrete road forms illustrated herewith is for casting a combined curb and base, and does not require any support inside the form. The entire form is held up by steel stakes driven through lugs riveted onto the outer channel. The road shown had a 6-in. base, and the curb was 12 in. high from sub-grade. It was surfaced with brick, and built this year by R. M. Sutton in Marion County, W. Va.

The other form has been used on New York State Highway work and provides a shoulder



FORM MAKES SHOULDER AT SIDE OF ROADWAY

from which the crown of the roadway starts. It also is supported without inside blocking by steel stakes. A feature of this form is the patented sliding plate shown in the view which covers the joint between form sections and prevents the escape of grout.

Both forms are manufactured by the Blaw Steel Construction Company, of Pittsburgh.



INTEGRAL CURB AND BASE FORM NEEDS NO SUPPORT INSIDE OF ROADWAY

New Portable Asphalt Plant Has Special Drying Drum

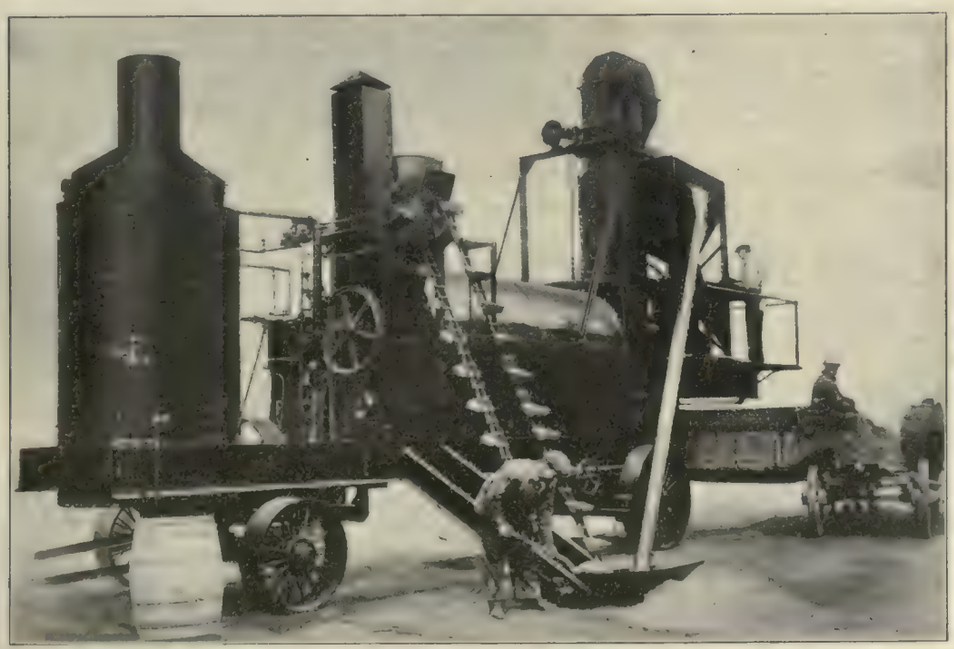
A new portable asphalt mixing plant has just been put on the market by the Iroquois Works of the Barber Asphalt Paving Company, Buffalo. For a plant of its size and cost it is claimed to be unusual in having a minimum capacity of 800 sq. yd. of 2-in. sheet asphalt topping per day of 10 hours. The capacity for asphaltic concrete, Topeka mix, or asphalt macadam is much larger.

The mixing platform of the plant is so elevated that a wagon can be driven under it to receive the load from the mixer without elevating the plant on its wheels or excavating for this purpose. The platform is arranged for one-man operation, the levers for controlling clutches and plant being within easy reach.

The mixer is a two-shaft, pugmill type, with removable side and end liners, and provided with two full sets of blades, the binder blades being solid manganese. The sand-measuring box and asphalt bucket are supported on scales. A drying drum of special construction has been designed for this plant to obviate the difficulties so often encountered in heating a sufficient amount of sand and stone.

Features that are considered important in the economical upkeep of such plants as this are the removable steel wearing plates in the material chutes, and chilled rims for all chain sprockets.

As illustrated, the plant would be operated as two units, the second unit being the asphalt kettle. The mixing plant is also supplied, however, without boiler and engine. In other words, the contractor or municipality already provided with portable boiler, engine and kettles, can secure the mixing plant without making an additional investment for these units. The plant is designed especially to meet the requirements of contractors and municipalities having new construction and maintenance work to perform in scattered territory, or in an amount insufficient to make a stationary plant economical.



PORTABLE PLANT ELEVATES MATERIALS AND DUMPS INTO HIGH WAGON

Business Notes

The Parsons Company, manufacturer of the Parsons trench excavators of Newton, Iowa, has opened an eastern sales office at 30 Church Street, New York City.

Albert R. Erskine, formerly first vice-president and treasurer of the Studebaker Corporation of South Bend, Ind., was elected president at a meeting of the board of directors held in New York City, July 7. He succeeds Frederick S. Fish, who becomes chairman of the board and of the executive and finance committees.

Thomas J. McMaster has been appointed district manager of the western territory of the Diamond Power Specialty Company, manufacturer of soot blowers for all types of boilers, of Detroit, Mich. He will be located in the Ashland Block, Chicago, and will be assisted by several assistant sales engineers and erecting engineers.

The J. I. Case Threshing Machine Company of Racine, Wis., has taken over the plant and equipment of the Perfection Road Machinery Company of Galion, Ohio, makers of Perfection road graders, drags and rooter plows. The product of this company has been sold exclusively by the Case Company for several years. The Perfection plant will be moved from Galion to Racine and the graders, with added improvements, will be manufactured and sold hereafter as Case graders.

The Virginia Machinery & Well Company, of 1319 E. Main Street, Richmond, Va., has entered the jobbing field, specializing in artesian well drillers, pumps, pipe, tanks, gas line engines, water and lighting systems, pumping machinery of all kinds, engines, boilers and saw mill supplies, and will cater to municipalities, mills, factories, contractors and railroads. It will also do a contracting business, drilling artesian wells and making test holes and borings. Charles F. Cole, formerly an officer of the Sydnor Pump & Well Company of Richmond, is president and treasurer of the company, and Charles R. Elam, formerly of the Thomas Hardware Company of Suffolk and Lawrenceville, Va., is vice-president and manager.

New Construction Activities

The developments of the past week, including the second German note on the Lusitania affair, have not relieved to any extent the underlying anxiety over our foreign relations. At the same time the immense British war loan appears to have been floated largely without direct outside help and without seriously disturbing the markets in this country.

The steel corporation booked orders during June in excess of capacity, the total orders amounting to more than 1,400,000 tons. Export business figures very largely in this total. Domestic structural orders for last week increased throughout the country as compared with the June rate, although the rate recorded is still below that for April or May. In addition to contracts already let, bids were opened for 24,000 tons of steel to complete the St. Louis Free Bridge, and it is expected that the low bidder will be awarded the contract this week.

Buildings

The lowest bids opened recently for constructing three Philadelphia schools totaled nearly $300,000. The contract for a $315,000 church building has been awarded at Lansdowne, Pa. It is reported that contracts for building a tuberculosis hospital at Buffalo amounting to more than $450,000 have been awarded. The lowest bid for erecting a high school at Syracuse, N. Y., was $289,000. Bids have been opened for a $240,000 post office at Charlotte, N. C. A bid of $170,000 has been received for extending the boiler plant of the U. S. Naval Proving Ground at Indian Head, Md. The contract for a $200,000 bank building has been awarded at South Bend, Ind. The contract for building an automobile factory at Milwaukee has been awarded at $250,000.

Bids are desired Aug. 2 for constructing a high school at Hammond, Ind. It is reported that the American Locomotive Company will spend $500,000 enlarging its Schenectady plant. New school buildings and extensions planned at Buffalo for construction this year will cost nearly $1,500,000. Bids will soon be asked on a $200,000 school building at Cleveland. Plans are being prepared for a $400,000 apartment house in the same city. It is reported that the Wheeling (W. Va.) Steel & Iron Company has authorized a large bond issue, and will spend $2,500,000 extending its plants.

A six-story warehouse to be built at Wheeling will cost $300,000. Plans are being prepared for a $500,000 apartment house in Washington, D. C., and for a fourteen-story fireproof hotel at Wilmington, N. C. Plans are being prepared for a $500,000 group of penitentiary buildings to be built at White Plains, N. Y. The University of Illinois will erect three buildings at Urbana to cost $270,000. Plans have been completed for a $150,000 building for Johns Hopkins University at Baltimore. Syracuse, N. Y., will soon let a contract for a $225,000 school, and plans for a $300,000 high school are being prepared at Tulsa, Okla.

Bridges and Roads

A contract for the substructure of a bridge at Wiscasset, Me., has been awarded at $150,000. Bids are desired July 31 at Minetto, N. Y., for a large concrete arch bridge with a bascule steel draw span over the Oswego River. Bids are desired until Aug. 7 for constructing a 2-mile pile railway bridge with a steel draw span at Clearwater, Fla. It is reported that the superstructure of the free bridge at Little Rock, Ark., will be replaced at a cost of $290,000. It is reported that the Kansas City Southern Railway, whose bridge over the Kaw River at Kansas City was damaged by the recent flood, is considering the construction of a new bridge. A proposed bridge at Alameda, Cal., will cost $700,000.

Bids have been opened on long lists of road contracts by the States of New York and California. It is reported that Ohio has awarded road contracts totaling $200,000. A $53,000 contract for concrete paving has been awarded at Batavia, N. Y. A $90,000 road contract has been awarded at Pine Bluff, Ark., and two paving contracts just awarded by the city of Los Angeles total $63,000. A paving contract involving $125,000 has been awarded at Edmonton, Alta.

Bids on highway repair work will be received Aug. 3 by the State of New York at Albany. Bids are desired by the State of Ohio on July 23 on a long list of good-sized road and bridge contracts. The State of California also desires bids on considerable road and paving work. Bids are asked for July 29 on more than $100,000 worth of paving at Norfolk, Va. New Orleans desires bids on paving work which will cost $1,500,000. On Sept. 1 Fairbury, Ill., will open bids for a $92,000 paving contract, and Spencer, Iowa, will soon let a contract for 70,000 sq. yd. of paving. Seguin, Tex., has sold road bonds amounting to $75,000.

Waterworks and Sewers

The waterworks contracts at Rittman, Ohio, have been awarded at about $45,000. Cheyenne, Wyo., has contracted for a $75,000 filter. Colfax, Wash., has bought cast-iron pipe valued at $54,000. Bids are desired for constructing the waterworks previously noted at Watervliet, N. Y., and bids are desired Aug. 10 for constructing waterworks and laying sewer pipe at Warrenton, N. C., where about 10 miles of pipe line will be built. Bids are desired at Cambridge, Ohio, for a reservoir and filter plant. Kenosha, Wis., will receive bids for a 42-in. intake pipe nearly a mile long, and for a 2-ft. water main in its harbor. It is reported that the proposed work on the Compton Hill Reservoir at St. Louis will cost $425,000. Bids will not be received until late in the fall. The report of the waterworks investigation recently completed at Hamilton, Ont., recommend the construction of a 50,000,000-gal. reservoir.

The lowest bid opened in New York City for constructing in tunnel the Forty-first Street relief sewer was $144,000. Bids opened on two sewer contracts in Cleveland total $238,000. The contract for the Columbus (Ohio) disposal plant has been awarded at $198,000. Bids were opened on a $78,000 sewer contract at Indianapolis. Work has started on a $108,000 sewer contract awarded at Kenosha, Wis. Bids are desired Aug. 31 by the Passaic Valley Sewage Commission at Newark for the superstructure of the Newark Bay pumping station. Bids are desired on 5 miles of pipe line and a pipe tunnel at St. Louis. Sacramento, Cal., has sold sewer bonds totaling $106,000.

Miscellaneous

The lowest bid opened for track laying on the Utrecht Avenue elevated line in Brooklyn was $71,000. Bids will be received by the New York Public Service Commission for laying track for the balance of the dual system July 27 and 28. In addition three more sections of subway construction on the dual system are to be let late this month in New York City. Bids are desired on the first contract for elevated work in Philadelphia on Aug. 16.

A contract for building 11 miles of railroad has been awarded at Oneida, Tenn., and a $152,000 grade-crossing contract has been awarded at Buffalo. It is reported that the first contract on the railroad to connect Little Rock, Ark., and Springfield, Mo., has been awarded. A $200,000 dredging contract has been awarded at Philadelphia. Drainage ditches at Bartow, Fla., involving 2,400,000 cu. yd. of excavation have been contracted for. A $600,000 irrigation contract has been awarded at Oroville, Wash. A further contract for $129,000 has been awarded on the Sault Ste. Marie locks.

Bids are desired for the steel superstructure of the reloading wharf at Balboa, Panama. A company has been chartered to construct 30 miles of railroad near Savannah, Ga. A 7-mile branch line has been surveyed for the Baltimore & Ohio Railroad near Farmington, W. Va., and it is reported that a 27-mile lumber railroad will be built near White Sulphur Springs, W. Va. Plans are being prepared for a canal near Gering, Neb., which involves 3,000,000 cu. yd. of excavation and two tunnels. A $370,000 irrigation development at Umatilla, Ore., is reported.

WATERWORKS

PROPOSED WORK.

Gloucester City, N. J.—All bids opened June 26 for furnishing and installing boilers, stacks, tank, service pumps, air compressors, together with deep well, air lifts, etc., have been rejected and new bids will be called for. Address A. Hatchler, Engr., 1421 Drexel Bldg., Philadelphia, Pa., or J. F. Leedy, City Clk.

West Orange, N. J.—William B. Fuller, Engr., 156 Nassau Street, N. Y., has recommended to Town Council purchase of present distributing system of West Orange Water Co., estimated at $261,425. If town should purchase present pipe line it will be necessary to lay 4 miles of 16, 12 and 10 in. mains to increase present supply. A gross system of feed mains would also be required.

Brownsville, Pa.—Plans have been submitted to State Bd. of Health for filtration plant to be constructed in South Brownsville.

Ringtown, Pa.—Borough Council reported to be considering construction of water works.

Contracting News

Of Special Interest to Engineers, Contractors, Builders and Manufacturers of Engineering and Building Supplies

Maryland.—Following are among permits issued during June by Maryland State Dept. of Health (Robert B. Morse, Ch. Engr., 16 W. Saratoga Street, Baltimore):

New Windsor—Extension of water distribution system.

Frederick—Construction of new water supply pipe line.

Orangeburg, S. C.—Citizens voted $30,000 bonds for water and light improvements.

Columbus, Ga.—O. B. Blackmon, Supt. Water Works, recommends larger filter.

Tallapoosa, Ga.—Citizens voted $35,000 bonds for water works.

Neshoba, Miss.—Citizens reported to have voted $30,000 bonds for water works and sewer system.

Sebring, Ohio. — Council considering issue of bonds to be used for purchasing water works owned by City Water Works Co. and Crescent Water Co. and improving same by construction of filter and softening plant.

Tiffin, Ohio.—Tiffin Water Works Co. contemplate laying 3000 ft. of new mains, construct filter plant and a new dam in Sandusky River.

Menominee, Mich.—W. J. Sherman Co., Nasby Bldg., Toledo, Ohio, retained to prepare estimates for municipal water works.

Fort Madison, Iowa.—George Sturdevent of Chicago, Ill., reported to be conferring with Water Com. on construction of water works.

Lakefield, Minn.—Earl D. Jackson of St. Paul is engineer for proposed water works improvements. E. Anderson, City Clk.

Anamoose, N. D.—Citizens voted $10,000 bonds for constructing water works; cost $12,000. Engineer not yet selected.

Polson, Mont.—Town Council considering purchase of local water system. Improvements and extensions are planned.

Three Forks, Mont.—City Council engaged Swearinger & McCulloch, Great Falls, to prepare plans and estimates for water works, to cost about $25,000.

Canton, Mo.—Henry Clusky, Town Clk., writes $14,000 bonds will be sold July 19 to be used for construction of water works. Address L. H. Condit, Chmn. Bd. Pub. Wks.

St. Louis, Mo.—It is proposed to rebuild Compton Hill reservoir, the first section to cost $425,000. Work will consist of raising outside wall, moving and rebuilding gate house, dividing wall, inlet and outlet chambers, connecting pipes and sewers, waterproofing bottom and slopes, driving steel sheet piling cutoff walls and concrete foundation piles, constructing roof over basins, with all necessary gates, stop planks, stairways, drains and appurtenances. Bids for construction to be received late this fall. J. Hooke, Dir. Public Utilities.

Kenedy, Tex.—Question of constructing water works under consideration; cost $32,000. Bonds not yet voted. No engineer engaged. R. R. Goff, Mayor.

Cleveland, Okla.—David H. Hollet, City Clk., writes that there is some talk here of constructing waterworks, to cost about $75,000.

Pateros, Wash.—Citizens reported to have voted bonds for constructing water works; cost about $10,000.

Burns, Ore.—Council reported to have authorized issue of $60.000 bonds for water works. H. C. Levins, Mayor.

Coeur D'Alene, Idaho.—Council will apply to Public Utilities Comn., Boise, for permission to construct and maintain municipal water works.

Hamilton, Ont.—Kerry & Chase, Toronto, have submitted to city a report on water works, and recommend construction of new reservoir on top of mountain, with a capacity of 50,000,000 gal. with provision for future extension.

BIDS DESIRED.

Brookline, Mass.—Local press reports state bids desired until July 19 by Bd. Selectmen for constructing a covered channel through the Brookline Reservoir.

Hartford, Conn.—Until Aug. 2 by Bd. Water Comrs. for constructing Richards Corner Dam, compensating reservoir, in town of New Hartford, Contract 10, advertised in Engineering Record.

Albany, N. Y.—Until July 19 by Bd. Contract and Supply (Isidore Wachsman, Secy.) for furnishing and delivering c. i. water pipe and special castings.

Watervliet, N. Y.—Until Aug. 16 by Bd. Water Comrs. (John G. Clute, Pres.), 1555 Broadway, for constructing water works, advertised in Engineering Record. Solomon, Norcross & Keis, Engrs., 1622 Candler Building, Atlanta, Ga.

Woodbury, N. J.—Until July 27 by Arthur Starr, City Clk., for additions to brick pumping station, foundations, brick chimney and water-tube boilers for the proposed artesian well water supply at pumping station on Mantua Creek. William H. Boardman, Engr., 426 Walnut Street, Philadelphia.

Mifflinburg, Pa. — Until July 22 by Borough Council for constructing 500,000 gal. concrete reservoir advertised in Engineering Record. Alexander Potter, Engr., 50 Church Street, New York, N. Y.

Baltimore, Md.—Until July 28 by Bd. Awards, care of City Register, for furnishing and delivering valves to the Water Dept., advertised in Engineering Record. Robt. L. Clemmitt, Acting Water Engr.

Warrenton, N. C.—Until Aug. 10 by Mayor and Bd. Town Comrs. (R. J. Jones, Secy.) for constructing water works and sewer system, advertised in Engineering Record. Gilbert C. White, Engr., Charlotte.

Covington, Ky.—Until July 20 by J. Mason Howk, Comr. Pub. Property, for pipe trenching and backfilling. The total length of trenching for the 24 in. main is 10,950 ft., of which 3650 ft. is in rock or creek bed and 7300 ft. in earth. Rock excavation will amount to about 1600 cu. yd. and trenching for cross-connecting the mains with the present distributing pipe system, about 1000 ft. made up of 6 to 12 in. pipe. George Hornung, Engr., Wool-Sack Building, Newport.

Cambridge, Ohio.—Until Aug. 5 by T. D. E. Lee, Dir. Pub. Service for improvements to water works including storage reservoir, filter plant, pumping machinery, etc., advertised in Engineering Record. The W. J. Sherman Co., Engrs., Toledo.

Cincinnati, Ohio.—Until July 22 by Edw. P. Durr, Secy., Director Public Service, for laying c.-i. pipe, special castings and valves and other miscellaneous work in connection with high pressure fire system in Central Ave. and 6th St.

Wellington, Ohio.—Until July 31 by Bd. Pub. Affairs (E. E. Goodrich, Clk.) for furnishing material and improving water works.

Chicago, Ill.—Until July 24 by W. R. Moorhouse, Comr. Pub. Wks., for furnishing and delivering at tunnel shaft, Wilson Avenue, a motor-driven centrifugal pump with accessories.

Rockford, Ill.—Until July 27, by Purchasing Comn., at office of Ross P. Beckstrom, Supt. Water Dept., for pumping equipment for deep well No. 8, advertised in Engineering Record.

Ellsworth, Wis.—Until July 29 by C. B. Wood, Village Clk., for constructing water works from plans of J. F. Druar of St. Paul, cost $7,500.

Kenosha, Wis.—Until July 26 by Bd. Water Comrs. for 42-in. c. i. intake, a submerged intake crib, and a 24-in. main under harbor, advertised in Engineering Record. B. C. Brennan, City Engr.

Cedar Rapids, Iowa.—About July 20 by Harry T. Hedges, Cedar Rapids, for sanitary sewers and water mains in Belmont Park, second addition. T. R. Warriner, Engr., Cedar Rapids.

Denison, Iowa.—Until July 22 by E. F. Tucker, City Clk., for drilling artesian well to consists of 100 ft. 12-in. and 300 ft. 10-in. well, cased complete; also 1400 ft. 8-in. hole. J. G. Thorne, Engr., Howes Bldg., Clinton, Iowa.

Iowa.—Owing to recent rulings of Supreme Court in regard to water works elections, it has been decided to cancel proposed lettings at Riverside, Iowa, for July 15, and Keota, Iowa, for July 20, so that Council proceedings may be made to conform accordingly and remove any grounds for contesting bonds. Work will probably be ready for bids about Sept. 1. Chas. P. Chase, Consulting Engr., Clinton.

Fargo, N. D.—Reported desired until July 21 by A. R. Watkins, City Aud., for furnishing and installing a 4,000,000 gal. service pump, centrifugal type driven by steam turbine, steam pressure at pump, 130 lb., etc.

Wibaux, Mont.—Until July 26, by Town Clerk, for constructing water works, from plans of C. H. Green, of Spokane, Wash.; cost, $27,000.

St. Louis, Mo.—Reported desired until July 20 by Bd. Pub. Service (William T. Findly, Secy.), for laying water mains to include 14,552 ft. 6-in., 3361 ft. 12-in. and 5915 ft. 30-in. pipe; also constructing a reinforced concrete pipe tunnel connecting Engine Houses 1 and 2, Bissell's Point Pumping Station.

Houston, Tex.—Until 2 p. m. July 23, for two 50,000-gal. elevated steel tanks. Address E. E. Sands, City Engr.

Pateros, Wash.—Until July 30 for constructing water works, advertised in Engineering Record. W. H. Noble, Town Engr.

West Lima, Ore.—Reported desired until July 29 by L. L. Porter, Secy. Water Comn., for water works to include 12,000 ft. 10-in. supply mains, 30,000 ft. 4-in. and 6-in. mains, 2,000,000 gal. concrete-lined reservoir and concrete standpipe.

Oakville, Ont.—Until July 26 by C. G. Marlatt, Chmn. Oakville Water & Light Comn., for furnishing and installing an electrically operated turbine pump of 600 imperial gals. capacity against a head of 300 ft.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**New York, N. Y.**—Contracts awarded by Bd. Water Supply, on bids opened July 7, as follows:

Contract 140—drainage equipment for unwatering city tunnel of Catskill Aqueduct and shafts 11 and 12, to M. L. Bayard, Philadelphia, Pa., at $37,000.

Contract 149—racks, shutters, screens, lifters, etc., in gate chambers at Ashokan, Kensico and Hill View Reservoirs, town of Olive, Ulster County, and Mount Pleasant and Yonkers, to Concord Constr. Co., Brooklyn, at $17,842.

★**Oswego, N. Y.**—Contracts for water works improvements awarded as follows: To M. B. Crawford & Son, Oswego, for c.-i. pipe and valves, $16,189; Rensselaer Valve Co., Troy, valves and hydrants, $1,580; Chas. Millar & Sons Co., Utica, pig lead, $1,680; Vincent Tesciero, Oswego, for trenching, $4,832. J. F. Flanigan, City Engr.

Media, Pa.—Following are totals of 4 complete bids opened June 28 by M. C. Michener, Chmn. Water Com., for water works improvements, from plans of J. W. Ledoux, Ch. Engr. American Pipe & Constr. Co., 112 N. Broad Street, Philadelphia: Carl R. Camp, Crozer Building, Philadelphia, $35,729; A. M. Herkness, Philadelphia, $35,493; Field, Barker & Underwood, Commercial Trust Building, Philadelphia, $36,232; Ambler, Davis & Co., Harrison Building, Philadelphia, $35,827.

★**Cleveland, Ohio.** — Contract awarded by Bd. Control to Allis-Chalmers Co., Milwaukee, Wis., for rebuilding 3 vertical triple expansion pumping engines for Division Avenue pumping station at $68,000.

★**Rittman, Ohio.**—Contracts awarded by Village Council as follows for water works improvements (bids opened June 29): W. F. Peters, Engr., Medina; R. Winthrop Pratt, Consulting Engr., Hippodrome Building, Cleveland.

★Pumping equipment awarded to Bessemer Gas Engine Co., Cleveland, at $4,694, to include gas engine (2 cycle), triplex pump, air compressor, receiver, motor, centrifugal pump and appurtenances.

★Pumping station, reservoir, water mains, etc., awarded C. A. Pierce of Rittman, at a total of $40,487, including valves, hydrants, brick masonry, carpentry, roofing, etc. Some of the principal unit prices are as follows:

1,125	cu. yd. ea. ex. pump sta. and reservoir	$0.50
78	cu. yd. plain conc., Class "A"	7.00
25	cu. yd. plain conc., Class "B"	6.50
370	cu. yd. reinforced concrete	14.00
	C.-i. Pipe in Place with Trench Excav.:	
600	lin. ft. 3 in.	0.57
4,200	lin. ft. 4 in.	0.50
16,355	lin. ft. 6 in.	0.69
16,386	lin. ft. 8 in.	0.87
	W.-i. Pipe, Valves and Fittings, in Place:	
120	lin. ft. 1 in.	0.40
50	lin. ft. 1½ in.	0.75
25	lin. ft. 2 in.	1.00
170	lin. ft. 2½ in.	1.00

★**Batesville, Ind.** — Contract awarded July 2 by Batesville Waterworks Co. for constructing earth dam to Hillenbrand Co., at $12,600; dam to be 250 ft. long, 12 ft. high, reinforced concrete face, and include 5000 ft. 8-in. c. i. mains and 9000 ft. electric transmission line. Chas. Brossmann, Consulting Engr., Indianapolis.

★**Berwyn, Ill.**—Contract awarded by Bd. Local Improv. (Oscar N. Lindahl, Secy.) for water supply pipe in Ogden and other streets to T. H. Iglehart, Chicago, at $12,282. Other bids: Charles M. Porter Co., Chicago, $13,161; T. C. Brooks & Sons, Chicago, $15,341.

★**Kohler, Wis.** — Contract reported awarded to E. M. Schreflow of Elgin, Ill., for constructing water works and sewer system at $10,633.

★**Cheyenne, Wyo.**—Contract awarded July 7 to Pittsburgh Filter Mfg. Co., Pittsburgh, Pa., for constructing rapid sand filter plant at Round Top reservoir, at $75,450. J. J. Showalter, City Clk.

★**Colfax, Wash.** — Contract to furnish 32,000 ft. c. i. water pipe to be used to bring water from Glenwood Springs to local reservoir, has been awarded to U. S. C. I. Pipe Co., Portland, Ore., at $54,386.

SEWERAGE AND SEWAGE DISPOSAL

PROPOSED WORK.

Amherst, Mass.—Sewer bonds for $30,000 reported sold.

Kenmore, N. Y.—Bonds for $20,000 for surface and storm water sewers reported sold.

Arlington, Md.—County Comrs. at Towson reported to have signed an order providing for a sewer system for Arlington.

Johnstown, Pa.—Council reported to have passed ordinance providing bond issue of $150,000 for sanitary sewers.

Maryland.—Following are among permits issued by Maryland State Dept. of Health (Robert B. Morse, Ch. Engr., 16 W. Saratoga Street, Baltimore) during June:

Easton—Addition to sewage disposal plant and permission to issue $15,000 in bonds for improvements.

Loch Lynn—Lateral sewer extensions.

Frostburg—Lateral sewer extensions.

Pocomoke City—Lateral sewer extensions.

Marianna, Fla.—Citizens voted $18,000 bonds for constructing sewer system.

Marianna, Fla.—Citizens voted $18,000 bonds for a sewer system.

Ft. Wayne, Ind.—Bd. of Pub. Wks. reported to have ordered construction of a main sewer for Spy Run Avenue district.

Aurora, Ill.—City Council considering construction of a sewer in Arlington Heights addition, to cost about $13,000. Myron Tarble, City Engr.

Three Forks, Mont.—Swearinger & McCulloch, Great Falls, making surveys and estimates for sewer system, to cost about $20,000.

Muskogee, Okla.—About $23,000 will be spent by City Comrs. in construction of North Mill Street sewer.

Tulsa, Okla.—T. C. Hughes, City Engr., writes plans will be prepared for proposed storm and sanitary sewer as soon as bonds are sold. Cost $100,000.

Boulder, Colo.—City considering construction of storm sewers and has appointed committee to look into matter. O. P. Clark, City Clk.

Seattle, Wash.—Plans for installation of sewers in Ferdinand Avenue at a cost of $65,000 have been approved by Bd. Pub. Wks. A. H. Dimock, City Engr.

Burns, Ore.—Bond issue of $40,000 reported authorized by City Council for sewer system. H. C. Levins, Mayor.

Compton, Cal.—Citizens reported to have voted $70,000 bonds for sewer system, from plans of Olmsted & Gillelen, Hollingsworth Bldg., Los Angeles.

Sacramento, Cal.—Sewers and drainage bonds for $106,000 have been sold.

San Francisco, Cal.—Bd. City Supervisors appropriated $65,000 for construction of sewers in Fifth Street.

Visalia, Cal.—Citizens reported to have voted $60,000 bonds for sewer system.

Berlin, Ont.—Willis Chipman of Toronto has submitted a tentative report on extension of sewage disposal plant, and recommends additional filtration beds and construction of new septic tank. Estimated cost $55,000.

BIDS DESIRED.

Bridgeport, Conn.—Until July 19 by Bernard Keating, Secy. Paving and Sewer Comn., for constructing sewers in portions of Seaview and Fairview Aves., Ford Pl., Lindley and several other streets.

Brooklyn, N. Y.—Until July 21 by L. H. Pounds, Boro. Pres., for furnishing material and constructing sewers in portions of Gravesend, 8th and Hegeman Aves. and 15th St. Engineer's estimate, $21,601.

Fairport, N. Y.—Until July 23, by Village Board (R. L. Williams, Clk.), for 1 mile of 8 and 10 in. sewer, advertised in Engineering Record. Engineer, C. F. Fisher, 526 Flower City Park, Rochester.

Camden, N. J.—Reported desired until July 19 by Com. on Streets and Highways, for constructing sewers in Chelton, Langham and Wildwood Avenues, Carman and several other streets.

Newark, N. J.—Until Aug. 31 by Passaic Valley Sewerage Comrs. (Joseph H. Quigg, Clk.) for constructing superstructure and appurtenances for Newark Bay Pumping Station, Part of Sect. 5 of Passaic Valley Sewerage Wks., advertised in Engineering Record. William M. Brown, Ch. Engr.

Until July 29 by Bd. Street & Water Coms. (Morris R. Sherrerd, Ch. Engr.) for constructing Frelinghuysen Ave. and Bound Creek sewer.

Warrenton, N. C.—See "Water Works."

Cheviot, Ohio.—Until July 28 by Albert J. Reusing, Village Clk., for constructing trunk drain.

Cincinnati, Ohio.—Until July 27 by Director Pub. Service (Parke S. Johnson, Secy.) for constructing sewers in Pogue Avenue and Strong Street.

Marion, Ohio.—Until July 21 by Director Pub. Service, for constructing sewers in portions of Waterloo St., Ballentine and Barks Ave.

Alma, Mich.—Until July 20 by D. W. Adams, City Clk., for furnishing material and constructing Rockingham, Woodworth and Gratiot Ave. sewers.

Appleton, Wis.—Reported desired until July 20 by E. L. Williams, City Clk., for sewer in College Ave. and State Road.

Cedar Rapids, Iowa. — See "Water Works."

Sandstone, Minn.—Until July 26 by C. Rudsuhle, Village Recorder, for constructing 9025 ft. 10, 8 and 6-in. sewer, 34 manholes, etc.

Wibaux, Mont.—Until July 26 for constructing sewer system from plans of C. H. Green Co., Spokane, Wash.; cost, $13,000.

Springfield, Mo.—About July 20, by City Clerk, for constructing sewer in Dist. 22 of Sect. 3 to include 10,392 ft. 8 in. and 967 ft. 10 in. pipe; 11 lampholes, 5 flush tanks, 29 manholes and 11,358 cu. yds. excav.

Toronto, Ont.—Until July 20 by T. L. Church (Mayor), Chmn. Bd. Control, for constructing sewers in Erie Terrace, Cloverdale Road, Welland Avenue and West Toronto sewer system, Div. No. 2; also storm overflow sewer in Atlantic Avenue and Liberty Street.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Danbury, Conn.—Only bid recently received to construct sewers on Crane, Osborne, Tamarack Streets and Ninth Avenue submitted by Luke E. Sweeney, Danbury, at $11,839.

★**Buffalo, N. Y.** — Contract reported awarded by Bd. Aldermen for sewer in Fillmore Avenue, between Appenheimer and Dewey Avenues, to the Fahning-Garey Constr. Co., Erie County Bank Bldg., at $22,249.

★**Syracuse, N. Y.**—Contract for constructing Huntley reinforced-concrete sewer system (bids opened July 12) awarded to J. C. Schrade, Inc., Brooklyn, at $82,731. M. B. Palmer, Deputy City Engr.

★**Harrisburg, Pa.**—Contract reported awarded by City Comrs. to Shessley & Son of Johnstown to construct three 48-in. reinforced concrete segment sewers on Rudy, Delancey and Spencer Streets, at $7638.

Washington, D. C.—Bids opened July 7 by Comrs. D. C. (Oliver P. Newman, Chmn.) for constructing 6000 ft. 10 and 12-in. pipe sewers, and following are lowest bids received: Section 1—Outlet sewer, William F. Cush, Washington, $3,634; Section 2—Service sewers, George Hyman, Washington, $2,450. Asa E. Phillips, Engr. and Supt. Sewer Dept.

New York, N. Y.—Following are bids opened July 9 by Pres. borough of Manhattan for constructing tunnel relief sewer in E. Forty-first Street and Madison Avenue: (a) Kingsbridge Constr. Co., 30 E. Forty-second Street, $143,839; (b) Leo Kelly, Inc., 1... Montague Street, Brooklyn, $175,051; (c) H. E. Fox Constr. Co., 81 E. 125th Street, $1... (d) Rodgers & Hagerty, 152d Street and Hudson River, $194,451; (e) Battery Eng. & Contr. Co., 7 Battery Place, $199,628.

	(a)	(b)	(c)	(d)	(e)
2... cu. yd. excav. shafts	$6.00	$3.50	$10.00	$10.00	$16.00
2... cu. yd. excav. shafts	9.00	16.25	15.00	20.00	20.00
7... cu. yd. excav. tunnels	9.00	10.20	10.00	12.00	12.00
... cu. yd. backfill	1.00	1.50	1.00	0.50	2.50
...4 cu. yd. Class A concrete	9.00	9.00	9.00	12.00	12.00
2,9... cu. yd. Class A concrete	9.00	9.65	10.00	10.00	11.00
... cu. yd. dry packing	2.00	2.50	2.00	5.00	3.50
... sq. yd. addl. trim. in shafts	0.50	1.00	3.00	3.00	4.00
1,0... sq. yd. addl. trim. in tunnels	0.50	1.00	3.00	3.00	3.00
4... bbl. Portland cement	1.50	2.50	2.50	5.00	7.00
29,870 sq. ft. hollow tile	0.25	0.31	0.50	0.30	0.25
95,000 lb. structural steel	0.01	0.01	0.04	0.04	0.06
56,500 ft. timber and lumber	0.01	60.00	50.00	50.00	50.00
290 lin. ft. 7 x 9 ft. sewer	45.00	51.00	60.00	50.00	45.00
100 lin. ft. 8 x 8 ft. sewer	36.00	46.60	50.00	50.00	50.00
60 lin. ft. brick sewer	20.00	24.00	24.00	15.00	16.90
170 lin. ft. brick sewer	18.00	24.00	24.00	17.00	15.00
1 transition section and sanitary branch	500.00	4,000.00	1,000.00	1,500.00	2,000.00
5 manholes	75.00	80.00	150.00	50.00	80.00
1... cu. yd. Class B concrete	6.00	7.00	7.50	8.00	8.50
25 cu. yd. dry rubble masonry	1.00	3.00	4.00	5.00	5.00
780 cu. yd. rock excav.	2.00	5.00	6.00	5.00	2.00
75 lin. ft. 12-in. vitr. pipe	1.00	3.00	1.50	1.00	0.50
22.7 M ft. timber	40.00	40.00	45.00	50.00	35.00
70 M ft. sheeting and bracing	30.00	30.00	45.00	30.00	45.00
5,500 lin. ft. piles	0.40	0.50	0.60	0.40	0.35
60 cu. yd. brick masonry	12.00	16.00	12.00	15.00	12.00
10 cu. yd. brick masonry	18.00	22.00	12.00	30.00	24.00
50 cu. yd. rubble masonry	4.00	4.00	5.00	6.00	5.00
400 cu. yd. stone ballast	1.50	2.00	1.00	2.00	5.00
6,000 lb. steel beams	0.03	0.05	0.04	0.03	0.06
9,000 lb. misc. cast iron	0.02	0.03	0.04	0.05	0.09
10,000 lb. steel rods	0.03	0.04	0.03	0.03	0.05
1,000 lin. ft. vitr. drain pipe	0.40	0.50	0.30	0.75	0.40
200 lin. ft. drain pipe	0.35	1.00	0.25	0.50	0.50
200 lin. ft. drain pipe	0.25	0.50	0.20	0.30	0.50

★**Memphis, Tenn.**—Contract for building Bayou Gayaso outfall from North Memphis pumping station to mouth of ... River, reported awarded to Koehler Bros., Fowler Constr. Co., Memphis, at $23,692.

Brewster, Ohio.—Following are 4 lowest bids opened July 2 for constructing sewers from plans of W. J. Sherman Co., Toledo: Rose-Cook Eng. Co., Akron, $9,267; Hadley & Dickey, Canton, $10,017; Wise Bros., Canton, $13,257; Kohlberger & Hoyles, Marion, $13,822. Work includes 11,175 ft. 8, 10, 12 and 18 in. sewer pipe, 10,875 lin. ft. trenching 6 to 22 ft. deep, 17 manholes, 6 drop manholes, etc.

★**Cleveland, Ohio.**—Contract awarded to Lake Erie Paving & Construction Co. for constructing sewer in Sandusky Avenue E. E., between E. Ninety-third and E. 102d Streets, at $19,000.

★**Cleveland, Ohio.**—Contract awarded by Bd. Control to Amata Constr. Co., Engineers Bldg., for constructing sewer in Superior Avenue northeast, at $26,000; to J. Connolly Constr. Co., for sewer in Luke Road, southeast, at $9,000; to William Lehman, for sewer in Prospect Avenue and W. Third Street at $16,036.

Cleveland, Ohio.—Following 8 lowest bids opened July 7 by Dept. Pub. Service, for constructing Walworth Run Diversion sewer, Sect. No. 1 (a) The Gawne Contr. Co., Cleveland, $137,590; (b) Dock Contractor Co., Hoboken, N. J., $140,460; (c) Jos. Winterbottom, Cleveland, $142,700.

Brick Sewer, Complete (Circular)	(a)	(b)	(c)
4... lin. ft. 5' 6" ...	$24.00	$25.65	$27.80
4600 lin. ft. 6' 6" ...	27.31	28.30	27.80
4... lin. ft. 6' 6" ...	26.45	28.30	27.80
4609 lin. ft. 6' 6" x 5' 6" section ...	26.47	29.11	27.80
1 — drop manhole and overflow chamber ...	4,500.00	3,500.00	3,200.00

Cleveland, Ohio.—Following 3 lowest bids opened July 7, by Dept. Pub Service, for Walworth Run Diversion Sewer, Sect. 2, (a) Donnelly & Graham, Cleveland, $161,262; (b) Haag & Zollo, Cleveland, $116,925; (c) Jos. Winterbottom, Cleveland, $116,925.

Brick Sewer, Complete (Circular)	(a)	(b)	(c)
3... lin. ft. 5' 6" ...	$27.26	$25.45	$35.00
2... lin. ft. 6' 6" ...	27.00	28.56	35.00
3750 lin. ft. 6' 6" ...	28.25	29.70	20.50
2... lin. ft. 6' 6" x 5' 6" section ...	29.11	27.72	35.00
1—manhole, "B" ...	2,800.00	6,000.00	2,400.00
1—manhole, "C" ...	100.00	100.00	150.00

★**Columbus, Ohio.**—Contract awarded by Bd. Pub. Service for constructing South Side storm sewer to J. C. Carland Co. of Toledo at $226,... Maryland Avenue storm sewer to O'Donnell & Thornberry, Connersville, Ind., for $49,256, and Greenville Street relief sewer to I. O. Jones, Columbus, at $12,702.

Contract for an addition to sewage disposal plant reported awarded to D. W. McGrath, Columbus, at $197,996.

Indianapolis, Ind.—Lowest bid opened June 25 for 16... Pipe ... for constructing 6546 ft. overflow sewer, 8 ft. 6 in. diameter on Mayne Road, submitted by Marion County Constr. Co., Indianapolis, at $18 and $19.00 per foot; total cost, $...

★**Berwyn, Ill.**—Contract awarded by Bd. Local Improv. Owner E. Fletcher, Supt., for constructing sewers in Oaklawn Ave. and other streets, to Chas. M. Porter Co., Chicago, at $16,684. Other bidders: T. H. Iglehart, Chicago, $19,230; Angelo Mascia, Chicago, $16,996.

★**Gibson City, Ill.**—Contract awarded by Comrs. of Sangamon & Drummer Drainage Dist. at office of Phillips & Swanson, Attorneys, Gibson City, to Henry Rees of Quincy, at $33,422, for constructing covered drains, about 12,928 ft., and 2 laterals; about 3304 ft. 38, 40 and 45-in. segment block sewer pipe; 9312 ft. 22 to 32-in. standard vitr. sewer pipe, 120 ft. 32 and 38-in. light weight c.-i. pipe, etc.

★**Kenosha, Wis.**—Work has started on the proposed sewers, to cost about $108,000. Contractors, Albert H. Prange & Co., Grand Rapids, Mich.

Kohler, Wis.—See "Water Works."

★**Sheboygan, Wis.**—Contract awarded by Bd. Pub. Wks. (C. U. Boley, Chmn.) for 12,055 ft. 12, 10 and 8-in. vitr. pipe sewers, 58 manholes, etc., to Birdsall-Griffith Constr. Co., Racine, at $8,398 (bids opened June 2). Next 3 lowest bidders: D. Van Stelle Co., Sheboygan, $8,902; A. H. Pits, Manitowoc, $9,357; P. Borst, Port Washington, $9,320.

★**Waupaca, Wis.**—Contract for constructing sewers in Main Street (bids opened June 26) awarded to C. H. Phillips, Waupaca, at 65 cts. per ft. J. F. Knudsen, City Clk.

★**Alameda, Cal.**—Contract awarded July 6 for constructing sewers to Tibbitts-Pacific Co., San Francisco, at $9,667. R. E. Bosshard, City Clk.

★**Port Angeles, Cal.**—Contract for constructing Lincoln Street trunk sewer (bids opened June 29) awarded to Mettler & Coit, Port Angeles, at following bid: 3420 ft. 8 to 21 in. vitr. Clay pipe sewers 36 cts. to $2.05 per ft.; 2670 ft. 24-in. reinforced concrete pipe, with specials, etc., $1.89, and 220 ft. 30-in. $3.13; 225 ft. c.-i. pipe with excav. and backfill, $4; 220 ft. 1 ring brick sewer 30-in., $4; 25 brick manholes, 4½ x 8 ft. each $4; 76 additional depth of M. H., $4; 1 brick flush tank, $100; 21 brick catch basins, each $40; 12 cu. yd. reinforced concrete in saddles and out fall, $12; 400 lin. ft. lumber cradle to carry sewer on trestle, 85 cts.; trenching and backfilling 6 to 26 ft. deep, 29 cts. to $2.64 per ft.; total, $28,064.

★Salt glazed vit. clay or cement pipe sanitary sewers in portions of three alleys (bids opened July 6), awarded contract to Christopher Kuppler, Port Angeles, at $7,982. J. L. Beam, City Clk.

BRIDGES

PROPOSED WORK.

Albany, N. Y.—Delaware & Hudson R. R. Co. (James MacMartin, Ch. Engr., Albany) submitted to Public Service Comm. plans for bridge to be constructed over Island Creek.

Binghamton, N. Y.—Council will soon call election to vote $30,000 bonds for 2 bridges, one on Noyse Island and one over Pierce Creek. J. A. Giles, City Engr.

Lewistown, Pa.—Plans submitted to Borough Council for constructing bridge at Dorcas Street, to be 130 ft. long, 30 ft. wide and paved with brick.

Clay, W. Va.—Reported to be a movement on foot to bond Clay County for $250,000 to be used for building bridges and constructing public roads.

Rainelle, W. Va.—J. S. Crawford, Clk. County Court, Lewisburg, writes all bids opened July 6 for constructing 3 steel or reinforced concrete bridges, one 25 ft. and two each 26 ft. with 16-ft. roadways, have been rejected.

Lexington, Ky.—Plans being considered for constructing bridge over Kentucky River at or near Clay's Ferry, which will be part of Dixie Highway through Madison and Fayette Counties. Harry B. Hanger, Vice-Pres. Dixie Highway Asso., Richmond, Va., said to be interested.

Zanesville, Ohio—The Swingle Bridge over Brush Creek on Stoverton Rd. reported destroyed by floods. County Comrs. contemplate constructing temporary bridge.

Detroit, Mich.—Citizens rejected proposition to construct the new Belle Isle Bridge at a cost of $2,000,000, at election held July 9. There is $110,000 available, and it may be used to repair bridge or to build a temporary bridge.

Somerset, Kan. — Comrs. of Pulaski County, at Somerset, considering construction of a bridge over Fishing Creek, to have one 110-ft. span.

Kansas City, Mo.—Kansas City Southern R.R. Co. (C. E. Johnson, Ch. Engr., Kansas City, Mo.) reported to be considering constructing 2-pier concrete bridge over Kaw River; cost about $115,000.

Little Rock, Ark.—The County, Interurban & Intercity Traction Co. and property owners on Main Street, it is reported, have agreed upon a plan to widen and strengthen the free bridge. Plans provide for creosoted block roadway, 32 ft. wide, with concrete sidewalks each side, 6 ft. wide, entire superstructure to be replaced; cost about $290,000.

Spokane, Wash.—Plans are being prepared by City Engineer for steel bridge to be constructed over river at Howard Street and for repaving and painting Division Street Bridge.

Portland, Ore.—Reported contract will soon be let by Commissioner Public Docks, Worcester Building, for constructing concrete viaduct 20 ft. wide and 180 ft. long at the end of Seventeenth Street on the county ferry right-of-way.

Alameda, Cal.—Plans being considered to construct a bridge at Webster Street; cost about $700,000. Frank Bartlett, Mayor, said to be interested.

San Francisco, Cal.—Bd. Supervisors appropriated $120,000 for constructing Strauss trunnion bascule bridge, substructure and approaches over channel waterway at Fourth Street, $120,000.

BIDS DESIRED.

Minetto, N. Y.—Until July 31 by E. A. Howard, County Supt. Highways, Oswego, for building concrete steel arch bridge over Oswego River at Minetto, advertised in Engineering Record. Engrs., Concrete Steel Eng. Co., Park Row Bldg., New York.

New York, N. Y.—Bids will probably be called for some time in Sept. by the Pub. Service Comm., 154 Nassau Street, for proposed rapid transit bridge over Bronx River at Westchester Avenue.

Glenolden, Pa.—Until Aug. 2 by Co. Comrs. at Media (Orion L. Davis, Controller) for constructing reinforced concrete bridge on Glenolden Ave., over Muckinapatus Creek, Glenolden, advertised in Engineering Record.

Harrisburg, Pa.—Reported desired until July 21 by Co. Comrs. for constructing concrete bridge across Philadelphia & Reading tracks at Nineteenth Street.

Houtzdale, Pa. — Until July 29 by Charles Dickey, Secy. Boro. Council, for constructing 20-ft. reinforced concrete bridge 60 ft. long. E. W. Hess, Engr., Clearfield.

Williamson, W. Va.—Until July 26 by Town of Williamson for constructing a joint bridge between Pike County, Ky., and town of Williamson; same consists of 3 130-ft. 1-in. spans, 176-ft. approach, piers between 40 and 62 ft. high.

Clearwater, Fla.—Until Aug. 7, by E. W. Parker, Curry Bldg., Tampa, Pres. and Gen. Mgr. of Tampa, Clearwater & Island City Railroad Co., for construction of bridge from Clearwater to Clearwater Key, to be about two miles long of standard pile and timber construction; to have one steel draw of 50 ft. clear opening, either swing or lift type, to rest on concrete piers: the bridge and two miles of approach will be 18 ft. wide and will have railroad track on one side, which will be decked over flush with top of rails, and used for roadway; bridge must be designed to carry 30-ton locomotive; bids wanted on steel draw bridge; all other material will be purchased locally.

Columbus, Ohio.—Until July 30 by Bd. County Comrs. (John Scott, Clk.) for superstructure, substructure and roadway of Eberly Bridge over Alum Creek, Truro and Madison Townships; removing and re-erecting Third Avenue Bridge over Olentangy River on Eberly Road over Alum Creek, Truro and Madison Townships; approaches to Shrock Bridge over Alum Creek, Blendon Township.

Coshocton, Ohio.—Reported desired until July 27 by Co. Comrs. Coshocton (F. C. McCullough, Co. Aud.), for block floor in Nellie River bridge and substructure and superstructure of 40 ft. Lennon Bridge, near Canal, Lewisville.

St. James, Minn.—Reported desired until July 19 by John C. Jensen, Co. Aud., for constructing steel and reinforced concrete bridges. Probable cost, $20,000. J. H. A. Bratz, Engr., Commercial Bldg., St. Paul.

North Yakima, Wash.—Reported desired until July 23 by Chas. E. Barrett, Co. Aud., for constructing a steel bridge, 60 ft. long, 18 ft. wide, northeast of Sunnyside, across the Yakima River; also a steel bridge 45 ft. long, 24 ft. wide, over Wenas Creek.

California.—Bids desired until July 26 by State Highway Comn., Sacramento, as follows:

Colusa County, through Arbuckle, about 0.3 miles, to be surfaced with asphalt, 55 ft. wide.

Marin County, between Burdell and St. Vincent, about 4 miles, to be graded.

Monterey County, from Greenfield to Camphora, about 11.7 miles, to be paved with Portland cement concrete.

Santa Barbara County, from Gaviota Pass to Zaca Station, about 11.4 miles, to be graded.

San Luis Obispo County, from Atascadero Creek to Paso Robles, about 10 miles, to be paved with Portland cement concrete.

Los Angeles, Cal.—Until Aug. 2 by Bd. Superv. H. L. Lelande, Clk., for constructing plate girder bridge over San Gabriel River at El Monte and Pomona Road.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Wiscasset, Me.**—Contract for constructing foundations for bridge over Maine Central R. R. tracks awarded to Holbrook, Cabot & Rollins, Boston, Mass.; cost of structure complete about $150,000.

★**Boston, Mass.**—Contract awarded by Bridge Comn. (John S. Merrill, Chmn.) to Clark & Gove, Boston, for work on Spring Street bridge over Charles River, at $15,850.

Buffalo, N. Y.—See "Railroads."

★**Cranford, N. J.**—Contract for constructing Union Avenue Bridge in Cranford awarded by Union County Bd. Freeholders at Elizabeth to Weldon Contr. Co., Rahway, at $11,270.

★**Bucyrus, Ohio.** — Contract for constructing Parcher Bridge substructure, fill and cutting new channel awarded by Co. Comrs. to Brady, O'Donnell & Malloy, at $8,543.

★**Rockford, Ill.**—Contract for constructing concrete bridge over Keith Creek at Kishwaukee Street awarded to Gust Holm, Rockford, at $8878.

St. Louis, Mo.—Bids were opened June 29 by Bd. Pub. Service (Wm. T. Finley, Secy.) for steel to complete east approach of Free Bridge, approximately 24,000 tons, and following are reported to be the two lowest bidders: American Bridge Co., St. Louis (lowest bidder), 2.165 cts. per lb., aggregate cost $1,035,000; Cambria Steel Co., Johnstown, Pa., 2.175 cts. per lb.

★**Bryan, Tex.**—Contract for constructing Pitts Bridge over Brazos River awarded by County Court to Austin Bros., Dallas, at about $7500.

★**Pawnee, Okla.**—Contract awarded by County Comrs. for Cimmaron River bridge to Midland Bridge Co., Kansas City, Mo., at $17,249. It will consist of four 150-ft. spans, with 16-ft. roadway, and 4 combination concrete piers. Other bids: Missouri Bridge & Iron Co., St. Louis, Mo., $17,690; Canton Bridge Co., Kansas City, Mo., $17,495.

★**Montesano, Wash.**—Contract for constructing Chehalis River Bridge awarded by county to Coast Bridge Co., Portland, Ore., at about $11,000.

Seattle, Wash.—Lowest bid opened by County Comrs. for constructing Strossel Bridge, at 209-ft. steel span, submitted by A. H. Cox & Co., 309 First Avenue, at $14,735.

★**Salinas, Cal.**—Contract for constructing Nacimiento Bridge over Salinas River awarded by Monterey County Bd. Supervs. to W. L. Gilham & Son, San Jose, at $29,030.

★**San Luis Obispo, Cal.**—Contracts awarded by County Comrs., July 8, for constructing Miles Station concrete bridge, 684 ft. long, to Gutleben Bros., New Call Building, San Francisco, at $21,700, and Sulphur Creek Bridge to E. J. Hunt, Oakland, at $2,245.

PAVING AND ROADS

PROPOSED WORK.

Fall River, Mass.—About $75,000 to be spent by city for street improvements.

Springfield, Mass.—The city will pave St. James Avenue with concrete.

Berlin, Pa.—Citizens voted June 29 to issue $8,000 bonds for repaving Main St. Engineer, Chas. S. Lemon of Hollidaysburg.

Darby, Pa.—About $30,000 will be spent by Borough Council for paving streets.

Richmond, Va.—All bids opened by Administrative Bd. for paving Fourteenth Street rejected; according to reports new bids will be received.
About $25,000 to be spent by city for street improvements in Norwood section of city.

Clay, W. Va.—See "Bridges."

Elkins, W. Va.—City will spend $40,000 for street pavements.

Byrdstown, Tenn.—About $50,000 is to spent by Quarterly Court for constructing pikes.

Elizabethton, Tenn. — Citizens voted $365,000 bonds July 7 for county road improvements. W. A. Williams, Co. Clk.

Defiance, Ohio.—City Council voted to spend about $89,500 for paving Arabella, Wayne, Jefferson, Washington and Front Sts.

Warren, Ohio.—County Comrs. sold about $63,000 good road bonds.

South Bend, Ind.—Bd. Pub. Wks. voted to pave S. Franklin Street; cost $18,000.

Moline, Ill.—Proposed to pave Fourth, Twenty-fourth and Twenty-fifth Streets with brick, about 8918 sq. yd.; also concrete sidewalks on various streets and avenues. Lyle Payton, City Engr.

Green Bay, Wis.—Until July 27, by W. L. Kerr, City Clk., for laying concrete pavement on W. Mason Street.

Le Mars, Ia.—City Council voted to pave 43 blocks of streets.

Vinton, Iowa.—Proposed to pave Whipple and Concord Streets with vertical fiber brick, on concrete foundation with concrete curb; asphalt covering 9200 sq. yd.; cost about $19,539. Percy P. Smith, Engr., Cedar Rapids; W. E. Klingaman, City Clk.

Hastings, Neb.—Citizens voted $50,000 bonds for paving. A. T. Bratton, City Clk.

Bozeman, Mont.—About 622,210 sq. ft. in W. Main St. Dist. is to be paved by city; cost $49,912.

Livingston, Mont.—City Council voted to pave Second and Callender Streets; cost about $12,000.
Main St. is to be paved by city at cost about $35,000.

Roundup, Mont.—City Council voted to construct cement sidewalks in Dist. No. 10; cost $10,000.

Walkersville, Mont.—City Council voted to pave N. Main Street; cost $10,000.

Cuero, Tex.—Bids are being received by County Judge for constructing roads in De Witt County Rd. Dist. No. 1; cost about $50,000.

Howe, Tex.—Citizens of Howe voted $60,000 bonds for road improvements.

Valliant, Okla.—Citizens of Wilson Township voted $14,000 bonds for improving roads.

Auburn, Wash.—City Council voted to grade, pave and curb 17 blocks in First Precinct.

Bellingham, Wash.—City Council voted to pave 5 blocks with concrete and 3 blocks with asphalt on Madison, Walnut Streets, etc.

Bremerton, Wash.—City Council voted to pave with concrete Fourth Street; cost about $20,000.

Cheney, Wash.—Plans and specifications being prepared by W. L. Morgan, Spokane, for 7 miles concrete sidewalks and 3 miles concrete curb, for city.

Everett, Wash.—Hans Mumm, Jr., County Engineer, been directed to prepare surveys for improving Road No. 14, Heberlein Road, Road No. 8 and Arlington-Stamwood Road.

Seattle, Wash.—Contract about to be let by Bd. Pub. Wks. for paving with brick Utah Ave.; estimated cost $87,000.
City Council voted to pave Rainier and Railroad Avenues with brick; also construct concrete sidewalks.
Bd. Pub. Wks. approved plans for paving Meridian Avenue; cost $35,000.

Tacoma, Wash.—City Council decided to pave South O Street from Sixth Avenue to S. Eleventh Street. Estimated cost $11,700. W. C. Raleigh, City Engr.

Clatskanie, Ore.—City Council contemplates constructing cement sidewalks on main street of city. A concrete retaining wall will be constructed along both sides of street distance of 3 blocks; cost $20,000.

Eastside, Ore.—City Engineer has been directed to prepare plans and specifications for paving and concrete sidewalks on Tenth and Eleventh Avenues, G, H Streets.

Portland, Ore.—County Comrs. considering constructing mountain road between Mount Hood Lodge in Multnomah County and Summit House in Wasco County.

Victoria, B. C.—Contract is about to be let by City Council for constructing concrete sidewalks; cost about $25,000.

BIDS DESIRED.

Holyoke, Mass.—Until July 23 by Bd. Pub. Wks. (Oscar C. Ferry, Asst. Clk.) for approximately 1500 sq. yd. prepared wooden paving blocks, advertised in Engineering Record.

Meriden, Conn.—Until July 27 by Bd. Pub. Wks. for wood block and reinforced concrete pavt. on Hanover St., advertised in Engineering Record.

Albany, N. Y.—Until July 19 by Bd. Contract and Supply (Isidore Wachsman, Secy.) for improving portions of Main Avenue, Bancker, Third, Quail and several other streets, to include paving with asphalt, vitr. brick, vitr. shale blocks, laying concrete walks, vitr. pipe sewers, extending water services, etc.
Until Aug. 3 by State Comn. of Highways (Edwin Duffey, Comr.) for repair of various highways, advertised in Engineering Record.

Brooklyn, N. Y.—Until July 21 by L. H. Pounds, Boro. Pres., for regulating, grading, curbing, and laying sidewalks on Montgomery and 81st Sts. and Porter Ave.; paving 63d and W. 36th Sts., in all 4695 sq. yds. asphalt pavement, 25,910 sq. ft. cement sidewalk, etc.

Hackensack, N. J.—Until July 19 by Hackensack Improv. Co. (Milton Demarest, Pres.) for surfacing State and Bergen Streets, requiring approximately 13,950 sq. yd. bituminous concrete surface, 1500 tons broken stone foundations and macadam surface, 7150 sq. yd. scarifying, etc.

Morristown, N. J.—Press reports state bids desired until July 19 by Co. Bd. Freeholders, Morristown, for constructing 2 sections of the Morristown-Dover Road from Denville Station to the Dover town line. Wm. E. King, Co. Engr.

Glenlyon, Pa.—Reported desired until July 19 by W. O. Davis, Secy. Comrs. of Newport Township, for about 7300 lin. ft. brick pavement. W. S. Norton, Engr., Alden Station.

Jewett, Pa.—Until July 26 by A. O. Lantz, Town Clk., for paving with vitr. brick on Main Street about 5857 sq. yd., advertised in Engineering Record. A. F. Bannon, Jr., Engr., Bradford.

Takoma Park, D. C.—Until July 26 at office B. Davis, Town Clk., 110 Oak Avenue, for constructing cement curbs, macadamizing roadways and constructing concrete streets.

Washington, D. C.—Until Aug. 10, by Secy. Bd. Comrs. D. C. Room 509 District Bldg. for laying cement sidewalks in Dist. of Columbia, advertised in Engineering Record.

Norfolk, Va.—Until July 29 by Bd. of Control, for about 36,000 sq. yd. sheet asphalt paving, and 800 sq. yd. wood block, as advertised in Engineering Record. W. H. Taylor, City Engr.

Bakersville, N. C.—Reported desired until July 19 by Bd. Road Comrs. (Bythe S. Peyton, Engr., and Supt.), for 8½ miles highway construction in Grassy Creek Township.

Sanford, Fla.—Until July 19 by M. W. Lovell, City Clk., for laying approximately 3000 sq. yds. brick paving on Magnolia Ave. F. T. Williams City Engr.

West Palm Beach, Fla.—Until Aug. 3 by A. M. Lopez, City Clk., for an 8-ton gasoline road roller.

New Orleans, La.—Until July 20 by A. G. Ricks, Comr. Finances, for installing sub-surface drains and paving eleven streets—75,510 sq. yd. paving will be either refined Trinidad Lake asphalt, oil manufactured asphalt, rock asphalt, bitulithic, asphaltic concrete, creosoted wood block or creolite wood lug block and approximately 1260 sq. yd. will be either vitr. brick, small granite block, creosoted wood block or kreolite wood lug block; also constructing approximately 55,000 sq. yd. gravel macadam oiled surface roadway. Bids also opened until Aug. 3 and Aug. 10 for paving additional streets with the materials above enumerated. Total approximate cost, $1,500,000. W. J. Hardee, City Engr.

Greenwood, Miss.—Until July 20 by Warner Wells, City Clk., for constructing approximately 18,000 sq. yd. concrete pavement, 10,000 lin. ft. concrete curb and gutters. Alternate bids desired on gravel instead of concrete pavement.

Memphis, Tenn.—Until Aug. 17, by City Clerk, for paving Wellington Street with asphaltic concrete on concrete foundation; cost $10,000. J. W. Weatherford, City Engr.

Cincinnati, Ohio.—Until July 22 by Director Pub. Service (Parke S. Johnson, Clk.) for grading, curbing and paving with asphalt and granite, Wade St. and with brick Starry Alley.

Lima, Ohio.—Until July 29 by H. J. Lawlor, Co. Aud., for 35,186 sq. yds. concrete pavement, 18 ft. wide, on public highway.

Mount Gilead, Ohio.—Until Aug. 6 by County Comrs. for constructing a macadamized road, known as the Sexon-Thacher Road, Gilead and Canaan Townships, about 2½ miles.

Ohio.—Until July 23 by Clinton Cowen, State Highway Comr, Columbus, for improvement on following roads (work in all counties includes bridges ad culverts, grading roadway and paving):
Allen County, Section "D," of Lima-Spencerville Road, Amanda and Spencer Townships: Constructing bridges and culverts, grading roadway and paving with bituminous macadam; length 16,403 ft.; cost, $35,988.
Ashland County, Section "J," of Ashland-Loudonville Road, Vermillion Township: Waterbound macadam; length 18,939 ft.; cost $45,727.
Ashtabula County, Section "I," of Hampden-Andover Road, Cherry Valley and Andover Townships: Paving with brick; length 14,861 ft.; cost, $37,248.
Athens County, Section "G," of Athens-McArthur Road, Alexandria Township: Paving with brick; length 7605 ft.; cost, $36,084.
Belmont County, Section "M," of Barnesville-Hendrysburg Road, Warren Township. Contract 1: Grading and building roadbed; length 13,491 ft.; cost, $10,588. Contract 2: With brick 16 ft. wide: length 13,491 ft.; cost, $50,935.
Champaign County, Section "M," of Urbana-West Jefferson Road, Union Township: Paving with waterbound macadam; length 2118 ft.; cost, $3,650.
Crawford County, Section "I," Columbus-Sandusky Road, Holmes Township: Paving with brick; length 12,100 ft.; cost, $46,976.
Harrison County, Section "O," Steubenville-Cambridge Road, Green Township: Paving with waterbound macadam; length 10,830 ft.; cost $18,885.
Hardin County, Section "I," of Ada-Forest Road, Liberty Township: Paving with waterbound macadam; length 7810 ft.; cost, $12,395.
Highland County, Section "K," of Hillsboro - Greenfield Road, Madison Township: Paving with waterbound macadam; length 5814 ft.; cost, $5,347.
Highland County, Section "H," Milford-Hillsboro Road, Liberty Township: Paving with waterbound macadam; length 4870 ft.; cost $4,589.
Highland County, Section "J," Cincinnati-Chillicothe Road, Madison Township: Paving with waterbound macadam; length 6737 ft.; cost, $7,796.
Highland County, Section "L," Hillsboro-Washington C. H. Road, Penn Township: Paving with waterbound macadam; length 5500 ft.; cost, $4,996.
Highland County, Section "I," Hillsboro-Piketon-Waverly Road, Liberty Township: Paving with waterbound macadam; length 25,116 ft.; cost, $19,023.
Huron County, Section "R," of Mansfield-Norwalk Road, Fitchville Township: Paving with concrete; length 10,365 ft.; cost, $28,415.
Lawrence County, Section "G," Ohio River Road, Union Township: Paving with bituminous macadam; length 10,150 ft.; cost, $22,061.
Mahoning County, Section "Q," Canfield-Poland Road, Canfield Township: Paving with waterbound macadam; length 7079 ft.; cost, $11,350.
Marion County, Section "J," Marion-Waldo Road, Waldo and Pleasant Townships: Paving with waterbound macadam; length 22,075 ft.; cost, $40,132.
Marion County, Section "I," of Marysville-Marion Road, Prospect Township: Paving with waterbound macadam; length 14,989 ft.; cost, $26,972.
Meigs County, Section "L," of Middleport-McArthur Road, Salisbury Township: Paving with brick; length 5280 ft.; cost $17,282.
Miami County, Section "D," Piqua-Urbana Road, Brown Township: Paving with bituminous macadam; length 22,658 ft.; cost, $44,279.
Monroe County, Section "I," Woodsfield-Marietta Road, Center Township: Paving with brick; length 400 ft.; cost, $2,166.
Montgomery County, Section "J," of Cincinnati-Dayton Road, Van Buren Township. Contract No. 1: Bridges and culverts, grading roadway and paving with brick; length 12,792 ft.; cost, $71,729. Contract No. 2: Grout pavement and dressing bermes, slopes and ditches; length 12,792 ft.; cost, $2,722.
Morgan County, Section "F," of McConnellsville-Athens Road, Marion Township: Paving with waterbound macadam; length 15,000 ft.; cost, $48,519.
Muskingum County, Section "L," Zanesville-Caldwell Road, Wayne Township: Paving with bituminous surface treated macadam; length 10,560 ft.; cost, $26,988.
Pickaway County, Section "J," of Lancaster-Circleville Northern Road, Circleville and Washington Townships: Paving with waterbound macadam; length 18,480 ft.; cost, $37,529.
Pike County, Section "L," Jackson-Piketon Road, Beaver Township: Paving with waterbound macadam; length 9765 ft.; cost, $15,633.
Portage County Section "P," of Cleveland-East Liverpool Road, Edinburg Township: Paving with concrete; length 16,727 ft.; cost, $30,387.
Portage County, Section "O," of Ravenna-Painesville Road, Ravenna Township: Bridges and culverts, grading roadway and paving with concrete; length 12,733 ft. or 2.41 miles; cost $27,403.
Preble County, Section "F," of Edon-Richmond Road, Jackson Township: Bridges and culverts, grading roadway and paving with bituminous surface treated macadam; length 30,086 ft.; cost, $32,661.
Scioto County, Section "I," of Jackson-Portsmouth Road, Clay Township: Bridges and culverts, grading roadway and paving with brick; length 10,560 ft.; cost $43,985.
Stark County, Section "H," of Canton-Steubenville Road, Osnaburg Township: Bridges and culverts, grading roadway and paving with brick; length 13,689 ft.; cost, $57,964.
Trumbull County, Section "O," Warren-Sharon Road, Howland Township: Paving with brick; length 7505 ft.; cost, $29,043.
Union County, Section "E," Urbana-Marysville Road, Paris and Union Townships: Paving with concrete; length 22,570 ft.; cost, $59,525.
Van Wert County, Section "D," Van Wert-Rockford Road, Pleasant Township: Constructing paving with waterbound macadam; length 11,640 ft.; cost, $18,955.
Vinton County, Section "I," of McArthur-Logan Road, Swan Township: Paving with waterbound macadam and concrete; length 6856 ft.; cost, $13,805.
Vinton County, Section "J," of Chillicothe-McArthur Road, Richland Township: Paving with bituminous surface treated macadam; length 5985 ft.; cost, $11,620.
Williams County, Section "K," of Bryan-Pioneer Road, Pulaski and Jefferson Townships: Paving with surface treated macadam; length 16,800 ft., or 3.18 miles; cost, $32,970. Alternate bids will also be received for paving with bituminous macadam; cost, $38,047.
Wyandot County, Section "F," of Upper Sandusky-Findlay Road, Crane and Salem Townships: Paving with waterbound macadam; length 20,600 ft.; cost, $35 288
For Bureau of Maintenance and Repair, Medina County, Sections A, B. C and H of the Cleveland-Wooster Road, I. C. H. No. 25, in Medina, Brunswick, Guilford and Montville Townships: Paving with surface treatment of H. O. and grit, 10 and 12 ft. in width; length 15,067 ft.; cost, $1.702.
Muskingum County, Section "B," of the Zanesville-Dresden Road, Falls Township: Paving with brick on a concrete foundation: length 5935.5 ft.; cost, $15,204.
Preble County, Section "C," of Hamilton-Eaton Road, Washington and Jasper Townships: By surface treating with H. O. and grit 16 ft. wide; length 13.368 ft.; cost. $2.400.
Preble County, Section "B," of Dayton-Indianapolis Road, Washington Township: Paving with surface treatment of H. O. and grit, 16 ft. wide; length 10,560 ft.; cost. $1,877.
Sandusky County, Section "A-1," of Fremont-Port Clinton Road, Rice Township: Paving with surface treatment of H. T.-1 and grit 16 ft. wide; length 8115 ft.; cost $1,442.

Zanesville, Ohio.—Until July 22 by Director Pub. Service (A. J. Voll, Clk.) for furnishing material and improving Second and Third Streets, Lake and Jewett Drives, by grading, curbing and paving.

Ann Arbor, Mich.—Until July 21 by Bd. Pub. Wks. for 3200 sq. yds. reinforced concrete pavement. Manley Osgood, City Engr.

Fairbury, Ill.—About Sept. 1, by C. R. Virgin, City Clk., for paving Maple, Walnut, First, Second, Third, Fourth and Fifth Streets with brick block on 5-in. concrete foundation, sandstone curb, asphalt or grout filler; total cost about $92,000. Engineers Melluish & Broyhill, Unity Bldg., Bloomington.

Oak Park, Ill.—Until July 20 by B. C. Branstadt, Secy. Bd. Local Improv., for grading and paving with asphaltic concrete, constructing granite combined curb and gutters, etc., on portions of Jackson Street, Lyman, Highland, Humphrey and Seventy-second Avenues.

Milwaukee, Wis.—Bids being received by Pub. Wks. Dept. for paving Center Street with creosote block and Vliet Street with asphalt and sandstone pavement.
Until July 20 by Louis M. Kotecki, City Compt., for grading, constructing cement sidewalks and driveways, combination curb and gutter, on a portion of several streets, including 33d and 8th Sts., Finn Pl. and 10th Ave.

Burlington, Iowa.—Until July 26 by F. W. Barrett, Co. Aud., for grading, tiling and laying concrete pavement on one mile of road.

Clinton, Iowa.—Until July 20 by F. W. Leedman, City Clk., for 12,238 sq. yds. vitr. block paving, 3800 lin. ft. concrete curbing. J. G. Thorne, City Engr., 317 Howe Blk.

Glenwood, Iowa.—Until July 19 by City Clerk, for paving Walnut, Vine, Sharp, 1st and 4th Sts. with 6-in. Portland concrete mixture 1:2:4; cost $18,000. A. O. Garrett, City Engr.

Le Mars, Iowa.—Until July 21 by D. Struble, City Clk., for paving Plymouth, Eagle and other streets with 6-in. concrete pavement, 30 ft. wide, about 3 miles in length; estimated cost $1.25 per sq. yd. B. C. Woolley, City Engr.

Spencer, Iowa.—Until July 27 by E. O. Keefe, City Engr., for about 70,000 sq. yd. paving. Bids will be received on Natural Lake sheet asphalt, brick block, creosoted wood block and cement concrete.

Kansas City, Mo.—Until July 20 by Bd. Pub. Wks. (Edw. F. Webster, Acting Secy.) Warwick Boule., 62d St. and Lydia Ave.

Springfield, Mo.—About July 26 by City Clk. for paving with asphaltic concrete Nettleton Ave. about 3,000 sq. yds. estimated at $1.50 per sq. yd. and with Tarvia on Jones from Chestnut St. to Grand Ave. 12,000 sq. yds. estimated at $1.28 per sq. yd.

St. Louis, Mo.—Until July 23 by Bd. Pub. Service (William T. Reedy, Secy.) for grading and improving various streets, including Berlin Ave., Kingshighway Boulevard, etc., Lettings Nos. 134 to 137, inclusive, and costing a total of about $[illegible].

Ashdown, Ark.—Until July 23 by Comrs. Road Improv. Dist. No. 1 (A. N. Wood, Comrs.), for improving approximately sixteen miles road. The work consists of grading, bridging and surfacing.

Ashdown, Ark.—Until July 26 by Co. Comrs. for 25 miles gravel road. Little River Road Improv. Dist. No. 1; cost, $60,000. H. R. Carter, State Highway Engr., Little Rock.

Russellville, Ark.—Until Aug. 6 by Co. Comrs. for 25 miles gravel road. Road Improv. Dist. No. 1, cost $150,000. H. R. Carter, State Highway Engr., Little Rock.

McKinney, Tex.—Until July 29 by Charles Schultz, City Engr., for 2300 sq. yds. asphalt pave., 2000 sq. yds. brick pave and 1500 ft. curb and gutter.

Seguin, Tex.—Precinct No. 2, Guadalupe County, has sold $75,000 road bonds, and County Clerk will receive bids on 6 miles of road July 15. Engineer, F. E. Hess, 1604 Southwestern Life Bldg., Dallas.

Dewey, Okla.—Reported desired until July 26 by City Clerk, for about 16,000 sq. yd. concrete paving. J. H. Chandler, Engr., 104 E. Fourth Street, Bartlesville.

Issaquah, Wash.—Reported desired until Aug. 2 by Byron Phelps, Clk. Bd. County Comrs., Seattle, for laying crushed rock surface on Highway No. 7B, between Issaquah and Falls City, about 8 miles. Preamble cost $[illegible].

Seattle, Wash.—Reported bids desired until Aug. 2 by Byron Phelps, Co. Aud., for constructing Permanent Highway No. 11, Enumclaw-Buckley Road. Probable cost $[illegible].

Tacoma, Wash.—About July 20, by County Pub. Wks. for paving Pacific Highway between Center Street and South Tacoma, with asphalt on a 5-in. concrete foundation. Cost about $38,000. W. C. Raleigh, City Engr.

Los Angeles, Cal.—Until July 26 by Bd. Supervs. (H. J. Lelande, Clk.) for improving portion of Crescent Ave., Road Dist. No. 9 and Colorado St. and Rose Ave., Road Dist. No. 1.

PRICES AND LETTINGS.

★Indicates award of contract.

★Boston, Mass.—Contract awarded by Public Works Dept. to Coleman Bros., Pearl and Marginal Streets, Chelsea, for wood block paving in Tremont Street, at $[illegible].

★Windsor Locks, Conn.—Contract for constructing sidewalks awarded by Bd. Selectmen to Gifford Constr. Co., Jamaica, N. Y., at about $30,000.

Albany, N. Y.—Following are lowest bids opened July 7 by State Highway Comr. at 65 Lancaster Street for repair of highways by State Aid:

Repair Contract 792, Albany County, 7.69 miles: W. L. Lawton, Glens Falls, $23,411; Olin T. Benedict, Pittsfield, Mass., $24,[illegible]; De Graff & Hardenburg, Kingston, $26,[illegible]; A. J. Medley, Schenectady, $25,[illegible].

Repair Contract 794, Albany County, 2.02 miles: Belmar Contr. Cor., Inc., Troy, $10,516; Huntoon & Ferguson, Hudson Falls, $10,602; James Anderson, Menands, $11,[illegible]; M. F. Howard Asphalt, $10,[illegible].

Repair Contract 799, Broome County, 6.21 miles: Kingsbury & Ryan, Binghamton, $[illegible].

Repair Contract 741, Cayuga County, 6.15 miles: Semper Bros., Watertown, $31,[illegible]; Pioneer Bros., Auburn, $31,082; Antonio Mondo, Syracuse, $34,369; Thomas Grady, Rochester, $34,[illegible].

Repair Contract 798, Cayuga County, 11.52 miles: Dana W. Robbins, Inc., New York, $5,933; Pathfinder Constr. Co., Inc., Fulton, $[illegible].

Repair Contract 791, Columbia County, 7.[illegible] miles: Henry Clinton, Poughkeepsie, $8,[illegible].

Repair Contract 788, Columbia County, 7.[illegible] miles: William Doyle, Saugerties, $5,116; Thomas H. Karr, Troy, $5,139.

Repair Contract 787, Columbia County, 2.[illegible] miles: William Doyle, Saugerties, $5,085; Marks Mearney, Hudson, $5,275.

Repair Contract 784, Columbia County, 7.63 miles: William Doyle, Saugerties, $[illegible]; Dickinson Bros., Madison, $4,[illegible].

Repair Contract 786, Delaware County, 7.[illegible] miles: [illegible] Contr. Co., Troy, $14,689; McGreevey, McGuigan & Baum, Elmira, $14,417; Richard Hopkins, Troy, $[illegible].

Repair Contract 490, Dutchess County, 2.[illegible] miles: Henry Clinton, Poughkeepsie, $9,995; Thomas J. Martin, Beacon, $10,258; William Doyle, Saugerties, $10,870.

Repair Contract 796, Erie County, 3.15 miles: Cold Spring Constr. Co., Buffalo, $16,971; John W. Landel, Tonawanda, $[illegible].

Repair Contract 805, Franklin and St. Lawrence Counties, 32.7 miles: Harry W. Roberts & Co., Utica, $11,073; Spellman-Oliver Co., Chateaugay, $11,117; E. T. Eagleston, Yonkers, $11,563; Richard Hopkins, Troy, $11,764.

Repair Contract 800, Rockland County, 3.3 miles: John A. Jova, Inc., Newburgh, $21,166; Schunnemunk Constr. Co., Highland Mills, $22,165; H. B. Sproul Contr. Co., Inc., Peekskill, $24,525.

Repair Contract 803, Rockland County, 3.33 miles: John J. Guinan Contr. Co., Brooklyn, $17,885; Paul Granger, Monsey, $18,241; John A. Jova, Inc., Newburgh, $18,783; H. B. Sproul Constr. Co., Inc., Peekskill, $22,987.

Repair Contract 793, Saratoga County, 3.09 miles: William J. Morrissey, Saratoga Springs, $13,497; Gaylor Stone Co., Inc., Saratoga Springs, $14,633; Huntoon & Ferguson, Hudson Falls, $15,245; William L. Sherrill, Hudson Falls, $15,561.

Repair Contract 795, St. Lawrence County, 17.66 miles: P. J. Kennedy, Brasie Corners, $5,956; Richard Hopkins, Troy, $6,865.

Repair Contract 808, Schenectady County, 3.34 miles: Huntoon & Ferguson, Hudson Falls, $3,800.

Repair Contract 790, Westchester County, 14.87 miles: Miguel Houck, White Plains, $6,679; Tri-County Constr. Co., Mount Vernon, $7,479.

Repair Contract 804, Greene County, 14.85 miles: Catskill Constr. Co., Catskill, $7,184; Conway Bros. & Kennedy, Eddyville, $7,267.

Repair Contract 797, Herkimer County, 8.78 miles: Daniel B. Donovan, Rome, $11,440; W. L. Lawton, Glens Falls, $13,813; John J. Guinan Contr. Co., Brooklyn, $13,857; John A. Jova, Inc., Newburgh, $14,347.

Repair Contract 662, Madison County, 5.68 miles: J. H. Weidman, Syracuse, $26,884; Paddelford & King, Sherburne, $27,033; John H. Gordon, Albany, $27,146; Charles E. Haney, Camillus, $27,195.

Repair Contract 633, Monroe County, 1.39 miles: I. M. Ludington Sons, Inc., Rochester, $10,686; Monroe Roads Co., Pittsford, $11,083; Ribstein-Holter Co., Inc., Rochester, $11,691; Whitmore-Rauber & Viemans, Rochester, $12,538.

Repair Contract 676, Oneida County, 1.04 miles: Phelan & Sullivan, Utica, $5,972; Charles E. Haney, Camillus, $6,189.

Repair Contract 782, Oneida County, 1.58 miles: Harry W. Roberts & Co., Utica, $9,011; Charles E. Haney, Camillus, $9,525.

Repair Contract 783, Oneida County, 1 mile: Daniel O'Connell & Sons, Holyoke, Mass., $16,937; Langan Contr. Co., Albany, $17,391; Harry W. Roberts & Co., Utica, $17,981; R. B. Cooper, Little Falls, $28,883.

Repair Contract 784, Oneida County, 4.02 miles: Dana W. Robbins, Inc., New York City, $5,936; Charles E. Haney, Camillus, $6,132.

Repair Contract 801, Oneida County, 24.82 miles: Harry W. Roberts & Co., Utica, $8,490; Dana W. Robbins, Inc., New York City, $8,974.

Repair Contract 644, Ontario County, 5.68 miles: Semper Bros., Watertown, $16,531; Chambers & Barnes, Rochester, $17,825; Thomas Grady, Rochester, $18,273; Dale Eng. Co., Utica, $18,444.

Repair Contract 802, Ontario County, 7.37 miles: County Const. Co., Troy, $4,358; Sweeney & Boland, Rochester, $4,524.

Repair Contract 789, Orange County, 37.71 miles: Edward Hartney, Modena, $2,736; Westchester-Dutchess Cor., Mount Vernon, $3,120.

Repair Contract 807, Rensselaer County, 5.94 miles: Gleason & Davitt, Albany, $30,921; Olin T. Benedict, Pittsfield, Mass., $31,644; Huntoon & Ferguson, Hudson Falls, $31,663; Belmar Contr. Co., Inc., Troy, $31,766.

★Batavia, N. Y.—Contract for paving with concrete Washington, Tracy, Dellinger and Vernon Avenues and Elm Street awarded by Common Council to Thomas Holahan, Rochester, at $53,156.

Elmira, N. Y.—Lowest bid opened June 24 for paving William Street submitted by Holleran Bros., Elmira, as follows: 11,788 yd. Tuna Valley-Wire Cut Lug, $2.14; 10 lin. ft. Medina headers, 90 cts.; 700 lin. ft. reset curb, 50 cts.; 11,788 sq. yd. Elastite sandwich expansion joints, 2 cts.; total $25,842. Other bids: McGreevy, McGuigan & Baum Constr. Co., Elmira, $26,375; Connors & Gallavan, Elmira, $26,644.

Totals of bids for paving W. Water Street opened June 24, 3019 yd. Corning repressed block: Holleran Bros., Elmira, $11,047; McGreevy, McGuigan & Baum Constr. Co., Elmira, $10,477; Connors & Gallavan, Elmira, $11,316; John O. Weston, Yonkers, $11,240. Louis C. Andrews, City Clk.

★Allentown, Pa.—Contracts for paving awarded by City Council as follows (price given per sq. yd.): Howard, Seventeenth, E. Hamilton and Hanover Streets with asphalt, to Barber Asphalt Paving Co., at $1.76; Tenth and Jackson Streets with amiesite, to Weaver Contr. Co., at $1.30; Chew, Ninth and Linden Streets with bituminous macadam, to Geo. H. Harder, at 95 cts.

★Philadelphia, Pa.—Contracts for paving awarded by M. L. Cooke, Dir. Dept. Wks., as follows: Eleventh, Fairhill, Media, Seventh Streets, Cobb's Creek Parkway and Lansdowne Avenue, at $23,833, and for Crefeld St., with bituminous, at $13,257, to Eastern Paving Co., 1414 S. Penn Square. Gross and Thompson Streets, with asphalt, to Barber Asphalt Paving Co., Land Title Bldg., at $19,189.

★Elkton, Md.—Contract for constructing roads awarded by County Comrs. (bids opened June 24) as follows: Cecilton-Warwick Road, 3.77 miles, to Juaniata Paving Co., at $36,827; Rowlandsville-Five Point Road, 2.96 miles, to E. Ward Brown, Port Deposit, at $28,277.

Frederick, Md.—Lowest bid received by County Comrs. (H. L. Gaver, Clk.) for State Aid Road near Petersville and Brunswick, submitted by M. J. Grove Lime Co. of Lime Kiln, at $34,027.

★Drainage Work—Westlake, La.—Contract awarded July 7 by Sulphur Drainage Dist. (W. H. Managan, Pres.) for 15 miles open ditches to Gray & Webster of Vinton, La., at $17,500. F. Shutts & Son, Engrs., Lake Charles.

★Carlisle, Ky.—Contract awarded June 29 by County Comrs. (J. F. Sugg, Clk.) for reconstruction of about 16 miles of turnpike in Nicholas County to Brent Haggard of Winchester and Chandler & Son, Versailles.

★Canton, Ohio.—Contract for paving portion Harrisburg Rd. (bids opened June 23 by Bd. Pub. Service) awarded to F. A. Downs Constr. Co., Canton, at $25,306, for Metropolitan wire cut lug brick with grout fill, asbestos protected Metal Company's expansion strip, Ohio quarries Berea stone curb and concrete sidewalks.

Contracts for paving awarded by Bd. Control as follows: Dueber Avenue, S. W., with asphalt to Cleveland Trinidad Paving Co., Cleveland, Ohio, at $49,797, and Fifth Street, N. E., to Peter Christensen, Canton, at $28,015.

Circleville, Ohio.—Three lowest bids opened June 24 for paving Scioto Street with Hocking block, cement fill: Reichelderfer Bros., Circleville, $14,233; Harpster & Stewart, Bremen, $14,646; Strodbeck Bros., Middletown, $15,286.

★Cleveland, Ohio.—Contract awarded by Bd. Control to Cleveland Trinidad Paving Co. for grading, draining and paving E. Seventy-second Street, from St. Clair Avenue northeast to N. Y. Central R.R. at $16,500.

★Dayton, Ohio.—Contract for constructing approach to Stewart Street Canal bridge awarded to Geiger & Finke, at about $5500.

★Grand View Heights, Franklin County, Ohio.—Contract for grading, macadamizing, etc., Wyandotte, Lane and Lincoln Roads awarded to W. M. Graham, Hartman Bldg., Columbus, at $25,798. D. E. Sullivan & Son, Columbus, also bid for the work $27,383. Thomas G. Constable, Village Clk.

★Ohio.—Contracts for state highways awarded by State Highway Comn., Columbus, on June 29, as follows:

Sandusky County, Sandusky-Clyde Road, Townsend Township, concrete, 1.2 miles, Earl Walters, Sandusky, $15,490.

Medina County, Cleveland-Wooster Road, Medina Township, macadam, 1.8 miles, Kennedy-Warner Co., Medina, $13,152.

Lake County, Painesville-Warren Road, Concord Township, macadam, 2 miles, Public Constr. Co., Elyria, $14,802.

Union County, Marysville-Marion Road, Paris Township, macadam, 1.3 miles, Sylvester Maughman, Marysville, $10,642.

Franklin County, Columbus-Newark Road, Marion and Jefferson Township, 8.5 miles, bituminous macadam, Graham & Kinnear, Columbus, $60,128; or alternative of Lignin liquor macadam, Graham & Kinnear, Columbus, $63,341.

Columbus - Marysville Road, Perry Township, macadam, 3.3 miles, Graham & Kinnear, $29,635.

Licking County, Summit Station extension; Lima Township, macadam ½ mile, J. C. Imboden, Logan, $3,375.

Licking County, Columbus-Newark Road, Lima Township, macadam, 1 mile, E. C. Radebaugh, Logan, $6,566.

Lucas County, Toledo-Wauseon Road, Swanton Township, macadam, 4.7 miles, The Public Contr. Co., Elyria, $17,374.

Muskingum County, Zanesville-McConnelsville Road, Wayne Township, brick, 6 miles, Ward, Patrick & Co., Wheeling, W. Va., $9,927.

★Toledo, Ohio.—Contract awarded by County Comrs. June 29 as follows: To Doan & Langenderfer, Toledo, to grade, drain and surface with a waterbound macadam or a bituminous binder, Road 63, about ½ mile, and to Phil Garrigan & Son, Toledo, for paving with bituminous binder, Road 64, about 3.35 miles, both in Monclova Township.

Contracts for paving awarded by Bd. Control as follows: Summit Avenue, to H. P. Streicher & Co., Toledo, at $15,601, and Main and Monroe Streets, to Russell & Jennison Co., 313 Huron Street, at $35,641.

★Utica, Ohio.—Contract for paving Mill, Spring, Church and Mechanic Streets with brick awarded by City Council to Henderson & Co., Coshocton, at $32,336.

★Zanesville, Ohio.—Contract for paving South River Road awarded by State Highway Comn., Columbus, to Ward, Patrick & Co., Wheeling, W. Va., at $9927.

★Peoria, Ill.—Contract awarded by Bd. Local Improv. for paving Fisher Street with brick to John McAllister, Peoria, at $16,884. Other bids: A. D. Thompson Co., $17,250; Chas. T. McElwee, $17,589; Canterbury Bros., $17,762; D. A. Myers, $18,630. (Bidders all of Peoria.)

★Sheboygan, Wis.—Following are 4 lowest bids opened July 2 for grading, paving with vitr. brick, including concrete curb, sidewalk, etc., on S. Fourteenth Street: John Braun, Sheboygan, $30,260 (awarded contract); Murphy Constr. Co., Manitowoc, $30,447; Pestien & Naumann, Sheboygan, $32,505; Birdsall & Griffith Constr. Co., Racine, $33,012. C. W. Boley, City Engr.

Davenport, Iowa.—McCarthy Improv. Co., submitted lowest bid July 6, for paving Forest Road and Muller Ave. with asphaltic concrete; 8250 sq. yds. at $1.60 and $1.63 per sq. yd., and 16th St. with sheet asphalt; 2160 sq. yds. $1.89 per sq. yd.; curb and gutter, 62 cts. per lin. ft. excav., 40 cts. per cu. yd. J. W. Crowley, Chmn. Bd. Pub. Wks.

★West Minneapolis, Minn.—Contract awarded by Village Trus. to L. Lundquist of Hopkins for constructing cement or concrete sidewalks for ensuing year at 58 cts. per sq. yd.; 27 cts. per lin. ft. for curb (bids opened July 6). E. A. Close, Village Recorder.

★Fargo, N. D.—Contract for paving Fourth Street with bitulithic awarded by City Comrs. to S. Birch & Son, Fargo, at $26,123.

★Levee — Redfork, Ark.—Contract for levee work, about 354,000 cu. yd., reported awarded to Denison & Rogers of Memphis, at 13.75 cts. per cu. yd.

★Pine Bluff, Ark.—Contract for constructing 22 miles gravel road from Pine Bluff south to Lincoln County line awarded by Comrs. Rd. Dist. No. 7 to Henslee & Perdue Co., Pine Bluff, at $90,000.

★McAlester, Okla.—Contract for paving Third Street awarded by City Council to John W. Rook, McAlester, at $12,032.

★Seattle, Wash.—Contract awarded to Booker Kiehle & Whipple for paving Woodinville-Duvall Road (bids opened by Co. Comrs. June 21) as follows: 41.13 acres clearing, $90; 12.38 acres grubbing, $125; 84,806 cu. yd. excav., common, including 400 ft. free haul, 25 cts.; 500 cu. yd. excav., solid rock, 75 cts.; 4252 cu. yd. loose rock, 40 cts.; 10,318 cu. yd. borrow common, including 400 ft. free haul, 30 cts.; 77,060 cu. yd. overhaul on any of above 1¼ cts.; 58 cu. yd. rip rap hand placed $3; 259.91 cu. yds. concrete 1:2:4 mix, $11.50; 13,908 lb. reinforcing bars, 5 cts.; 2100 sq. ft. cedar log bulkhead, 25 cts.; 1200 sq. ft. cedar tie and anchor logs, 15 cts.; 200 lin. ft. 6-in. porous tile drain, 25 cts.; 425 lin. ft. 8-in. vitr. tile pipe, 2nd grade, 50 cts.; 2208 lin. ft. 12-in., 85 cts.; 117 lin. ft. 18-in., $1.75; 66 lin. ft. 24-in., $3; removing old puncheon bridge (lump sum), $200; 510 ft. embankment rail, 25 cts.; 12,705 cu. yd. crushed rock, $2.50; 12,705 cu. yd. screening gravel, 20 cts.; 266,074 cu. yd. overhaul gravel, 1¼ cts.; total, $45,275.

★Tacoma, Wash.—Contract for constructing 31 blocks cement sidewalks in North End awarded by City Council to Erickson & Anderson, Tacoma, at $13,879.

★Contract for constructing cement sidewalks in N. Thirty-seventh, Thirty-eighth, Thirty-ninth, Mason and other streets awarded by Bd. Pub. Wks. to S. R. Gray, Tacoma, at $9695.

Linnton, Ore.—Following are lowest bids opened by City Council for constructing 2 sections of Hillside Boulevard—(a) includes 28,000 cu. yd. excav, 10,000 yd. hard rock, etc.; (b) includes 14,000 yd. excav., etc.: Standifer-Clarkson Co., Portland, at $14,709 for (a) and Eliott Contr. Co., Portland, (b) $7,177.

★Oregon City, Ore.—Contract for paving Main St. with asphaltic concrete awarded by City Council to Worswick Paving Co., Astoria, at $14,184.

California.—Bids opened July 6 by State Highway, Comn., Sacramento, for state road work as follows:

Tehama County, Div. 3, Route 3, Section C—Lowest bidder, James Fitzpatrick, Sacramento, as follows: 83,400 cu. yd. excav., without classification, 45 cts.; 2268 lin. ft. 12-in. corrugated iron pipe, 45 cts.; 670 lin. ft. 18-in., 55 cts.; 288 lin. ft. 24-in., 70 cts.; 700 cu. yd. cement concrete, Class "B" (culverts and slope paving), $11; 120 cu. yd. cement concrete, Class "C" (retaining walls), $9; 236 monuments, to haul and set, each $1; total $48,136. Next 3 lowest bids: F. Rolandi, San Francisco, $48,773; H. H. Harlan & C. M. Harlan of Williams, $49,214; G. W. Conners, Eureka, $52,117. Engineer's estimate, $54,093.

Tulare County, Div. 6, Route 10, Section A—Lowest bidder, White & Gaskill, Long Beach, as follows: 2970 cu. yd. excav. (ordinary), 55 cts.; 2220 cu. yd. excav. (borrow), 55 cts.; 210 lin. ft. corrugated iron pipe, 12 in., 65 cts.; 174 lin. ft. 18-in., 75 cts.; 11 cu. yd. cement concrete, Class "B," $14; 3840 cu. yd. cement concrete, Class "B" (pavement), $3; 16 monuments, to haul and set, ea. $1; total $14,812. Next 3 lowest bids: John D. Marsh, Bakersfield, $15,270; Highway Paving & Constr. Co., San Francisco, $17,439; Shattuck & Nimmo Warehouse Co., Bakersfield, $17,522. Engineer's estimate, $17,934.

Tulare County, Div. 6, Routes 4 and 10, Sections D and E—Lowest bidder, White & Gaskill, Long Beach, as follows: 14,350 cu. yd. excav. (ordinary), 45 cts.; 2000 cu. yd. excav. (borrow), 50 cts.; 210 lin. ft.

12-in. corrugated iron pipe, 65 cts.; 130 lin. ft. 18-in., 75 cts.; 195 lin. ft. 24-in., 85 cts.; 248 cu. yd. cement concrete, Class "B" (culverts and monuments), $14; 6350 cu. yd. cement concrete, Class "B," $2.85; 1500 lin. ft. guard rail, 60 cts.; 51 monuments, to haul and set, each $1; total $30,378. Next 3 lowest bids: John D. Marsh, Bakersfield, $30,408; Shattuck & Nimmo Warehouse Co., Bakersfield, $32,460; Highway Paving & Constr. Co., San Francisco, $33,451. Engineer's estimate, $35,063.

★Contra Costa County, Div. 4, Route 14, Section B—Lowest bidder, Urban Constr. Co., San Francisco, as follows: 65,000 cu. yd. excav., without classification, 36 cts.; 640 lin. ft. corrugated iron pipe, 12 in., 40 cts.; 680 lin. ft. 15-in., 50 cts.; 470 lin. ft. 18-in., 50 cts.; 92 lin. ft. 21-in., 60 cts.; 370 lin. ft. 24-in., 70 cts.; 72 lin. ft. 30-in., $1; 555 cu. yd. cement concrete, Class "B," $9; 147 monuments, to haul and set, each $1.50; total $29,833. Next 3 lowest bids: Bates, Borland & Ayer, Oakland, $33,622 (awarded contract); Richard R. Rothwell, Los Angeles, $34,054; Fairbanks & Baechtel, Willits, $34,190. Engineer's estimate, $46,845.

★Glenn County, Div. 3, Route 7, Section B—Successful bidder, Taylor & Berliner, Los Angeles, as follows: 14,700 cu. yd. excav., without classification, 60 cts.; 300 lin. ft. corrugated iron pipe, 12 in., $1; 210 lin. ft. 18-in., $1.50; 120 lin. ft. 24-in., $2; 176 cu. yd. cement concrete, Class "B" (culverts and monuments), $10; 9190 cu. yd. cement concrete, Class "B," $2.40; 440 lin. ft. guard rail, 60 cts.; 62 monuments, to haul and set, each $1; total $33,817. Next 3 lowest bids: H. G. Vaughn Constr. Co., San Francisco, $35,209; Marin Rock Co., San Anselmo, $37,204; L. F. Gerdetz, San Francisco, $37,327. Engineer's estimate, $42,665.

★**Fullerton, Cal.**—Contract for paving Bread Road with asphaltic concrete awarded by city to O. & C. Construction Co., La Habra, at about $36,000.

★**Los Angeles, Cal.**—Contract for 90,697 sq. ft. Warrenite paving awarded by city to Fairchild-Gilmore Wilton Co., 396 Pacific Electric Building, at $26,047.

Lowest bid opened by city for 4½ miles oil macadam pavement in Rd. Dist. 45 submitted by Rogers Bros. Co., 350 Merrick Street, at $36,800.

★**San Diego, Cal.**—Contract for paving Broadway with asphalt awarded by Atchison, Topeka & Santa Fé R.R. Co. to Fairchild, Gilmore, Wilton Co., Los Angeles.

★**San Francisco, Cal.**—Contract for paving Arguello Boulevard awarded by Bd. Wks. to Federal Constr. Co., San Francisco, at $12,198.

★**Salt Lake City, Utah.**—Contract for paving Fourth West Street with asphalt awarded by City Comn. to G. A. Heman, Salt Lake City, at $9,618.

★Contracts for paving "B" Street with bitulithic and Sixth E. Street with rock asphalt awarded by City Comn. to J. W. Mellen, Salt Lake City, at $23,371 and $37,796, respectively.

★**Sandpoint, Idaho.**—Contract for paving (bids opened June 15) awarded by City Council to Spokane Bitu-Mass Co., Spokane, at $1.17 per sq. yd., or total of $25,692.

★**Edmonton, Alta.**—Contract for paving on Hudson Bay Reserve awarded to Crown Paving Co., Calgary, at $125,000. Cost to be shared by city and Hudson Bay Co.

STREET CLEANING AND GARBAGE DISPOSAL

PROPOSED WORK.

Far Rockaway, N. Y.—Bd. of Estimate of New York has set aside $100,000 to be used for erection of garbage disposal plant for Rockaway Section, known as the Fifth Ward of borough of Queens.

Pittsburgh, Pa.—Council considering construction of a municipal garbage and rubbish disposal plant. Robert Swan, Dir. Dept. Pub. Wks.

BIDS DESIRED.

Albany, N. Y.—July 19 by Bd. Contract and Supply (Isidore Wachsman, Secy.) for the collection, removal and disposal of garbage during the period of one year, beginning Sept. 1, 1915, all that section of city bounded on the south by Gansevoort Street, on the east by the river and on the north by the north city line and on the west by the east line of N. Pearl Street from State to Tivoli Streets, the Shaker Road and Rensselaer Avenue.

New York, N. Y.—Until July 20 by J. T. Fetherston, Street Cleaning Comr., for right to test, manufacture, construct, use and operate for period of one year patented refuse receptacles and loading devices for dustless and odorless collection of ashes, garbage and street sweepings, for the acquisition of such patent rights in and for the City of New York and for exclusive use of such refuse receptacles and loading devices for said city.

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS

PROPOSED WORK.

Pier—Chester, Pa.—City Council reported to have approved plans of Philadelphia Suburban Gas & Electric Co. for erection of recreation pier at foot of Norris Street, double deck, 20 x 30 ft.

River Improvement—Philadelphia, Pa.—Council has passed ordinance for an allotment of $75,000 state funds for deepening and widening ship channel between lower end of Cramps shipyard and Port Richmond export pier, south of Allegheny Avenue, and $67,000 for constructing plan of bulkheading Schuylkill River.

Ditch — Wooster, Ohio. — Comrs. of Wayne and Summit Counties reported to have decided to construct Chippewa ditch, about 12 miles in length; estimated cost $49,000.

Drainage—Grand View, Wis. — White River Drainage Dist. reported organized by Adolph Habelt, Grand View, Frank Lemoreux of Ashland, and others, to drain 20,000 acres of swamp land in vicinity of Grand view.

Canal — Gering, Neb. — Specifications being prepared for first section of south side canal in Scott Bluff County on south side of North Platte River. Work includes 2 tunnels and 3,000,000 yd. dirt and rock excavation.

Drainage — Victoria, Tex. — Citizens voted to issue $190,500 bonds for construction of Victoria County Drainage Dist. 3.

Sumas, Wash.—County Comrs. at Bellingham reported to have authorized construction of Deem Drainage Ditch, in Drainage Dist. No. 9, near this city, to be 4 miles long, draining 1000 acres.

Irrigation — Umatilla, Ore. — Western Land & Irrigation Co. reported granted permit to store 14,000 acre-feet of water for irrigating 15,000 acres of land. Reported about $370,000 will be spent for the improvement.

Irrigation—Anderson, Cal.—Citizens reported to have voted $480,000 bonds to build irrigation system in Anderson-Cottonwood irrigation district.

Irrigation—Madera, Cal.—Madera Irrigation Dist. reported to have appointed a committee, with C. D. Petty as Chairman, to secure plans, estimates, etc., and report on feasibility of irrigation district.

Tunnel—Oakdale, Cal.—Plans reported being prepared by Oakdale Irrigation Dist. for an 8000-ft. tunnel through Cape Horn to water north side of irrigation district.

BIDS DESIRED.

Dredging—Portland, Me.—Until Aug. 16 by U. S. Engineer, Portland, for dredging in St. Croix River, Maine, advertised in Engineering Record.

Cylinder Gates—Washington, D. C.—Until July 28 by U. S. Reclamation Service, Washington, D. C. (Morris Bien, Acting Dir.), for furnishing 2 c.-i. cylinder gates of 12-in. diameter for service under 100-ft. head for Keechelus Reservoir, Yakima Project, Wash., and a duplicate set for Sherburne Reservoir, Milk River Project, Mont.

Stone for Jetties—New Orleans, La.—Until July 21 at U. S. Engr. office, New Orleans, for furnishing and placing on the jetties at Southwest Pass, Mississippi River, about 12,000 tons of stone.

Breakwater—Lorain, Ohio.—Until July 30 by U. S. Engineer Office, Cleveland, for repairing rubble mound breakwater at Lorain Harbor, Ohio, advertised in Engineering Record.

Dredging—Indianapolis, Ind.—Reported desired until July 16 by Bd. Park Comrs., for dredging the lagoon in Garfield Park; also that portion of Pleasant Run between Shelby and Raymond, and that portion of Bean Creek lying within Garfield Park.

Dredge Work—Austin, Minn.—Until July 21 by O. F. Weissgerber, City Engr., for dredge work in Horace Austin State Park, advertised in Engineering Record. About 72,432 cu. yd. excav.

Ditch—Marshall, Minn.—Until July 26 by E. S. Shepard, Co. Aud., for constructing Ditch Nos. 13, 15 and 16. Cost $21,928. $7,585 and $53,345 respectively.

Ditch—Slayton, Minn.—Until July 27 by E. V. O'Brien, Co. Aud., for furnishing material and constructing ditches as follows: Ditch No. 9, total length, 28,285 ft.; cost, $9,015. Ditch No. 9A, total length, 43,800 ft.; cost, $12,250. Ditch No. 45, total length, 16,000 ft.; cost, $4,360. Ditch No. 5, total length, 23,835 ft.; cost, $8,563.

Irrigation Work — Saco, Mont.—Until Aug. 13 by U. S. Reclamation Service, Malta, for about 355,000 cu. yd. canal excav., advertised in Engineering Record. Work located from 3 to 10 miles from Saco on Great Northern Ry.

Dredging—Kansas City, Mo.—Until July 20 by Edw. F. Webster, Acting Secy. Bd. Pub. Wks., for grading and dredging Turkey Creek, about 3000 ft. long, near Rosedale.

Wharf, Etc.—Houston, Tex.—Until July 23 for wharf, cotton sheds and 100,000 cu. yd. dry excavation for same. Estimated cost, $150,000. E. E. Sands, City Engr.

North Yakima, Wash.—Until July 31, by J. O. Greenway, Drainage Engr., Sunnyside, for constructing 4.6 miles of open ditch, excav. 126,520 cu. yd., and 2.8 miles of closed ditch in Dist. No. 25.

Drains—North Yakima, Wash.—Reported desired until July 31 by Charles E. Barrett, Co., Aud., for constructing system of open and closed drains in Drainage Improv. Dist. 25. Work will consist of about 4.6 miles open ditch, excav. 126,520 cu. yds., furnish and lay pipe and backfill about 2.8 miles closed drain, etc.

Pier—Redondo, Cal.—Reported desired until July 26 by City Trustees, for constructing reinforced concrete pleasure pier for which bonds in the sum of $121,000 have been voted.

Structural Steel for Wharf—Panama.—Until July 23 by Major F. C. Boggs, Corps Engrs. U. S. A., General Purchasing Officer, Panama Canal, Washington, D. C., for Cir. 948—Furnishing or furnishing and erecting structural steel and accessory parts for the decking of the reloader wharf at Balboa.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Dredging—New York, N. Y.**—Contract awarded P. Sanford Ross, Jersey City, N. J., for dredging Newton Creek, at $94,937 (bids opened June 28). Unit prices in Engineering Record of July 10.

★**Breakwater—Oswego, N. Y.**—Contract for constructing concrete superstructure on outer breakwater, at Oswego Harbor awarded H. S. Kerbaugh, Inc., Buffalo, at $78,606 (bids opened June 23). Unit prices in Engineering Record of July 3.

★**Dredging—Philadelphia, Pa.**—Contract for dredging Delaware River, opposite Port Richmond coal piers, Philadelphia Harbor, awarded to Maryland Dredging & Contr. Co., Baltimore, Md., at 24.9 cents per cu. yd. Total $199,200. (Bids opened June 21).

Riprap — Philadelphia, Pa.—Following bids opened July 8 by Col. George A. Zinn, Corps Engrs., U. S. A., for furnishing and placing approximately 12,000 tons of riprap along channel face of the bulkhead inclosing end of Artificial Island in the Delaware River at point about 48 miles below Philadelphia: Coast & Lake Contr. Cor., 41 Broad Street, New York, $1.39 (recommended for award); Ellis D. Thompson, 1505 Arch Street, Philadelphia, $1.89, and C. R. Simpson, 170 Broadway, New York, $1.72; Edwin S. Sickles, New Baltimore, N. Y., $2.18.

Wharf—Cape Fear, N. C.—Following bids opened by Superv. Archt., Treas. Dept., Washington, D. C., for constructing wharf, mooring piers, etc., at U. S. Quarantine Station, Cape Fear: G. E. Tilt & Co., New York, $24,732; Simons-Mayrant Co., Charleston, S. C., $25,788; A. J. Robbins, Southport, N. C., $24,271; Diamond Steamboat & Wrecking Co., Wilmington, N. C., $24,272.

★**Bank Protection—Augusta, Ga.**—Contract awarded Simons-Mayrant Co., Charleston, S. C., for repairs to bank protection of Savannah River at Augusta, for $17,275 (bids opened June 21).

★**Drainage Ditches—Bartow, Fla.**—Contract awarded July 1 by Peace Creek Drainage Dist., 77 Main Street, for constructing 142 miles of drainage ditches, approximately 2,432,743 cu. yd. excav., to A. V. Wills & Sons, Pittsfield, Ill., at 8.5 cts. per cu. yd. C. G. Elliott, Engr., McLachlen Building, Washington, D. C.

★**Ditch—Lexington, Tenn.**—Contract reported awarded by Beech River Drainage Dist. Board to Tupelo Dredging Co., Tupelo, Miss., for digging canal along Beech River at 6.47 cts. per cu. yd.; total cost about $20,000.

★**Excavation and Lock Work—Sault Ste. Marie, Mich.**—Contract awarded Great Lakes Dredge & Dock Co., Chicago, for excavation of earth and rock at U. S. power plant, Tail Race, St. Mary's River, Mich., at $129,700 (bids opened June 15).

★Contract awarded Penn Bridge Co., Beaver Falls, Pa., to furnish and deliver at Sault Ste. Marie about 325 tons steel for fourth lock, at $26,264.

★**Ditch—Three Lakes, Wis.**—Contract for constructing about 11 miles open ditches (bids opened June 25) awarded to Schultz & Biecy, of Clarion, Iowa.

★**Drainage—Logan, Iowa.**—Contract reported awarded by County Comrs. for constructing the Annis drainage system as follows: Section 1, to C. E. Delzy, Nevada, Iowa, at $3,624; Sections 2, 3 and 4, to V. Petersen, Des Moines, at $38,011.

★**Ditch—Buffalo, Minn.**—Contract for constructing County Ditch No. 24 (bids opened June 28) awarded to Ewing & Brochenbrough, Chicago, Ill., at $8886.

★**Irrigation—Oroville, Wash.**—Contract awarded to A. Guthrie & Co., St. Paul, Minn., for an irrigation system near Oroville, at $600,000.

Pier—Venice, Cal.—Lowest bid submitted by Mesmer & Rice, Marsh-Strong Bldg., Los Angeles, for completing Center Street pier, at $8149.

ELECTRIC RAILWAYS

PROPOSED WORK.

Binghamton, N. Y.—Binghamton St. Ry. Co. is to extend line to north village line of Port Dickinson.

Syracuse, N. Y.—New York State Rys. Co. plans to spend about $200,000 for trackage improvements.

Allentown, Pa.—It is reported that work will begin in fall by Lehigh Valley Transit Co. on new route through Center Valley.

Scranton, Pa.—Scranton & Binghamton R. R. Co. plans to construct an extension of lines from Foster to Brooklyn, distance 5 miles.

Petersburg, Va.—Petersburg & James River Ry. Co. is about to begin work on constructing railway from Petersburg to City Point. The road will require about 9¼ miles single track. J. Walter Long, 110 Bellingbrook Street, Petersburg, Pres.

Glenville, Ga.—East Georgia Ry. Co. chartered to construct an electric or steam railroad, from Glenville north via Hagan to Adabelle, about 30 miles. Capital, $212,000. Headquarters, Savannah. H. P. Talmage and C. J. Baldwin among incorporators.

Pocatello, Idaho.—Plans are being considered to build an electric railway from Arbon to Pocatello. George Williams, Pocatello, is interested.

Moncton, N. B.—Moncton Tramway, Electric & Gas Co., Ltd., plans to construct an extension of line on Bonaccord Street from Main to Church Street, 1 mile.

Calgary, Alta.—Plans being considered by City Comrs. to construct temporary railway 1½ miles toward military camp on Sarcee Indian Reserve for Calgary St. Ry. Co.

BIDS DESIRED.

New York, N. Y.—By Bd. Public Service Comn., 154 Nassau Street, for furnishing track material for use upon all lines of dual system not already provided for as follows: Until July 27, for supply of manganese rails; and until July 28, for rail splice bars anti-creepers and nut locks; according to official reports bids to be received include about 3000 tons of rolled manganese rails, over 1,000,000 tie plates, about 356,000 cu. yds. of broken stone ballast, and about 30,000,000 ft. ties and timber.

New York, N. Y.—By Bd. Public Service for First District, 154 Nassau Street, New York, for constructing sections of the subway as follows: Advertised in Engineering Record.

July 27—Section 3, Route 12, Eastern Parkway, subway, Brooklyn.

July 27—Section No. 3, Routes 4 and 36, Broadway subway, Manhattan.

July 28—Section 2, Route 29, Nostrand Avenue, subway, Brooklyn.

Aug. 3—Station finish Route No. 50, Queensboro Subway extension, and on

Brooklyn, N. Y.—Following are unit prices of 4 lowest bids opened July 9 by Public Service Commission for First Dist., 154 Nassau Street, New York, for track laying on New Utrecht Avenue elevated line in Brooklyn: (a) Ward & Tully, Inc., W. Twentieth Street, Brooklyn, $71,355; (b) Joseph A. McElroy, 51 E. Forty-second Street, New York, $75,183; (c) W. F. Jordon, 383 Madison Avenue, New York, $78,525; (d) Post & McCord, 101 Park Avenue, New York, $82,640.

	(a)	(b)	(c)	(d)
48,770 lin. ft. hand rail complete	$0.10	$0.16	$0.20	$0.14
563 lin. ft. plank walks complete	11.00	10.00	12.00	14.00
14,300 anti-creepers, each	0.10	0.10	0.10	0.10
Type III Track Complete:				
57,300 lin. ft. on tangents and curves of more than 2,000 ft. radius	0.60	0.65	0.65	0.70
300 lin. ft. on curves of 2,000 ft. to 701 ft. radius	1.25	1.25	1.25	1.19
6,400 lin. ft. on curves of less than 701 ft. radius	1.55	1.45	1.30	1.40
14,300 lin. ft. at and adjoining stations	0.60	0.65	0.70	0.75
Installation of Special Work:				
Portion 35 complete	1,000.00	800.00	840.00	1,125.00
Portion 36 complete	1,000.00	800.00	840.00	1,125.00
Portion 37 complete	1,000.00	800.00	840.00	1,125.00
Portion 38 complete	1,000.00	800.00	840.00	1,125.00
Portion 39 complete	1,300.00	600.00	925.00	1,500.00

Sections 1 and 3 of Routes 36 and 37, Corona elevated railroad in Queens.

Aug. 4—Station finish on Section 2, Routes 36 and 37, Astoria elevated railroad, Queens.

Philadelphia, Pa.—Until Aug. 16 by A. M. Taylor, Dir. Dept. City Transit, 754 Bourse Bldg., for constructing concrete caisson foundations and piers for about 2,800 lin. ft. of elevated railway in Front Street, Kensington Avenue and Frankford Avenue, known as Contract 501 advertised in Engineering Record.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Brooklyn, N. Y.**—The Public Service Commission for First Dist., New York, awarded contract for wrecking and removal of certain buildings owned by City at 161 to 171 Flatbush Avenue, Brooklyn, to S. Kaufman, of W. 126th Street, New York, at $2,[illegible] (bids opened July 9.)

RAILROADS

PROPOSED WORK.

Farmington, W. Va.—Western Maryland Ry. Co. (H. R. Pratt, Ch. Engr., Baltimore, Md.) has made survey for a spur 3 miles long from Baltimore & Ohio Railroad at Farmington to new coal mines of Consolidated Coal Co. on Helena Run.

White Sulphur Springs, W. Va.—It is reported that White Sulphur & Huntersville Railroad Co. will build a lumber line from White Sulphur Springs, via Montague, Marlinton, Levale, Alvon and Sharvick, about 27 miles, with a branch near Sharvick to Neola.

Savannah, Ga.—A charter reported granted to East Georgia Ry. Co. of Savannah, to construct a railroad from Glenville to Adabelle, with a branch line from Hagan to Claxton, 30 miles; capital, $212,500. Incorporators include J. F. Minis, T. M. Cunningham, Jr., W. W. Mackall and others.

El Paso, Tex.—It is reported that El Paso & Southwestern Railroad Co. has secured permission to issue $15,000,000 bonds on its properties in Arizona, to cover merged lines of its system; part of proceeds will be used to purchase additional equipment and to make improvements.

Davenport, Wash.—It is reported that the Northern Pacific Ry. Co. (A. R. Cook, Asst. Engr., Tacoma) will replace track between Davenport and Cheney with heavier steel rails.

Seattle, Wash.—Port Comm. (Robt. Bridges, Pres., Central Building) will soon let contract for construction of belt railway to connect all port facilities on water front. First unit to cost $35,000.

BIDS DESIRED.

Alaska.—Until July 21 at office of C. E. Dale, Purchasing Agent, Alaskan Eng. Comm., Bureau Mines Bldg., Seattle, Wash., for 70-lb. steel rail, angle splice bars, track bolts, nut locks and track spikes.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Buffalo, N. Y.**—Contract awarded by Grade Crossing Comr. to Lathrop, Shea & Henwood, Ellicott Square Bldg., for construction of viaduct in Bailey Avenue over Pennsylvania R. R. with subway under Lehigh Valley R. R. and change of subway in Seneca Street under Delaware Lackawanna & Western R. R. at $152,217.

★**Oneida, Tenn.**—Contract for building 11 miles of railroad from Oneida to Petros reported awarded to J. C. Rodes & Co., of Franklin.

★**Springfield, Mo.**—Work of constructing [illegible] of Cotton Ry., between Springfield and Little Rock, Ark., will start about Aug. 1. First contract reported awarded to Blodgett Constr. Co. of Kansas City, Mo., for a stretch of 15 miles, between Mountain Home and Rothville, Ark.

PUBLIC BUILDINGS AND SCHOOLS

PROPOSED WORK.

Springfield, Mass.—Preliminary plans prepared by W. J. Holmes for 2-story, 40 x 150 ft. [illegible] hospital have been accepted in city.

Westfield, Mass.—Citizens voted July 9, to erect a school on Union Street to cost, including site and equipment, $40,000.

New Haven, Conn.—Bonds in the sum of $[illegible] will be sold Aug. 31 by Arthur D. Mullen, Controller, for improving lands and buildings known as the old County Courthouse property.

Binghamton, N. Y.—Reported contract soon to be let by Bd. Contract & Supply for erecting Helen and New Street schools.

Brooklyn, N. Y.—Plans filed for 5-story brick hospital which Brownsville East New York Hospital Co. intends erecting on Avenue A and Rockaway Parkway; cost $[illegible]. E. M. Adelsohn, Archt., 1776 Pitkin Avenue.

Buffalo, N. Y.—Improvements to various schools planned for this fall include: School 44, Broadway and Krupp Street, 16 rooms, $140,000; School 7, Clinton and Bailey Avenues, 10-room addition, $65,000; School 9, Doat and Poplar Streets, 16 rooms, $135,000; School 17, Main Street and Lafayette Avenue, 10 rooms, $65,000; School 63, Lisbon and Cordova Streets, 16 rooms, $135,000; School 31, Emslie and Peckham Streets, 48 rooms, $400,000; School 45, Auburn Avenue and Baynes Street, 8-room addition, $100,000; School 61, Grider and Kehr Streets, 10-room addition, $125,000; School 55, Weber and Lang Streets, 16 rooms, $160,000; School 60, Ontario and Saratoga Streets, 18-room addition, with gymnasium and assembly hall, $160,000.

Syracuse, N. Y.—Contract soon to be let by Bd. Educ. for erecting Delaware School at Delaware and Geddes Streets; cost, $225,000; James A. Randall, City Archt.

White Plains, N. Y.—Plans prepared by Alfred Hopkins, 101 Park Avenue, New York, for brick, white marble and granite county workhouse and penitentiary accepted by Westchester County Bldg. Comm., of which Robert S. Brewster of Mount Kisco is a member; cost $500,000..

Lansford, Pa.—Bd. Educ. having plans prepared for 3-story school; cost $150,000.

Lock Haven, Pa.—Plans being prepared by Harris & Rush, 1001 Chestnut Street, Philadelphia, for 3-story brick, stone and terra cotta nurses' home for Lock Haven Hospital.

Philadelphia, Pa.—State Armory Bd., Harrisburg, will soon let contract for erecting cavalry armory at Thirty-third Street and Lancaster Avenue.

Washington, Pa.—A $30,000 armory is to be erected here by State Armory Bd., Harrisburg.

Baltimore, Md.—Plans completed by Joseph Evans Sperry, Baltimore, for three-story Civil Engineering Building to be erected at Johns Hopkins Univ.; cost, $150,000.

Triadelphia, W. Va.—Bonds sold for $125,000 for high school.

Florence, S. C.—Citizens voted $52,000 school improvement bonds.

Florence, S. C.—School bonds in the sum of $52,000 will be sold Aug. 4 by W. R. Barringer, Chmn. Bd. School Comrs.

Atlanta, Ga.—Bd. Educ. accepted plans for Meader Goldsmith School.

East Point, Ga.—Citizens voted $30,000 bonds for erecting new school.

Tallapoosa, Ga.—Citizens voted $25,000 school improvement bonds.

Pensacola, Fla.—Bd. Public Instruction having plans prepared for 9-room school.

Athens, Ohio.—Plans for girls dormitory at Ohio Univ. to be prepared by F. L. Packard, Columbus; cost $120,000.

Cambridge, Ohio.—Bd. Educ. intends erecting school to be known as Domestic Arts Manual Recreation Building; cost $25,000. This building is a gift from Mr. C. S. McMahon.

Cleveland, Ohio.—Contract soon to be let for erecting 3-story concrete, brick and steel school on Almira Avenue S. W. and W. 99th Street, to cost $200,000. Address Bd. Educ.; Walter R. McCornack, Archt., care of Bd. Educ.

Kirkersville, Ohio.—Citizens of Harrison Township voted $30,000 bonds for new school in Kirkersville.

Wilmington, Ohio.—Bonds for $300,000 to be sold July 15 by Harry Gaskill, Co. Aud., for purchasing site and erecting court house and jail.

Evansville, Ind.—Bonds for $150,000 sold for city schools.

Hubbell, Mich.—New High School costing $100,000 contemplated here.

Manistique, Mich.—High School costing $100,000 to be erected. A. S. Putnam, Pres. Bd. Educ.

Urbana, Ill.—Following buildings are to be erected at University of Illinois. Women's residence hall, $120,000; addition to natural history building, $75,000; addition to engineering hall, $75,000.

Kenosha, Wis.—Bd. Educ. authorized erection of $100,000 grade school.

Grinnell, Iowa.—Plans being prepared for $150,000 building to be erected at Grinnell College.

Tipton, Iowa.—Citizens voted $50,000 bonds to erect a court house.

State Bd. Control, Des Moines, approved plans of Chas. A. Diemann, Granby Block, Cedar Rapids, for County Hospital for Insane; cost $50,000.

Calumet, Minn.—School Trus. decided to erect a school north of village; cost $25,000.

Beatrice, Neb.—Bd. Superv. intends erecting jail and sheriff's residence; cost $35,000.

Palestine, Tex.—Citizens voted $100,000 high school building bonds.

Tulsa Okla.—Plans being prepared for $300,000 high school. Address Bd. Educ.

Seattle, Wash.—Port Comm. reported to be considering erecting 300-ft. extension to Whatcomb Avenue warehouse.

Plans filed with Bd. Pub. Wks. by Daniel Huntington, City Archt., for remodeling present city hall for use of Health and other departments; cost $65,000.

BIDS DESIRED.

Beverly, Mass.—Until July 27 by Public Library Comn., City Hall, Beverly (Katherine P. Loring, Secy.), for erecting a branch Public Library at Beverly Farms. Loring & Leland, Archts., 7 Water Street, Boston.

Medford, Mass.—Reported desired until July 22 by Chas. B. Dunham, Archt., 6 Beacon St., Boston, for erecting 2-story and basement school; cost, $45,000.

Blackwells Island, N. Y.—Until July 19 by John A. Kingsbury, Comr. Dept. Pub. Wks., New York City, for furnishing material and erecting the day-room and industrial building and alterations to existing Ward building for Women, in New York City Home Dist., Blackwells Island; also plumbing and drainage and low pressure steam heating plant and ventilating apparatus. Security $25,000, $41,200 and $2,000 respectively.

Buffalo, N. Y.—Until July 22 (readvertisement) by Frank J. Reynolds, Deputy Bldg. Comr., for erecting a 3-story and basement brick, stone and concrete addition (8 rooms) to School 54, Main Street and Leroy Avenue. Estimated cost, $75,000. Green & Wicks, Archts., 110 Franklin Street.

New Dorp, S. I., N. Y.—Until July 23 by John A. Kingsbury, Comr. Dept. Pub. Charities, New York City, for furnishing material and erecting Cottage No. 2, New York City Farm Colony, borough of Richmond; also plumbing, drainage and water supply; also heating. Security $13,000, $1000 and $800 respectively. Charles B. Meyers, Archt., 1 Madison Avenue, New York.

New York, N. Y.—Until July 19 by Bd. Trus., Bellevue and Allied Hospitals, New York City (John W. Brannan, Pres.), for furnishing material and erecting building for Gouverneur Out Patient Dept., Front Street and Gouverneur Slip, Boro. Manhattan; also plumbing, drainage, water and gas supply; also steam boiler heating and ventilating apparatus. Security $45,000, $8,000 and $4,000 respectively.

Peekskill, N. Y.—Until July 27, by State Armory Comn., Albany (Frank W. Ward, Secy.), for erecting storage house at State Camp of Instructions in Cortland, near Peekskill, advertised in Engineering Record.

Oradell, N. J.—Until July 29 by Bldg. Com., County Bd. Chosen Freeholders, Hackensack (Chas. N. Cumberland, Chmn.), for erecting an isolation hospital at the County Poor Farm, Oradell. John J. Ferry, Archt., Englewood.

Lansford, Pa.—Until Aug. 9 by Thomas Whildin, Secy. Bd. Educ., for furnishing material and erecting the Lansford High School. Tooker & Marsh and John T. Simpson, Archts., 101 Park Avenue, New York.

Muncy, Pa.—Reported new bids until July 23 by Dept. State Bd. Charities, Harrisburg, for erecting buildings on the cottage plan for State Women's Industrial Home, Muncy, including heating, plumbing and electrical equipment. Horace Trumbauer, Archt., Land Title Bldg., Philadelphia.

Philadelphia, Pa.—Reported desired until July 20 by Zantziger, Borie & Medary, Archts., Fifteenth and Walnut Streets, for additions and alterations to Jewish hospital on York and Tabor Roads.

Pittsburgh, Pa.—Until July 21 by Hyatt M. Cribbs, County Controller, for the structural steel work for the city and county building, Grant and Diamond Streets. Probable cost, $29,000. Edward B. Lee and Palmer, Hornbostel & Jones, Archts., 345 Fourth Avenue, Pittsburgh.

Upper Darby, Pa.—Until July 26 by Bd. School Dirs. at residence of J. Milton Lutz, Secy., West Chester Pike, Upper Darby, for erecting school in Highland Park, Upper Darby. Shore & Dodge, Archts., 608 Chestnut Street, Philadelphia.

Cleveland Heights, Cuyahoga County, Ohio.—Until Aug. 6 by Ezra K. Bryan, Clk. Bd. Educ., for furnishing material and erecting grade school. Franz C. Warner and John H. Graham, Assoc. Archts., Hippodrome Building, Cleveland.

Kent, Ohio.—Reported desired until Aug. 2 by Bd. Trus., Kent State Normal School, for ventilating and heating auditorium, library, gymnasium and office building and the ventilating and heating of an agricultural and training school building. J. F. Hammond, Archt., 4220 Prospect Avenue, Columbus.

Millfield, Ohio.—Until July 31 by E. S. Dent, Clk. Bd. Educ., for erecting a school. E. S. Matheny, Archt., Harrison Building, Columbus.

New Bloomington, Marion County, Ohio.—Until July 27 by Bd. Educ. New Bloomington Village School Dist., at County Superintendent's office, Marion, for erecting fireproof high and grade school; also as a whole or separate bids for ventilating and heating; also plumbing, gas fitting and sewerage. Howard & Merriam, Archts., 8 E. Broad Street, Columbus.

Bloomington, Ind.—Contract will be let latter part of July or early in Aug. by Library Board (E. M. C. Hobbs, Pres.) for erecting Carnegie library; to be of stone, backed by tile with tile roof; cost about $29,000. Wilson B. Parker, Archt., Indianapolis.

Hammond, Ind.—Until Aug. 2 by Bd. School Trus. (John T. Krost, Pres.), for erecting Hammond Industrial High School, including heating, ventilating, plumbing, etc., advertised in Engineering Record. J. T. Hutton & Son, 314 Hammond Bldg., Archts.

Detroit, Mich.—Until July 20 by Bd. Educ. (Charles A. Gadd, Secy.) for furnishing material and erecting a 20-room school, at Charlevoix Street and Lakeside Avenue, including ventilation, heating, plumbing and electric wiring. Malcomson & Higginbotham, Archts., Moffat Bldg.; Ammerman & McColl, Engrs., Penobscot Bldg.

Ypsilanti, Mich.—Until July 20 by James A. Wetmore, Acting Superv. Archt., Washington, D. C., for the construction, complete (including mechanical equipment and approaches), of U. S. Post Office, Ypsilanti.

Chicago, Ill.—Bids desired until July 22 by W. R. Moorhouse, Comr. Pub. Wks., for furnishing and delivering at the Marshall Boulevard Municipal Plant about 42,000 sq. ft. metal fabric reinforcement.

Pisgah, Iowa.—Reported desired until Aug. 2 by Bd. Educ. for erecting a 2-story and basement, 60 x 80 ft., school. Probable cost, $30,000. Chas. M. Nye, Archt., Natl. Bank Bldg., Omaha, Neb.

Wheaton, Minn.—Until July 19 by Bd. Educ. (V. E. Anderson, Secy.) for erecting a brick gymnasium and manual training building. E. F. Bromhall, Archt., Alworth Bldg., Duluth.

Schuyler, Neb.—Reported desired until Aug. 15 by Bd. Educ., for erecting a 2-story and basement 80x110 ft. high school. Probable cost $40,000. Grabe & Helleberg, Archts., Columbia.

Richmond, Mo.—Until July 28 by Bd. Educ. for furnishing material and erecting high school and two grade schools, including ventilation, heating and plumbing. J. H. Felt & Co., Archts., Kansas City.

Dallas, Tex.—Reported desired until July 20 by Bd. Educ. for erecting 12-room school on Corinth and Gould Sts.

Blackwell, Okla.—Until Aug. 19 by James A. Wetmore, Acting Superv. Archt., Wash., D. C., for construction, complete (including mechanical equipment, interior lighting fixtures and approaches) of U. S. Post Office at Blackwell.

Ringling, Okla.—Reported desired until July 20 by Bd. Educ., Dist. No. 14, for erecting 2-story brick school.

Portland, Ore.—Local press reports state bids are desired until July 22 by Comn. of Pub. Docks for Warehouse B, to be erected in rear of Municipal Dock No. 1, foot of Sixteenth Street. The new building to have width of 176 ft. and length of 330 ft., including a loading platform, the width will be 192 ft.

Los Angeles, Cal.—Until July 22 by William A. Sheldon, Secy. Bd. Educ., for furnishing material and erecting Lincoln High School at N. Bway and Pritchard Sts.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Buffalo, N. Y.—Following are lowest bidders for erecting addition to School 54 on Main Street and Jewett Avenue, to cost $40,468: Carpentry, Mosier & Summers; heating, Daniel Burgmaster; plumbing, Wilson Plumbing Co.

★Reported contracts for erecting group of buildings for Tuberculosis Hospital on West Farm site awarded as follows: General contract, Mosier & Summers, Buffalo, $384,275; heating, Fitzpatrick & Hoepfner, Cleveland, $62,029; electric work, Bison Electric Co., $17,328.

★**Holtsville, Long Island, N. Y.**—Contract for erecting addition to tuberculosis Hospital awarded by Bd. Superv., Riverhead, to B. & M. Bldg. Constr. Co., 17 W. Forty-second Street, New York, at $31,000.

★**New York, N. Y.**—Contract for additions to and alterations in School 3 on Grove and Hudson Streets awarded to J. Kresse Co., 52 Vanderbilt Avenue at $43,400 (bids opened July 12) by C. B. J. Snyder, Supt. School Bldgs.

Syracuse, N. Y.—Lowest bid opened June 30 by Bd. Educ. for erecting Vocational School was from Phalen Eng. Constr. Co. of Hoboken, N. J., at $288,750 for limestone or granite and $289,000 for terra cotta.

★**Bayonne, N. J.**—Contract for erecting Parental Home awarded at Jersey City by Hudson County Bd. Freeholders, to Jersey City Constr. Co., 75 Montague Street, Jersey City, at $38,595.

★**Collingswood, N. J.**—Contract for erecting annex to high school awarded George Shaner & Son, Palmyra. Probable cost $40,000.

★**Braddock, Pa.**—Contract awarded Hodder Constr. Co. Braddock, for erecting Kenmawr School at $76,926.

★**Germantown—(P. O. Philadelphia), Pa.**—Contract for erecting recreation building on Waterview Playground, Haines and McMahon Streets, awarded E. W. VanLoon, Denckler Bldg., Philadelphia, at $87,971; plumbing, Powers & Magee, 5657 Chew Street, Philadelphia, at $6,847; heating, Bulman Bros., 2532 N. Fifth Street, Philadelphia, $4,267.

★**Philadelphia, Pa.**—Contract for erecting alterations and additions to the Central High School awarded William H. Mundy, Philadelphia. Horace Cook, Archt., Philadelphia.

Lowest bids received recently for erecting schools were as follows: At Sixty-fifth Street and Limekiln Pike, three-story brick and terra cotta, Cramp & Co., Denckler Bldg., $278,056; Crescentville School addition, William R. Dougherty, 1608 Sansom Street, at $68,229; at Sixth Street and Huntington Park Avenue, Wilbert Beaumont, St. Girard Bldg., $52,735. Horace Cook, Archt., Philadelphia.

★**Pittsburgh, Pa.**—Contract awarded by Co. Comrs. (Hyatt M. Cribbs, Co. Compt.), to M. O'Herron Co., First and McKean Streets, Pittsburgh, for rough excavation work in connection with the city and country building at $1.23 per cu. yd.; cost, $32,000.

★**Reading, Pa.**—Contract for erecting U. S. Post Office awarded John Lowry, Jr., New York, at $90,880.

★**Renovo, Pa.**—Contracts awarded by Bd. Educ. (C. W. Weeks, Secy.), to erect a high school as follows: (Bids opened July 1). General contract to Shamokin Lumber Mfg. Co., Shamokin; heating & ventilating, E. Keeler Co., Williamsport. Woodnutt & Schmohl, Archts., 150 W. Fourth Street, Williamsport.

★**Stoneboro, Pa.**—Contract for erecting high school awarded D. D. Ershine Co. of Butler at about $25,000. C. F. Owsley, Archt., Youngstown, Ohio.

Indian Head, Md.—John W. Danforth Co., Buffalo, N. Y., submitted to Bureau Yards & Docks, Navy Dept., Washington, D. C., July 3, only bid for work complete for constructing extension to boiler plant at U. S. Naval Proving Ground at $168,987.

★**West Virginia.**—Contracts awarded by State Bd. Control at Wheeling as follows: (Bids opened June 29), P. Q. Shrake & Son, New Matamoras, Ohio, addition to Mechanical Hall and a school for medicine, West Virginia Univ., Morgantown, at $57,000; Longest & Tessier, Greensboro, N. C., science hall, Marshall College, Huntington, at $48,000 and also dormitory at State College, Glenville, at $39,000.

Charlotte, N. C.—Following are four lowest bids opened July 2 by Supervising Architect, Washington, D. C., for constructing U. S. Post Office at Charlotte: (a) marble, (b) granite, Barnes Bros., Loganport, Ind., (a) $240,000, (b) $249,000; John G. Unkefer & Co., Minerva, Ohio, (a) $242,294, (b) $253,294; Westchester Eng. Co., White Plains, N. Y., (a) $243,000; P. F. Gormley Co., Washington, (a) $243,000, (b) $253,000; James Devault, Canton, Ohio, (b) $233,000.

★**Andalusia, Ala.**—Contract for erecting court house awarded Little Cleckler Constr. Co., at $70,000.

★**Milford Center, Ohio.**—Contract for erecting two-story brick centralized school awarded A. M. Fry of Piqua at $27,000.

Waterford, Ohio.—Following are four lowest bids opened by Bd. Educ. for erecting first grade high school: E. Mast, Zanesville, $23,375; J. W. Showers, Zanesville, $25,600; Showers & Taylor, Crooksville, $25,777, and Foreman & Putnam, Marietta, $26,574. P. Myers, Zanesville, Archt.

★**Indianapolis, Ind.**—Contracts awarded by J. E. Cleland, Business Dir. Bd. Educ. for erecting addition to grade school No. 12 as follows: General construction, H. W. Klausman, $34,534; heating and plumbing to Hayes Bros., $15,648. Snider & Rotz, Archt., 1004 Merchants Bank Bldg.

★**New Albany, Ind.**—Contract for erecting U. S. Post Office awarded R. P. Farnsworth & Co., Owensboro, Ky., at $67,675.

★**Brown City, Mich.**—Contract for erecting high school awarded Cadillac Cabinet & Constr. Co., Cadillac, and plumbing to Cadillac Plumb. & Htg. Co. Cost about $40,000.

★**Lansing, Mich.**—Contract for erecting administration building for State School for Blind awarded Strom & Lansing of Grand Rapids. Cost about $100,000. This company also has contract at $25,000 for erecting nurses' lodge at the Michigan Soldiers' Home.

★**Newberry, Mich.**—Contract for erecting additions to Hospital for Insane, including nurses home, cottage and addition to tuberculosis ward, awarded Herman Gundlach, of Calumet, at about $75,000.

★**Sault Ste. Marie, Mich.**—Contract for erecting high school awarded L. E. Chaussee, Negaunee, $106,863.

Ottawa, Ill.—Lowest bid for erecting building for dependent children opened by Detention Home Com. of Bd. Superv. submitted by Sanders Bros., Ottawa, at $25,722; plumbing and heating John W. Clegg & Son, Ottawa, $8,453.

★**Rock Island, Ill.**—Contracts for erecting county jail awarded as follows: General contract, Paul H. Lorenz, Moline, $39,590; plumbing, also heating, Channon & Dufva, Rock Island, $10,254, and $10,911 respectively; electric work, W. A. Robb, Moline, $1,169; steel construction and cells, Van Dorn Iron Co., Cleveland, Ohio, $22,926.

★**Primghar, Iowa.**—Contracts for erecting court house awarded as follows: General contract, J. E. Lovejoy of Des Moines, at $118,302; heating and plumbing, Clefont Co., Owatonna, Minn., at $9,446.

★**Sheldon, Iowa.**—Contract for erecting court house awarded J. E. Lovejoy, Des Moines, at $118,302; and for heating and plumbing, Clefton Co., Owatonna, Minn., $9,447.

★**Owatonna, Minn.**—Contract awarded to erect power house at State Public School to William O'Neil Sons Co., Faribault. C. H. Johnson, Archt., St. Paul.

★**Milbank, S. D.**—Contract awarded July 2 by County Comrs. for erecting three-story stone fireproof court house: J. B. Evans Constr. Co., Mexico, Mo., for general construction; heating, plumbing and electric work to Hass & Rau, Watertown. C. E. Bell, Archt., Security Bldg., Minneapolis, Minn.

★**Great Falls, Mont.**—Contract awarded June 28 to erect 12-room Emerson school to Rude & Searles, Great Falls, at $69,304.

★**Little Rock, Ark.**—Contract awarded by J. P. Almand, Archt., Southern Trust Bldg. for erecting U. M. Rose School, a two-story brick building, to Stewart McGehee, Little Rock, at $45,000.

Portland, Ore.—Following four bids opened June 30 by School Bd. for erecting Franklin High School: James S. Winters, Couch Bldg., $74,897; Sound Constr. & Eng. Co., Inc., Seattle, Wash., $82,332; Parker & Banfield, Portland, $83,222; John Almeter, care of Builders Exchange, $83,600.

PRIVATE BUILDINGS

PROPOSED WORK.

Manchester, N. H.—D. B. Curtis, Manchester Street, to erect 3-story brick and steel business building on Manchester Street.

Brooklyn, N. Y.—Plans filed for following buildings: 6-story brick tenement at Montrose Avenue and S. Fifth Streets for Montrose Ave. Co., cost $50,000, Shampan & Shampan, Archts., 772 Broadwty; three 4-story brick tenements at Bedford Avenue and Lenox Road for Fort Realty Co., cost $155,000, Young & Wagner, Archts., 347 Fifth Avenue, New York.

Buffalo, N. Y.—The Bank of Buffalo intends erecting a new building.

New York, N. Y.—Plans filed for following buildings: 5-story brick tenement at Crotona Park East for Wey Bldg. Co., cost $75,000, Goldner & Goldberg, Archts., 391 E. 149th Street; 5-story brick tenement at Creston Avenue and 184th Street for Gersmann Lozner, Inc., cost $50,000, Moore & Landsiedel, Archts., Third Avenue and 148th Street; 5-story brick tenement at Morris Avenue and 166th Street for Farago Constr. Co., cost $50,000, Lucian Pisciotta, Archt., 391 E. 149th Street.

Paterson, N. J.—Plans accepted for $100,000 church to be erected at Broadway and E. Twenty-seventh Street, Church of the Covenant. Lee & Hewitt, Archts., 1123 Bway., New York.

Philadelphia, Pa.—Plans being prepared by Frederick Webber, Morris Building, for 12-story apartment house to be erected at 235 S. Fifteenth Street; cost $125,000.

Washington, D. C.—Macneil & Macneil, Union Trust Bldg., are preparing plans for a ten-story apartment house on Sixteenth Street for Columbia Property Co. Cost, $500,000.

Staunton, Va. — First Presbyterian Church intends enlarging the church and erecting a Sunday school building; cost $50,000.

Fairmont, W. Va.—Henry Schmukbach, Wheeling, will erect a $75,000 store and hotel building.

Fairmont, W. Va.—Henry Schmulbach, Wheeling, will erect store and hotel building; cost $75,000.

Huntington, W. Va.—Plans being prepared by Fisher & Rabenstein, Richmond, Va., for a three-story stone building, 100x150 ft. for the Huntington Institutional Baptist Church. Cost, $100,000. Rev. C. E. Wren, Pastor.

Wheeling, W. Va.—Plans being prepared by Paul Gerhart, 64 W. Randolph Street, Chicago, Ill., for a six-story brick reinforced concrete and steel fireproof storage warehouse for Wheeling Corrugating Co.; cost about $300,000.

Louisville, Ky.—Plans completed by D. X. & J. C. Murphy, Louisville, for 3-story addition to Tyler Hotel; cost $200,000.

Cleveland, Ohio.—Arthur M. Gordon Co., Illuminating Building, reports plans being prepared for $400,000 apartment hotel to be erected at Seventy-ninth Street and Hough Avenue.

Indianapolis, Ind.—John B. Bright & Son, 130 S. Pennsylvania Street, will erect on S. Meridian Street a building costing $40,000.

Terre Haute, Ind.—Masonic Temple Assoc. will erect temple on Eighth and Eagle Streets, costing $90,000. A. H. Hubbard, Champaign, Ill., Archt.

Minneapolis, Minn. — Salvation Army Industrial Home, Nicolett Island, recently destroyed by fire, is to be rebuilt at a cost of $100,000. Maj. Arthur H. Case may be able to give further information.

St. Paul, Minn.—Gamble-Robinson Commission Co., 222 Sixth Street N., Minneapolis, will erect a 6 or 8-story fruit and produce building, costing about $100,000.

North Platte, Neb.—Dr. N. McCabe, North Platte, will erect 3-story hotel; cost $75,000.

White Sulphur Springs Mont.—Reported A. F. Conrad, Great Falls, is interested in erecting 3-story 175 x 185 ft. fireproof hotel here; cost $100,000.

Corpus Christi, Tex.—Plans completed by Henry T. Phelps, San Antonio, for 3-story brick and concrete apartment house to be erected by T. Vakay; cost $60,000.

Tacoma, Wash.—Rev. D. H. Trimble, Pastor First Methodist Church, it is reported, will soon let contract for erecting church at S. Fifth and K Streets; cost $60,000.

Idaho Falls, Idaho.—Mayor Shane, it is reported, will erect a 2-story and basement brick and concrete business building; cost $50,000.

BIDS DESIRED.

Great Falls, Mont.—Reported desired until July 20 for erecting 2-story and basement reinforced concrete, 75 x 150 ft., building for Tribune Properties, Great Falls. Henry Hall, Johnson & Co., Archts., Ford Bldg., Great Falls.

Richmond, Mo.—Until July 26 at office of S. L. Bay, Richmond Trust Co., for furnishing material and erecting edifice for M. E. Church South, including plumbing and heating. Eckel & Aldrich, Archts., Corby-Forsee Building, St. Joseph.

PRICES AND LETTINGS.

★Indicates award of contract.

★**Worcester, Mass.**—Contract for erecting St. Casimir's Church awarded E. L. Santson & Bros. Co., Springfield. Cost, including furnishings, $60,000. William J. Donahue, Archt., Springfield.

★**New Britain, Conn.** — Contract for erecting 4-story brick building on Main and N. Main Sts. for Sam Berkowitz awarded Conrad Cianci; cost $50,000. Unkelbach & Perry, Archts., New Britain.

★**Brooklyn, N. Y.**—Contract for erecting two-story brick parochial school at Boyd Avenue and Syosset Street for St. Thomas Apostle R. C. Church awarded Frank Droesch Woodhaven, and carpenter work to Charles Singer, Woodhaven; cost about $30,000. Francis J. Berlenbach, Archt., 260 Graham Avenue.

★**Buffalo, N. Y.**—Contract for erecting 3-story brick and steel parochial school for R. C. Church of the Transfiguration awarded W. J. Wierzbowski, 1427 Bway; cost $60,000. W. H. Zawadski, Archts., 798 Fillmore St.

★**Schenectady, N. Y.**—Contract for enlarging the Mohawk Baths Hotel, S. Centre Street, awarded to J. F. Growe Constr. Co., at about $125,000 for general construction; heating, W. B. Armstrong; plumbing, Peter Keeler Bldg., Co., all of Albany.

★**Ebensburg, Pa.**—Contract for erecting 4-story building for Cambria Title Savings & Trust Co. awarded Andrew J. Robinson Co., 123 E. Twenty-third Street, New York. Cost about $60,000.

★**Erie, Pa.**—Contract for erecting 3-story steel, concrete and brick lodge building at 7th and French Sts. for Loyal Order of Moose awarded George J. Ecker, 950 W 5th St., at $55,000. James B. Yard, Archt., Penn Bldg.

★**Lansdowne, Pa.**—Contract for erecting Presbyterian Church awarded W. Beaumont, St. Girard Bldg., Philadelphia, at $315,000.

★**Baltimore, Md.**—Contract for erecting 4-story fireproof garage for Baltimore City Garage Co., at 29 S. Charles Street, awarded Joseph C. Schamberger, 2122 E. Baltimore Street; cost $100,000. Wyatt & Nolting, Archts., Baltimore.

★**Atlanta, Ga.**—Contract awarded Gude & Co., Atlanta, for erecting 3-story brick and terra cotta apartment house at Peachtree and Fourth Sts. for Ralph Peters Black; cost $60,000. C. E. Frazier, Archt., Candler Bldg.

★**Baton Rouge, La.**—Contract for erecting fireproof concrete, steel and terra cotta newspaper building for State-Times awarded J. D. Brown, Baton Rouge. Favrot & Livaudais, New Orleans, Archts.

★**Louisville, Ky.**—Contract for erecting Y. W. C. A. building at Second Street and Broadway awarded Geo. H. Rommel Co., Louisville; cost to be about $175,000. J. B. Hutchings & Son, Archts., Columbia Bldg.

★**Columbus, Ohio.**—Contract for erecting office building and storehouse for Rosenthal Bros. on W. Spruce Street awarded D. W. McGrath, New Frist Natl. Bank Bldg., at $32,500. Reibel & Son, Archts., New First Natl. Bank Bldg.

★**Toledo, Ohio.**—Contract for erecting brick addition to garage on Monroe St. for Atwood Automobile Co., awarded Schmidt Hardwood Co.; cost $30,000. Manfred & Mark Stophlet, Archts., Nasby Bldg.

★Contract for rebuilding the Water St. section of Niagara Hotel awarded H. J. Spieker Co., 409 Michigan St., at $37,050. Thomas F. Huber, Archt., The Spitzer.

★Contract awarded Theodore Starrett, Detroit, Mich., for erecting 7-story storage building for Schiewe Storage Co.

★**South Bend, Ind.**—Contract for erecting at Jefferson Boulevard and Michigan Street a 4-story building for the Union Trust Co. awarded H. G. Christman Co., 125 S. St. Joe Street; cost $200,000.

★**Grand Rapids, Mich.**—Contract awarded by Standard Oil Co. to Hauser Owens Ames Co., Grand Rapids, for erecting 3-story brick and terra cotta building on Butterworth Street; cost $25,000.

★**Champaign, Ill.**—Contract for erecting 4-story fireproof steel, brick and terra cotta building for Morrissey Stipes at Park Avenue and Neil Street awarded Freeman & Brooks, Champaign; cost approximately $155,000.

★**Decatur, Ill.**—Contract for erecting Old Folks Home awarded by Pythian Home Bd. to L. N. Cope & Son, Decatur, at about $32,000; heating, plumbing and sewerage to C. C. Schureman, Jacksonville, at $5,600.

★**Albert Lea, Minn.**—Contract for erecting office building on Newton and William Streets for Harm Subby & Erickson, awarded Wm. S. Kingsley, Faribault, at $140,000.

★**Wichita, Kan.**—Contract for erecting the 6-story brick and concrete fireproof building for Fourth Natl. Bank awarded Swenson Constr. Co., Kansas City, Mo., at $109,072.

★**Seattle, Wash.**—Contracts for materials for the 10-story building at Third Avenue and Stewart Street being erected for Washington Securities Corp. awarded as follows: Terra cotta, to Northern Clay Co.; granite, Sizer Stone Co.; 100 tons of reinforcing steel, Pacific Coast Steel Co.; 300 M ft. lumber, Schwager-Nettleton Mill Co.; all of Seattle.

NEW INDUSTRIAL PLANTS

PROPOSED WORK.

Schenectady, N. Y.—American Locomotive Co. reported planning improvements costing $500,000.

Bloomfield, N. J.—Permit issued to International Arms & Fuse Co. of New York to erect a factory here for manufacture of time fuses for shells. A building 525 x 125 ft., with wing 300 x 60 ft., is to be erected; also a magazine for storage of black powder. Francisco & Jacobus, Consulting Engrs., 200 Fifth Avenue, New York, representatives.

Oil City, Pa.—Church costing $35,000 to be erected for St. Agatha Congregation at Fifth Street and Spring Avenue.

Philadelphia, Pa.—Plans prepared by Horace Trumbauer, Land Title Bldg., for club house for City Club to be erected on Broad and Pine Streets.

Washington, D. C.—American Federation of Labor, Ouray Building, will erect building in downtown section to cost $150,000.

Wheeling, W. Va. — Stockholders of Wheeling Steel & Iron Co. authorized $5,000,000 bond issue; $2,500,000 to be used for improvements.

Cleveland, Ohio.—Standard Welding Co., W. Seventy-sixth Street and N. Y. Central R.R., plans erecting $100,000 manufacturing plant adjacent to present plant.

Findlay, Ohio.—Plans being prepared for addition, 90 x 140 ft., to be erected to factory of Toledo Ford Tire Co. on Western Avenue.

Toledo, O.—Reported Gortland Bros. of Marion, Ind., will erect foundry to be known as Grey Iron Foundry; cost $30,000.

Sioux Falls, S. D.—Reported Sulzberger & Sons Co. will erect a $[illegible] plant here.

Galveston, Tex.—J. St Mary will erect cotton concentration plant of Forty-second and Forty-third Streets and Avenue M; capacity 25,000 bales; cost, about $75,000.

BIDS DESIRED.

Philadelphia, Pa.—Reported desired until July 26 by Pennsylvania R. R. Co. (A. C. Shand, Ch. Engr., Philadelphia) for erecting a 5-story reinforced concrete, 100 x 200 ft., grain elevator at Girard Point.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Rochester, N. Y.**—Contract awarded Turner Constr. Co., 11 Broadway, New York, for erecting 5-story, 95 x 217 ft., reinforced concrete factory and warehouse, beam and girder construction, for Vacuum Oil Co.

★**Syracuse, N. Y.**—Contract awarded W. J. Barry Co., Syracuse, for erecting 4-story addition, 133 x 180 ft., automobile plant of H. H. Franklin Mfg. Co., Orchard Street; cost $[illegible]. Structural steel contract awarded to Williams Bridge Co., Syracuse.

★**Warren, Pa.**—Contract awarded McClintic-Marshall Co., Pittsburgh, for erecting shop building for Struthers-Wells Co.; cost $[illegible]. Machinery to be installed will cost $60,000 additional.

★**Hamilton, Ohio.**—Contract awarded Cullen & Cullen & Vaughn Co., Hamilton, for erecting addition to factory of Herring-Hall-Marvin Safe Co. in East Hamilton; cost $40,000.

★**Milwaukee, Wis.**—Contract for erecting Ford assembly plant on Prospect and Farwell Avenue awarded O. H. Bossery Co., 848 Jackson Street, building to be brick and concrete, and cost complete about $250,000.

★**Keokuk, Iowa.** — Contract awarded Stone & Webster Eng. Corp., Boston, Mass., for erecting smelting plant for River Smelting & Refining Co. (R. G. Hall, Gen. Mgr.).

MISCELLANEOUS

BIDS DESIRED.

Skylights—Albany, N. Y.—Until July 27 by Tray. Pub. Bldgs., Executive Chamber, Capitol, Albany, for restoration of interior skylights over Western Staircase, N. Y. State Capitol, advertised in Engineering Record. Lewis F. Pilcher, State Archt., Albany.

Sprinkler System—New Orleans, La.—Reported desired until July 21 by Port Comm. (Ernest M. Loeb, Pres., New Orleans Court Bldg.) for furnishing and installing sprinkler equipment for buildings and underground water piping system for cotton warehouses and terminal now under construction on Mississippi River between Valence and Soulat Streets. Ford, Bacon & Davis, Engrs., 921 Canal Street.

Iron Fence — Cleveland, Ohio. — Until July 19 by Commissioner Purchases and Supplies for iron fencing at E. Ninety-third street bath house and Brookside Park.

Elevators—Chicago, Ill.—Until July 20 by W. S. Monroe, Comr. Pub. Wks., for furnishing and installing complete, 2 electric passenger elevators in No. 3 Ward Building, Contagious Disease Hospital, S. California Ave. and W. 21st St.

Cement Roofing Tile—Panama.—Until Aug. 2 by Maj. F. C. Boggs, Corps Engrs., U. S. A., General Purchasing Officer, the Panama Canal, Washington, D. C., for furnishing cement roofing tile according to Circular 64, advertised in Engineering Record.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Plaza Work—Philadelphia, Pa.—Lowest bid opened July 2 by Dept. Pub. Wks. for improvement of S. Broad St. plaza from Oregon Avenue to Ellsworth Street, between Tasker Street and Fifteenth Streets, submitted by Edwin H. [illegible] of Philadelphia at $[illegible].

★**Cement — Washington, D. C.**—Contracts awarded by Secy. Interior for furnishing cement for use on various government irrigation projects as follows: To Ideal Portland Cement Co., Ida., Kan., 52,000 bbls. at $2.35 per bbl.; the Lehigh Portland Cement Co., Metaline Falls, Wash., 47,000 bbls. at $1 per bbl.; the Northwestern Portland Cement Co., El Paso, Tex., 12,000 bbls. at $2.40 per bbl.; Three Forks Portland Cement Co., Trident, Mont., 17,000 bbls. at $1.25 per bbl.; and Pacific Portland Cement Co., Tolenas, Cal., 5,500 bbls. at $1.40 per bbl.

Proposals

For Proposals Advertised, see Pages 45, 47, 48 and 49.

WATERWORKS.

Bids Close.		See Eng. Record.
July 20	System, West Lynn, Ore.	July 3
July 20.	Intake, Etc., Kenosha, Wis.	July 10
July 20.	Pipe Trenching, Covington, Ky.	July 17
July 20.	Mains and Tunnel, St. Louis, Mo.	July 17
July 20.	Mains, Cedar Rapids, Ia.	July 20
July 21.	Pump, Fargo, N. D.	July 17
July 22	Filters, Paris, Ill. Adv. July 3, 10.	July 3
July 22.	Reservoir, Mifflinburg, Pa. Adv. July 10, 17.	July 10
July 22.	Laying pipe, Cincinnati, O.	July 20
July 23.	Reservoir, Binghamton, N. Y. Adv. July 3 to 17.	July 3
July 23.	Tanks, Houston, Tex.	July 17
July 24.	Reservoir, Gallitzin, Pa. Adv. July 10, 17.	July 10
July 24.	Pump, Chicago, Ill.	July 17
July 26.	Reservoir, etc., Sioux Falls, S. D. Adv. July 10.	July 10
July 26.	Intake, Etc., Kenosha, Wis. Adv. July 17.	July 17
July 26.	Pump, Oakville, Ont.	July 17
July 26.	Water Wks., Wilbaux, Mont.	July 17
July 27.	Pumping Station, Woodbury, N. J.	July 17
July 27.	Pump. Equip., Rockford, Ill. Adv. July 17.	July 17
July 28.	Water Wks. Improv., Lake Field, Minn.	July 10
July 28.	Valves, Baltimore, Md. Adv. July 20.	July 20
July 30.	Waterworks, Pateros, Wash. Adv. July 20.	July 20
July 31.	Improvements, Wellington, Ohio	July 17
Aug. 2.	Dam, Contract 10, Hartford, Conn. Adv. July 10, 17.	July 10
Aug. 5.	Water Wks. Improv., Cambridge, Ohio Adv. July 17.	July 17
Aug. 10.	System, Warrenton, N. C. Adv. July 17.	July 17
Aug. 16.	System, Watervliet, N. Y. Adv. July 17.	July 17

SEWERAGE AND SEWAGE DISPOSAL.

July 20.	Brazil, Ind.	July 3
July 20.	Eveleth, Minn.	July 3
July 20.	Alma, Mich.	July 17
July 20.	Toronto, Ont.	July 17
July 20.	Cedar Rapids, Ia.	July 20
July 21.	Baltimore, Md.	July 10
July 21.	Marion, Ohio	July 17
July 21.	Brooklyn, N. Y.	July 17
July 22.	Milwaukee, Wis. Adv. July 10, 17.	July 10
July 23.	Fairport, N. Y. Adv. July 17.	July 17
July 26.	Maywood, N. J. Adv. July 3, 10.	July 3
July 26.	Ocean City, Md. Adv. July 10, 17.	July 10
July 26.	Sandstone, Minn.	July 17
July 26.	Wilbaux, Mont.	July 17
July 26.	Appleton, Wis.	July 20
July 27.	Cloverdale, Ala.	July 10
July 27.	Cincinnati, Ohio	July 17
July 28.	Cuyahoga Falls, Ohio.	July 10
July 28.	Cheviot, Ohio	July 27
July 29.	Newark, N. J.	July 20
Aug. 3.	Paducah, Ky. Adv. July 3, 10.	July 3
Aug. 10.	Warrenton, N. C. Adv. July 17.	July 17
Aug. 31.	Newark, N. J. Adv. July 17.	July 10

BRIDGES.

July 20.	Watertown, S. D.	July 3
July 20.	Seattle, Wash.	July 3
July 20.	Columbus, Ohio	July 17
July 21.	Hardin, Mont.	July 3
July 21.	Youngstown, Ohio	July 10
July 21.	Minetto, N. Y. Adv. July 17.	July 17
July 21.	Harrisburg, Pa.	July 17
July 22.	Moundsville, W. Va.	July 10
July 23	Seattle, Wash. Adv. Jun. 19 to July 17.	Jun. 19
July 23.	North Yakima, Wash.	July 20
July 24.	Moorefield, Ont.	July 3
July 24.	Newark, Ohio	July 3
July 25.	Holton, Kan.	July 3
July 26.	Williamson, W. Va.	July 17
July 27.	Coshocton, O.	July 20
July 28.	Mansfield, Ohio	July 10
July 29.	Houtzdale, Pa.	July 17
Aug. 2.	Los Angeles, Cal.	July 20
Aug. 2.	Glenolden, Pa. Adv. July 20.	July 20
Aug. 4	South Amboy, N. J.	July 10
Aug. 7.	Clearwater, Fla.	July 17

PAVING AND ROADS.

July 20.	Oelwein, Ia.	Jun. 19
July 20.	Huntington, W. Va.	July 3
July 20.	Seattle, Wash.	July 3
July 20.	Laurel, Miss.	July 10
July 20.	Xenia, Ohio	July 10
July 20.	New Orleans, La.	July 17
July 20.	Greenwood, Miss.	July 17
July 20.	Dewey, Okla.	July 17
July 20.	Oak Park, Ill.	July 17
July 20.	Clinton, Ia.	July 20
July 20.	Kansas City, Mo.	July 20
July 20.	Milwaukee, Wis.	July 20
July 21.	Le Mars, Iowa	July 17
July 21.	Brooklyn, N. Y.	July 17
July 21.	Ann Arbor, Mich.	July 17
July 22.	Boonville, N. Y. Adv. July 3.	July 3
July 22.	Newark, N. J.	July 10
July 22.	Zanesville, Ohio	July 17
July 22.	Cincinnati, Ohio	July 17
July 23.	Spokane, Wash.	July 10
July 23.	Ashdown, Ark.	July 17
July 23.	Ohio	July 17
July 23.	Holyoke, Mass.	July 17
July 23.	Holyoke, Mass. Adv. July 17.	July 17
July 23.	St. Louis, Mo.	July 20
July 24.	Spencer, Ia.	Jun. 26
July 24.	Sarasota, Fla.	July 10
July 25.	Tiffin, O.	Jun. 26
July 26.	Albany, N. Y. Adv. July 10, 17.	July 10
July 26.	Burlington, N. J. Adv. July 10.	July 10
July 26.	West Jefferson, Ohio.	July 10
July 26.	Burlington, Iowa	July 17
July 26.	California	July 17
July 26.	Jewett, Pa. Adv. July 17.	July 17
July 26.	Takoma Park, D. C.	July 17
July 26.	Los Angeles, Cal.	July 20
July 26.	Ashdown, Ark.	July 3
July 27.	New Orleans, La.	July 10
July 27.	Seattle, Wash.	July 10
July 27.	Janesville, Wis.	July 17
July 27.	Green Bay, Wis.	July 17
July 27.	Spencer, Iowa	July 17
July 27.	Meriden, Conn. Adv. July 20.	July 20
July 28.	Cuyahoga Falls, Ohio.	July 10
July 29.	Norfolk, Va. Adv. July 17.	July 17
July 29.	McKinney, Tex.	July 20
July 29.	Lima, O.	July 20
Aug. 2.	Fort Scott, Kan.	July 3
Aug. 2.	Issaquah, Wash.	July 17
Aug. 2.	Seattle, Wash.	July 17
Aug. 3.	Road Roller, West Palm Beach, Fla.	July 17
Aug. 3.	New Orleans, La.	July 17
Aug. 3.	Albany, N. Y. Adv. July 17.	July 17
Aug. 4.	Butte, Mont.	July 10
Aug. 6.	Mount Gilead, Ohio.	July 17
Aug. 6.	Russellville, Ark.	July 20
Aug. 7.	Butte, Mont.	July 10
Aug. 10.	New Orleans, La.	July 17
Aug. 10.	Washington, D. C. Adv. July 17.	July 17
Aug. 17.	Memphis, Tenn.	July 17
Aug. 18.	Belding, Mich.	July 17

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS.

July. 19.	Steel Gates, Wilmington, N. C. Adv. Jun. 19 to July 10.	Jun. 19
July 20.	Irrigation Work, Washington, D. C. Adv. July 3.	July 3
July 21.	Ditch Improvement, Canton, Ohio	July 3
July 21.	Pumping Plant, Etc., Quincy, Ill. Adv. July 3, 10.	July 3
July 21.	Dredge Work, Austin, Minn. Adv. July 17.	July 17
July 21.	Stone for Jetties, New Orleans, La.	July 17
July 22.	Pier, Augusta, Ga. Adv. July 10, 17.	July 10
July 23.	Structural Steel for Wharf, Panama	July 17
July 23.	Wharf, Etc., Houston, Tex.	July 17
July 24.	Dredging, Jacksonville, Fla. Adv. Jun. 10 to July 17.	Jun. 26
July 26.	Ditch, Marshall, Minn.	July 17
July 26.	Pier, Redondo, Cal.	July 17
July 28.	Cylinder Gates, Washington, D. C.	July 17
July 30.	Irrigation Work, Great Falls, Mont.	July 3
July 30.	Dredging, Port Chester, N. Y. Adv. July 3 to 17.	July 3
July 30.	Breakwater, Conneaut, Ohio Adv. July 3 to 17.	July 3
July 30.	Breakwater, Lorain, Ohio Adv. July 17.	July 17
July 20.	Dredging, Kansas City, Mo.	July 20
July 31.	Dredging, Pearl Harbor, Hawaii	Jun. 19
July 31.	Dam and Shore Protection, Rock Island, Ill. Adv. July 10, 17.	July 10
July 31.	Levee, Caldwell, Tex.	July 10
July 31.	Ditch, North Yakima, Wash.	July 17
July 31.	Drains, North Yakima, Wash.	July 20
Aug. 2.	Dredging, New York, N. Y. Adv. July 10, 17.	July 10
Aug. 3.	Breakwater, Chicago, Ill. Adv. July 10, 17.	July 10
Aug. 4.	Dredging, Norfolk, Va. Adv. July 10.	July 10
Aug. 9.	Pier, Philadelphia, Pa. Adv. July 10, 17.	July 10
Aug. 9.	Dredging, Philadelphia, Pa. Adv. July 10, 17.	July 10
Aug. 13.	Irrigation Work, Saco, Mont. Adv. July 17.	July 17
Aug. 14.	Dredging, Bremerton, Wash.	July 10
Aug. 15.	Dredge Work, Rosseau, Minn.	Jun. 26
Sep. 18.	Pier, Pearl City, T. H.	July 10
Aug. 16.	Dredging, Portland, Me. Adv. July 17.	July 17
Aug. 24.	Dredger, Adelaide, Australia	Jun. 19

PUBLIC BUILDINGS AND SCHOOLS.

July 20.	Indianapolis, Ind.	Jun. 12
July 20.	Watertown, S. D.	July 3
July 20.	Cleveland, Ohio	July 10
July 20.	Milaca, Minn.	July 10
July 20.	Philadelphia, Pa.	July 17
July 20.	Ypsilanti, Mich.	July 17
July 20.	Detroit, Mich.	July 17
July 20.	Dallas, Tex.	July 20
July 20.	Ringling, Okla.	July 20
July 21.	New Orleans, La. Adv. Jun. 19 to July 17.	Jun. 19
July 21.	Roland, Iowa	July 3
July 21.	Salem, Ore.	July 3
July 21.	Kinbrae, Minn.	July 10
July 21.	Pittsburgh, Pa.	July 17
July 22.	Cleveland, Ohio	July 3
July 22.	Los Angeles, Cal.	July 17
July 22.	Buffalo, N. Y.	July 17
July 22.	Chicago, Ill.	July 17
July 22.	Portland, Ore.	July 17
July 22.	Medford, Mass.	July 20
July 23.	Fort Hancock, N. J.	July 3
July 23.	New Dorp, N. Y.	July 17
July 23.	Muncy, Pa.	July 17
July 24.	San Diego, Cal.	Jun. 26
July 24.	Lowell, Ohio	July 3
July 24.	Fayetteville, Ohio	July 3
July 24.	Tabor, S. D.	July 10
July 26.	Webb City, Mo.	Jun. 19
July 26.	Springfield, Ill.	July 10
July 26.	Upper Darby, Pa.	July 17
July 27.	Weston, W. Va. Adv. July 3.	July 3
July 27.	New Bloomington, Ohio.	July 3
July 27.	Albany, N. Y. Adv. July 3, 10.	July 3
July 27.	Boston, Mass.	July 10
July 27.	Peekskill, N. Y. Adv. July 17.	July 17
July 27.	Beverly, Mass.	July 17
July 27.	New Bloomington, Ohio.	July 17
July 28.	Jersey City, N. J.	July 3
July 28.	Hayti, S. D.	July 10
July 28.	Richmond, Mo.	July 17
July 29.	Quitman, Ga.	Jun. 26
July 29.	Oradell, N. J.	July 17
July 30.	Albion, Mich.	Jun. 26
July 30.	Cincinnati, Ohio	July 10
July 30.	Kenosha, Wis.	July 10
July 31.	Guantanamo, Cuba	July 3
July 31.	Muncie, Ind.	July 3
July 31.	Stevens Point, Wis.	July 10
July 31.	Millfield, Ohio	July 17
Aug. 1.	Seattle, Wash.	Jun. 5
Aug. 2.	Fort Atkinson, Wis.	July 3
Aug. 2.	Washington, D. C. Adv. July 3, 10.	July 3
Aug. 2.	Kent, Ohio	July 17
Aug. 2.	Pisgah, Iowa	July 17
Aug. 2.	Hammond, Ind. Adv. July 17.	July 17
Aug. 6.	Cleveland Heights, Ohio.	July 17
Aug. 9.	Lansford, Pa.	July 17
Aug. 11.	Wellsburg, W. Va.	July 10
Aug. 12.	North Attleboro, Mass.	July 10
Aug. 13.	Gardiner, Me.	July 10
Aug. 15.	Schuyler, Neb.	July 17
Aug. 16.	Baltimore, Md. Adv. Jun. 26 to July 3.	Jun. 26
Aug. 19.	Blackwell, Okla.	July 17
Sep. 1.	Wisner, Neb.	July 10

PRIVATE BUILDINGS.

July 20.	Great Falls, Mont.	July 17
July 26.	Richmond, Mo.	July 17

MISCELLANEOUS.

July 20.	El. Ry., Brooklyn, N. Y. Adv. July 3, 10.	July 3
July 20.	Steel Beams, Washington, D. C.	July 10
July 20.	Garbage Disposal, New York, N. Y.	July 17
July 20.	Elevators, Chicago, Ill.	July 17
July 21.	Elevator, Port Townsend, Wash.	Jun. 26
July 21.	Power Plant Machinery, Greencastle, Ind. Adv. July 3.	July 3
July 21.	Railroads, Alaska	July 17
July 21.	Sprinkler System, New Orleans, La.	July 17
July 27.	Manganese Rails, New York, N. Y.	July 17
July 27.	Skylights, Albany, N. Y. Adv. July 17.	July 17
July 27.	El. Ry., Section 3, New York, N. Y. (2 prop. Adv. July 17.	July 17
July 28.	Section 2, El. Ry., New York, N. Y. Adv. July 17.	July 17
July 28.	Rail Splice Bars, Etc., for Rys., New York, N. Y.	July 17
July 31.	Timber, Detroit, Mich. Adv. Jun. 26, July 10, 17.	Jun. 26
Aug. 3.	Route 50, Station Finish, El. Ry., New York, N. Y. Adv. July 17.	July 17
Aug. 3.	Cement Roofing Tile, Panama Adv. July 17.	July 17
Aug. 4.	Station Finish, Section 2, El. Ry., New York, N. Y. Adv. July 17.	July 17
Aug. 12.	Steel Barges, Vicksburg, Miss. Adv. July 10, 17.	July 10
Aug. 16.	Towing Locomotives, etc., Panama.	Jun. 26
Aug. 16.	Subway Work, Philadelphia, Pa.	July 10
Aug. 16.	Found. and Piers for El. Ry., Philadelphia, Pa. Adv. July 17.	July 17
Sep. 18.	Ry. at Naval Station, Pearl Harbor, Hawaii.	July 10

Steel Plates Are Improvement in Tunnel Lining

Steel tunnel-lining plates are said to be proving more economical and safer than timbering in building tunnels in soft ground. The photograph, shown herewith, illustrates the way in which these pressed steel plates are



SEGMENTAL LINING FOR 8-FOOT TUNNEL

fitted together. The rings shown are for an eight-foot tunnel. They were made by the Blaw Steel Construction Company of Pittsburgh.

Electrification Data

Under the caption of "Results of Electrification" the Westinghouse Electric & Manufacturing Company, of East Pittsburg, Pa., has issued an ornate booklet of 72 8½ x 11-in. pages on heavy paper, showing by engraving and text the principal installations in which the company has had a hand. These include those on the Pennsylvania, New Haven, Norfolk & Western and numerous other railroads in the United States, not to mention the Italian State Railways. They also embrace urban lines, tunnel work, mountain grades, yard work, high-class electric interurban lines —virtually every class of railroad transportation to which the electric locomotive or multiple-unit system has been applied. On next to the last page is a table of mileage and electric equipment of all electrified steam roads in the United States, with the dates of electrification and information as to which are Westinghouse installations.

The company has also issued the first number (June, 1915) of a periodical called "Westinghouse Electrification Data." This is an 8½ x 11-in. illustrated pamphlet of 12 pages, giving technical data, performance records, comparative costs and other pertinent information.

Business Notes

Charles Allison Lamb, formerly a manager of the National Tube Company, died at his home in Chicago, July 18.

The Cambridge Works of the Interstate Iron & Steel Company of Chicago, at Cambridge, Ohio, was destroyed by fire, July 18.

W. Spencer Robertson was appointed secretary of the American Locomotive Company, 30 Church Street, New York City, at a meeting of the board of directors, held July 14.

William T. Dunn, formerly tool steel expert for the Carpenter Steel Company in New England, has been appointed district sales agent for New England and eastern Canada for the International High Speed Steel Company of New York.

Robert C. Scott, for many years secretary and treasurer of the Morris Machine Works, builders of dredges, centrifugal pumps and pumping engines, of Baldwinsville, N. Y., died July 3.

The Austin-Western Road Machinery Company of 910 South Michigan Avenue, Chicago, has arranged to open a branch office in the Bulletin Building, Philadelphia, under the supervision of E. M. Terwilliger.

George P. White has been appointed manager of the Philadelphia office of the Buffalo Steam Roller Company, sole builder of Buffalo Pitts Rollers, of Buffalo. He has been connected with the company for several years. The Philadelphia office is located in the Bulletin Building.

C. F. Rouze has been appointed sales manager for the Knox Motor Association of Springfield, Mass., sole distributors of the products of the Knox Motors Company, succeeding H. F. Blanchard, resigned. Mr. Rouze was formerly in charge of the Knox branch office at Kansas City.

Ralph T. Coe, manager of the Canadian Sirocco Company, Ltd., of Windsor, has resigned to enter the engineering service and sales field in New York State with offices at the Insurance Building, Rochester, and the Live Stock Exchange Building, Buffalo. He has been appointed district manager for Warren, Webster & Company and the American Blower Company of Detroit.

M. Beatty & Sons, Ltd., manufacturer of dredges, hoisting engines, ditchers, locomotive cranes and other equipment, of Welland, Ont., announce a change of control and management, effective July 19. H. L. Beatty has been elected president of the company. A. O. Beatty, formerly consulting engineer, vice-president and general manager and Harris T. Dunbar, a member of the board of directors. V. R. Browning, formerly president; R. A. Green, formerly general manager and B. F. Miles, of the board of directors, who had charge of the business for the past three years have severed their connection with the company.

The Harvey Company, with office and warehouse located at 113 South Street, Baltimore, has recently been incorporated to sell railroad, contractors', builders', marine and industrial equipment. It will also maintain a storage yard at Curtis Bay, Md., along the Baltimore & Ohio Railroad tracks, where facilities will be arranged for the storage of contractors' engines, cars and other items of plant. It is desirous of receiving a complete line of catalogs and prices from all manufacturers of materials in its line. J. Edward Harvey, formerly vice-president of the South Baltimore Steel Car & Foundry Company, and also proprietor of the Eastern Railway Supply Company, is president of the company.

Trade Publications

The following companies have recently issued trade literature:

Beaudry & Company, 141 Milk Street, Boston, Mass. Catalog, 3½ x 6 in., 16 pages, illustrated. Beaudry Champion and Peerless power hammers.

Trussed Concrete Steel Company, Youngstown, Ohio. Circular, 12½ x 10 in., colored and illustrated. Relates how United steel sash was tested at the Edison plant after the fire and accepted for the reconstruction.

Builders' Iron Foundry, Providence, R. I. Bulletin 140, sheet folder, illustrated. Brief outline of the principal features of type M register-indicator-recorder for the Venturi meter, which records autographically the rate of flow of fluid through the meter tube.

Carbo Steel Pole Company, Rand-McNally Building, Chicago. Catalog 4 x 9 in., 20 pages, illustrated. Descriptive of the principle governing the construction of Carbo stand and steel poles for transmission lines and of their economy over wooden poles in actual transmission-line construction, which is said to be a saving of $585 per mile.

Keystone Blue Paper Company, 912 Filbert Street, Philadelphia. Sample book, 8 x 3½ in., 20 pages, illustrated. Contains specimens of blue process paper for blue printing and specifications for ordering same. Certain processes of manufacture are described and illustrated.

A. Leschen & Sons Rope Company, St. Louis. "Leschen's Hercules," June, 1915, 8 x 10¼ in., 12 pages, illustrated. Contains brief articles on hardwood logging and manufacturing in Mississippi and sand and gravel handling in Louisiana, etc., where "Hercules" cables are used.

Austin-Western Road Machinery Company, Chicago. Two folders, 10 x 6¾ in., 4 pages each, illustrated. Describe the latest additions to this company's line of earth handling and road making machinery. The Austin road ripper and the Western No. 10 traction engine grades.

Rochester Excavating Machinery Company, Rochester, N. Y. Catalog, 12½ x 10½ in., 21 pages, illustrated. A detailed and complete description of the Fogarty excavating bucket, showing with reproduced photographs its capacities as a bucket, for what work it is designed and its wide range of usefulness.

Ingersoll-Rand Company, 11 Broadway, New York. Bulletin 3031, 6 x 9 in., 24 pages, illustrated. Describes the new Ingersoll-Rogler, class FR-1 steam-driven, single-stage, straight-line air compressor, which has for its principal features special air valves in the air cylinder and the balanced piston steam valve with automatic cut-off control in the steam cylinder. Bulletin 4034, 6 x 9 in., 4 pages, illustrated. Describes the smaller, type 26, Leyner-Ingersoll water drill, which is similar to type 18 in design, yet considerably lighter and is intended for smaller diameter and shorter depth holes.

Emerson Pump & Valve Company, Alexandria, Va. Catalog, 6¼ x 9½ in., 80 pages, illustrated. A comprehensive presentation of facts, information and instructions as to their installation and operation, relative to Emerson steam pumps is contained in the first portion of this catalog. The uses to which they have been applied in connection with contracting work, raising sunken ships, etc., are reproduced in the illustrations. Tables containing data for sizes, prices, etc., and contents of cylinders are included. A second portion of the book consists of a list of parts and their prices and a third and last section of testimonials.

Picher Lead Company, Joplin, Mo. Booklet, 6 x 9 in., 48 pages, illustrated. The subject of this publication is protective coatings for structural metals with special reference to the merits of sublimed blue lead and white lead. Corrosive action and prevention, paint values and paints tested at Atlantic City from 1908 to 1914 under the auspices of the American Society for Testing Materials are discussed, while the special points of sublimed blue lead and white lead, which are classed as eight, are briefly elucidated. The illustrations show some of the sections of the metal panels tested at Atlantic City and several large structural steel constructions upon which the sublimed blue lead was used.

Robert W. Hunt & Company, engineers, Chicago. Six useful booklets, devoted respectively to cement and concrete, paving brick, highway bridges, creosoted timber, steel rails and the engineering division of the company. The first four mentioned are similar, 4 x 9¼ in., containing from 8 to 19 pages; each includes standard or proposed standard specifications. The rail booklet, 8½ x 11 in., 16 pages, contains the standard specifications of the American Railway Association, the American Society for Testing Materials, and three sets of manufacturers' specifications, together with tabulated dimensions of standard sections. The sixth booklet, 5 x 8 in., 16 pages, is printed in an attractive manner, and sets forth the field covered by the company, and its departmental organization and equipment.

New Construction Activities

Railway earnings throughout the country showed an increase over last year for the first time in the statement for May just made public by the Interstate Commerce Commission. Increases had been recorded in previous statements, but the gain was confined to the Eastern roads. It is expected that revenues will show a still further improvement when the statistics for June are given out.

Work calling for structural steel has shown increased activity this month throughout the country. Contracts already awarded total 75,000 tons, and it is expected that work involving 80,000 tons more will be let before the end of the month. This would make the structural business for July the heaviest in many months. A large part of this tonnage is made up by four New York City rapid-transit contracts, and by the St. Louis Free Bridge, awarded July 18. Aside from these contracts, the principal gain is in the volume of building work, bridge work being still very light.

Labor troubles, arising apparently from a desire on the part of the unions to take advantage of the increased export business in some lines to improve their position, have not yet seriously affected construction projects.

Buildings

The lowest bid submitted for erecting a building for the Department of the Interior at Washington, D. C., was $1,622,000. A contract for building a $200,000 hospital has been awarded at New Hartford, N. Y. A contract for building a State hospital has been awarded at Woodward, Iowa, at $230,000. The lowest bid for erecting an orphanage at Superior, Wis., was $103,000. Bids are asked on a $100,000 municipal building for Little Falls, N. Y. It is reported that a contract for 1500 tons of steel to complete the Grand Central Terminal in New York City will be awarded this week by the New York Central Railroad. A contract will soon be let for erecting a $1,000,000 bank building in Philadelphia. Plans have been completed for a $250,000 hospital building at Boston. Plans have been filed for a $600,000 gymnasium for Barnard College in New York City. A $400,000 store building is to be erected at Detroit. Plans will be prepared for a $300,000 court house at Wilmington, Ohio. It is reported from Toronto that a $2,000,000 hotel will be built in that city. A permit has been issued for erecting the warehouse for a grocery company in Kansas City noted several weeks ago. The estimated cost is $175,000. It is reported that a $1,200,000 office building will be put up in Salt Lake City.

Bridges and Roads

A contract has been awarded at New Gretna, N. J., for a bascule drawbridge, at $78,800. The Pennsylvania Railroad has awarded a contract for its 1600-ft. concrete viaduct across the Schuylkill River at Manayunk, Pa. A concrete viaduct contracted for at Portsmouth, Ohio, will cost $120,000. Bids are desired for the substructure and superstructure of a concrete bridge with a bascule draw span at Bridgeport, Conn. Bids are desired for four bridges by the city of Philadelphia. Bids are desired in Cleveland for building the reinforced-concrete floor of the Clark Avenue viaduct, estimated to cost $100,000.

Plans are being prepared for a $250,000 bridge at Kingston, N. Y. Plans have been approved for a $500,000 bridge over the Susquehanna River at Wilkes-Barre, Pa. Plans for the Neville Island Bridge at Pittsburgh, which will cost $1,596,000, have been submitted to the U. S. War Department for approval. The contract for a $175,000 concrete bridge at Dayton, Ohio, will soon be let. Plans are being prepared at Portland, Ore., for grade crossing elimination work, involving eight bridges, which will cost $400,000.

A paving contract totaling $75,000 has been awarded at Lebanon, Pa. A $90,000 asphalt-road contract has been awarded at St. Albans, W. Va. A contract for surfacing gravel roads awarded at Crystal Springs, Miss., amounts to $150,000. Kaufman, Tex., has awarded a $161,000 road contract. Bids are desired on considerable paving work at Middletown, Ohio. Bids are desired by the State of Washington on approximately $100,000 worth of road work. Bids will soon be opened on additional paving work in Manhattan and Brooklyn, New York City. Paving contracts totaling $180,000 will soon be let at Zanesville, Ohio. Williamsburg, Ky., has sold $150,000 road bonds, and road bonds totaling $375,000 have been sold at McKinney, Tex.

Waterworks and Sewers

Bids opened July 12 for city connections to the Catskill supply by New York City total nearly $135,000. Bids have been opened for a $35,000 reservoir at Media, Pa. A $120,000 waterworks contract has been awarded at Warrenton, Ore. Bids will be received Aug. 3 for laying 14,000 lin. ft. of 51-in. steel pipe at Ottawa, Ont. A report has been made at Aberdeen, Wash., recommending a $500,000 water-supply project.

The lowest bid received by New York City July 15 for sewer work was $81,293. Bids have been opened on a $60,000 sewer contract at Avalon, N. J. An $83,000 sewer contract has been awarded at Syracuse, N. Y. The lowest bid submitted for constructing the South End sewer at Peoria, Ill., was $221,000. Bids are desired Aug. 23 for constructing improved sewerage works at Dallas. Bids are desired for constructing a $300,000 reinforced-concrete sewer at Salt Lake City. The Joint Sewerage Commission of Vancouver, B. C., has approved the Hastings Park sewer.

Miscellaneous

The lowest bid received July 20 at New York City for constructing the Culver elevated line in Brooklyn was $877,959. The contract for laying track on the Utrecht Avenue line in Brooklyn was let at $71,000, and the low bid received for furnishing track and materials for the remaining lines of the dual system in New York City amounted to $1,202,000. The Thirty-Fifth Street pier in Brooklyn was contracted for last week at $319,000. The contract for the Pittsburgh highway tunnel was awarded this week at $1,145,625. Bids opened at Vicksburg, Miss., for $1,415,000 cu. yd. of levee work were rejected. The lowest bid for U. S. Government wharf and jetty work opened July 12 at Portland, Ore., was $176,000.

Plans of the Municipal Railway Corporation of New York City for rebuilding the Broadway and Myrtle Avenue lines in Brooklyn have been approved by the Public Service Commission. Bids are desired at Palmetto, Fla., for constructing a $110,000 drainage system. Bids are desired at Windom, Minn., for constructing ditches which will cost $130,000. It is reported that a franchise has been granted to a lumber railroad at Americus, Ga. It is also reported that a $500,000 causeway will be built at Fairmont, W. Va. Application has been made to the U. S. Government for aid in building a $3,000,000 dam for the Turlock and Modesto irrigation districts.

WATERWORKS

PROPOSED WORK

Pittsfield, Mass.—Plans reported completed by General Electric Co. for a reservoir to be constructed on the former Allen property east of present works.

Le Roy, N. Y.—Citizens reported to have voted an additional $15,000 bonds for water works extensions.

Camden, N. J.—Under direction of Water Chief Long of Camden, plans have been completed for an auxiliary pumping station to be located at Delair. It provides for a building in which will be installed 2 pumps each with a daily capacity of 5,000,000 gal.

Seaside Park, N. J.—Extension of water mains contemplated. Address Frank Brookaway, Boro. Clk.

Philadelphia, Pa.—Chief Davis, of the Bureau of Water, reported to be planning expenditure of $20,000 for improvement of water supply of south Philadelphia, to be devoted to reconstruction of new valve house of concrete masonry.

Wilson, N. C.—Citizens reported to have voted bonds for water works and street improvements.

Orangeburg, S. C.—Water and light bonds for $50,000 will be sold Aug. 9 by T. O. S. Dibble, City Clk.

Columbus, Ga.—Bd. of Water Comrs. (John C. Cook, Chmn.) has petitioned Bd. of Aldermen for an additional $50,000 to complete the water works.

Covington, Ky.—Water works improvement bonds for $200,000 will be sold July 29 by H. G. Klosterman, City Clk.

Attica, Ohio.—Citizens reported voted $10,000 bonds for installation of a filtration plant.

Cincinnati, Ohio.—City considering construction of high-pressure fire system, new tanks and relining reservoirs. J. A. Hiller, Gen. Supt. Water Wks.

Farmersville, Ohio.—A. F. Gilbert, City Clk., writes that wells are being drilled preliminary to construction of water works. Bids for bonds or construction not yet called for. Cost $16,000.

Grafton, Ohio.—J. R. Knight, Village Clk., writes P. J. Fitzgerald of Elyria secured franchise for water works and gas plant.

Hamilton, Ohio.—Bonds for $10,000 have been authorized for 3 new 10-in. wells and intake for water works system. Proposes second pumping unit in pumping station size not yet decided upon, will be at least 2100 gal. per min. pump. 16-in main extension and other pipes extended. Joseph B. Meyers, Dir. Pub. Service.

Marietta, Ohio.—Bd. Pub. Service (J. W. Pryce, Dir.) engaged Chester & Fleming, Pittsburgh, Pa., to report on different locations for high level reservoir and fitness of present pumping machinery relative to its ability to deliver into same.

Wellington, Ohio.—Bonds for $35,000 for constructing water works system will be sold July 29 by J. B. Murray, Village Clk.

Versailles, Ind.—Citizens voted bonds for construction of water works.

Waukegan, Ill.—City proposes purchasing high-pressure boilers for pumping station. A. L. Rogers, Clk. Bd. Local Improv.

Sidney, Iowa.—Citizens reported voted $20,000 bonds to extend water system.

Helena, Mont.—Water Comn. reported to have recommended to City Council the construction of 6300 ft. of flume.

Wellston, Okla.—Plans being prepared by Benham Eng. Co., Oklahoma City, for water works to cost $20,000. O. H. Coxes, City Clk.

Aberdeen, Wash.—H. H. Thompson, 520 Alaska Bldg., Seattle, recently engaged to make investigation of proposed water system recommends Wishkah River water head, where there is a dam which would supply 35,000,000 gal. of water daily, sufficient to supply a city of 300,000 inhabitants. He estimates cost of getting water at this point, which is twenty-three miles north of Aberdeen, at about $500,000. This would include a concrete dam, 25 ft. high, and purchase of 3500 acres of watershed. With this dam, later, if city desires, a canal may be dug from Wynoochee to connect with Wishkah dam. Council will soon call election to vote on proposition.

Florence, Ariz.—Plans being prepared by F. N. Ensign, Phoenix, for constructing municipal water works and an electric distributing system; cost, $50,000.

Bingham, Utah. — Citizens reported voted $17,000 bonds to improve and enlarge water works.

Pocatello, Idaho.—City proposes acquiring plant and holdings of Pocatello Water Co.; negotiations now pending. Citizens recently voted $400,000 bonds for water works. J. H. Giles, City Engr.

Sugar City, Idaho.—Citizens reported voted $15,000 bonds for installing munipal water works.

Toronto, Ont.—Civic Works Com. has sent a recommendation to Bd. of Control urging that construction of proposed duplicate water works system at Victoria Park be proceeded with immediately; probable cost $4,000,000.

BIDS DESIRED.

Hartford, Conn.—Plans and specifications are now on file at New York office of Engineering Record, for Contract 10, bids to be opened Aug. 2 by Bd. Water Comrs. for constructing Richards Corner Dam, compensating reservoir, in town of New Hartford.

Lockport, N. Y.—Until Aug. 5 by William G. Spalding, Clk. Bd. Water Comrs., for construction of a 10 and 12-in. water pipe in Market and Mill Streets, advertised in Engineering Record.

Contracting News

Of Special Interest to Engineers, Contractors, Builders and Manufacturers of Engineering and Building Supplies

New York, N. Y.—Until Aug. 10 by Bd. Water Supply, New York City (John F. Galvin, Comr.) for Contr. 165: Making 6 borings through rock, each over 500 ft. deep at the East shaft of Hudson Siphon, Catskill Aqueduct, Dutchess County.

Philadelphia, Pa.—Until July 30 by M. L. Cooke, Dir. Pub. Wks., for Oak Lane Pumping Station, main sewers, test borings.

Washington, D. C.—Until Aug. 10 at Bureau Supplies and Accounts, Navy Dept., Washington, D. C., for furnishing to the Navy Yards and Naval Stations the following: Brooklyn, N. Y., Sch. 8608—21,500 lb. seamless drawn brass pipe. Sch. 8603—Miscellaneous seamless drawn copper pipe. Sch. 8605—20,800 ft. standard weight wrought strong pipe. Philadelphia, Pa., Sch. 8605—13,300 ft. standard weight and double extra strong wrought pipe. Charleston, S. C., Sch. 8605—10,100 ft. galvanized wrought pipe. Norfolk, Va., Sch. 8608—312 brass gate valves, etc. Applications for proposals should designate the schedules desired by number.

Monticello, Ill.—Until July 28 by City Council, for water works improvements, to consist of installation of two steam pumps, each with a capacity fo 750 gals. per min., 12-in. deep well with all necessary equipment, 250,000-gal. concrete reservoir, laying approximately 1640 ft. 4-in. c. i. pipe line, and razing a 120-ft. stand-pipe of brick and steel.

Oglesby, Ill.—Until 8 p. m. July 26 by John Corgiat, City Clk., for deep well pumping machinery, pump house and 100,000-gal. steel tank and tower. Aetna Eng. Bureau, 17 N. La Salle Street, Chicago.

Ellsworth, Wis.—Until July 29 by C. B. Wood, City Clk., for extension to waterworks system. The work will consist of furnishing and installing, complete, additions to the pipe line system, requiring approximately 6541 ft. 6-in. Class C. C. I. B. S. and 4-in. C. I. B. S. water main, together with 700 ft. old 4-in. pipe to be taken up and relaid, including three 5-in. and six 4-in. Waterous hydrants, four 6-in. and four 4-in. valves and resetting of one 40-in. valve. J. F. Druar, Engr., Commercial Bldg., St. Paul, Minn.

Keota, Iowa.—Until Aug. 5 (readvertisement) by Town Clk. for constructing water works, consisting of an 8-ft. well, 100 ft. deep, pumping station, deep well engine, 80,000 gal. steel tank and 6 miles mains. Bids desired as a whole or in sections. Charles P. Chase, Engr., Clinton.

Kingsley, Iowa.—Reported desired until Aug. 5 by W. R. Payne, Town Clk., for a 100,000 gal. water supply tank.

Ogden, Iowa.—Until July 30 at office of the Mayor, for constructing water works extension, requiring approximately a 100,000-gal. reinforced concrete reservoir, 18,006 lin. ft. 4-in. c. i. mains laid complete, twenty-three 4-in. hydrants, fifteen 4-in. gate valves and boxes. R. B. Reasoner, Engr., Perry.

Milligan, Neb.—Reported desired until July 27 by E. J. Kotas, Village Clk., for constructing a waterworks system. Bids desired on 8 different sections.

Ord, Neb.—Reported desired until Aug. 13 by O. P. Cromwell, City Clk., for constructing water works, from plans of Bruce & Standeven of Omaha.

Watertown, S. D.—Until Aug. 2 by City Auditor for c.-i. pipe and special castings, advertised in Engineering Record. F. W. Shreiber, City Engr.; Metcalf & Eddy, Consulting Engrs., 14 Beacon Street, Boston, Mass.

Fromberg, Mont.—Until Aug. 14 by Charles J. Jones, Town Clk., for constructing water works, from plans of B. C. Lillis, of Billings. Cost, $17,500.

Beaumont, Tex.—Until Aug. 17 at office of J. G. Sutton, City Secy., for furnishing material and laying a 30-in. c.-i. pipe line across the Neches River and for constructing a canal intake and other improvement in connection with the canal extension for the water works system. Burns & McDonnell, Engrs., Scarritt Bldg., Kansas City, Mo.

Ottawa, Ont.—Until Aug. 3 by John B. McRae, Consulting Engr., 310 Booth Bldg., Ottawa, for steel pipe, valves, etc., advertised in Engineering Record.

PRICES AND LETTINGS.

★*Indicates award of contract.*

New York, N. Y.—Following are bids opened July 12 by William Williams, Comr. Water Supply, Gas and Electricity:

Section 1, connection between distribution system and various shafts of city tunnel, Catskill Aqueduct, Bronx: Four lowest bidders (all of New York): Soraci Contr. Co., $41,961; Beaver Eng. Co., $42,533; Melrose Constr. Co., $46,032; Rodgers & McManus $46,998.

Unit prices of some of the principal items of lowest bidder, Soraci Contr. Co., 170 Bway.:

800 tons c. i. pipe	$26.00
100 tons c. i. castings	55.00
22 tons c. i. castings	35.00
3 36-in. valves	1,000.00
10 20-in. valves	115.00
19 12-in. valves	35.00
11 6-in. valves	15.00
7 fire hydrants	200.00
2500 lin. ft. 36-in. pipe	1.00
800 lin. ft. 30-in. pipe	1.00
1100 lin. ft. 20-in. pipe	0.50
900 lin. ft. 12-in. pipe	0.25
1 48-in. valve to set	500.00
3 36-in. valves to set	100.00
10 20-in. valves to set	10.00
19 12-in. valves to set	10.00
11 6-in. valves to set	10.00
8 fire hydrants	10.00
1 12-in. Venturi meter	500.00
Hauling 2 20-in. meters	500.00
2 30-in. meters	500.00
1 36-in. meter	500.00

Section 2, connection between distribution system and various shafts of the city tunnel, Catskill Aqueduct, Manhattan: Soraci Contr. Co., $93,908; Beaver Eng. Co., $98,588; Jas. O'Leary, $103,595; Laurence Constr. Co., $106,045.

Unit prices of principal items of lowest bidder, Soraci Contr. Co.:

1600 tons c. i. pipe	$27.00
200 tons c. i. castings	59.00
43 tons c. i. castings	40.00
6 36-in. valves	1,000.00
17 20-in. valves	150.00
39 12-in. valves	50.00
22 6-in. valves	20.00
16 fire hydrants	100.00
2900 lin. ft. 36-in. pipe	1.00
4900 lin. ft. 30-in. pipe	0.50
1900 lin. ft. 12-in. pipe	0.25
6 36-in. valves	300.00
17 20-in. valves	100.00
39 12-in. valves	25.00
22 6-in. valves	10.00
16 fire hydrants	100.00
2 20-in. venturi meters	1,000.00
8 30-in. venturi meters	1,000.00
2 36-in. venturi meters	1,000.00

Section 3, connection between distribution system and shaft 22 of city tunnel of Catskill aqueduct and Brooklyn conduit, Brooklyn. Four lowest bidders: Charles O'Hara Co., Inc., 481 Flatbush Avenue, Brooklyn, $12,651; Mescia & Dragonetti, $13,069; Soraci Contr. Co., $13,187; William R. Nealy, $13,647.

Unit prices of principal items of lowest bidder Charles O'Hara Co., Inc., 481 Flatbush Avenue, Brooklyn:

270 tons c. i. pipe	$2,523.00
25 tons c. i. castings	60.00
5 tons c. i. castings	40.00
2 12-in. valves	40.00
2 6-in. valves	18.00
2 fire hydrants	35.00
1900 cu. yd. earth excav.	0.75
1400 lin. ft. 30-in. pipe	0.80
50 lin. ft. 24-in. pipe	0.50
50 lin. ft. 20-in. pipe	0.45
50 lin. ft. 12-in. pipe	0.30
50 lin. ft. 6-in. pipe	0.20
2 30-in. valves	25.00
2 24-in. valves	15.00
2 12-in. valves	5.00
2 6-in. valves	3.50
2 fire hydrants	5.00
25 cu. yd. brick masonry	8.00
5 cu. yd. concrete	4.00
2 M. ft. lumber	20.00
320 sq. yd. granite block	0.50
420 sq. yd. asphalt	3.00
60 tons load pipe	0.30
140 ton-mile pipe	0.50
1 30-in. venturi meter	50.00
80 lb. ¾-in. brass pipe	0.12

★**Oakfield, N. Y.**—Contracts awarded by Village Trus. for constructing water works, from plans of H. C. Kittredge, of Rochester, as follows: Pipe and specials, U. S. Cast Iron Pipe & Foundry Co., Philadelphia, Pa.; hydrants, R. D. Wood & Co., Philadelphia, Pa.; valves, Chapman Valve Co., Indian Orchard, Mass.; pumps, Deming Pump Co., Salem, Ohio, and general construction to Lane Heating & Plumbing Co., Cortland, N. Y.

★**Rochester, N. Y.**—Contract awarded by Bd. Contract & Supply to W. E. Kinney Co., Rochester, for laying water mains, at $10,556.

Media, Pa.—Following are unit prices of Morris Constr. Co., Land Title Building, Philadelphia, lowest bidder on 2,000,000-gal. settling basin with reinforced concrete retaining wall, etc., from plans of J. W. Ledoux, Ch. Engr. American Pipe & Constr. Co., 112 N. Broad Street, Philadelphia (bids opened June 28):

8,000 cu. yd. excav.	$0.44
2,000 cu. yd. embankment	0.49
220 cu. yd. plain concrete	5.25
75 cu. yd. concrete foundations	6.50
916 cu. yd. reinforced concrete	7.60
54,500 lb. reinforcing bars	0.03
880 cu. yd. puddle in bottom of basin	1.20
210 cu. yd. dry slope wall paving	3.00
670 lin. ft. iron fencing	0.95
410 sq. yd. seeding	0.01
200 sq. yd. sodding	0.30
25 tons 16-in. c.-i. pipe	25.00
5 tons 12-in. c.-i. pipe	25.00
Laying c.-i. pipe, valves and spec.	5,731.40
8 tons 16-in. condemned pipe	25.00
8 tons 12-in. perforated pipe	29.00
470 lin. ft. 1½-in. lead pipe, furnished and laid	1.00
200 lin. ft. 2-in. Orangeburg fiber pipe	0.35
Intake chamber complete	90.00
300 lin. ft. old 12-in. pipe to remove	0.30
Cofferdam and pumping	200.00
Wash water tank, wrt. iron	1,050.00
Improvements to mechanical filter	1,256.00
Chlorine sterilizer plant	500.00
Corliss pump. engine, 1 mil. cpcy.	3,150.00
Razing and removing boiler, setting and walls	225.00
250 hp. boiler, erected complete	3,513.00
New fireproof partition	400.00
Laboratory and painting	300.00
140 sq. yd. concrete flooring	1.00
Total	$35,493

Covington, Va.—Following are lowest bids opened July 12 by Town Council for c.-i. pipe specials, valves and other water works material and for constructing a 2,000,000-gal. concrete reservoir: W. T. Jones, Lynchburg, Va., $12,996; H. C. Brock, Martinsburg, W. Va., $13,250; J. R. Crosby, Pulaski, Va., $15,894. Beardsley, Dongan & Beardsley, Roanoke, Va., $12,021 for reservoir only. E. B. Butler, Mayor.

★**Pensacola, Fla.**—Contract for constructing pumping station awarded July 6 to F. W. Blount Constr. Co., Pensacola, at $12,842. Other bids: S. F. Fulghum & Co., $13,287; C. H. Tuoner Co., $14,747; J. M. Crona, $18,153; bidders all of Pensacola. L. Earl Thornton, City Engr.

★**Shadyside, Ohio.**—Contracts for constructing water works (bids opened July 15 by Pub. Affairs) awarded as follows: 600 tons c.-i. pipe, Massilon Iron & Steel Co., Massilon, $22.80 per ton; total $12,654; one 11 x 12-ft. triplex plunger pump and installation, Gould Pump Co., Seneca Falls, N. Y., $2,825; one 50-hp., 3-cyl., vertical gas engine, to Foos Gas Engine Co., Springfield, $1,940; fire hydrants, to Bourbon Brass Co., Cincinnati, $960; labor on distribution system lead, jute, reservoir, pump well and power house, Harper & Stewart, B. Bellaire, $14,217. A. J. Harbaugh, Village Engr.

★**Detroit, Mich.**—Contracts for furnishing f.o.b. Detroit pipe line material awarded as follows: To American Car & Fdry. Co., Detroit, fittings, $2.50 cwt.; Roe Stephens Mfg. Co., Detroit, hydrants, $41.98, and gate valves, $9.95 each, and Walker Mfg. Co., Detroit, gate boxes, $2.67 each. George J. Finn, Secy. Fire Comn.

Chicago, Ill.—Following are bids opened July 8, for installing five water tube boilers in Thirty-ninth Street Pumping Station: E. Kealer Co., Williamsport, Pa., $18,648; Cahall Boiler Co., Chicago, $18,500; Edge Moor Iron Co., Edge Moor, Del., $18,850.

★**Oglesby, Ill.**—Contract reported awarded by Bd. Local Improv. to Thos. Wilcox, of Oglesby, for laying about 8 miles pipe, with hydrants, etc., at about $35,000.

★**Fond du Lac, Wis.**—Contract for approximately 13,900 ft. 4 to 14 in. c.-i. water mains, awarded to George A. Mallory & Co., Kewanee, Ill. (bids opened July 8), J. F. Hohense, City Clk.

★**Lowden, Iowa.**—Contract for constructing water works from plans of J. G. Thorner, Howes Blk., Clinton, awarded to W. D. Lovell, Minneapolis, Minn., at $12,601, to include pipe line, elevated tank, tower and motor. Next three lowest bidders: M. McElligott, Evanston, Ill., $12,868; G. W. Roland, Des Moines, $13,109; Des Moines Bridge & Iron Wks., Des Moines, $13,116.

★**Thief River Falls, Minn.**—Contract awarded July 6, for furnishing f.o.b. 8064 lin. ft. standard c.-i. mains, 13 hydrants, etc., to Robinson Valentine Co., Grand Forks, N. D., at $8,398. E. J. Overland, City Clk.

★**Canova, S. D.**—Contract for constructing water works awarded to Des Moines Bridge & Iron Co., Des Moines, Iowa, at $8,509 (bids opened July 7. H. H. Schulte, Town Clk.

★**Broken Bow, Neb.**—Contract reported awarded to Alamo Engine & Supply Co., Omaha, for water works and an electric light plant, at about $16,000.

★**Warrenton, Ore.**—Contract for construction of gravity water system and reservoir reported awarded by City Council to C. H. Green, Spokane, Wash., at $120,000. Wood pipe mains and a local steel distributing system included in improvement. System will supply Gearhart, Sunset, Columbia and Delaura beaches, Clatsop, Fort Stevens, Hammond, the Hill Terminals and this city.

Logan, Utah.—Following are reported to be bids opened July 13 by City Comrs. for (a) pipe line and (b) reservoir: Olof Nelson, Logan (a) $49,549, (b) $16,612; Owen H. Gray, Salt Lake City (a) $53,673, (b) $18,447; J. E. Wilson, Jr., Logan (a) $54,011, (b) $20,616.

SEWERAGE AND SEWAGE DISPOSAL

PROPOSED WORK

Lowell, Mass.—Council voted to borrow $20,000 to start work on sewer in Wigginville, and for the completion of other sewer construction.

La Salle, N. Y.—Village Trus. reported considering construction of a sewer system.

Utica, N. Y.—Bonds for $18,000 for constructing Kossuth Avenue relief sewer will be sold July 28 by A. M. Burke, City Comptroller.

Seaside Park, N. J.—Citizens July 12 voted to construct sewage disposal plant. Engineers, Remington & Vosbury, Camden. Frank Brockaway, Boro. Clk.

Erie, Pa.—Plans reported completed for experimental sewage disposal plant, to cost $6,000 to $8,000. E. B. Briggs, City Engr.

Darby, Pa.—Plans reported completed for sewage disposal plant to be constructed in Upper Darby Township.

Baltimore, Md.—Specifications for 8 miles of lateral sewers, to cost about $100,000, reported completed by Sewerage Comn. They are to be built south of Lexington Street and west of Carey Street and will extend to Pratt Street.

Govans, Md.—County Comrs. at Towson reported to have engaged Ezra B. Whitman of Baltimore to prepare plans for a sewer system for Govans and vicinity.

Wilmington, Del.—City Council considering construction of Henry Clay sewer, to cost about $50,000.

Eustis, Fla.—Reported to be a movement on foot to construct sewer system to cost $20,000 and pave streets with asphalt at a cost of $40,000.

Clarksdale, Miss.—Bonds will be sold Aug. 3 to be used for 8, 10 and 12-in. pipe sewers. Address W. S. Bobo, City Engr.

Lexington, Ky.—James J. O'Brien, City Clk., writes citizens will vote at November election on bond issue for proposed sewage disposal plant, for which Solomon-Norcross Co., Atlanta, Ga., are preparing reports and preliminary plans. There will be no construction during 1915.

Harlan, Ky.—Citizens voted $7,500 bonds July 13 for construction of sewer system.

Lakewood, Ohio.—See "Paving and Roads."

Toledo, Ohio.—William H. Gould, County Sanitary Surveyor, preparing plans for 14 miles of 8, 10, 12, 15, 18 and 24-in. vitr. pipe sewers; will be ready for letting about Dec. 1.

Chrisman, Ill.—Proposed to construct sewer to cost $9,500. Geo. W. Fair, City Engr.

Rock Island, Ill.—City Comn. reported considering construction of 42-in. storm drain in southwestern section of city. Wallace Treichler, City Engr.

Grand Island, Neb.—City Council considering calling an election to vote on $100,000 bonds for sewers.

St. Louis, Mo.—Bd. Pub. Service has recommended to Bd. of Aldermen construction of sewers in the North Rock Creek Joint Sewer District.

Austin, Tex.—City Comn. reported to have purchased site for sewage disposal plant.

Beeville, Tex.—Citizens voted $15,000 bonds July 12 to extend sewer system, approximately 4½ miles. John S. Fenner, City Engr.

San Antonio, Tex.—City Council reported considering issue of $300,000 bonds for construction of sanitary sewer laterals and additional storm sewers.

West, Tex.—Citizens voted $15,000 bonds July 6 for constructing sewer system, from plans of O'Neill Bros. of Dallas.

Enterprise, Ore. — Reported Council passed ordinance for lateral sewers in certain streets, to cost $23,000.

Portland, Ore.—City Commission reported decided to construct trunk sewer to cost about $16,000 along Water Street. Plans completed for sewers in Thirty-first Avenue, S. and E. Tibbetts Street. A. L. Barbur, City Aud.

New Toronto, Ont.—New Toronto Council reported to have decided to join with Mimico and construct a sewer system and disposal plant to accommodate the needs of both cities. The disposal plant will be built in Mimico; total cost of new system about $50,000.

Toronto, Ont.—Contract about to be let by Comr. Public Works for construction of a storm sewer for St. Clair Avenue district between Avenue Road, Parkwood Avenue and Russell Hill Road; estimated cost, $51,000.

Vancouver, B. C. — Reported Joint Sewerage Comn. has approved Hastings Park trunk sewer and outfall, the sewer to run from waterfront south, with one branch east, on Hastings, and south on Nootka, and to the other directly down Rupert, to Union Street, and east on Union Street to boundary road. Cost about $200,000. The work is practically all tunneling.

BIDS DESIRED.

Boston, Mass.—Until July 28 by Metropolitan Sewerage Works, Boston (F. D. Smith, Engr.) for constructing High Level Sewer, Wellesley Extension, South Metropolitan System, as follows: Needham, length of 24x27 in. concrete sewer in trench and embankment, 4425 ft., 60 cu. yds. Portland brick masonry, 2000 cu. yds. concrete masonry in trench, 100 cu. yds. rock excavation in trench. Sect. 106—Needham and Wellesley. Length of 24x27 in. concrete sewer in trench and embankment, 4330 ft., length of 24x27 in. concrete sewer in tunnel, 25 ft., 60 cu. yds. Portland brick masonry, 1950 cu. yds. concrete masonry in trench, 15 cu. yds. concrete masonry in tunnel.

Pittsfield, Mass.—Until Aug. 4 by Clerk Bd. Pub. Wks., for sanitary sewer and sewage filtration beds, advertised in Engineering Record. A. B. Farnham, City Engr.

Syracuse, N. Y.—Until Aug. 4 by Harry J. Hartman, Secy., Intercepting Sewer Bd., for a storm water sewer and brook improvement in northeasterly section of city, advertised in Engineering Record.

Wallingford, Conn.—Until Aug. 3 by John E. Martin, Warden, at office of Boro. Clerk for tile pipe sewers and completion of low level trunk sewer, advertised in Engineering Record. W. A. Mackenzie, City Engr.

Lebanon, Pa.—Until Aug. 18 by Mayor and Council for construction of sewage disposal plant, advertised in Engineering Record. T. R. Crowell, City Engr. James H. Fuertes, Consulting Engr., 140 Nassau Street, New York.

Philadelphia, Pa.—See "Water Works."

Philadelphia, Pa.—Until Aug. 2, also until Aug. 4, by M. L. Cooke, Dir. Dept. Pub. Wks., for branch sewers.

Cincinnati, Ohio.—Until July 30 by Dir. Pub. Service (Clarke S. Johnson, Secy.) for constructing sewers in Dunlap and Lossing Sts.

Long Island City, L. I., N. Y.—Bids desired until July 28 by Maurice E. Connelly, Boro Pres., for constructing sewers in Westmere Pl., Cedar, Briggs, Myrtle and Atlantic Aves.; total security, $29,250.

Columbus, Ohio.—Until Aug. 3 by Director Pub. Service (Paul B. Kemper, Clk.) for constructing Milo main truck sewer, Contr. 4.

Dayton, Ohio.—Until Aug. 1 by J. E. Barlow, Dir Pub. Service, for constructing storm sewers in Old Orchard, Summit, Second, Arbor, Evanston, Eaton, Commercial and Highland Streets. F. O. Eichelberger, City Engr.

Toledo, Ohio.—See "Paving and Roads."

Toledo, Ohio.—Until Aug. 3 by County Comrs. for 2000 ft. 8-in. sanitary sewers. William H. Gould, County Sanitary Engr.

Glencoe, Ill.—Reported desired until Aug. 3 for constructing sanitary sewer system in Milton Avenue and other streets. Windes & Marsh, Engrs., Winnetka.

Beaver Dam, Wis.—Until Aug. 2 by Bd. Pub. Wks. for constructing sanitary sewers and appurtenances in the East Sewerage Dist., comprising approximately 13,473 ft. 8 to 24-in. pipe, 1700 lin. ft. 6-in. pipe, risers, etc. E. B. Parsons, Engr., Watertown.

Bridgeport, Neb.—Until Aug. 3 by City Clerk for construction of about 5700 ft. 12-in. and 3400 ft. of 10-in. sewer.

Dallas, Tex.—Until Aug. 23 by J. B. Winslett, City Secy., for Contract 5, north interceptor (concrete portion), Contract 6, pumping station and 36-in. force main and Contract 7, disposal works, etc., advertised in Engineering Record.

Salt Lake City, Utah.—Until Aug. 4 for constructing approximately 23,632 ft. reinforced concrete sewer, from 20 to 78 in. diameter or the equivalent in rectangular section. Estimated approximate cost, $260,000. Sylvester Q. Cannon, City Engr.

PRICES AND LETTINGS.

★*Indicates award of contract.*

North Andover, Mass.—Lowest bid opened July 16 for sewer construction in North Andover submitted by Cenedella Bros., Milford, at $29,139.

★**White Sulphur Springs, W. Va.**—Contract reported awarded to W. P. Carter, Richmond, Va., to construct sewer system at $8,245.

Portsmouth, Ohio.—Following reported to be lowest bids opened by city for sewers: E. G. Nave Bros., Portsmouth, for 2-ft. length tile sewer, $43,606; J. H. Sluss & Co., Huntington, W. Va., 3-ft. length tile, $43,632, Kelley Bros., Portsmouth, on both 2 and 3-ft. length segment block sewer, a total of $50,244.

★**Peoria, Ill.**—Contract awarded by Bd. Local Improv. (Sherman W. Eckley, Pres.) for constructing South End Sewer, East Section, to E. R. Harding Co., Racine, Wis., at $202,825 (bids opened July 12). Other bidders: J. B. Sheets Co., Pittsburgh, Pa., $208,353; Cedar Rapids Constr. Co., Cedar Rapids, $221,984; Foulks Contr. Co., Terre Haute, Ind., $217,023, and Public Service Constr. Co., Omaha, Neb., $251,332.

Whitewater, Wis.—Lowest bid opened July 12 for constructing sewers reported submitted by M. A. Lanyon, Waukegan, Ill., at $23,900.

★**Pratt, Kan.**—Contract for constructing sanitary sewers in Dist. No. 3, consisting of about 4 miles of pipe, 21 flush tanks and 48 manholes, awarded to Lander Constr. Co., Kansas City, Mo., $11,436. Other bidders: Bash & Jones, Joplin, Mo., $12,073; Tonkawa Constr. Co., Kansas City, Mo., $12,725.

Chouteau, Mont.—Contract for sanitary sewers, including 5176 lin. ft. 8 and 9-in. vitr. sewer pipe (bids opened July 9), awarded to Two Miracle Concrete Cor., Kalispel, at $10,824. Next three lowest bids: G. H. Nash & Co., Missoula, $10,820; George H. Kemper, Minot, N. D., $10,832; F. E. Evans Great Falls, $11,502. A. L. Powers, Town Clk.

★**Kirksville, Mo.**—Contract for constructing storm sewers in Joint Storm sewer Dist. 3, about 3682 lin. ft. 10 to 36 in. storm sewer, awarded to Hiram Lloyd Bldg. & Constr. Co., St. Louis. (Bids opened June 28).

BRIDGES

PROPOSED WORK.

Worcester, Mass.—Samuel H. Pitcher Co., 418 Main Street, Worcester, retained by city to design and supervise construction of Lake Quinsigamond Bridge, bill for which was recently passed by Legislature and order to construct by City Council. Appropriation, $250,000. Cost is to be borne by City, County, Town of Shrewsbury and Worcester Consolidated St. Ry. It is to be a reinforced concrete structure of 6 arches, one 120 ft., two 70 ft. and three 60 ft. Length of bridge 850 ft., width 60 ft.

Buffalo, N. Y.—Francis G. Ward, Comr. Pub. Wks., has been directed to receive bids for constructing steel viaduct over tracks of Erie, Pennsylvania, New York Central and Lehigh Valley Railroads at Chicago Street.

Kingston, N. Y.—Plans being prepared under direction of State Highway Dept., Albany, for concrete and steel bridge to be constructed over Roundout Creek; cost about $250,000. J. L. Loughran, Co. Supt. of Highways, Kingston.

Utica, N. Y.—Bonds for $85,000 will be sold July 28 by A. M. Burke, City Comptroller, for constructing a new bridge over Mohawk River at N. Genesee Street and constructing temporary bridges, and the cost of property acquisition in connection therewith.

Plainfield, N. J.—Union County Bd. Freeholders at Elizabeth on July 1 voted expenditure of $7,373 by Somerset and Union Counties, jointly, for constructing concrete arch bridge at Grove Street, Plainfield.

Coatesville, Pa.—County Comrs. at West Chester reported to have rejected bids recently received for 2-span steel girder bridge over west branch of Brandywine Creek, near Coatesville, and will call for new bids. Lowest bid $7,356. Isaac Y. Ash, Co. Controller.

Pittsburgh, Pa.—Plans submitted to Bd. U. S. Engineers by J. G. Chalfant, County Engineer, for constructing bridge with two spans, 600 ft. each, over river at foot of Neville Island, connecting Lower North Side with McKees Rocks; estimated cost, $1,596,000.

Sharon, Pa.—Contract about to be let for constructing concrete bridge over Shenango River at State Street for county, city and street railway company; cost, about $40,000.

Wilkes-Barre, Pa.—Plans approved for constructing bridge over Susquehanna River at W. Market Street for county; cost $500,000.

Chattanooga, Tenn.—Hamilton County Court is favorable to issue of $400,000 bonds for constructing bridge over Tennessee River to connect Chattanooga with Moccasin Bend.

Covington, Tenn.—The Tipton County Quarterly County Court voted appropriation of $20,000 toward constructing an iron bridge over Big Hatchie River, Lauderdale County to contribute $20,000 toward cost.

Maynardville, Tenn.—Bonds for $100,000 will be sold Aug. 23 by County Comrs. (George N. Taylor, Chmn.) to be used for roads and bridges, advertised in Engineering Record.

Cleveland, Ohio.—County Comrs. authorized bond issue of $100,000 for acquiring land and for approaches for second high-level bridge from Huron Road at Ontario Street to Lorain Avenue.

Dayton, Ohio.—Bd. Pub. Service (J. L. Barlow, Dir.) will soon let contract for a 5-span concrete arch bridge, to cost $175,000. F. O. Eichelberger, City Engr. County Comrs. (W. H. Aszling, Secy.) will let contract late this fall for four river bridges destroyed by flood of 1913.

Lake Geneva, Wis.—City about to construct 35-ft. reinforced concrete highway bridge by State Aid. J. L. Skeels, City Engr.; A. R. Hirst, State Engr., Madison.

Camden, Ark.—County proposes constructing coffer dam and strengthen Ouachita River bridge; cost, $10,000. I. A. Baum, Co. Engr. B. McCall, Co. Judge.

Silver City, N. M.—County Comrs. considering construction of bridge over Gila River at Old Fort West, to cost $20,000. F. L. Cox, Co. Engr.

Montesano, Wash.—See "Paving and Roads."

Eugene, Ore.—H. W. Libby, County Engr., directed to prepare plans and specifications for concrete bridge to be constructed over River Road Crossing; cost about $11,000.

Portland, Ore.—Plans being prepared by George S. Edmondstone, City Hall, to be ready about Oct. 15, for eight viaducts in connection with elimination of grade crossings on the O. W. R. & H. Co., in "Sullivan Gulch," Bethlehem girder beams encased in concrete; reinforced substructure and retaining walls, earth fill; estimated cost, $400,000.

Marysville, Cal.—Plans approved by County Bd. Supervisors for constructing 3 concrete bridges over creeks crossing state highway laterals between Morrison's Crossing and Wheatland; cost about $18,000.

BIDS DESIRED.

Bridgeport, Conn.—Until Aug. 7 by Bd. Contracts and Supplies for constructing reinforced concrete girder bridge, with double leaf bascule channel span and all substructures and approaches. The bridge to have roadway 54 ft. clear of the curbs, two sidewalks 13 ft. wide; length from abutment to abutment being 499 ft. Greiner & Whitman, Engrs., Fidelity Bldg., Baltimore, Md.

New York, N. Y.—Following are 4 lowest bids opened July 15 by Douglas Mathewson, Pres. borough of the Bronx, for constructing sewers in portions of various streets, including W. 175th and W. 176th Streets, Davidson and Grand Avenues: (a) Rodgers & Haggerty, $81,293; (b) Delson Contr. Co., $93,895; (c) S. Russik, $104,084; (d) F. V. Smith Contr. Co., $107,172.

		(a)	(b)	(c)	(d)
15,450	cu. yd.	earth excav.	$0.75	$0.44	$0.57	$0.50
2,[illegible]	cu. yd.	rock excav., above subgrade of street	0.75	1.49	1.70	1.70
5,[illegible]	cu. yd.	rock excav., in trenches	2.75	2.50	3.25	3.00
6,020	lin. ft.	new curb	0.65	0.80	0.75	0.80
[illegible]	lin. ft.	old curb reset	0.15	0.05	0.15	...
21,[illegible]	sq. ft.	concrete sidewalk	0.15	0.13	0.14	0.17
1,[illegible]	sq. ft.	new bridgestone	0.50	0.50	0.50	0.50
[illegible]	cu. yd.	dry rubble masonry	1.50	1.00	1.50	3.00
[illegible]	cu. yd.	rubble masonry in mortar	3.00	4.00	5.00	4.00
20	cu. yd.	broken range Ashlar masonry	15.00	15.00	12.00	10.00
[illegible]	cu. yd.	Class A concrete	7.00	7.50	8.00	10.00
10	cu. yd.	Class B concrete	6.00	6.00	6.00	8.00
22[illegible]	cu. yd.	Class C concrete	6.00	5.00	5.00	5.00
[illegible]	sq. yd.	granite slope	3.00	4.50	3.00	3.50
175	cu. yd.	granite coping	4.00	4.50	4.50	4.50
		Vitr. Pipe Sewer:				
200	lin. ft.	30-in.	5.50	5.00	6.00	6.00
[illegible]	lin. ft.	24-in.	4.10	3.25	4.50	5.00
27[illegible]	lin. ft.	20-in.	3.10	4.50	4.00	4.50
7[illegible]	lin. ft.	15-in.	3.10	4.00	3.00	4.00
27[illegible]	lin. ft.	12-in.	2.40	2.00	2.50	3.50
2,1[illegible]	lin. ft.	12-in.	1.85	2.55	2.50	3.00
3[illegible]	lin. ft.	branch connections, 12-in.	1.50	1.25	1.00	2.00
[illegible]	lin. ft.	branch connections, 8-in.	1.50	1.00	1.00	1.50
[illegible]	lin. ft.	vitr. pipe drains, 12-in.	1.50	1.00	0.50	1.00
6[illegible]	spurs for house connections		0.01	1.00	1.00	0.50
25	manholes		75.00	55.00	57.00	65.00
13	receiving basins, Type C		75.00	160.00	125.00	120.00
1	receiving basin (special)		35.00	160.00	200.00	150.00
1	inlet (special)		5.00	25.00	70.00	60.00
100	lb.	steel reinforcement bars	0.03	0.03	0.03	0.10
5	lamp posts		25.00	30.00	25.00	40.00
1	subway conduit system		200.00	390.00	650.00	400.00
7	M ft.	timber sheeting	20.00	...	10.00	30.00
2,1[illegible]	sq. ft.	sodding	0.10	0.01	0.03	0.05
265	lin. ft.	iron pipe railing	1.50	1.50	1.00	1.20
1,360	lin. ft.	guard rail	0.25	0.18	0.20	0.20

★**Syracuse, N. Y.**—Following are unit prices of 4 lowest bids opened July 12 for constructing Huntley sewer system No. 2, to be of concrete construction: (a) J. C. Schrade, Inc., Brooklyn, $82,731 (awarded contract); (b) Mondo Constr. Co., Syracuse, $84,305; (c) Bonn & Marnell, Syracuse, $85,516; (d) Frank George, White Plains, $85,921.

		(a)	(b)	(c)	(d)
	Reinforced Concrete Storm Sewer:				
1,250	lin. ft. 66-in.	$9.25	$7.90	$7.55	$6.99
640	lin. ft. 60-in.	7.15	7.00	6.07	5.90
860	lin. ft. 45-in.	4.60	5.50	4.41	4.17
860	lin. ft. 42-in.	4.15	5.20	4.12	3.84
920	lin. ft. 36-in.	3.85	4.50	3.71	3.71
1,600	lin. ft. 33-in.	2.95	3.25	2.95	2.89
2,930	lin. ft. 27-in.	2.65	2.60	2.55	2.45
	Vitrified Pipe Storm Sewer:				
1,080	lin. ft. 24-in.	1.65	1.25	1.74	2.01
590	lin. ft. 22-in.	1.60	1.10	1.74	1.86
1,680	lin. ft. 20-in.	1.35	1.00	1.40	1.60
1,020	lin. ft. 18-in.	1.10	1.00	1.25	1.36
2,380	lin. ft. 15-in.	0.95	0.85	1.09	1.25
4,460	lin. ft. 12-in.	0.40	0.60	0.87	0.84
	Vitrified Pipe Sanitary Sewer:				
80	lin. ft. 24-in.	3.35	1.50	2.01	2.38
820	lin. ft. 22-in.	3.20	1.40	1.92	2.14
120	lin. ft. 20-in.	2.75	1.40	1.98	2.55
950	lin. ft. 18-in.	1.80	1.25	1.48	1.35
5,750	lin. ft. 12-in.	0.90	1.00	1.05	1.15
6,450	lin. ft. 10-in.	0.55	0.60	0.93	1.10
5,880	lin. ft. 8-in.	0.45	0.55	0.93	0.85
12,100	lin. ft. 6-in. sanitary laterals	0.40	0.40	0.50	0.40
1,700	lin. ft. 10-in. storm laterals	0.50	0.60	0.50	0.59
39	line manholes, 3 x 4 ft.	40.00	55.00	40.00	37.50
8	line manholes, 4 x 4 ft.	45.00	60.00	55.00	58.25
6	line manholes, Type "L"	60.00	160.00	80.00	71.50
25	double line manholes	75.00	150.00	60.00	72.00
3	junction manholes	60.00	60.00	60.00	58.75
17	double junction manholes, Type "O"	140.00	150.00	85.00	88.00
9	double junction manholes, Type "D"	175.00	150.00	125.00	137.00
2	double drop junction manholes	200.00	200.00	155.00	180.00
1	special manhole, No. 8	330.00	200.00	160.00	300.00
6	large catchbasins	40.00	60.00	35.00	55.00
75	small catchbasins	25.00	23.00	25.00	25.00
1	connecting existing sewer	500.00	5.00	25.00	15.00
2	connecting existing manholes	50.00	5.00	5.00	5.00
5	cu. yd. brick or concrete piers	15.00	8.00	5.00	7.50

Avalon, N. J.—Following are bids opened July 12 by Gilbert S. Smith, Mayor, for constructing intercepting sewers and disposal plant. (Ralph L. Goff, Boro. Engr.) (a) Edward L. Bader Co., Atlantic City, N. J.; (b) James McLinden Co., Wildwood, N. J.; (c) Sutton & Corson Co., Ocean City, N. J.:

	(a)	(b)	(c)
500 lin. ft. 12-in. Class A c.-i. pipe	$2.00	$1.72	$1.70
1,150 lin. ft. 12-in. Class B c.-i. pipe	3.00	1.92	2.37
2,000 lin. ft. 12-in. d. s. vitr. pipe	2.30	1.29	2.00
950 lin. ft. 14-in. Class A c.-i. pipe	3.00	6.31	3.00
950 lin. ft. 15-in. d. s. vitr. pipe	2.50	5.58	1.90
700 lin. ft. 15-in. d. s. vitr. pipe	3.00	5.06	2.00
6,400 lin. ft. 16-in. Class A c.-i. pipe	4.10	5.02	4.00
6,400 lin. ft. 18-in. d. s. vitr. pipe	3.00	4.17	3.20
190 lin. ft. 20-in. Class A c.-i. pipe	4.00	6.63	5.00
190 lin. ft. 20-in. d. s. vitr. pipe	3.00	5.56	4.42
500 lin. ft. 6-in. d. s. vitr. pipe, including Y's	1.30	0.60	1.25
36 lin. ft. 6-in. Class A c.-i. pipe (under railroad)	3.00	1.00	2.51
29 double drop manholes	150.00	100.00	100.00
2 concrete manholes	100.00	75.00	75.00
300 lin. ft. ¾-in. galv. water pipe, etc.	0.10	0.15	0.11
Sedimentation tanks, etc.	13,100.00	9,172.00	10,708.00
Pumps, engines, etc.	4,900.00	3,500.00	5,000.00
Chlorine system	400.00	650.00	500.00
60 lin. ft. 12-in. Class B flexible pipe	20.00	5.00	15.00
1 anchor plate, etc.	200.00	350.00	350.00
100 white oak piles, furnish and set	1.50	1.75	2.00
Extra lumber, per M ft.	40.00	40.00	40.00
20 cu. yd. concrete	6.50	6.50	6.50
Total for Class A c.-i. pipe	$66,458.00	$66,320.00	$60,002.00
Total for d. s. vitr. pipe	58,853.00	59,983.00	53,727.00

Minetto, N. Y.—Until July 31 at office of County Supt. of Highways, Oswego, for constructing a concrete-steel arch bridge over the Oswego River at Minetto. Concrete Steel Eng. Co., Engrs., Oswego.

Philadelphia, Pa.—Until Aug. 2 by Dept. of Pub. Wks. (M. L. Cooke, Dir.) for constructing 2 bridges, one on Cambria and A Streets, the other at Holme Avenue over Pennypeck Creek; also until Aug. 4 for 2 bridges, one on Whitby Avenue over railroad tracks, the other on Front Street; both proposals advertised in Engineering Record.

Pittsburgh, Pa.—Until July 30 by Hyatt M. Cribbs, Co. Controller, Pittsburgh, for repairs to Bridge over Deer Creek, Harmer Township; constructing reinforced concrete stone-faced elliptical arch, Bridge No. 2 over Howes Run, Fawn Township, and reinforced concrete elliptical arch, Bridge No. 4 over Painters Run, Mount Lebanon Township.

West Chester, Pa.—Until July 26 by County Comrs., for furnishing material and constructing sub and superstructure for a two span steel girder highway bridge over Brandywine Creek. I. Y. Ash, County Controller.

Bowling Green, Va.—Reported desired until July 30 by County Clerk's office, Bowling Green, for constructing a 65 ft. span bridge over South River, about 5 miles from Rixey. G. P. Coleman, State Highway Comr., Richmond.

Lake Charles, La.—Reported desired until Aug. 3 by E. C. House, Clk. Police Jury, for constructing a steel drawbridge over Bayou Choupique on Lockport-Ged Highway.

Sardis, Miss.—Until Aug. 2 for constructing two bridges and a trestle, to be built of steel with concrete abutments: Bridge on Hemphis Road, 3½ miles west of Sardis, 1-40 x 12 ft.; bridge on Taylor Road, 3 miles southwest of Sardis, 1-35 x 12 ft.; trestle on Como and Glenville Road, 2½ miles east of Como, 140 x 12 ft. R. W. Draper, Co. Clk.

Cleveland, Ohio.—Until July 29 by Bd. Pub. Service (F. D. Richards, Bridge Engr.) for constructing reinforced concrete floor of Clark Avenue Viaduct. Approximate cost, $100,000.

Toledo, Ohio.—Until Aug. 6 by County Comrs. for furnishing material and constructing bridge work as follows: New substructure and superstructure for bridge in Marengo Street over Miami and Erie Canal, Adams Township; new bridge and abutments over Ten Mile Creek, near Glantown, Sylvania Township; new bridge abutments and approaches for bridge on Marengo Street over ravine, Adams Township; new abutments to bridge on Crabb Road over Shantee Creek, Washington Township; new culvert on Wernert stone road, Washington Township.

Crawsfordsville, Ind.—Reported desired until Aug. 3 by County Comrs. for constructing concrete bridge.

Crown Point, Ind.—Reported desired until Aug. 5 by County Comrs. for constructing a Scherzer rolling lift bridge, also concrete bridge. E. Simon, Co. Aud.

Frankfort, Ind.—Reported desired until Aug. 3 by Edward Spary, Co. Aud., for constructing 46-ft. span reinforced concrete flat top bridge on E. Sputh Street. Probable cost, $3,500. G. D. Brewer, Co. Surveyor.

Paris, Ill.—Until Aug. 2 by K. J. Barr, Co. Supt. Highways, Paris, for constructing the Reservoir Bridge, a steel plate girder structure on reinforced concrete and abutments. Span 60 ft., roadway 30 ft.

Waukon, Iowa.—Until Aug. 3 at office of County Aud. for constructing 80-ft. pony truss bridge with concrete abutments, abutments for 140 ft. span bridge, abutments for a 2-span 200 ft. bridge, a 25 ft. 5 in. "I" beam span, 3 standard box culverts. H. O. Orr, Co. Engr.

Wichita, Kan.—Reported desired until July 31 by County Comrs., for constructing a 100 ft. bridge over Jester Ceek, Valley Center Township. Probable cost, $4,500.

Canton, S. D.—Reported desired until Aug. 3 by County Auditor, for constructing superstructure for structural steel span, 120 ft. concrete floor, 18 ft. roadway.

Kansas City, Mo.—Until July 31 by Allen C. Southern, County Surveyor, Kansas City, for constructing a reinforced concrete girder bridge, 50 ft. long, 18 ft. wide on section line between Sections 20 and 21, Township 49, Range 29.

Louisiana, Mo.—Reported desired until July 28 by County Comrs., Bowling Green, for constructing an 180-ft. steel bridge over Buffalo Creek, near Louisiana.

Washington.—Reported desired until Aug. 9 by William R. Roy, State Highway Comr., Olympia, for constructing a 195 ft. steel riveted truss bridge over Skokomish River on Olympic Highway, Maso County.

Grants Pass, Ore.—Reported desired until Aug. 4 by County Court, for constructing a bridge across Sucker Creek: "A" one wooden span, one combination span, one steel span. "B" three steel spans.

Portland, Ore.—See "Public Buildings."

Portland, Ore.—About Aug. 2 by A. L. Barbour, City Aud., for constructing substructure of reinforced girder bridge at Union Ave., over Peninsular branch of O. W. R. & N. Co. This bridge will have nine 24-ft. 6-in. spans; width, 58 ft.; foundation, gravel; cost complete, $50,000. Engineer, George S. Edmonstone, City Hall.

San Jose, Cal.—Until Aug. 2 by Co. Bd. superv. (Henry A. Pfister, Clk.), for constructing a reinforced concrete bridge on Northern Rd. over Guadalupe Creek.

Santa Clara, Cal.—Reported desired until Aug. 2 by County Bd. Superv., for constructing a concrete bridge over Guadalupe Creek.

Ottawa, Ont.—Until Aug. 3 by John B. McRae, Consulting Engr., 310 Booth Bldg., Ottawa, for constructing a concrete steel arch bridge, four spans 106 ft. each, advertised in Engineering Record.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Springfield, Mass.**—Contract for erecting Plainfield St. Bridge awarded by Bd. Supervs. (bids opened July 8), as follows: Jobson & Gifford Co., 30 E. 42d St., New York, N. Y., general contract at $25,950 and American Bridge Co., Boston, for structural steel at $12,450. F. H. Clark, Engr. & Supt Streets. H. M. Gray, Designing Engr.

★**Utica, N. Y.**—Contract for constructing 3-span steel and concrete bridge over Mohawk River at N. Genesee Street awarded by Bd. Contract and Supply to William F. Cogley, Utica, at $59,158.

Morristown, N. J.—Lowest bid opened by Union and Morris County Bd. Freeholders for constructing 2 concrete bridges over Passaic River, between Gillette and Murray Hill, submitted by Philip A. Hickey, Somerville, at $7,333.

Joint Bridge Comn., Essex and Morris County Freeholders, recommends award of contract for erecting bridge over Passaic River at Pine Brook Road to Averhill-Matthews Co., Newark, at $39,860.

★**New Gretna, N. J.**—Contract for erecting 742-ft. bascule drawbridge over Mullica River awarded by Bd. Freeholders Atlantic and Burlington Counties to Lupfer & Remick, Buffalo, N. Y., at $78,800.

★**Philadelphia, Pa.**—Following are 2 lowest bids opened July 8 by Bureau Surveys for constructing 3 bridges:

Fifth Street Bridge: Brown King Constr. Co., Philadelphia, $59,940 (awarded contract), and F. J. Boas, Philadelphia, $61,710.

Third Street Bridge: Thomas F. Reilly, 1616 Thompson Street, $24,000 (awarded contract), and F. J. Boas, Philadelphia, $26.945.

Fisher's Avenue: Thomas F. Reilly, $22,000 (awarded contract), and F. J. Boas, $22,600.

★**Pittsburgh, Pa.**—Contracts awarded by County Comrs. as follows (bids opened July 16), for constructing reinforced concrete elliptical arches—Bridge No. 3 over Deer Creek, West Branch in Richland Township, to John H. Howley & Co., 237 Fourth Avenue, at $5,887; Bridge No. 4, Flaughertys-Run in Moon Township; extension of arch Bridge No. 1, Kilbuck Run, borough of Glenfield, to Adam Laidlow Co., Bessemer Building, at $9,547, and for diversion of Pine Creek, eliminating county bridges Nos. 17 and 18, over Pine Creek, Shaler Township, to J. Toner Barr, 237 Fourth Avenue, at $11,290.

★**Manayunk, Pa.**—Contract awarded by Pennsylvania Railroad Co., Philadelphia (Alex. Shand. Ch. Engr.), for reinforced concrete bridge across Schuylkill River 1600 ft. long to T. L. Eyre, Commercial Trust Bldg., Philadelphia.

★**Baltimore, Md.**—Contract awarded by State Roads Comn., Garrett Bldg., to A. J. Boyle, Baltimore, for constructing reinforced concrete bridge over Patapsco River near Elkridge, on B. and W. Boule., at $24,706.

Owensboro, Ky. — See "Paving and Roads."

★**Lebanon, Ohio.**—Contract for constructing steel bridge over Caeser's Creek awarded as follows: Superstructure, to Oregonia Bridge Co., Lebanon, $3,865; substructure, G. C. Harden, Middletown, $2,600. John W. Mulford, Co. Aud.

★**Portsmouth, Ohio.**—Contract awarded by Bd. Control to L. E. Strum, Columbus, for constructing concrete viaduct at $120,356 (bids opened July 3). Wm. Gergens, Dir. Bd. Pub. Service.

Indianapolis, Ind.—Only bid received by Bd. Pub. Wks. for adding 2 spans to W. Washington Street Bridge over White River submitted by National Concrete Co., Indianapolis, at $110,000.

★**Shelbyville, Ind.**—Contracts awarded July 7, for 110 ft. span steel girder bridge, with reinforced concrete abutments, over Little Blue River, as follows: Superstructure to Central States Bridge Co., Indianapolis, substructure to Craig Constr. Co., Greensburg. Frank W. Fagel, Co. Aud.

★**Sullivan, Ind.**—Contracts awarded by County Comrs. for constructing bridges as follows (bids opened June 26): To Vincennes Bridge Co., Vincennes, for 2 steel bridges; to Montgomery Parker Co. of Hatfield, for 1 steel bridge, and to George Soller, Princeton, for 6 concrete bridges.

★**Elkader, Iowa.**—Contracts awarded on July 14 by Bd. of Co. Supervisors for construction of 9 I-beam spans, 32 reinforced concrete box culverts, 2 pony trusses, 2 reinforced concrete slabs, and 2 reinforced concrete wing walls, to the following: P. N. Kingsley, Strawberry Point, $20,404; N. M. Stark & Co., Des Moines, $3,707; A. C. Boyle, McGregor, $3,650; Worden-Allen, Milwaukee, Wis., $2,720; C. E. Walker, Calamus, $1,700; Louis Martie, Elgin, $325; Jos. Vogt, Guttenberg, $260; total award, $32,766; engineer's estimate, $34,645. E. B. Tourtellat, Co. Engr.

★**St. Paul, Minn.**—Contract for constructing bridge over railroad tracks on Wheeling Parkway awarded by City Purchasing Com. to A. H. Heimbach, St. Paul, at $6,750.

★**Osborne, Kan.**—Contract for constructing low water bridge with concrete floor awarded to Missouri Valley Bridge & Iron Co., Leavenworth, at $2,235. John Doane, Co. Clk.

★**Jamestown, N. D.**—Contract awarded July 8, by County Comrs. (And. Blewitt, Clk.) for constructing reinforced concrete culverts to Jardine & Anderson of Fargo.

★**Marmarth, N. D.**—Contract for constructing bridge over Little Missouri River at Marmarth awarded by County Comrs. to Security Bridge Co., Minneapolis, Minn., at $11,243.

★**Williston, N. D.**—Contract awarded July 15 by Co. Comrs. for constructing bridges for period of 1 year to M. A. Adama & Co., Buffalo. M. H. Aaon, Co. Aud.

★**Kansas City, Mo.**—Contract for constructing reinforced concrete viaduct on Blue Avenue (bids opened July 7) awarded to J. W. McMurray Constr. Co., Bryant Building, at $24,312. R. A. Hartung, Asst. County Highway Engr.

★**Rockport, Tex.**—Contract for constructing Bayside Bridge over Puerto Bay connecting Aransas and Refugio Counties awarded to Alamo Constr. Co., San Antonio, at $19,400.

★**Olympia, Wash.**—Contract for constructing Mashell River Bridge in Pierce County awarded by State Comn. at Olympia to H. C. Mallotte, 6525 Seventeenth Avenue, N. E., Seattle, at $7,850 (bids opened by State Highway Com., July 7).

★**Hanford, Cal.**—Contract awarded by Bd. Superv. to S. G. Smart of Bakersfield for reinforced concrete bridge over Cross Creek, at $5.284 (bids opened July 6). E. F. Pickerell, Co. Clk.

★**San José, Cal.**—Contract awarded by Bd. Co. Superv. to C. J. Meyerholz of Cupertino for constructing a reinforced concrete bridge on Quito and Pollard Roads over Wildcat and San Tomas Aquino Creeks, at $7.272. Next 3 lowest bids: The Turner Co., San Francisco, $7,567; W. H. Otts. San José, $7,889; M. E. Kilcouse, San José, $8,100.

★Contract awarded by Co. Supervisors July 6 for constructing reinforced concrete bridge in Fremont to John Doyle, San José, at $3,363.

PAVING AND ROADS

PROPOSED WORK

Albany, N. Y.—All bids opened my Bd. Contract and Supply for repaving State Street rejected. According to reports new bids will be received.

Buffalo, N. Y.—Common Council voted to pave Navajo, Pawnee, Roanoke and Seminole Parkways.

Contract about to be let by Bd. Pub. Wks. for paving Edison, Fourth, Halbert, Seventh, S. Cedar Streets and Hubbell and Kenefick Aves.

Cattaraugus, N. Y.—Bonds for $18,000 highway improvements will be sold July 26 by M. Tuller, Village Clk.

New York, N. Y.—Borough President Marcus M. Marks announced to-day that the following list of streets are about to be repaved: Fifty-fifth Street, Third to Park Avenue; Sixty-fourth Street, Park to Fifth Avenue; Sixty-seventh Street, Park to Fifth Avenue; Sixty-eighth Street, Park to Fifth Avenue; Eightieth Street, Lexington to Fifth Avenue; Eighty-fifth Street, First to Park Avenue; Twenty-fifth Street, Seventh to Eighth Avenue; Fifty-fifth Street, Sixth to Seventh Avenue; 100th Street, Central Park West to Amsterdam Avenue; 100th Street, West End Avenue to Riverside Drive. A new sidewalk is to be laid on Cathedral Parkway (W. 110th Street) from Seventh to Eighth Avenue.

Jersey City, N. J.—Contract about to be let by Bd. Comrs. for paving Stegman Street and Jackson Avenue.

Newark, N. J.—Bd. of Works voted to pave Yates Avenue, Vesey, Oxford and Tyler Streets with bitulithic.

Warren, Pa.—City Council voted to spend about $35,000 for street improvements.

Matewan, W. Va.—Citizens voted $12,000 bonds for grading streets and constructing sidewalks.

Wilson, N. C.—See "Water Works."

Florence, S. C.—Citizens voted $40,000 bonds for 20 miles concrete and bitulithic walks.

Bostwick, Fla.—Citizens voted $25,000 bonds for constructing brick roads.

De Land, Fla.—Citizens voted July 13 to issue $350,000 bonds for road improvements. J. B. McCrary Co., Engrs., Atlanta, Ga.

Eustis, Fla.—See "Sewerage and Sewage Disposal."

Linden, Ala.—About $120,000 to be spent by Comrs. Court, Marengo County, at Linden, for road improvements in Faunsdale, Dayton, Demopolis and Spring Hill.

Maynardville, Tenn.—See "Bridges."

Morristown, Tenn.—Hamblen County Court is to spend $150,000 for constructing macadam roads.

Rogersville, Tenn.—Citizens of Hawkins County voted $500,000 bonds for constructing pike roads.

Newport, Ky.—All bids opened for reconstructing Flagg Springs-Alexandria Pike rejected by Campbell County Fiscal Court. According to reports new bids will be received; estimated cost $20,000.

Williamsburg, Ky.—Bonds amounting to $150,000 for constructing roads sold by Whitley County Fiscal Court.

Cambridge, Ohio.—Bd. Pub. Service (T. D. E. Lee, Dir.) will soon let contract for street paving, to cost about $20,000.

Cleveland, Ohio.—A 2½ mile speedway is to be erected near Cleveland; cost, about $700,000. M. L. Yuster said to be interested.

Columbiana, Ohio.—Proposed to pave E. Park Ave. 8038 sq. yds. with brick on gravel or concrete foundation, stone or concrete curb, brick gutter. C. E. Beard, City Engr.

East Cleveland, Ohio.—City and county contemplate paving three miles on Euclid Avenue in East Cleveland; cost, about $200,000.

Dayton, Ohio.—County Comrs. (W. H. Aszling, Secy.) will let contract this fall for 8 miles of bituminous macadam on Germantown Pike.

Lakewood, Ohio.—Bonds will be sold Aug. 16 by B. M. Cook, Dir. Finance, as follows: $43,000 Nicholson and Donaldson Avenue paving bonds; $12,050 Morrison Avenue sewer bonds; $3,240 Morrison Avenue water bonds.

Logan, Ohio.—Bonds for $33,000 for grading, curbing and paving with brick on Second Street will be sold Aug. 10 by Fred Allen, Village Clk.

Middleport, Ohio.—Proposed to pave 4th, 5th, Elm, Hooker, and other streets, with brick on gravel and sand foundation, about 19,300 sq. yds. A. L. Sheldon, City Engr.

Zanesville, Ohio.—Contract will soon be let by Co. Comrs. (Fred C. Werner, Clk.) for paving Adamsville Road out of Zanesville, to cost $140,000.

Bd. of Pub. Service (W. W. Roach, Dir., Room 304, Masonic Temple) will soon let contract for street improvements, including repaving Fifth, Second and Third Streets. Cost about $40,000.

Deerfield, Mich.—Plans being prepared for construction of about 12½ miles of stone road for the Township of Deerfield. Clarence Munson, Deerfield, is Township Highway Comr., and Colman & Tyler, Kresge Building, Detroit, Engrs.

Illinois.—The State Highway Comn., at Springfield, will distribute $990,000 among the various counties of Illinois for good roads purposes during the year 1915-16, of which Cook County will receive a total of $108,994.

Tuscola, Ill.—Profiles and estimates submitted to City Council by W. E. Price, Surveyor, for about 1½ miles concrete pavements; cost $45,000.

Spencer, Iowa.—Contract about to be let by City Council for 70,000 yd. pavements.

Bozeman, Mont.—City Council voted to improve pavements in Dists. Nos. 101 and 102; cost about $45,742.

Aransas Pass, Tex.—Citizens Rd Dist. No. 3, San Patricio County, voted $75,000 bonds for constructing roads.

Beaumont, Tex.—City Council considering about 200,000 sq. yd. paving; material not yet decided upon. C. L. Scherer, City Engr.

Clarksville, Tex.—Citizens voted $405,000 bonds for constructing roads in Red River County.

El Paso, Tex.—Proposed to pave California, Texas and Piedras Sts. with bituthlithic. J. F. Dawson, City Clk.

Bd. County Comrs. considering constructing 2-mile concrete road from New Mexico-Texas State Line to Fabens. Bond issue to be voted on Aug. 3 for $750,000.

Houston, Tex.—City Council voted to pave Main Street, cost $55,000.

McKinney, Tex.—About $375,000 road bonds sold by County Comrs. Court.

Bellingham, Wash.—City Council voted to pave Lake Road from Queen Street to Hastings, cost [illegible].

City Council considering paving Silver Beach Rd. from bridge crossing Lake Whatcom to city limits, distance 1½ miles.

Montesano, Wash.—County Comrs. contemplate spending about $100,000 for roads and bridges.

Mount Vernon, Wash.—Contract about to be let by County Comrs. for paving ¾ mile concrete road in city limits of Sedro Wooley and Skagit County.

Seattle, Wash.—Plans approved by Bd. Pub. Wks. for constructing concrete walks on Fairmount Street, cost $13,000.

All bids opened by Bd. Pub. Wks. for paving Massachusetts Street rejected. According to reports new plans and specifications will be prepared, estimated cost $200,000.

Sedro-Wooley, Wash.—Contracts about to be let by City Council for paving State and Pacific Sts., cost, about $20,000.

Walla Walla, Wash.—City Comn. voted to pave Rose and Twelfth Streets; cost about $15,000.

Pendleton, Ore.—Proposed to pave Main, Webb, and Perkins Streets ten blocks with gravel bituthlithic, 16-ft roadway. George Kimbrell, City Engr.

Portland, Ore.—All bids opened by city for paving Brook Street with asphaltic concrete rejected.

Portland, Ore.—New bids are to be received by County Comrs. for paving St. Helens Road with bituthlithic.

City Comn. considering paving E. Fifty-sixth, Flanders, Siskiyou, E. Forty-ninth, E. Thirteenth Streets and Minnesota Avenue; cost about $15,000.

Roseburg, Ore.—Surveys completed by State Engineering Dept. at Salem and Douglas County Court for Pacific Highway near Cottage Grove cost about $12,000.

San Francisco, Cal.—Bd. Supervisors appropriated $25,000 for constructing boulevard through city property from St. Germain Avenue to southerly boundary line of said city property, grading, paving and sewering San Bruno Avenue, $25,000; improving Van Ness Avenue, $8,000.

Visalia, Cal.—Bids being received by County Surveyor for constructing road from Valley to General Grant Park, cost about $25,000.

Wallace, Idaho.—City Council voted to pave Bank, Cedar, Pine and River Streets.

BIDS DESIRED.

Massachusetts.—Until July 27 by Massachusetts State Highway Comn., Boston (William D. Sohier, Chmn.), for constructing a section of State highway about 4500 ft. in length in the town of Andover.

Providence, R. I.—Until July 26 for furnishing 10,000 granite paving blocks. William C. Pelky, Clk., Com. on Contract and Supply.

Brooklyn, N. Y.—Until July 23 by L. H. Pounds, Boro. Pres., for regulating and repaving Newton Street in all 436 sq. yd. granite pavement, etc., regulating and repaving, including restoration of pavement removed and damaged in connection with construction of Chasson Avenue, relief sewer, Div. 1, Sect. 2, requiring 6½ sq. yd. Grade 1 and 2775 sq. yd. Grade 2 granite block, 7000 sq. yd. asphalt pavement, etc., also furnishing and delivering the following: 50,000 asphalt paving blocks, 4,000 wood paving blocks, 1000 cu. yd. broken trap rock and 1200 cu. yd. trap rock screenings, furnishing and delivering 91,000 ft. b. m. yellow pine and spruce lumber.

Utica, N. Y.—Bonds for $37,000 for extension of Parkway westerly, including constructing retaining wall and beautification, and widening of said Parkway will be sold July 29 by A. M. Burke, City Comptroller.

Bloomfield, N. J.—Until Aug. 3 by Raymond F. Davis, Town Clk., for improving Grove Street, requiring 3900 sq. yd. concrete, bituthlithic, asphalt block, asphalt, brick or Topeka pavement, etc.

East Orange, N. J.—Until July 26 by Lincoln E. Rowley, City Clk., for grading, curbing and paving E. Day Street, Linden and Grand Avenues, in all 4677 sq. yd. Tarvia pavement, 1115 sq. yd. Belgian block pavement, etc.

Hoboken, N. J.—Bids desired until July 29 by City Comrs. for paving and reimproving River and Fourth Streets and grading, paving and reimproving Fourteenth Street.

Jersey City, N. J.—Until July 29 by Bd. City Comrs., for repaving with asphalt block, Whiton Street, and with wood block Tonnnelle Avenue.

Keyport, N. J.—Until Aug. 9, by Borough Council (A. R. Van Buskirk, Clk.) for 7620 sq. yd. reinforced concrete pavt. on Broad Street, advertised in Engineering Record. Engineer, George P. Cooper, 60 Broad Street, Red Bank. R. O. Walling, Mayor.

Trenton, N. J.—Until July 28 by Frank Thompson, City Clk., for improving portions of Fulton, Lamberton, Copper Streets, S. Clinton, Whittaker and Admore Avenues by paving with bituminous concrete on a 5-in. concrete base.

Lebanon, Ohio.—Until Aug. 2 by John M. Mulford, Co. Aud., Lebanon, for constructing creosoted plank and block floor for bridge over Clear Creek, near Village of Franklin; also bridge over Little Miami River, Village South Lebanon.

Mount Jewett, Pa.—Until July 29, by Borough Clerk for 6000 sq. yd. vitr. brick paving and 3000 lin. ft. curb. A. F. Bannon, Jr., Boro. Engr.

Philadelphia, Pa.—Until Aug. 4 by M. L. Cooke, Dir. Pub. Wks., for grading, paving, repaving and appurtenant work of opening Emerald Street under the Richmond Branch of the P. & R. Ry.; probable cost $120,000.

Norfolk, Va.—Reported desired until July 29 by Bd. Control, for 36,000 sq. yds. sheet asphalt on concrete base and 800 sq. yds. wood block pavement on concrete base. W. H. Taylor, Jr., City Engr.

Broad Oaks (P. O. Clarksburg), W. Va.—Reported desired until Aug. 2 by Common Council, for grading, curbing, paving with brick on concrete base Harrison, Marshall, Main, Daisy and several other streets.

Huntington, W. Va.—Reported desired until Aug. 3 by County Comrs. for constructing fifteen additional miles road, to include paving eight miles Kanawha and James River Turnpike, two miles Ohio River Road, four miles Hamlin Pike and one mile Harveytown and Wayne County Pike.

Kissimmee, Fla.—Reported desired until Aug. 2 by County Comrs. for paving with brick the county road to Orange County line.

Huntsville, Ala.—Competitive bids desired by W. P. Monroe, City Clk., for resurfacing 10,000 sq. yd. of street with mineral rubber, tarvia or asphalt.

Ashtabula, Ohio.—Until July 29 by Director Pub. Service (Lulu Rennick, Clk.) for grading, draining and paving portions of Starkweather and Grove Avenues, Spencer, Todd and Booth Streets.

Bowling Green, Ohio.—Until Aug. 16 by C. E. Stinebaugh, Co. Aud., for constructing the Elizabeth Schnell bituminous-bound macadam road and the John Minning water-mound macadam road.

Bryan, Ohio.—Until Aug. 9 by O. R. Lowe, Co. Aud., for grading and paving with waterbound macadam 1.24 miles on Elm Grove Rd. Section 1, Pulaski Township; also 2.72 miles said road in Springfield Township. Cost, $10,246 and $24,660 respectively.

Defiance, Ohio.—Until Aug. 4 (extension of date from July 28) by Clayton M. Rath, Dir. of Service, for 32,129 sq. yd. of pavement. Bids will be received on all materials.

Toledo, Ohio.—Until July 27 by Clerk Bd. Public Service for paving 6 streets with wood block, brick, asphalt or concrete; also for constructing 3 sewers.

Gary, Ind.—Until July 27 by City Clerk for paving Washington Street with asphalt-macadam, about 8500 sq. yd.; cost $9,000.

Indiana.—By County Comrs. for constructing roads as follows:

Until Aug. 2:

Jasper, 3 gravel roads in Boone Township. George W. Stoner, Co. Aud.

Franklin, 3 gravel roads in Pleasant and Union Townships. H. L. Knox, Co. Aud.

Tipton, concrete road in Cicero Township. Oscar Vannes, Co. Aud.

Until Aug. 3:

Goshen, a concrete road in Concord Township; also a gravel, concrete and brick road in Elkhart Township. J. W. Brown, Co. Aud.

Decatur, a macadamized road in Wabash Township. T. H. Baltzell, Co. Aud.

Boonville, a rock or concrete road in Boon Township. G. H. Bass, Co. Aud.

Valparaiso, gravel road in Morgan, Center and Portage Townships. C. A. Blachly, Co. Aud.

Rochester, a stone and 2 gravel roads in Rochester Township. W. C. Miller, Co. Aud.

Indianapolis, Ind. — Reported desired until Aug. 4 by Bd. Pub. Wks. for grading and paving portions of Oak Avenue, Eighteenth and several other streets.

South Bend, Ind.—Until Aug. 18 by County Comrs., South Bend, for constructing Lincoln Highway, extending from the East city limits of Mishawaka, to the St. Joseph County line, requiring 16,000 yd. excavation and 49,150 yd. concrete. Estimated cost, $64,000.

Winamac, Ind.—Until Aug. 3, by County Clk., for construction of Wildermuth Road about 14,575 ft. in length; estimated cost $7,997. C. E. Paul, Co. Surveyor.

Balding, Mich.—Until Aug. 18 by F. E. Conant, City Clk., for 15,000 sq. yds. paving on Main, Bridge, Pleasant and Pearl Streets. Bonds to be sold Aug. 6. Smith & Boulay Co., Engrs., Nasby Bldg., Toledo.

Illinois.—Until July 28 by State Highway Comn., Springfield, for constructing State aid work as follows: (All cement to be furnished by State). County Kankakee, Section C, Nearest P. O. Exline, Approximate Length Feet 3560, Engineer's Estimate $6,047; County Kankakee, Section D, Nearest P. O. Momence, Approximate Length Feet 5000, Engineer's Estimate $9,159.

South Dixon, Ill.—Reported desired until July 27 by J. W. Cortright, Town Clk., for macadamizing Chicago Road.

Racine, Wis.—Reported desired until Aug. 7 by Bd. Pub. Wks. for paving W. Boulevard and Washington Avenue, in all 6226 sq. yd. brick paving, 2660 lin. ft. combined curb and gutter, etc.

Council Bluffs, Iowa.—Until July 26 by Charles J. Duff, City Clk., for about 21,880 sq. yd. repressed vitr. brick block paving on 6-in. concrete base on Broadway.

Mount Ayr, Iowa.—Reported desired until July 28 by H. M. Miller, Mayor, for 35,000 sq. yd. bitulithic, brick block, brick fiber and concrete paving, concrete curb and gutters on portions of various streets. E. T. Archer & Co., Engrs., New England Building, Kansas City, Mo.

College View, Neb.—Reported desired until Aug. 2 by J. G. Hornung, Village Clk., for grading, curbing and paving with asphaltic concrete, artificial repressed or vertical fiber brick in Dists. Nos. 1 and 2.

Kearney, Neb.—Reported desired until July 26 for constructing 30,000 sq. yd. repressed vitr. brick, fiber brick, asphaltic concrete or concrete pavement. E. H. Morey, City Engr.

Lincoln, Neb.—Reported desired until Aug. 14 by Arthur Edgren, Co. Engr., for paving with asphaltic concrete and brick on Sheridan Boulevard; probable cost $70,000.

Bozeman, Mont.—Reported desired until Aug. 5 by C. A. Speith, City Clk., for paving and curbing in Special Improvement Dist. Nos. 94, 96 and 97, includes 5056 sq. yds. paving, etc.

Laurel, Mont.—Reported desired until Aug. 3 by O. H. Bundy, City Clk., for 14,500 sq. yds. bitulithic pavement, etc.

Kansas City, Mo.—Until July 27, by Bd. Pub. Wks. (Edw. F. Webster, Acting Secy.) for furnishing material and resurfacing with asphalt brick pavement on 9th St. from Lydia Ave. to west line of The Paseo, also constructing asphalt pavement on Askew Ave., 26th St., and alley between Main and Walnut Sts., also Portland cement concrete pavement on Park, Agnes Aves. and other streets.

Silver City, N. M.—Until Aug. 2 by City Clerk for 10,000 sq. yd. concrete paving on Broadway and Bullard Streets to include 3000 lin. ft. concrete curb; cost $20,000.

Denver, Col.—Reported desired until Aug. 30 by Bd. Pub. Wks. (J. B. Hunter, Pres.) for concrete paving. Probable cost, $15,411.

Seattle, Wash.—Reported desired until Aug. 9 (readvertisement) by Byron Phelps, Co. Clk., for constructing Bond Road No. 11 (Duwamish-Renton Junction); cost $102,000, and Bond Road No. 9 (Enumclaw-Franklin Road); cost $452,000.

Walla Walla, Wash.—Until Aug. 3 by M. A. Power, City Clk., for paving N. 12th and W. Rose Sts. with bitulithic or asphalt concrete about 7000 sq. yds., crushed rock foundation; cost, $12,000. W. R. Rehorn, City Engr.

Washington.—Reported desired until Aug. 9 by William S. Roy, State Highway Comr., Olympia, for clearing, grading and draining about fourteen miles McClellan Pass Highway between Naches and the Summit, Yakima County.

Until Aug. 9 by William R. Roy, State Highway Comr., Olympia, for constructing five miles Inland Empire Highway from Colville, Stevens County, south toward Spokane. Probable cost, $17,000.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Maine. — Following are lowest bids opened July 15 by State Highway Comn., Augusta:

★1 Hermon Road, 1.09 miles: Ahern Constr. Co., Willimantic, Conn., $7,369 (awarded contract); R. G. Miller Contr. Co., Hartford, Conn., $8,462; James H. Kerr, Rumford, $8,584; Small & Ingalls, Bar Harbor, $9,328.

★M Ellsworth Road, .78 mile: Ahern Constr. Co., Willimantic, Conn., $5,610 (awarded contract); A. Williams Co., Boston, Mass., $6,004.

★M Brewer Road, .43 mile: H. A. & S. G. Day, Bangor, $1,905 (awarded contract).

★J Monson Road, 2.27 miles: James H. Kerr, Rumford, $13,850 (awarded contract); Horatio L. Baker, Woolwich, $13,244; Ahern Constr. Co., Willimantic, Conn., $14,175; John G. Fleming, Lincoln, $19,993.

★**Massachusetts.** — Contract awarded July 13 by State Highway Comn., Boston, for macadam road in Amherst, about 8000 ft. in length, to Lane Constr. Cor., Meriden, Conn., at $19,135. Next 3 lowest bids: Alco Contr. Co., Boston, $19,539; Perini Constr. Co., Ashland, $19,806; D. O'Connell Sons, Holyoke, $20,803.

★**Connecticut.**—Contracts awarded July 13, by Charles J. Bennett, State Highway Comr., Hartford, as follows:

Killingworth, graded road, 7150 ft., to Louis Longhi & Bro., Torrington, at $6,000.

Glastonbury, 2-in. bituminous macadam surface on Hartford-New London Road, 6500 ft., to A. E. Douglas, Glastonbury.

Sprague—gravel on 1630 ft. of Occum-Versailles Road, to F. A. Wilcox, Norwich, at $1,094.

Canterbury, resurfacing 1995 ft. and native stone 5100 ft. on the Westminster Road, to Goodman & Trumbull Co., Litchfield, at $8,154.

Bethel, gravel on Bridgeport-Newton Turnpike, 6315 ft., to Kellogg & Gregory, Danbury, at $8,803.

Roxbury, 12,800 ft. Roxbury-Woodbury graded road to John Michiel & Bro., Torrington, at $15,000.

Walpole, Mass.—Following are lowest bids opened July 15 for macadam road in Walpole: A. Ross & Son, Woburn, $33,345; P. A. Dingley, Walpole, $33,767; Perini Constr. Co., Ashland, $34,644.

★**Stamford, Conn.**—Contract awarded by City to W. H. Arthur, Stamford, for paving Summer and E. Main Sts. with asphalt paving on 5-in. concrete base, 2 in. thick at $1.40 per sq. yd.

Albany, N. Y.—Following are lowest bids opened July 13 by State Highway Comn., 55 Lancaster Street, for construction of highways by State Aid:

Road 5565, Chenango Forks-Greene, Chenango Co., 7.78 miles—Fred E. Gross & Sons, Yonkers, $85,290; T. H. Gill Company, Binghamton, $86,184; Paddelford & King, Sherburne, $86,547; Weed & Walsh, Mechanicville, $87,896.

Road 5568, Sherburne-Earlville, Chenango Co., 4.02 miles—Paddelford & King, Sherburne, $46,693; Newport Constr. Co. Herkimer, $47,965; Greenfield Constr. Co., Hornell, $48,572; Joseph McCormick, E. Providence, R. I., $51,414.

Road 1225, Lorraine-Worth, Part 1, Jefferson Co., 2.86 miles—Joseph McCormick (only bidder), E. Providence, R. I., $17,830.

Road 1226, Lorraine-Worth, Part 2, Jefferson Co., 2.40 miles—Joseph McCormick (only bidder), E. Providence, R. I., $15,621.

Road 1299, Constableville-Lyons Falls, Part 1, Lewis Co., 2 miles—Spellman-Oliver Co., Chateaugay, $18,646; Thomas Grady, Rochester, $19,416.

Road 1300, Barnes Cors.—W. Lowville, Part 2, Lewis Co., 8.82 miles—Fred E. Gross & Son, Yonkers, $76,244; J. A. Culkin, Oswego, $81,385; Brady-Oltarsch Constr. Co., Inc., New York, $84,545; J. G. Hayes Co., Inc., Rome, $86,361.

Road 1301, Lowville Village-Shady Avenue and East State Street, Lewis Co., 1.27 miles—Harry W. Roberts & Co., Utica, $32,398; R. E. Cooper, Little Falls, $34,235.

Road 410, Fort Plain-Hessville-Sprout Brook, Montgomery Co., 7.10 miles—James Anderson, Menands, $70,465; Brady-Oltarsch Constr. Co., Inc., New York, $71,965; Conroy & Nixdorf, Oneida, $76,328; James E. Martin, Utica, $81,144.

Road 1265, Massena-Helena, Part 2, St. Lawrence Co., 5.50 miles—Fred E. Gross & Son, Yonkers, $48,961; Thomas Grady, Rochester, $51,882; Henry P. Burgard Co., Buffalo, $51,948.50; E. T. Eggleston, Yonkers, $51,949.

Road 5569, Sharon Springs-Sharon, Schoharie Co., 4.79 miles—DeGraaff & Hogeboom, Inc., Kingston, $47,980; Weed & Walsh, Mechanicville, $48,243; S. V. Van Wagonen, Inc., Rondout, $48,612; Ruddy-Saunders Constr. Co., Troy, $48,842.

Road 5557, Townsend-Watkins, Schuyler Co., 6.03 miles—James T. Moore, Elmira, $61,507; J. W. Brennan Constr. Co., Inc., Geneva, $61,954; Sullivan Constr. Co., Syracuse, $62,425; Atlanta Constr. Co., Atlanta, $63,828.

Road 1232, Montour Falls-Alpine, Part 1, Schuyler Co., 1.11 miles—Frank Malone, Syracuse, $26,157; J. W. Brennan Constr. Co., Inc., Geneva, $26,533; Peter F. Connolly Co., Horseheads, $27,105; John R. Burchill, Syracuse, $28,123.

Road 1102, Savona-Bradford, Steuben County, 9.09 miles—Atlanta Constr. Co., Atlanta, $77,710; Sullivan Constr. Co., Syracuse, $81,202; Richard Hopkins, Troy, $83,331; Dale Eng. Co., Utica, $83,679.

Road 1292, Wayland-Dansville, Part 1, Steuben Co., 3.42 miles—J. G. Hayes Company, Inc., Rome, $34,178; Dale Eng. Company, Inc., Utica, $34,566; Thomas Grady, Rochester, $34,946; Atlanta Constr. Co., Atlanta, $34,964.

Road 5564, Avoca-Wallace-Cohocton, Steuben Co., 7.31 miles—Dale Eng. Co., Utica, $59,744; Kennedy Constr. Co., Albany, $61,974; Atlanta Constr. Co., Atlanta, $65,125; P. H. Murray, Rochester, $65,859.

Road 5457-A, Bloomingburg-Monticello, Part 2, Sullivan Co., 0.72 miles—John A. Jova, Inc., Newburgh, $12,266; John J. Keating, Monticello, $12,672; Jackson Bros., Cuddebackville, $12,964.

Road 5567, Ithaca-West Danby, Part 2, Tompkins Co., 3.04 miles—John R. Burchill, Syracuse, $28,872; Frank Malone, Syracuse, $29,104; Sullivan Constr. Co., Syracuse, $29,779; Brady-Oltarsch Constr. Co., Inc., New York City, $30,643.

Road 5571, White Plains-East View, Westchester Co., 4.32 miles—Fagnani & Marra, Tuckahoe, $49,822; Fred E. Gross & Sons, Yonkers, $52,430; John L. Hayes Constr. Co., Yonkers, $53,620; Westchester-Dutchess Cor., Mount Vernon, $53,846.

Road 1088, Castile Village, Wyoming Co., 1.53 miles—Frank M. Foote, Arcade, $24,-932; John Johnson Constr. Co., Buffalo, $25,172.

Road 1267, Bennington-Attica-Attica Center, Parts 2 and 3, Wyoming Co., 6.99 miles—Fred E. Gross & Son (only bidder), Yonkers, $67,390.

Lowest bids opened same time and place for repair of highways by State Aid:

Repair Contract 556, Roxbury, Delaware Co., 0.95 miles—Schunnemunk Constr. Co., Highland Mills, $7,901; De Graafe & Hogeboom, Inc., Kingston, $10,236.

Repair Contract 809, Lyons-Geneva, Ontario Co., 1.69 miles—Harry W. Roberts Company, Utica, $17,170; Lane Constr. Cor., Meriden, Conn., $18,830; Langan Constr. Cor., Albany, $18,885; J. W. Brennan Constr. Co., Inc., Geneva, $19,467.

Repair Contract 813, Jericho Turnpike, Parts 21 and 3, Suffolk Co., 4.08 miles—William Doyle, Saugerties, $17,787; Municipal Asphalt Co., New York City, $19,-967; Barker-Bonner Company, Inc., New York City, $20,405.

Albany, N. Y.—Following are lowest bids opened July 15 by State Comn. of Highways, at 55 Lancaster Street, Albany, for repair of highways by State Aid:

Road 1240, Binghamton City-Conklin Avenue, Broome Co., 0.91 mile—Fitch & Douglas, Rochester, $43,212; Frank Stento, Binghamton, $43,870; Tyne & Willey, Binghamton, $45,095.

Road 5265-A, Salamanca-Little Valley, Part 1, Cattaraugus Co., 0.93 mile—Thomas Fitzgerald Co., Fredonia, $47,994; H. E. Bunce, Olean, $51,056; South Shore Constr. Co., Erie, Pa., $52,329; William C. Evans, Ambler, Pa., $52,359.

Road 1012-A, Sinclairville-Cassadaga, Part 2, Chautauqua Co., 1.51 miles—Dunkirk Constr. Co., Dunkirk, $19,760; Woolsey Constr. Co., Davenport, Iowa, $19,830; William C. Evans, Ambler, Pa., $20,592; Shaw & Lakin, Jamestown, $20,744.

Road 1296, Brocton Village-Mill Street, Chautauqua Co., 0.77 mile—William C. Evans, Ambler, Pa., $11,983; Dunkirk Constr. Co., Dunkirk, $11,996; Elmer M. Love & Sons, Corry, Pa., $12,144.

Road 1297, Ripley-Sherman, Part 1, Chautauqua Co., 3.55 miles—John F. Dolan Contr. Co., New York, $72,537; William C. Evans, Ambler, Pa., $73,814; Dunkirk Constr. Co., Dunkirk, $74,154; O. M. Severson, Erie, Pa., $74,416.

Road 1298, Cassadage-Burnhams, Chautauqua Co., 0.93 miles—William C. Evans, Ambler, Pa., $21,875; Dunkirk Constr. Co., Dunkirk, $21,943; O. M. Severson, Erie, Pa., $22,167; South Shore Constr. Co., Inc., Erie, Pa., $22,752.

Road 5566, Cortland City-Owego Street, Cortland Co., 0.23 mile—S. P. Hull, Cortland, $2,318; Richard Hopkins, Troy, $2,498.

Road 1289, East Aurora Village-East Main Street, Erie Co., 0.34 mile—Busch & Percival, Buffalo, $16,601; Rich Constr. Co., Inc., East Aurora, $17,627.

Road 5550, Aurora-Buffalo, Part 4, Erie Co., 0.59 mile—Busch & Percival, Buffalo, $28,459; William C. Evans, Ambler, Pa., $28,789; Rich Constr. Company, Inc., East Aurora, $30,230.

Road 619, Sammonsville - Johnstown, Fulton Co., 2.12 miles—Brady-Oltarsch Constr. Co., Inc., New York City, $20,237; Clarence Welsh & Company, Gloversville, $20,264.

Road 1290, Hannons Corners-Fairport, Monroe Co., 1.53 miles— Thomas Grady, Rochester, $15,679; Newport Constr. Co., Herkimer, $16,284; Monroe Roads Company, Pittsford, $16,436; Ribstein-Holter Co., Inc., Rochester, $16,578.

Road 511, Glen-Charleston, Montgomery Co., 3.81 miles—Dale Eng. Co., Utica, $31,869; Semper Brothers, Watertown, $32,310; Brady-Oltarsch Constr. Co., Inc., New York, $33,010; Newport Constr. Co., Herkimer, $33,390.

Road 5280, Little Neck-Old Westbury, Nassau Co., 1.57 miles—Ulrich & Persicane, Brooklyn, $24,035; Westchester-Dutchess Cor., Mount Vernon, $24,208; Nordone & Petrillo, Mount Vernon, $24,-762; E. T. Eggleston, Yonkers, $25,811.

Road 1209, Syracuse City-Court Street, Onondaga Co., 0.27 mile—Mondo Constr. Co., Syracuse, $12,654; C. T. Hookway Constr. Co., Syracuse, $12,660; John Davin, Syracuse, $12,944; M. J. Gleason & Co., Syracuse, $13,156.

Road 1294, Manchester Village-State, Clifford and North Streets, Ontario Co., 1.38 miles—Chambers & Barnes, Rochester, $14,520; Ribstein-Holter Co., Inc., Rochester, $15,140.

Road 1302, Morris-Oneonta, Otsego Co., 12.66 miles—J. A. Culkin, Oswego, $130,-509; Ruddy-Saunders Constr. Co., Inc., Troy, $132,741; Peter F. Connolly Co., Horseheads, $133,067; Weed & Walsh, Mechanicville, $133,734.

Road 1303, Unadilla Forks-Bridgewater, Otsego Co., 2.52 miles—Alonzo Schaupp, Guilderland, $19,982; Newport Constr. Co., Herkimer, $21,275; Weed & Walsh, Mechanicville, $22,049; John H. Gordon, Albany, $22,186.

Road 1295, Nyack-Rockland Lake, Rockland Co., 2.95 miles—Brady-Oltarsch Constr. Co., Inc., New York, $38,135; Ruddy-Saunders Constr. Co., Troy, $39,-914; John A. Jova, Inc., Newburgh, $40,279; William F. McCabe Contr. Co., Inc., White Plains, $40,326.

Road 5537, Canisteo-Whitesville, Part 1, Steuben Co., 1.72 miles—Kennedy Constr. Co., Albany, $29,880; Frank Malone, Syracuse, $30,964; Greenfield Constr. Co., Hornell, $30,995; William C. Evans, Ambler, Pa., $31,607.

Road 1291, Smithtown-Fort Salonga, Part 2, Suffolk Co., 3.25 miles—Nordone & Petrillo, Mount Vernon, $39,879; Westchester-Dutchess Cor., Mount Vernon, $41,544; Brady-Oltarsch Constr. Co., Inc., New York, $42,025; John L. Hayes Constr. Co., Yonkers, $42,530.

Road 5570, West Hurley-Woodstock, Ulster Co., 2.97 miles—Frank Salvoucci, West Hurley, $29,214; Marks Kearney, Hudson, $31,139; Henry Clinton, Poughkeepsie, $31,870; Ruddy-Saunders Constr. Co., Troy, $32,755.

Road 1228, Chestertown-Hague, Part 3, Warren Co., 5.13 miles—Kingsbury Constr. Co., Hudson Falls, $69,583; D. L. Anderson, Albany, $69,707; John H. Gordon, Albany, $69,852; Brady-Oltarsch Constr. Co., Inc., New York, $71,420.

Repair Contract 812, Roads 125 and 174, Broome Co., 3.67 miles—Lane Constr. Cor., Meriden, Conn., $33,292; Charles E. Haney, Camillus, $33,415; Ruddy-Saunders Constr. Co., Troy, $34,596; W. C. Evans, Ambler, Pa., $36,969.

Repair Contract 810; Road 294, Monroe Co., 2.92 miles—Dodge Constr. Co., Inc., Rochester, $12,591; Monroe Roads Company, Pittsford, $12,828; Ribstein-Holter Co., Inc., Rochester, $12,859; I. M. Ludington Sons, Inc., Rochester, $13,168.

Repair Contract 811, Road 172, Portland Avenue, Part 1, Monroe Co., 0.67 mile—Flower City Contr. Co., Rochester, $14,-828; Dodge Constr. Co., Rochester, $14,841; Whitmore-Rauber & Vicinius, Rochester, $14,895; Ribstein-Holter Co., Inc., Rochester, $15,204.

Repair Contract 489, Roads 63 and 79, Monroe Co., 1.52 miles—Union Paving Co., Schenectady, $15,074; Langan Constr. Cor., Albany, $15,317; Whitmore-Rauber & Vicinius, Rochester, $18,195; Peter F. Connolly Co., Horseheads, $18,648.

★**Buffalo, N. Y.**—Contract for paving Grider St. awarded by Bd. Aldermen to H. P. Burgard Co., Buffalo, at $31,900.

Contracts for paving awarded by Common Council as follows: Lakewood Street to Erie Contr. Co., Morgan Bldg., at $9,800 and for Moselle Street to Henry P. Burgard, 1968 Fillmore Avenue, at $21,651.

★Contract for paving Chapin Parkway with wood block awarded by Park Bd. to Constantine Constr. Co., Buffalo, at $41,000.

★**Cohoes, N. Y.**—Contract awarded by Bd. Estimate and Apportionment for paving with brick Bowery St. to Walsh & Keegan, Albany, at $17,045. Next 3 lowest bids: P. W. Mulderry, Albany, $18,404; James P. Kelly, Cohoes, $18,410; J. B. Dower, Mechanicsville, N. Y., $18,523.

★**Islip, L. I., N. Y.**—Contract for constructing 200,000 sq. ft. concrete sidewalks awarded by Town Bd. to Clifford Constr. Co., Jamaica, at 11¾ cts. per sq. ft.

New York, N. Y.—Lowest bid opened July 15 by President borough of the Bronx for regulating, grading, setting curb, etc., in Holland Avenue, from Baker Avenue to Hunt Avenue, submitted by Delson Contr. Co., at following bid: 1850 cu. yd. earth excav., 20 cts.; 250 cu. yd. rock excav., $2; 16,500 cu. yd. fill, 29 cts.; 4160 lin. ft. curb, 85 cts.; 20,800 sq. ft. concrete sidewalk, 14 cts.; 560 sq. ft. new bridgestone, 50 cts.; 775 cu. yd. dry rubble masonry, $1.75; 15 cu. yd. Class A concrete, $7; 500 lin. ft. 12-in. vitr. pipe, $1; 3000 lin. ft. guard rail, 18 cts.; 1100 lb. steel reinforcement bars, 3 cts.; 2 Type B inlets, $30; 3 manholes, $60; 10 cu. yd. brick masonry, $15; total, $15,307. Next 3 lowest bids: J. Di Menna, $15,500; Burnside Contr. Co., $15,860; Di Menna & Del Balso, $16,218.

Following are totals of bids opened July 15 by President borough of the Bronx, for regulating, grading, setting curb, flagging sidewalks, laying crosswalks, building approaches and erecting fences where necessary in Glover Street, from Castle Hill Avenue to Westchester Avenue: J. DiMenna, $9,275; Burnside Contr. Co., $9,322; J. F. Callahan, $9,586; Di Menna & Del Balso, $10,050; Delson Contr. Co., $10,379.

★**Rochester, N. Y.**—Contracts for paving awarded by the Board of Contract and Supply as follows: North Street brick pavement, to Ribstein-Holter Co., Rochester, $34,674; Pinnacle Road asphalt pavement, to Rochester Vulcanite Pavement Co., Rochester, $14,260.50; Post Avenue brick pavement, to Flower City Contr'g Co., Rochester, at $5,195.50.

★**Salamanca, N. Y.**—Contract for constructing concrete sidewalks awarded by Common Council to P. H. Goggin, Fredonia, at about $17,000.

★**Syracuse, N. Y.**—Contracts for paving awarded by Bd. Contract and Supply as follows: Park Street with vitr. block to Warner-Quinlan Asphalt Co., Syracuse, at $27,454, and for paving E. Fayette Street with vitr. block, to Guy B. Dickison, Kirk Building, at $14,454.

Lowest bid opened July 14 for paving Madison, Pine Streets, Walnut, Euclid and Maryland Avenues submitted by Schenectady Constr. Co., Schenectady, at about $46,000.

★**Troy, N. Y.**—Contract for paving Glen Avenue with bitulithic awarded by Bd. Contract & Supply to John W. Davitt, Troy, at $9,399.

★**Hackensack, N. J.**—Contract for constructing road from Nutley Bridge to Belleville Turnpike awarded by Bd. Freeholders to Uvalde Asphalt Paving Co., 1 Broadway, New York City, N. Y., at $38,470.

★**Morristown, N. J.**—Contracts for paving awarded by Bd. Chosen Freeholders at Morristown as follows: Road from Morris Plains Station to Denville, to Charles T. Eastburn Co., Philadelphia, Pa., at $34,512; road from Morristown line on Speedwell Avenue to Morris Plains Station, and Boonton-Montville Rd. and road from Landing Post Office to Sussex County Line, to Salmon Bros., Netcong, at $19,227; from railroad crossing at Ralston to cross road at Chester, to William R. Moore, Long Branch, at $10,947.

Newark, N. J.—Lowest bid opened July 15 by Bd. of Works for paving S. Orange Avenue, from S. Ninth to S. 20th Streets, submitted by Ralph Sangiovanni, 78 Hoyt Street, at following bid: 10,000 sq. yd. 3-in. asphalt block, 6-in. concrete base, $2.19; 4700 lin. ft. 20 x 6 in. four cut granite curb. $1.05; 2 sets 20 x 6 in. four-cut granite corners, 6 ft. radius, $13; 575 ft. granite corners, $1.40; 200 ft. 18 x 6 in., 4-cut header curb, 80 cts.; total $27,826. Next 2 lowest bids: John E. Donovan, Port Richmond, S. I., N. Y., $28,885 Newark Paving Co., Newark, $30,923.

★**Trenton, N. J.**—Contract for paving Whittaker, S. Clinton, Ardmore Avenues, Cooper, Fulton, Lamberton Streets, awarded by City Comn. July 7 to Newton Paving Co., Trenton, at $45,000.

★**Lebanon, Pa.**—Contract for 1¼ miles wood block pavements awarded by City Council to Franklin Constr. Co., 52 Vanderbilt Avenue, New York, at $75,000.

Norristown, Pa.—Lowest bids opened by County Comrs. for constructing Spring House and Sumneytown turnpike from Spring House to Kulpsville, 6¼ miles, submitted as follows: Section from Kulpsville to North Wales, William C. Evans, Ambler, $22,880, and section from North Wales to Spring House, Ambler-Davis Co., Philadelphia, $23,000.

★**Pittsburgh, Pa.**—Contract for improving Noblestown No. "0," Braddock and Ardmore Connecting, Newton and Rodi and other roads, about 6 miles, to J. Toner Barr, 434 Diamond Street, Pittsburgh.

★Contracts for road improvements awarded by County Comrs. as follows: (Bids opened July 8.) Wilmerding and Monroeville Connecting Rd. in Patton Township, 1¼ miles to R. H. Cunningham & Sons Co., Pittsburgh, at $25,203; Millers Run Extension Rd. in South Fayette Township, 2 miles, to William J. Payne, Jr., Co., 7 Beltzhoover Avenue, at $42,473.

★**Plymouth, Pa.**—Contract for paving W. Main St. awarded by Borough Council to Edw. Quinn, Plymouth, at $11,181.

★**Baltimore, Md.**—Contract for paving with brick Tyson, Trenton and other streets awarded by Paving Com. to Martin J. Beach, Baltimore, at $20,740.

Two lowest bids opened by Bd. Awards July 14 for paving Cliftview Avenue and Norwood Street with asphalt submitted by P. Flanigan & Sons, 120 E. Lexington Street, $10,924, and American Paving Co., Baltimore, $10,717.

★**Cumberland, Md.**—Following 4 lowest bids opened July 7 by Mayor and City Council for grading, recurbing and repaving Baltimore Street, approximately 6000 sq. yd. creosoted wood block pavement: J. T. Barr, Pittsburgh, Pa., $20,974; John J. Curley, Richmond, Va., $22,281; Brady Bros., Frostburg, Md., $23,227; Louis Lawson, Norfolk, Va., $23,640. James P. Gaffney, City Engr.

★**St. Albans, W. Va.**—Contract for constructing 5½ mile asphalt road through St. Albans awarded by county to Carey-Reed Co., Lexington, Ky., at $90,000.

★**Clearwater, Fla.**—Contract awarded July 8 by Bd. Co. Comrs. (C. Wiecking, Clk.) to Edwards Constr. Co., Tampa, at $616,578, for constructing about 50 miles brick roadway, 9 ft. wide, backed by 3 ft. on each side of shell or rock, subject to an election to be held Aug. 18 to vote on issuing bonds for this work.

★**Jacksonville, Fla.**—Contract for constructing brick road through Black Point awarded to State Armory Bd. at Tampa to J. Y. Wilson Constr. Co., Jacksonville, at about $12,000.

★**Canton, Miss.**—Contract for improving roads, including concrete bridges and culverts, awarded to S. A. Gano of Jackson, at $10,959.

★**Crystal Springs, Miss.**—Contract for graveling roads in Beat 5, comprising Hopewell, Gatesville and Crystal Springs, awarded to McTigue & Huey, Hazlehurst, at $150,000. Southern Sewer Pipe Co., Birmingham, secured contract for culverts.

Memphis, Tenn.—Lowest bid opened by Bd. City Comrs. for improving Mississippi Boulevard submitted by L. W. Johnson at $9,308.

★**Louisville, Ky.**—Contracts for constructing 2 miles Lexington Pike, one mile with crushed rock and one with washed gravel, awarded by County Comn. to F. J. Lewin, Covington, and Daniels & List, Anderson, Ind., at total $29,000.

★**Owensboro, Ky.**—Contract for constructing 4¾ miles on Hardinsburg Rd. leading to Hawesville awarded by Daviess County Fiscal Court to Martin & Martin, Evansville, Ind., at $24,500. Three steel bridges are included in contract.

★**Owensboro, Ky.**—Contract for constructing ¾ miles Hardinsburg Road awarded by Daviess County Fiscal Court to Martin & Martin, Evansville, Ind., at about $24,500.

★**Bellefontaine, Ohio.**—County Comrs. awarded contract for improving south end of Anderson Bell Pike to M. R. Koffroth, Richwood, at $9,560.

★**Cincinnati, Ohio.**—Contract awarded by Co. Bd. Comrs. (Albert R. Reinhart, Clk.) for improving Compton Rd., from Cincinnati and Hamilton Pike to Carthage Pike, Springfield Township, to John Ruebel Constr. Co., Colerain and Virginia Ave., at $9,138. Next 3 lowest bids: R. E. Cash, 90 E. Mitchell St., $9,635; A. E. Dean, Mt. Healthy, Ohio, $9,941; Van Camp Bros., 3312 East Side, Hyde Park, $10,850.

★Contract awarded by County Comrs. (Albert Reinhart, Clk.) for improving Lee Creek Road in Harrison Township, to Goph & Holden of Harrison, at $9,550 (bids opened July 9). Other bidder: Nugent & Hines, Cleves, at $10,087.

★**Lakewood, Ohio.**—Contracts awarded by Bd. Pub. Wks., July 12, for paving as follows: To Cleveland Trinidad Paving Co., Cleveland, Lake Avenue with Bermudez Lake sheet asphalt, $35,292; also Cedarwood Avenue with bitulithic, $4,-260; to Pace Bros. for brick paving on French Avenue, $13,274; also brick paving on Virginia Avenue, $10,469; to Baldwin Bros., Cleveland, brick paving on Dowd Street, $11,151; and to Cleveland Paving & Constr. Co., Cleveland, brick paving on Morton Avenue, $5,707. E. A. Fisher, City Engr.

★Following are unit prices of Cleveland Trinidad Paving Co., successful bidder, as above, for paving of Lake Avenue, with Bermudez sheet asphalt:

1500 cu. yd. grading	$0.01
500 cu. yd. binder foundation	6.89
100 lin. ft. 7 x 20 in. boulevard curb.	.65
Iron cover reset to grade	2.50
1000 lin. ft. old stone curb reset	.15
198 lin. ft. 6-in. c. i. water main	1.25
3 pieces 6 x 6-in. c. i. tees	15.00
3 pieces 6-in. c. i. valves and boxes.	25.00
25,000 sq. yd. sheet asphalt pavt. Bermudez or Trinidad Lake	1.25

★**St. Clairsville, Ohio.**—Contract for resurfacing 9000 ft. High Ridge Road with slag awarded to Seiple & Wolf of Toledo. Emerson Campbell, Co. Aud.

★**Upper Sandusky, Ohio.**—Following are bids opened July 14 for 9994 sq. yd. paving on Eighth and South Streets as follows: Modern Constr. Co., Fremont, Ohio, $20,202; Herring & Sons, Mansfield, $21,-023; Gessner & Cothrel, Toledo, $21,613; Torrence & Jenney, Muncie, Ind., $21,862. W. E. Martinn, City Engr.

★Unit prices of Modern Constr. Co., Fremont, (successful bidder):

9,994 sq. yd. speedway brick	$0.91
3,937 cu. yd. excav.	0.30
7,020 lin. ft. curb. (Berea stone)	0.46
504 lin. ft. headers (Berea stone)	0.30
9 inlets	18.00
4 catchbasins	35.00
150 lin ft. 10-in. pipe	0.60
968 lin. ft. 4-in. drain tile	0.06
9,994 sq. yd. 4-in. concrete foundation	0.45
9,994 sq. yd. tar filler	0.15

★**Elkhart, Ind.**—Contract for 7290 sq. yd. sheet asphalt and 12,000 sq. yd. tarvia macadam awarded to Tarvia Northern Constr. Co.; cost reported to be about $13,000.

★**Indiana.**—Contracts for constructing roads awarded by County Comrs. as follows:

Jonesboro, Union County, road in Union Township, to Wilk & Co., Rushville, at $19,767.

Hartford City, Blackford County, macadam road, to Albert Clamme, Hartford City, at $11,740.

Decatur, Adams County, road macadam in Preble Township, to Hauck & Son, Decatur, at $10,500.

★**Indianapolis, Ind.** — Following bids opened by Bd. Pub. Wks. July 12 for resurfacing (a) Maryland Street, (b) Pennsylvania Street with asphalt. Price given per lin. ft. on each side of street. Union Asphalt Constr. Co., American Central Life Bldg., (a) $2.95, (b) $2.80; Marion County Constr. Co., 1600 S. West St.; (a) and (b) $3.35.

★**Laporte, Ind.**—Contract for constructing Lincoln Highway in Hudson Township with brick awarded by County Comrs. to George Gross, Laporte, at $15,490.

★**Detroit, Mich.** — Contract for constructing 15 miles cement sidewalks at Westlawn and Strathmoor awarded by B. E. Taylor to Otis Cement & Constr. Co., Detroit, at about $35,000.

★**Brockton, Ill.**—Contract awarded by County Highway Engineer Townsend at Lee Rock City for constructing combination rock and gravel road on 4 highways to Snyder & Barnett of Frankfort at $26,245.

★**Peoria, Ill.**—Contract awarded by Bd. Local Improv. (Sherman W. Eckley, Pres.) for repaving with asphaltic concrete portion of Callender Avenue, about 5800 sq. yd. Bids opened July 6). to E. E. Harding of Racine, Wis.

Milwaukee, Wis.—Lowest bids opened by Bd. Pub. Wks. for paving with asphalt submitted as follows: Twenty-seventh Avenue, White Constr. Co., Milwaukee, at $1.298; and Atkinson Avenue and Graham Street, F. P. Caughlin, Humboldt and North Avenues, $17,827.

★**Des Moines, Iowa.**—Contract for paving Grand Avenue with brick awarded by Municipal Council to J. Herraton & Co., Des Moines, at $1.64 per sq. yd.

★**Tonganoxie, Kan.**—Contract for concrete paving awarded July 12 to H. A. Kepler, Kansas City, Mo., at following bid: 28 ft. pav., $1.28 per sq. yd.; 20 ft. pav., $1.295 per sq. yd.; 20-in. curb, 28 cts. per lin. ft.; 18-in. curb, 26 cts.; 8-in. curb and 24-in. gutter, 48 cts.; 6-in. tile, 18 cts. per ft.

★**Helena, Ark.**—Contract awarded to Southern Bitulithic Co., Nashville, for 11 blocks bitulithic pavement, at Helena, Ark., not Helena, Mont., as recently stated. Approximate cost $41,000.

★**Kaufman, Tex.**—Contract awarded by Co. Comrs. for highway improvements (bids opened July 13) to ... E. Cashman Constr. Co., Omaha, Neb., at the following bid: clearing, per acre, $25; 4 acres of grubbing, each $60; 34,127 cu. yd. earth excav., 12 cts.; 58,456 cu. yd. embankment, 1000 ft. free haul, 16 cts.; 83,518 lin. ft. machine work, 4 cts.; 41,841 sq. yd. road gravel, 1 mile free haul, $1.29; 27,228 sq. yds. overhaul on road gravel, 35 cts.; 625 cu. yd. 1:3:5 concrete, $13.50; 1603 cu. yd. 1:2:4 concrete, $14.10; 16,450 sq. yd. 5-in. concrete pavement, $1.28; 45,500 ft. mesh reinforcement in place, 6 cts.; 590,025 lb. steel bridges erected, 3.64 cts.; 2000 cu. yd. riprap in place, $2.50; total, $161,207. Other bids: Cobb & Gregory, Dallas, $182,794; W. T. Montgomery, San Antonio, $189,012. Charles Chappell, Co. Highway Engr.

★**Blaine, Wash.**—Contract for paving 4 blocks with concrete awarded by city to Hooker & Campbell, Bellingham, at $1.15 per sq. yd.

★**Cathlamet, Wash.**—Contract awarded by County Comrs. for clearing, grubbing and grading Road No. 19, approximately 6½ miles, from Kelso to Ilwacco, to Salem Bros., Seattle, at $26,312 (bids opened July 6).

★**Ferndale, Wash.**—Contract for paving two streets with concrete awarded by City Council to Tropman & Boerhave, Lynden, at $12,485.

★**Mount Vernon, Wash.** — Contract awarded by Co. Comrs. to Farsh & Gass, Room 202, White Building, Seattle, for paving with concrete 16,832 sq. yd., reinforced concrete 4160 sq. yd., in all about 2¼ miles Permanent Highway No. 2A, near Sedro Woolley, at $23,900, and constructing reinforced concrete bridge, 76 ft. in length, at $2,600. Next 3 lowest bids on road work: Chamberlain Constr. Co., Seattle, $24,000; N. W. Hall, Seattle, $25,358; D. H. Traphagen, Seattle, $25,300.

Olympia, Wash.—Lowest bid opened by State Highway Comrs., Olympia, for clearing, grading and draining 11 miles Olympic Highway between Mud Bay and McCleary in Thurston County, submitted by Burnette & Bankston, Tacoma, at $31,992.

Port Angeles, Wash.—Only bid opened for grading 12 miles streets in Port Angeles submitted by Ferch & Gass, White Building, Seattle, at $94,532.

Seattle, Wash.—Contract for grading and graveling Highway No. 7A awarded by King County Comrs. Bid opened July 6) to Salem Bros., 1717 Belmont Avenue, at $14,000.

★Lowest bids opened by Bd. Pub. Wks. for paving submitted as follows: Thirty-seventh Place E. (1 Street, 1207 Ewing Street, at $11,750; Horton Street, D. H. Traphagen, Artic Club, $20,555; W. Seventy-first Street, L. E. Ellis, Central Building, $10,549.

★**Vancouver, Wash.**—Contract for constructing roads awarded by Clark County Comrs. as follows: Camas Dist. Road, to J. P. Swanson, Vancouver, at $10,000; Ridgefield Road to Arthur Kern, Portland, Ore., at $9,500.

★**Wenatchee, Wash.**—Contracts for paving awarded by County Comrs. as follows: One mile Permanent Highway No. 7 with rock to Quigg Constr. Co., Hoge Building, Seattle, at $16,000; and Permanent Highway No. 6 (Monitor Rd.), to James Gerard, Wenatchee, at $14,000.

★**Portland, Ore.**—Contract for paving with concrete Powell Street awarded by City Council to Giebisch & Joplin, Portland, at $14,071.

★**Tillamook, Ore.**—Contract for paving Tillamook Parkview Road (bids opened July 2) awarded to Arenz Contr. Co., Salem, at $24,227. Next 3 lowest bids: Contractor Bidwell, Portland, $33,260; Hemlake Bros., Portland, $33,460; Tillamook Bay Contr. Co., Tillamook, $34,026. J. C. Holden, Co. Clk.

★**Los Angeles, Cal.**—Contracts for paving awarded by city as follows: 103,784 sq. ft. asphalt on Cambridge Street to Benjamin F. Ford and Fred H. Stout, Bradbury Building, at $17,471; $2,835 sq. ft. asphalt pavements on Beaudry Avenue, to Fairchild-Gilmore-Wilton Co., 296 Pacific Electric Building, at $10,411, and 103,300 sq. ft. asphalt concrete pavement on Gramercy Place, to George R. Curtis, 552 S. St. Louis Street, at $12,373.

★**Manhattan Beach, Cal.**—Contract for 57,996 sq. ft. concrete pavement awarded July 7 to Modern Constr. Co., Los Angeles, at $16,206. M. M. Murray, City Engr.

★**San Francisco, Cal.**—Contract for improving Nineteenth Avenue awarded by Works Bd. to F. R. Ritchie, San Francisco, at $23,255.

★**Salt Lake City, Utah.**—Contracts for paving (bids opened July 1) awarded as follows: To J. W. Mellen, 29 Richards Street, 13,716.3 sq. yd. 6-in. concrete base 1½ in. binder, rock asphalt 1½ in. top, $1.65 per sq. yd.; total, $34,773; and 9678.5 sq. yd. 4-in. bituminous macadam base, bitulithic 2-in. wearing surface, $1,955; total, $21,380; to G. A. Heman, 643 W. Eighth S. Street, 4240 sq. yd. 6-in. concrete base 1½-in. binder sheet asphalt top at $1.57 per sq. yd.; total $8,848; and to P. J. Moran, 152 W. Second S. Street, 2188 sq. yd. 6-in. concrete base 1½-in. binder sheet asphalt 1½-in. top, $1.54 per sq. yd.; total, $4,909. Sylvester Q. Cannon, City Engr.

STREET CLEANING AND GARBAGE DISPOSAL

PROPOSED WORK

Gainesville, Fla.—City contemplates installation of garbage incinerator.

Beaumont, Tex.—City contemplates construction of an incinerator. C. L. Scherer, City Engr.

BIDS DESIRED.

Asbury Park, N. J.—Until July 27 (extension of date from July 13) by Bd. Comrs. for collection, removal and disposal of garbage, rubbish, ashes and dead animals; also separate bids for collection and operation of a disposal plant for collecting and transporting for garbage, rubbish, ashes and dead animals. Howard D. LeRoy, Comr. Pub. Wks.

Berlin, Ont.—Until July 29 by A. H. Millar, City Clk., for steeet sprinkler and flusher, advertised in Engineering Record.

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS

PROPOSED WORK

Dock—Buffalo, N. Y.—Reported New York Central R.R. Co. about to let contract for concrete dock on Buffalo River adjoining dock of Eastern Grain & Elevator Co. Estimated cost $30,000.

Flood Abatement—Olean, N. Y.—E. W. Fitzgerald, President Flood Abatement Comn., writes selection of engineers being considered by Committee; plans for proposed flood abatement will probably be ready for contractors about Sept. 15. Cost, $150,000.

Channel Cut, Etc.—Hamilton, Ohio.—County Comrs. soon to let contract for channel cut break at Summerville; also for concrete road and revetment, to cost $8,000. F. M. Hammerle, Co. Engr.

Drainage—Bloomington, Ill.—Blue Ridge Special Dist. reported organized to install a drainage system in McLean, De Witt and Pratt Counties from plans of Bell & Hare.

Drain—Atlantic, Iowa.—A hearing on petition to drain Indian Creek will be held Aug. 14; cost $14,503. Address C. E. Kringel, Co. Aud.

Ione, Cal.—Ione Valley Development Assoc. reported organized to construct irrigation system in Amador County, about 200,000 acres.

Irrigation—Madera, Cal.—C. M. Petty and G. H. Rothe, have been appointed as a special committee to secure an engineer from University of California or the dept. of Agriculture to investigate and report on feasibility of forming an irrigation district.

Irrigation Dam—Turlock, Cal.—Through Engineer R. V. Meikle of the Turlock Irrigation Dist. and Engineer Herman of the Modesto District, applications have been made to U. S. Government for aid in building a dam at Don Pedro reservoir site. Total cost of work proposed said to be about $3,000,000.

Irrigation—Mantua, Utah.—Press reports state that work will soon begin on construction of irrigation system in Canyon east of Dock Flat in Devils Gate Valley, about 6 miles from Mantua. A. K. Chatfield of Salt Lake City reported interested.

BIDS DESIRED.

Channel—Boston, Mass.—Until July 26 by Metropolitan Park Comn., Boston (John B. Rabin, Engr.) for excavating the channel of Aberjona River from B. & M. R. R. Bridge to Waterfield St.

Dredging—Boston, Mass.—Bids desired until July 28 by Harbor and Land Comrs., Boston (Wm. F. Williams, Ch. Engr.) for dredging a channel in Wellfleet Harbor, requiring removal of about 57,000 cu. yds. material. In Nobscusset Harbor, Dennis, dredging a channel and basin, requiring removal of about 30,000 cu. yds. of material; in Barnstable Harbor, dredging a channel and basin requiring removal of about 60,000 cu. yds. material.

Riprap—New London, Conn.—Until Aug. 10 by U. S. Engineer for furnishing and placing about 2000 long tons riprap for repair of breakwaters at Duck Island Harbor, and at mouth of Housatonic River, Conn., advertised in Engineering Record.

Pittsburgh, Pa.—Until Aug. 20 by U. S. Engineer for furnishing and erecting steel lock gates, valves and operating machinery at Lock 6, Monongahela River, advertised in Engineering Record.

Jetty Work—Wilmington, Del.—Until Aug. 5 by U. S. Engineer, for repairs to jetties at mouth of Missillion River, Del., advertised in Engineering Record.

Drainage—Palmetto, Fla.—Until Sept. 7 by County Comrs. (Charles S. Hill, Ch. Engr.), for constructing Gamble Creek about 120,000 cu. yd. excavation. Chas. S. Hill, Engr., Palmetto.

Canal—Parish, Fla.—Reported desired until Aug. 2 by Drainage Comrs., for main canal and nine parallels to include drainage system, about 900,000 cu. yd.; cost about $110,000.

Levee—Greenville, Miss.—Press reports state bids desired until Aug. 17 by Bd. Mississippi Levee Comrs., Greenville (W. L. Thompson, Ch. Engr.), for constructing approximately $100,000 worth of levee work, most of which is on the Issaquena County front.

Ditch—Richmond, Ind.—Until Aug. 5, by L. C. Peacock, Co. Surveyor, for constructing Nettle Creek ditch about 6 1-3 miles in length with a bottom width of 6 to 13 ft. and in depth of cut of from 5 to 12 ft., to be constructed by floating dredge.

Drain—Constantine, Mich.—Until July 27 by H. W. Kelley, Drain Comr., Sturgis, for 200,000 yds. excav., consisting of main line of drain and 2 laterals. Average depth 9 ft., bottom width 8-6 ft. and 4 ft. Railroad Station Constantine.

Dredging—Chicago, Ill.—Until Aug. 17 by U. S. Engineer, for dredging in Calumet River, Ill., advertised in Engineering Record.

Pumping Plant, Etc.—Quincy, Ill.—Until Aug. 4 (extension of date from July 21) by Bd. Superv. Fabius River Drainage Dist., at office of John H. Best, Illinois State Bank of Quincy, Quincy, for a steam-driven pumping plant, containing 2 42-in. centrifugal pumps, having a normal capacity of 46,000 gals. per minute each, against a maximum static pumping head of 15 ft. Alternate bids will also be received same time for an oil engine driven plant and on an electrically driven plant of same capacity and type of construction; also same time for reinforced concrete sluiceway. Harman Eng. Co., Engrs., Peoria.

Ditch—Windom, Minn.—Reported desired until July 30 by S. A. Brown, Co. Aud., for constructing ditches as follows: Judicial Ditch No. 9, cost $108,087; Judicial Ditch No. 13, cost $3,493; Judicial Ditch No. 14, cost $4,743; Judicial Ditch No. 17, cost $14,567.

Irrigation—Saco, Mont.—Until Aug. 12 by U. S. Reclamation Service, Malta, for about 355,000 cu. yds. canal excav., about 3 to 10 miles from Saco.

Reclamation Work—St. Ignatius, Mont.—Bids desired until Aug. 18 at office of U. S. Reclamation Service, for constructing laterals, sub-laterals and appurtenant structures on the Flathead Project, involving about 33,000 cu. yd. excav., 560 cu. yd. concrete, 3500 sq. yd. paving, placing about 33,500 lb. reinforcing steel, 74 ft. b. m. lumber, manufacturing and laying about 1000 lin. ft. concrete pipe. The work is situated on East Side of Flathead River from 10 to 18 miles southwest of Polsin and 9 to 16 miles northwest of Ronan, Mont.

Levee—Cummins, Ark.—Reported desired until Aug. 2 by Linwood and Auburn Levee Bd., Cummins (G. Waterman, Chmn.), for constructing 4½ miles levee; 355,000 cu. yd. E. C. Price, Engr., Dumas.

Drainage—Monte Vista, Col.—Until Aug. 9, by Rio Grande Drainage Dist. (O. A. Cramer, Secy.), for constructing 17 miles of drainage outlet ditches, approximately 325,000 cu. yds. of earth excavation.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Breakwater and Dredging — Block Island, R. I.—Following are bids opened June 29 by Col. John Millis, Corps Engrs., Newport, for rebuilding basin walls and repairing breakwater at Block Island Harbor. E. S. Belden & Sons, Hartford, Conn.; (2 bids), $9,138 and $10,098. Estate of John Beattie, Leets Island, Conn., $9,460.

★Contract awarded to Charles M. Cole, Fall River, Mass., for dredging in Harbor of Refuge, Block Island, at $16,622. (Bids opened June 16).

★**Pier — Brooklyn, N. Y.** — Contract awarded by R. A. C. Smith, Comr. Docks and Ferries, Pier A, New York, for building new pier at foot of Thirty-fifth Street, borough of Brooklyn, to Geo. B. Spearin, 90 West Street, New York, at $319,201. Other bidders: H. S. Kerbaugh, Inc., $363,092; Foundation Co., $349,777; Phoenix Constr. Co., $347,897; Stillman-Delehanty-Ferris Co., Jersey City, $333,879; Henry Steers, Inc., $342,869. (Bidders of New York unless otherwise stated.)

Dredging—Brooklyn, N. Y.—Following are bids opened July 16 by R. A. C. Smith, Comr. Docks, Pier A, New York, for dredging in Mill Basin, Jamaica Bay, Boro. Brooklyn, about $15,000 cu. yd. (price per cu. yd.); Atlantic Gulf-Pacific Co., 13 Park Row, New York, 5 cts.; Maryland Dredging & Constr. Co., Produce Exchange, New York, 10 cts.

★**Pier—Erie, Pa.**—Contract for constructing superstructure on north pier Erie Harbor, awarded to T. A. Gillespie Co., Pittsburgh, at $20,248. (Bids opened June 19). Unit prices in Engineering Record June 26.

Dredging — Philadelphia, Pa. — Bids opened July 12 by John Meigs, Dir. Dept. Wharves, Docks and Ferries, 555 Bourse Bldg., for dredging at Moyamensing Piers, Delaware River, at foot of McKean Street, about 400,000 cu. yd.: (a) dredging and depositing material removed above high water mark in city limits; (b) dredging and delivering material in front of municipal rehandling machine at Cannon Ball Farm: American Dredging Co., Philadelphia, (a) 14¼ cts.; (b) 10¼ cts.; Bowers Southern Dredging Co., (a) 19 cts.; (b) 14½ cts.

★**Riprap—Philadelphia, Pa.**—Contract awarded by U. S. Engineer Office to furnish and place riprap in Delaware River at Artificial Island, to Coast & Lakes Constr. Co., of New York, at $16,680. (Bids opened July 8).

★**Timber Wharf—Charleston, S. C.**—Bids were opened July 15 by Lighthouse Inspector to construct creosoted timber wharf at site of new lighthouse depot on Ashley River, Charleston, and the bid of Charleston Eng. & Contr. Co., Charleston, at $46,418, recommended for award.

Levee Work—Vicksburg, Miss.—All bids opened July 12 by Third Mississippi River Dist., P. O. Box 404, for about 1,415,000 cu. yd. levee work have been rejected. Work was divided in ten sections and five bids were received as follows: John G. Sessions, Oldtown, Ark., bid on four sections, 29 cts. per cu. yd.; Roach Stansell, Lowrance Bros. Co., Memphis, Tenn., on all ten sections, 26 cts. to 39 cts. per cu. yd.; R. L. Leonard Memphis, Tenn., seven sections, 21.5 cts. to 32 cts.; Hercules Co., Ltd., Hibernia Bank Bldg., New Orleans, La., one section only 35 cts.; Owens Constr. Co., Vicksburg, Miss., 10 sections, 33 cts. to 40 cts.

★**Levee—Hickman, Ky.** — Contract reported awarded to Bondurant Constr. Co., Hickman, for enlarging Reelfoot levee, at about $18,000.

★**Revetment Wall—Columbus, Ohio.**—Contract awarded July 12 by State Dept. Pub. Wks. for constructing revetment wall to Philip Kirschner, 831 Cuyahoga Bldg., Cleveland, at $15,140. Next 3 lowest bids: Iliff Bros., London, $15,362; E. K. Hibbs, Columbus, $17,747; D. E. Sullivan & Son, Columbus, $17,994.

★**Indianapolis, Ind.**—Contract awarded by Park Comrs. July 16 for dredging lagoon in Garfield Park to S. M. Timberlake Co., 1434 Broadway. Engineer's estimate, $10,200.

★**Levee Work—East St. Louis, Ill.**—Contract awarded July 12 by Bd. Trus. East Side Levee and Sanitary Dist., Sexton Bldg. (G. L. Barton, Pres.), for constructing earth levee, requiring 80,000 cu. yd. earth embankment, 230 cu. yd. reinforced concrete, 2 hand gates and 2 automatic flood gates, to John Keeley, of East St. Louis, at 36 cts. per cu. yd.

★**Drainage—Harlan, Ia.** — Contract for draining Mosquito Creek (bids opened July 9) has been awarded to Lana Constr. Co., Council Bluffs. E. A. Schell, Co. Aud.

Irrigation Work—Babb, Mont.—Only bid opened July 7 by U. S. Reclamation Service, Babb (Camp 9), for excav. and backfilling around about 1300 lin. ft. St. Mary crossing pressure pipe, about 6000 cu. yd. backfill and excav., submitted by J. W. Powell of Babb. Work is situated in Blackfeet Indian Reservation about 38 miles northwest of Browning.

Repairing Wharves, Etc.—Portland, Ore.—Following are bids opened July 12 by Lieut.-Col. Jay J. Morron, Corps Engrs., U. S. A., 802 Couch Building, for enlarging and repairing receiving wharves and extending north and south jetties: (a) L. W. Day, Portland, $183,613; (b) Porter Bros. Co., Portland, $187,283; (c) Beers Building Co., Portland, $176,884; (d) Miami Quarry Co., Selling Building, Portland, $176,416 (lowest bidder); (e) Johnson-Anderson Co., Portland, $181,560.

	(a)	(b)	(c)	(d)	(e)
34,000 lin. ft. piles	$0.25	$0.25	$0.30	$0.25	$0.20
2,205 M. ft. lumber	22.00	22.00	22.00	30.00	20.00
9,600 lb. drift bolts	0.04	0.047	0.05	0.05	0.05
10,320 lin. ft. track, relay, rails furnished by U. S.	0.10	0.10	0.50	0.12	0.10
1,050 lb. wire spikes	0.05	0.049	0.06	0.05	0.05
3,100 lb. ship spikes	0.07	0.05	0.05	0.05	0.06
179,000 tons of stone	0.94	0.96	0.87	0.89	0.94
450 lb. straps and stirrups	0.05	0.08	0.05	0.05	0.10
450 lb. bolts with head nuts and washers	0.09	0.05	0.05	0.05	0.10
50 steel point shoes	5.00	6.80	4.00	3.50	5.00

★**Ditch—Eagle Lake, Tex.**—Contract awarded by County Drainage Dist. No. 1 (F. C. Koons, Secy.) for 16 miles drainage ditches with bridges and concrete culverts, to Howard Kenyon of Houston.

★**Gates for Irrigation Dam—El Paso, Tex.**—Contract awarded by the U. S. Reclamation Service, Washington, D. C., to Chicago Bridge & Iron Co., Chicago, Ill., f.o.b. Chicago, to furnish one set of steel Tainter gates consisting of 4 gates 6 ft. 3 in. x 21 ft. 5¾ in. and 9 gates 4 ft. 6 in. x 21 ft. 5¾ in., all complete with fittings, for Mesilla Diversion Dam, Rio Grande Project, N. Mex., at 5.53 cts. per lb.; total cost $1,942.

★**Irrigation—Modesto, Cal.**—Contract for an earthen fill and concrete lined flume at Gasburg Gulch, on main canal of Modesto Irrigation Dist., near La Grange, reported awarded to Tibbitts Pacific Co., San Francisco, at $54,950.

★**Pier Repair—San Francisco, Cal.**—Contract awarded by Bd. State Harbor Comrs. for repairing pier 11, to the Healey Tibbitts Constr. Co., San Francisco, at $14,281.

RAILROADS

PROPOSED WORK

Scranton, Pa.—Improvements to cost approximately $225,000 are contemplated by the Delaware & Hudson Co. in a resurvey of its road through Scranton for elimination of all grade crossings. James McMartin, Ch. Engr., Albany, N. Y.

Spartanburg, S. C.—Southern Ry. Co. (B. Herman, Ch. Engr., Washington, D. C.) reported received permission from State Railroad Comn. to issue $3,500,000 bonds, proceeds to be used in double-tracking line between Spartanburg and Central, S. C., a distance of about 56 miles, and between New Holland and Cornelia, Ga., a distance of 21 miles.

Americus, Ga.—City Council reported to have granted the Georgia Lumber Co. a franchise to build a railway into Americus from Byromville on the Atlanta, Birmingham and Atlantic Railway, thus connecting with that system.

Roseburg, Ore.—J. W. Blain and A. L. Reed of Roseburg reported interested in construction of a narrow gage railroad from Green to lime quarries of D. W. Reidle, 7 miles east of Roseburg; to cost about $50,000.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**St. Helens, Ore.**—Contract reported awarded by St. Helens Lumber Co. for construction of four miles of standard gage railroad, to Elliott Contr. Co., Portland, to include grading, bridges and track laying.

ELECTRIC RAILWAYS

PROPOSED WORK

Brooklyn, N. Y.—The Public Service Comn. for the First District, New York, has approved plans and form of contract submitted by New York Municipal Railway Corp., for erection of steel, construction of tracks, etc., on Broadway elevated railroad in Brooklyn, between Myrtle Avenue and Aberdeen Street, in connection with third-tracking of that line. Commission also approved company's plans and form of contract for supply of structural steel for widening and strengthening Myrtle Avenue elevated railroad from Willoughby Avenue to Wyckoff Avenue for the third-tracking of that line. The company must submit both contracts to public bidding.

Peoria, Ill.—Peoria & Chillicothe Electric Ry. Co. incorporated to construct an electric railway between Peoria and Chillicothe, 18 miles. Among incorporators John L. Lynch, Chillicothe, and A. C. Black, Peoria.

Des Moines, Iowa.—Work about to begin on 5-mile railway for Fort Dodge, Des Moines & Southern R.R. Co. from Swanwood Junction to Des Moines. C. H. Crooks, Gen. Mgr., Boone.

Mitchell, S. D.—Mitchell Street Car & Interurban Co. incorporated to construct an electric railway. Plans being made to construct 3 miles city line this year. Capital $200,000. Among incorporators A. N. Hill, Mitchell; D. N. Hill, Lake Hills, Iowa.

Sarnia, Ont.—Contract about to be let by Sarnia St. Ry. Co. for ½ mile rails, trolley wire, ties, etc.

BIDS DESIRED.

Long Island City, L. I., N. Y.—Until Aug. 18 by Public Service Comn., 154 Nassau Street, New York, for Special Work for the new rapid transit system in Queens, to consist of frogs and switches, and to be used upon new elevated railroad from the Queensboro Bridge to Corona, on junction section on the Queensboro Bridge Plaza, for new elevated railroad from the Queensboro Bridge to Astoria, and for the extension of Queensboro Subway from its present terminus at Jackson and Van Alst Avenues, Long Island City, through Davis Street and Ely Avenue to Queensboro Bridge Plaza.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Brooklyn, N. Y.**—Contract awarded by Public Service Commission for First Dist., 154 Nassau Street, New York, for track laying on New Utrecht Avenue elevated line in Brooklyn, to Ward & Tully, Inc., W. Twentieth Street, Brooklyn, at $71,344 (bids opened July 9). Unit prices in Engineering Record of July 17.

New York, N. Y.—Following are bids opened July 16 by Bd. Public Service, 154 Nassau Street, for open hearth rails to be used to equip new rapid transit lines of the dual system, approximately 37,800 tons open hearth track rails and about 2400 tons open hearth guard rails. There were only two bidders, Bethlehem Steel Products Co. and Lackawanna Steel Co., and the prices named by each were exactly the same, total of each bid being $1,202,126.50. Only difference between bidders was as to rate of delivery, Bethlehem Co. offering to deliver the whole lot in one week and the Lackawanna Co. at rate of 12,000 tons per week.

Following are unofficial totals of 4 lowest bids opened July 20 by Pub. Service Comn. for First Dist., for construction of Section 1 of Route 49, a part of Culver rapid transit railroad: Post & McCord, 101 Park Avenue, $877,959; Phoenix Bridge Co., 49 William Street, $894,000; A. L. Guidone, 131 E. Twenty-third Street, $903,000; Cooper & Evans, 220 Broadway, $914,000. This is a 3-track elevated railroad, which will connect Fourth Avenue subway through Thirty-eighth Street and Gravesend Avenue with Coney Island. Section 1 extends from a point in Thirty-seventh Street, 246 ft. southeast of Tenth Avenue, under private property and intersecting streets to Gravesend Avenue and over Gravesend Avenue to point about 525 ft. south of Bay Parkway (Twenty-second Avenue).

PUBLIC BUILDINGS AND SCHOOLS

PROPOSED WORK

Manchester, N. H.—Plans submitted by William R. Towner, 320 Fifth Avenue, New York, for rebuilding Bakersville School; one set provides for alterations at a cost of $61,101; the other for an entire new building to cost about $75,000.

Fair Haven, Vt.—School costing $50,000 to be erected here.

Amherst, Mass.—High school bonds for $90,000 have been sold.

Boston, Mass.—Plans completed by Shepley, Rutan & Coolidge, 122 Ames Bldg., for 4-story brick and stone administration building to be erected at Massachusetts General Hospital; cost $250,000.

Marlboro, Mass.—Bd. Aldermen authorized $40,000 bond issue to erect school on Washington Street.

West Springfield, Mass.—E. L. Tilton, 32 Broadway, New York, preparing plans for a library.

Cranston, R. I.—City Council appropriated $25,000 to erect 6-room school in Knightsville, Cranston.

Providence, R. I.—Contract about to be let by Bd. Contract and Supply for erecting nineteen-room Beaufort Street School in Mt. Pleasant Dist. Murphy, Hindle & Wright, Archts., 146 Westminister Street.

New York, N. Y.—Plans filed for erecting 5-story gymnasium and students' building at 119th Street and Clermont Avenue for Barnard College; cost $600,000. Rich & Mathesius, Jr., Archt., 320 Fifth Avenue.

Ogdensburg, N. Y.—Erection of hospital is contemplated by city, cost about $60,000.

Rensselaer, N. Y.—Bd. Educ. contemplates addition and alterations to School No. 1, Washington Street and Third Avenue; cost about $40,000.

Syracuse, N. Y.—All bids opened by Bd. Contract and Supply July 12 for erecting Engine House No. 1 rejected. Plans are to be revised according to reports.

Utica, N. Y.—All bids opened July 13 by Dennis J. Kelly, Clk. Bd. School Comrs., for erecting Keenan School, rejected. Plans will be revised and new bids called for. Cost $140,000.

Watertown, N. Y.—Preliminary plans prepared by A. F. Lansing for the Arsenal Street school, cost $60,000, for addition to high school, by D. D. Kieff, have been accepted.

Yonkers, N. Y.—Plans being considered for erecting building adjoining Monastery of Sacred Heart, on Convent Avenue, for preparatory school for boys.

Plans prepared by I. E. Ditmars, 111 Fifth Avenue, New York City, for 4-story addition to be erected at St. Joseph's Hospital; cost, abot $225,000.

Bloomfield, N. J.—Bd. Educ. authorized to erect addition to Park Grammar School; cost, $35,000.

Jersey City, N. J.—No bids will be opened July 28 by Bd. of Chosen Freeholders for erecting the Hudson County jail. Bids will be called for at a later date. Plans not yet ready.

Morristown, N. J.—Directors of Library and Lyceum engaged Edward Tilton, 32 Broadway, New York, N. Y., to prepare plans for library to be erected at South and Boykin Streets; cost, about $60,000.

Pleasantville, N. J.—Bonds for $48,000 for high school sold.

Erie, Pa.—Willam B. Ittner, St. Louis, Mo., retained to prepare plans for high school to be erected at Twenty-sixth and State Streets; cost about $250,000.

Farrell, Pa.—Citizens voted $60,000 bonds for improvements, including garage, incinerating plant and paving streets.

Leighton, Pa.—Plans being prepared by E. Shol, 31 N. Sixth Street, Reading, for a school to cost about $75,000. L. M. Beidler, Secy. Bd. Educ.

Washington, D. C.—Bids will probably be called for about Aug. 1 for erecting truck house on New Jersey Avenue. S. Ashford, Municipal Archt.

Plans completed by Snowden Ashford, Municipal Archt., for Powell School to be erected at School and Irving Streets N. W., to contain 8 rooms and assembly hall; also for truck house No. 1 to be erected at New Jersey Avenue and E Street N. W., and for engine house 28 to be erected at Connecticut Avenue and Porter Street.

Charleston, W. Va.—Plans being prepared by David Dick, Charleston, for 2-story stone and brick addition to court house; cost $80,000. Address Co. Comrs.

Chapel Hill, N. C.—N. W. Walker, Secy. School Bd., writes $30,000 bonds sold June 30 for erecting graded school from plans of C. C. Hook of Charlotte. Contract for construction not to be let for several weeks.

Durham, N. C.—Co. Comrs. propose erecting new court house; cost $150,000.

Orangeburg, S. C.—Bonds sold for $30,000 for high school.

Savannah, Ga.—Co. Comrs. decided to erect a modern home for juvenile delinquents and improve buildings at county farm; cost $75,000.

Nashville, Tenn.—Wm. P. Ittner, St. Louis, Mo., engaged to prepare plans for addition to Hume-Fogg High School.

County Court appropriated $25,000 for erecting woman's building at the State Fair grounds.

Columbus, Ohio.—Bd. Educ. will soon let contract for constructing foundation for East High School on Broad Street and Parkwood Avenue; cost $35,000.

Plans selected for the recreatioon building for Schiller Park.

Dayton, Ohio.—Contract will probably be let late this winter for erecting a tuberculosis hospital; cost $150,000. W. H. Aszling, Secy. Co. Comrs.

Gallipolis, Ohio.—Two cottages costing $70,000 each are to be erected at the Hospital for Epileptics by the State Bd. of Administration, Columbus.

Proctor, Ohio.—Plans for school to be prepared by A. W. Stover, Springfield; cost $35,000.

Troy, Ohio.—Bonds for $30,000 for school improvements sold.

Wilmington, Ohio.—Weber, Werner & kins, Cincinnati, retained to prepare plans for two-story Bedford stone court house; probable cost, $300,000.

Normal, Ill.—Governor signed a bill appropriating $95,000 for erecting dormitory here.

Peoria, Ill.—Governor signed bill appropriating $50,000 for erecting armory here.

West De Pere, Wis.—Plans accepted for 3-story building to be erected at St. Norbert College; cost about $60,000.

Alta, Iowa.—Citizens vote $55,000 bonds to erect school.

Proctor, Minn.—Plans completed by Vernon J. Price & Co., Duluth, for high school; cost about $40,000.

Beatrice, Neb.—Co. Bd. Superv. in favor of erecting $35,000 jail.

Butte, Mont.—Additional story to be erected at St. Joseph Hospital; cost $60,000. Sister Felixitas, Superior.

San Antonio, Tex.—Contract soon to be let for proposed Robert B. Green Memorial Hospital to be erected jointly by the city and county. Clinton G. Brown, Mayor; James R. Davis, County Judge; Henry T. Phelps, Gunter Building, Superv. Archt.

Portland, Ore.—Reported Commissioner of Pub. Docks will soon let contract for erecting 1-story, 330 x 176 ft., reinforced concrete warehouse to be erected for Port Comrs. adjoining Municipal Dock No. 1. Plans provide for a four-ply asbestos roof, sprinkler system, concrete floors, and 100 concrete piles.

Berkeley, Cal.—Plans completed for Benjamin Ide Wheeler Hall to be erected on Campus, University California, to be 4 story, 200 by 200 ft.; cost about $800,000.

San Francisco, Cal.—Bd. Superv. appropriated $32,543 for erecting Engine House No. 5, on Post Street.

BIDS DESIRED.

Boston, Mass.—Until July 29 by Trustees of Norfolk State Hospital, Boston (W. Rodman Peabody, Chmn.), for erecting a dining room building and 5 cottages on the grounds of said hospital at Pondville. Separate bids for plumbing, wiring and heating. Kendall, Taylor & Co., Archts., 93 Federal St., Boston.

Dedham, Mass.—Until Aug. 3 by High School Bldg. Com. (S. H. Capen, Chmn.) for furnishing material and erecting a high school; also separate bids for ventilating and heating. Isaac Coffin, Archt., 52 Sudbury St., Boston.

Warren, R. I.—Until July 26 by School Com. (H. W. Watyen, Chmn.) for erecting an 8-room, 2-story and basement, 64x94 ft. brick school.

Buffalo, N. Y.—Until twelve M July 24 by Robert North, Archt., 1314 Prudential Bldg., Buffalo, for erecting a concrete and brick school at Orchard Park for Union Free School Dist. No. 6, East Hamburg, Erie County.

Little Falls, N. Y.—Until July 28 by City Clerk for construction of municipal building, advertised in the Engineering Record. William Neil Smith, Archt., 101 Park Avenue, New York.

Portchester, N. Y.—Reported desired until Aug. 4 by Bd. Educ. (C. D. Camp, Clk., 394 Irving Avenue) for erecting a 3-story high school. Probable cost $125,000. Hewitt & Bottomley, Archts., 597 Fifth Avenue, New York City.

Scarsdale, N. Y.—Reported desired until July 26 by Bd. Educ. (Herbert C. Lakin, Clk.), for erecting one-story brick school with auditorium on Post Road. Guy Lowell, Archt., 225 Fifth Avenue, New York.

Watertown, N. Y.—Until July 29 by Bldg. Com., Bd. Educ. (Homer H. Rice, Chmn.) for furnishing material and erecting 3-story and basement addition to the high school on Sterling Street, including heating, plumbing and wiring, etc. D. D. Kieff, Archt., Flower Bldg.

Caldwell, N. J.—Until July 30 by Bd. Educ., for furnishing material and erecting a school on Crane Street. Holmes & Winslow, Archts., 103 Park Avenue, New York City.

Clifton, N. J.—Until July 27 by Township Com., Acquackanock Township (E. Yereance, Clk.), for furnishing material and erecting a Municipal building on Main Avenue. William T. Fanning, Archt., Colt Bldg., Paterson.

Paterson, N. J.—Until Aug. 2 by Bd. of Educ. (Jas. F. Dunphey, Secy.) for a steam and electric power plant for high school at Hamilton and De Grasse Streets, advertised in Engineering Record. Louis E. Eden, Consulting Engr., 1 Madison Avenue, New York.

Allentown, Pa.—Until Aug. 4 readvertisement) by T. P. Wenner, Secy. School Dist., for erecting 2-story and basement school on Dauphin Street. Ruhe & Lange, Archts., 12 N. Sixth Street.

Westmont (P. O. Johnstown), Pa.—Until Aug. 16 by Harry P. Shomo, Boro. Secy., 206 Green Street, Westmont, Johnstown, for erecting Municipal Building in Reservoir Park. H. M. Rogers, Archt., Johnstown Trust Co. Bldg., Johnstown.

Oil City, Pa.—Until July 31 by C. A. Gilliland, Chmn. Bldg. Com. School Bd., for erecting a Junior High School, also separate bids for plumbing, heating, electric wiring etc. E. E. Joralemon, Archt., 547 Franklin Street, Buffalo, N. Y.

Philadelphia, Pa.—Until July 31 by Bd. of Inspectors, Philadelphia County Prison Office, Tenth and Reed Streets, Philadelphia, for erecting Ward Building No. 1, to include plumbing, heating, ventilating and electric lighting; constructing 2 new stairways to present rotunda; additions and alterations to boiler room, ventilating hospital, etc., at County Prison, Hartranft and Reed Streets. Demolishing present hospital and erecting new hospital, including plumbing, heating and electric lighting, etc., at Moyamensing Prison, Tenth and Reed Streets, Philadelphia. Philip H. Johnson Engr and Archt., Land Title Bldg., Philadelphia.

Washington, D. C.—Until Sept. 30 by Bureau of Lighthouses, Dept. of Commerce, for constructing Navassa Island light station, West Indies, advertised in Engineering Record.

St. Augustine, Fla.—Reported desired until Aug. 9 by State Bd. Control, Jacksonville, for erecting hospital building; also a building for colored pupils at State Deaf and Dumb Institute.

Akron, Ohio.—Reported desired until Aug. 1 by Armory Bd. for erecting armory building on S. High Street. Probable cost, $165,000. W. E. Harpster, Archt., Akron.

West Alexandria, Ohio.—Until Aug. 14 by Bd. Educ., Lanier Township School Dist. (N. L. Paxson, Clk., R.R. No. 2, West Alexandria), for erecting the Central School, including ventilating and heating. E. J. Mountstephen, Archt., U. B. Bldg., Dayton.

Cedarville, Ohio.—Until July 30 by Andrew Jackson, Clk. Bd. Educ., for furnishing material and erecting a school. Frank L. Packard, Archt., New Hayden Bldg., Columbus.

Warnock, Ohio.—Until Aug. 14 by Oscar Gladden, Clk. Bd. Educ., for furnishing material and erecting a grade school; also bids as a whole or separately for ventilating and heating.

West Alexandria, Ohio.—Until Aug. 14 by Bd. Educ. N. L. Paxson, Clk., Lanier Township, R. R. No. 2, West Alexandria, for furnishing material, including ventilating and heating. E. J. Mountstephen, Archt., U. B. Bldg., Dayton.

Dayton, Ind.—Reported desired until Aug. 2 by W. H. Warren, Trus. Sheffield Township, for erecting two-story brick and stone trimmed brick school.

Hartford City, Ind.—Reported desired until Aug. 2 by Co. Comrs. for erecting new infirmary building; also repairs to present building. Charles Brossman, Archt., Indianapolis.

La Crosse, Ind.—Reported desired until July 28 by Trustees of Dewey Township, for erecting high school. George M. Shults, Trustee.

Sanford, Ind.—Reported desired until Aug. 2 by Trustees of Fayette Township, Sanford, R. R. No. 1, for erecting a 2-story brick school.

Ypsilanti, Mich.—Until Aug. 20 (not July as previously stated) by James A. Wetmore, Acting Superv. Archt., Washington, D. C., for the construction, complete, including mechanical equipment and approaches, of U. S. Post Office, Ypsilanti.

Charleston, Ill.—Until July 26 by Bd. Trus. Eastern Illinois State Normal School for erecting a Manual Training School. James B. Dibelka, State Archt., 140 N. Fifth Avenue, Chicago.

Chicago, Ill.—Until July 29 by Dept. Pub. Wks. (W. R. Moorhouse, Comr.) for furnishing material and erecting a 2-story and basement engine house at Fifty-third and S. Parkside Streets.

Until July 28 by Com. on Bldgs. and Grounds at Office of Business Manager, Bd. Educ., for school work, Morgan Park School, Hartzell and Pryor Avenues, also Ray School, Kimball Avenue and Fifty-sixth Street. Bids desired on masonry, steel work, carpentry, concrete and asphalt floors, plumbing, gas fitting, ventilating and heating, electric work, etc. A. F. Hussander, Archt., 714 Tribune Bldg.

Chicago, Ill.—Until July 26 by W. R. Moorhouse, Comr. Pub. Wks. for erecting two-story and basement engine house at 817 E. Ninety-first Street.

Halfa, Iowa.—Until Aug. 13 by Peter Tunell, Pres. Independent Consolidated School Dist., for furnishing materials and erecting a school building, ventilating and heating, electrical work and fixtures. A. Jones & Lindhart, Archts., Endicott Bldg., St. Paul.

Somers, Iowa.—Until Aug. 10 by Bd. Educ., Consolidated School Dist. (H. W. Hansen, Secy.), for erecting a high school building, including heating and ventilating. Thos. W. Keely, Archt., 1202 Central Ave., Fort Dodge.

Howard, Kan.—Reported desired until Aug. 1 by Bd. Educ. (E. Reed, Secy.) for erecting a school and basement 60 x 84 ft., 2-story. Probable cost $25,000.

Schuyler, Neb.—Reported desired until Aug. 15 by Bd. Educ. for erecting a 3-story and basement high school. Probable cost, $45,000. Grabe & Hellberg, Archts., German Natl. Bank Bldg., Columbus, Neb. Probable cost, $45,000.

Kansas City, Mo.—Reported desired until Aug. 5 by Wilder & Wight, Archts., First Natl. Bank Bldg., for erecting a hospital and chapel for St. Joseph's Hospital. Probable cost, $600,000. Henrici, Kent & Lowry, Engrs., Reserve Bank Bldg.

New Madrid, Mo.—Reported desired until July 29 by County Comrs. for erecting a 3-story, 75 x 107 ft., courthouse. Clymer & Drischler, Archts., Wainwright Bldg., St. Louis.

St. Louis, Mo.—Until July 30 by Bd. Pub. Service (Wm. T. Findly, Secy.) for erecting nurses' dormitory on the grounds of the Robert Koch Hospital.

Grand Junction, Col.—Until Aug. 24 by James A. Wetmore, Superv. Archt., Washington, D. C., for construction, complete (including mechanical equipment and approaches), of U. S. Post Office, Grand Junction.

Monmouth, Ore.—Reported desired until July 31 by State Supt. Pub. Instruction, Salem, for erecting a normal school in Monmouth. Probable cost, $50,000. John V. Bennes, Archt., Chamber of Commerce Bldg., Portland.

Portland, Ore.—Reported desired until July 27 by Comr. Pub. Docks at 502 Worcester Bldg., for erecting a warehouse and reinforced concrete viaduct in rear of Municipal Dock No. 1, between Seventeenth and Eighteenth Streets on west side of Willamette River.

Toronto, Ont.—Until July 26 by Bd. Educ. (W. C. Wilkinson, Secy.-Treas.), for enlargement of Manning Avenue School; new building, manual training and domestic science departments, King Edward School; iron fence, iron stairs, concrete floors, etc. at sundry schools.

PRICES AND LETTINGS.

★Indicates award of contract.

★Lewiston, Me.—Contract for administration building, Goodwill Farm, awarded by Edgar A. Josselyn, Archt., New York, to George W. Wilbur & Son, Bangor. Wilbur A. Mansur of Bangor will act as supervising architect.

★Plymouth, N. H.—Contract for erecting addition to dormitory at Normal School awarded by Bd. Control, Concord, to E. H. Wiggin & Co., Lowell, Mass., at $37,830.

★Newport, R. I.—Contract awarded for erecting the John Clarke school on Mary St. to Darling & Slade Constr. Co., Newport, at $68,500. F. N. Fullerton, City Clk.

★Hartford, Conn.—Contract awarded Van Dorn Iron Wks., Cleveland, Ohio, for installing 60 cells in the State Prison at $375 per cell; total about $24,000.

★New Haven, Conn.—Contract awarded for erecting Tuberculosis Sanitarium, 3-story administration building, east and west wards, nurses' home, and east and west dormitories, all 2-story, and 1-story power house to Tracy Bros., Waterbury (bids opened June 26). Scopes & Feustmann, Archts., 37 E. Twenty-eighth Street, New York.

★Delhi, N. Y.—Contract awarded by Bd. Educ. (W. W. Honeywell, Clk), for erecting 3-story concrete high school 72 x 90 ft. from plans of Pierce & Bickford, Elmira, to F. H. Johnson Constr. Co., Newark, N. Y., at $44,000. (Bids opened July 7).

Lockport, N. Y.—Lowest bids opened July 1 by Bd. Superv. for jail and court house improvements were: Manion Bros., Rochester, for general work, and Pauly Jail Bldg. Co., New York, cell work at a total of about $45,000, and John Moon of Lockport for county clerk's office at about $24,111.

★Mount Vernon, N. Y.—Contract for erecting U. S. Post Office awarded Joseph di Beneditto, 422 E. 115th Street, New York, at $87,737.

★New Hartford, N. Y.—Contract awarded by Directors of St. Elizabeth's Hospital to Pius Kerner & Son, Utica, for construction of hospital, of brick, stone and steel at $200,000. Structural steel let to Kellogg Structural Steel Co., Buffalo.

★Syracuse, N. Y.—Contract for erecting vocational school awarded Phalen Eng. & Constr. Co., Hoboken, N. J., at $289,600 for cast stone; plumbing and gas fitting, John R. Walsh, Syracuse, $21,297.

★Bath, Pa.—Contract for erecting 2-story 8-room high school awarded Stoudt & Merdinger, Bethlehem, at $23,100.

★Kingston, Pa.—Contract for erecting school in Fourth Ward awarded John C. Curtiss & Co., Wilkes-Barre, two bids were submitted, $28,770 and $28,122; heating and ventilating, Wyoming Eng. Co., $6,375.

★Philadelphia, Pa.—Contracts awarded by Bd. Educ. for erecting school on Sixty-fifth Avenue as follows: Building to Cramp & Co., $73,450; heating, S. Faith & Co., $12,111; ventilating, Thompson Bros., $2,883; electric work, J. F. Buchanan, $15,134; plumbing, S. Faith & Co., $11,— (Contractors all of Philadelphia).

★Pittsburgh, Pa.—Contract awarded D. T. Riffle, Keenan Bldg., for erecting addition to surgical ward and making alterations in Mercy Hospital, Locust and Stevenson Streets. Cost, $25,000.

★West View, Pa.—Contract for erecting addition to public school awarded to Geo. A. Cochrane Co., 1210 Washington Avenue, Pittsburgh, at $30,000.

Wilmington, Del.—Following are lowest bids opened July 12 by Bd. Educ. for erecting annex to high school from plans of W. E. Hance, Archt., 204 W. Twenty-fourth Street:

★General Construction, A. S. Reed & Bro. Co., Wilmington, $123,773 (awarded contract); J. E. Healey & Son, Inc., Wilmington, $126,000; J. N. Gill, Philadelphia, Pa., $133,200.

Heating and Plumbing, Walters, Parks & Mullen, Philadelphia, $20,209; Bowser Bros. Co., Philadelphia, $21,843; Thompson Bros., Philadelphia, $22,222.

★Electric Work. E. F. Higgins & Co., Wilmington, $3,781 (awarded contract); J. S. Miller & Co., Philadelphia, $4,238.

Washington, D. C.—Following are reported to be lowest bids opened July 13 for Interior Department Building to be erected on Eighteenth and E Streets: John H. Parker Co., New York, $1,622,487; George A. Fuller Co., New York, $1,645,000; Thompson Starrett Co., New York, $1,675,000; P. F. Gromley Co., Washington, $1,676,960.

★Charleston, W. Va.—Contracts for erecting schools awarded by State Bd. Control at Charleston as follows:

Morgantown, addition to Mechanical Hall and School of Medicine at West Virginia Univ. to P. Q. Shrake & Son, New Matamoras, Ohio, at $57,000.

Huntington, science hall at Marshall College, Longest & Tesier, Greensboro, N. C., $48,600.

Glenville, dormitory at State College, Longest & Tesier, at $39,800.

★Savannah, Ga.—Contract for erecting Carnegie Library awarded A. A. Artley, Savannah, at $54,400. H. W. Witcover, Archt., Natl. Bank Bldg.

★Bessemer, Ala.—Contract awarded by Bd. Educ. (I. A. Lewis, Secy.) to erect addition to Clarendon Avenue school and Roberts school (bids opened July 7) to Crotwell Bros., Bessemer. Cost about $25,000.

Opelika, Ala.—Following four lowest bids opened July 14 by Superv. Archt., Washington, for erecting U. S. Post Office: Algernon Blair, Montgomery, $85,971; George A. Clayton, Atlanta, Ga., $84,364; W. H. Fissell & Co., New York, $84,735; Christ. Kanzler & Sons, Evansville, Ind., $84,898.

★Canton, Ohio.—Contract awarded by Bd. Educ. (W. C. Lane, Clk.) for erecting Henry C. Martin school (bids opened July 8) to Indiana Eng. & Constr. Co., Ft. Wayne, Ind., at $81,000. Frank L. Packard, Archt., Columbus.

★Lisbon, Ohio.—Contract for erecting county high school awarded to Cullen & Vaughn, Hamilton, at $62,000. Architect, Frank L. Packard, Columbus. J. T. Kennedy, Co. Clk.

Mount Vernon, Ohio.—Lowest bid for erecting school submitted by Robert C. Anderson of Mount Vernon. Building complete will cost about $40,000.

★Xenia, Ohio.—Contract for erecting centralized school for Ross Township awarded by Ross Township Bd. Educ. to Jewell & Co., Cincinnati, at $28,600. C. W. Moorman of Jamestown, has contract for carpenter work.

★Columbus, Ind.—Contract for erecting vocational school awarded J. R. Dunlap & Co., Columbus, $26,335.

★New Albany, Ind.—Contract for erecting school in Seventh Ward awarded George D. Smith, New Albany, for general construction at $34,000. Clarence Martindale, Indianapolis, Archt.

Beardstown, Ill.—Following are lowest bids opened July 9 by Superv. Archt., Washington, D. C., for constructing complete U. S. Post Office (a) limestone, (b) sandstone: John Lauritzen, Fergus Falls, Minn. (a), $39,990; Clarke Constr. Co., Danville (a), $40,985; George A. Shaul, Seneca, Kan. (a), $41,974; W. G. Carter Co., Chicago (a), $41,968, (b) $42,318; Colonial Constr. & Supply Co., Charlottesville, Va. (b), $42,860; Hiram-Lloyd Bldg. & Constr. Co., St. Louis, Mo. (b), $43,737; R. S. Moore, Lafayette, Ind. (b), $45,180.

★Galesburg, Ill.—Contract awarded to Galesburg Constr. Co., Galesburg, for erecting state arsenal, at $40,422 (bids opened July 15. James B. Dibelka, State Archt., Springfield.

★Galesburg, Ill.—Contract awarded July 15 for erecting armory for Sixth Infantry as follows: General contract to Monmouth Constr. Co., Galesburg, at $40,422; heating and plumbing to Daily & O'Brien, Peoria, $5,700. James B. Dibelka, State Archt., Chicago.

★Kellerton, Iowa.—Contract awarded by Bd. Educ. (A. Smith, Secy.) for erecting 2-story and basement school, from plans of Trunk & Gordon, Archts., Donnell Court Bldg., St. Joseph, Mo., to F. H. White, Eldora, at $27,959.

★Woodward, Iowa.—Contract awarded by Bd. Control of State Inst., Des Moines (F. S. Treat, Secy. to Bailey-Marsh Co., Minneapolis, Minn., at $230,602, for erecting at State Hospital and Colony for Epileptics at Woodward, to include medical group—one 2-story and 9 1-story structures, a power plant, radial brick smokestack, 175 ft. high 7 ft. top, and 1-story laundry. H. F. Liebbe, State Archt., Des Moines; Proudfoot, Bird & Rawson, Consulting Archts., Des Moines.

★Grand Forks, N. D.—Contract for erecting high school awarded Gray Constr. Co., Watertown, S. D., at $169,918.

★Great Falls, Mont.—Contract awarded Rude & Searles, Great Falls, for erecting Emerson School at $68,194. Next two lowest bidders: C. O. Jarl, Great Falls, $68,540; Lease & Richards, Great Falls, $68,899.

★Poplar, Mont.—Contract for erecting school awarded Meinecke Building Co., Fargo, who bid $28,738 for Hebron brick and $29,708 for Twin City brick. T. P. Riley awarded contract for heating, plumbing and ventilating at $6,511.

Davenport, Wash.—Following are four lowest bidders for erecting high school: John Sheridan, Butte, $32,850; T. E. Young, Spokane, $33,971; J. J. Lorenz, Spokane $35,230; E. E. Peterson, Spokane, $35,634.

★Portland, Ore.—Contract for erecting Franklin High School awarded J. S. Winters, Couch Bldg., at $74,897.

★Chico, Cal.—Contract awarded by W. T. McClure, State Engr., Sacramento, for power house at Chico Normal School, to E. D. Sharp of Chico (bids opened July 7).

PRIVATE BUILDINGS

PROPOSED WORK

Boston, Mass.—The various locals of the carpenters unions have plans ready and will soon start construction on a fireproof headquarters building to cost $150,000. P. R. Kickham, Chm. Bldg. Com.

High Street Trust, 20 High Street, is to build a 10-story brick and stone office building on High Street. Parker, Thomas & Rice, Archts., 110 State Street.

Worcester, Mass.—Strand Theatre Co. of Worcester incorporated by Moe Mark of Lynn and Joseph M. and Max L. Levenson, both of 749 Old South Building, Boston, for purpose of erecting on Frant Street and Leland Court a motion picture theater.

Plans being prepared by Frederick Coulson, Walker Building, for 4-story store and lodge building which Aerie Eagles will erect on Main and Chariton Streets; cost $75,000.

Albany, N. Y.—Fifty thousand dollars given to St. Paul's R. C. Church to erect a convent.

Brooklyn, N. Y.—Plans filed for erecting buildings as follows: Two 4-story brick tenements, one at President Street and Voorhies Avenue and one at Nostrand Avenue and President Street for Max Schoenenberg & Rudolf Rab, cost $45,000 each, Louis Berger & Co., Archts., Cypress and Myrtle Avenues, Queens; 4-story brick tenement at Beverly Rd. and E. Sixteenth Street for Mary C. Blanchard, cost $30,000, Gorman & Schwartz, Archts., 367 Fulton Street; two 3-story brick tenements at Coney Island Avenue and O Streets for Homecrest Bldg. Co., cost total $40,000, E. M. Adelsohn, Archt., 1776 Pitkin Avenue.

Buffalo, N. Y.—Plans being prepared by Cleveland & Buffalo Transit Co. (M. Newman, Pres., Cleveland, Ohio) for passenger and freight terminal building to be erected at Buffalo River and Michigan Avenue.

New York, N. Y.—Plans filed for erecting buildings as follows: Two 6-story brick tenements at 552 W. 188th Street for Mose Goodman Cor., cost $90,000; George F. Pelham, 30 E. Forty-second Street, Archt.; 5-story brick tenement at Broadway and 207th Street for Seaman Constr. Co., cost $110,000, Moore & Landsiedel, Archts., 148th Street and Third Avenue; 4-story dwelling at 16 Sixty-ninth Street for William B. Bro cost $30,000, Frederick R. Loney, Archt., 15 W. Thirty-eighth Street; 3-story garage at Broadway and 135th Street, cost $75,000, Mason R. Strong, Archt., 7 Wall Street; 3-story brick garage at 614 W. Fifty-sixth Street for Thomas G. Patterson, cost $35,000, Marshall R. Grimes, 39 E. Forty-second Street, Archt.; 16-story lofts and stores at Thirty-eighth Street and Madison Avenue for A. Heckscher, cost $550,000, A. L. Harmon, 3 W. Twenty-ninth Street, Archt.; 12-story loft at 7 E. Thirty-eighth Street for Naola Cor., cost $250,000, Herman L. Meader, Archt., 2 W. Thirty-third Street; 5-story brick tenement at 173d Street and Weeks Avenue for Adavine Constr. Cor., cost $65,000, Charles B. Meyers, 1 Union Square West, Archt.

Braddock, Pa.—Plans completed by W. Ward Williams, Magee Building, Pittsburgh, for fireproof terra cotta and stone church to be erected for St. Peter and St. Paul's Greek Catholic Church; cost $75,000.

Johnstown, Pa.—Plans completed by H. M. Rogers, Johnstown, for 5-story Pythian Home to be erected on Vine Street; cost about $60,000.

Philadelphia, Pa.—Ballinger & Perrot, Seventeenth and Arch Streets, are architects for the club house for City Club to be erected on Broad and Pine Streets (not H. Trumbauer, as previously stated). Building will be of Colonial design, of colored colonial brick and marble, of fireproof construction, and the plans have been approved by an Art Jury of which Horace Trumbauer is one of the Committee.

Philadelphia, Pa.—Trus. of St. Matthew's Methodist Church, Fifty-third and Chestnut Streets, authorized improvements to the church to cost $30,000.

Preliminary plans being prepared by Horace Trumbauer, Land Title Building, for 8-story brick, stone and steel Y. M. C. A. building at Fifteenth and Cherry Streets.

Contract soon to be let for erecting bank and office building at 14 to 18 Chestnut Street for Franklin Natl. Bank; cost $1,000,000. McKim, Mead & White, New York, and Farness Evans & Co., Philadelphia, Assoc. Archts.

Pittsburgh, Pa.—Plans prepared by O. M. Topp, Jenkins Arcade, for 3-story fireproof school to be erected on Kincaid Street and N. Atlantic Avenue for St. Lawrence R. C. Church; cost $30,000.

Plans prepared by Janssen & Abbott, Ninth and Liberty Avenues, for fireproof home to be erected in Beaver Road, Ben Avon, for George J. Schmidt; cost $25,000.

Union Storage Co. purchased a site at Smallman and Twenty-second Streets for erection of 8-story cold storage warehouse; cost $500,000.

Scranton, Pa.—Plans completed by John J. Howley of Scranton for Anthony Polish Church; cost $30,000.

Hagerstown, Md.—Leiter Bros., 56 W. Washington Street, to erect a business building on W. Washington Street; cost $50,000.

Washington, D. C.—Plans completed by Milburn, Heister & Co., 710 Fourteenth Street, N. W., for erecting 5-story stone and brick building at Ninth Street and Massachusetts Avenue N. W. for home for American Federation of Labor; cost about $100,000.

Fairmont, W. Va.—Henry Schmulback of Wheeling will erect a store and hotel costing $75,000.

Warwood, W. Va.—Methodist Church intends erecting church and Sunday school building costing $50,000.

Wilmington, N. C.—Plans being prepared by Kenneth Murchison, 101 Park Avenue, New York, for fourteen-story fireproof steel constructed hotel which J. H. Hinton, owner of the Orton, will erect.

Meridian, Miss.—East End Methodist Congregation contemplates erecting an edifice at Sixteenth Avenue and Fifteenth Street; cost about $25,000.

Canton, Ohio.—Plans completed by W. C. Owens & Co., 449 Leader-News Bldg., Cleveland, for 4-story reinforced concrete and terra cotta commercial building for C. N. Viakary, Canton.

Terre Haute, Ind.—Plans prepared by Archie H. Hubbard, Champaign, Ill., for 3-story steel and concrete Masonic Temple to be erected on N. Eighth and Eagle Streets; cost $90,000.

Detroit, Mich.—An 8-story annex is to be erected to store building at Monroe and Library Avenues for Crowley, Milner & Co.; cost about $400,000.

Hoyleton, Ill.—A 5-story brick building is to be erected at Evangelical Orphan's Home; cost about $50,000.

Dubuque, Iowa. — Plans prepared by Cyrus D. McLane, Rock Island, Ill., for 8-story, 102 x 113 ft., Y. M. C. A. building to be erected in Dubuque; cost about $100,000.

St. Paul, Minn.—Tentative plans for St. Mary's Episcopal Church have been approved; cost $30,000.

Lyons, Kan.—Plans for 2-story brick fireproof community building to be prepared by Lorentz Schmidt, 128 N. Market Street, Wichita; cost $35,000.

Butte, Mont.—Contract soon to be let for erecting 4-story fireproof building for Knights of Columbus, according to plans by Linke & Haire, Butte.

Kansas City, Mo.—Permit issued to Ridenour Realty Grocery Co. to erect a 9-story fireproof steel, concrete and brick building at St. Louis Ave. and Mulberry Street; cost, $175,000.

St. Louis, Mo.—St. Charles Borromeo Catholic Church recently destroyed is to be rebuilt; cost about $70,000. J. G. Lawler member building committee.

Seattle, Wash.—Plans being prepared by Somervell & Putnam, White Bldg., for a 3-story and basement brick hotel which F. A. Welty, New York Blk., will erect; cost $50,000.

Plans completed by Beeb & Gould, Denny Building, for four-story reinforced concrete fireproof office building to be erected on Second Avenue and Virginia Street for the Puget Sound News Co.; cost, $50,000.

Isham B. Johnson, 3838 Evanston Avenue, Seattle, about to let contract for erecting 4-story, 120 x 120 ft. brick and concrete apartment house on Summit Avenue and University Street for Kreilsheimer Bros., Seattle. Cost, $100,000.

Portland, Ore.—Contract about to be let by Tourtellotte & Hummel, Rothschild Bldg., for constructing superstructure of First Methodist Sunday School building at Twelfth and Taylor Streets, cost about $45,000.

Salt Lake City, Utah.—Salt Lake Security & Trust Co., it is reported, will erect a 17-story building at Main and First S. Streets to cost $1,200,000. Dr. E. D. Woodruff, Chmn. Bd. Directors.

Valdez, Alaska.—Business section of Valdez reported destroyed by fire July 17. Loss estimated at $500,000, including loss by the Valdez Dock Co. and S. Blum & Co.

Toronto, Ont.—E. M. Statler of the Statler Hotel of Detroit, Mich., reported planning erecting a $2,000,000 hotel in this city.

BIDS DESIRED.

Roanoke, Va.—Reported desired until Aug. 1 by Melrose Baptist Church, for erecting a 95 x 120-ft. edifice at Melrose Avenue and Twelfth Street. Probable cost, $50,000. N. T. Wingfield, Archt., Charlottesville.

St. Paul, Minn.—Bids being received by Buechner & Orth, 500 Schubert Bldg., for erecting 6-story arcade building at Robert and Seventh Streets for Adolph and Otto Bremer; cost about $250,000.

Topeka, Kan.—Until July 25 by City Clerk for constructing concrete bridge over Shunganunga Creek.

Oklahoma City, Okla.—Bids reported desired until July 31 by Leonard H. Bailey, Archt., Suite 204 Colcord Bldg. for erecting a theater on Robinson Street.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Lenox, Mass.**—Contract for erecting residence on Cliffwood Street for Dr. H. P. Jacques awarded Louis E. Stickles, Lenox; cost, $25,000.

★**New Bedford, Mass.**—Contract for erecting 1-story brick Whaling museum for the Old Dartmouth Historical Society awarded John Crowe, 78 Bedford Street, Fall River. Henry Vaughn, Boston, Archt.

★**Worcester, Mass.**—Contract for erecting store and building at Main and Webster Streets awarded John J. Power, 1 Granite Street, at about $25,000.

★**Ithaca, N. Y.**—Contracts awarded as follows for erecting automobile sale and service building on W. State Street; general contract Fred Lyon, Ithaca Steel Work Seneca Engineering Co., Montour Falls; plumbing, Jamieson—McKinney Co., Ithaca; total cost, $40,000.

★**New York, N. Y.**—Contract awarded Clark & Appelman, 419 E. Sixteenth Street, for erecting Mount Gilead Baptist Church, at 39 E. 132d Street. Cost about $25,000. F. E. Glasser, Archt., 70 Manhattan Street.

★**Utica, N. Y.**—General contract for construction of 7-story and basement addition 168 x 110 ft. to Martin's Hotel (William Martin, Proprietor) reported awarded to Griffith & Pierce; structural steel to Kellogg Structural Steel Co., Buffalo.

★**Lansdowne, Pa.**—Contract for erecting Presbyterian Church awarded W. Beaumont, Philadelphia, at $31,000.

★**Marcus Hook, Pa.**—Contract awarded William Provost, Jr., Chester, for erecting weave shed and carpenter shop brick, reinforced concrete and terra cotta for Viscose Company.

★**Philadelphia, Pa.**—Contract awarded H. C. Rea Co., 1027 Wood St., for erecting six-story reinforced concrete loft building at Eleventh and Race Streets. Ballinger & Perrot, Archts., 1211 Arch St.

★**Philadelphia, Pa.**—Contract reported awarded Turner Concrete & Steel Co., 1713 Sansom Street, for erecting eight-story stone reinforced concrete and brick building at Pine Street and Delaware Avenue for Pennsylvania Warehousing & Safe Deposit Co.; cost, $60,000.

★**Pittsburgh, Pa.**—Walter S. Cohen awarded to H. Miller & Son, Center and La Place Streets, contract for erecting 3-story brick building at Wylie Avenue and Green Street for Hebrew Institute of Pittsburgh, to cost $30,000.

★**Pittsburgh, Pa.**—Contract awarded D. T. Riffle for erecting six-story reinforced concrete warehouse on Penn Avenue for George S. Daugherty Co.

★**Pittsburgh, Pa.**—Contract for erecting 2½-story fireproof addition to St. Joseph R. C. Orphan Asylum awarded Golden & Crick, 3512 Fifth Avenue, at $55,000.

★**Sharon, Pa.**—Contract for erecting 2-story office building for Petroleum Iron Wks. Co. awarded William McIntyre Co., Sharon. Cost about $30,000.

★**Alliance, Ohio.**—Contract for erecting Masonic Temple on Linden Avenue and Columbia Street awarded F. C. Kroemer, Dayton; cost, $65,000.

★**Marion, Ohio.**—Contract for erecting Odd Fellows Temple awarded John Baldauf and Leffler & Bland, Marion, at about $40,000.

★**Franklin, Ind.**—Contracts for constructing State Masonic Home awarded to State Constr. Co., Indianapolis, at $140,779, and for heating and plumbing to Woolen & Callon, Indianapolis, at $41,500, and electrical work to Hatfield Electrical Co., Indianapolis, at $11,704.

★**Chicago, Ill.**—Reported contract for erecting Field Museum of Natural History awarded Thompson-Starrett Co.

★**Kewanee, Ill.**—Contract awarded to Jos. Nelson & Sons, Chicago, for erecting the new C., B. & Q. passenger depot and rearranging freight offices here, at $80,000.

★**Sesser, Ill.**—Contract awarded by Thomas Ogilvie, Secy. U. M. W. of A., No. 1237, for erecting 2-story lodge building, to G. Harman Contr. Co., Chemical Building, St. Louis, Mo., at $22,310. R. Z. Gill, Archt., Murphysboro.

Superior, Wis.—Lowest bid opened July 12 for erecting St. Joseph's Orphange for Catholic Diocese of Superior submitted by W. F. Hoy, Minneapolis, Minn., at $103,000. Emil Ulrich, 705 Euclid Building, Cleveland, Ohio, and John Bach, Newton Building, Superior, Asso. Archts.

★**Imogene, Iowa.**—Contract for erecting Roman Catholic Church awarded G. W. Sprague & Son, Omaha, Neb., at $45,000.

★**St. Paul, Minn.**—Contract awarded H. M. Sebu, 2042 Dayton Avenue, at about $51,000 for alterations and repairs to Willard Hotel, Tenth and St. Peter Streets. J. P. Cedarberg, Jr., Archt., Endicott Building.

★**Emporia, Kan.** — Contract awarded July 12 for erecting 3-story addition and remodeling present brick and stone Masonic Temple to A. W. Davis, Emporia. Architect, C. W. Squires, Emporia.

Pine Bluff, Ark.—Lowest bid received for erecting 3-story Masonic Temple was from E. C. Royce, Pine Bluff; cost about $35,000.

★**Beaumont, Tex.**—Contract for improvements and additions to Santa Fé station awarded Gross Constr. Co. of Galveston, at $55,000.

★**Ocean Park, Wash.**—Contract awarded to Martin & Dugan, Northern Bank Bldg., Seattle, for erection of reinforced concrete and steel moving picture theater and dancing pavilion at about $60,000.

★**Seattle, Wash.**—Contract awarded to Metropolitan Bldg. Co., White Building, for construction of 120 x 240 ft. reinforced concrete and steel, ice arena on Fifth Avenue, between University and Seneca Streets, to Grant, Smith & Co., Henry Building. Structure will be built for Patrick & Patrick, Lessees, of Victoria and Vancouver, B. C.; cost about $70,000.

★Contract awarded by R. Hamilton Rowe, Archt., Green Bldg., for a 4-story, reinforced concrete apartment and hotel, to be erected on First Hill to Martin & Dugan, Northern Bank Bldg., at $80,000. Quaker Investment Co., Green Bldg., owners.

★**Victoria, B. C.**—Contract awarded Luney Bros., Victoria, for erecting 2-story and basement store and office building, brick and mill construction, on Broad and View Streets, to cost about $75,000. Percy Fox, Archt., Victoria.

NEW INDUSTRIAL PLANTS

PROPOSED WORK

Worcester, Mass. — Preliminary plans being prepared by Lockwood, Green & Co., Boston, for annex to plant of Heald Machine Co., New Bond Street, Greendale, to provide a building 120 x 200 ft.

Pawtucket, R. I.—Two stories 200 x 63 ft. is to be erected to plant of Jeckes Spinning Co.; cost, $35,000.

Albany, N. Y.—Contract about to be let by Peter J. Callan, 13 N. Pearl Street, for erection of 4-story and basement factory 35 x 70 ft. brick and steel from plans of D. Stuart Douglass, 100 State Street; estimated cost, $30,000.

Buffalo, N. Y.—Pillsbury Flour Mills Co., Minneapolis, Minn., has purchased site on Buffalo River with trackage facilities from Pennsylvania R. R. and the Buffalo Creek Terminal R. R., upon which it will build a large branch plant including elevators, flour mills, etc.

Archer-Daniels Linseed Co., Minneapolis, Minn., has purchased a site of 4 acres on Buffalo River having Pennsylvania and Buffalo Creek Terminal R. R. track facilities, and will build a large elevator and crusher plant.

Lesterville, N. Y.—Gould Paper Co., Lyons, intends rebuilding Paper Mill B. recently destroyed by fire.

New Hartford, N. Y.—H. L. Meader, 178 Fifth Avenue, New York, completed plans for two manufacturing buildings, one 194 x 58 ft., the other 101 x 143 ft., 3 stories and basement, to be erected for the Sauquoit Paper Co.; cost $100,000.

Walkill, N. Y.—James B. Crowell & Son, manufacturers of brick molds, barrows, etc., has completed plans for rebuilding the plant destroyed by fire.

Birmingham, Ala.—Woodward Iron Co. will erect a benzol plant in Woodward to cost $100,000. A. H. Woodward, Pres.

Cambridge, Ohio.—Cambridge works of the Interstate Iron & Steel Co., of Chicago, Ill., a bar mill, was seriously damaged by fire July 18.

Lindsay, Ont.—Plant of Horn Bros. Woolen Co. destroyed by fire is to be rebuilt.

BIDS DESIRED.

Hagerstown, Md.—By Peuckert & Wunder, Archts. and Engrs., 310 Chestnut Street, Philadelphia, Pa., for erecting 2-story, 100 x 200 ft., brick, steel and concrete factory for Pangborn Corporation.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Buffalo, N. Y.**—General contract awarded to Eastern Concrete Steel Co., Morgan Bldg., for erection of reinforced concrete mill and elevator 34 x 128 ft., 160 ft. high at New York Central R. R. and Toisul Road for Clover leaf milling; cost, $100,000.

★Contract awarded by Danaby Packing Co., to the Lackawanna Bridge Co., Buffalo, for cooler building to be erected at its plant Metcalfe Street and New York Central R. R., at $25,000.

★**Poughkeepsie, N. Y.**—Contract reported awarded to Kingston & Campbell for erection of a cough drop factory. 191 x 141 ft., 3-story brick and steel for Smith Bros., at $75,000; steel work to Mitchell & Co., Poughkeepsie.

★**Utica, N. Y.**—Contract awarded by Bossert Mfg. Co., to Griffith & Pierce for erection of nickel plating and polishing building, 34 x 90 ft., 2-story and basement.

★**West Point, Ga.**—Contract for erecting mill between West Point Mfg. Co.'s mill and Riverdale Cotton Mills awarded by George H. Lanier to Gallivan Building Co., Greenville, S. C.; building is to be 3 stories, 428 x 132 ft., with a weave shed in basement.

★**New Westminster, B. C.**—Contract reported awarded by Brackman-Ker Milling Co., for erection of superstructure for a flour mill and grain elevator to F. T. Sherborne, of Vancouver and Victoria, B. C. Flour mill will be a 3-story structure, and elevator will contain sixteen bins with a capacity of 50,000 bushels.

MISCELLANEOUS

PROPOSED WORK

Subway Bonds—Utica, N. Y.—Bonds for $53,000 for constructing electric subways in various streets for use of fire and police wires and other wires as may be placed therein, enlarging service boxes in Genesee Street subway and draining existing subways, will be sold July 28 by A. M. Burke, City Comptroller.

Causeway—Fairmont, W. Va.—Albert J. Kern, City Clk., writes the proposed 300 ft. causeway across Coal Run ravine to connect Main Street and Fairmont Avenue will be constructed by a private company in which John R. Bennett and C. D. Robinson are interested; cost about $500,000.

Subway—Flint, Mich.—Bids will probably soon be called for by City Council for subway under tracks of Pere Marquette Ry. Co., to cost about $50,000. W. R. Drury, Asst. City Engr.

BIDS DESIRED.

Coal Handling Equipment—Springfield, Mass.—Until Aug. 6 by Commanding Officer, Springfield Armory, for constructing a cold storage and coal-handling equipment, consisting of six bins of 1000 tons capacity, of reinforced steel, one rail-track hopper with reciprocating feeder and coal crusher, the equipment to be capable of transferring from cars to bins thirty tons per hour. For further information refer to Proposal No. 2.

Lumber—Philadelphia, Pa.—Until July 28, by Lieut.-Col. Cyrus S. Radford, Asst. Q. M., U. S. A., for furnishing Marine Corps with 520M. ft. white pine and spruce.

Air Compressors, Etc.—Pittsburgh, Pa.—Until Aug. 21 by U. S. Engineer, for air compressors, gas engine, turbine, electric light plant, etc., at Lock 6, Monongahela River, advertised in Engineering Record.

Elevators — Cincinnati, Ohio. — Until Aug. 1 by Ed Tress, Pub. Library, Second Asst. of Chairman of L. Storage, Clerk, for installing electric elevators in Public Library building, 629 Vine Street.

Track Platform—Chicago, Ill.—Until June 28, by Director and Subway Comm. (R. C. Stanchfield, Clerk), for constructing track platforms along freight and passenger buildings on Pier No. 2, Harbor Dist. No. 1.

Elevator—Galveston, Tex.—Until July 5 by City Comr. (Jno. Sealy, Jr.), for furnishing and installing passenger elevator in Municipal Building.

Elevators—Seattle, Wash.—Reported designed until Aug. 4 by Port of Seattle (Jno. Cantig, Engineer), C. E. Remsberg, Seattle, for furnishing and installing 2 electric freight elevators in new fruit storage warehouse, Seattle Harbor Improvement.

Structural Steel, Elevators, Steel Pipe, Etc., Panama.—At office of Maj. F. C. Boggs, Corps Engrs., U. S. A., Gen'l Purchasing Officer, Panama Canal, Washington, D. C., for work as follows:

Until July 26 CE 62, structural steel framing for pump and compressor house and crane girders for support of crane rail for dry dock No. 1.

Until Aug. 2 CE 561, steel, w. i. and steel pipe, iron and steel chain, etc.

Until Aug. 6 CE 563, electrically operated passenger elevator and hand-operated freight elevator, steel cable, cold rolled steel, etc.

PRICES AND LETTINGS.

*Indicates award of contract

Tunnel—Pittsburgh, Pa.—Following are bids opened July 12 by Pratt M. Gibbs, Co. Comptr., for constructing 4875 lin. ft. tunnel and approaches known as County Highway 3 Tunnel No. 1 (a) complete tunnel brick lining, (b) tunnel concrete block, (c) tunnel monolithic block, (A. D. Neeld, County Consulting Engr., 327 Fourth Avenue): (Bids were received on 3 classes of construction): Booth & Flinn, Ltd., 1502 Forbes Street, Pittsburgh, Pa., (a) $1,265,000, (b) $1,118,812.50, (c) $1,147,500; (a) $2,141,762.50, Rinehart & Dennis Co., Inc., Charlottesville, Va., (a) $2,[illegible], (b) $1,[illegible], (c) $1,223,625, (d) $164,543; H. S. Kerbaugh, Inc., 6 Church Street, New York City, (a) $1,545,812.50, (b) $1,[illegible], (c) $1,425,[illegible], (d) $188,-[illegible]; John B. Carter Co., New York City, (a) $1,[illegible], (b) $2,[illegible], (c) $1,520,750, (d) $184,[illegible]; Arthur McMullen Co., 149 Broadway, New York City, (a) $1,766,250, (b) $1,[illegible], (c) $1,[illegible], (d) $[illegible]; T. A. Gillespie Co., Westinghouse Building, Pittsburgh, (a) $1,789,125, (b) $1,789,-125, (c) $1,656,500, (d) $194,676; (Bennett & Talbot, Greensburg, Pa., (a) $2,682,-[illegible], (b) $2,047,602.50, (c) $2,047,500, (d) $[illegible].

★Contract awarded on above tunnel to Booth & Flinn, Ltd., with monolithic concrete lining.

★**Subway—Kansas City, Mo.**—Contract awarded by Co. Comrs. to K. Cleyer of Kansas City for constructing approach of subway at separation of grades on Blue Avenue and Missouri Pacific Railroad tracks about 2½ miles east of corporate limits of city, at $26,200. Work includes 22,[illegible] cu. yd. earth excav.; 35,000 yds. overhaul; 2½-cu. yd. reinforced concrete retaining wall, 3550 sq. yds. asphaltic macadam, etc. Allen C. Southern, Co. Surveyor and Highway Engr.

Proposals

For Proposals Advertised, see Pages 48, 49, 50 and 51.

WATERWORKS.

Bids Close.		See Eng. Record.
July 26	Reservoir, etc., Sioux Falls, S. D. Adv. July 10.	July 10
July 26	Intake, Etc., Kenosha, Wis. Adv. July 17, 24.	July 17
July 27.	Pumping Station, Woodbury, N. J.	July 17
July 27.	Pump Equip., Rockford, Ill. Adv. July 17.	July 17
July 27	System, Milligan, Neb.	July 24
July 28	Water Improvements, Md. Adv. July 17.	July 17
July 28	Improv., Monticello, Ill.	July 24
July 29.	Extensions, Ipswich, Wis.	July 24
July 30	Waterworks, Paterson, N. J. Adv. July 17.	July 17
July 31.	Improvements, Iowa	July 24
July 31.	Pumping Station, Philadelphia, Pa.	July 24
July 31	Improvements, Wellington, Ohio	July 17
Aug. 2.	Intake Contract 16, Hartford, Conn. Adv. July 10, 17.	July 10
Aug. 2.	Pipe and Castings, Watertown, S. D. Adv. July 24.	July 24
Aug. 3.	Pipes, Valves, Etc., Ottawa, Ont. Adv. July 24.	July 24
Aug. 5.	Water Wks. Improv., Cambridge, Ohio Adv. July 17, 24.	July 17
Aug. 5	Water Works, Keota, Ia.	July 24
Aug. 5.	Tank, Kingsley, Ia.	July 24
Aug. 5.	Pipe Line, Lockport, N. Y. Adv. July 24.	July 24
Aug. 10.	System, Warrenton, N. C. Adv. July 17, 24.	July 17
Aug. 10.	Pipe, etc., Washington, D. C.	July 24
Aug. 10.	Contr. 165, Boring, Etc., New York, N. Y.	July 24
Aug. 13.	Water Works, Ord, Neb.	July 24
Aug. 14.	Water Works, Fromberg, Mont.	July 24
Aug. 16.	System, Watervliet, N. Y. Adv. July 17, 24.	July 17
Aug. 17.	Pipe, Intake, etc., Beaumont, Tex.	July 24

SEWERAGE AND SEWAGE DISPOSAL.

July 26.	Maywood, N. J. Adv. July 3, 10.	July 3
July 26.	Ocean City, Md. Adv. July 10, 17.	July 10
July 27.	Cloverdale, Ala.	July 10
July 27.	Cincinnati, Ohio	July 17
July 27.	Toledo, Ohio	July 24
July 28.	Cuyahoga Falls, Ohio.	July 10
July 28.	Chevett, Ohio	July 17
July 28.	Boston, Mass.	July 24
July 28	Newark, N. J.	July 17
July 28	Long Island City, N. Y.	July 24
July 30.	Cincinnati, Ohio	July 24
July 30.	Philadelphia, Pa.	July 24
Aug. 1.	Dayton, Ohio	July 24
Aug. 2.	Philadelphia, Pa.	July 24
Aug. 2.	Beaver Dam, Wis.	July 24
Aug. 3.	Paducah, Ky. Adv. July 3, 10.	July 3
Aug. 3.	Bridgeport, Neb.	July 24
Aug. 3.	Columbus, Ohio	July 24
Aug. 3.	Glencoe, Ill.	July 24
Aug. 3.	Toledo, Ohio	July 24
Aug. 3.	Wallingford, Conn. Adv. July 24.	July 24
Aug. 4.	Philadelphia, Pa.	July 24
Aug. 4.	Syracuse, N. Y. Adv. July 24.	July 24
Aug. 4.	Pittsfield, Mass. Adv. July 24.	July 24
Aug. 4.	Salt Lake City, Utah	July 24
Aug. 10.	Warrenton, N. C. Adv. July 17, 24.	July 17
Aug. 18.	Lebanon, Pa. Adv. July 24.	July 24
Aug. 23.	Dallas, Tex. Adv. July 24.	July 24
Aug. 31.	Newark, N. J. Adv. July 17, 24.	July 10

BRIDGES.

July 27.	Coshocton, O.	July 17
July 27.	Portland, Ore.	July 24
July 28.	Mansfield, Ohio	July 10
July 28.	Louisiana, Mo.	July 24
July 29.	Houtzdale, Pa.	July 17
July 29.	Cleveland, Ohio	July 24
July 30.	Pittsburgh, Pa.	July 24
July 30.	Bowling Green, Va.	July 24
July 31.	Wichita, Kan.	July 24
July 31.	Kansas City, Mo.	July 24
July 31.	Minetto, N. Y. Adv. July 17, 24.	July 17
Aug. 2.	Los Angeles, Cal.	July 17
Aug. 2.	Glenolden, Pa. Adv. July 17.	July 17
Aug. 2.	Paris, Ill.	July 24
Aug. 2.	Montpelier, Vt. Adv. July 17, 24.	July 17
Aug. 2.	Sardis, Miss.	July 24
Aug. 2.	Philadelphia, Pa. Adv. July 24.	July 24
Aug. 2.	San José, Cal.	July 24
Aug. 2.	Santa Clara, Cal.	July 24
Aug. 3.	Lake Charles, La.	July 24
Aug. 3.	Canton, S. D.	July 24
Aug. 3.	Crawfordsville, Ind.	July 24
Aug. 3.	Frankfort, Ind.	July 24
Aug. 3.	Ottawa, Ont. Adv. July 24.	July 24
Aug. 3	Waukon, Iowa	July 24
Aug. 4	South Amboy, N. J.	July 10
Aug. 7	Crown Point, Ind.	July 24
Aug. 6	Toledo, Ohio	July 24
Aug. 7	Clearwater, Fla.	July 17
Aug. 7.	Bridgeport, Conn.	July 24
Aug. 8	Washington	July 24
Aug. 23.	Maynardsville, Tenn. Adv. July 24.	July 24

PAVING AND ROADS.

July 26.	Albany, N. Y. Adv. July 10 to 24.	July 10
July 26.	Burlington, N. J. Adv. July 10.	July 10
July 26.	Mount Jewett, Pa. Adv. July 17, 24.	July 17
July 27	New Orleans, La.	July 3
July 27.	Seattle, Wash.	July 10
July 27	Janesville, Wis.	July 10
July 27.	Green Bay, Wis.	July 17
July 27.	Spencer, Iowa	July 17
July 27.	Meredith, Conn. Adv. July 17.	July 17
July 27	Mount Kisco, N. Y.	July 24
July 27	Toledo, Ohio	July 24
July 27	South Bend, Ill.	July 24
July 27	Carey, Ind.	July 24
July 27	Kansas City, Mo.	July 24
July 28	Cuyahoga Falls, Ohio.	July 10
July 28	Brooklyn, N. Y.	July 24
July 28	Illinois	July 24
July 28	Trenton, N. J.	July 24
July 28.	Hoboken, N. J.	July 24
July 28.	Mount Ayr, Iowa	July 24
July 29.	Norfolk, Va. Adv. July 17, 24.	July 17
July 29.	McKinney, Tex.	July 17
July 29.	Lima, O.	July 17
July 29	Jersey City, N. J.	July 24
July 29.	Ashtabula, Ohio	July 24
July 29.	Norfolk, Va.	July 24
Aug. 2.	Fort Scott, Kan.	July 3
Aug. 2.	Issaquah, Wash.	July 17
Aug. 2.	Seattle, Wash.	July 17
Aug. 2.	Kissimmee, Fla.	July 24
Aug. 2.	Broad Oaks, W. Va.	July 24
Aug. 2.	Silver City, N. M.	July 24
Aug. 2.	Lebanon, Ohio	July 24
Aug. 2.	College View, Neb.	July 24
Aug. 2.	Indiana	July 24
Aug. 3.	Road Roller, West Palm Beach, Fla.	July 17
Aug. 3.	New Orleans, La.	July 17
Aug. 3.	Albany, N. Y. Adv. July 17, 24.	July 17
Aug. 3.	Laurel, Mont.	July 24
Aug. 3.	Bloomfield, N. J.	July 24
Aug. 3.	Walla Walla, Wash.	July 24
Aug. 3.	Winamac, Ind.	July 24
Aug. 3.	Huntington, W. Va.	July 24
Aug. 3.	Indiana	July 24
Aug. 4.	Butte, Mont.	July 10
Aug. 4.	Grants Pass, Ore.	July 24
Aug. 4.	Indianapolis, Ind.	July 24
Aug. 4.	Philadelphia, Pa.	July 24
Aug. 4.	Defiance, Ohio.	July 24
Aug. 5.	Bozeman, Mont.	July 24
Aug. 6.	Mount Gilead, Ohio.	July 17
Aug. 6.	Russellville, Ark.	July 17
Aug. 7.	Butte, Mont.	July 10
Aug. 7.	Racine, Wis.	July 24
Aug. 9.	Keyport, N. J. Adv. July 24.	July 24
Aug. 9.	Bryan, Ohio	July 24
Aug. 9.	Washington	July 24
Aug. 9.	Seattle, Wash.	July 24
Aug. 10.	New Orleans, La.	July 17
Aug. 10.	Washington, D. C. Adv. July 17.	July 17
Aug. 14.	Lincoln, Neb.	July 24
Aug. 16.	Bowling Green, Ohio.	July 24
Aug. 17.	Memphis, Tenn.	July 17
Aug. 18.	Belding, Mich.	July 17
Aug. 18.	South Bend, Ind.	July 24
Aug. 30.	Denver, Col.	July 24

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS.

July 27.	Drain, Constantine, Mich.	July 24
July 28.	Cylinder Gates, Washington, D. C.	July 17
July 28.	Dredging, Boston, Mass.	July 24
July 30.	Irrigation Work, Great Falls, Mont.	July 3
July 30.	Dredging, Port Chester, N. Y. Adv. July 3 to 24.	July 3
July 30.	Breakwater, Conneaut, Ohio Adv. July 3 to 24.	July 3
July 30.	Breakwater, Lorain, Ohio Adv. July 17.	July 17
July 30.	Ditch, Windon, Minn.	July 24
July 31.	Dredging, Pearl Harbor, Hawaii	Jun. 19
July 31.	Dam and Shore Protection, Rock Island, Ill. Adv. July 10 to 24.	July 10
July 31.	Levee, Caldwell, Tex.	July 10
July 31.	Ditch, North Yakima, Wash.	July 17
July 31.	Drains, North Yakima, Wash.	July 17
Aug. 2.	Dredging, New York, Adv. July 10 to 24. Adv. July 10, 17.	
Aug. 2.	Levee, Cummins, Ark.	July 24
Aug. 2.	Canal, Parish, Fla.	July 24
Aug. 3.	Breakwater, Chicago, Ill. Adv. July 10, 24.	July 10
Aug. 4.	Dredging, Norfolk, Va. Adv. July 10 to 24.	July 10
Aug. 4.	Pumping Plant, Etc., Quincy, Ill.	July 24
Aug. 5.	Ditch, Richmond, Ind.	July 24
Aug. 5.	Jetty Work, Wilmington, Del. Adv. July 24.	July 24
Aug. 9.	Pier, Philadelphia, Pa. Adv. July 10, 17.	July 10
Aug. 9.	Dredging, Philadelphia, Pa. Adv. July 10, 24.	July 10
Aug. 9.	Drainage, Monté Vista, Col.	July 24
Aug. 10.	Riprap Work, New London, Conn. Adv. July 24.	July 24
Aug. 12.	Irrigation, Saco, Mont.	July 24
Aug. 13.	Irrigation Work, Saco, Mont. Adv. July 17.	July 17
Aug. 14.	Dredging, Bremerton, Wash.	July 10
Aug. 15.	Dredge Work, Rosseau, Minn.	Jun. 26
Aug. 16.	Dredging, Portland, Me. Adv. July 17, 24.	July 17
Aug. 17.	Dredging, Chicago, Ill. Adv. July 24.	July 24
Aug. 17.	Levee, Greenville, Miss.	July 24
Aug. 18.	Reclamation Work, St. Ignatius, Mont.	July 24
Aug. 20.	Steel Lock Gates, etc., Pittsburgh, Pa. Adv. July 24.	July 24
Aug. 24.	Dredger, Adelaide, Australia	Jun. 19
Sep. 17	Drainage, Palmetto, Fla.	July 24
Sep. 18.	Pier, Pearl City, T. H.	July 10

PUBLIC BUILDINGS AND SCHOOLS.

July 27.	Weston, W. Va. Adv. July 3	July 3
July 27.	New Bloomington, Ohio.	July 3
July 27.	Albany, N. Y. Adv. July 3, 10.	July 3
July 27.	Boston, Mass.	July 10
July 27.	Peekskill, N. Y. Adv. July 17, 24.	July 17
July 27.	Beverly, Mass.	July 17
July 27.	New Bloomington, Ohio.	July 17
July 27.	Clifton, N. J.	July 24
July 28.	Hayti, S. D.	July 10
July 28.	Richmond, Mo.	July 17
July 28.	Little Falls, N. Y.	July 24
July 28.	Chicago, Ill.	July 24
July 29.	Quitman, Ga.	Jun. 26
July 29.	Oradell, N. J.	July 17
July 29.	Boston, Mass.	July 24
July 29.	Chicago, Ill.	July 24
July 29.	New Madrid, Mo.	July 24
July 29.	Watertown, N. Y.	July 24
July 30.	Albion, Mich.	Jun. 26
July 30.	Cincinnati, Ohio	July 10
July 30.	Kenosha, Wis.	July 10
July 30.	Caldwell, N. J.	July 24
July 30.	Cedarville, Ohio	July 24
July 30.	St. Louis, Mo.	July 24
July 31.	Guantanamo, Cuba	July 3
July 31.	Muncie, Ind.	July 3
July 31.	Stevens Point, Wis.	July 10
July 31.	Millfield, Ohio	July 17
July 31.	Oil City, Pa.	July 24
July 31.	Philadelphia, Pa.	July 24
July 31.	Monmouth, Ore.	July 24
Aug. 1.	Seattle, Wash.	Jun. 5
Aug. 1.	Akron, Ohio	July 24
Aug. 2.	Fort Atkinson, Wis.	July 3
Aug. 2.	Washington, D. C. Adv. July 3, 10.	July 3
Aug. 2.	Kent, Ohio	July 17
Aug. 2.	Pisgah, Iowa	July 17
Aug. 2.	Hammond, Ind. Adv. July 17, 24.	July 17
Aug. 2.	Dayton, Ind.	July 24
Aug. 2.	Hartford City, Ind.	July 24
Aug. 2.	Paterson, N. J. Adv. July 24.	July 24
Aug. 3.	Howard, Kan.	July 24
Aug. 3.	Sanford, Ind.	July 24
Aug. 3.	Dedham, Mass.	July 24
Aug. 4.	Allentown, Pa.	July 24
Aug. 4.	Portchester, N. Y.	July 24
Aug. 5.	Kansas City, Mo.	July 24
Aug. 6.	Cleveland Heights, Ohio.	July 17
Aug. 9.	Lansford, Pa.	July 17
Aug. 9.	St. Augustine, Fla.	July 24
Aug. 11.	Wellsburg, W. Va.	July 10
Aug. 12.	North Attleboro, Mass.	July 10
Aug. 12.	Somers, Iowa	July 24
Aug. 13.	Gardiner, Me.	July 10
Aug. 13.	Halfa, Iowa	July 24
Aug. 14.	Warnock, Ohio	July 24
Aug. 14.	West Alexandria, Ohio.	July 24
Aug. 15.	Schuyler, Neb.	July 17
Aug. 15.	Schuyler, Neb.	July 24
Aug. 16.	Baltimore, Md. Adv. Jun. 26 to July 3.	Jun. 26
Aug. 16.	Westmont, Johnstown, Pa.	July 24
Aug. 19.	Blackwell, Okla.	July 17
Aug. 20.	Ypsilanti, Mich.	July 24
Aug. 24.	Grand Junction, Col.	July 24
Sep. 1.	Wisner, Neb.	July 10
Sep. 30.	Washington, D. C. Adv. July 24.	July 24

PRIVATE BUILDINGS.

July 27.	The Dalles, Ore.	July 24
July 31.	Oklahoma City, Okla.	July 24
Aug. 1.	Roanoke, Va.	July 24

MISCELLANEOUS.

July 27.	Manganese Rails, New York, N. Y.	July 17
July 27.	Skylights, Albany, N. Y. Adv. July 17, 24.	July 17
July 27.	El. Ry., Section 3, New York, N. Y. (2 prop.) Adv. July 17, 24.	July 17
July 27.	Garbage, Asbury Park, N. J.	July 24
July 28.	Section 2, El. Ry., New York, N. Y. Adv. July 17, 24.	July 17
July 28.	Rail Splice Bars, Etc., for Rys., New York, N. Y.	July 17
July 28.	Lumber, Philadelphia, Pa.	July 24
July 29.	Sprinkler and Flusher, Berlin, Ont. Adv. July 24.	July 24
July 29.	Elevator, Galveston, Tex.	July 24
July 31.	Timber, Detroit, Mich. Adv. Jun. 26, July 10, 17.	Jun. 26
Aug. 2.	Elevators, Cincinnati, Ohio	July 24
Aug. 2.	Steel Pipe, Etc., Panama.	July 24
Aug. 3.	Route 50, Station Finish, El. Ry., New York, N. Y. Adv. July 17, 24.	July 17
Aug. 3.	Cement Roofing Tile, Panama Adv. July 17.	July 17
Aug. 4.	Station Finish, Section 2, El. Ry., New York, N. Y. Adv. July 17, 24.	July 17
Aug. 4.	Elevators, Seattle, Wash.	July 24
Aug. 6.	Elevators, Etc., Panama.	July 24
Aug. 6.	Coal Handling Equipment, Springfield, Mass.	July 24
Aug. 12.	Steel Barges, Vicksburg, Miss. Adv. July 10 to 24.	July 10
Aug. 16.	Towing Locomotives, etc., Panama.	Jun. 26
Aug. 16.	Subway Work, Philadelphia, Pa.	July 10
Aug. 16.	Found. and Piers for El. Ry., Philadelphia, Pa. Adv. July 17, 24.	July 17
Aug. 18.	El. Ry. Supplies, Etc., Long Island City, N. Y.	July 24
Aug. 21.	Air Compressors, etc., Pittsburgh, Pa. Adv. July 24.	July 24
Sep. 18.	Ry. at Naval Station, Pearl Harbor, Hawaii.	July 10

New Locomotive Crane Can Be Steered from Operator's Seat

A small traction wheel locomotive crane, with a clam shell bucket for loading trucks and other uses, that is so light that it will travel on standard wheels over ordinary hard roads without the use of planking, has recently been put on the market by the Davenport Locomotive Works of Davenport, Iowa. It may be driven by gasoline, kerosene, steam engine or electric motor and, besides being provided with the ordinary rotating propelling and hoisting mechanism usually found on cranes, is equipped with a device by which the operator can control the steering mechanism and travel brakes from the operator's

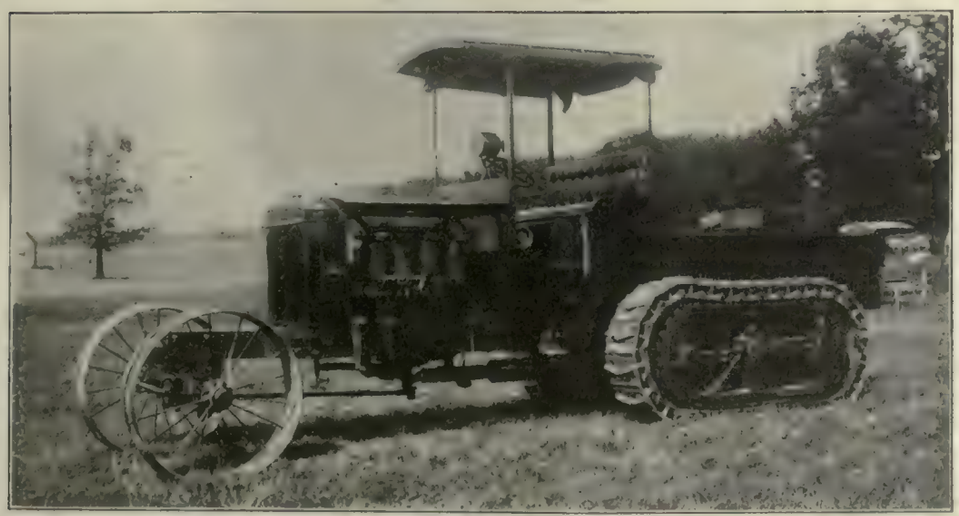


THIS CRANE TRAVELS ORDINARY HARD ROADS ON STANDARD WHEELS

platform. They are designed for use in coal and material yards, for unloading gondola cars on team tracks and for contractors having loose materials to handle on country roads, or elsewhere. For work over soft ground caterpillar wheels are provided.

Power and Flexibility Features of This New Tractor

Traction engine power combined with motor truck flexibility are said to be the features of the Centiped tractor truck which has recently been placed on the market. The 60-hp. gasoline engine of the tractor is supported on springs, with three-point suspension, and each centiped wheel is constructed so that it can oscillate independently. The average consumption of gasoline is 20 gal. per ten hours when hauling the maximum load at an average speed of 3 miles per hour. The machine, which is equipped with forward speeds of 1½, 3 and 5½ miles per hour, together with one reverse, is manufactured by the Phoenix Manufacturing Company, Eau Claire, Wis.



NEW TRACTOR TRUCK HAS THREE FORWARD SPEEDS AND ONE REVERSE

Business Notes

The De Laval Steam Turbine Company will build an addition to the machine shop at its Trenton, N. J., plant.

The Trexler Lumber Company moved its sales office, formerly located at 30 Church Street, New York City, to its yard on the east bank of the Passaic River, midway between Newark and Jersey City, July 1. The telegraph, telephone and mailing address is Newark, N. J.

Henry J. Waldorf, at one time a superintendent with the Crane Company, Chicago, and for the last twenty years with the Kewanee works of the National Tube Company, died July 25, at Kewanee, Ill.

The Metals Coating of America, Chicago, has opened an office at 30 Church Street, New York City, with Edward McFarlan in charge. Herbert Jacques, Jr., is in charge of offices recently opened at 100 Summer Street, Boston.

J. L. Mott, president of the J. L. Mott Iron Works, 118 Fifth Avenue, New York City, died in New York, July 26. He attained the management of the iron works in 1866, when the main plant was located at Mott Haven, N. Y. He was a member of the original rapid transit commission under which the present elevated railroads of New York City were chartered.

The Dunn Wire-Cut-Lug Brick Company of Conneaut, Ohio, has engaged Mr. R. T. Stull as its ceramic engineer. His duty will be to advise with the licensees of the Dunn company and help them with their brick-making problems. Mr. Stull is a graduate of the ceramic course of the Ohio State University, class of 1902, and has been engaged continuously in ceramic work since graduation. For the past eight years he has been in the ceramic department of the University of Illinois, first as an instructor and, since August, 1913, as acting director of the department. He is widely known in the ceramic industry, being at present vice-president of the American Ceramic Society. He has contributed extensively to American ceramic literature.

Trade Publications

The following companies have recently issued trade literature:

Walter A. Zelnicker Supply Company, St. Louis, Mo. A descriptive leaflet on the double-clutch car-mover. Price list, 4 pages, 3¾ x 6½ in., on hickory handles.

Samuel Cabot, Inc., Boston, Mass. Booklet, 4 x 8½ in., 24 pages, illustrated. Describes Cabot's deafening, sound-proof and asbestos "quilts" for school buildings.

Brown Hoisting Machinery Company, Cleveland, Ohio. Pamphlet, 6 x 9 in., 12 pages, illustrated. Embraces the construction of Brownhoist Shnable patented dragline bucket and its advantages, which according to this pamphlet are eleven in number. The illustrations are excellent.

Town Supply Company, Williamson Building, Cleveland, Ohio. Booklet, 5¼ x 7¾ in., 28 pages, illustrated. Detailed formulas and directions for the manufacture, use and care of sanitary composition products, and explicit instructions for mixing, applying and finishing composition flooring, base, etc.

Tiffin Wagon Company, Tiffin, Ohio. Catalog, 7 x 10 in., 16 pages, illustrated. Embraces Tiffin horse-drawn sprinklers and flushers of the gravity and automatic types and gasoline motor pressure types mounted either on horse-drawn gear or motor chassis, as well as bottom dumping wagons and sanitary carts.

Waterbury Company, 80 South Street, New York City. Catalog, 3½ x 6¼ in., 32 pages, illustrated. Describes briefly numerous dredging, hoisting and excavating jobs where Waterbury armored rope has been used, and gives specifications of the different sizes. Catalog, 3½ x 6¼ in., 24 pages, illustrated. Describes Waterbury fireclad wire rope and contains a price list of this brand.

Fairbanks, Morse & Company, Chicago. Catalog 114 A, 6 x 9 in., 40 pages, illustrated. The object of this publication is to show the practical application of Fairbanks-Morse pumping machinery to irrigation. The book is illustrated with pictures showing actual installations under a multitude of working conditions. Below each photograph complete data is given of the installation and the results obtained.

Stone and Webster Engineering Corporation, Boston. Illustrated booklet, 7½ x 6 in., 30 plates. Consists of photographs of building construction, taken during erection, or after completion. Includes size, material, floor area and cubic contents in most cases. In some instances, the progress of work is illustrated by successive photographs. Some of the important structures included are the new buildings of the Massachusetts Institute of Technology, the hydroelectric power station of the Mississippi River Power Company, at Keokuk, Iowa, and the shop buildings of the General Electric Company, at Schenectady, N. Y.

Trussed Concrete Steel Company, Youngstown, Ohio. United steel sash Catalog, paper, 8½ x 11, 128 pages, illustrated. This book is a well worked-up description of the various types of steel sash and their application to building construction. The illustrations and drawings are exceptionally good, and explain clearly all the important features of this material, including questions of strength, weathering, ventilation and glazing. The large variety of sections used in the make-up of the sash are illustrated. Standard pivoted sash, with both horizontal and vertical pivots, continuous sash of the top-hung and center-pivoted type, vertical sliding sash of various kinds, and casements of both standard and economical form are all completely described. United steel partitions and sliding and swinging doors are shown, including details.

New Construction Activities

The statement of earnings of the United States Steel Corporation for the second quarter shows a record jump of 125 per cent over the first quarter. The net earnings, nearly $28,000,000, rank high, having been exceeded by but one second quarter since 1911, that of 1913. They represent a 1.63-per cent dividend on the common stock after depreciation and preferred dividends are taken out. The common-stock dividend, however, was again passed. The net earnings exceeded predictions by $3,000,000, and the constantly increasing volume of business, with rising prices, warrants the belief that the next quarter will rank well with the most prosperous in the corporation's history.

Exports for last week again passed the $54,000,000 mark, giving the largest excess of exports over imports since May 1. It is instructive to note from the May report of our foreign commerce recently issued that explosives, shells and fire arms formed only 4½ per cent of our $214,000,000 worth of exports for the month, and that the export of nearly all products manufactured in times of peace has increased both in quantity and in unit value in a way that indicates that the entire country is benefiting by the extra business which the stoppage of European manufacture has thrown on us.

Domestic structural steel business seems to be steadily growing, and promises to show a fair total for the month of July.

Buildings

It is reported that the Field Museum in Chicago has been contracted for at $5,100,000. A Y. M. C. A. building in Chicago, costing, with the land, $1,175,000, has been contracted for. A $154,000 hospital contract has been awarded in New York City. A six-story hotel has been contracted for at $210,000 in Petersburg, Va. The structural steel contract, totaling nearly $194,000, for the city and county building at Pittsburgh has been awarded. A contract for three steel mills at Youngstown, Ohio, has been awarded at about $2,000,000. The lowest bid received recently for building a library at Indianapolis was $417,000.

Bids are desired for a $165,000 high school at Akron, Ohio. It is reported that bids will soon be received for a $130,000 city hall at Sheboygan, Wis. A $500,000 lodge building is contemplated at Boston. It is reported that $3,000,000 has been bequeathed to a college at Langhorne, Pa., and that new buildings will be erected in the near future. Plans are being prepared for a $250,000 college building in Cincinnati.

A number of projects for enlarging industrial plants are reported this week, including a $1,500,000 plant for the Baldwin Locomotive Works at Philadelphia. It is said that a $2,000,000 blast furnace will soon be erected at Canton, Ohio, and that the building of a $1,000,000 furnace and tube mill is contemplated at Youngstown, Ohio. Plans are being prepared for a $1,500,000 rubber factory for a manufacturer of automobile tires at Detroit, and a $500,000 tire factory is being planned at Akron, Ohio. It is reported that a $500,000 automobile plant will be built at Jacksonville, Fla., and that a $250,000 addition to another automobile plant will be made at Lansing, Mich.

Bridges and Roads

Several small bridge contracts have been awarded by the Michigan State highway commissioner at Lansing. A $26,000 steel draw span has been contracted for at Seattle. Bids are asked Aug. 26 on a concrete arch bridge of eighteen spans over the Arkansas River at Tulsa, Okla. Bids are desired Aug. 10 for a twelve-span reinforced-concrete bridge at Westport, Conn. It is reported that a $125,000 bridge contract will be let next fall at Salem, Mass., and plans have been approved for three concrete bridges to cost $75,000 at Reading, Pa.

The lowest bid opened in Albany for constructing the Storm King State highway from Cornwall to West Point was about $274,000. The lowest bids for paving opened in Philadelphia July 13 total $132,000. A $79,000 paving contract has been awarded at Cincinnati. A contract for asphalt paving to cost $100,000 has been awarded at Milwaukee. Two paving contracts totaling $84,000 were awarded on bids opened July 19 at Olympia, Wash. Bids are desired on 90,000 sq. yd. of paving in New York City on Aug. 8. Bids are asked Aug. 9 for 62,000 sq. yd. of concrete road at Indianapolis. Bids are also desired on further State road work by the highway commissioner of Ohio. The city council of Sioux City, Iowa, has voted for paving work which will cost $125,000. Paving work contemplated at Seattle has been estimated by the city engineer to cost more than $285,000.

Waterworks and Sewers

New bids are desired for laying 3½ miles of cast-iron pipe and constructing a concrete dam at Ilion, N. Y., the work having been readvertised. A public service corporation has contracted with Columbia, Tenn., to install a filtration plant and new water mains, together with extensions to the lighting system. A $25,000 filtration plant is contemplated at Jersey Shore, Pa. Waterworks bonds totaling $125,000 are advertised for sale Aug. 9 at East Orange, N. J. An expenditure of $250,000 for waterworks, for which a bond issue would be necessary, has been recommended at Buffalo. Engineers are now engaged on the $8,000,000 water system at Denver.

The lowest bid opened July 15 for constructing sewers in the Bronx, New York City, was $80,806. The contract for a sewage-treatment plant at Milwaukee has been awarded at $55,000. Bids are desired for sewer mains and filter beds at La Porte, Iowa. Bids are also desired for a sewage system at Watertown, S. D., and for sanitary sewers to cost $62,000 at Steamboat Springs, Col. Bonds amounting to about $250,000 for sewer work have been voted at Austin, Tex.

Miscellaneous

Bids have been opened on three new subway sections in New York City, the low bids being $2,170,000, $1,700,000 and $3,741,000. A drainage contract amounting to about $200,000 has been awarded at Selmer, Tenn. The contract for a wharf at New Orleans has been let at $79,600. At Roseburg, Ore., contracts for an $800,000 railroad and a $400,000 lumber mill have been awarded. Bids are desired for an underground conduit to contain forty electric ducts for supplying the Queensborough subway in New York City. Bids are desired at Albany for two contracts on the State Barge Canal for dock walls and harbors. A contract for 1,000,000 cu. yd. of ditch excavation will be let Aug. 14 at Tekamah, Neb. Plans are being prepared for a concrete dam at York, Pa. A contract for a 13½-mile ditch will be let next month at Morganfield, Ky. Plans are being prepared for a $1,000,000 irrigation project at Doyle, Col. It is reported that work will soon be started on the Hatchtown dam at Salt Lake City. Surveys will soon be started to determine the feasibility of a $3,000,000 ship canal from Sacramento to San Francisco Bay.

WATERWORKS

PROPOSED WORK

Dalton, Mass.—Dalton Fire Dist. expects to lay between 7000 and 8000 ft. 4 and 6-in. water pipe.

Buffalo, N. Y.—Capt. George H. Norton, Acting Comr. Pub. Wks., has recommended to Council a bond issue of $250,000 for water works improvements, to include extension in various sections of Buffalo, cost $50,000; extension of high pressure mains for fire purposes in Main, Washington, Pearl and Franklin Sts., cost $[illegible]; extension of 36-in. water main at Bailey Ave. and Seneca St., cost $40,000, to extend a main in Bailey Ave., cost $46,000, and $10,000 to place a 36-in. water main in 7th St.

Lewiston, N. Y.—A. O. Peabody, Village Engr., reported preparing plans for water works, to cost about $39,000.

Newark, N. Y.—Question of erecting new water pressure standpipe under consideration.

East Orange, N. J.—Reported bonds for $125,000 for [illegible] water distributing system will be sold Aug. 9 by L. E. Rowley, City Clk.

Jersey Shore, Pa.—Work contemplated by Jersey Shore Water Co. includes the following: Diversion dam, intake, sedimentation basin and filtration plant, capacity 2,000,000 gal. per 24 hr. Cost, $25,000. Engineers, W. H. Dechant & Son, Reading.

Ringtown, Pa.—H. F. Hartman, Boro. Secy., writes that it is proposed to construct small reservoir to receive supply and about 2 miles 6-in. pipe. Supply to be furnished by Girard Water Co. from its reservoir at Ringtown.

Pennsylvania.—Following permits issued by State Dept. of Health, Harrisburg, to July 15:

Arnot; Arnot Water Co., new source of water supply from drilled well.

Gaysport; municipal water works, storage reservoir.

Cherrytree; Cherrytree Water Co., disinfection apparatus.

McConnellsburg, McConnellsburg Water Co., gravity supply main.

Mifflinburg; municipal water works system, concrete storage reservoir.

Farmville, S. C.—$40,000 water, sewerage and electric light extension bonds will be sold by B. A. Joyner, Mayor, Aug. 17.

Atlanta, Ga.—An election will probably soon be held to vote on issuing bonds for water works improvements as follows: For 20,000,000 gal. pump with boilers and equipment at Station No. 1, $175,000; new 20,000,000 gal. pump, with all connections and equipment at Station No. 2, $175,000; additional coagulating basins and land for same, $125,000; new supply main for Chattahoochee River to reservoir, $100,000; duplicate intake from river to pump well No. 1, $40,000; completing connections of 48-in. line from coagulating basin to filters, $10,000; construction of dams in river and removal of shoals, $10,000.

Columbus, Ga.—Item recently reported under Columbus that filter plant was recommended should have been under Phenix City. O. O. Blackmon is Supt. Water Works, at Phenix City, Ga., (P. O. is R. D. Eatonton, Ga.), and Dudley Chipley is Supt. Water Works at Columbus.

Dunedin, Fla.—Election will soon be held to vote $25,000 bonds for water works, sewers and paving. Engineer, J. N. Drew, Clearwater.

Columbia, Tenn.—Columbia Water & Light Co., has entered into contract with City to install a filtration plant, daily capacity about 1,000,000 gal. every 24 hrs., water supply from Duck River; also to construct necessary buildings, etc. It will also construct new fire hydrants, pipes and mains, install new street lighting system, and provide for a White-Way system. Company will be ready to let contract for filtration plant and other apparatus and appliances between Aug. 5 and 15. Address, J. S. Robinson, Secy. and Supt.

West Park, Ohio.—Reported bonds for $10,000 for improving water system will be sold Aug. 17 by Fredk. Feuchter, City Clk.

Zanesville, Ohio.—State Bd. of Health reported to have approved plans for a well system.

City proposed constructing three c.-i. pipe lines of 16-in. and 12-in. diameter. W. W. Roach, Dir. Pub. Service.

Murphysboro, Ill.—Murphysboro Water Works & Electric & Gas Light Co. have engaged Edward Flad & Co., St. Louis, Mo., in connection with installation of filter plant for water works.

Oshkosh, Wis.—Plans being prepared by Henry A. Allen, Chicago, Ill., for filtration plant. John Mulva, Mayor.

Broken Bow, Neb.—City Council reported to have rescinded recent action awarding contract for new water works and electric light plant, and will receive new bids, from plans of Engineer Sturtevant of Holdredge, Neb.

Hamilton, Mont.—City Council considering establishment of municipal water works and distributing system.

Star City, Ark.—City Council reported to have granted Star City Water & Sewer

Contracting News

Of Special Interest to Engineers, Contractors, Builders and Manufacturers of Engineering and Building Supplies

Co. franchise for water works. D. A. McIntosh and J. C. Hellums, of Collins, Miss., reported interested.

Lockhart, Tex.—E. B. Cooper, Pres. First National Bank, reported interested in construction of water works, electric light and ice plant.

Denver, Col. — City Public Utilities Comn. (A. Lincoln Fellows, Pres.) reported to have engaged Van Sant-Houghton Eng. Co., San Francisco, Cal., to make survey of supply and distribution system and prepare plans and specifications for proposed municipal water works; total cost $8,000,000.

Kirkland, Wash.—Reported City Council rejected bids for construction of water main system in Dist. 32, and will do work under direction of City Engineer.

Seattle, Wash.—Mayor Hiram C. Gill, in a message to City Council, states that no more money should be spent in connection with Cedar River reservoir until further investigation is made. This recommendation is in connection with request of Chamber of Commerce, Municipal League and Pacific Northwest Society of Engineers. It is urged that a board of 5 engineers be employed to investigate and report best method to be adopted in order to make basin back of the $1,500,000 masonry dam available.

Milwaukie, Ore.—Reported City Council will shortly call election to vote on issuing bonds to complete distribution system.

Vernal, Utah—George A. Davis, City Recorder, writes that it is not intended to extend water system this year, but may do some work next year.

San Juan, P. R.—No bids opened July 9 Quartermaster, U. S. A., to furnish material and construct 70,000-gal. steel standpipe or tank and trestle at Fort El Morro, on account of a change of plans. New bids will be called for.

Pacific, Wash.—City contemplates installation of water works.

Montreal, Que.—Local press reports state that the Bd. of Control has rescinded its action of last June in appointing New York engineers to prepare plans for enlargement of filtration plant, and local engineers will probably make the new plans, in order to save duty, etc.

Port Arthur, Ont.—City Council decided to purchase 200 water meters. F. M. Jones, City Engr.

BIDS DESIRED.

Ilion, N. Y.—Until Aug. 3 (readvertisement), by Bd. Water Comrs. (Geo. R. Russell, Secy.), for furnishing about 3½ miles 10-in. c.-i. pipe and constructing a concrete diverting dam, intake chamber and gate house. J. D. Ringwood, City Engr.

Wellsville, N. Y.—Until Aug. 25 by Bd. Water and Light Comrs. (F. M. Leonard, Acting Clk.) for water works improvements, advertised in Engineering Record. Work includes three contracts, as follows: First, valves, valve boxes and hydrants; second, storage reservoir, filters and control house, reservoirs, gate house and piping, and third, piping system, force main, intake dam and intake chamber, intake pipe line and pump well. Engineer, Charles C. Hopkins, Rochester.

Philadelphia, Pa.—Until Aug. 12 by M. L. Cooke, Dir. Dept. Pub. Wks., for the following: Furnishing pipe and specials, laying pipe and specials, mechanical stoker equipment, retaining wall, concrete valve boxes, steel and concrete trestles, roof and sash for tank and fan house.

Pittsburgh, Pa.—Until Aug. 6 by Dept. Pub. Wks. (Robert Swan, Dir.), for construction of foundations and appurtenances at Brilliant Pumping Station. Contr. 13-F.

Clearwater, Fla.—Until Aug. 3 by County Comrs., Clearwater, for furnishing material and installing a modern water works plant and necessary plumbing, including sanitary system and small septic tank for convict camp. Clements McMullen, Co. Highway Engr., Largo.

Sumner, Miss.—Until Aug. 6 by Mayor and Aldermen, for 25 hp. kerosene engine, 300 g.p.m. centrifugal pump in unit, erected; 50,000 gal. steel tank, 100 ft. tower; 50,000 gal. concrete reservoir, 4500 lin. ft. 8-in. sewers, pipe separate. Dabney Eng. Co., Engrs., Memphis, Tenn.

Cleveland, Ohio.—Until Aug. 4, by A. B. Callow, Comr. Purchases and Supplies, for 42-in. riveted steel pipe for Div. of Water; also additional steel work for Division Avenue Pumping Station.

West Allis, Wis.—Reported desired until Aug. 6, for installing water mains and laying hydrants in 7 streets. George Mahoney, City Clk.

Choteau, Mont.—Until Aug. 9 by A. L. Powers, Town Clk., for constructing water works from plans of Swearingin & McCulloh, of Choteau. Work includes electric-driven pumps delivering 600 gal. per minute, reservoir holding 200,000 gals. on elevation 186 ft. above city, iron and steel pipe from 6 to 10 in. diameter. Cost, $42,000.

St. Louis, Mo.—Until Aug. 13 according to press reports by Bd. Pub. Service (William T. Findly, Secy.), for some construction work on Compton Hill Reservoir at a cost of $40,000.

Arcadia, Cal.—Until Aug. 5 by George E. Grimes, City Clk., for constructing two approximately 1,000,000 gal. reservoirs.

Drumheller, Alta.—Until Aug. 16 by O. McKee, Secy.-Treas., for contracts as follows: Furnishing about one mile 6 and 4 in. steel or c.i. pipe; furnishing valves and hydrants; furnishing a H. R. T. boiler and stack; furnishing a duplex pump; furnishing material for 30,000 gal. wood tank and housing; all labor and certain materials for laying water mains, sinking an open well, constructing pumping station and erecting a wood tank and housing.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Mifflinburg, Pa.**—Following are totals of 4 lowest bids opened July 22 by Borough Council for constructing 500,000-gal. concrete reservoir from plans of Alexander Potter, 50 Church Street, New York: F. H. Gimberling, Selins Grove, $3,979 (awarded contract); G. A. & F. M. Wagman Co., Dallastown, $4,286; N. R. Porterfield, New York, $4,979; Kelly & Wheeler, Buffalo, N. Y., $5,155; Engineer's estimate, $5,195.

Unit prices of F. H. Gimberling, successful bidder:

800 cu. yd. excav.	$1.35
262 cu. yd. concrete masonry	5.50
440 bbl. of cement	1.55
33,000 lb. steel reinforcements	0.015
65 lin. ft. of 8-in. c.-i. pipe	0.55
87 lin. ft. of 6-in. c.-i. pipe	0.41
830 lb. c.-i. pipe specials	0.09
2 8-in. gate valves	55.00
1 6-in. gate valve	25.00

★**Baltimore, Md.**—Contract awarded July 14 by Bd. of Awards to Westinghouse Electric & Mfg. Co., Pittsburgh, Pa., at $12,538, for a 20,000,000-gal. centrifugal pump and electric power equipment for Eastern pumping station, Water Dept. Ezra B. Whitman, Consulting Engr.

★**Covington, Ky.**—Contract awarded to U. S. Cast Iron Pipe & Fdry. Co., Chicago, Ill., by J. Mason Howk, Comr. Pub. Property, for pipe trenching and filling (bids opened July 20), at $92,000. Total length of trenching for 24-in. main is 10,950 ft., of which 3650 ft. is in rock or creek bed and 7300 ft. in earth. Rock excavation will amount to about 1600 cu. yd. and trenching for cross-connecting the mains with the present distributing pipe system, about 1000 ft. made up of 6 to 12-in. pipe. George Hornung, Engr., Wool-Sack Building, Newport.

★**Clayton, Del.**—Contract awarded by Town Council for water supply, sewerage system and disposal plant, to Ambler Davis Co., Philadelphia, Pa., from plans of Herbert W. Hatton, Consulting Engr., Equitable Bldg., Wilmington, at the following detailed bid:

1,200 ft. 4 in. cast iron	$0.50
1,300 ft. 6 in. cast iron	0.69
Three fire hydrants	39.07
Ten 4 in. valves	14.00
Six 6 in. valves	21.00
Two 1 in. air valves	6.00
⅝ in. service pipe, per ft.	0.15
200 ft. 3 in. wells, per ft.	2.00
3 in. screen and point, ft.	1.60
320 ft. 2 in. wells, per ft.	1.70
Tower and tank (lump sum)	3,062.00
160 ft. 4 in. flange pipe	0.85
160 ft. 6 in. flange pipe	1.25
100 ft. 3 in. flange pipe	0.60
2 in. galv. pipe, per ft.	0.25
2 in valves, to set	3.00
4 in. valves, to set	10.00
6 in. valves, to set	16.50
Ten 3 in valves, to set	8.00
8 in. pipe, 6,500 ft., 4 to 6 ft. deep	0.34
1,200 ft. 6 to 8 ft. deep	0.40
8 to 10 ft. deep	0.48
10 to 12 ft. deep	0.58
12 to 14 ft. deep	0.70
14 to 16 ft. deep	0.84
100 ft. 8 in c.i. pipe, 8 to 12 ft. deep	2.00
10 in 6 to 8 ft. deep	0.48
8 to 10 ft. deep	0.56
300 ft. 10 to 12 ft. deep	0.70
1,500 ft. 12 to 14 ft. deep	0.84
200 ft. 14 to 16 ft. deep	1.00
16 to 20 ft. deep	1.34
200 ft. 12 in. c.i. pipe 0 to 4 ft. deep	0.43
700 ft. 4 to 6 ft. deep	0.54
400 ft. 6 to 8 ft. deep	0.66
100 ft. 8 to 10 ft. deep	0.78
100 ft. 10 to 12 ft. deep	0.94
200 ft. 12 to 14 ft. deep	1.12
14 to 16 ft. deep	1.32
5 in. connections	0.24
300 8 in. Y-branches	0.60
70 10 in. Y-branches	0.75
10 12 in. Y-branches	1.00
320 ft. of manholes	2.25
Sludge bed	135.00
Engine and pump, etc.	220.00
Tank and house	2,625.00
Three-lamp poles, each	1.50
Total	$18,285.86

★**Cincinnati, Ohio.**—Contract awarded July 22 by Edward P. Durr, Secy., Director Public Service, for laying c.-i. pipe, special castings and valves and other miscellaneous work in connection with high-pressure fire system in Central Avenue and Sixth Street, to Kirchner Constr. Co., 221 W. Ninth Street, at $13,555. Next 2 lowest bids: M. J. McCarthy, Cincinnati, $14,427, and T. P. Strack, Cincinnati, $16,621.

★**Kenosha, Wis. — Contract** awarded July 26 by Bd. Water Comrs. to Geo. A. Greene, Green Bay, for 42-in. c. i. intake, a submerged intake crib, and a 24-in. main under harbor. B. C. Brennan, City Engr.

★**Keota, Iowa.**—Contract awarded July 20 for constructing water works to Bash & Jane, Joplin, Mo. Work includes an 8-ft. well, 100 ft. deep, pumping station, deep well engine, 80-000-gal. steel tank and 6 miles mains. Charles P. Chase, Engr., Clinton.

★**Dallas, Tex.**—Local press reports state that Bd. City Comrs. have awarded contract for 12,500 water meters equally between Thompson Meter Co. and Neptune Water Co.

★**Lehigh, Okla.**—Contract awarded to W. C. Swansick, Joplin, Mo., for water works extensions from plans of Benham Eng. Co., Oklahoma City; cost about $38,600.

SEWERAGE AND SEWAGE DISPOSAL

PROPOSED WORK.

Portland, Me.—Council has been asked to appropriate $30,000 for new sewers.

Buffalo, N. Y.—Aldermanic Com. on Sewers voted to approve purchase of a 60-ft. strip in the bed of Scalaquada Creek for construction of an 18-ft. concrete culvert from Genesee St. to Main St., emptying into Delaware Park Lake.

Buffalo, N. Y.—Construction of tile sewers in Hanover, Holly Lake and Mississippi Streets has been authorized by Common Council.

Pitman, N. J.—Borough Council reported to have selected Remington & Vosbury, Camden, as engineers for new sewer system. Election to vote on issuing $100,000 bonds will soon be held.

Franklin, Pa.—Borough Council considering construction of sanitary sewer system.

Pennsylvania. — Following are among permits issued by State Dept. of Health, Harrisburg:
Philadelphia—Lateral sewer extensions.
Greensburg—Lateral sewer extensions.
Perkasie — Remodel sewage treatment works. Philip Cressman, owner of system.
Sellersville—Sanitary sewer system.
Smethport—Sewer extensions.
State College—Sewage treatment plant.
Bellwood—Sanitary sewer system.
Juniata—Sanitary sewer system.
Upper Darby Township, Delaware County—Approval of site for sewage treatment works.
West End—Sewer extensions.
York—Sewer extensions.

West Chester, Pa.—N. R. Rambo, Boro. Engr., preparing tentative plans preliminary to construction of a sewage pumping station at Everhart Grove.

Wilmington, Del.—Mayor Price has signed ordinance authorizing city to borrow $50,000 for extension of Brandywine intercepting sewer.

Richmond, Va. — The Administrative Board has adopted plan of Commissioner John Hirschberg to improve the eastern section of the city by installation of sewers to eliminate all dry closets; estimated cost, $42,000.

Farmville, S. C.—See "Water Works."

Atlanta, Ga.—Election will soon be held to vote on issuing $1,000,000 bonds for sewers and extension of disposal plants.

Dunedin, Fla.—See "Water Works."

Meridian, Miss.—Citizens voted $25,000 bonds July 23 for sanitary sewers and concrete bridges. Bonds have been sold. R. Blanks, City Clk.

Lafayette, Ind.—H. B. Obersch, Jr., City Engr., writes that preliminary survey has been started for storm and sanitary sewer, but no bids for construction will be called for this year.

East Grand Rapids, Mich.—See under "Prices and Lettings."

Chrisman, Ill.—Plans being prepared by George A. Fair, Chrisman, for brick and concrete sewer; cost $9,500. Frank McCuddy, City Clk.

East St. Louis, Ill.—E. F. Harper, City Engr., instructed by Bd of Local Improv. to prepare plans for construction of the Bowman Avenue sewer to extend from First to Sixteenth Street.

Clinton, Iowa—City Council reported to have decided to install sewer in 4th Ward, to cost about $80,000.

Norton, Kan.—Plans being prepared by Worley & Black, Kansas City, Mo., for construction of sewer system. V. Fawcett, City Clk.

Crofton, Neb.—City will install sewer system and septic tank to cost about $8,000, from plans of J. D. Clair Smith of Hartington.

Austin, Tex.—Citizens voted $50,000 for sanitary sewer extensions and $225,000 for storm sewers and a number of small bridges. M. C. Wellborn, City Engr.

Port Angeles, Wash.—All bids for constructing Francis Street sewer rejected; new bids to be received. Lowest bid was $9,320.

Santa Ana, Tex.—Citizens voted to issue bonds for sewers.

Trinidad, Colo.—We are informed that sewage disposal plant construction has been postponed until 1917. C. T. Day, Asst. City Engr.

Tacoma, Wash.—City Council authorized construction of 8-in. sanitary pipe sewers on Berde, Cheyenne and N. Thirty-third Streets to N. Thirty-fifth Street, and along N. Thirty-fifth Street to a connection with present sewer at Berde Street.

Stockton, Cal.—Bonds for $230,000 for installing sanitary and storm water systems will be sold Aug. 10 by City Clerk.

BIDS DESIRED.

New York, N. Y.—Until Aug. 3 by Marcus M. Marks, Pres. Boro. Manhattan, for relocating and reconstructing Rector St. sewer. Security, $7,000.

Paterson, N. J.—Until Aug. 3 by Bd. Pub. Wks., for constructing sewers in Knickerbocker Avenue, Kearney, E. Nineteenth. Turner, Marion and several other streets. H. J. Harder, City Engr.

Greenville, S. C.—Until Aug. 10 by C. P. Ballenger, City Engr., for about 19,000 lin. ft. 8-in. sanitary sewer, with manholes, flush tanks, etc., advertised in Engineering Record.

Sumner, Miss.—See "Water Works."

Cincinnati, Ohio.—Until Aug. 3 by Director Dept. Pub. Wks. (Parke S. Johnson, Secy.) for constructing sewers in Hoge, Street, Schiff, Handman and St. Lawrence Avenues.

Chicago, Ill.—Until Aug. 5 by Bd. Local Improv. (Edward J. Glackin, Secy.) for constructing tile pipe sewers in portions of Kimball and Oak Park Avenues, W. Sixty-ninth, S. Morgan and a number of other streets.

West Allis, Wis.—Reported desired until Aug. 6, for constructing sewers in various streets. George Mahoney, City Clk.

Fairfield, Iowa.—Reported desired until Aug. 7. by City Clerk for constructing sanitary sewers; probable cost, $10,000.

La Porte, Iowa.—Until Aug. 4 by G. E. Stebbins, Town Clk., for constructing sewers and disposal plant, to consist of 22,160 lin. ft. 8 to 15 in. vitr. pipe sewers, 54 manholes, 13 flush tanks, two filter beds, sewage ejector pump and well. M. Tschirgi & Sons, Engrs., American Trust Bldg., Cedar Rapids.

St. Paul, Minn.—Reported desired until Aug. 2 by August Hohenstein, Purchasing Agt., for constructing sewers in Glenham, Maplewood and Medford Avenues.

Norton, Kan.—Until Aug. 2 by Vernie Fawcett, City Clk., for constructing main outfall sewer and purification plant, intercepting sewers in Intercepting Sewer Dist. No. 1. lateral sewers in Sewer Dists. Nos. 1 to 13 inclusive. Worley & Black, Engrs., Reliance Building, Kansas City, Mo.

Mitchell, S. D.—Reported desired until Aug. 2, by Thomas Estacott, City Aud., for constructing sewers in various streets.

Watertown, S. D.—Until Aug. 16 by O. M. Lane, City Aud., for constructing sewers and system of sewerage, requiring 10,642 ft. 15, 18, 30 and 33 in. sanitary sewers, 9688 ft. 36, 42 and 57 in. concrete storm sewers or equivalent special sections, 1417 ft. 4 ft. 0 in. x 2 ft. 6 in. concrete storm sewer, also 27,450 cu. yd. excavation for open storm water ditch; total estimated cost, $105,000.

St. Louis, Mo.—Until Aug. 6 by Bd. Pub. Service (William T. Findly, Secy.) for constructing Florissant Avenue sewer, Extension Nos. 1 and 2, and Florissant Avenue inlet line, requiring approximately 422 ft. 5 ft. 20 ft., 33 in. inside diameter circular brick sewer, 2180 ft. 18, 15 and 12-in. vitr. clay pipe sewer.

Beeville, Tex.—Until Aug. 20, by W. G. Gayle, City Clk., for extending sewer system, from plans of Bartlett & Ranney of San Antonio. Bonds will be sold Aug. 2.

Sand Springs, Okla.—Until Sept. 1 by City Clerk for constructing 8350 ft. 6 in. pipe sewers; average depth 8 ft.; cost $4,000.

Steamboat Springs, Col.—Until Aug. 9 by Town Council for sanitary sewer system; estimated cost $62,000; advertised in Engineering Record. B. G. Bradley, Town Engr.

Enumclaw, Wash.—Until 6 P. M. Aug. 3 by O. E. Magnuson, City Clk., for construction of sanitary sewer system, consisting of 6486 ft. trench, laying pipe, 17 manholes, etc. W. I. Lippard, Engr., Enumclaw.

Toronto, Ont.—Until Aug. 2, by T. L. Church (Mayor), Chmn. Bd. Control, for constructing sewers in Jones Avenue, Queen Street.

PRICES AND LETTINGS.

★Indicates award of contract

★**Andover, Mass.**—Contract awarded July [illegible] Record Pub Wks. for constructing about [illegible] ft sewers, to Cenedella & Co., Milford, at $32,739. Other bids: Philip Richard, Lawrence, $39,980, and John Wasserback, Lawrence, $40,242.

★**New Haven, Conn.**—Contract reported awarded July 16 by Bd. Pub. Wks. to Dwyer & Mannix, 335 Shelton Ave., for constructing Whalley Ave. sewer, at $81,002. F. L. Ford, City Engr.

★**New Haven, Conn.**—Contract reported awarded to Dwyer & Mannix, 335 Shelton Avenue, for constructing sewers through Whalley Avenue, at $81,000.

Fairport, N. Y.—Following are 3 lowest bids opened July 22 by Village Board (K. L. Williams, Clk.) for 1 mile of 8 and 10-in. sewers from plans of C. F. Fisher, 128 Flower City Park, Rochester: H. & S. Francesco Co., Rochester, $5,995; William L. Pfeffer, Rochester, $7,753; Ralph F. Reiss, Utica, $7,814.

★**Yonkers, N. Y.**—Contract reported to Joseph Ciamelli & Son, Yonkers, for constructing sewer and storm water sewer in Fortheld Street, at $14,700.

★**Camden, N. J.**—Contract awarded by Com. on Streets and Highways for constructing sewers in Chelton Avenue, Fairview and N. Sixth Streets to F. A. Ward, 524 Trenton Avenue, at 99 cts., $1.19 and $1.25 per lin. ft.

★**Ocean City, Md.**—Contract awarded July 25 by Mayor and Council (J. M. Mumford, Secy.) for constructing sewage pumping station, clarification tank, intercepting and branch sewers, to Boyle-Lattomus Constr Co., Calvert Building, Baltimore, at $14,296. Pugh & Hubbard, Engrs., 731 Witherspoon Building, Philadelphia, Pa.

★**East Grand Rapids, Mich.**—Contract reported awarded by Village Council to Albert H. Franks, Grand Rapids, for sewer system, at $36,916. Plans being prepared for sewage disposal plant.

★**Milwaukee, Wis.**—Contract awarded by Sewerage Comn. (John H. Fowles, Secy.) for constructing a plant for treating a part of sewage to John F. Casey Co., Pittsburgh, Pa., at $55,000 (bids opened July 22). Other bids: Hansen Constr. Co., Milwaukee, Wis., $65,308; U. S. Dredge & Dock Co., Chicago, Ill., $46,570.

★**Whitewater, Wis.**—Contract for constructing sewers awarded July 20 to A. M. Lorman, Waukegon, Ill., at $23,900. Next 3 lowest bids: A. C. Schreiter, Manitowoc, $25,[illegible]; F. E. Kaminski, Watertown, $28,549; Peter Borst, Port Washington, $31,210. A. N. Sawer, City Clk.

★**Eveleth, Minn.**—Contract awarded for constructing sewage disposal plant, Imhoff tank and sludge bed to Eveleth Constr Co., Eveleth, at $12,595 (bids opened July 20). C. M. Dorway, City Engr.

★**Omaha, Neb.**—Contract reported awarded to James Jenson, of Omaha, for construction of storm water sewer from Thirty-sixth Avenue to junction with Everett Place sewer in Fontenelle Park, at $39,546.

★**Springfield, Mo.**—Contract awarded July [illegible] for constructing sewer in Dist. 22 of Section 3 to Plumner-Adams Co., Springfield, at $9,153. Work includes [illegible] ft. 8-in. and 967 ft. 10-in. pipe, 71 lampholes, 5 flush tanks, 29 manholes and [illegible] cu. yd. excav. Next 3 lowest bids: W. W. Whitaker, Springfield, $9,222; C. H. McMurry, Springfield, $9,871; John Spandri, Springfield, $9,992.

Portland, Ore.—Following are bids recently received by City Council for constructing reinforced concrete sewer in East Adler Street, East Second Street, to Willamette River, Acme Contract Co., Portland, $21,106; Girbach & Joplin, Portland, $25,[illegible].

BRIDGES

PROPOSED WORK.

Salem, Mass.—County Comrs. and cities of Salem and Beverly will about Oct. 1 let contract for construction of a bridge between Salem and Beverly; it will probably be let in three sections; total cost, $125,000.

Woonsocket, R. I.—Plans being prepared by Frank H. Mills, City Engr., for concrete highway bridges to be constructed over Blackstone River. Appropriation available $90,000.

Reading, Pa.—Plans of Philadelphia & Reading Ry. Co. (S. T. Wagner, Ch. Engr., Philadelphia) have been approved by City Engineer for three concrete bridges to be erected at Center Avenue, Fourth Street and Schuylkill Avenue, to cost about $75,000.

Portsmouth, Va.—Construction of concrete bridge over Tanner's Creek on Jamestown Boulevard contemplated by County Road Bd. at Portsmouth.

Spartanburg, S. C.—Contract about to be let by Southern Ry Co. (W. H. Wells, Ch. Engr., Washington, D. C.) for constructing concrete bridge over railroad tracks at Church Street.

Springfield, Ga.—Effingham and Bullock Counties will construct a bridge over Ogeechee River at Elkins Landing. Cost $5,000. Statesboro County seat Bullock County.

Cocoa, Fla.—C. M. Rogers, Daytona, engaged to prepare plans for concrete bridge 1¼ miles in length across Indian River at Cocoa.

St. Francisville, La.—Police Jury of West Feliciana Parish voted an appropriation of $25,000 for erecting bridges over streams of county.

Dandridge, Tenn.—County Court appropriated $5,000 toward constructing steel bridge over Houston River near Jefferson City.

Green Bay, Wis.—City contemplates constructing 2 highway bridges, one a Strauss bascule, to cost $50,000, and a swing, cost $5,000. Felix Biemeret, Ch. Com. Streets and Bridges, 909 Main Street. Aug. Brauns, City Engr.

Austin, Tex.—See "Sewerage and Sewage Disposal."

Walla Walla, Wash.—Grova Cookerly, County Engineer, directed to prepare plans for constructing steel bridge over Walla Walla River at Swegle Crossing; cost about $18,000.

BIDS DESIRED.

Montpelier, Vt.—Reported desired until Aug. 2 by J. M. Boutwell, Mayor, for constructing a steel girder bridge with concrete floor on State Street.

Woonsocket, R. I.—Until Aug. 9 by Bd. of Aldermen for building 2 reinforced concrete bridges on Clinton St., advertised in Engineering Record. Frank H. Mills, City Engr.

Westport, Conn.—Until Aug. 10 by C. J. Bennett, State Highway Comr., Hartford, for constructing 12-span reinforced concrete girder highway bridge over Saugatuck River, advertised in Engineering Record.

Harrisburg, Pa.—Until Aug. 11 by Henry W. Cough, County Controller, for rebuilding County bridge over lines of P. & R. Ry., Nineteenth Street, to be of reinforced concrete, bow string arch.

Grimesland, N. C.—Reported desired until Aug. 2 by County Comrs., Greenville (Brascoe Bell, Clk.), for constructing reinforced concrete bridge across Chicod Creek near Grimesland.

Athens, Ga.—Until Aug. 17 by Tate Wright, City Clerk, for new abutments and raising existing piers, advertised in Engineering Record.

Hamilton, Ga.—Until Aug. 7 by County Comrs. for constructing steel bridge over Mulberry Creek, 2 miles north of Waverly Hall, to consist of a 40-ft. span with 16-ft. roadway with banisters and concrete floor.

Marysville, Ohio.—Until Aug. 16 by Charles A. Morelock, Co. Aud., for furnishing material and constructing substructures and superstructures of bridges as follows: Ford Bridge, 125-ft. span, 16-ft. roadway, over Bokes Creek, Taylor Township; Evan T. Jones Bridge, 90-ft. span, 16-ft. roadway, over Fulton Creek, Claibourne Township; McCullough Bridge, 75-ft. span, 16-ft. roadway, over Robinson Run, Jerome Township; Temple Bridge, 60-ft. span, 16-ft. roadway, over Rush Creek, Washington Township.

Girard, Kan.—Reported desired until Aug. 11 by County Comrs. for steel or reinforced concrete or steel bridges to include the construction of 3 new bridges and removal of 2 old ones to other locations. Probable cost of steel bridges, $7,475, and reinforced concrete, $9,717.

Richmond, Mo.—Reported desired until Aug. 4 by Howard M. Shirkey, Co. Clk., for constructing three concrete bridges.

Tulsa, Okla.—Until Aug. 26 by Bd. Co. Comrs. for constructing reinforced concrete bridge over Arkansas River, at Tulsa, advertised in Engineering Record. Engineers, Harrington, Howard & Ash, Kansas City, Mo.

Wagoner, Okla.—Reported desired until Aug. 2 by County Comrs. for constructing two 60-ft. steel approaches to a steel bridge over Ditch D, Verdigris Drainage Dist. No. 1.

Coloma, Cal.—Until Aug. 16, according to press reports by County Supervisors at Placerville for constructing a steel truss bridge across the South Fork of the American River. Probable cost, $10,000.

Kennett, Cal.—Until Aug. 21 according to press reports by County Superv., Redding, for constructing a combination reinforced concrete and wooden structure of 3 spans of 200 ft. each, with approaches, 80 ft. in length at each end. Probable cost, $40,000.

Visalia, Cal.—Until Aug. 16 by County Clerk for constructing 400-ft. concrete bridge on concrete foundation over Kings River on state highway; cost, $20,000.

PRICES AND LETTINGS.

★Indicates award of contract.

★**Sayreville, N. J.**—Contract for constructing drawbridge over South River at Sayreville awarded by County Bd. Freeholders at New Brunswick to General Engineering and Contr. Co., New York City, at $66,714.

★**West Chester, Pa.**—Contract awarded July 26 for constructing 65 ft. span bridge over Brandywine Creek to Dunleavy Bros., Coatesville, at $6,500. Isaac Y. Ash, County Controller.

Youngstown, Ohio.—See "Paving and Roads."

★**Indianapolis, Ind.**—Contract for constructing two additional spans to bridge over White River at West Washington Street awarded by Bd. Pub. Wks. to National Concrete Co., Indianapolis, at $110,000.

★**Lansing, Mich.**—Contracts awarded by Frank F. Rogers, State Highway Comr., for constructing trunk line bridges (bids opened July 9).

Bridge 24—Over Sturgeon River, Chasseli Township, Houghton County, 2 piers, 2 abutments and approach floors, to Illinois Bridge Co., Chicago, Ill., at $5377.

Bridge 43—Over Sugar River, Gladwin Township, Gladwin County, substructure to E. C. Nolan & Son, Edenville, Mich., at $2610, and superstructure to American Bridge Co., Detroit, at 2.9 cts. per 100 lb.; estimated weight 48,300 lb.

Bridge 45—Over Eagle River, Houghton Township, Keweenaw County, substructure and floor to Smith-Byers-Sparks Company, Houghton, at $1528.82, and superstructure to Wisconsin Bridge Co., Milwaukee, Wis., at 3.49 cts. per 100 lb.; estimated weight 72,000 lb.

Bridge 52—Over Pine River, Wales Township, St. Clair County, Illinois Bridge Co., Chicago, Ill., at $2347.

Bridge 54—Over Eagle River, Houghton Township, Keweenaw County, substructure and floor to Smith-Byers-Sparks Company, Houghton, and superstructure to Michigan Bridge & Pipe Co., Lansing, at 3.35 cts. per 100 lb.; estimated weight 36,000 lb.

★**Lewiston, Ill.**—Contract for constructing Bernadotee bridge 5 miles north of Ipawa, awarded to Central States Bridge Co., Indianapolis, Ind. To be of steel and have three spans, totaling 255 ft.; concrete foundation.

★**Peoria, Ill.**—Contract for concrete abutment and wing wall, also superstructure of bridges on Fisher Rd., awarded to Barnewolt Constr. Co., Peoria, at $2,484. Walter E. Emery, Co. Supt. of Highways.

★**Holton, Kan.**—Contract awarded July 25 by Co. Comrs. for constructing one 50, one 60 and one 70-ft. steel bridge to Vincennes Bridge Co., Vincennes, Ind. William H. Webster, Co. Clk.

★**Tecumseh, Neb.**—Contract awarded July 21 for steel highway bridge over North Canadian River at Beard Street to Kansas City Bridge Co., Kansas City, at $5,570. B. B. Wyatt, Deputy County Clk.

★**Hardin, Mont.**—Contracts awarded by Co. Comrs. (R. P. Ross, Clk), for constructing bridges as follows (bids opened July 21): To Security Bridge Co., Billings, for Hardin bridge, at $27,622, and Sarpy bridge at $8,540; and to Jess Stout, Sheridan, Wyo., for Wyola bridge at $3,798.

★**Lajunta, Col.**—Contract awarded by Co. Comrs. for reinforced concrete bridge over Anderson Arroyo of Fifth Street in Lajunta, including removal of present bridge, one 75-ft. arch or two 50-ft. arches, to Pueblo Bridge Co., Pueblo, at $6,640.

★**Colville, Wash.**—Contract awarded by Co. Comrs. for constructing a steel truss highway bridge near Kettle Falls, to Northwestern Paving Co., Spokane, at $3,500. R. B. Thomas, Co. Engr.

Seattle, Wash.—Following are lowest bids opened July 23 by Bd. Pub. Wks. (C. B. Bagley, Secy.) for constructing 2 steel bascule bridges on concrete foundations:

Fifteenth Avenue N. W., over Salmon Bay Waterway: Substructure, Booker, Kiel & Whipple, Central Bldg., $92,145; superstructure, Beers Bldg. Co., Pittock Bldg., Portland, Ore., $146,049.

Fremont Avenue bridge, over Lake Washington Canal: Substructure, Pacific States Constr. Co., Burke Bldg., $112,651. F. A. Rapp, Structural Engr., Room 307, City Hall.

★**Seattle, Wash.**—Contract for constructing steel swing span bridge over Duwamish River awarded by County Comrs. (bids opened July 20) to Manhattan Contr. Co., Central Building, at $26,594.

★**Tacoma, Wash.**—Contract awarded by city for constructing S. Thirty-fourth Street bridge to Graff & Sheldon, at lump sum bid of $10,894. Next 3 lowest bids: M. Hugh & Johnson, $11,709; A. Rydstrom, $11,758; Bachelor Bros., $12,250.

★**Eugene, Ore.**—Contract for constructing Coast Fork wooden bridge, awarded to Portland Bridge Co., Portland, at $9,450. Stacy M. Russell, Co. Clk.

★**Eugene, Ore.**—Contract for constructing wagon bridge over Coast Fork, Willamette River, awarded by County Comrs. July 19 to Portland Bridge Co., Portland, at $9,450.

PAVING AND ROADS

PROPOSED WORK

Buffalo, N. Y.—Contract is about to be let for paving Seventh Street, repaving Carolina, Jersey, Maryland and Virginia Streets.

Common Council voted to pave Tifft Street with brick, cost $25,000.

Buffalo, N. Y.—See "Railroads."

Patchogue, L. I., N. Y.—About $23,079 is to be spent for highway repairs in Patchogue by Bd. Supervisors.

Hilton, N. J.—Road Com. Bd. Chosen Freeholders at Newark voted to macadamize Springfield Avenue.

Brackenridge, Pa.—Citizens voted $35,000 bond issue for paving streets.

Camp Hill, Pa.—Citizens voted $30,000 bonds for paving Mark Street. Arthur W. Lebo, Boro. Secy.

Philadelphia, Pa.—Plans completed by Bureau Highways for paving Emerald Street, estimated cost $120,000.

Baltimore, Md.—Paving Comn. voted to pave Hillen, Fayette and Gold Streets with sheet asphalt.

Elkton, Md.—Bonds amounting to $25,000 sold by County Comrs. for constructing roads.

Jackson, N. C.—All bids opened July 10 by Bd. Road Comrs. Jackson Township (G. A. Moore, Secy.), for constructing 8 or 10 miles of clay-gravel and sand-clay roads have been rejected. No date yet set for new bids.

Dunedin, Fla.—See "Water Works."

Selma, Ala.—Dallas County Bd. Revenue voted to construct a road from Point Clear between Central Mills and Safford to Wilcox County Line about three miles.

Meridian, Miss.—See "Sewerage and Sewage Disposal."

Bexley, Ohio.—Reported bonds for $124,000 for improving streets will be sold Aug. 6 by Chas. E. Miller, Village Clk.

Chillicothe, Ohio.—H. M. Redd, City Engr., instructed to prepare plans and estimates for cement sidewalks, curbs and gutters on E. Water Street.

Lima, Ohio.—Contract will soon be let for 9000 sq. yds. brick paving on E. Pearl and State Streets. Cary Bryson, City Engr.

Belding, Mich.—Bonds for $40,000 will be sold Aug. 5 by F. E. Conant, City Clk., for paving Main, Bridge and Pleasant Streets, about 18,000 sq. yd. Material not yet selected. Engineers, Smith & Boulay Co., Nasby Building, Toledo, Ohio.

New York, N. Y.—Following are 4 lowest bids opened July 15 by Douglas Mathewson, Pres. borough of the Bronx, for constructing sewers and appurtenances in Randall and Pennyx River Avenues: (a) Rodgers & Hagerty, Inc., 152d Street and Harlem River, $30,806; (b) Joseph L. Sigretto & Co., Fort Schuyler Road, $31,868; (c) Lawrence Constr Co., 2409 Walton Avenue, $39,944; Hanover Contr. Co., 271 W. 125th Street, [illegible].

	(a)	(b)	(c)	(d)
Concrete Sewers:				
$14 lin. ft. 6 ft. 9 in. x 6 ft.	$14.20	$14.26	$17.00	$17.00
557 lin. ft. 6 ft. 6 in. x 6 ft.	14.20	14.26	16.00	16.00
211 lin. ft. 6 ft. 3 in. x 6 ft.	12.90	14.26	15.00	15.00
213 lin. ft. 5 ft. 6 in. x 6 ft.	10.35	14.26	11.00	13.00
1,516 lin. ft. 5 ft. 3 in. x 6 ft.	11.40	14.26	12.80	13.00
Vitrified Pipe Sewer				
70 lin. ft. 20 in.	1.70	3.00	4.00	5.00
32 lin. ft. 12 in.	1.75	2.50	3.25	4.00
38 lin. ft. 10 in.	0.60	1.50	3.25	3.00
524 lin. ft. 12 in.	1.25	1.50	2.25	2.75
6 lin. ft. of wash connections	0.60	1.00	3.00	1.50
200 lin. ft. vitr. pipe drains, 12 to 30 in.	0.01	4.00	3.00	2.00
465 spurs for house connections	0.75	0.30	0.50	0.40
20 manholes	45.00	50.00	50.00	45.00
2,400 sq. yd. slope pavt.	0.50	0.01	0.50	0.60
1,200 cu. yd. rock excav.	2.00	4.00	3.00	3.50
1,450 cu. yd. Class B concrete	7.50	5.00	6.50	6.50
32 cu. yd. Class C concrete	6.00	5.00	6.50	6.00
50 cu. yd. dry rubble masonry	2.00	1.00	3.00	1.50
75 cu. yd. stone ballast	2.00	0.01	2.30	2.00
60,000 lb. of steel reinforcement bars.	0.02	0.03	0.03	0.03
2 M ft. timber	25.00	26.00	50.00	30.00
2 M ft. timber sheeting	0.01	0.01	40.00	40.00
62,000 lin. ft. piles	0.27	0.25	0.32	0.30

Paulding, Ohio.—Bonds amounting to $95,700 sold by county for road improvements.

Sheboygan, Wis.—City contemplates laying about 20,000 sq. yd. concrete paving during summer, in addition to paving now under way. C. U. Boley, City Engr.

Jefferson, Iowa.—City Council voted to pave 28 blocks of city streets.

Sioux City, Iowa—City Council voted to pave Perry Creek and Broken Kettle Roads, cost about $125,000.

University, Neb.—About $27,800 to be spent by city for street improvements.

York, Neb.—Citizens voted $25,000 bonds for intersection paving. Address A. B. Chatterton, City Clk.

Missoula, Mont.—Council considering paving of Pattee and E. Pine Streets with bitulithic, wood block or vitr. brick on 5-in. concrete foundation; cost, $35,000. L. E. Harris, City Clk.

St. Louis, Mo.—Bd. of Public Service recommended to Bd. of Aldermen street improvements as follow: Bernays Avenue with asphalt, $30,944; Theckla Avenue, asphalt, $14,670; January Avenue, brick, $19,705; Kaiser Street, telford, $6,073; Waterman Avenue, resurfacing brick pavement with asphalt, $5,800.

Austin, Tex.—Citizens voted $200,000 bonds for street improvements. M. C. Wellborn, City Engr.

San Antonio, Tex.—V. N. Zizly, Houston, has been selected to make survey of Kings Highway from Nacogdoches to San Antonio.

Pueblo, Col.—City will improve Mineral Palace Paving Dist. Work includes gravel surface streets, 197,300 sq. yd. curb and gutter, 34,250 lin. ft. storm sewers, including manholes, intakes, catch basins, etc.; total cost $50,743; it is also proposed to curb around parks in Abriendo Avenue, 11,700 lin. ft.; also to lay asphalt floors on C Street viaduct; also on E. Fourth Street viaduct. D. P. Gaymon, City Engr.

Aberdeen, Wash.—Contract about to be let by City Council for paving Washington Street; cost $16,000.

Bellingham, Wash.—City Council voted to pave Chestnut, Wharf, Maple Streets, construct concrete sidewalks on Newell, Mason, Garden, Humboldt, Chestnut and Whatcom Streets.

Eltopia, Wash.—About 6 miles road in Eltopia to be paved with crushed rock by Co. Comrs. at Pasco.

Everett, Wash.—Plans being prepared by J. W. Hoover, City Engineer, for constructing cement sidewalks on S. Rucker Ave.; cost, $15,000.

Seattle, Wash.—City Engineer estimates cost of paving as follows: E. and W. Green Lake Way, $123,936; Forty-seventh Avenue, $29,000; Donald Street, $16,000; Ninth Avenue South, $107,000.

Stevenson, Wash.—Citizens Skamania County voted $210,000 bonds for road improvements.

Tacoma, Wash.—City Council voted to pave South Tacoma Boulevard between S. Twenty-seventh to S. Thirty-eighth Streets; cost $38,000. City and county to share cost.

Plans being prepared by D. H. White, County Engr., for hard surfacing Pacific Highway from Country Club to Dupont; distance 5.6 miles; cost about $60,000.

Contract about to be let by County Comrs. for paving 7 mile highway between Orting and Alberton with concrete base and bitulithic surface.

Cottage Grove, Ore.—About $15,000 will be spent for macadamizing Pass Creek Canyon Road by State Highway Dept., at Salem.

Glenada, Ore.—About $10,000 will be spent by city for hardsurfacing road from city limits to railroad at South Slough.

Gresham, Ore.—Contract about to be let by City Council for hardsurfacing Roberts Avenue and Second Street; cost about $12,000.

Tillamook, Ore.—Counties of Tillamook and Yamhill voted to construct 10-mile road from Grande Ronde to the coast. J. C. Holden, Tillamook, County Clerk.

Hayward, Cal.—All bids opened by Bd. Trus. for paving 1 mile "C" Street with asphalt rejected. According to reports new bids will be received; cost about $43,000.

Provo, Utah.—City Comn. voted to pave Center Street; cost $20,016.

Pocatello, Idaho.—Contract about to be let by City Council for paving Garfield and Benton Streets; cost, about $30,000.

Toronto, Ont.—York Township Council considering construction of an asphalt roadway on Dundas Street; cost about $19,000.

BIDS DESIRED.

Boston, Mass.—Until Aug. 2 by Edw. F. Murphy, Comr. Pub. Wks., Boston, for bituminous macadam roadway on Montebello Rd., Roxbury; also Hassam block pavement on public alleys 809, 810 and 811.

Massachusetts.—Until Aug. 3 by State Highway Comrs., Boston (William D. Sohier, Chmn.), for constructing State highways in towns as follows:

Ashburton, 5200 ft. in length.
Chelmsford, 2500 ft. in length.

New York, N. Y.—Until Aug. 3 by Douglas Mathewson, Pres. Boro. Bronx, for improving streets as follows: White Plains Rd., 7060 sq. yd. granite block, 1900 sq. yd. sheet asphalt pavement, etc.; Webster Ave., 24,950 sq. yd. redressed granite block pavement, etc.; Manida St. and Benedict Ave., 4965 sq. yd. bituminous concrete pavement, etc.; Mott Ave., 13,100 sq. yd. sheet asphalt and 570 sq. yd. redressed granite block pavement, etc.; Baker Ave. and Victor St., 15,980 sq. ft. concrete sidewalk, etc.; also furnishing and delivering 350 tons asphaltic cement; 350 tons limestone dust, etc.

Until Aug. 3 by Marcus M. Marks, Pres. Boro. Manhattan, for regulating and repaving with sheet asphalt, portions of Twenty-fifth, Fifty-fifth, Sixty-fourth, Eighty-fifth and several other streets, requiring in all about 25,000 sq. yd. pavement, etc.; also reconstructing sidewalks on Cathedral Parkway, in all 2000 sq. ft. concrete sidewalks, Class A.

Yonkers, N. Y.—Until Aug. 2, according to press reports, by Bd. Contract and Supply (Edw. P. Walsh, Secy.) for regulating, grading and otherwise improving portions of Morsemere Avenue, Wilson Place, Tibbets Road and several other streets.

Newark, N. J.—Bids desired until Aug. 5, by Bd. Street and Water Comrs. (Morris R. Sherred, Ch. Engr.), for paving and repaving portions of Hinsdale Place, Yates Avenue, Oxford, Tyler, Vesey and Read Streets, requiring in all 13,250 sq. yd. bitulithic pavement, on a 6-in. concrete base, etc.

Until Aug. 12 by Bd. Street and Water Comrs. (M. R. Sherred, Ch. Engr.), for paving Belleville Avenue from Broad Street to Bloomfield Avenue, requiring 4500 sq. yd. granite pavement on a 6-in. concrete foundation, etc.

Paterson, N. J.—Until Aug. 3 by Bd. Pub. Wks., for macadamizing portions of Trenton Avenue, Elk, Mercer, E. Eleventh. E. Twenty-third and numerous other streets. H. J. Harder, City Engr.

Rutherford, N. J.—Until July 30 by F. A. Stedman, Boro. Clk., for laying waterbound macadam on portions of Walnut Street, Morse and Woodland Avenues.

Pennsylvania.—Until Aug. 10, by State Highway Dept. (Robt. J. Cunningham, Comr.), Harrisburg, for reconstructing State roads as follows:

Muncy, Lycoming County, 5843 ft. in length.

Milton, Northumberland County, 4940 ft.

Stroudsburg, Monroe County, 4871 ft.

Bids desired on brick block pavement.

Baltimore, Md.—Until Aug. 4 by Bd. of Awards, care of City Register, for constructing approximately 17,000 sq. yd. concrete paving around the filtration plant, Lake Montebello.

Wilmington, Del.—Until Aug. 16, by Bd. Directors, Street and Sewer Dept. (L. V. Christy, Secy.), for grading and excavating streets, constructing concrete foundations, concrete and brick gutters, sheet asphalt, asphaltic concrete, bitulithic, Warrenite, asphalt block and vitr. block pavements. Bids desired on not less than 50,000 sq. yd. street surface.

Orlando, Fla.—Reported desired until Aug. 2 for grading and paving with second quality brick, 2.25 miles road between Oakland and dividing line between Orange and Lake Counties. Address G. R. Ramsey, Highway Engr., Orlando.

St. Petersburg, Fla.—Until Aug. 5 by City Comrs. for grading, curbing with granite surb and paving with vitr. brick, Roser Park Drive, Seventh, Emma Avenues and several other streets.

Louisiana.—Until Aug. 16 by State Highway Dept., New Orleans (Frank M. Kerr, Ch. Engr.) for constructing with gravel, about 26 miles highway in Road Dist. No. 1, West Baton Rouge Parish.

Winchester, Ky.—Reported desired until Aug. 6 by S. B. Tracy, City Clk., for constructing about 13,000 sq. yd. sheet asphalt pavement.

Cincinnati, Ohio.—Until Aug. 5 by Director Pub. Service (Parke S. Johnson, Secy.), for improving Rittenhouse Street, by grading, curbing and paving with asphalt, constructing necessary drains and inlets and laying 6-in. water mains.

Until Aug. 3, by Director Pub. Service (Parke S. Johnson, Secy.), for grading, curbing and paving with bituminous macadam, Herbert Avenue, and paving with concrete Tusculum Avenue.

Until Aug. 9 by Dir. Pub. Service (Parke S. Johnson, Secy.), for improving Morgan Street and Ridgeway Avenue, by grading, curbing and paving with brick, etc.

Findlay, Ohio.—Until Aug. 5 by Director Pub. Service (John Page, Clk.) for furnishing material and improving East Hardin Street from Main to East Street by paving with brick, sheet asphalt, asphaltic concrete, wood block or bitulithic.

Galion, Ohio.—Until Aug. 10, by Director Pub. Service, for furnishing material and improving portions of S. Market, Jefferson and South Streets, with brick, asphalt, asphalt block, wood block or treated macadam, together with necessary gutter curbing and drainage, requiring approximately 26,000 sq. yd.

Goshen, Ind.—All bids for concrete road work opened July 22 rejected, and new bids desired by County Auditor until Aug. 14. Lowest bids opened July 22 and rejected reported as follows: Torrensce & Janney, Muncie, at $54,997 for 4 miles of Oakland Avenue; A. M. Smith, of Elkhart, at $49,840, for Kauffman Road; Gross Bros., La Porte, at $24,990, for Diner Southern Road.

Logan, Ohio.—Until Aug. 10 by Fred Allen, City Clk., for paving Second Street and Zanesville Avenue with brick on gravel foundation, stone curb, cement fill.

Lyons, Ohio.—Reported desired until Aug. 3 by Floyd Carpenter, City Clk., for 10,000 sq. yd. paving. George Champe, Engr., The Nasby, Toledo.

Marion, Ohio.—Until Aug. 18 by County Comrs. (V. Perle Garfield, Clk.) for reflooring bridges with rectangular, lug or hex. creosoted wood block as follows: 16 ft. roadway, 153.6 ft. span bridge, over Scioto River, Bowling Green Township; 16 ft. roadway, 143 ft. span bridge over Whetstone River, Waldo Township; double span bridge and 52.5 ft. span and one 104.2 ft. span bridge over Scioto River, Green Camp Township.

Ohio.—Until Aug. 6 by Clinton Cowen, State Highway Comr., Columbus, for improvements on following roads (work in all counties includes bridges and culverts, grading roadway and paving):

Champaign County, Section "N" of Urbana-Sidney Road, Concord Township—Constructing bridges and culverts, grading roadway and paving with waterbound macadam; length 5280 ft.; estimated cost $8,401.

Clermont County, Section "J" of Cincinnati-Chillicothe Road, Goshen Township—Paving with waterbound macadam; length 16,178 ft.; cost $15,977.

Clermont County, Section "D" of Cincinnati-Batavia Road, Union and Batavia Townships — Paving with waterbound macadam; length 16,071 ft.; cost $19,308.

Cuyahoga County, Section "I" of Cleveland-East Liverpool Road, Bedford Township—Paving with brick, bitulithic or bituminous concrete; length 15,883 ft. Estimates: Brick, using sand cushion, $82,602; brick, using sand cement cushion, $87,834; bitulithic, or bituminous concrete, using sand cushion with hillside block, $88,064; bitulithic, or bituminous concrete, using sand cement cushion with hillside block, $88,497.

Fairfield County, Section "C" of Columbus-Lancaster Road, Violet and Bloom Townships—Bridges and culverts; cost $3,991.

Hocking County, Section "I" of Logan-Athens Road, Green Township—Paving with brick; length 7700 ft.; cost $26,967.

Licking County, Section "O" of Columbus-Millersburg Road—Paving with waterbound macadam; length 14,400 ft.; cost $27,688.

Licking County, Section "L" of National Road, Contract 1—Main Market 4, Union Township, paving with concrete; length 4583 ft.; cost $12,038, and Contract 2, Union Township, bridges and culverts; length 4698 ft.; cost $876.

Licking County, Section "M" of National Road, Union, Harrison and Etna Townships. Contract 1—Main Market 4, paving with concrete, tarbound or asphalt bound macadam; length 39,625 ft. Estimated cost of concrete, $110,850; tar bound macadam, $99,885; asphalt bound macadam, $98,460. Contract 2—Bridges and culverts; length 39,625 ft.; cost $11,032.

Licking County, Section "N" of National Road, Etna Township. Contract 1—Main Market 4, paving with concrete, tar bound or asphalt bound macadam; length 37,349 ft. Estimated cost of concrete, $97,367; tar bound macadam, $85,781; asphalt bound macadam, $84,405. Contract 2—Bridges and culverts; cost $6,333.

Lorain County, Section "D" of Milan-Elyria Road, Amherst, Russia and Henrietta Townships—Paving with waterbound macadam; length 23,272 ft.; cost $32,611.

Muskingum County, Section "O" of National Road, Union Township—Paving with concrete (reinforced); length 309.7 ft.; cost $1,105.

Muskingum County, Section "P" of National Road, Union Township—Paving with concrete (reinforced); length 254.3 ft.; cost $899.75.

Shelby County, Section "C" of Sidney-Wapakoneta Road, Clinton and Franklin Townships — Paving with waterbound macadam; length 14,520 ft.; cost $30,013.

Trumbull County, Section "P" of Youngstown - Sharon Road, Hubbard Township—Paving with bituminous macadam; length 19,300 ft.; cost $46,702.

Wood County, Section "C" of Toledo-Perrysburg Road, Perrysburg Township: Contract 1—Main Market 7, 1.15 miles, reinforced concrete pavement; cost $14,884; Contract 2—Paving with 18-ft. reinforced concrete, 2.5 miles; cost $38,316. Alternative bids will also be received for following: Contract 1—Main Market 7, building 1.3 miles reinforced concrete pavement; cost $14,699; Contract 2—Paving with reinforced concrete 2.35 miles; cost $33,081.

Licking County, Section "E" of Columbus-Newark Road, Newark Township—Paving with bituminous macadam; length 5187.8 ft., or 0.98 miles; width of pavement 16 ft.; width of roadway 26 ft; cost $7,214.

Lawrence County, Section "A" of Ironton-Miller Road, Upper Township—Lining tunnel for approximately 100 ft; cost $2,399.

Plans and specifications are on file in the office of County Comrs. and at the State Highway Dept., Hartman Building,

Toledo, Ohio—Until Aug. 23 by County Comrs., for grading, draining and macadamizing with a bituminous or other suitable binder, Jerusalem and Oregon townships stone and gravel road No. 71, about 1¾ miles in Oregon township and 5¼ miles in Jerusalem township. Charles J. Sanzenbacher, Co. Aud.

Brownstone, Ind.—Until Aug. 9, according to press reports, by Town Council for paving streets with vitr. brick, asphalt, concrete or tarvia bound, 17 blocks.

Indiana.—By County Comrs. for constructing roads as follows:

Until Aug. 3:

Bedford, a macadamized or gravel road in Shawswick Township. E. W. Edwards, Co. Aud.

Rochester, a stone and two gravel roads in Rochester Township. W. C. Miller, Co. Aud.

Until Aug. 5:

Spencer, a stone and gravel road in Marion Township. George W. Stwalley, Co. Aud.

Until Aug. 9:

Peru, gravel roads in Peru and Jackson Townships. F. K. McElheny, Co. Aud.

Until Aug. 14:

Greencastle, gravel roads in Franklin and Madison Townships. C. L. Airhart, Co. Aud.

Until Aug. 16:

South Bend, concrete road in Penn Township. Clarence Sedgwick, Co. Aud.

Indianapolis, Ind.—Until Aug. 9 by W. T. Patten, Co. Aud., for constructing 5 concrete roads, about 62,000 sq. yd. C. E. Cheney, Co. Engr.

Aurora, Ill.—Until 2 p. m. Aug. 2 by City Clerk for 10,000 sq. yd. brick pavement,, 4800-ft. curb and gutter, etc., advertised in Engineering Record.

Dixon, Ill.—Until Aug. 7 at office of County Supt. of Highways, L. B. Neighbour, Dixon, for reflooring the Grand Detour Bridge, between Nacusa Township, Lee Co:, and Grand Detour Township, Ogle Co., known as Grand Detour Bridge, 4 spans, 200 ft. each, roadway, 18 ft. The work to be done includes the removal of the present floor, cleaning and painting all steel work and placing a creosoted block floor. Engineer's estimate, $7,900.

Fulton, Ill.—Until Aug. 2 by Bd. Local Improv. (J. C. Snyder, Secy.) for constructing Fifteenth Avenue and Lincoln Avenue paving system. The work will consist of 12,250 sq. yd. concrete pavement and 12,963 sq. yd. No. 1 brick block pavement, etc.

Mount Carmel, Ill.—Until Aug. 12 by E. E. Seiler, Clk., Road Dist. 3, for 20 miles gravel road, estimated cost $60,000. advertised in Engineering Record.

Council Bluffs, Iowa—Until Aug. 2 by Charles J. Duff, City Clk., for furnishing material and constructing sidewalks, in all about 202,630 sq. ft. sidewalk, etc.

McGregor, Iowa.—Until Aug. 2 by F. C. Sloane, City Clk., for paving Main Street from Front to Center Street, with brick block, vertical fiber brick, cement concrete, asphaltic concrete, creosoted block or bitulithic on 5-in. concrete foundation; about 19,353 sq. yd. M. Tschirgo, Engr., Cedar Rapids.

College View, Neb.—Reports state bids desired by Village Clerk until 5 P. M., Aug. 2, for work in Paving Dist. 1. Estimated cost, $42,200 for asphaltic concrete; $55,000 for vitr. repressed brick; $50,000 for 3 in. vertical fibre brick and $40,500 for concrete.

Lincoln, Neb.—Until Aug. 18 by H. E. Wells, County Clk., for constructing paving in Paving Dist. No. 8. County Surveyor's estimate: Vertical fibre brick, 3 in., $44,000; repressed brick block, $50,000; asphaltic concrete, $40,500.

Mitchell, S. D.—Until Aug. 10 by Thomas Eastcott, City Aud., for grading, curbing and paving Railroad Street and W. Fourth Avenue, approximately 13,793 sq. yd. paving, etc. Bids desired on two-coat Portland cement, brick, creosoted wood block, single-coat Portland cement and asphaltic concrete pavement.

Watertown, S. D.—Until Aug. 9 by O. M. Lane, City Aud., for furnishing material and paving with Portland cement a number of alleys.

Missoula, Mont.—Until Aug. 3 by L. E. Harris, City Clk., for furnishing material and constructing a pavement of vitr. brick, creosoted wood block, standard bitulithic, asphaltic concrete or asphaltic macadam on a 5-in. concrete base, in Special Improv. Dist. No. 35, in all 6660 sq. yd. E. S. Hathaway, City Engr.

Kansas City, Mo.—Until Aug. 3 by Bd. Park Comrs. (T. C. Harrington, Secy.) for constructing bituminous macadam pavement on Euclid Avenue from Spring Valley Park to Twentieth Street.

Russellville, Ark.—Until Aug. 3 by County Road Improv. Dist. No. 1 (W. J. Simpson, Secy.) for furnishing material and constructing approximately 14 miles native stone, macadam and 12 miles macadam native stone base with trap rock binding course. Otto Yengin, Engr., Russellville.

Sequin, Tex.—Until Aug. 2 (readvertisement) by County Clerk, 6 miles of road in Precinct No. 2, Guadalupe Co. Engr. F. H. Hess, 1604 Southwestern Life Bldg., Dallas.

Colfax, Wash.—Bids desired until Aug. 7, by County Comrs. at Colfax, for draining, grading and bridging 11½ miles of permanent highway between Colfax and Pullman. John McCaw, County Engr.

Tacoma, Wash.—Reported desired until Aug. 14 by Thomas Norris, Co. Aud., for improving Permanent Highway No. 5A, a distance of about five miles, to consist of grading, preparing sub-grade, ditches, shoulders, etc. Bids desired on Warrenite, bituerete, asphaltic concrete, bitulithic, asphalt, highway brick, No. 2 highway blocks, No. 2 paving brick, two course concrete, one course concrete or wood block pavement.

Waitsburg, Wash.—Reported desired until Aug. 4, by City Clerk, for graveling and macadamizing a portion of West Fourth Street. Probable cost $12,000.

Washington.—Reported desired until Aug. 4 by State Highway Comr., W. R. Roy, Olympia, for grading and surfacing a strip of highway near Marysville; probable cost, $10,000.

Waterville, Wash.—Until Aug. 17 by County Comrs., Waterville, for grading, draining and surfacing with crushed gravel or rock, 2¾ miles Sunset Highway near Orondo on Columbia River, 10 miles above Wenatchee; probable cost $20,000. R. F. Foster, Co. Engr.

Coquille, Ore.—Reported desired until Aug. 5 by Robt. Watson, Co. Clk., for surfacing a mile of crushed stone macadam road in Road Dist. No. 5, with an asphaltic wearing surface 2 in. thick, 8 ft. wide, with crushed stone shoulders, 4½ ft. wide.

PRICES AND LETTINGS.

★Indicates award of contract.

★Andover, Mass.—Contract awarded by Massachusetts Highway Comn., Boston, for building section of highway in Andover to D. J. Sheehan Co., Lynn, at $18,896. Next 3 lowest bids: Philpot Constr. Co., Melrose, $12,000; R. F. Hudson, Melrose, $12,250; T. H. Moynihan, Hamilton $12,475.

★New Britain, Conn.—Contract for paving Lafayette Street with concrete awarded by Bd. Pub. Wks. to Good Roads Constr. Co., New Britain, at $1.24 per sq. yd.

★New Haven, Conn.—Contract for paving Exchange Street with sheet asphalt awarded by Permanent Paving Comn. to C. W. Blakeslee Sons Co., New Haven, at $1.42½ per sq. yd., total $14,298.

Albany, N. Y.—Following are lowest bids opened July 26 by State Comn. Highways, 55 Lancaster Street, for construction of highways by State Aid:

Road 5654, Cornwall-West Point, Parts 1 and 2, Orange County, 4.62 miles—John L. Hayes Constr. Co., Yonkers, $272,736; John J. Hart, Peekskill, $291,065; Nordone & Petrillo, Mount Vernon, $294,646; Samuel Berkin, Inc., Benson, $295,322; William Horne Co., New York, $297,882; P. J. Carlin Const. Inc., New York, $298,620.

Road 5673, Cornwall-West Point, Part 3, Orange County, 3.37 miles—Nordone & Petrillo, Mount Vernon, $12,241; Woolsey Constr. Co., Davenport, Iowa, $13,287; Samuel Berkin, Inc., Benson, $13,400; James Anderson, Menands, $13,637.

Boonville, N. Y.—Following are four lowest bids opened July 22 by Village Council of A. Patterson (Clk.) for 2766 sq. yd. brick paving and 1,170 Ln. ft. concrete curb: Bass & Gribbs, Marcena, $16,581; Hugh Hogan, New Berlin, $16,710; William King Constr. Co., Ogdensburg, $16,818; James E. Martin, Utica, $16,886.

★Buffalo, N. Y.—Contract for paving West Street with asphalt awarded by Common Council to Henry P. Burgard Co., Buffalo, at $39,595.

★New York, N. Y.—Contracts for sheet asphalt repaving awarded by President Boro. of Manhattan, July 15, as follows: Sixty-eighth Street from Park to Fifth Avenue, to Asphalt Constr. Co., 208 Penn., $7,808. Fifth Street from C. P. West to Amsterdam Avenue, to Sicilian Co., 45 Park Row, $13,324, and 160th Street from West End Avenue to Riverside Drive, to Barber Paving Co., 233 Bway., $8,951.

★Salamanca, N. Y.—Contract for paving Seventh, Wilson, Armstrong and Jefferson Streets with brick awarded by Common Council to H. E. Burton, Olean, at $24,560.

Syracuse, N. Y.—Lowest bid opened for paving Court Street submitted by Mondo Constr. Co., Syracuse, at $12,654.

★Yonkers, N. Y.—Contract awarded to John O. Weston, Yonkers, for regrading, grading, improving Portfield Avenue, at $22,466.

★Hackensack, N. J.—Contract awarded July 16 for 13,950 sq. yd. bituminous macadam, etc., to E. C. Humphrey, Hackensack, at $15,080. Other bids: Continental Pub. Wks., New York, $15,559; Weldon Contr. Co., Rahway, N. J., $16,938; A. N. Gill, Hackensack, $17,208; F. J. Thomson, Clk. Bd. Chosen Freeholders.

★Jersey City, N. J.—Contracts for paving Pavonia Avenue from Summit to Chestnut Avenue, and on Mercer Street from Baldwin Avenue to Summit Avenue awarded to W. T. Crichfield, 54 Fifth Avenue, Hoboken, at 83 per cent standard price.

★Morristown, N. J.—Contracts for roads awarded by Morris County Bd. as follows (bids opened July 19): Denville-Rockaway Road, to Weldon Contr. Co., Rahway, at $26,180, and Rockaway-Dover Road, to Osborne-Marseilles Co., Montclair, at $31,992.

★Clarion, Pa.—Contract awarded July 15 for 1446 cu. yd. excav., 2464 lin. ft. curb, 4255 sq. yd. pavt., etc., to L. H. Hileman & Co., New Kensington, Pa. F. M. Arnold, Jr., Boro. Secy.

★Franklin, Pa.—Contract awarded July 6 by Campbell & Curry, Engrs., First National Bank Building, Johnstown, for approximately 9000 sq. yd. brick or concrete paving, to Suppes Contr. Co., Johnstown, at $3.46 per sq. yd.

★Nanticoke, Pa.—Contract for constructing about $70,000 worth of brick pavements awarded by Newport Township Comrs. to Caradoc Reese, Nanticoke, at $2.20 per sq. yd.

Philadelphia, Pa.—Following are bids opened July 13 by Dept. of Pub. Wks., Bureau of Highways (William H. Connell, Chief), for street improvements.

Asphalt paving, including 6-in. concrete base, average price $1.431 per sq. yd.; and vitr. block gutter pavt., 6-in. concrete base, average price, $2.147 per sq. yd. Low bidders: Eastern Paving Co., Penn Square Bldg.; Barber Asphalt Paving Co., Land Title Bldg.; Union Paving Co., Thirtieth and Locust Streets; total amount of low bids, $132,075.

Vitrified block paving, including 6-in. concrete base, low bidder, Cunningham Paving & Constr. Co., 1345 Arch Street, $2.191 per sq. yd.; total, $18,748.

Repaving with asphalt, including 6-in. concrete base, average price, $1.224 per sq. yd. Low bidders: Union Paving Co., Thirtieth and Locust Streets; Eastern Paving Co., Penn Square Bldg.; total amount of low bids, $79,492.

Repaving with vitr. block, including 6-in. concrete base, low bidder, Cunningham Paving & Constr. Co., 1345 Arch St., $2.028 per sq. yd.; total, $18,684.

Repaving with wood block, including mortar cushion and 6-in. concrete base, average price, $2.796 per sq. yd. Low bidders: McNichol Paving & Constr. Co., 1923 Cherry St.; Philadelphia Paving Co., 1345 Arch St.; Mack Paving & Constr. Co., Twentieth and Sedgley Avenue; Edwin H. Vare, Lincoln Bldg.; total amount of low bids, $124,322.

Repaving with granite block, including 6-in. concrete base, average price $2.915 per sq. yd. Low bidders: Mack Paving & Constr. Co., Twentieth and Sedgley Avenues; J. J. McHugh, Sixtieth and Baltimore Avenue; total amount of low bids, $26,273.

Resurfacing with asphalt, including 6-in. concrete base, average price $1.232 per sq. yd. Low bidders: Eastern Paving Co., Penn Square Bldg.; Union Paving Co., Thirtieth and Locust Streets; total amount of low bids, $14,938.

Surfacing waterbound macadam 3-in. on 5-in. broken stone base, 96.1 cts. per sq. yd.; 4-in. on 8-in. Telford base, $1.118 per sq. yd.; concrete gutters, $1.369 per sq. yd. Low bidders: W. J. Henderson, 6736 Ridge Avenue; P. J. Snyder, Bailey Bldg.; J. F. Shanley, Commercial Trust Bldg.; total amount of low bids, $26,883.

Resurfacing with bituminous pavement, 5-in. concrete base, low bidder, Eastern Paving Co., Penn Sq. Bldg., $1.15 per sq. yd.; total, $8258.

Repaving bridge with wood, low bidder, M. & J. B. McHugh, 892 N. Markoe Street, $9715

★Philadelphia, Pa.—Contracts for repaving awarded July 24 by Dept. Pub. Wks. as follows: Market Street with asphalt to Newton Paving Co., Trenton, N. J., at $9,050; Crefeldt, Hampton Avenues, Eleventh, Fairhill, Seventh, Thirtieth and Diamond Streets to Eastern Paving Co., 1414 S. Penn Square, at $24,030.

★Wheeling, W. Va.—Contract for macadamizing 3 miles of Fairmont Road awarded by County to Seipel & Wolfe, Toledo, Ohio; about $50,000 is available for improvement.

Montgomery, Ala.—Lowest bid opened by City Comn. for paving Finley Curve in Cloverdale Terrace Dist. submitted by Jamison & Hallowell, Montgomery, at $10,700.

Memphis, Tenn.—Only bid received by Bd. City Comrs. for paving Mississippi Boula. submitted by Memphis Asphalt Paving Co., Memphis, at $9,208.

★Elkton, Ky.—Contract for constructing 4¾ miles pike from city limits to Logan county line awarded by Fiscal Court to Roy L. Gowel, Russellville, at $17,445.

★Louisville, Ky.—Contract for constructing 2 1/3 miles of Taylorville Road awarded by Fiscal Court to Hoke Co., Louisville, at $11,575.

★Williamstown, Ky.—Contract for constructing ten mile road from Williamstown to Kenton County line awarded to W. F. Woodruff, Louisville, at $20,172.

★Cincinnati, Ohio—Contract awarded July 12 by Philip Fosdick, Dir. Pub. Service, for grading, setting curb and paving with granite blocks portion of Warsaw and Glenway Aves. to Kirchner Constr. Co., Cincinnati, at $79,752.

★Greenford, Ohio.—Contract for surfacing roads east, west, north and south through Greenford awarded by Green Township Trus. to Smith Constr. Co., Youngstown, at $32,245.

★Indianapolis, Ind.—Contract for paving Keystone Ave. with asphalt awarded by Bd. Pub. Wks. to Republic Constr. Co., Merchants Bank Bldg., at $12,008.

★New Philadelphia, Ohio.—Contract awarded July 19 for constructing 1 mile brick road to W. M. Brode Co., Newcomerstown, at $16,800. Edward Stingel, Co. Engr.

★Oak Hill, Ohio—Contract awarded for grading, curbing and paving W. Main Street with brick and Water Street with macadam to W. H. Ringwald & Sons Co., Chillicothe, at $11,450 (bids opened July 17). D. Spurge Perry, Village Clk.

★Ohio.—Contracts for constructing state highways awarded by State Highway Comn. at Columbus, July 23, as follows:

Ashland County, Ashland-Loudonville Road, 3.58 miles macadam, to D. A. Phillips, Ashland, at $44,036.

Montgomery County, Cincinnati-Dayton Road, 2.45 miles, brick, to Strodbick Bros., Middletown, at $62,359.

Stark County, Canton-Steubenville Road, 2.59 miles, to Turnbull Bros. Co., Canton, at $51,084.

Union County, Urbana-Marysville Road, 4.27 miles, concrete, to Oather M. Junk, Chillicothe, at $51,990.

★Sandusky, Ohio—Contract for paving W. Monroe Street with brick awarded by Bd. Control to A. G. O'Donnell, Sandusky, at $21,777.

★Toledo, Ohio.—Contracts awarded by Bd. Control for paving as follows: Hawthorne, Thompson and Lucas Streets, to H. P. Streicher Co., Toledo, at $40,906; Foster and Berry Streets, to Harris & Tansey, Toledo, at $16,039.

★Westerville, Ohio.—Contract for paving with brick awarded as folows (bids opened July 16): W. Home St., to Monarch Constr. Co., Columbus, at $10,748, and Vine Street to Walsh & Jones, Mount Vernon, at $7197. R. D. Bennett, City Clk.

★Youngstown, Ohio.—Contract for repaving floor of South Avenue Viaduct awarded by County Comrs. to Colucci Bros., Youngstown, at $5073.

Elkhart, Ind.—Following are lowest bids opened by County Comrs. for constructing concrete roads: William Torrence, Muncie, for Whittaker Road, $54,997; A. M. Smith, Elkhart, for Kaufman Road, $49,840; Gross Brothers, Laporte, for Diener Southern Road, $24,990, and Sparks & McGlanock, of Kirklin, for Diener Central Road, $5,605.

★Warsaw, Ind.—Contract for constructing Gwin Road, extending two miles south of Nappanee, awarded by county to T. E. Sparks, Kirkland, at $19,500.

★Oak Park, Ill.—Contract awarded July 20 by Bd. Local Improv. (B. C. Brandstadt, Secy.) for grading and paving with asphaltic concrete, constructing granite combined curb and gutters, etc., on portions of Jackson Street, Lyman, Highland, Humphrey and Seventy-second Avenues, to American Asphalt Paving Co., Chamber of Commerce Bldg., Chicago, Standard Paving Co., 29 S. La Salle Street, Chicago, and H. G. Goelitz Co., Oak Park.

★Milwaukee, Wis.—Contracts for paving with asphalt awarded by Bd. Public Works as follows, total cost $100,000: Vliet, Galena and Cherry Streets, to Badger Constr. Co., Milwaukee; Eighth and Twenty-first Avenues, to White Constr. Co., Milwaukee.

★Clinton, Iowa.—Contract for block paving (bids opened July 20) awarded to Thomas Carey & Sons, Clinton, at following bid: 10 cu. yd. excess excav., 60 cts.; 12,238 sq. yd. vitr. block pav., $2.10; 363 sq. yd. alley crossings, $1.50; 2344 lin. ft. old stone curb, reset, 15 cts.; 872 lin. ft. new concrete curb, 50 cts.; 695 lin. ft. special concrete curb, 60 cts.; 362 lin. ft. curb bars, 25 cts.; 5 pavements adjusted, $10; 10 cu. yd. excess concrete, $8; 500 sq. ft. sidewalk, 13 cts.; 3 catchbasins, $35; 120 lin. ft. c. b. pipe, 60 cts.; total $27,917. Independent Constr. Co., Devanport, bid for this work $29,736.

★Glenwood, Iowa.—Contract awarded July 19 for paving Walnut, Vine, Sharp, First and Fourth Street with 6-in. Portland cement concrete mixture 1:2:4 to Samuel Friedman, Omaha, Neb., at $1.33 per sq. yd.; total cost $20,000.

★Le Mars, Iowa.—Contract for paving Plymouth, Eagle and other streets with 6-in. concrete pavement, 30 ft. wide, about 3 miles in length, to A. R. Lake, Le Mars, at $1.09 per sq. yd. Other bids per sq. yd.: Moore Sieg Constr. Co., Waterloo, $1.15; C. H. Atkinson, Watertown, S. D., $1.17; Delben Wheeler, Ireton, $1.19½; M. L. Flinn Paving Co., Sioux City, $1.18. B. C. Woolley, City Engr.

★Duluth, Minn.—Contracts for paving Grand and Commonwealth Aves. with 1-course reinforced concrete awarded to E. W. Coons Co., at $43,613; Hilliard & Julien received contract for surfacing E. 5th St. with Rocmac and 5th Alley with concrete, at $4,008. Lyonel Ayers, City Engr.

★Fairmont, Minn.—Contract awarded July 20 to Fielding & Shepley, St. Paul, for 24,208 sq. yd. paving with 7968 lin. ft. curb, 3037 cu. yd. extra grading, etc., at $57,299. Frank O. Jones, City Engr.

★Norfolk, Neb.—Contract awarded for paving (bids opened July 19) to H. J. Cathroe Co., Omaha, at following bid: 29,135 sq. yd. 6-in. concrete paving, 1-course 1-2½-4 gravel concrete, $1.24; 15,928 ft. 6 x 18 in. cement curb with ½-in. cement facing on curb, 27 cts.; 1261 cu. yds. extra grading, 30 cts. H. H. Tracy, City Engr.

★Helena, Mont.—Contract for paving Wilder Avenue awarded by City Council to Adami Bros., Helena, at $9,529.

★Phillipsburg, Mont.—County Comrs. Granite and Deer Lodge Counties awarded contract for constructing Flint Creek Hill Road to Clifton-Applegate Co., Anaconda, at $13,000.

★Springfield, Mo.—Contract awarded July 20 by City Clerk, for paving with asphaltic concrete as follows: Normal Avenue, about 5575 sq. yd., to Jarrett Richardson Paving Co., Springfield, at $1.46 per sq. yd., and with Tarvia on boulevard from Cherry Street to Grand Avenue, 10,500 sq. yd., to A. A. Hofman, Union National Bank Bldg., $1.02 per sq. yd.

★Cuero, Tex.—Contract for constructing gravel roads in Yoakum Hochheim Precinct of De Witt County awarded to R. F. Field, Victoria. About $50,000 is to be spent for roads.

★Longview, Tex.—Contract awarded July 14 by Co. Comrs. for grading and surfacing with stone and gravel fifteen miles of Dallas-Shreveport Highway, to Owens Constr. Co., Vicksburg, Miss., at $67,166. Other bids: M. W. Taylor & Co., Marshall, $67,688; O. C. McElrath, Gilmer, $77,974; Roach-Mannigan Paving Co., Fort Worth, $80,190.

★Dewey, Okla.—Contract for paving (bids opened July 20) awarded to Connelly Constr. Co., El Reno, Okla., as follows: 16,075 sq. yd. concrete paving, $1.20; 7360 lin. ft. concrete curb, 60 cts.; 16,075 sq. yd. grading, 17 cts.; 105 lin. ft. water crossing, $3.25; total cost about $25,000. Other bids: W. W. Fuller, Muskogee, Okla., $27,904; Municipal Eng. & Constr. Co., Oklahoma City, Okla., $28,621; Green & Cullen, Independence, Kan., $30,160. J. H. Chandler, Engr., 104 E. Fourth Street, Bartlesville.

★Anacortes, Wash.—Contract for paving State Street with concrete awarded by City Council to N. W. Ball, Seattle, at $10,000.

★Everett, Wash.—Contracts awarded by Co. Comrs. for highways 17 and 18 to Ward & Templeton, Everett, at $9,510 and $13,694 respectively.

★Olympia, Wash.—Contracts for constructing highways awarded by State Highway Comn. as follows:

Whatcom County, Pacific Highway between Custer and Enterprise, 2⅝ miles, to Charles F. Lind, Bellingham, at $12,186.

Spokane and Pend Orielle Counties, Highway No. 23, between Mead and Newport, 35½ miles, to General Constr. Co., Spokane, $89,692.

★Olympia, Wash.—Following are bids opened July 19 by State Highway Comr. for paving:

★Whatcom County, Custer to Enterprise. Totals of bids: Charles E. Lind, 1525 Forest Street, Bellingham, $12,186 (awarded contract); Worthen & Satterthwaite, Lynden, $14,489; Sloane Bros., Box 848, Seattle, $14,734; L. H. Goerig, 1027 Bellevue Court, Seattle, $14,324.

★Spokane and Pend Orielle Counties, road from Mead to Newport. Totals of four lowest bidders: General Constr. Co., 806 Mallon Ave., Spokane, $69,692 (awarded contract); Clifton Applegate, Hutton Building, Spokane, $78,191; Carlson-Chindahl Co., Realty Building, Spokane, $78,476; Spokane Asphalt Paving Co., 725 Hutton Building, Spokane, $82,683.

Unit prices of General Constr. Co., successful bidder on above:

126,030 cu. yd. common excav., inc. haul 400 ft.	$0.20
6,540 cu. yd. loose rock excav., inc. haul 400 ft.	0.70
13,240 cu. yd. solid rock excav., inc. haul 400 ft.	0.98
135,000 cu. yd. overhaul on any of above materials, per sta. 100 ft.	0.015
20 cu. yd. riprap hand placed	2.50
115 cu. yd. concrete 1st Class	13.25
151 cu. yd. concrete 2d Class	11.75
6,160 lb. steel I-beams and struct. shapes in place	0.06
8,800 lb. steel reinforcing bars in place	0.06
900 sq. ft. expanded metal in place	0.07
500 sq. ft. chicken wire in place	0.03
160 lin. ft. pipe rail in place	0.70
2,000 lin. ft. guard rail in place, inc. spikes and bolts	0.25
1,920 lin. ft. fir piling driven, below cut-off	0.85
550 lin. ft. plain concrete pipe in place, 18-in. diameter	1.35

436 lin. ft. reinforced concrete pipe in place, 24-in. diameter.. 2.60
Clearing and grubbing (lump sum) 10,000.00
15,500 lin. ft. side surfacing..... 0.08
Concrete arch bridge, 70 ft. long (lump sum)..... 2,730.00
Concrete arch bridge, 75 ft. long (lump sum)..... 3,455.00

Thurston County, Mud Bay to McCleary. Four lowest bidders: Rignell & Bankston, 1518 C Street, Tacoma, Wash., $31,922; August Wallin, Aberdeen, $32,146; Sloane Bros., Box 348, Seattle, $33,582; L. H. Goerig, Lacey, $33,792.

Unit prices of Rignell & Bankston, lowest bidders:
69,000 cu. yd. common excav., inc. haul of 400 ft..... $0.24
4,500 cu. yd. loose rock excav., inc. haul of 400 ft..... 0.40
4,000 cu. yd. solid rock excav.., inc. haul of 400 ft..... 0.80
25,000 cu. yd. overhaul on any of above materials, per ea. 100 ft.... 0.02
37 acres clearing.....100.00
28 acres grubbing.....125.00
6,380 lin. ft. plain concrete culverts in place..... 0.10
622 lin. ft. plain concrete pipe in place, 12-in. diameter..... 1.00
386 lin. ft. plain concrete pipe in place, 18-in. diameter..... 2.00
156 lin. ft. reinforced concrete pipe in place, 24-in. diameter..... 2.50
80 lin. ft. reinforced concrete pipe in place, 30-in. diameter..... 3.00

Seattle, Wash.—Lowest bid opened by Bd. Pub. Wks. July 23 for paving Massachusetts Avenue submitted by Ferguson Constr. Co., 407 White Building, at $24,752.

★**Corvallis, Ore.**—Contract awarded to John W. Ash, Corvallis, for paving Twenty-sixth Street, between Monroe and Orchard, with reinforced concrete, concrete curb, etc.

★**Pendleton, Ore.**—Only bid received by City Council for paving twenty-three blocks with gravel bitulithic submitted by Warren Constr. Co., Portland, at $42,-180.

Portland, Ore.—Lowest bid opened by City Council for paving Rodney Avenue and San Rafael Street submitted by Oskar Huber, Portland, at $13,003.

Tillamook, Ore.—Lowest bid opened July 14 by city, submitted by Arenz Constr. Co., Salem; it bid for paving with concrete a portion of Fifth Street, at $1.34 per sq. yd., and with concrete, asphalt wearing surface, Second Avenue E. and another portion of Fifth Street at $1.80 per sq. yd.; excav., 60 cts. per cu. yd. John Aschin, City Recorder.

★**California.** — Contracts awarded by Dept. of Engineering, State Highway Comn., Sacramento, July 20, for road work as follows:

Tehama County (between Red Bluff and Northerly boundary), to James Fitzpatrick, Ochsner Bldg., Sacramento, at $48,136.

Shasta County (across the Pitt River south of Baird), to Ross Constr. Co., Forum Bldg., Sacramento.

Shasta County (across Boulder Creek and Shotgun Creek), F. Rolandi, Bank of Italy Bldg., San Francisco.

Alameda County (between and Santa Rita), H. G. Vaughn Constr. Co. and William A. Newson and C. S. Laumeister, Sharon Bldg., San Francisco.

★**Moscow, Idaho.**—Contract awarded July 19 for 7000 sq. yd. hard surface pavement on 5-in. concrete base 1¼ top with storm sewers and curbs. George E. Wyckoff, Spokane, Wash. J. R. Strong, City Clerk.

STREET CLEANING AND GARBAGE DISPOSAL

BIDS DESIRED.

Berlin, Ont.—Until Aug. 5 (extension of date from July 29) by A. H. Millar, City Clk., for street sprinkler and flusher, advertised in Engineering Record.

PRICES AND LETTINGS.

★*Indicates award of contract.*

New York, N. Y.—Following are lowest bids opened July 16 by J. T. Fetherston, Comr. Street Cleaning, for all labor, equipment and appliances required for the removal of snow and ice during the winter season 1915-1916:

Boro. of Manhattan: Celestino De Marco, 239 E. 17th St., 37 cts. per cu. yd.

Boro. of Bronx: Thomas Cummins Contr. Co., 444 E. 69th St., 30 cts. per cu. yd.

Boro. of Brooklyn: Rosenthal Eng. & Contr. Co., 165 Hooper St., Brooklyn, 35.3 cts. per cu. yd.

Manhattan Boro., Dists. 1, 2 and 3: Snow Contr. Co., 1 Madison Ave., 42 cts. per cu. yd.

Brooklyn Boro., Dists. 1, 2, 3 and 4: Parsons & Langtry Co., 30 Church St., New York, lowest on Dist 1, 34.7 cts. per cu. yd.; Rosenthal Eng. & Contr. Co., 165 Hooper St., Brooklyn, lowest on Dists. 2 and 3, 28 cts. and 31 cts. per cu. yd.; Thomas Callandrello, 425 Malbone St., only bidder on Dist. 4, at 34 cts. per cu. yd.

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS

PROPOSED WORK

Flood Abatement—Olean, N. Y.—The Flood Abatement Comn. has appointed John A. O'Connor and Arnold G. Chapman of Albany as Executive Engineers. The plans are to be ready for the contractors not later than Oct. 1. E. W. Fitzgerald, Pres.

The Olean Flood Abatement work will cost $300,000 instead of $150,000, as previously stated. One-half is to be paid by City and balance by State. Entire amount will be available before contracts are let.

Concrete Dam—York, Pa.—William Russell Smith Co., York, write that they are preparing plans and specifications for concrete dam, to be erected at Castle Finn Forge, across Muddy Creek, for the Delta Water Power Co.; it will be about 200 ft. long and 30 ft. high, with sluice way and other incidental improvements about the head race, all of which are to be completed this year.

Canal—New Orleans, La.—Ford, Bacon & Davis of New Orleans have submitted to Bd. Port Comrs. report on industrial canal project authorized by State. The engineers submitted four tentative plans for a barge canal, and as many for a combined ship basin and barge canal. In all five routes were considered, and it is probable that the city authorities will select one of these. Estimated cost of Route 1, $4,120,137; No. 2, $6,819,000; No. 3, $4,534,880; No. 4, $2,437,046.

Drainage Bonds—Sulphur, La.—$20,000 drainage bonds will be sold July 31 by Sulphur Drainage Dist. No. 2 (Edward J. Rusillon, Secy. and Treas., Box 228, Lake Charles).

Terminal System—Louisville, Ky.—Bd. of Trade is said to favor construction of a terminal system on water front, to include 2-story wharf warehouse.

Power Plant—Hazard, Ky.—Arrangements reported completed by E. C. Lilley Bluefield, W. Va., D. Terpstra, Norton, Va., and others, for establishment of power plant near Hazard in Perry County coal field, plant to cost $350,000. R. D. Baker of Big Stone Gap, Va., will have charge of construction work.

Ditch—Morganfield, Ky.—Contract for construction of O'Nan Public Ditch will probably be let within thirty days. Work includes 13½ miles open ditch, requiring 622,000 cu. yd. excav. Norman R. Orcutt, Ch. Engr., Morganfield.

Drainage — Bloomington, Ill.—Preliminary plans are being prepared by A. H. Bell and J. G. Hare of Bloomington for proposed Blue Ridge special drainage district; this ditch will be all tile, 33 to 18 in.

River Straightening—Villisca, Iowa.—Co. Comrs. about to begin survey for straightening West Nodaway River near Villisca; about nine miles of ditch.

Wharves and Docks—Orange, Tex.—Citizens July 20 voted $150,000 bonds for municipal wharves and docks.

Irrigation—Doyle, Col.—William Wales of Woodland, preparing plans for irrigation system for Southern Lessen Irrigation Dist. After bonds are voted, contract will be let for construction. Cost about $1,000,000. Elbert Howard, Chmn. Com.

Irrigation — Prosser, Wash. — Reported Comrs. of Benton County, have approved plans of Horse Heaven Land Owners' Assoc. for irrigation district and have ordered election Aug. 7. The district as outlined, comprises about 500,000 acres lying in Benton, Yakima and Klickitat Counties; engineering work has been done by Klickitat Irrigation Co. Directors include C. H. Hinman, North Yakima, and Ira W. Carter, Prosser.

Canal Survey—Sacramento, Cal.—According to press reports State Eng. Dept. will begin survey of route of sea-level canal from Sacramento to the bay next month, as soon as 1915 appropriation made by recent Legislature is available. Survey is to show feasibility of deep-water ship canal independent of Sacramento River; proposed canal will cost about $3,000,000.

Dam—Salt Lake City, Utah—Press reports state that work will soon begin on construction of Hatchtown dam, to be done by State Land Board, under direction of W. D. Beers, State Engr.

Harbor Improvements, Etc.—Alaska.—It is reported that Alaska Engineering Comn., L. C. Smith Building, Seattle, Wash., will start work shortly on harbor improvements at Anchorage, including dredging inner harbor for deep water vessels, construction of machine and repair shops, commissary building, coal terminal docks, etc. A freight yard with side tracks will be built north of present main line.

BIDS DESIRED.

Dredging—Boston, Mass.—Until Aug. 11 by Directors of Port of Boston, 40 Central Street, for dredging at Malden bridge in Mystic River, Charlestown; also same time and place for dredging at Pleasant Park Yacht Club, Winthrop; Orient Heights Yacht Club, East Boston, and Wessagusset Yacht Club, North Weymouth; under three separate contracts. Both proposals advertised in Engineering Record.

State Canal Work—Albany, N. Y.—Until Aug. 17, by W. W. Wetherspoon, State Supt. Pub. Wks., Albany, for the following: Terminal Contr. No. 37—Constructing a harbor and dockwall on the south side of the Mohawk River, near the outlet of Canajoharie Creek at Canajoharie. Contr. Plans, sheets 1 to 4, inclusive. Terminal Contr. No. 46—Constructing a dockwall and approach on the south side of the Seneca River, west of the Weedsport Bridge. Contract plans, sheets 1 to 3 inclusive.

Dredging—Brooklyn, N. Y.—Until Aug. 4 by L. H. Pounds, Boro. Pres., for dredging Newtown Creek Canal in the canal and basin included within the boundaries of Johnson, Montrose, Morgan and Varick Aves. and also in Stagg St. Basin and in Newtown Creek, near intersection of Scott and Metropolitan Aves. Engineer's preliminary estimate, 15,000 cu. yd., scow measurement. Security, $3,000.

Dredging, Etc. — Philadelphia, Pa.—Until Aug. 16 by Dept. of Wharves, Docks and Ferries (John Meigs, Dir.), for dredging in Delaware River Channel opposite Port Richmond coal piers; also constructing a temporary bulkhead, Schuylkill River.

Trestles at Dam—Pittsburgh, Pa.—Until Aug. 26 by U. S. Engineer to furnish and deliver service bridge and Poiree trestles at Dam 10, Ohio River, advertised in the Engineering Record.

Stone for Jetties, Wilmington, Del.—Until Aug. 20 at U. S. Engineer Office, Old Federal Building, Wilmington, for furnishing and placing stone for repairs to jetties, Cold Spring Inlet, N. J.

Drainage—New Albany, Miss.—Reported desired until Aug. 9 by Big Creek Drainage Dist., New Albany, for constructing a canal, requiring about 276,822 cu. yd. excav.

Canal—Selmer, Tenn.—Until Aug. 12, according to press reports, by Cypress Creek Drainage Dist. No. 9, for constructing a canal 4.8 miles in length, extending from a mile above Bethel Springs nearly to Selmer. H. P. Wood of Selmer is attorney for the district.

Ditch—Kankakee, Ill.—New bids until Aug. 17 by Co. Comrs. for tile and bridge work for ditch in Momence and Yellowhead drainage district.

★Contract for open ditch, earth excav. and rock excav. from river on above district awarded to R. H. and J. A. McWilliams of Chicago; total estimated cost about $38,000.

Ditch—Webster City, Iowa.—Until Aug. 3 by County Bd. Superv. for widening and deepening part of open ditch of the Castner, Williams, Askland Drain No. 4, as follows: Williams Branch, 11,200 ft. 115,-400 yd.; Main Line, 18,700 ft., 123,800 yd.; Main line, deepening 4000 ft., 3000 yd. On this work there are 6 wood pile and 75 ft. iron bridge. A. J. Peterson, Co. Aud.

Bids desired same time and place as above for constructing Nail Drain No. 173, Salt glazed vitr. Clay tile construction; probable cost, $16,100. R. G. Austin, Engr., Webster City.

Ditch—Fairmont, Minn.—Reported desired until Aug. 5 for constructing Judicial Ditch No. 47 and 48; probable cost, $27,494 and $10,759 respectively. Address County Comrs.

Ditch—Mankato, Minn.—Reported desired until Aug. 16 for constructing Ditch No. 37; probable cost, $11,856. C. L. Kennedy, Co. Aud.

Irrigation Work—Newell, S. D.—Until Aug. 27 by U. S. Reclamation Service, Newell, for construction of North Canal extensions and laterals, advertised in Engineering Record.

Ditches—Tekamah, Neb.—Until Aug. 14 by Burt-Washington Drainage Dist., Tekamah (J. J. Breckenridge, Secy.) for 1,000,000 cu. yd. diversion ditches and levees. Towl Eng. Co., Engrs., Omaha.

Irrigation Work—Malta, Mont.—Until Sept. 8 by U. S. Reclamation Service, Washington, for steel bridge and structural steel movable crest for Vandalia dam of Milk River project, advertised in Engineering Record.

Pivot Pier Addition—Camden, Ark.—Until Aug. 9 by Comrs. of Martin Free Bridge (I. A. Baum, Engr.) for additions and reinforcements to pivot pier, advertised in Engineering Record.

Wharf—San Francisco, Cal.—Until Aug. 21, at Bureau Yards and Docks, Navy Dept., Washington, D. C., for extension of wharf at Naval Training Station, San Francisco, Cal.

Harbor Improvements—Fort William, Ont.—Until Aug. 4 by R. C. Desrochers, Secy. Dept. Pub. Wks., Ottawa, Ont., for constructing harbor and river improvements in Mission River, Fort William.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Channel—Boston, Mass.—Following are three lowest bids opened July 26 by Metropolitan Park Comn. (John B. Rabin, Engr.), for excavating the channel of Aberjona River, from B. & M. R. R. Bridge to Waterfield St. (price given per cu. yd.): Coleman Bros., Chelsea, 90 cts.; William R. Farrell, Allston, 91 cts.; Eastern Dredging Co., E. Boston, 91½ cts.

★**Dredging—Hackensack, N. J.**—Bids were opened July 15 by Col. F. V. Abbott, Corps Engrs., U. S. A., 39 Whitehall Street, New York, for dredging, and the bid of Coastwise Dredging Co., Norfolk, Va., was recommended for award at 14.47 cts. per cu. yd. scow meas. for dredging Hackensack River and 11.65 cts. for dredging channel north of Shooters Island.

★**Dredging — Philadelphia, Pa.** — Contract awarded on July 23 by Dept. Wharves, Docks and Ferries (John Meigs, Director) to American Dredging Co., Mariner & Merchants Bldg., Philadelphia, for dredging at Moyamensing Piers, Delaware River, at foot of McKean Street and Snyder Avenue (bids opened July 12) at $75,000.

★**Wharf—Washington, D. C.**—Contract reported awarded by Potomac & Chesapeake Steamboat Co., to Clarke & Winston Co., Washington, for a wharf at Philpots, about a mile and a half below the present wharf at Clymont, Md., to be about 300 ft. long.

★**Slide Gate Structures, Etc.—Washington, D. C.**—Contracts awarded at Washington, D. C., to Hardie-Tynes Mfg. Co., Birmingham, Ala., on Specification 307, slide gate structures for reservoir outlets, Keechelus and Sherburne Lakes dams (bids opened July 9); and to Power & Mining Machinery Co., 115 Broadway, New York, for cylinder gates, Specification 310 (bids opened July 19).

Steel Gates—Wilmington, N. C.—Following are 4 lowest bids opened July 21 by U. S. Engineer, Wilmington, for steel lock gates: Riter-Conley Mfg. Co., Pittsburgh, Pa., $9,460; Steacy-Schmidt Mfg. Co., York, Pa., $9,500; Penn Bridge Co., Beaver Falls, Pa., $10,300; Whitehead & Kales Iron Wks., Detroit, Mich., $10,732.

★**Wharf—New Orleans, La.**—Contract reported awarded by Dock Board to Creosoted Wood Block Paving Co., New Orleans for constructing Julia St. wharf at $79,599.

★**Levee Work—Memphis, Tenn.**—Contracts reported awarded by Major E. M. Markham, Corps Engrs., U. S. A., Mississippi River Comn., 1st and 2d Dists., Room 20, Custom House, for about 700,000 cu. yds. levee work, Lower St. Francis Levee Dist., as follows: To R. H. & G. A. Williams, for portion of work at $12,600; W. T. & E. M. Lowrence Co., at $21,250, and Linnan Bros. & Malachi Tausey, $39,600; all contractors of Memphis.

★**Drainage — Selmer, Tenn.** — Contract reported awarded to Swamp Dredging Cor., Tupelo, Miss., for construction of Big Snake drainage canal in eastern portion of McNairy County, at 6.25 cts. per cu. yd. for excavating and clearing right-of-way. The canal will be 12½ miles long, 22 ft. wide at top, 12 ft. wide at bottom and 8 ft. deep. Work includes 4500 ft. of laterals and 351,266 cu. yd. earth excav.

Ditch—Kankakee, Ill.—See under "Bids Desired."

★**Drainage Ditches—Poplar Bluff, Mo.**—Contract awarded by County Comrs. (James P. Chambers, Clk.) for constructing 9 drainage ditches, about 189,567 ft. long and totaling about 1,021,608 cu. yd., to Northern Constr. Co., Elkhart, Ind., at 6.6 cts. and 6.95 cts. per cu. yd. (bids opened July 19).

★**Gate Frames, Etc.—Yakima, Wash.**—Contract awarded by Secretary of Interior, Washington, D. C., to Hardie-Tynes Mfg. Co., Birmingham, Ala., for slide gate bodies and gate frames for reservoir outlets at Kocheelus Dam, Yakima Storage Unit, and Sherburne Lake Dam, St. Mary Storage Unit, Milk River project, Mont., at $7,276 f.o.b. cars Birmingham, Ala.

Irrigation Work—Goshen, Utah—Following are reported to be totals of bids opened July 15 by U. S. Reclamation Service, Provo, about 50,000 cu. yds. canal excav., 8000 cu. yds. rolled embankment, 3000 cu. yds. excav. for structures, 950 cu. yds. reinforced concrete and 525,000 sq. ft. canal lining. Work near Goshen, on Tintic Branch, Denver & Rio Grande R. R.; Heuser & Sims, Salt Lake City, $73,547; G. H. Gilkerson, Salt Lake City, $74,342; Mendenhall, Straw & Bird, Springville, $93,111.

Irrigation—Fort Shaw, Mont.—Following are totals of bids opened July 1 by U. S. Reclamation Service, Fort Shaw, for constructing first unit of laterals on Greenfields distribution system, earthwork and structures. Schedules 1 to 10 (Charles P. Williams, Project Mgr., Fort Shaw): Entire work (2 bids), West Coast Constr. Co. and Hans Pederson, Madison Building, Seattle, Wash., $125,529, and Winston

Bros. Co., Globe Building, Minneapolis Minn., $148,435; Schedules 1, 2, 3, 4 and 5. 3 - 5, Hutson Buildings $16,122; Class White & Co., Marks Building, Schedules 1, 2, 3, 4 and 10; Gardner & Hannan, Great Falls, $98,524; Schedules 6, 7, 8, 9 and 10. 1 - 2, Bertsch, Oleman, Mont., $84,000; Schedules 6 and 10, Security Bridge Co., Minneapolis, Minn., $58,629; Schedule 10 only, Threet Bros. & Jolley, Lovell, Wyo., $7,342.

Following are unit prices of West Coast Construction Co. and Hans Pedersen, Seattle, lowest bidders on complete work (schedules 1 to 10):

$4,000	cu. yd. excav., Class 1	$0.12
400	cu. yd. excav., Class 2	0.25
50	cu. yd. excav., Class 3	0.25
800	sta. cu. yd. overhaul	0.02
	Total Schedule 1	$10,333
98,000	cu. yd. excav., Class 1	$0.12
1,000	cu. yd. excav., Class 2	0.25
11	cu. yd. excav., Class 3	0.50
800	sta. cu. yd. overhaul	0.02
	Total Schedule 2	$12,173
50,000	cu. yd. excav., Class 1	$0.12
500	cu. yd. excav., Class 2	0.25
50	cu. yd. excav., Class 3	0.50
1,600	sta. cu. yd. overhaul	0.02
	Total Schedule 3	$11,442
78,000	cu. yd. excav., Class 1	$0.12
800	cu. yd. excav., Class 2	0.25
40	cu. yd. excav., Class 3	0.50
1,300	sta. cu. yd. overhaul	0.02
	Total Schedule 4	$9,686
57,500	cu. yd. excav., Class 1	$0.125
1,000	cu. yd. excav., Class 2	0.25
60	cu. yd. excav., Class 3	0.50
800	sta. cu. yd. overhaul	0.02
	Total Schedule 5	$8,059
11,400	cu. yd. excav., Class 1	$0.35
350	cu. yd. excav., Class 2	0.50
50	cu. yd. excav., Class 3	0.50
2,000	cu. yd. backfill	0.30
1,000	cu. yd. puddling	0.10
1,570	cu. yd. concrete	8.00
187,000	lb. place reinforcing steel	0.01
600	lb. place structural steel	0.025
320	sq. yd. grouted paving	0.90
2,480	lin. ft. lay, 6-in. drain pipe	0.12
	Total Schedule 6	$19,688
7,500	cu. yd. excav., Class 1	$0.40
600	cu. yd. excav., Class 2	0.50
60	cu. yd. excav., Class 3	0.50
3,000	cu. yd. backfill	0.30
1,000	cu. yd. puddling	0.12
70	cu. yd. concrete	8.00
52,000	lb. place reinforcing steel	0.01
14,000	lb. erect. gates and other metal work	0.02
24	sq. yd. grouted paving	1.00
36	lin. ft. lay 12-in. vitr. pipe	0.75
1,110	lin. ft. 18-in. concrete pipe	1.60
350	lin. ft. 20-in. concrete pipe	2.00
150	lin. ft. 24-in. concrete pipe	2.50
450	lin. ft. lay 18 and 20-in. corr. metal pipe	0.50
144	lin. ft. lay 30-in. corr. metal pipe	0.60
108	lin. ft. lay. 36-in. corr. metal pipe	0.80
90	lin. ft. lay. 42-in. corr. metal pipe	1.00
16.5	M ft. erecting lumber	10.00
	Total Schedule 7	$13,952
7,000	cu. yd. excav., Class 1	$0.35
500	cu. yd. excav., Class 2	0.50
70	cu. yd. excav., Class 3	0.50
3,450	cu. yd. backfill	0.35
1,700	cu. yd. puddling	0.10
800	cu. yd. concrete	8.00
56,000	lb. place reinforcing steel	0.01
14,000	lb. erect. gates and other metal work	0.02
90	sq. yd. grouted paving	1.00
80	lin. ft. lay. 12-in. vitr. pipe	0.75
720	lin. ft. 18-in. concrete pipe	1.60
500	lin. ft. 20-in. concrete pipe	2.00
420	lin. ft. 24-in. concrete pipe	2.30
630	lin. ft. lay. 18 and 20-in. corr. metal pipe	0.50
18	lin. ft. lay. 24-in. corr. metal pipe	0.60
306	lin. ft. lay. 30-in. corr. metal pipe	0.60
90	lin. ft. lay. 36-in. corr. metal pipe	0.80
108	lin. ft. lay. 42-in. corr. metal pipe	1.00
360	lin. ft. erect metal flumes, 2 ft. 7 in.	0.40
10	lin. ft. erect. metal flumes, 3 ft. 2 in.	0.40
5	lin. ft. erect. metal flumes, 3 ft. 10 in.	0.50
400	lin. ft. lay 4-in. drain pipe	0.10
21,500	M ft. erecting lumber	10.00
	Total Schedule 8	$15,865
6,500	cu. yd. excav., Class 1	$0.35
500	cu. yd. excav., Class 2	0.50
50	cu. yd. excav., Class 3	0.50
3,900	cu. yd. backfill	0.30
1,900	cu. yd. puddling	0.10
810	cu. yd. concrete	8.00
57,000	lb. place reinforcing steel	0.01
19,000	lb. erect. gates and other metal work	0.02
320	sq. yd. grouted paving	0.90
960	lin. ft. 18-in. concrete pipe	1.75
280	lin. ft. 20-in. concrete pipe	2.00
660	lin. ft. 24-in. concrete pipe	2.25
594	lin. ft. lay. 18 and 20-in. corr. metal pipe	0.50
72	lin. ft. lay 24-in. corr. metal pipe	0.60
162	lin. ft. lay. 30-in. corr. metal pipe	0.65
270	lin. ft. lay. 36-in. corr. metal pipe	0.75
90	lin. ft. lay. 42-in. corr. metal pipe	1.00
22.5	M ft. erect. lumber	10.00
	Total Schedule 9	$16,471
5,000	cu. yd. excav., Class 1	$0.35
200	cu. yd. excav., Class 2	0.50
20	cu. yd. excav., Class 3	0.50
1,800	cu. yd. backfill	0.40
325	cu. yd. concrete	10.00
205	M ft. erect. lumber	10.00
	Total Schedule 10	$7,880
	Grand total	$125,529

New York, N. Y.—Following are unit prices of 4 lowest bids opened July 20 by Pub. Service Comn. for First Dist., for construction of Sect. 1, Route 49, part of Culver rapid transit railroad. (a) Post & McCord, 101 Park Ave., $871,959; (b) Phoenix Bridge Co., 49 William St., $894,554. (c) A. L. Guidone, 131 E. 23d St., $904,437; (d) Cooper & Evans, 220 Broadway, $914,732. This is a 3-track elevated railroad, to connect 4th Ave. subway through 38th St. and Gravesend Ave. with Coney Island. Length of section about 11,195 ft.

Item			(a)	(b)	(c)	(d)
1B	21,900	cu. yd. column excavation	$1.15	$1.40	$1.45	$2.50
1C	12,800	cu. yd. railroad dust excavation	1.10	1.00	1.50	1.00
6	5,600	cu. yd. concrete masonry	5.85	5.65	7.00	5.00
8	10	cu. yd. brick masonry	15.00	20.00	15.00	20.00
12	500	lin. ft. timber piles	0.35	0.50	1.00	1.00
12	2	M. ft. timber foundations	60.00	60.00	54.00	50.00
13c	320	lin. ft. vitrified pipe, 4 in.	0.20	0.50	0.20	0.60
13A	329,000	duct. ft. railroad ducts	0.12	0.10¼	0.14	0.10½
15	14,500	lbs. reinforced steel (painted and erected)	46.50	48.00	46.00	47.85
20	600	tons steel beams and shapes	46.50	48.00	46.00	47.85
21	2	tons steel rods and bars in concrete	60.00	42.00	60.00	40.00
25	180	tons miscellaneous iron castings	55.00	45.00	60.00	36.00
30b	3,600	sq. yd. street surface restored	3.00	2.50	2.50	2.50
)	300	lin. ft. new 5 in. blue stone curb	1.00	0.90	1.00	1.25
B	100	lin. ft. new 4 in. blue stone curb	1.00	0.70	0.90	1.00
C	1,000	lin. ft. restoring old curb	0.20	0.25	0.25	0.25
72a	12,150	lin. ft. electric overhead trolley	1.20	0.70	1.00	0.60
75P	100	lin. ft. depressing street surface R.R.	0.50	2.00	4.50	5.00
75G	200	lin. ft. lateral mov't of turnout tracks	0.50	2.50	4.50	4.00
75H	6,865	lin. ft. lateral mov't of surface tracks	0.50	1.25	1.30	1.50
76a	1,500	lin. ft. removing street surf. tracks	0.30	0.45	0.60	1.00
b	1,500	lin. ft. rebuilding street surf. tracks	0.85	0.70	0.90	1.00
78	100	lin. ft. 4 in. water pipes in street	0.50	0.90	0.50	1.00
79	100	lin. ft. 6 in. water pipes in street	0.75	1.00	0.50	1.25
80	100	lin. ft. 8 in. water pipes in street	1.00	1.10	0.50	1.50
84	100	lin. ft. 20 in. water pipes in street	2.00	2.50	1.50	3.00
87	100	lin. ft. 36 in. water pipes in street	7.00	6.00	4.00	5.00
90	100	lin. ft. 4 in. c.i. gas pipes	0.50	0.70	0.45	1.00
91	100	lin. ft. 6 in. c.i. gas pipes	0.75	1.00	0.45	1.25
92	100	lin. ft. 8 in. c.i. gas pipes	1.00	1.10	0.50	1.50
94	100	lin. ft. 12 in. c.i. gas pipes	1.50	1.80	0.75	2.00
96Cb	60	lin. ft. 6 in. w.i. gas pipes	1.00	1.05	1.00	2.00
c	60	lin. ft. 8 in. w.i. gas pipes	1.00	1.15	1.00	3.00
100	4	each c.i. hub & spigot str'ght pipe	50.00	35.00	65.00	70.00
100Ab	50	lin. ft. new standard wt. 6 in. w.i. gas pipe	1.00	1.00	1.10	2.00
c	50	lin. ft. new standard wt. 8 in. w.i. gas pipe	1.00	1.10	1.40	3.00
101	10	tons new c.i. hub and spigot pipe spec. casting	70.00	60.00	65.00	70.00
101A	100	lb. new malleable fittings for w.i. gas pipe	0.10	0.10	0.05	1.00
127	2,000	duct ft. electric ducts and conduits	0.35	0.25	0.40	0.40
127Aa	100	lin. ft. 2½ in. w.i. pipe electric ducts and conduits	0.80	0.70	0.45	1.00
127D	100	duct ft. wooden ducts and conduits	0.80	0.60	0.90	1.00
127E	100	duct ft. fibre electric ducts and conduits	0.30	0.60	0.40	1.00
136	5	each electric ground conn. to R.R. structure	50.00	40.00	100.00	75.00

ELECTRIC RAILWAYS

PROPOSED WORK

Chicopee Mass.—Springfield Street Ry. Co. received franchise to construct railway from East Springfield to Chicopee. Herbert M. Flanders, Gen. Mgr., Springfield.

St. Clair, Pa.—Eastern Pennsylvania Rys. & Schuylkill Electric Ry. Cos. (W. B. Rockwell, Mgr., Pottsville) received franchise to construct electric railway in St. Clair which will connect northern part with southern part of Schuylkill County.

South Brownsville, Pa.—South Brownsville St. Ry. Co. contemplates constructing electric railway from Brownsville to South Brownsville. W. E. Moore and J. S. Jenks said to be interested.

Goldsboro, N. C.—Goldsboro Electric Ry. Co. will build 1 mile new track in Goldsboro.

Ashtabula, Ohio.—East Village & Harbor Traction Co. about to begin surveys for constructing railway in Ashtabula. In connection with railway a steel and concrete bridge is to be constructed at Main Street. Mark E. Copeland, Cleveland, said to be interested.

Cleveland, Ohio.—Cleveland, Akron & Canton Terminal Ry. Co. received franchise from Council to construct subway under E. Fifty-fifth Street from lake to southerly limits of city. This part of plan to construct railway from Cleveland along old Ohio Canal to Dresden.

Fort Wayne, Ind.—Fort Wayne & Northern Indiana Traction Co. considering constructing line to Spencer Park, Logansport.

Henryetta, Okla.—Plans being considered to construct electric railway from Henryetta to Dewar, 3 miles. Z. T. Sweeney, Columbus, Ind., interested.

Los Angeles, Cal.—F. D. Cornelius received franchise to construct electric railway in Brooklyn, Evergreen and Wabash Avenues in Los Angeles.

Ogden, Utah.—Surveys completed and right-of-way being secured for constructing railway from Ogden to Brigham City for Ogden, Logan & Idaho Ry. Co.

BIDS DESIRED.

New York, N. Y.—Bids desired by Pub. Service Comn., First Dist., New York City (Travis H. Whitney, Secy.), for work as follows:

Aug. 4—For constructing a railroad duct for the Queensboro Rapid Transit R. R., to be a subsurface duct line consisting of 40 ducts with manholes at intervals extending under East Forty-fourth Street from Lexington to First Avenues, under First Avenue to East Forty-second Street and thence under East Forty-second Street to Shaft No. 2, Queensboro Subway Rapid Transit Railroad on southerly side of East Forty-second Street between First Avenue and the East River.

Aug. 4—For supply of ballast for use in construction of rapid transit railroads. There are three portions of ballast to bid upon, known as Portion A, B and C respectively.

Aug. 18, supply of special work, Order No. 3, for use in construction of Rapid Transit railroads.

Aug. 18, supply of ties and timber for use in construction of Rapid Transit railroads.

Aug. 18, supply of track materials for use in construction of Rapid Transit railroads.

Aug. 18, station finish work for parts of the Seventh Avenue, Lexington Avenue, and White Plains Rapid Transit railroads.

Toronto, Ont.—Until Aug. 3 by T. L. Church (Mayor), Chmn. Bd. Control, for furnishing tie rods and tie plates; also special track work for Lansdowne Avenue extension. Toronto Civic Ry.

PRICES AND LETTINGS.

★*Indicates award of contract.*

New York, N. Y.—Following are unofficial totals of bids opened July 27 by Bd. Public Service for First District, 154 Nassau Street, for constructing sections of the subway as follows:

Section 3, Route 12, Eastern Parkway, subway, Brooklyn, Rodgers & Hagerty, Inc., 152d Street and Harlem River, New York, $2,170,000; W. H. Gahagen, Inc., 189 Montague Street, Brooklyn, $2,200,000; T. A. Gillespie Co., 50 Church Street, New York, $2,203,000; Charles Cooper, 1251 Bedford Avenue, Brooklyn, $2,204,000; Battery Eng. & Const. Co. and Fraser, Burchenell Co., 80 Maiden Lane, New York, $2,260,000; Dock Contractor Co., Hoboken, N. J., $2,294,000; A. L. Guidone & Son, Inc., 131 East Twenty-third Street, New York, $2,296,000; Mason & Hanger Co., Van Cortlandt Park, New York, $2,333,000; Connex Eng. and Constr. Co., 19 East Twenty-fourth Street, New York, $2,424,000; James E. Gaffney, 52 Vanderbilt Avenue, New York, $2,438,000; Degnon Contracting Co., 30 East Forty-second Street, New York, $2,544,000; John J. Creem, 688-A Green Avenue, Brooklyn, $3,196,000.

Section No. 3, Routes 4 and 36, Broadway subway, Manhattan, Holbrook, Cabot & Rollins Corp., 52 Vanderbilt Avenue, New York, $3,741,000; Rodgers & Hagerty, Inc., $3,754,000; Smith, Hauser & McIsaacs, 18 East Forty-first Street, New York, $3,814,000; MacArthur Bros. Co., 11 Pine Street, New York, $3,959,000; Underpinning & Foundation Co., 290 Broadway, New York, $3,987,000; Oscar Daniels Co., Woolworth Building, New York, $3,953,516; Degnon Contracting Co., $4,162,920; T. A. Gillespie Co., $4,230,000; Rapid Transit Subway Constr. Co., 165 Broadway, New York, $4,444,000.

Manganese Rails: Manganese Steel Rail Co., 30 Church Street, New York, $263,592. First delivery within 60 days, last Feb. 1, 1917; Pennsylvania Steel Co., 71 Broadway, New York, $367,307. First delivery within 60 days, last Aug. 31, 1916.

Following are unofficial totals of 4 lowest bids opened July 28, for Section 2, Route 29, Nostrand Avenue, subway, Brooklyn: Dock Constr. Co., $1,700,000; B. Donegan Co., Brooklyn, $1,845,000; T. A. Gillespie Co., $1,879,000; Rodgers & Hagerty, $2,010,000.

RAILROADS

PROPOSED WORK

Buffalo, N. Y.—Devoe P. Hodson, Pub. Service Comr., reported to have obtained a $100,000 appropriation from the State, to eliminate Harlem Ave. grade crossing in Cheektowaga and to erect a viaduct which will span 55 railroad tracks at that crossing, to be about 2900 ft. in length.

Delawanna, N. J.—Delaware, Lackawanna & Western R. R. Co. (G. P. Ray, Ch. Engr., Hoboken), reported to have decided to eliminate grade crossing at River Road, Delawanna, to include construction of bridge and depressing roadway at William Street.

Fort Wayne, Ind.—Common Council reported to have approved revised plans for track elevation at Osage St. between city, the Lake Shore and Nickel Plate Railroads. Council also adopted resolution for track elevation by the Nickel Plate at Coombs St.

PRICES AND LETTINGS.

★**Roseburg, Ore.**—Contract reported awarded by City Council to Kendall Bros. Pittsburgh, Pa., for construction of railroad from Roseburg to line of Umpqua National Forest Reserve and erection of a sawmill. Mill erection has been sublet to Allis-Chalmers Co., Milwaukee, Wis., It is said that the mill will cost approximately $400,000 and the railroad about $800,000.

PUBLIC BUILDINGS AND SCHOOLS

PROPOSED WORK

Chelsea, Mass.—Aldermen have appropriated $120,000 for addition to Williams School.

Southbridge, Mass.—All bids opened recently for erecting high school rejected as being too high. Plans to be revised and new bids asked. F. E. Corbin, Supt. Schools.

Westfield, Mass.—J. D. Cadle, Elm St., is architect for the proposed school on White Street, to cost $60,000. Dr. J. M. Dutton, Chmn. Com.

Bridgeport, Conn.—Contract soon to be let by Bd. Educ. for erecting addition to City Normal School.

Buffalo, N. Y.—Dept. of Pub. Wks. has asked bond issue of $150,000 for erection of Street Department barns and storage buildings, including repair shop, wagon shop and paint shop.

New York, N. Y.—Plans filed for erection of 4-story brick hospital at Grand Concourse and 196th Street for House of Holy Comforter; cost $175,000. John B. Snook Sons, Archts., 261 Broadway.

Rochester, N. Y.—Louis F. Pilcher, State Archt., Albany, and Walker Livingston & Bracket, Archts., Rochester, are preparing plans for armory and stable, 200 x 250 ft., 1 and 2-story brick and concrete, to be erected on Culver Road by State of New York.

Stockton, N. Y.—Plans prepared by H. P. Beebe, Fredonia, for school to be erected in Stockton; cost, $35,000.

Morristown, N. J.—Reported $75,000 additional high school bonds will be sold Aug. 15 by Bd. of Educ.

Summit, N. J.—Erection of 3-story high school is contemplated; cost, $150,000.

Baltimore, Md.—Plans being prepared by Archer & Allen, Central Savings Bank Building, for addition to mechanical laboratory of Johns Hopkins Medical School at Monmount Street and Broadway; cost about $50,000.

Shepherdstown, W. Va.—Site has been selected for dormitory for Shepherd College, to be erected at cost of about $25,000.

Raleigh, N. C.—Citizens to vote on $100,000 bond issue for repairing Murphey School, completing Glenwood School and repairs to other schools in township.

Columbia, S. C.—Plans being prepared by Urquhart & Johnson of Columbia for high school, and George E. Lafaye, Columbia, for the Negro school. E. S. Dreher, Supt. of Schools.

Sumter, S. C.—Bonds for $50,000 for school improvements sold.

Atlanta, Ga.—Election will soon be held to vote on issuing $1,000,000 for public schools and $375,000 for Grady Hospital.

Jackson, Miss.—Bonds amounting to $65,000 sold for school improvements.

Cincinnati, Ohio.—Plans being prepared by Hannaford & Co., Hulbert Block, for a building for Medical College, University of Cincinnati; cost $250,000.

C. W. Handman, 511 W. Court Street, preparing plans, to be ready about Aug. 20, for the proposed Madisonville high school.

Richwood, Ohio.—Plans prepared by Paul T. Cahill, Cleveland, for erecting central school; cost about $40,000.

Zanesville, Ohio.—City Council voted to erect a city hall and market house.

Monmouth, Ill.—Temple & Burrows, Davenport, Iowa, are architects for city hall; cost, $50,000.

Rock Island, Ill.—Bd. Educ. rejected all bids received recently for erecting school on Twelfth Street and Tenth Avenue.

Beloit, Wis.—Citizens voted to erect 12-room school.

Monroe, Wis.—Citizens voted $60,000 bonds for erecting school.

Sheboygan, Wis.—City Council reported to have authorized Bd. Pub. Wks. to receive bids in part for proposed city hall; total cost, $130,000. C. U. Boley, City Engr.

Anaconda, Mont.—Reported an additional story will be erected to St. James Hospital; cost $60,000.

Fort Benton, Mont.—Bonds amounting to $20,000 sold by Trus. Fort Benton School Dist. for erecting annex to school.

Albany, Mo.—Plans completed by W. H. Shumaker, Kansas City, for girls' dormitory and gymnasium to be erected at Palmer College; cost $30,000.

Austin, Tex.—Citizens voted $250,000 bonds for new schools.

Orange, Tex.—Citizens July 20 voted $150,000 bonds for schools.

Grand Mound, Wash.—Plans of Watson Vernon, Aberdeen, approved by State Bd. Control at Olympia, for administration building at State School for Girls at Grand Mound; cost $60,000.

Medical Lake, Wash.—Julius A. Zittel, The Rookery, Spokane, reported completing plans for new building for feebleminded to be erected at Medical Lake, and bids will probably be received in August by State Board of Control at Olympia. Appropriation available, $292,000, to include new administration building, custodial building, 2 ward buildings, power house and laundry.

Seattle, Wash.—Plans being prepared by Bebb & Gould, Denny Bldg., for 4-story and basement brick concrete and terra cotta, 60 x 120 ft., office building for the U. S. Immigration Comn. on Western Avenue and Union Street; cost $75,000.

Sedro Woolley, Wash.—State Bd. of Control, at Olympia, approved plans of Heath & Gove, National Realty Building, Tacoma, for construction of ward buildings and auditorium for Northern Hospital for Insane, at Sedro Woolley; cost about $135,000. Buildings will be of reinforced concrete and steel construction. Contract to be let at once.

Monmouth, Ore.—Plans for State Normal School reported completed by J. V. Bennes, Chamber of Commerce Building, Portland, and contract will be let soon; it will be 84 x 128 ft., 2 stories and basement, of mill and concrete construction; cost about $50,000 and $60,000.

Pasadena, Cal.—Preliminary plans prepared by Elmer Grey, 511 Wright & Callender Bldg., Los Angeles, for 3-story reinforced concrete chemistry building for Throop Polytechnic School; cost $60,000.

Redondo, Cal.—Plans prepared by L. B. Pemberton, 900 Auditorium Bldg., Los Angeles, for 2-story brick grammar school, have been accepted by Redondo Grammar School Trus.

San Francisco, Cal.—Plans being prepared by Norman Coulter, 46 Kearney Street, for concrete building to be erected at Tenth and Market Streets for San Francisco Veterinary College.

Plans being prepared for Forest Hill Station to be erected by city on line of Twin Peaks Tunnel; cost about $250,000.

Bd. of Wks. directed John Reid, Jr., Chronicle Building, to prepare plans for northeast wing for San Francisco Hospital.

Fred H. Meyer, Bankers' Investment Building, directed to prepare plans for Redding School, to be erected at Pine and Larkin Streets.

Ward & Blohme, Alaska Commercial Building, selected to prepare plans for buildings to be erected at 34 Mint Avenue and 672 Howard Street, for Fire Dept.

Seven-story hospital is to be erected at Fourth and Parnassus Avenues for Affiliated Colleges; cost $550,000.

Visalia, Cal.—Citizens voted $50,000 bonds for purchase of site and erection of municipal auditorium.

BIDS DESIRED.

Bangor, Me.—Until Aug. 3, by Superintendent of Bangor State Hospital, Bangor, for erecting an addition to the hospital. Wilfred E. Mansur, Archt., 15 Cross Street; also same time and place as above for erecting a 2-story sun parlor on Building C, above hospital. C. Parker Crowell, Archt., 44 Central Street.

Gardiner, Me.—Until Aug. 12 at office of Superv. Archt., Washington, D. C., for construction, complete, including mechanical equipment, lighting fixtures and approaches of U. S. Post Office, Gardiner.

Worcester, Mass.—Reported desired until Aug. 2 by George Halcott, Supt. Pub. Bldgs., for erecting an 8-room brick addition to the Midland Street School; also alterations to original building. L. W. Briggs, Co. Archts., 314 Main Street.

Providence, R. I.—Until Aug. 2 by Bd. Contract and Supply (William C. Pelkey, Clk.), for erecting a grammar school on Beaufort Street, including plumbing, ventilating, heating and electrical work. Murphy, Hindle & Wright, Archts., 146 Westminster Street.

Binghamton, N. Y.—Until Aug. 4 by Bd. Contract and Supply, for erecting the Fourth and Fifth Ward Schools. Sanford O. Lacey, Archt., Phelps Building.

Syracuse, N. Y.—Reported desired until Aug. 30 by R. D. Rooney, Secy. Bd. Contract and Supply, for erecting the Delaware School, 2-story and basement, 248x140 ft. Probable cost $225,000. James Randall, Archt., S. A. and K. Building.

Utica, N. Y.—Until Aug. 3 by Bd. School Comrs. (Dennis J. Kelly, Clk.), for erecting Kernan School. Separate bids desired on main building and tubercular and anaemic building. Bids to include plumbing, ventilating and heating, electric work, etc. Gouge & Ames. Archts., Utica.

Harrisburg, Pa.—Until Aug. 10 by Comrs. Pub. Bldgs. and Grounds (Samuel B. Rambo, Supt.), for furnishing material and erecting a fireproof main building (the first floor and basement having been constructed under a former contract) on the State Arsenal grounds, Eighteenth and Herr Streets.

Larimer, Pa.—Until Aug. 18, by School Board North Huntington Township, Irwin, R. F. D. 1 (A. M. Peters, Secy.), for erecting a 6-room brick school, at Larimer. W. G. Sloan, Archt., Greensburg.

Pittsburgh, Pa.—Until Aug. 25 by U. S. Engineer for building 2 brick lockkeepers' houses at Dam 10, Ohio River, advertised in Engineering Record.

Pittsburgh, Pa.—Until Aug. 10 by Hyatt M. Cribbs, Co. Controller, for the structural steel erection for the new City and County Building, Grant and Diamond Streets. Probable cost, $60,000; Also same time and place, separate bids for sub-surface structure work for above building. Probable cost, $50,000. Edward B. Lee, and Palmer, Hornbostel & Jones, Archts., 345 Fourth Avenue, Pittsburgh.

Madison, W. Va.—Reported desired until Aug. 10, by Elmer Nelson, Co. Clk., for constructing a courthouse. H. Rus Warne, Archt., Charleston.

Rock Hill, S. C.—Until Aug. 2 by Winthrop Normal and Industrial College (D. B. Johnson, Pres.), for furnishing material and erecting gymnasium for above institution. Hook & Rogers, Archts., Charlotte, N. C.

Palatka, Fla.—Until Aug. 27, by Jas. A. Wetmore, Acting Superv. Archt., Washington, D. C., for the construction, complete (including mechanical equipment, lighting fixtures and approaches) for the U. S. Post Office at Palatka.

St. Augustine, Fla.—Until Aug. 9 by State Bd. Control, Jacksonville (P. K. Yonge, Chmn.), for erecting a negro building and hospital building for the State School for the Deaf and Blind, St. Augustine. Edwards & Sayward, Archts., Candler Bldg., Atlanta, Ga.

Henderson, Ky.—Reported desired until Aug. 3 by A. B. Jarvis, Chmn. Bldg. Com. Henderson General Hospital, for furnishing material and erecting a 2-story and basement, 41 x 102 ft. hospital. Gilbert, Fabian & Bretano, Archts., Furniture Exchange Building, Evansville.

Athens, Ohio.—Until Aug. 10 by Bd. Educ., New Marshfield Rural School Dist., Athens (E. L. Wilson, Clk.), for furnishing material and erecting a school. E. S. Matheny, Archt., Harrison Building, Columbus.

Camden, Ohio.—Until Aug. 20 by G. M. Homsher, Clk., Camden Village School Dist., Somers Township, for furnishing material and erecting 8-room brick fireproof school with auditorium and gymnasium. H. Rufus Thompson, Archt., 524 Belmont Avenue, Youngstown.

Gratis, Ohio.—Until Aug. 16, by Bd. Educ., Village School Dist. (J. T. Street, Clk.), for furnishing material and erecting a 2-story and basement fireproof school. Edw. P. Musselman, Archt., Reibold Annex, Dayton.

New Paris, Ohio.—Reported desired until Aug. 5 by E. C. Miskell, Clk. Bd. Educ., for erecting a 2-story and basement, 117 x 110 ft. school. F. L. Packard, Archt., New Hayden Building, Columbus.

Terre Haute (R. D. Urbana), Ohio—Until Aug. 21 by Bd. Educ., Mad River Rural School Dist. (Alpha Evilsizor, Clk.), for furnishing material and erecting grade school; also separate bids for heating and ventilating. F. S. Rusk and Cree Sheets, Archts., 145 N. High St., Columbus.

Toledo, Ohio.—Until Aug. 23 by Bd. Educ., for furnishing material and erecting the Mott School, Colorado and Worthington Streets. Edwin M. Gee, Archt., Bd. Educ.

Hartford City, Ind.—Until Sept. 1, according to press reports by County Comrs., for erecting a building at the County Infirmary.

Detroit, Mich.—Until Aug 10 by Bd. Educ. (Charles A. Gadd, Secy.), for furnishing material and erecting 20-room school at Montclair and Meadowbrook Avenues, including ventilating, heating, plumbing and electric wiring. Malcomson & Higginbotham, Archts., Moffat Building. Ammerman and McColl, Engrs., Penobscot Building.

Morenci, Mich.—Until Aug. 18 at residence of G. W. Lee, Clk., Bd. Educ., Chesterfield Township, Morenci R. F. D. No. 2 for erecting a brick school about one mile west of Oak Shade; also separately for plumbing and sewers ventilating and heating. W. H. Nicklas, Archt., Euclid Bldg., Cleveland, Ohio.

Chicago, Ill.—Until Aug. 2, by John Dill Robertson, Comr. of Health, for furnishing, delivering and erecting, complete in place, approximately 45 tons structural steel and iron work for office and shop building at the Municipal Reduction Plant, Thirty-ninth and Iron Streets.

Until Aug. 4 by W. R. Moorhouse, Comr. Pub. Wks., for furnishing material and erecting a 2-story fire-engine house on Natchey Avenue; also plumbing, drainage and electrical work.

Superior, Wis.—Until Aug. 5 by Rev. A. Gawenda, Rector, for erecting a school and church building; also heating, plumbing and electric wiring. Victor Cordella, Archt., Kasota Blk., Minneapolis, Minn.

Cherokee, Iowa.—Until Aug. 17 by Directors Independent School Dist., William Shardlow, Secy.) for erecting high school. Proudfoot, Bird & Rawson, Archts., Des Moines.

Davenport, Iowa.—Reported desired until Aug. 12 by Bd. Educ. (J. D. McCollister, Secy.), for erecting Manual Training School at Eleventh and Main Streets. Clausen & Kruse, Archts., Davenport.

Fontanelle, Iowa.—Reported desired until Aug. 2 by Bd. Educ., for erecting a 2-story and basement, 70 x 94 ft. school. Probable cost $40.000. L. D. Willis, Archt., City National Bank Building, Omaha.

Forest City, Iowa.—Until Aug. 16 by Independent School Dist. (Dr. H. R. Irish, Pres.) for erecting a high and grade school, including heating, plumbing, electrical work and fixtures. Alban & Lockhart, Archts., Endicott Bldg., St. Paul, Minn.

Anoka, Minn.—Until Aug. 3 by State Bd. Control, St. Paul, for erecting a cow barn at State Hospital, Anoka. C. H. Johnston, Archt., Capital Bank Bldg., St. Paul.

Buffalo, Minn.—Until Aug. 10 by C. S. Hawker, Clk. Independent School No. 23, for erecting an addition and remodeling high school, including ventilating and heating and plumbing. Kirby T. Snyder, Archt., Plymouth Bldg., Minneapolis.

Hastings, Minn.—Until Aug. 10 by State Bd. Control, St. Paul, for furnishing material and erecting the new east wing, main building, Hastings State Asylum, Hastings, including plumbing and electrical work. C. H. Johnston, Archt., Capital Bank Bldg., St. Paul.

Worthington, Minn.—Until Aug. 11 by State Bd. Control, St. Paul, for furnishing material and erecting a tuberculosis sanatorium at Worthington. Sund & Dunham, Archts., Essex Building, Minneapolis; Rose & Harris, Engrs., Minneapolis.

Syracuse, Kan.—Reported desired until Aug. 9 by W. E. Hulse & Co., Archts., First National Bank Building, Hutchinson, for erecting a 2-story and basement school. Probable cost, $28,000.

Kearney, Neb.—Until Aug. 3 by State Bd. Educ., Lincoln, for erecting a brick and stone auditorium for the State Normal School, Kearney. J. H. Craddock, Archt., Continental Building, Omaha.

Lincoln, Neb.—Until Aug. 18, by H. E. Wells, Co. Clk., for erecting a tile and stucco fireproof building to be used as a residence, wards and hospital at the County Farm, to be 2 stories and basement, 47 x 64 ft., the same being the completion of the building, the east portion of which is already completed.

Schuyler, Neb.—Until Aug. 16 by Otto Zuelow, Secy. Bd. Educ., for erecting a high school. Grabe & Helleberg, Archts., Columbus, Neb.

Tekamah, Neb.—Until Aug. 6 by James A. Clark, Secy. Library Bd., for erecting Public Library. R. W. Grant, Archt., Beatrice.

Miles City, Mont.—Reported desired until Aug. 12, by Clerk of School Bd., for erecting 3-story, 63 x 123-ft. school. Probable cost, $60,000. B. Rivenes, Archt., Miles City.

Laramie, Wyo.—Reported desired until Aug. 10 by F. S. Burrage, Secy. Bd. Trus., University of Wyoming, for erecting Women's dormitory on Campus of said University. William Dubois, Archt., Cheyenne.

Pharr, Tex.—Until Aug. 3 by School Bd. (Lee Walsh, Secy.), and opened at the First Natl. Bank, for erecting the Pharr-San Juan High School. M. L. Waller & Co., Archts., Fort Worth.

Berkeley, Cal.—Until Aug. 9 at the office of the Comptroller, University of California, for erecting Wheeler Hall on grounds of said University.

Los Angeles, Cal.—Until Aug. 5 by Bd. Educ. (William A. Sheldon, Secy.), for furnishing material and erecting the Cahunega School, 4147 W. Second Street.

Susanville, Cal.—Reported desired until Aug. 2, by W. W. Sharp, Co. Treas., for erecting a courthouse and County Hospital. Estimated cost, $100,000.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Boston, Mass.—Following are three lowest bids opened July 27 by State House Bldg. Comn. (John F. Keliher, Chmn.) for erecting addition on the westerly side of State House: William Crane, Cambridge, $304,750; McGahey & O'Connor, Cambridgeport, $307,234; Norcross Bros., Worcester, $308,500.

★**Springfield, Mass.**—Contract for remodeling and altering Winchester Square fire station awarded to L. S. Wood, Springfield, at $23,095. Bids opened July 12 by Fire Comrs.

★**Saylesville, R. I.**—Contract for erecting school awarded to Albert F. Smiley, Saylesville, at $25,000.

Harriman, N. Y.—Following are four lowest bids opened recently for erecting school: Jersey City Constr. Co., Jersey City, $33,190; L. F. Bannon Co., Kingston, $36,800; Wilson & Miller, Middletown, $37,659; Harriman Industrial Co., Harriman, $39,895.

★**New York, N. Y.**—Contract awarded by Bd. Trus., Bellevue and Allied Hospitals (Dr. John W. Brannan, Pres.) for erecting the Gouverneur Out-Patient Building at Front St. and Gouverneur Slip (bids opened July 19): General construction to John H. Parker Co., 315 4th Ave., $141,997; plumbing to James McCullagh, Inc., 218 W. 36th St., $11,324, and heating to E. Rutzler Co., 404 E. 49th St., $1,889.

★**Bridgewater, Pa.**—Contract for erecting grade school awarded Henry Shaffer of New Brighton; cost $25,000.

★**Harrisburg, Pa.**—Contract for erecting Tenth Ward School at Fifth and Mahantongo Streets, awarded to John F. Barnhart, Harrisburg, at $63,850.

★**Pittsburgh, Pa.**—Contract awarded for structural steel work for city and county building, Grant and Diamond Streets, to Jones & Laughlin Steel Co., Pittsburgh, at $193,965 (bids opened July 21). Hyatt M. Cribbs, Co. Controller. Edward B. Lee and Palmer, Hornbostel & Jones, Archts., 345 Fourth Avenue, Pittsburgh.

Albany, Ga.—Lowest bid opened by City Council for erecting auditorium at Pine and Jackson Streets submitted by Pike Bros. Lumber Co., La Grange, at $39,163.

Indianapolis, Ind.—Following are 2 lowest bids opened for erecting library: George A. Fuller Co., Cleveland, Ohio, $416,900, and Thompson-Starrett Co., Chicago, Ill., $418,440.

★**Metz, Ind.** — Contract for erecting grade and high school awarded to J. C. Bontrager, Elkhart, at $25,000.

★**Grand Rapids, Mich.**—Contract for erecting addition to Sigsbee School award to John McNabb & Son, Grand Rapids, at $21,300.

★**Beardstown, Ill.**—Contract for erecting Post Office (bids opened July 9 by Supervising Architect at Washington, D. C.) awarded to John Lauritzen, Fergus Falls, Minn., at $39,990 for limestone.

★**Chicago, Ill.**—Local press reports state that the proposed Field Museum of Natural History recently awarded to Thompson-Starrett Co., 175 W. Jackson Boulevard, will cost $5,100,000. It will be 3 stories high, of marble, 700 x 350 ft. Architects, Graham, Burnham & Co., 80 Maiden Lane, New York.

Nashwauk, Minn.—Lowest bid opened for erecting village hall submitted by Hugh Fawcett, Duluth, at $21,995.

★**Wheaton, Minn.**—Contract awarded by Bd. Educ. (V. E. Anderson, Secy.) for erecting a brick gymnasium and manual training building to Johnson Constr. Co., Minneapolis, at $42,000; bids opened July 15. E. F. Bromhall, Archt., Alworth Building, Duluth.

★**Grand Forks, N. D.**—Contracts awarded for erecting school units opened July 6 as follows: General construction, Gray Constr. Co., Watertown, S. D., $268,918; and heating and ventilating, Healy Plumbing & Heating Co., St. Paul, Minn., $33,397. F. F. Burchard, Secy. Bd. of Educ.

★**Los Angeles, Cal.**—Contract for erecting academy building on Wilshire Boulevard for Marlborough School for Girls awarded Fred W. Siegel 406 Haas Bldg. Cost about $70,000.

★General contract for erecting 2-story brick and concrete school at 2055 W. Twenty-fourth Street awarded M. Hurwitz & O. N. Land, 528 E. Forty-sixth Street, at $22,311, and general contract for erecting similar building on Annandale site to Hetzel-Winget Co., Grant Bldg., at $32,150.

★**Duncan, Ariz.**—Contract awarded by Bd. of Educ. for erecting 2-story brick school, 68 x 120 ft. to W. S. Humphreys of Clifton, at $25,350. Other bids: C. H. Foote, Clifton, $25,900, and Clinton Campbell, Phoenix, $27,900. Lescher & Kibbey, Archts., Phoenix.

PRIVATE BUILDINGS

PROPOSED WORK.

Boston, Mass.—Knights of Columbus Bldg. Asso. of Greater Boston contemplate erecting building; cost about $500,000.

Bridgeport, Conn.—Contract soon to be let by Brooklawn Country Club for erecting club house costing $75,000 according to plans by Briggs & Caldwell, Security Bldg.

Bayside, N. Y.—Site purchased at Bell Avenue and Lawrence Boulevard, for erection of bank building for Bayside National Bank; cost about $30,000.

Brooklyn, N. Y.—Site purchased at Ocean Parkway and Neptune Avenue, Coney Island, for erection of 3-story brick hotel for Felix Miserocchi, to cost about $30,000.

Plans filed for erection of following buildings: 6-story brick store and tenement at Forty-fifth Street and Fourteenth Avenue for Kornblum Bldg. Corp., cost $24,000; S. Millman & Son, Archts., 1780 Pitkin Avenue; two 4-story brick tenements at E. Fourth Street and Avenue C for De Haven Constr. Co., cost $75,000; W. T. McCarthy, Archt., 16 Court Street; three 4-story brick tenements at E. Fourteenth Street and Foster Avenue for Jamaville Realty Co., cost $120,000; William T. McCarthy, Archt., 16 Court Street; 6-story brick stores and tenement at Lee Avenue and Hooper Street for P. & S. Realty Co., cost $40,000; Sass & Springsteen, Archts., 32 Union Square.

Buffalo, N. Y.—Plans have been filed for proposed Lackawanna Terminal Station at Main and Ohio Streets, to be of steel construction, cost $962,000. George J. Ray, Ch. Engr. Delaware, Lackawanna & Western R.R. Co., Hoboken, N. J.

New York, N. Y.—Plans filed for erection of following buildings: 2 five-story brick tenements at Seaman Avenue and Academy Street, for Frank Wilson Constr. Co., cost $75,000; Samuel Katz, Archt., 405 Lexington Avenue; two 5-story brick tenement at 78 Edgecombe Avenue for 114th Street and Seventh Avenue Constr. Co., cost $130,000; Gronenberg & Leuchtag, Archts., 302 Fifth Avenue; 6-story brick stores and tenement at Eleventh Street and Sixth Avenue for Leonard Weill Constr. Co., cost $85,000; Gronenberg & Leuchtag, Archts., 302 Fifth Avenue; 2 five-story brick tenements at 210th Street and Tenth Avenue for Ewall Heating Co., cost $60,000; Samuel Katz, Archt., 405 Lexington Avenue; 2 five-story brick stores and tenements at Sherman Avenue and Dyckman Street for J. B. C. Building Co., cost $160,000; Gronenberg & Leuchtag, Archts., 302 Fifth Avenue; 12-story apartment house at West End Avenue and Eighty-first Street for J. C. & M. G. Mayer, cost $250,000; Schwartz & Gross, Archts., 347 Fifth Avenue; two 5-story brick tenements at Fort Washington Avenue and 171st Street W. for One Seventy two Bldg. Co., cost $160,000; Gronenberg & Leuchtag, Archts., 302 Fifth Avenue; 6-story brick tenement at 95 Vandalia Avenue and 175th Street for Lehigh Bldg. Co., cost $90,000; Gronenberg & Leuchtag, Archts., 302 Fifth Avenue; 12-story apartment house at 170 W. Seventy-ninth Street, for William Allen, cost $60,000; J. Sandhill Kennedy, Archt., 157 Remsen Street; 15-story store and loft at 48 Madison Avenue for George Backer Realty Co., cost $550,000, Sommerfeld & Steckler, Archts., 31 Union Square; 1-story brick market, Pleasant Avenue at 99th E. Fourteenth Street for New Fourteenth Street Theatre Co., cost $40,000; Lorenz & F. J. Weiher, 271 W. 125th Street, Archt.; 5-story brick tenement at Anthony Avenue and 176th Street for Henry Cleland, cost $75,000, Tremont Architectural Co., 401 Tremont Avenue, Archts.; 6-story brick stores and tenement at Boston Road and Wilkins Avenue for Avenue St. John and Fox Street Corp., cost $85,000, Andrew J. Thomas, Archt., 2526 Webster Avenue; 5-story brick tenement at Marmion Avenue and 176th Street for Kirwan Bldg. Co., cost $60,000, Tremont Architectural Co., 401 Tremont Avenue, Archts.; 3-story brick stores and loft at Washington Avenue and 166th Street for Irving Levy, cost $35,000, Gronenberg & Leuchtag, Archts., 305 Fifth Avenue; 1-story brick stores and market at Elm Place and Fordham Road, cost $40,000, Frankfort & Kirchner, Archts., 830 Westchester Avenue.

Rochester, N. Y.—Maurer & Mills, Schofield Bldg., Cleveland, Ohio, directed to prepare plans for limestone and brick edifice to be erected for Congregation of Dewey Avenue Presbyterian Church, cost about $55,000.

Atlantic City, N. J.—Three-story store building to be erected at Atlantic and Ohio Avenues for George Kelly, Market Street, Philadelphia, Pa.

Newark, N. J. — Market & Beaver Realty Co., reported considering construction of new playhouse in place of present Newark theater, to cost about $750,000.

Allentown, Pa. — Plans adopted by Alumnae Assoc. of Allentown College for Women for alumnae hall; cost $30,000.

Pittsburgh, Pa.—A 6-story, 45 x 110 ft., mercantile building or warehouse is to be erected at 315 Liberty Street for E. H. Coveney.

Plans reported being prepared by Architect Geisey, in care of Mellon Estate, Smithfield Street, for a 15-story office building, to be erected at Fifth Avenue and Smithfield Street for the Mellon Estate (Bankers).

Huntington, W. Va.—Contract about to be let by Mrs. T. W. Dinkins for apartment house to cost about $40,000.

Ashland, Ky.—Ashland Hotel & Realty Co., Cincinnati, Ohio, it is reported, will erect a five-story fireproof addition to Ventura Hotel.

Cleveland, Ohio.—Contract about to be let for erecting 4-story brick, stone and terra cotta building at Mayfield and Lee Roads for Cleveland Heights Masons; cost about $100,000. F. W. Striebinger, Archt., New England Building.

Plans prepared by H. A. Cone, Schofield Building, for 5-story, 47 x 190 ft. building to be erected at Euclid Avenue and E. Seventeenth Street for M. G. Glauber; cost about $125,000.

Cleveland, Ohio.—Plans prepared by A. F. Janowitz, Permanent Building, Cleveland, for three-story brick and steel commercial and apartment building which H. A. Kangesser, Williamson Building, will erect on St. Clair and Hayden Avenues; cost, $75,000.

Plans being prepared by Richard Irvin, Pittsburgh, Pa., for mercantile building to be erected at Lakeside Avenue and W. Third Street, for Harry J. Schlosser, Erie, Pa.; cost, $120,000.

Elyria, Ohio.—Lorain County Banking Co. purchased a site, 42 x 132 ft., at Cheapside for erection of 10-story bank building.

Wilmington, Ohio.—Contract about to be let by Weber, Werner & Atkins, Cincinnati, for Clinton County Court House; cost about $300,000.

Marquette, Mich.—First Church of Christ (Scientist) to erect white granite church; cost $50,000.

Chicago, Ill.—Plans being prepared by Henry L. Newhouse, 4630 Prairie Avenue, for hotel to be erected at Grand Boule. and Fifty-first Street at cost of about $1,400,000. First unit to be 4-story 105 x 50-ft., and second unit to be 10 story.

Moving picture theater to be erected at Division Street and Washtenaw Avenue for Fred Becklenberg; cost about $85,000. Thomas R. Bishop, Archt., 85 S. Dearborn Street.

Des Moines, Iowa.—Clemens Automobile Co. purchased a site at Tenth and Mulberry Streets for erection of 4-story, 66 x 132 ft., concrete building; cost about $40,000.

Jefferson, Iowa.—Proudfoot, Bird & Rawson, Des Moines, selected to prepare plans for three-story, Bedford stone, 74 x 118 ft., court house for Greene County, to be erected at Jefferson; cost about $150,000.

Storm Lake, Iowa.—Northern Telephone Co. will erect fireproof brick and tile office building costing $25,000.

Arlington, S. D.—Construction of an elevator is contemplated; cost about $25,000. T. Converse said to be interested.

Spokane, Wash.—Contract soon to be let for erecting 3-story brick and stone home for the sisters of Franciscan Monasteries of St. Clare; cost $40,000.

Powell-Sanders Wholesale Grocery Co. to erect 5-story and basement reinforced concrete building costing $50,000.

Redwood City, Cal. — Congregational Church intends to erect $40,000 edifice. Rev. C. H. Stevens, Pastor.

BIDS DESIRED.

Cleveland, Ohio.—Bids being received by W. S. Ferguson, Co. Archt., 1900 Euclid Avenue, for constructing commercial building at 6415 Detroit Avenue for Charles H. Conners; cost, $30,000.

Pipestone, Minn.—Until Aug. 5 by Rev. Joseph Mangan, for erecting a brick edifice for the Catholic Church. W. E. E. Greene, Archt., Luverne.

Chillicothe, Tex.—Until Aug. 9 by O. H. Dodson, Chillicothe, for erecting a two-story brick church. R. H. Stuckney, Archt., Chillicothe.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Philadelphia, Pa.**—Contract awarded by Peuckert & Wunder, Archts., 310 Chestnut St., to Philip Haibach Contr. Co., 2530 Thompson Street, for rebuilding premises at 503 Market Street and 4-6 North Fifth Street, for Haverford Cycle Co. New building will be 5 stories high, of brick and steel, with ornamental terra cotta and granite trimming.

★**Petersburg, Va.**—Contract for erecting 6-story Hotel Petersburg on W. Tabb Street awarded to Fulton Brick Wks., Richmond, at about $210,000.

★**Petersburg, Va.**—Contract for erecting 6-story hotel on Tabb Street for Petersburg Investment Co. awarded to Fulton Brick Wks., Richmond, at about $210,000.

★**Beckley, W. Va.**—Contract for erect-superstructure of brick and stone hotel at Main and Kanawha Streets awarded to Crosier & Freeman, Beckley, at $34,000.

Fostoria, Ohio.—Lowest bid opened for erecting packing house for Fostoria Provision Co. submitted by J. J. Myer, Lorain, at $31,975.

Fort Wayne, Ind.—Lowest bid opened by J. M. E. Reidel, Archt., for erecting edifice for Trinity German Lutheran Church submitted by W. Wolke, 1210 Jones Street; estimated cost $35,000.

★**Bloomington, Ill.**—Contract awarded to Eicher & Ward, Bloomington, for general construction of C. U. Williams & Son building. Supplementary contracts yet to be let; total cost of building estimated at $75,000.

★**Chicago, Ill.**—Contract awarded July 26 to Lanquist & Ilsley, Chicago, for erecting Y. M. C. A. hotel at Wabash Avenue and Eighth Street. Cost, including site, $1,175,000.

★**Kewanee, Ill.**—Contract for erecting passenger station for Chicago, Burlington & Quincy Ry. Co. awarded to Jos. E. Nelson & Sons, Chicago, at $80,000.

★**Superior, Wis.**—Contracts for constructing St. Joseph's Orphanage for Catholic Diocese of Superior awarded to Tomlinson & Egan, Ashland, at $101,431.

★**Duluth, Minn.**—Contract for erecting an additional story on Fargusson Building at Fourth Avenue and Superior Street awarded by Massachusetts Realty Co. to Smith & Vokes, Duluth, at $27,000.

★**Devils Lake, N. D.**—Contract for erecting Masonic Temple awarded July 17 to Fjelseth & Johnson, Devils Lake, at $28,709, and heating to S. H. Klemetsind, Devils Lake, at $4,480. J. A. Shannon, Archt., Devils Lake.

★**Omaha, Neb.**—Contract for erecting apartment house at Thirty-third and Dewey Streets awarded to Peter Kiewit & Sons, 2567 Marcy Street, at $25,000. Hastings & Heyden, Archts., Omaha.

Contract for erecting three-story concrete building at Twenty-second and Farnham Streets for Dresher Bros., awarded to B. J. Jobst, Paxton Building, at about $30,000.

★**Lewistown, Mont.**—Contract for erecting Catholic Church on Brooks Island site awarded to Charles Smith and B. Stanton, Lewistown, at $25,787.

★**Dallas, Tex.**—Contract for erecting Labor Temple at Young and Evergreen Streets awarded to Hughes-O'Rourke Constr. Co., Dallas, at about $48,000.

NEW INDUSTRIAL PLANTS

PROPOSED WORK

Worcester, Mass.—Maurice F. Reidy, State Mutual Bldg., is promoting plan to erect an 8-story industrial building on Federal Street, of steel and concrete construction.

Binghamton, N. Y.—Plant of Union Forging Works recently damaged by fire to be rebuilt at once of fireproof construction.

Buffalo, N. Y.—Sun Motor Car Co., Buffalo, recently incorporated with capital of $750,000 has purchased plant of James Sick Co., at South Park Boule. and will equip same for manufacture of Sunlight Six automobiles. Contract has also been let for erection of an additional building 600 x 150 ft. to H. R. Hankin Co., Buffalo and other buildings will be erected later on a 4-acre site adjoining. R. Crawford, Gen. Mgr.

Syracuse, N. Y.—New Process Gear Co. has had plans prepared for another 5-story building.

Millport, Pa.—The New Jersey Zinc Co. contemplates erecting rolling mill at Millport.

Philadelphia, Pa.—It is reported Baldwin Locomotive Wks. are taking steps to incorporate Eddystone Munitions Co.; about $1,500,000 will be spent for erection of plant.

Jacksonville, Fla.—Ford Motor Co., Detroit, Mich., contemplates erecting a factory at Ocean and Ashley Streets; cost about $500,000.

Knoxville, Tenn.—An addition is to be erected to plant of Southern Extract Co.; cost about $100,000.

Akron, Ohio.—Plans being prepared by Osborn Engineering Co. for addition to factory of B. F. Goodrich Co.; cost about $500,000.

Canton, Ohio.—Pickands, Mather & Co., Cleveland, and United States Steel Co., Canton, contemplate erecting blast furnace with coke and by-product ovens in Canton; cost about $2,000,000.

Youngstown, Ohio.—Republic Iron & Steel Co. (Thos. J. Bray, Pres.) will erect 2 open-hearth furnaces and 4 tube mills to their plant; cost, $1,000,000.

Detroit, Mich.—Plans being prepared by Osborn Engineering Co., Cleveland, Ohio, for rubber factory for Kelly-Springfield Tire Co., at cost of $1,500,000.

Lansing, Mich.—Reo Motor Car Co. contemplate erecting 2 buildings on S. Cedar Street; cost about $250,000.

Harrisburg, Tex.—A cement plant is to be erected on south bank Houston Ship Channel for Texas Portland Cement Co. (F. R. Bissel, Pres.)

Seattle, Wash.—Broderick & Bascom Rope Co. will erect unit adjoining present factory at Eighth Avenue, S. E. P. Frederick, Gen. Supt.

Tacoma, Wash.—Reported the Friddle Motor Car Co. (Jas. A. Friddle, Pres.) has purchased site, and will erect a $50,000 plant.

St. Catharines, Ont.—Reported Lord & Burnham Co. of Irvington-on-Hudson, N. Y., manufacturers of skylight adjusters, will erect branch plant here; cost $100,000.

Welland, Ont.—Canadian Billings Spencer Co. will erect 70 x 80 ft. addition to plant; cost, including equipment, $30,000.

Prince Rupert, B. C.—George L. Clayton, Prince Rupert, will erect a cold storage plant; cost $150,000.

BIDS DESIRED.

Milwaukee, Wis.—Reported desired until Aug. 5 by C. and N. W. R. R. Co., Chicago, Ill., for erecting a grain elevator capacity 2000 bushels at Milwaukee. Foltz Eng. Co., Engrs., Pioneer Building, St. Paul, Minn.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Brooklyn, N. Y.**—Contract awarded to Turner Constr. Co., 11 Bway., New York, for construction of 2-story and basement manufacturing building, 40 x 75 ft., for William Becker's Aniline & Chemical Works, Inc., E. Eighty-third Street and Ditmars Avenue, Brooklyn, to be of reinforced concrete construction. Architect, Benjamin Driesler, 153 Remsen Street, Brooklyn.

★**Jamestown, N. Y.**—General contract awarded to Lackawanna Bridge Co., Buffalo, for construction of new plant of Gurney Ball Bearing Co., brick and steel; 200 tons of structural steel will be used. H. P. Sheldon & Sons, Archts., Providence, R. I.

★**Niagara Falls, N. Y.**—Contract for erecting furnace building, 40 x 220 ft., at Sugar Street and Whirlpool Avenue, for General Abrasive Co., awarded to Braas Bros., Niagara Falls. Plans being prepared by Thomas B. Allen, Toronto, for additional buildings.

★**Troy, N. Y.**—Contract for erecting concrete mill and elevator at Madison Street for Boutwell Milling & Grain Co. awarded to Deverall-Spencer Co., Baltimore, Md., at about $75,000.

★**Trenton, N. J.**—Contract awarded to John W. Ferguson Co., Paterson, for erecting a 80 x 120-ft. addition to machine shop of De Laval Steam Turbine Co.

★**Philadelphia, Pa.**—Contract for erecting 3-story brick, concrete and stone factory at Seventh and Wood Streets for Charles W. Lawsen awarded to Barclay White & Co., 1530 Chestnut Street; cost $27,000.

★**Youngstown, Ohio.** — Contract for erecting 3 bar mills at Struthers plant of Youngstown Sheet & Tube Co. awarded to McClintic-Marshall Co., Pittsburgh, Pa., at about $2,000,000.

★**Iona, Mich.**—Contract for erecting 5-story, 165 x 110 ft. building for Ypsilanti Reed Furniture Co., awarded to Jacob Herrmann & Son, Grand Rapids, at about $65,000.

Elgin, Ill.—Lowest bid opened for improvements to Standard Oil Co's plant at Grove Avenue and Lake Street submitted by Charles E. Giertz & Son, Elgin, at about $30,000.

MISCELLANEOUS

BIDS DESIRED.

Piles—New York, N. Y.—Until Aug. 5 by R. A. C. Smith, Comr. Docks, for Contr. 1460—Furnishing and delivering piles.

Iron, Steel, Etc.—New York, N. Y.—Until Aug. 6 by Bd. Trus., Bellevue and Allied Hospitals, Dept. Bridges, Dept. Correction, Dept. Docks and Ferries, Fire Dept., Dept. Public Charities, Dept. Water Supply, Gas and Electricity, at Room 1230, Municipal Bldg., Boro. Manhattan, for furnishing and delivering iron, steel and other metals.

Fencing—Paterson, N. J.—Until Aug. 3 by Bd. Recreation Comrs. (John McCutcheon, Secy.), for metal fencing and playground equipment for playground at Grand, Slater and Perry Sts.

Steel Derrick Boat—Washington, D. C.—Until Aug. 23 by U. S. Engineer, Southern Building, for steel derrick boat complete, advertised in Engineering Record.

Traveling Crane—New Orleans, La.—Reported desired until Aug. 3 by Sewerage and Water Bd. (F. S. Shields, Secy.) for furnishing and erecting a 15-ton traveling crane in Drainage Pumping Station No. 2.

Retaining Wall—Cincinnati, Ohio.—Until Aug. 3, by Director Pub. Service (Parke S. Johnson, Secy.), for improving Torrence Rd. at Holy Angels Church, by constructing a concrete retaining wall.

Locomotive Crane—Cleveland, Ohio.—Until Aug. 4, by A. B. Callow, Comr. Purchases and Supplies, for locomotive crane for Div. of Water.

Track Elevation Work—Fort Wayne, Ind.—Until Aug. 12 by Dept. Pub. Wks. (H. W. Becker, Clk.) for constructing city's portion of work to be done under Track Elevation Resolution No. 12.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Coal Handling Plant—New York, N. Y.**—Contract for office, scale house, a part of coal handling plant for C. H. Perry & Son, Inc., foot of East Nineteentn Street, has been awarded to Hugh Getty, Inc., 359 West Twenty-sixth Street, New York.

★**Steel—West Apollo, Pa.**—Contract awarded by Paulton Coal Co., West Apollo, to Wm. A. Scaife & Sons Co., Pittsburgh, for structural steel, for steel frame tipple to replace one recently burned.

★**Sprinkler System—New Orleans, La.**—Contract awarded July 23, by Bd. Comrs. Port New Orleans, to General Fire Extinguisher Co., through its New Orleans Office, for installation of sprinkler equipment and underground water supply system for that portion of cotton warehouses and terminals now under construction, at $65,275. Four bids were received for this work, ranging from $69,875 to $99,036. Engineer, Ford, Bacon & Davis, 921 Canal Street, New Orleans.

Proposals

For Proposals Advertised, see Pages 45, 46, 47 and 48.

WATERWORKS.

Bids. Close.		See Eng. Record.
Aug. 2.	Dam, Contract 10, Hartford, Conn.	July 10
	Adv. July 10, 17.	
Aug. 2.	Pipe and Castings, Watertown, S. D.....	July 24
	Adv. July 24.	
Aug. 3.	Pipes, Valves, Etc., Ottawa, Ont.	July 24
	Adv. July 24, 31.	
Aug. 3.	Pipe dam, etc., Ilion, N. Y.	July 31
Aug. 3.	Waterworks for Convicts Camp, Clearwater, Fla..	July 31
Aug. 4.	Pipe, Cleveland, Ohio....	July 31
Aug. 5.	Water Wks. Improv., Cambridge, Ohio	July 17
	Adv. July 17, 24.	
Aug. 5.	Water Works, Keota, Ia.	July 24
Aug. 5.	Tank, Kingsley, Ia.....	July 24
Aug. 5.	Pipe Line, Lockport, N. Y.	July 24
	Adv. July 24.	
Aug. 5.	System, Riverside, Iowa..	July 31
Aug. 5.	Reservoir, Arcadia, Fla.	July 31
Aug. 6.	Found. for Pump. Station, Pittsburgh, Pa.	July 31
Aug. 6.	Pump, etc., Sumner, Miss.	July 31
Aug. 6.	Mains, West Allis, Wis.	July 31
Aug. 9.	Waterworks, Choteau, Mont.	July 31
Aug. 10.	System, Warrenton, N. C.	July 17
	Adv. July 17 to 31.	
Aug. 10.	Pipe, etc., Washington, D. C.	July 24
Aug. 10.	Contr. 165, Boring, Etc., New York, N. Y.....	July 24
Aug. 12.	Pipe, Etc., Philadelphia, Pa.	July 31
Aug. 13.	Water Works, Ord, Neb.	July 24
Aug. 13.	Reservoir, St. Louis, Mo.	July 31
Aug. 14.	Water Works, Fromberg, Mont.	July 24
Aug. 16.	System, Watervliet, N. Y.	July 17
	Adv. July 17 to 31.	
Aug. 16.	Waterworks, Drumheller, Alta.	July 31
Aug. 17.	Pipe, Intake, etc., Beaumont, Tex.	July 24
Aug. 25.	Hydrants, reservoir, piping system, etc., Wellsville, N. Y.....	July 31
	Adv. July 31.	

SEWERAGE AND SEWAGE DISPOSAL.

Aug. 3.	Paducah, Ky.	July 3
	Adv. July 3, 10.	
Aug. 3.	Bridgeport, Neb.	July 24
Aug. 3.	Columbus, Ohio	July 24
Aug. 3.	Glencoe, Ill.	July 24
Aug. 3.	Toledo, Ohio	July 24
Aug. 3.	Wallingford, Conn.	July 24
	Adv. July 24.	
Aug. 3.	Cincinnati, Ohio.	July 31
Aug. 3.	Enumclaw, Wash.	July 31
Aug. 3.	New York, N. Y.....	July 31
Aug. 3.	Toronto, Ont.	July 31
Aug. 3.	Paterson, N. J.....	July 31
Aug. 4.	Philadelphia, Pa.	July 24
Aug. 4.	Syracuse, N. Y.....	July 24
	Adv. July 24.	
Aug. 4.	Pittsfield, Mass.	July 24
	Adv. July 24.	
Aug. 4.	Salt Lake City, Utah....	July 24
Aug. 4.	La Porte, Iowa.....	July 31
Aug. 5.	Chicago, Ill.	July 31
Aug. 6.	St. Louis, Mo.....	July 31
Aug. 6.	Sumner, Miss.	July 31
Aug. 6.	West Allis, Wis.....	July 31
Aug. 7.	Fairfield, Iowa	July 31
Aug. 9.	Steamboat Springs, Col..	July 31
	Adv. July 31.	
Aug. 10.	Warrenton, N. C.....	July 17
	Adv. July 17 to 31.	
Aug. 10.	Greenville, S. C.....	July 31
	Adv. July 31.	
Aug. 16.	Watertown, S. D.....	July 31
Aug. 18.	Lebanon, Pa.	July 24
	Adv. July 24.	
Aug. 20.	Beeville, Tex.	July 31
Aug. 23.	Dallas, Tex.	July 24
	Adv. July 24.	
Aug. 31.	Newark, N. J.....	July 10
	Adv. July 17 to 31.	
Sep. 1.	Sand Springs, Okla.....	July 31

BRIDGES.

Aug. 2.	Philadelphia, Pa.	July 24
	Adv. July 24, 31.	
Aug. 3.	Lake Charles, La.....	July 24
Aug. 3.	Canton, S. D.....	July 24
Aug. 3.	Crawfordsville, Ind.	July 24
Aug. 3.	Frankfort, Ind.	July 24
Aug. 3.	Ottawa, Ont.	July 24
	Adv. July 24.	
Aug. 3.	Waukon, Iowa	July 24
Aug. 4.	South Amboy, N. J.....	July 10
Aug. 4.	Grants Pass, Ore.	July 24
Aug. 4.	Richmond, Mo.	July 31
Aug. 4.	Philadelphia, Pa.	July 24
	Adv. July 24, 31.	
Aug. 5.	Crown Point, Ind.....	July 24
Aug. 6.	Toledo, Ohio	July 24
Aug. 7.	Clearwater, Fla.	July 17
Aug. 7.	Hamilton, Ga.	July 31
Aug. 7.	Bridgeport, Conn.	July 24
Aug. 9.	Washington	July 24
Aug. 9.	Woonsocket, R. I.....	July 31
	Adv. July 31.	
Aug. 10.	Westport, Conn.	July 31
	Adv. July 31.	
Aug. 11.	Harrisburg, Pa.	July 31
Aug. 11.	Girard, Kan.	July 31
Aug. 16.	Marysville, Ohio	July 31
Aug. 16.	Colma, Cal.	July 31
Aug. 16.	Visalia, Cal.	July 31
Aug. 17.	Athens, Ga.	July 31
	Adv. July 31.	
Aug. 21.	Kennett Cal.	July 31
Aug. 23.	Maynardsville, Tenn.	July 24
	Adv. July 24, 31.	
Aug. 26.	Tulsa, Okla.	July 31
	Adv. July 31.	

PAVING AND ROADS.

Aug. 3.	Road Roller, West Palm Beach, Fla.	July 17
Aug. 3.	New Orleans, La.....	July 17
Aug. 3.	Albany, N. Y.....	July 17
	Adv. July 17 to 31.	
Aug. 3.	Laurel, Mont.	July 24
Aug. 3.	Bloomfield, N. J.....	July 24
Aug. 3.	Walla Walla, Wash.....	July 24
Aug. 3.	Winamac, Ind.	July 24
Aug. 3.	Huntington, W. Va.....	July 24
Aug. 3.	Indiana	July 24
Aug. 3.	Massachusetts	July 31
Aug. 3.	Kansas City, Mo.....	July 31
Aug. 3.	Cincinnati, Ohio.	July 31
Aug. 3.	New York, N. Y.....	July 31
Aug. 3.	Paterson, N. J.....	July 31
Aug. 3.	Missoula, Mont.	July 31
Aug. 3.	Lyons, Ohio.	July 31
Aug. 3.	Indiana	July 31
Aug. 4.	Butte, Mont.	July 10
Aug. 4.	Indianapolis, Ind.	July 24
Aug. 4.	Philadelphia, Pa.	July 24
Aug. 4.	Defiance, Ohio.	July 24
Aug. 4.	Delaware, Ohio.	July 31
Aug. 4.	Baltimore, Md.	July 31
Aug. 4.	—Waitsburg, Wash.	July 31
Aug. 5.	Bozeman, Mont.	July 24
Aug. 5.	Findlay, Ohio.	July 31
Aug. 5.	Coquille, Ore.	July 31
Aug. 5.	Newark, N. J.....	July 31
Aug. 5.	Cincinnati, Ohio.	July 31
Aug. 5.	Indiana	July 31
Aug. 5.	Jersey City, N. J.....	July 31
Aug. 6.	Mount Gilead, Ohio.....	July 17
Aug. 6.	Russellville, Ark.	July 17
Aug. 6.	Beckley, Ohio.	July 31
Aug. 6.	Winchester, Ky.	July 31
Aug. 6.	Ohio	July 31
Aug. 7.	Butte, Mont.	July 10
Aug. 7.	Racine, Wis.	July 24
Aug. 7.	Dixon, Ill.	July 31
Aug. 7.	Colfax, Wash.	July 31
Aug. 9.	Keyport, N. J.....	July 24
	Adv. July 24, 31.	
Aug. 9.	Bryan, Ohio	July 24
Aug. 9.	Washington	July 24
Aug. 9.	Seattle, Wash.	July 24
Aug. 9.	Indianapolis, Ind.	July 31
Aug. 9.	Washington.	July 31
Aug. 9.	Brownstown, Ind.	July 31
Aug. 9.	Cincinnati, Ohio	July 31
Aug. 9.	Indiana	July 31
Aug. 9.	Watertown, S. D.....	July 31
Aug. 10.	New Orleans, La.....	July 17
Aug. 10.	Washington, D. C.....	July 17
	Adv. July 17.	
Aug. 10.	Pennsylvania.	July 31
Aug. 10.	Galion, Ohio.	July 31
Aug. 10.	Mitchell, S. D.....	July 31
Aug. 10.	Logan, Ohio	July 31
Aug. 12.	Newark, N. J.....	July 31
Aug. 12.	Mount Carmel, Ill.....	July 31
	Adv. July 31.	
Aug. 14.	Lincoln, Neb.	July 24
Aug. 14.	Goshen, Ind.	July 31
Aug. 14.	Tacoma, Wash.	July 31
Aug. 14.	Indiana	July 31
Aug. 16.	Bowling Green, Ohio.....	July 24
Aug. 16.	Wilmington, Del.	July 31
Aug. 16.	Louisiana.	July 31
Aug. 16.	St. Petersburg, Fla.....	July 31
Aug. 16.	Indiana	July 31
Aug. 17.	Memphis, Tenn.....	July 17
Aug. 17.	Waterville, Wash.	July 31
Aug. 18.	Belding, Mich.	July 17
Aug. 18.	South Bend, Ind.....	July 24
Aug. 18.	Marion, Ohio	July 31
Aug. 18.	Lincoln, Neb.	July 31
Aug. 23.	Toledo, Ohio.	July 31
Aug. 30.	Denver, Col.	July 24

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS.

Aug. 2.	Dredging, New York.....	July 10
	Adv. July 10 to 31.	
Aug. 3.	Breakwater, Chicago, Ill.	July 10
	Adv. July 10, 24 and 31.	
Aug. 3.	Ditch, Webster City, Iowa	July 31
Aug. 4.	Dredging, Norfolk, Va...	July 10
	Adv. July 10 to 24.	
Aug. 4.	Pumping Plant, Etc., Quincy, Ill.	July 24
Aug. 4.	Dredging, Brooklyn, N. Y.	July 31
Aug. 4.	Harbor Improv., Fort William, Ont.	July 31
Aug. 5.	Ditch, Richmond, Ind...	July 24
Aug. 5.	Jetty Work, Wilmington, Del.	July 24
	Adv. July 24, 31	
Aug. 5.	Ditch, Fairmont, Minn...	July 31
Aug. 9.	Pier, Philadelphia, Pa...	July 10
	Adv. July 10, 17.	
Aug. 9.	Dredging, Philadelphia, Pa.	July 10
	Adv. July 10, 24 and 31	
Aug. 9.	Drainage, Monté Vista, Col.	July 24
Aug. 9.	Pivot pier addition, Camden, Ark.	July 31
	Adv. July 31.	
Aug. 9.	Drainage, New Albany, Miss.	July 31
Aug. 10.	Riprap Work, New London, Conn.	July 24
	Adv. July 24, 31.	
Aug. 11.	Dredging, Boston, Mass..	July 31
	(2 Props.) Adv. July 31.	
Aug. 12.	Irrigation, Saco, Mont...	July 24
Aug. 12.	Canal, Selmer, Tenn.....	July 31
Aug. 13.	Irrigation Work, Saco, Mont.	July 17
	Adv. July 17.	
Aug. 14.	Dredging, Bremerton, Wash.	July 10
Aug. 14.	Ditches, Tekamah, Neb.	July 31
Aug. 15.	Dredge Work, Rosseau, Minn.	Jun 26
Aug. 16.	Dredging, Portland, Me.	July 17
	Adv. July 17 to 31.	
Aug. 16.	Dredging, etc., Philadelphia, Pa.	July 31
Aug. 16.	Ditch, Mankato, Minn....	July 31
Aug. 17.	Dredging, Chicago, Ill...	July 24
	Adv. July 24, 31.	
Aug. 17.	Levee, Greenville, Miss..	July 24
Aug. 17.	State canal work, Albany, N. Y.	July 31
Aug. 17.	Ditch, Kankakee, Ill.....	July 31
Aug. 18.	Reclamation Work, St. Ignatius, Mont.	July 24
Aug. 20.	Steel Lock Gates, etc., Pittsburgh, Pa.	July 24
	Adv. July 24, 31.	
Aug. 20.	Stone for jetties, Wilmington, Del.	July 31
Aug. 21.	Wharf, San Francisco, Cal.	July 31
Aug. 24.	Dredger, Adelaide, Australia	Jun. 19
Aug. 26.	Trestles, etc., for dam, Pittsburgh, Pa.	July 31
	Adv. July 31.	
Aug. 27.	Irrigation, Newell, S. D..	July 31
	Adv. July 31.	
Sep. 8.	Irrigation, Malta, Mont...	July 31
	Adv. July 31.	
Sep. 17.	Drainage, Palmetto, Fla.	July 24
Sep. 18.	Pier, Pearl City, T. H....	July 10

PUBLIC BUILDINGS AND SCHOOLS.

Aug. 2.	Washington, D. C.....	July 3
	Adv. July 3, 10.	
Aug. 2.	Hammond, Ind.	July 17
	Adv. July 17 to 31.	
Aug. 2.	Paterson, N. J.....	July 24
	Adv. July 24, 31.	
Aug. 3.	Howard, Kan.	July 24
Aug. 3.	Sanford, Ind.	July 24
Aug. 3.	Dedham, Mass.	July 24
Aug. 3.	Bangor, Me.	July 31
Aug. 3.	Utica, N. Y.....	July 31
Aug. 3.	Anoka, Minn.	July 31
Aug. 3.	Henderson, Ky.	July 31
Aug. 3.	Kearney, Neb.	July 31
Aug. 3.	School, Pharr, Tex.....	July 31
Aug. 4.	Allentown, Pa.	July 24
Aug. 4.	Portchester, N. Y.....	July 24
Aug. 4.	Binghamton, N. Y.....	July 31
Aug. 4.	Chicago, Ill.	July 31
Aug. 5.	Kansas City, Mo.....	July 24
Aug. 5.	Tekamah, Neb.	July 31
Aug. 5.	Superior, Wis.	July 31
Aug. 5.	Los Angeles, Cal.....	July 31
Aug. 5.	New Paris, Ohio.....	July 31
Aug. 6.	Cleveland Heights, Ohio.	July 17
Aug. 9.	Lansford, Pa.	July 17
Aug. 9.	St. Augustine, Fla.....	July 24
Aug. 9.	St. Augustine, Fla.....	July 31
Aug. 9.	Berkeley, Cal.	July 31
Aug. 9.	Syracuse, Kan.	July 31
Aug. 10.	Madison, W. Va.....	July 31
Aug. 10.	Detroit, Mich.	July 31
Aug. 10.	Athens, Ohio.	July 31
Aug. 10.	Harrisburg, Pa.	July 31
Aug. 10.	Laramie, Wyo.	July 31
Aug. 10.	Buffalo, Minn.	July 31
Aug. 10.	Pittsburgh, Pa.	July 31
Aug. 10.	Hastings, Minn.	July 31
Aug. 11.	Wellsburg, W. Va.....	July 10
Aug. 11.	Worthington, Minn.	July 31
Aug. 12.	North Attleboro, Mass...	July 10
Aug. 12.	Somers, Iowa	July 24
Aug. 12.	Gardiner, Me.	July 31
Aug. 12.	Miles City, Mont	July 31
Aug. 12.	Davenport, Iowa.	July 31
Aug. 13.	Gardiner, Me.	July 10
Aug. 13.	Haifa, Iowa	July 24
Aug. 14.	Warnock, Ohio	July 24
Aug. 14.	West Alexandria, Ohio...	July 24
Aug. 15.	Schuyler, Neb.	July 17
Aug. 15.	Schuyler, Neb.	July 24
Aug. 16.	Baltimore, Md.	Jun. 26
	Adv. Jun. 26 to July 3.	
Aug. 16.	Westmont, Johnstown, Pa.	July 24
Aug. 16.	Schuyler, Neb.	July 31
Aug. 16.	Gratis, Ohio.	July 31
Aug. 16.	Forest City, Iowa.....	July 31
Aug. 17.	Cherokee, Iowa	July 31
Aug. 18.	Lincoln, Neb.	July 31
Aug. 18.	Morenci, Mich.	July 31
Aug. 18.	School, Larimer, Pa.	July 31
Aug. 19.	Blackwell, Okla.	July 17
Aug. 20.	Ypsilanti, Mich.	July 24
Aug. 20.	Camden, Ohio.	July 31
Aug. 21.	Terre Haute (R. D. Urbanna), Ohio.	July 31
Aug. 23.	Toledo, Ohio	July 31
Aug. 24.	Grand Junction, Col.....	July 24
Aug. 25.	Pittsburgh, Pa.	July 31
	Adv. July 31.	
Aug. 27.	Palatka, Fla.	July 31
Aug. 30.	Syracuse, N. Y.....	July 31
Sep. 1.	Hartford City, Ind.....	July 31
Sep. 1.	Wisner, Neb.	July 10
Sep. 30.	Washington, D. C.....	July 24
	Adv. July 24, 31.	

PRIVATE BUILDINGS.

Aug. 9.	Chillicothe, Tex.	July 31

MISCELLANEOUS.

Aug. 3.	Route 50, Station Finish, El. Ry., New York, N. Y.	July 17
	Adv. July 17, 24.	
Aug. 3.	Cement Roofing Tile, Panama	July 17
	Adv. July 17.	
Aug. 3.	Retaining wall, Cincinnati, Ohio.	July 31
Aug. 3.	Traveling cranes, New Orleans, La.	July 31
Aug. 3.	El. Ry., Toronto, Ont....	July 31
Aug. 3.	Fencing, Paterson, N. J..	July 31
Aug. 4.	Station Finish, Section 2, El. Ry., New York, N. Y.	July 17
	Adv. July 17, 24.	
Aug. 4.	Elevators, Seattle, Wash.	July 24
Aug. 4.	Cranes, Cleveland, Ohio. .	July 31
Aug. 4.	Duct Line; also ballast El. Ry., New York, N. Y.	July 31
Aug. 5.	Piles, New York, N. Y..	July 31
Aug. 6.	Elevators, Etc., Panama.	July 24
Aug. 6.	Coal Handling Equipment, Springfield, Mass.	July 24
Aug. 6.	Iron, steel, etc., New York, N. Y.	July 31
Aug. 12.	Steel Barges, Vicksburg, Miss.	July 10
	Adv. July 10 to 31.	
Aug. 12.	Track Elevation Work, Fort Wayne, Ind.....	July 31
Aug. 16.	Towing Locomotives, etc., Panama.	Jun. 26
Aug. 16.	Subway Work, Philadelphia, Pa.	July 10
Aug. 16.	Found. and Piers for El. Ry., Philadelphia, Pa...	July 17
	Adv. July 17, 24.	
Aug. 18.	El. Ry. Supplies, Etc., Long Island City, N. Y.,	July 24
Aug. 18.	El. Ry. work, New York, N. Y.	July 31
Aug. 21.	Air Compressors, etc., Pittsburgh, Pa.	July 24
	Adv. July 24, 31.	
Aug. 23.	Derrick boat, Washington, D. C.....	July 31
	Adv. July 31.	
Sep. 18.	Ry. at Naval Station, Pearl Harbor, Hawaii..	July 10



Photo by A. H. Schaefer, Buffalo, N. Y.

Technical High School, Buffalo, N. Y.
Architect: Martin C. Miller, Buffalo, N. Y.
General Contractors: Mosier & Summers, Buffalo, N. Y.
Roofers: Kelker Blower Co., Buffalo, N. Y.

On a modern building—

Here is the handsome, new High School at Buffalo, New York — a fine example of first-class, modern construction throughout.

It is covered with a Barrett Specification Roof.

Now that the roof is completed, it will not be necessary for the authorities to give any further thought to it for twenty years or more. It will require no painting, no repairs, no maintenance cost of any kind.

These roofs take the base rate of insurance and are approved by the Underwriters' Laboratories.

It is a bit unusual, perhaps, to find that the cheapest permanent roof to build is also the *best* roof—yet that is the case with Barrett Specification Roofs. Their low cost and long life account for their high standing and popularity with first-class architects, engineers and roofers.

To be sure of getting a Barrett Specification Roof on your building, send to our nearest office for a copy of The Barrett Specification, with diagrams and *incorporate same in your building plans.*

We should like to send every architect, engineer and building owner a copy of the Underwriters' Laboratories report on Barrett Specification Roofs. Address our nearest office.

Hydronon

The Damp-proofing Paint

Construction expenses can be reduced by applying plaster directly on the brick or concrete without air space or lath construction. The use of Hydronon makes this practicable. This paint applied to the interior surface of the wall seals it tight and furnishes a safe and dry base for the plaster. Booklet free on request.

Tar-Rok (Tar Concrete) Sub-Floors

The most suitable surface on which to bed plank where a wooden lower floor is desired in factories, storehouses, etc., providing a maximum of strength, rigidity and fire protection at a minimum cost. The planking is laid on the tar concrete while the latter is still soft, giving perfect solidity and making vibration impossible. The tar excludes dampness, provides a warm floor and protects the plank from decay. Booklet on request.

Special Note We advise incorporating in plans the full wording of The Barrett Specification, in order to avoid any misunderstanding. If any abbreviated form is desired, however, the following is suggested:

ROOFING—Shall be a Barrett Specification Roof laid as directed in printed Specification, revised August 15, 1911, using the materials specified and subject to the inspection requirement.

BARRETT MANUFACTURING COMPANY

New York Chicago Philadelphia Boston St. Louis Cleveland Cincinnati Pittsburgh
Detroit Birmingham Kansas City Minneapolis Salt Lake City Seattle
The Paterson Mfg. Co., Limited: Montreal Toronto Winnipeg Vancouver
St. John, N. B. Halifax, N. S. Sydney, N. S.

TRADE B MARK

New Post for Stucco Work Is Also Useful in Concrete Construction

A new patented device, known as the Furr-Easy post, designed to insure thorough covering of the metal lathe in stucco work, and to provide an absolute and positive fastening for the reinforcement in concrete floor slabs as well as wire screens and guards, has been put on the market by the Wagner-Behm Company, 20 East Jackson Boulevard, Chicago. It is a metal device, tubular in form, with openings at the sides and a perforated flap at the end, made in various lengths to suit requirements. In its application it is inserted through the openings of the metal or wire lathe, the lip is turned down over the strand and the nail, of whatever length desired, is driven through the aperture in the flap thereby, it is claimed, producing a positive fastening that holds the lathe rigidly in place and produces a smooth and even surface. Being open at the back and sides, the soft plaster enters and fills the interior. The device is claimed to eliminate the cracking of the stucco and consequently the deterioration of the metal lathe due to the moisture entering through such cracks. It may also be used for semi-fireproof construction and on the inside of exterior walls to provide an unobstructed air circulation.



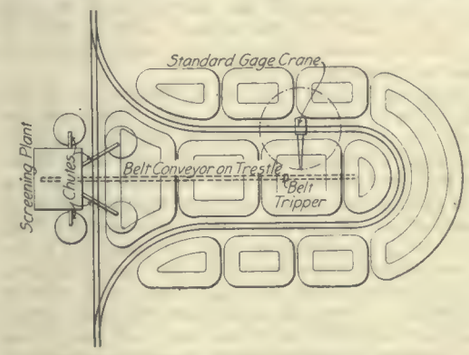
"FURR-EASY" POST

Practically No Strain on Crank Shaft in New Close Quarter Drill

A new close quarter drill, known as the Little David close quarter drill, which is particularly adapted for working in cramped or confined positions where the regular type of four piston, reciprocating pneumatic drill cannot be used, has been put on the market by the Ingersoll-Rand Company, of 11 Broadway, New York City, to meet the needs of those having portable drilling to do, whether in machine shop, boiler shop, foundry, or in the field, on bridge construction or structural steel work. The motor is of a novel 3-cylinder design and operates in a bath of oil. The valve is of the rotary type, which is common to all "Little David" drills and is gear driven from the pinion of a 3-way crank shaft. This is operated by three ratcheted levers which directly connect the pistons to the drill spindle, eliminating practically all strain on the crank shaft. The spindle has a triple ratchet. One of these is engaged with the spindle at all times. This construction is claimed by the manufacturer to develop more power and a much more constant pull in the spindle. The casting is divided in such a way that the loosening of a few cap screws allows easy access to all moving parts, and it is claimed the drill can be dismantled and completely reassembled in thirty minutes. It is fitted in the No. 4 Morse Taper socket, is rated for drilling up to 3 in. and reaming and tapping to 2 in., and operates at a speed of 150 r.p.m. It is claimed that this drill is the most powerful tool of its type and size on the market.

Circular Storage System Applied to Stone Crushing Plants

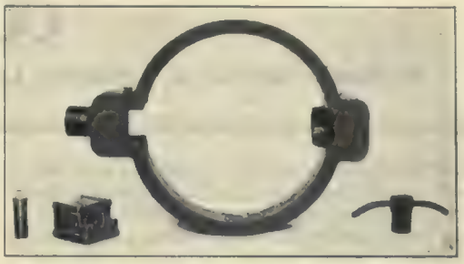
The circular storage system which has been employed for years for the storage of coal, both at the mines and at tide water, has been utilized by the Link-Belt Company of Chicago, in the design of various patented layouts for rock crushing plants. In general, it consists of a central point for the delivery of broken stone by belt and bucket conveyor, around which there is a circular track with the radius the length of the boom. This permits the locomotive crane to deposit the material in a ring concentric with the track, and either inside or outside of it. The idea, in some cases, is to store a sufficient quantity of stone during the summer months to provide for the demand without operating the quarries during the winter. Another advantage is that an economical method is provided for storing the product in sizes so as to eliminate the necessity of disposing of the various sizes promptly, as they are turned out with the consequent price cuttings and losses from not being able to fill orders, due to the variable demand for particular sizes.



CRANE TRAVELS ABOUT CIRCULAR TRACK

Meter Coupling Yoke Holds Meter and Riser Pipes Perfectly Rigid

The Clark meter coupling yoke, manufactured by the H. W. Clark Company, Mattoon, Ill., makes meter connections possible without the use of unions or right and left fittings. The meter and riser pipes are held perfectly rigid and contact with the walls of the meter box is avoided, thus eliminating dangers of freezing of the meter thereby. The pipes and meter are relieved of all strains, the manufacturer states, and expansion and contraction of lines is allowed. A ready and easy sliding adjustment is provided for taking care of meters of different lengths. Necessity of sealing the meter is eliminated by the lock shield adjusting screw construction, requiring a special socket key to operate. The yoke accommodates meters of every manufacture.



YOKE SUITED FOR METERS OF ANY MAKE

New Flow Recorder Gives Total Flow Without Use of Planimeter

The total flow of a liquid over a weir may be obtained directly, without the use of a planimeter, by means of a counting train suspended from the pen carriage of the Cochrane recorder, which has been put on the market by the Harrison Safety Boiler Works of Seventeenth Street and Allegheny Avenue, Philadelphia. The instrument includes a float, which moves vertically in response to changes in head; a cam, laid out as a spiral on a flat circular plate, that modifies the motion of the float and the recording pen; a multiplying mechanism consisting of a small drum mounted on the spindle of the cam; a pen carriage provided with large rollers; a chart drum; an integrating attachment; a counting train; a visible pointer and scale, and a heavy pendulum movement clock. The counting train, suspended from the pen carriage, is driven by a small roller, which rests upon an aluminum clock-driven disk. When the float and cam are at the position corresponding to the zero head, this roller is at the center of the disk and receives no motion from the latter. As the pen carriage is moved away from the zero position, the small roller is carried away the same distance from the center and, hence, is propelled at a rate corresponding to the rate of flow over the weir. The total movement of the counting train corresponds to the total flow.

Business Notes

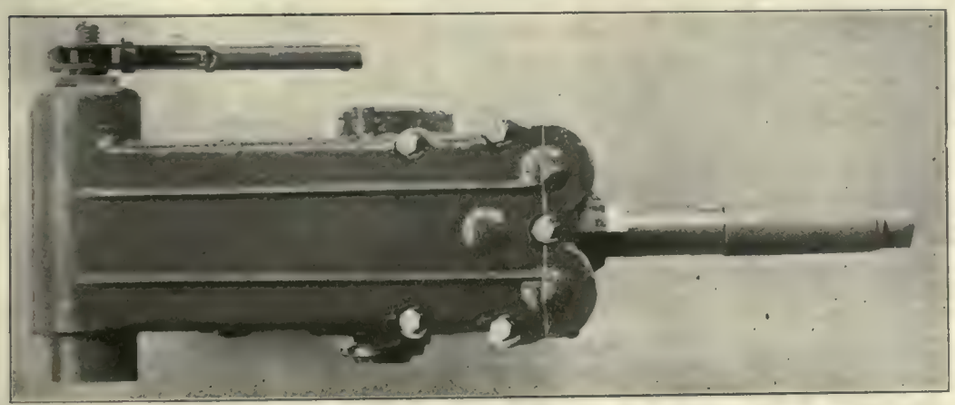
Chester A. Phillips, formerly with the Willis-Shaw Machinery Company, Chicago, has opened offices in the Monadnock Block, Chicago, under the firm name of Chester A. Phillips & Company. He will deal exclusively in contractors' rebuilt equipment.

Willy Lamot, Shardhighs, Halstead (Essex), England, has, in conjunction with several Belgian business men, formed an organization to introduce American products in Belgium when the present war is terminated. The organization will employ as agents and representatives, Belgian manufacturers and business men who have been partly ruined by the devastation of that country, but still possess sufficient capital to give the necessary guarantees as agents and dealers.

Trade Publications

Central Foundry Company, 90 West Street, New York, N. Y. Booklet, 3½ x 6¼ in., 8 pages, illustrated. A descriptive comparison of cast-iron soil pipe and wrought pipe for installations of wastes and vents, illustrated with examples of actual cases.

Atlantic Refining Company, Philadelphia. Booklet, 4¾ x 8¾ in., 12 pages, illustrated. Summarizes several points about road building and maintenance, and describes briefly several applications of Atlantic asphalts and road oil, the illustrations showing them.



NEW DRILL IS ESPECIALLY ADAPTED FOR WORKING IN CRAMPED POSITIONS

CONTRACTING NEWS

Of Special Interest to Engineers, Contractors, Builders and Manufacturers of Engineering and Building Supplies

CROP REPORTS continue to indicate that the year will be an unusually profitable one for the farmers and stock raisers of the country. Not only are crops large, but the foreign situation has insured a good market for practically all staple products except cotton. These facts have a direct bearing on construction work by increasing the credit of rural communities and of the country generally. Taken in connection with low prices, they tend to stimulate construction. It will be noted that the depression in contract work has held on longest in the South, where the practice of depending on a single crop has resulted in over-production, and seriously affected credit. Both exports and the excess of exports over imports were greater last week than in the week previous.

Reports from all over the country show an increase in lumber shipments for July over those for June, although the total for each month is under that for the same month of last year. Conditions in this business should stimulate construction work involving the use of timber.

Inquiries are said to be in sight for considerable structural steel, in addition to the good business already done in July.

Buildings

The lowest bid received July 21 for constructing the cotton warehouses and terminal at New Orleans was $1,109,000. A contract for a twelve-story reinforced-concrete building has been awarded in Brooklyn. A contract for building a dormitory for Cornell University, at Ithaca, N. Y., has been awarded at $170,000. Contracts awarded at Buffalo for additions to the plant of the Buffalo Copper & Brass Rolling Mill Company total $212,000. A $250,000 factory building has been contracted for at North Tonawanda, N. Y. A $200,000 hotel has been contracted for at Springfield, Ohio, and a contract for an office building at the same cost has been awarded at Louisville, Ky. A high school to cost $173,000 has been contracted for at Minneapolis. The contract for a $200,000 hospital has been awarded at Dallas, Tex.

Bids are asked on a $100,000 municipal building for Little Falls, N. Y. Plans are being prepared for a $250,000 dispensary to be erected at Rochester, N. Y. Plans have been filed for a $300,000 apartment house in New York City. Plans are being prepared for a $250,000 school building at Parkersburg, W. Va. A $400,000 office building is proposed at Chattanooga, Tenn. Plans are being prepared for a $350,000 library for the University of Michigan, at Ann Arbor. A $500,000 addition to a St. Louis office building is contemplated. An architect has been engaged to prepare plans for a $500,000 building at Seattle.

Bridges and Roads

A highway bridge to cost $46,000 has been contracted for at Winnisquam, N. H. Bids have been opened by the State highway commission of California for three bridges that will cost $60,000. Bids are desired on small bridges by the cities of Quincy and Lawrence, Mass. Bids are desired Aug. 20 at Greenwich, N. Y., for three concrete arch bridges.

The low bids opened Aug. 3 by the State of New York for highway repair work total $214,000. Paving contracts amounting to $159,000 have been awarded at Philadelphia. A $95,000 paving contract has been awarded at Laurel, Miss. Contracts for paving totaling $278,000 have been awarded by San Antonio. Tucson, Ariz., has contracted for paving work to cost $118,000. The low bids opened July 19 and 26 by the California State highway commission for road work totaled $337,000.

Bids are desired Aug. 24 at Albany, N. Y. for 182 miles of State highway work. Bids are desired for further road work by the State of Connecticut. Philadelphia will open bids Aug. 10 on paving work that will cost $300,000. Bids are also desired for several miles of highway work at Pittsburgh. Zanesville, Ohio, will receive bids Aug. 16 for building 10 miles of road. It is reported from Georgetown, Del., that a 20-mile concrete highway will be built from that city to Selbyville. Portland, Ore., has sold road bonds totaling $210,000, and the State of California has disposed of $2,500,000 in bonds for constructing State highways.

Waterworks and Sewers

A $55,000 waterworks contract has been awarded at West Linn, Ore. Bids are desired Aug. 13 at St. Louis for reconstructing the first section of the Compton Hill reservoir, estimated cost $425,000. Bids are desired at Windsor, Conn., for waterworks construction, including 4 miles of 10-in. cast-iron mains. The lowest bids received for two sewer contracts at Boston total over $56,000. The lowest bid received July 25 for constructing a sewer at St. Paul, Minn., is reported to have been $303,000.

Bids are desired Aug. 17 for sewer work in Long Island City for which $154,000 security is asked. A sewage pumping station at Albany, N. Y., on which bids are asked Sept. 7 will require 15,000 cu. yd. of fill, the same quantity of excavation and 5000 cu. yd. of concrete. Cleveland desires bids for constructing a 3600-ft. outfall pipe on Aug. 18. Bids are desired for 8 miles of sewers at Chardon, Ohio. Bids are desired at Madison, Wis., for constructing cast-iron sewer mains. Dallas, Tex., will receive bids Aug. 23 for a sewer, force mains, pumping station and disposal works. It is reported that bids will soon be asked for constructing the Maspeth outfall sewer, to cost $300,000, at Long Island City, N. Y. Plans are being prepared for a sewage disposal system for Binghamton and Lestershire, N. Y. Plans are being prepared for a $100,000 sewage disposal plant at Pleasantville, N. J.

Miscellaneous

The Public Service Commission has opened bids in New York City for a $35,000 duct tunnel, noted last week, and for two station-finish contracts, the low bids on which total $883,000.

A new tunnel route crossing the East River in New York City from Sixtieth Street, Manhattan, to the Long Island bridge plaza has been laid out by the Public Service Commission. Unit prices bid for the three New York City subway contracts noted last week are published in this issue. A contract for park work totaling $123,000 has been awarded at Philadelphia. The lowest bid received for a breakwater at Conneaut, Ohio, was $99,000. It is reported that a contract for building 15 miles of railroad has been awarded at Mountain Home, Ark. It is said that 30 miles of extensions to lines of the Oregon-Washington Railroad & Navigation Company have been contracted for at Riverside, Ore. Bids are asked on drainage work at Corinne, Utah, and on three piers for the Board of Harbor Commissioners at Honolulu, Hawaii. Plans are being prepared for river improvements near Jamestown, N. Y., to cost $100,000. Grade-crossing elimination work which would cost $550,000 is being considered at Erie, Pa. A permit for a $135,000 irrigation system has been issued at Salem, Ore. The City Council of Montreal has voted $360,000 for constructing a retaining wall.

WATERWORKS

PROPOSED WORK

Allentown, Pa.—Chas. D. Weirbach, City Engr., submitted report to City Council on new equipment at pumping station, and estimates cost at $27,500 to $40,250 according to different types of pumps.

Shepherdstown, W. Va.—F. L. Weltzheimer, City Recorder, writes A. G. Alden of Shepherdstown, is interested in the construction of water works here to cost $20,000.

Philadelphia, Miss.—Citizens voted bonds for water and sewer system. M. L. Gilles, Engr., Jackson, Miss. Mr. Gilles, Mayor.

Maumee, Ohio.—Bonds for $25,000 water works improvements will be sold by Thomas Dowling, Village Clk., until Aug. 25.

Paris, Ill.—See "Prices and Lettings."

Kewaunee, Wis.—Board of Public Works considering construction of water works.

Germania, Iowa—Citizens voted $10,000 bonds July 2 for constructing water works. M. S. Stoddard, City Clk.

Cortland, Neb.—A petition is being circulated requesting Village Board to have estimates made for water works.

Columbia Falls, Mont.—City Council reported to have granted franchise to James A. Talbot, to construct water works. Engineer, A. L. Jaqueth, Kalispell.

Bellingham, Wash.—Reported Water Bd. will soon let contract for 8000 ft. 6-in. water pipe to be laid on William Street and on Lake Road.

Morton, Wash.—Reported contract about to be let by City Clerk for furnishing city 4-in., 160 lb. pressure wood stave pipe, and 6-in. low pressure pipe for water extensions to West Morton.

Seattle Wash.—Council passed ordinances calling for construction of watermains in East Fifty-fourth Street, also watermains in Bradner Street. A. H. Dimock, City Engr.

Local press reports state that City Council has approved plans of Bd. of Pub. Wks. for sealing Cedar River impounding dam by silting or any other method, and bids will probably soon be asked for the work; the successful contractor will not be paid unless basin is successfully sealed. A. H. Dimock, City Engr.

Halfway, Ore.—Reported State Engineer, at Salem, has granted permit to use water of Makinson Spring for municipal water supply; city proposes to erect plant to cost $20,000; pipeline to be 2½ miles in length.

San Diego, Cal.—City Manager Lockwood favors construction of a dam at Barrett, capable of impounding 13,000,000,000 gal. of water and a conduit from this dam to city.

St. Maries, Idaho.—Citizens voted $37,000 bonds June 27 for water works improvements from plans of A. L. Jaqueth, of St. Maries. Bonds to be sold Sept. 3. Charles E. Semple, City Clk.

Rogerson, Idaho.—W. R. McMillan and John McRae, reported to have petitioned Public Utilities Comn., at Boise, for permission to construct water works to cost about $15,000.

Matheson, Ont.—Citizens voted $20,000 bonds for constructing waterworks. F. W. Rockall, Clerk and Treas.

Toronto, Ont.—At City Council meeting July 27, the recommendation of Works Com. that bids be invited for construction of proposed new duplicate water works, estimated to cost $4,500,000, was rejected, and matter was referred back for reconsideration.

BIDS DESIRED.

Windsor, Conn.—Until Aug. 20 by Bd. Comrs. Windsor Fire Dist. (H. R. Turner, Supt., 224 Broad Street), for constructing about 28,000 ft. 10-in. and 6500 ft. 6-in. water main, installation of 35 hydrants, constructing steel stand pipe, about 30 ft. in diameter and 100 ft. high, and electrically driven pumping equipment, advertised in Engineering Record.

Gallitzin, Pa.—An injunction prevented Borough Council opening bids July 24 for constructing a storage reservoir on Gum Tree Run. Harry F. Conrad, Boro. Secy. W. Dillman, Engr., 47 Altoona Trust Building, Altoona.

Hatfield, Pa.—Until Aug. 16 by Jonas S. Moyer, Clk. Town Council, for about 2 miles of 4, 6 and 8-in. c-i. mains, etc., advertised in Engineering Record.

Brewster, Ohio.—Reported desired until Aug. 20 by L. S. Lash, Village Clk. at office of the Mayor, for Municipal water works. W. H. Sherman Co., Engrs., Toledo.

Illinois.—See "Public Buildings."

Rock Island, Ill.—Until Aug. 14 by Bd. Local Improv (William McConochie, Pres.) for three blocks of 6-in. water mains on Fifth Street.

State Sanatorium, Minn.—Until Aug. 13 by State Bd. Control, St. Paul, for filters and connections for State Sanatorium. Charles L. Pillsbury, Co. Engr., St. Paul.

Syracuse, Neb.—Until Aug. 19 by William Stanbro, Village Clk., for water works improvements; cost, $8,500. Engineer, C. O. Martz of Lincoln.

St. Louis, Mo.—Official reports state bids will be opened noon, Aug. 13, by Bd. Pub. Service (William T. Findly, Secy.), for furnishing material and reconstructing the first section of Compton Hill Reservoir. This section will cost $425,000. J. A. Hooke, Dir. of Public Utilities.

Galveston, Tex.—Until Aug. 26, by John D. Kelley, City Secy., for furnishing, delivering and erecting the complete mechanical equipment of an air pumping engine at Alta Loma. Pumping station, consisting of 2450 cu. ft. air compressor, a surface condensor aid reinforced concrete foundation and all necessary steam pipe connections, pipes, valves and unions; air pipe and connection from compressor to wells.

Regina, Sask.—Until Sept. 6, by J. W. Mackay, Supt. Water Wks., for furnishing, delivering and erecting a 7,000,000-gal. pumping unit at the City Power House.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Binghamton, N. Y.**—Following are totals of 4 lowest bids opened July 23 by Bd. Water Comrs. (Fred E. Beck, Engr.),

for constructing South Mountain covered reservoir, 750,000 gal.; Barrally & Ingersoll, Rochester, $19,786; K. O. Guthrie, Schenectady, $20,902; N. R. Porterfield, New York, $21,701; W. H. Gehagen, Brooklyn, $23,869.

Unit prices of Barrally & Ingersoll, successful bidders:

1,845 cu. yd. earth excav.	$0.35
4,735 cu. yd. rock excav.	0.70
2,868 cu. yd. backfill of selected material	0.40
1,006 cu. yd. reinforced concrete (other than gate house)	8.50
1 cu. yd. plain concrete (if necessary)	6.50
1,470 bbl. cement	1.40
103,580 lb. steel for reinforcement	0.025
4,600 sq. ft. wire mesh for reinforcement	0.03
734 lin. ft. vitr. clay pipe, 6 in.	0.20
270 lin. ft. vitr. clay pipe, 4 in.	0.15
38 cu. yd. crushed rock	2.00
20,000 lb. handling, caring for, and place, c.-i. pipe (including valves and floor-stands, etc.)	0.005
Gate house, complete above floor, or elevation 209 (lump sum)	8,000.00
184 lb. miscellaneous wrought iron, steel and cast iron	0.08
19 sq. yd. dry rubble masonry pavt.	2.00
1 cu. yd. grouting	20.00
Cleaning up (lump sum)	100.00

Hilton, N. Y.—Contract awarded July 16 by Myron Roberts, Chmn. Village Trus., for constructing water works from plans of H. C. Kittredge, German Insurance Bldg., Rochester, as follows: Pipe and specials to U. S. C. I. Pipe & Fdry. Co.; valves and hydrants, Ludlow Valve Co.; elevated water tank, Chicago Bridge & Iron Works, Chicago, Ill., and general construction, Applegate & Son, Bradford, Pa.

★Camden, N. J.—Contract reported awarded by Water Com. of Council, to Camden Iron Wks., Philadelphia, Pa., for two 5,000,000 gal. centrifugal pumps, at $12,000.

★Cincinnati, Ohio.—Contract awarded by Bd. of Control to Kirchner Constr. Co., 221 W. Ninth Street, for high pressure fire mains on Central Avenue and Sixth Street, at $13,555.

★Murphysboro, Ill.—Contract for constructing filtration plant for Water Works, Electric Light & Gas Co., has been awarded to New York Continental Jewell Filtration Co., New York. Engineers, Edward Flad & Co., De Minil Building, St. Louis, Mo.

Paris, Ill.—All bids opened July 22 by City Council (Simon Risser, Comr. Pub. Property), for constructing rapid sand filter plant 1,500,000 gals. capacity were rejected, and it is not likely that the bids will be readvertised. Bids received as follows: Jewell Water Improv. Co., 9 S. Clinton Street, Chicago, $26,365; International Filter Co., 38 S. Dearborn Street, Chicago, $20,979.

★Wibaux, Mont.—Contract awarded July 26 to Haggart Constr. Co., Fargo, N. D., for constructing water works, $24,500; and sewer system, $12,900. Engineer, C. H. Green, Spokane, Wash.

★West Linn, Ore.—Following are the unit prices of Oregon Eng. & Contr. Co., Oregon City, successful bidders for the water supply system (bids opened July 20) by Water Comm. (L. L. Porter, Secy.):

Schedule 1:

Proposal 3—Lap welded steel pipe, Matheson joint, National coating, double spiral wrap:

12,900 lin. ft. 10 in. pipe	$0.90
21,100 lin. ft. 6 in. pipe	0.47
12,700 lin. ft. 4 in. pipe	0.30
8000 lb. special castings	0.07
Total Schedule 1	$25,897.00

Schedule 2:

2 acres clearing and grubbing	$125.00
7000 cu. yd. earth exc.	0.40
600 cu. yd. hard pan exc.	0.75
800 cu. yd. concrete inc. forms	10.00
100 lb. reinforcing steel rods	0.10
4100 sq. ft. reinforcing wire mesh	0.03
200 lin. ft. 10 in. vitr. sewer pipe	0.45
50 lin. ft. 4 in. vitr. sewer pipe	0.20
4 2½ in. hose valves	5.00
1 grating for overflow weir	15.00
1 Pumphouse complete	350.00
5 tons asphalt	0.20
600 lb. sheet tin	0.15
Total Schedule 2	$12,308.00

Schedule 3:

1 Standpipe, complete	$2,000.00
Cu. yd. extra concrete 1:3:5	15.00

Schedule 4:

2 acres clearing and grubbing	150.00
4500 cu. yd. earth exc. trench	0.40
300 cu. yd. hardpan exc. trench	1.00
500 cu. yd. loose rock exc. trench	2.00
4800 cu. yd. solid rock exc. trench	2.60
3 10 in. gate valves, 125 lb. pres.	30.00
3 10 in. gate valves, 175 lb. pres.	32.00
1 8 in. gate valve, 200 lb. pres.	25.00
11 6 in. gate valves, 150 lb. pres.	15.00
13 4 in. gate valves, 225 lb. pres.	10.00
1 4 in. gate valve, 225 lb. pres.	12.00
23 hydrants, 125 lb. pressure	35.00
7 hydrants, 175 lb. pressure	40.00
1 6 in. relief valve, 225 lb. pres.	25.00
1 4 in. relief valve, 125 lb. pres.	25.00
4 ¾ in. Chabot air valves	7.50
32 extension valve boxes	5.00
Total Schedule 4	$17,723.00

SEWERAGE AND SEWAGE DISPOSAL

PROPOSED WORK

Binghamton, N. Y.—John A. Giles, City Engr., making preliminary surveys for the proposed sewage disposal system, to be constructed jointly by Binghamton and Lestershire in 1916 or 1917.

Pleasantville, N. J.—Plans being prepared by Remington & Vosbury, Camden, for sewer system and disposal plant; approximate cost $100,000.

West Chester, Pa.—Plans being prepared by Nathan Rambo, Boro. Engr., and Remington & Vosbury, Consulting Engrs., Camden, for sewage pumping station and c.-i. force main.

Philadelphia, Miss. — See "Water Works."

Cedar Rapids, Iowa.—Mound Farm Real Estate Co. about to let contract for 1400 lin. ft. 10-in. sanitary sewer in the Mound Farm addition. Address F. A. Greene, Resident Engr., Masonic Temple, Cedar Rapids.

Centerville, S. D.—Citizens reported to have voted $27,000 bonds for constructing sewer system.

Seattle, Wash.—Bd. of Pub. Wks. (L. B. Young, Chmn.) approved plans for construction of sewers in Sixth Avenue N. W.; cost estimated at $90,000.

Matheson, Ont.—F. W. Rockall, City Clk. and Treas., writes construction of sewer system in contemplation.

BIDS DESIRED.

East Gardner, Mass.—Until Aug. 18 by State Bd. Insanity, Room 36, State House, Boston (Michael M. O'Meara, M. D., Chmn.), for building a sewerage system for the Gardner State Colony at East Gardner, advertised in Engineering Record.

Albany, N. Y.—Until Sept. 7 by Bd. Contract and Supply (Isadore Waschman, Secy.), for construction, also separate bids for the equipment of 2 sewage pumping stations, advertised in Engineering Record.

Long Island City, L. I., N. Y.—Until Aug. 17 by Maurice E. Connolly, Boro. Pres., for furnishing material and constructing sewers in portions of Maspeth, Clark, Perry and Maurice Avenues, Rust and Grand Streets. Total security, $154,000.

Chardon, Ohio.—Until Aug. 19 by Robert S. Parks, Clk. of Council, for constructing sanitary sewers and a sewage treatment plant, advertised in Engineering Record. R. Winthrop Pratt, Consulting Engr., Hippodrome Bldg., Cleveland.

Cincinnati, Ohio.—Until Aug. 11 by Dir. Pub. Service (Parke S. Johnson, Secy.), for constructing sewers in portions of Columbia Avenue, McDowell and Strafer Streets.

Cleveland, Ohio.—Until Aug. 18 by A. R. Callow, Comr. Purchase and Supplies, for constructing at West Fifty-eighth Street Sewage Treatment Works, a concrete open channel outfall sewer approximately 630 ft. in length, supported on piling and a submerged outfall pipe line approximately 3600 ft. long, advertised in Engineering Record.

Chicago, Ill.—Until Aug. 11 by Bd. Local Improv. (Edward J. Glackin, Secy.), for constructing drains in portions of Cahojia and S. Hoyne Avenues, W. Forty-seventh, and various other streets.

Illinois.—See "Public Buildings."

Antigo, Wis.—Until Aug. 9 by Bd. Pub. Wks. for constructing 5000 ft. vitr. pipe sewers from 8 to 20-in. diameter, 24 ft. 12-in. c.-i. pipe and 17 manholes. G. O. Palmiter, City Clk.

Madison, Wis.—Until Aug. 13 by E. E. Parker, City Engr., for labor and materials, except c.-i. pipe for sewer force main 17,050 ft. 20-in. c.-i. pipe. A contract will also be let for labor and material for a cast iron intercepting sewer about 5700 ft. long, c.-i. pipe from 18 to 24 in. City will furnish pipe. Date of bids not yet set.

Sandstone, Minn.—Until Aug. 23 (re-advertisement) by C. Rudisuhle, Village Recorder, for constructing 9025 ft. 10, 8 and 6-in. sewer, 34 manholes, etc.

Poplar Bluff, Mo.—Until Aug. 16 by H. H. Wilcox, City Clk., for furnishing material and constructing sanitary Sewer Dist. No. 2, requiring approximately 822 ft. 6 in. riser pipe, 25,612 ft. 8 in., 1379 ft. 12 in. pipe, 35 manholes and one ejector outfit. Edward C. Thomes, City Engr.

Argenta, Ark.—Until 10 a. m., Aug. 11, for two 14,000 gal. sewage pumps and two 60-hp. slow speed motors and equipment. J. P. Faucette, Mayor.

Logan, Utah.—Reported desired until Aug. 10 by William Evans, Jr., City Recorder, for constructing sewers in Sewer Dist. No. 2. Roy Bullen, City Engr.

PRICES AND LETTINGS.

★Indicates award of contract.

Boston, Mass.—Following are lowest bids opened July 28 by Metropolitan Sewerage Works, Boston (F. D. Smith, Engr.), for constructing High Level Sewer, Wellesley Extension, South Metropolitan System, as follows—(a) Section 105 (b) 106: Hugh Nawn Contr. Co., 82 Savin St., Boston, (a) $28,875 (awarded contract), (b) $27,912 (awarded contract); Geo. M. Bryne, Winchester, (a) $36,212, (b) $43,315; Coleman Bros., Chelsea, (a) $42,850, (b) $43,315.

Newark, N. J.—Following are three lowest bids opened July 29 by Bd. Street & Water Comrs. (Morris R. Sherrerd, Ch. Engr.) for constructing Frelinghuysen Avenue and Bound Creek sewer: O'Gara & Maguire, Newark, $33,175; Averill Mathew Co., Montclair, $36,377; J. W. Heller, Newark, $37,956.

Unit prices of O'Gara & Maguire (lowest bidders) as follows:

2,050 ft. 4 x 6 ft. concrete sewer	$8.88
1,300 ft. 18 in. pipe sewer	1.68
2,700 ft. 15 in. pipe sewer	1.29
1,470 ft. 12 in. pipe sewer	0.79
110 ft. 16 in. cast iron pipe	3.30
60 ft. 12 in. cast iron pipe	2.75
7 basins, each	70.00
26 manholes over pipe sewer, ea.	41.00
12 manholes over conc. sewer, ea.	27.50
2 sumps, each	380.00
75 M. timber	34.75
450 piles, each	5.25

★Cleveland, Ohio.—Contracts awarded by Dept. Pub. Service for constructing Walworth Run Diversion sewer (bids opened July 7), Section No. 1, to Hoag & Zullo, Commercial Bank Building, $114,900. Section 2, to Donnelly & Graham, Cleveland, $101,262.

★Escanaba, Mich.—Contract awarded to John S. Lindsay for constructing trunk sewer line at $32,300.

Clinton, Iowa—Lowest bid recently received for constructing sewer in Fourth Ward, submitted by Thomas Carey & Son, Clinton, at $27,917. J. G. Thorne, City Engr.

★Cherokee, Iowa. — Contract awarded July 30 for 3½ miles of sewers to Moore-Sieg Constr. Co., Waterloo, at $24,380. Other bids: Geo. M. King, Des Moines, $26,993, and Wm. C. Fraser, St. Paul, Minn., $25,399. Wm. Shardlow, City Clk.

St. Paul, Minn.—Lowest bid opened July 25 for constructing Snelling-Como sewer submitted by Thornton Bros., St. Paul, at $303,571.

★Virginia, Minn.—Contract awarded by City Council July 21 to Eveleth Constr. Co., Eveleth, for constructing sewers, at $22,011.
$12,998.

★Portland Ore. — Contract reported awarded for construction of sewer of reinforced concrete pipe, in East Adler Street, from East Second Street to Harbor Line to Alexis Contract Co., Platt Bldg., at $21,106.

BRIDGES

PROPOSED WORK

Albany, N. Y.—Bridge bonds amounting to $58,000 sold by Rensselaer County.

Johnstown, Pa.—Plans submitted to State Water Supply Comn. at Harrisburg by Lee Masterton, City Engr., for bridge to be erected at Horner Street, to be one span, 225 ft.; cost about $50,000.

Shepherdsville, Ky.—Bridge Comn., Bullitt and Hardin Counties, selected Wooldridge's Ferry as site for constructing bridge over Rolling Fork River; cost about $16,000.

Youngstown, Ohio.—See "Railroads."

Windsor, Mich.—Plans of City Engineer for concrete bridge to be constructed over Michigan Central tracks at Wyandotte Street approved by City Council; cost about $45,000.

St. Louis, Mo.—Construction of viaduct over railroad tracks at Choteau Avenue is being considered by city. Missouri Pacific Ry. Co., United Rys. Co. and Frisco Lines to share about $200,000 of cost.

Dallas, Tex.—J. F. Witt, Co. Engr., writes that tentative plans only have been prepared to be completed in 60 or 90 days for bridge to be constructed over Trinity River, for which citizens recently voted $135,000 bonds.

Dallas, Tex.—Citizens voted $135,000 in bonds for constructing bridge over Trinity River at Commerce St.

Wenatchee, Wash.—County Comrs. considering plans for constructing steel or concrete bridge to be constructed over Wenatchee River, to cost about $30,000.

BIDS DESIRED.

Lawrence, Mass.—Until Aug. 16 by Co. Comrs., Salem (Moody Kimball, Chmn.), for rebuilding Loring St. Bridge over Shawsheen River in city of Lawrence at North Andoverline.

Quincy, Mass.—Until Aug. 10 by Bd. Metropolitan Park Comrs., 14 Beacon St., Boston (William B. DeLasCasas, Chmn.), for constructing concrete bridge across Black's Creek, Furnace Brook Parkway, Quincy. John R. Rablin, Engr.

Hartford, Conn.—Reported desired until Aug. 16 by Bd. Contract and Supply for constructing 75 ft. arch bridge over Park River at Trumbull Street, concrete and brownstone. Probable cost $20,000. R. N. Clark, City Engr.

Greenwich, N. Y.—Until Aug. 20 by N. S. Langdon, Justice of Peace, Greenwich, for building 3 concrete steel arch bridges over Battenkill River, advertised in Engineering Record. One at Greenwich, 1 span 120 ft., width 27 ft.; one at Middle Falls, two spans 33 ft. and 1 span 82½ ft., width 22 ft.; and the other at Clarks Mills, 3 spans, 86 ft., width 22 ft. Bids may be submitted on bridges as a whole or on each bridge separately.

South Amboy, N. J.—Later reports state bids desired until Sept. 8 (extension of date from Aug. 4) by Bd. Chosen Freeholders, Freehold (J. M. Corlies, Dir.), for constructing Strauss bascule trunnion bridge over Matawan Creek on road from South Amboy to Keyport. C. E. Close, Clk. Bd., 41 Main Street, Matawan. G. D. Cooper, Co. Engr., 60 Broad Street, Red Bank.

Trenton, N. J.—Until Aug. 10 by Co. Bd. Chosen Freeholders (John J. Power, Dir.), for furnishing material and constructing a reinforced concrete arch bridge over Sanhican Creek at Willow Street. Theodore Tobish, Co. Engr.

Pittsburgh, Pa.—Until Aug. 10 by Robert Swan, Dir. Dept. Pub. Wks., for reconstructing and remodeling the portion of Herron Avenue (formerly Forfar and Thirty-third Street) bridge and piers affected by the abolishment of the grade crossing over tracks of the Pittsburgh Junction R. R. Co., Liberty Avenue and Thirty-third Street.

Illinois. — By State Highway Comn., Springfield, for constructing following reinforced concrete bridges:

Until Aug. 11 at Newell, Vermillion County, 160 ft. span bridge, reinforced concrete abutments, cost $11,864.

Until Aug. 12, Hazelhurst, 12 ft. span in Brookville Township, Ogle County; cost $500; separate bids for Canada School and Cashman Bridges, spans 10 and 12 ft., built between Brookville and Lincoln Townships, Ogle County; cost $1,170 for both bridges. Alex. Anderson, Co. Supt. Highways, Polo.

Aug. 16, McVey, Charles Boston, bridge, 30 ft. span, in Nilwood Township, Macoupin County; cost $1,525. O. B. Conlee, Co. Supt. Highways, Carlinville.

Aug. 17, Greenville, George Wright, bridge, 30 ft. span, in La Grange Township, Bond County. Cost $1,020. R. O. Young, Co. Supt. Highways, Sorento.

Shawano, Wis.—Until Aug. 9 by Otto C. Rollman, Co. Highway Comr. for constructing a 112-ft. single span highway bridge.

Girard, Kan.—Reported desired until Aug. 18 by Co. Comrs. (Charles C. Everitt, Clk.), for constructing ten steel and reinforced concrete bridges.

Fremont, Neb.—Until Aug. 24 by P. J. Flananagon, Chmn. Bd. Superv. for constructing bridges during the year, one 30 and one 40 ft. steel girder, one 40, one 50, one 60, one 70 and one 80 ft. steel truss bridge and such other bridges as may be found necessary to be built or repaired during the year. John O'Connor, Co. Clk.

Salem, Ore.—Until Aug. 16 by County Court (Mas Gehlar, Clk.) for constructing truss bridge across Little North Fork of Sanitam River on road from Gates to Cold Creek. Reported cost will be about $10,000.

Bakersfield, Cal.—Reported desired until Aug. 16 by County Superv. for 40 ft. reinforced concrete bridge over Alta District Canal.

Dunsmuir, Cal.—Reported desired until Aug. 23 by State Highway Comn., Sacramento, for reinforced concrete bridge about 532 ft. long with one 180 ft. arch and two 114 ft. arches clear span across Sacramento River, near Dunsmuir.

Los Angeles, Cal.—Until Aug. 23 by H. J. Lelande, Co. Clk., for furnishing material and constructing a bridge over Rio Hondo River at Garvey Avenue.

Oroville, Cal.—Reported desired until Aug. 10 by County Superv., Oroville, for constructing eight bridges on the State Highway, between Chico and Nelson. Total estimated cost $40,000.

Placerville, Cal.—Reported desired until Aug. 16 by County Superv. Placerville, for constructing steel truss bridge, 160 ft. span near Colona.

San Jose, Cal.—Until Aug. 23 by County Bd. Superv., San Jose (Henry D. Pfister, Clk.), for furnishing material and constructing a two-span, girder type reinforced concrete bridge on the Bodfish Road over Bodfish Creek.

PRICES AND LETTINGS.

★Indicates award of contract.

★Winnisquam, N. H. — Contract awarded by Governor and Council July 29 to United Constr. Co., Albany, N. Y., for a 5-span steel highway bridge, 465 ft.

long over outlet of Lake Winnisquam at Winnisquam at 42 cts. per lin. ft. for piles and $48,226 for substructure and superstructure complete, except wearing surface. Cost to be proportioned $20,000 to State Highway Dept., $16,000 to town of Tilton and $12,000 to town of Belmont. Other bids: Boston Bridge Works, Inc., Boston, Mass., 50 cts. and $47,191; Berlin Constr. Co., Berlin, Conn., 35 cts. and $50,000; Bay State Dredging Co., Ltd., Boston, Mass., 40 cts. and $53,000.

★**Topeka, Kan.**—Contract awarded July 25 for constructing concrete bridge over Shunganunga Creek to Arthur E. Allen, 1347 Lane Street, Topeka, at $15,468. Topeka Bridge & Iron Co., Topeka, bid for this work $17,850.

★**Hardin, Mont.**—Contract for constructing bridge over Big Horn River and one over Little Horn awarded by County Comrs. (bids opened July 21) to Security Bridge Co., Billings, at $26,622 and $8,450 respectively.

★**Cameron, Tex.**—Contract for constructing Fort Sullivan Bridge on Brazos River awarded by Comrs. Courts of Robertson and Milam Counties at Hearne to Vincennes Bridge Co., Vincennes, Ind., at $15,449.

★**Longview, Tex.**—Contract for constructing 120-ft. steel bridge over Sabine River awarded by County Comrs. to Blodgett Constr. Co., Shreveport, La.

★**Seattle, Wash.**—Contracts awarded by Bd. of Pub. Wks., Aug. 4 for Lake Washington Bridges as follows: Fifteenth Avenue, N. W., complete structure to Hans Pedersen, Madrona Blk., Seattle, at $242,-628. Fremont Avenue superstructure, to Lord Bros. Co., Pittock Blk., Portland, Ore., $154,000 substructure, Pacific States Constr. Co., Burke Bldg., Seattle, $111,916. Both structures will be double leaf bascule trunnion type. (Bids for these bridges were opened July 28.) F. A. Rapp, Structural Engr.

California.—Following are bids opened July 19 by State Highway Comm., Sacramento, for bridges (all lump sum):

Sonoma County, Div. 2, Route 3, Section A (reinforced concrete bridge): Pacific Coast Constr. Co., Fresno, $26,922; P. Rolandi, San Francisco, $39,700; Engineer's estimate, $21,966.

Shasta County, Div. 2, Route 3, Section D (2 reinforced concrete bridges): Only bidder, P. Rolandi, San Francisco, $3,450; Engineer's estimate, $4,934.

Shasta County, Div. 2, Route 3, Section B (reinforced concrete arch): Ross Constr. Co., Sacramento, $28,235; Pacific Coast Constr. Co., Fresno, $32,941; P. Rolandi, San Francisco, $52,700; Carnahan & Mulford, San Francisco, $56,989. Engineer's estimate, $27,147.

★**New Market, Ont.**—Contract for constructing 2 bridges between East Gillimbury and Whitchurch, of reinforced concrete slab on clay foundation awarded July 20 to Alexander McDougall, Barrie, Ont.

★**Arden, Man.**—Contract for reinforced concrete arch 63 ft. over White Mud River awarded to Alex Scoble, Winnipeg.

PAVING AND ROADS

PROPOSED WORK

Elizabeth, N. J.—Ordinance providing for paving Broad Street with granite block passed second reading.

Jersey City, N. J.—See "Public Buildings."

Georgetown, Del.—Contract will be let at once for a 20 mile concrete highway, 20 ft. wide, from Selbyville to Georgetown. Address Charles Upham, Ch. Engr., Du Pont Road Dept., Georgetown.

Christiansburg, Va.—Citizens of Montgomery County voted $100,000 bonds for constructing highways.

Augusta, Ga.—City Council voted to pave Cumpsed and Walker Streets with creosote blocks; cost about $38,000.

De Land, Fla.—George T. Haynes, City Clk., writes that it is proposed to pave about 25 or 30 miles including New York Avenue and the Boulevard with brick or asphalt, concrete curb and gutter; $350,-000 was recently voted for this work. Engineers, J. B. McCrary & Co., Atlanta.

Pinellas Park, Fla.—All bids opened July 6 for curbing and paving with brick streets and avenues rejected, being considered too high. To be readvertised later. Edwards Constr. Co., Tampa, lowest bidder. T. J. De Haas, Town Clk.

Elizabethton, Tenn.—$165,000 road bonds will be sold Aug. 17 by J. M. Barnes, Chmn. County Court.

Zanesville, Ohio.—City proposes to pave Second, Third and Fifth Streets with brick, Lake Drive and Dewett Drive with concrete. W. W. Roach, Dir. Pub. Service.

Saginaw, Mich.—About $150,000 is to be spent by city for paving.

Missoula, Mont.—Contract about to be let by City Council for hardsurfacing Pine Street; cost $19,226.

Russellville, Ark.—Comr. Road Improvement Dist. No. 1 voted $150,000 bonds for constructing macadam highway from Russellville to Hector.

Orange, Tex.—Citizens July 20 voted $25,000 bonds for street improvements.

Shepherd, Tex.—Citizens of Shepherd and Camilla voted $75,000 bonds for road improvements.

Sand Springs, Okla.—City proposes paving Main and Second Streets, 12 blocks.

Cathlamet, Wash.—County Comrs. appropriated $12,000 toward constructing highway from Cathlamet eastward to Cowlitz County Line.

Tacoma, Wash.—City Council voted to construct concrete walks on S. Twenty-first and S. Forty-seventh Streets, cost about $15,000.

Marshfield, Ore.—City Council contemplates hardsurfacing Pine Street, cost about $10,000.

Portland, Ore.—About $15,000 is to be spent by city for paving Rodney Avenue with bitulithic.

Bonds amounting to $210,000 have been sold by county for constructing road along southern border of Skamania County and Columbia River.

City Council considering extending Willamette Boule.; cost, about $245000.

California.—About $2,500,000 state highway bonds have been sold by State Highway Comn., Sacramento.

BIDS DESIRED.

Connecticut.—Until Aug. 16 by Charles J. Bennett, State Highway Comrs., Hartford, for sections of highway in towns as follows:

North Haven, 4950 lin. ft. macadam construction. Plans and specifications at selectmen's office, North Haven.

Southington, 6200 lin. ft. 2-in. bituminous macadam surfacing. Plans and specifications at selectmen's office, Southington.

Waterford, 5937 lin. ft. native stone macadam construction. Plans and specifications at house of Albert H. Lamphier, First Selectman.

Durham, 4940 lin. ft. 2-in. bituminous macadam resurfacing. Specifications at house of J. Franklin Bailey, First Selectman.

Killingly, 2950 lin. ft. concrete, amiesite, Warrenite or bituminous concrete pavement. Specifications at office of E. C. Welden, Div. Engr., Jordon Blk., Williamantic.

Marlboro, construction of a 35-ft. span reinforced concrete girder bridge over Blackledge River on the Hartford-New London Rd. Plans and specifications at Town Clerk's office, Marlboro.

Also constructing about 14,264 lin. ft. standard wood guard rail in towns of Columbia, Winchester, Wethersfield, Somers, Old Lyme, Cornwall and Woodbury.

Albany, N. Y.—Until Aug. 24 by Edwin Duffey, Comr. Highways, 55 Lancaster Street, for constructing highways in various counties, approximately 100 miles also resurfacing several roads, also until Aug. 26 separate bids for constructing improvements and repairs to various other roads approximately 82 miles and resurfacing other roads, both proposals advertised in Engineering Record.

Brooklyn, N. Y.—Until Aug. 11 by L. H. Pounds, Boro. Pres., for regulating and repaving with permanent Grade 1 granite pavement on a 6-in. concrete foundation, Jamaica Avenue from B'way to the Borough Line, requiring approximately 27,150 sq. yd. pavement, etc. Security $35,000.

Scarsdale, N. Y.—Until Aug. 25 by Bd. Village Trus. (John R. Ross, Clk.) for Popham Road improvements, mainly pile driving and stone filling, to form a crib and a 24-in. c.-i. culvert across the road, advertised in Engineering Record. Waring, Chapman & Farquhar, Engrs., 874 Broadway, New York.

East Orange, N. J.—Until Aug. 9 by Lincoln E. Rowley, City Clk., for repaving with 8-in. concrete or granite block, 2-in. or 2½-in. asphalt block, 3, 3½, or 4-in. wood block on a 6-in. concrete base on Harrison Street, about 16,700 sq. yd., setting curb, etc.

Hackensack, N. J.—Until Aug. 16 by Road Com. Co. Bd. Chosen Freeholders, Hackensack (A. V. Morrison, Chmn), for improving Palisade Avenue, Englewood and Englewood Cliffs, by grading, guttering, concreting and paving with hillside brick and asphalt concrete; also improving Lemoine Avenue in Fort Lee and Sylvan Avenue, Englewood Cliffs, to consist of grading and shaping road and addition of stone and the application of asphalt; also repair of West Saddle River Road, Saddle River Boro.

Irvington, N. J.—Until Aug. 23 by Com. on Roads, Assessments and Speedway, of the Bd. Chosen Freeholders, Newark, for improving a portion of Lyon Avenue in Irvington. Frederick A. Reimer, Co. Engr., Newark.

Roseland, N. J.—Until Aug. 12 by E. Oscar DeCamp, Boro. Clk., for grading and macadamizing Cortlandt Street. P. L. Braunworth, Boro. Engr., 26 Spring Street, Montclair.

Philadelphia, Pa.—Until Aug. 10 by Dept. of Public Works, Bureau of Highways (William H. Connell, Ch.), for street improvements, Schedules A to K, with approximate cost as follows: Schedule (A) Grading, $68,000; (B) asphalt paving, $69,000; (C) vitrified block paving, $7,000; (D) granite block paving, $13,000; (E) asphalt repaving, $23,000; (F) vitrified block repaving, $44,000; (G) granite block repaving, $20,000; (H) surfacing bituminous macadam, $15,000; (I) surfacing waterbound macadam, $29,000; (J) resurfacing waterbound macadam, $9,000; (K) torpedo gravel, $3,000.

Pittsburgh, Pa.—Until Aug. 19 by Hyatt M. Cribbs, Co. Controller, for constructing highways as follows: Bethel Rd., Upper St. Clair and Bethel townships, 3.9 miles. Brownsville Extension Rd., Snowden Township, 2 miles. Horning Rd., Snowden and Baldwin townships, ¾ mile. Emsworth and Haysville Rd., No. 0, Emsworth Borough, 1075 lin. ft.. Troy Hill Extension, No. 3 Rd., Ross Township, 0.68 miles. Brackenridge Rd., Brackenridge Borough, 684 ft.

South Bethlehem, Pa.—Until Aug. 16 by Thomas Ganey, Boro. Secy., for 8400 sq. yds., amiesite paving and 330 sq. yds. brick paving, advertised in Engineering Record. E. H. Meglathery, Chmn. Street Com.

Hagerstown, Md.—Until Aug. 13 by Barry M. Hartle, Co. Clk., Hagerstown, for constructing a section of State aid highway in Washington Co., between Downsville and Spielman's Station, about 2.41 miles.

Rockville, Md.—Until Aug. 10, by Dept. of Agriculture, Washington, D. C. (D. F. Houston, Secy.), for bituminous surface treatment of the Falls Road, from Rockville to Potomac, Md., 5.4 miles lone, 15 ft. wide.

Wilmington, Del—Later official reports state bids desired until Aug. 10 (not Aug. 16, as previously stated), by Bd. Directors, Street and Sewer Dept. (L. V. Christy, Secy.), for grading and excavating streets, constructing concrete foundations, concrete and brick gutters, sheet asphalt, asphaltic concrete, bitulithic, Warrenite, asphalt block and vitr. block pavements. Bids desired on not less than 50,000 sq. yd. street surface.

Goldsboro, N. C.—Until Aug. 11, by Bd. of Aldermen, for brick and bituminous pavement on certain streets. D. J. Broadhurst, City Clk.

Fort Meade, Fla.—Until Aug. 17 by Bd. Bond Trus. (J. J. Singleton, Chmn.), for furnishing material and constructing approximately 30,000 sq. yd. vitr. brick, asphaltic concrete or bitulithic, or other pavement. H. S. Jaudon Eng. Co., Engrs., Savannah, Ga.

Marion, Ala.—Reported desired until Aug. 9, by County Comrs., for grading, draining and graveling about 8 miles of Marion and Uniontown Road.

Cadiz, Ohio.—Reported desired until Aug. 9 by W. H. Lucas, Village Clk., for paving with brick, 8512 sq. yd. on Park, St. Clair, Charleston and Grant Streets.

Columbus, Ohio.—See "Public Buildings."

Columbus, Ohio.—Until Aug. 17 by Dir. Pub. Service (Paul B. Kemper, Clk), for improving portions of Avon Court, Reynolds and Sheldon Avenues, Tiffin, Main and several other streets. To consist of wood block, asphalt and brick paving, constructing cement sidewalks and laying water service pipes.

Galion, Ohio.—Until Aug. 10 by A. F. Unckrich, Dir. Pub. Service, for improving with brick, asphalt, asphalt block, wood block, or treated macadam, together with necessary gutter, curbing and drainage, portions of S. Market, Jefferson and South Streets, advertised in Engineering Record. Approximately 26,000 sq. yd.

Uhrichsville, Ohio.—Reported desired until Aug. 17 by H. O. Snyder, City Clk., for constructing a mile of brick paving 14 ft. wide.

Zanesville, Ohio.—Until Aug. 16 by County Comrs., for furnishing material and constructing the Adamsville Rd., about 10 miles. Bids desired on brick, concrete, bituminous bound macadam with tarvia, glutrein or asphalt surface treatment.

La Porte, Ind.—For 10,000 sq. yds. modern pavement. Address City Engineer, 410 First National Bank Building.

Belding, Mich—Until Aug. 18 by F. E. Conant, City Clk., for paving Main, Bridge and Pleasant Streets, with cement, brick or asphalt, on concrete foundation; cost, $40,000. Engrs., Smith & Boulay Co., Toledo, Ohio.

Howell, Mich.—Until Aug. 17 by Lyle J. Pettibone, City Clk., for paving a portion of Grand River Street. George Champe, Engr., Toledo, Ohio.

Chicago, Ill.—Until Aug. 11 by Bd. Local Improv. (Edward J. Glackin, Secy.), for paving with vitr. brick and Portland cement concrete portions of various alleys also with asphalt on portions of various streets, including S. Central Park Avenue, Diversey Avenue, Janssen and Aberdeen Streets.

Illinois—Until Aug. 11 by State Highway Comn., Springfield, for following proposed State aid road work:

Kane County—D Sect., concrete, Geneva nearest P. O.; length 4828 ft., cost $9,942.

Kane County—E Sect., brick, Elgin nearest P. O., length 951.7 ft., cost $3,601.

Vermillion County—Sect. D, brick, Newell nearest P. O., length 15,600 ft.; cost $40,757.

Woodstock, Ill.—Until Aug. 14 by Bd. Local Improv. (G. W. Frame, Secy.), for concrete pavement on Newell and Madison Streets and McHenry Avenue, about 13,800 sq. yd. 8750 lin. ft. concrete curb, etc.

Kansas City, Mo.—Until Aug. 10 by Bd. Park Comrs. (T. C. Harrington, Secy.), curbing and paving with bituminous macadam Brush Creek Boulevard, also for grading Benton Boulevard.

Until Aug. 16 by Allen G. Southern, Co. Engr., Kansas City, for constructing bituminized earth pavt. clearing, ditching and grading on the Cross State Highway of Indpendence, approximately 1 mile.

Belton, Tex.—Reported desired until Aug. 11 by County Comrs., for about 50 miles gravel or macadam roads. W. E. Hall, Co. Aud.

Dunville, Ont.—Until Aug. 9 by J. W. Holmes, Town Clk., for paving Canal Street E. with either rocmac, tarvia, Westrumite or oil bound macadam.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Beverly, Mass.**—Contract for paving Rantoul Street awarded by City Council to M. McDonough, Swampscott, at about $40,000.

★**Fall River, Mass.**—Contract awarded July 25 to Warren Bros. Co., Boston, Mass., for about 25,000 sq. yd. 2-in. bitulithic pavement, at $1.55 per sq. yd. Where there is no macadam base, the company will put in a concrete base and then surface it with bitulithic at $2 per sq. yd.

★**Albany, N. Y.**—Contracts for paving awarded by Bd. Contract and Supply, July 27, as follows: Bancker, Mercer, Peyster, Warren Streets, Main, Glendale, Highland, Park, and Ryckmann Avenues to Gleason & Davitt, Troy, at $113,374; Third Street to Benjamin F. Muiderry, Albany, at $12,488, and to Martin Murray & Co., Troy, for grading Beaver Park at $80.743

Albany, N. Y.—Following are lowest bids opened by State Highway Comn. at 55 Lancaster Street for repair of highways by State Aid:

Repair Contract 825, Broome County, 1.76 miles: Charles E. Haney, Camillus, $12,690; Port Jervis Constr. Co., Port Jervis, $13,386.

No. 820, Chemung County, 2.35 miles: Frank K. Liberatore, Elmira, $12,198; John C. Bradley, Corning, $13,532; Charles E. Haney, Camillus, $13,528; McGreevey, McGuigan & Baum Constr. Co., Elmira, $13,620.

No. 830, Chenango County, 3.55 miles: Smith & Stoll, Port Crane, $13,391; Paddelford & King, Sherburne, $14,441; Charles E. Haney, Camillus, $14,614; Nash & Griffin, Norwich, $14,951.

No. 822, Clinton County, 1.99 miles: James Conway, Plattsburgh, $7,806; A. Florentine & Son, Plattsburgh, $7,863; Richard Hopkins, Troy, $7,972.

No. 816, Columbia County, 9.26 miles: Olin T. Bendict, Pittsfield, Mass., $15,426; Crowe & Walsh, Pittsfield, Mass., $16,499; William Doyle, Saugerties, $16,833; Marks Kearney, Hudson, $16,868.

No. 834, Dutchess County, 4.12 miles: Henry Clinton, Poughkeepsie, $12,950; Thomas H. Karr, Troy, $14,495; Conway Bros. & Kennedy, Eddyville, $14,793; Tri-County Constr. Corp., Mount Vernon, $14,794.

No. 827, Putnam and Dutchess Counties, 13.47 miles: Thomas H. Karr, Troy, $9,939; R. B. Strang, Cold Spring, $9,995; Edward Hartney, Modena, $10,721; William Doyle, Saugerties, $10.757.

No. 828, Erie County, 0.87 mile: Union Paving Co., Schenectady, $13,503; Langan Constr. Corp., Albany, $13,594; J. F. Driscoll, Buffalo, $15,252; Henry P. Burgard Co., Buffalo, $17,577.

No. 819, Herkimer County, 5.46 miles: R. D. Cooper, Little Falls, $6,715; Richard Hopkins, Troy, $7,482; Newport Constr. Co., Herkimer, $7,852.

No. 637, Monroe County, 0.56 miles: Crouch Bros., Rochester, $12,377; Whitmore, Rauber & Vicinus, Rochester, $12,412; Morrison & Quinn, Inc., Rochester, $12,867.

No. 817, Montgomery County, 10.91 miles: Charles Scott, Fort Plain, $4,004; Nash & Griffin, Norwich, $4,248.

No. 823, Otsego County, 1.88 miles: Newport Constr. Co., Herkimer, $19,192; Fulton Eng. Co., Inc., Albany, $19,992; Michael O'Brien, Cortland, $20,595; John H. Gordon, Albany, $21,335.

No. 818, St. Lawrence County, 5.5 miles: Orlando Beede, Keene Valley, $26,145; Weed & Walsh, Mechanicville, $26,578; Arthur F. McConville, Ogdensburg, $27,-865; Richard Hopkins, Troy, $29,128.

No. 815, St. Lawrence County, 19.32 miles: Clarence E. Walker, Troy, $3,344; Atlantic Refining Co., Philadelphia, Pa., $3,736.

No. 814, St. Lawrence County, 15.88 miles: Clarence E. Walker, $2,662; Pathfinder Constr. Co., Inc., Fulton, $2,739.

No. 824, Schoharie County, 0.104 mile: J. J. Malloy, Schenectady, $2,149; H. A. Knapp, Delmar, $2,281.

No. 832, Steuben County, 1.14 miles: Charles E. Haney, Camillus, $6,314; Kennedy Constr. Co., Albany, $6,334.

No. 831, Sullivan County, 2 miles: Armstrong & Trowbridge, Roscoe, $12,984; Ruddy-Saunders Constr. Co., Troy, $13,-343; Port Jervis Constr. Co., Port Jervis, $13,470; John A. Jova, Inc., Newburgh, $14,514.

No. 833, Tompkins County, 17.1 miles:

Richard Hopkins, Troy, $7,637; William Hasard, Trumansburg, $8,989; John H. Gordon, Albany, $9,204.

No. 835, Warren County, 14.37 miles: Defiance Corporation, Ticonderoga, $5,046; Kellogg & Boynton, Keeseville, $5,138.

No. 821, Westchester County, 2.22 miles: Delta Contr. Co., Inc., Jamaica, $3,996; Tri-County Constr. Corp., Mount Vernon, $4,104.

No. 826, Westchester County, 0.54 mile: Tri-County Constr. Corp., Mount Vernon, $3,454; Thomas H. Karr, Troy, $3,494.

★**Brooklyn, N. Y.**—Contract awarded July 28 by L. H. Pounds, Boro. Pres., for regulating and repaving, including restoration of pavement, etc., on Skillman Street, Myrtle, Nostrand and Vernon Avenues, to Borough Asphalt Co., 1301 Metropolitan Avenue, Brooklyn, as follows: 1330 lin. ft. old curb reset in concrete, 60 cts.; 3695 lin. ft. new curb set in concrete, 95 cts.; 355 lin. ft. granite heading stones set in concrete, $1.20; 60 sq. ft. granite crosswalks, 75 cts.; 700 sq. ft. bluestone crosswalks, 50 cts.; 1505 cu. yd. concrete, $4.70; 665 sq. yd. grade 1 granite pavt. with joint fill of coal tar pitch and sand, $2.40; 3340 sq. yd. grade 2 granite pavt. with jomt fill of sand, 90 cts.; 395 sq. yd. grade 2 granite pavt. with joint fill of coal tar pitch and gravel, $1.20; 7960 sq. yd. asphalt pavt., 85 cts.; 1 new cover and head for sewer manhole, $12; total, $24,057. Next 3 lowest bids: Sicilian Asphalt Paving Co., 14 Park Row, New York, $25,213; Rosenthal Eng. Contr. Co., Inc., 165 Hooper Street, Brooklyn, $26,444; Barber Asphalt Paving Co., Woolworth Building, New York, $26,519.

★**Niagara Falls, N. Y.**—Contract for constructing about 500,000 sq. ft. concrete sidewalks awarded by City Council to Thomas McPhearson, Niagara Falls, at 11½ cts. per sq. ft.

★**Kearny, N. J.**—Contract for paving Stewart Avenue with warrenite awarded by Town Council to Van Keuren & Son, Newark, at $17,183.

Newark, N. J.—Lowest bid opened July 22 by Bd. Street & Water Comrs. for paving submitted by Newark Paving Co., Newark, as follows: Conklin Avenue, 1300 sq. yd, and Chadwick Avenue, 3400 sq. yd., with bitulithic, $3,483, and $8,053 respectively, and S. Thirteenth Street with Telford, 4700 sq. yd., $6,401.

Harrisburg, Pa.—Lowest bid opened by City Comrs. for constructing driveway from terminus of Cameron Parkway to entrance of Reservoir Park submitted by Central Constr. & Supply Co., Harrisburg, at $12,560.

★**Philadelphia, Pa.**—Contracts for paving awarded by Dept. Pub. Wks. July 29 as follows: Fairmount Avenue, with asphalt, Union Paving & Constr. Co., Thirteenth and Locust Streets, $40,939; Pasayunk Avenue, with wood block, Edwin H. Vare, Lincoln Building, $98,004; Fourth and Fifth Streets, with wood block, to McNichol Paving & Constr. Co., 1923 Cherry St., at $9,874 and $10,147 respectively.

★**Norfolk, Va.**—Contract for paving (bids opened July 29) awarded to Louis Lawson. He bid for 12,330 sq. yd. sheet asphalt $1.49; 815 sq. yd. wood block $2.85, and 23,735 sq. yd. 4-in. sheet asphalt $1.39. W. H. Taylor, City Engr.

★**Atlanta, Ga.**—Contracts for about 10,300 sq. yd. pavements awarded by city follows (price given per sq. yd.): Euclid Avenue with tarvia to Nichols Contr. Co., Atlanta, $1.19; Elmira Street with tarvia to Southern Tile & Stone Co., Atlanta, $1.17, and Albermarle Street to Cement Stone & Tile Co., Atlanta.

★**Saratosa, Fla.**—Contracts for paving (bids opened July 24 by Bd. Pub. Wks.) have been awarded as follows: To Georgia Eng. Co., Augusta, Ga., for 20,000 sq. yd. brick (Augusta block) asphalt fill, $1.63 per sq. yd. and to Southern Asphalt & Constr. Co., Birmingham, Ala., for 40,000 sq. yd. 2-in. asphaltic concrete with 20,000 sq. yd. rock 6-in. thick at $1.63½ and 26,400 ft. 30-in. overall combination, combined gutter, 51 cts. per ft. Fitch P. Wright, Comr. Pub. Wks.

★**Laurel, Miss.**—Contract for 27,753 sq. yd. asphalt, 10,078 sq. yd. wood block and 35,200 sq. ft. cement sidewalks awarded by City Comrs. to Southern Paving & Constr. Co., Chattanooga, Tenn., at $95,000. Bids opened July 20.

★**West Jefferson, Ohio.**—Contract for paving main street awarded to Andrews Paving Co., Hamilton, at about $40,000.

★**Kalamazoo, Mich.**—Contract for asphaltic concrete pavement awarded to the Globe Constr. Co. of Kalamazoo and to Metropolitan Paving Brick Co., Canton, Ohio, for brick paving. A. Lenderink, City Engr.

★**Milwaukee, Wis.**—Contract awarded July 20 for paving Center Street with creosote block to John Weiher, 868 Franklin Street, at $9,710; Fifth to Holton with creosote, Dean Constr. Co., 304-82 Wisconsin Street, $26,815.

★**St. Louis, Mo.**—Contracts awarded as follows July 27 by Bd. of Pub. Service for street improvements: Grading Louisville Avenue, to Murphy Contr. Co., at $4,275; paving Berlin Avenue with treated wood block and granite curb, to Foxhall P. McCormick, at $27,119; paving California Avenue with vitr. brick and granite curb, to Century Constr. Co., at $11,868; paving Pattison Avenue with vitr. brick and granite curb, to Skrainka Constr. Co., at $26,320; paving Colorado Avenue with vitr. brick and granite curb, to Eyermann Constr. Co., at $21,525. Contractors all of St. Louis.

★**Bellingham, Wash.** — Contracts for paving awarded as follows: 22,400 sq. yd. asphalt on Lake Rd. to L. H. Lich, Bellingham, $41,236; Harris Avenue with sheet asphalt to K. Sauset, Bellingham, at $11,148; Horton Street to D. H. Traphagan, Alaska Bldg., $20,555.

★**Port Angeles, Wash.**—Contract for constructing sidewalks on 17 streets awarded by City Council to Antonio Belguzzo and C. W. Colt, Port Angeles, at $95,804.

★**Olympia, Wash.**—Contract for constructing road from Mason County line to Olympia awarded to Leisure, Kent & Allison of Shelton, at $18,975. W. H. Yeager, Jr., Co. Engr.

★**Seattle, Wash.**—Contract for paving Horton Street awarded by Bd. Pub. Wks. to D. H. Traphagen, Alaska Bldg., at $20,555.

★**Spokane, Wash.** — Contract awarded July 23 for constructing 4.09 miles Permanent Road No. 13 A, between Dennison and Deer Park, to Mitchell Bros. & Payne, Spokane, at $39,059. Works calls for 38,425 sq. yd. asphalt concrete on macadam base; 20,880 cu. yd. common excav.; 8854 cu. yd. rock excav.; 1434 lin. ft. cor. pipe 8 to 24-in.; 88 cu. yd. concrete.

★**Tacoma, Wash.**—Contract awarded by city July 20 for paving S. M Street and Flume Line Boulevard to McHugh Contr. Co., Tacoma, at $32,232. Next 3 lowest bids: Western Paving Co., $32,257; Washington Paving Co., $33,647; Jos. Warter, So. (Bidders all of Tacoma.) Work includes 19,603 sq. yd. asphalt paving, 1042 lin. ft. concrete curb and gutter, 18,880 cu. yd. excav., etc. W. C. Raleigh, City Engr.

★**Walla Walla, Wash.**—Contract awarded July 16 for constructing Permanent Highway No. 9 to L. Lanning, Walla Walla, at $16,461. Other bids: Cascade Constr. Co., North Yakima, $16,275; Tribou & Blackman, Walla Walla, $17,659; T. B. Bidwell, Spokane, $18,095; H. L. Wilson Constr. Co., Walla Walla, $19,926. G. C. Cookerly, Co. Engr.

California.—Following are bids opened July 19 by State Highway Comn., Sacramento, for construction of state highways:

★Los Angeles County, Div. 7, Route 9, Section A—Successful bidder, Andrew Holloway, Pasadena, as follows:

21,570 cu. yd. excav. (without classification), 51 cts.; 26 lin. ft. 12-in. corrugated iron pipe, 40 cts.; 516 lin. ft. 18-in., 50 cts.; 402 lin. ft. 24-in., 75 cts.; 485 cu. yd. cement concrete, Class B (culverts and monuments), $8; 4800 cu. yd. cement concrete, Class B (pavt.), $3.67; 3612 lin. ft. guard rail, 40 cts.; 72 monuments, haul and set, ea. $1; total $34,583. Next 3 lowest bids: Tryon & Brain, Los Angeles, $43,758; Peter L. Ferry, Tropico, $45,165; Leigh G. Garnsey, Los Angeles, $46,130; Engineer's estimate, $38,576.

★Santa Clara County, Div. 4, Route 5, Section B—Successful bidder, Mavin Rock Co., San Anselmo, as follows: 14,500 cu. yd. excav. (without classification), 57 cts.; 72 lin. ft. 12-in. corrugated iron pipe, 50 cts.; 230 lin. ft. 18-in., 70 cts.; 38 lin. ft. 24-in., 85 cts.; 100 cu. yd. cement concrete, Class B (culverts and monuments), $9.50; 12,380 cu. yd. cement concrete, Class B (pavt.), $2.77; 800 lin. ft. guard rail, 35 cts.; 79 monuments, haul and set, ea. $1.50; total $44,135. Next 3 lowest bids: Highway Paving & Constr. Co., San Francisco, $45,694; Raisch Improv. Co., San Francisco, $45,884; Commary Peterson Co., San Francisco, $46,710; Engineer's estimate, $53,161.

★Alameda County, Div. 4, Route 5, Section B, awarded to H. G. Vaughan Constr. Co., San Francisco, as follows: 13,800 cu. yd. excav. (ordinary), 51.5 cts.; 2800 cu. yd. excav. (borrow), 51.5 cts.; 300 lin. ft. 12-in. corrugated iron pipe, 75 cts.; 140 lin. ft. 15-in., $1; 290 lin. ft. 18-in., $1.25; 110 lin. ft. 21-in., $1.50; 36 lin. ft. 24-in., $2; 100 lin. ft. 30-in., $2.50; 215 cu. yd. cement concrete, Class B (culverts and monuments), $9.75; 7100 cu. yd. cement concrete, Class B (pavt.), $2.59; 10,500 lin. ft. guard rail, 40 cts.; 37 monuments, haul and set, ea. $1; total, $34,486. Next 3 lowest bids: Spring Constr. Co., Berkeley, $35,884; Parrott Bros. Co., Salt Lake City, $37,857; W. B. Hunt & Sons, Alameda, $39,230.

★**California.**—Following are bids opened July 26 by State Highway Comn., Sacramento, for state road work:

Monterey County, Div. 5, Route 2, Section D—Lowest bidder, Highway Paving & Constr. Co., San Francisco, as follows: 25,600 cu. yd. excav., (without classification), 52½ cts.; 1898 lin. ft, 12-in. cor. iron pipe, 50 cts.; 128 lin. ft. 18-in., 50 cts.; 80 lin. ft. 24-in., $1; 52 cu. yd. cement concrete, Class B (culverts and monuments), $12; 11,440 cu. yd. cement concrete, Class B (pavt.), $3.40; 890 lin. ft. guard rail, 40 cts.; 98 monuments, haul and set, ea. $1; total $54,507. Next 3 lowest bids: Hoffman & McLaren, Oakland, $63,395; Petersen & Grier, San Francisco, $66,733; W. A. Dontanville, Salinas, $69,064; Engineer's estimate, $83,020.

Colusa County, Div. 3, Route 7, Section A—Only bidder, Clark & Henery Constr. Co., Sacramento, as follows: 10,050 sq. yd. asphalt wearing surface, 57½ cts.; total $5,779; Engineer's estimate, $5,879.

Santa Barbara County, Div. 5, Route 2, Section D—Lowest bidder, C. H. Hudson, Los Angeles, as follows: 47,926 cu. yd. earth excav., 35 cts.; 27,700 cu. yd. loose rock excav., 50 cts.; 5200 cu. yd. solid rock excav., 70 cts.; 10,022 cu. yd. borrow excav., 25 cts.; 1769 lin. ft. 12-in. cor. iron pipe, 60 cts.; 395 lin. ft. 18-in., 70 cts.; 385 lin. ft. 24-in., 80 cts.; 335 lin. ft. 30-in., 90 cts.; 210 lin. ft. 36-in., $1; 1437 cu. yd. cement concrete, Class B (culverts and monuments), $10; 400 cu. yd. dry rubble (retaining walls), $2; 45 cu. yd. rubble masonry (retaining walls), $3; 354 monuments, haul and set, ea. $1; total $54,586. Next 3 lowest bids: Robt. Sherer, Los Angeles, $58,148; F. L. Smith Co., Eureka, $59,466; F. H. Green, Eureka, $59,994; Engineer's estimate, $62,162.

San Luis Obispo County, Div. 5, Route 2, Section B—Lowest bidder, John D. Marsh, Bakersfield, as follows: 60,750 cu. yd. excav. (without classification), 50 cts.; 1117 lin. ft. 12-in. cor. iron pipe, 45 cts.; 114 lin. ft. 18-in., 55 cts.; 557 lin. ft. 24-in., 60 cts.; 347 lin. ft. 30-in., 70 cts.; 80 lin. ft. 36-in., 75 cts.; 580 cu. yd. cement concrete, Class B (culverts and monuments), $8.25; 9740 cu. yd. cement concrete, Class B (pavt.), $2.90; 6740 lin. ft. guard rail, 45 cts.; 168 monuments, haul and set, ea. $1; total $67,809. Next 3 lowest bids. Pacific Coast Constr. Co., Fresno, $69,386; C. H. & A. W. Gorrill, San Francisco, $70,864; Bent Bros., Los Angeles, $72,495; Engineer's estimate, $71,709.

Marin County, Div. 4, Route 1, Section A—Lowest bidder, R. B. Markle, Jr., San Francisco, as follows: 44,900 cu. yd. excav. (without classification), 42 cts.; 350 lin. ft. 12-in. cor. iron pipe, 50 cts.; 30 lin. ft. 15-in., 60 cts.; 72 lin. ft. 18-in., 70 cts.; 220 cu. yd. cement concrete, Class B (culverts and monuments), $9; 36 monuments, haul and set, ea. $1.50; total $21,255. Next 3 lowest bids: J. H. Falconer, Pinole, $23,499; P. H. Hoare, Oakland, $24,476; Palmer & McBryde, San Francisco, $25,489; Engineer's estimate, $28,280.

★**Los Angeles, Cal.**—Contracts for paving awarded as follows: 120,680 sq. ft. on Allesandro Street with asphalt to California-Arizona Constr. Co., 1700 E. Washington Street, at $22,784; for 13,600 sq. ft. on Fifth Street with Warrenite, and 12,470 sq. ft. with vitr. brick to H. C. Withers, Builders Exchange, at $12,343; for 78,157 sq, ft. cultivate, tamp and oil, 28,048 sq. ft. walk on Lemoyne Street to F. W. Whittier, 1145 Title Insurance Building, at $19,502.

★**Los Angeles, Cal.**—Contract for 109,498 sq. ft. asphalt pavements on Adams Street, Grand Avenue and Hoover Street awarded to B. F. Ford and F. H. Stout, Bradbury Bldg., at $32,146.

★**Tucson, Ariz.**—Contract for paving Sixth Street with bitulithic awarded to Warren Bros., Co., California Bldg., Los Angeles, Cal., at $118,495.

STREET CLEANING AND GARBAGE DISPOSAL

PROPOSED WORK

Farrell, Pa.—J. F. Thomas, Boro. Engr., writes it is proposed to construct a 24-ton capacity incinerating plant this summer; cost $8,000.

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS

PROPOSED WORK

River Improvement—Jamestown, N. Y.—F. P. Williams of Rochester, Division Engr., State Dept. Pub. Wks., is preparing plans for improvement of Chadokoin River, Appropriation $100,000. Contract to be let by State Dept. Pub. Wks. (Frank M. Williams, State Engr.).

Drainage Bonds—Anderson, S. C.—$19,500 drainage bonds will be sold Aug. 21 by Drainage Comrs. of Rocky River Drainage Dist., No. 1, at office of Bonham, Watkins & Allen, Attorneys, Bleckley Building, Anderson.

Canal—Ocala, Fla.—Bd. of Trade reported interested in construction of a canal from Silver Springs to Ocala.

Drainage — Tampa, Fla.—Hiram McElroy of Tampa is engineer for the proposed drainage work contemplated in the county, which the Bd. of Trade (B. L. Hamner, Secy.) is promoting and aiding in formation of drainage districts. There is one district of about 30,000 acres north of Plant City, another district north of Seffner, with about same number of acres; another north of Thonotosassa, about same size, and there is one contemplated consisting of 360,000 acres in Sumter, Lake, Hernando and Pasco Counties. The first three districts are in the formative stage and at this time it cannot be stated when construction work will be commenced; 65,000 acres of the last-named district have been surveyed, but not yet ready for construction.

Drainage—Mount Ayr, Iowa.—P. S. Holbrook, Co. Engr., making preliminary survey of Grand River with a view of establishing a drainage district.

Ditch—Red Oak, Iowa.—Theo. S. DeLay, Creston, making preliminary surveys along West Nodawya River for drainage ditch.

Drainage—Fremont, Neb.—County has received two petitions for drainage ditches, one in Maple Township, about three miles long, and one eleven miles long in Union and Cotterell Townships. W. M. Sanders, Co. Surveyor, has made a survey of first named ditch and will file report in August. County Board granted last petition, but engineer has not yet made survey of same.

Levee—Ft. Worth, Tex.—City Engineer reported preparing plans for levee around city pumping plant, to cost about $16,000.

Drainage—Montesano, Wash.—Julius R. Pamrenk reported to have petitioned County Comrs. for permission to form a drainage district to reclaim 1686 acres of land south of South Bay.

Ditch—North Yakima, Wash.—Property owners in Modern Addition, working in conjunction with Yakima County Comrs., have taken steps to secure election to vote $50,000 bond issue to be used in constructing two branches to present West Side drain ditch. O. E. Brashears, County Engr.

Irrigation—Salem, Ore.—Public Utilities Comn. reported to have issued permit to Rogue River Public Service Cor. for irrigation of 12,640 acres in vicinity of Grants Pass, water to be diverted from Rogue River by means of 20-ft. dam. Estimated cost $135,000.

Pier—San Francisco, Cal.—Bd. State Harbor Comr. (Jerome Newman, Ch. Engr.), about to let contract for constructing Pier 22, foot of Harrison Street.

Retaining Wall—Montreal, Que.—City Council has voted $360,000 for the construction of a retaining wall on north side of the enlarged aqueduct.

BIDS DESIRED.

Dredging—New York, N. Y.—Bids desired on 100,000 cu. yd. dredging, suction or dipper, as advertised in Engineering Record. Address Box 1512, Engineering Record, 239 W. Thirty-ninth Street, New York.

Lock Gates, etc.—Pittsburgh, Pa.—Until Aug. 30 at U. S. Engr. Office, Pittsburgh, for furnishing and erecting steel lock gates and furnishing valves and lock operating machinery at Lock 6, Monongahela River.

Bulkhead — Charleston, S. C. — Until Aug. 10, by Lighthouse Inspector, Charleston, for furnishing material and constructing timber bulkhead at site of new Charleston Lighthouse Depot, Ashley River.

Levee—Greenville, Miss.—Later official reports state bids desired until Aug. 17 by Bd. Mississippi Levee Comrs., Greenville (W. L. Thompson, Ch. Engr.), for levee work includes Upper Vermillion Spur Enlargement, 24,000 cu. yd.; Black Bayou Spur Enlargement, 7000 cu. yd.; Upper Avon Banquette Enlargement, 23,000 cu. yd.; Lower Avon Banquette Enlargement, 20,000 cu. yd.; Moon Lake Enlargement, 200,000 cu. yd. and Mayersville to Baleshed Enlargement, 262,000 cu. yd.

Drainage Pump—Louisville, Ky.—Until Aug. 11 by Bd. Park Comrs. (Harry S. Smith, Bus. Dir.), for an automatic centrifugal pump with motor, to be used in connection with drainage of underpass on Eastern Parkway. Stonestreet & Ford, Park Engrs., Louisville Trust Building.

Channel for Creek—East St. Louis, Ill.—Reported desired until Aug. 16, East Side Levee and Sanitary Dist. (G. T. Tarlton, Pres.), for constructing a channel for Cahokia Creek, about 12,900 ft. long in Collinsville Township, 115,000 cu. yds. excav., 20 acres of clearing.

Lake Shore Protection—Evanston, Ill.—Until Aug. 16 by John H. Moore, Comr. Pub. Wks., for lake shore protection work, including construction of 18 wooden piers of crib pattern, with alternative bids for constructing 18 piers of Coignet-Ravier reinforced concrete wing piling, advertised in Engineering Record.

Ditch—Redwood Falls, Minn.—Until Aug. 12 by L. P. Larson, Co. Aud., for constructing County Ditch No. 20 and furnish about 105,000 ft. of tile from 4 to 28 in. Estimated total cost, $32,438.

Drainage Work, Corinne, Utah.—Until Aug. 21 by Board of Supervisors, for drainage work approximately 8 miles open ditch, 20 miles of mains, from 12 to 20-in. diameter and 220 miles of lateral pipes ranging from 4 to 8-in. advertised in Engineering Record. W. M. Bostaph, Engr., 204 Kearns Building, Salt Lake City; C. G. Adney, Secy. Drainage Dist., Corinne.

Piers—Honolulu, T. H.—Until Sept. 22 by Charles R. Forbes, Chmn. Bd. Harbor Comrs., Honolulu, for constructing reinforced concrete piers No. 8, 9 and 10 at foot of Fort Street, Honolulu, advertised in Engineering Record.

Filling in of Pond—Toronto, Ont.—Until Aug. 17, by T. L. Church (Mayor), Chmn. Bd. Control, for filling in of Catfish Pond and construction of sewer in connection therewith.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Dredging—Boston, Mass.—Following are 2 lowest bids opened July 28 by Harbor and Land Comrs., Boston (William F. Williams, Ch. Engr.), for dredging channels as follows (price given per cu. yd.):

Wollaston Harbor, 31,000 cu. yd.: J. H. Gerrish, 10 Tremont Street, Boston, 14.3 cts.; Bay State Dredging Co., Boston, 20 cts.

Barnstable, 60,000 cu. yd.: J. H. Gerrish, 10 Tremont Street, Boston, 16.3 cts.; J. F. O'Hearden, Charlestown, 19 cts.

Nobsconset Harbor, 20,000 sq. yd.: Eastern Dredging Co., East Boston, 19.45 cts.; J. H. Gerrish, 10 Tremont Street, Boston, 21.3 cts.

★**Channel Work—Winchester, Mass.**—Following are bids opened July 26 by Metropolitan Park Comn., Boston (John R. Bailey, Engr.), for excavating channel of Aberjona River from Boston & Maine R. R. Bridge to Waterfield Street, Mystic Valley Parkway, Winchester, about 15,000 cu. yds.: (a) price given per cu. yd., (b) totals: Lawler Bros., Charlestown, (a) $2.20; (b) $33,000; John P. Cavanagh Co., Dorchester, (a) $1.75, (b) $26,250; Bay State Dredging Co., Ltd., Boston, (a) $1.89, (b) $28,350; Eastern Dredging Co., East Boston, (a) 91½ cts., (b) $13,725; Wm. R. Farrell, Somerville, (a) 91 cts., (b) $13,650; Coleman Bros., Chelsea, 90 cts.; (b) $13,500 (awarded contract).

★**Pier—Augusta, Ga.**—Contract reported awarded July 22 by City Council for furnishing material and constructing a reinforced concrete pier and steel warehouse to Georgia Constr. Co., Augusta, at $27,958. Other bids: Carolina Constr. Co., Columbia, S. C., $28,750; A. J. Twiggs & Son, Augusta, $27,500; Lawrence Constr. Co., Augusta, $28,654; Snare & Triest Co., New York, $48,500. Nisbet Wingfield, City Engr.

★**Stone for Jetties—New Orleans, La.**—Contract to furnish and place on jetty at Southwest Pass, Mississippi River, about 12,500 tons of stone awarded to A. F. Alexander, New Orleans, La., at $47,640 (bids opened July 21).

Breakwater — Conneaut, Ohio.—Lowest bid opened July 30 by U. S. Engineer, Cleveland, for constructing pierhead and rubble mound breakwater at Conneaut Harbor, submitted by Coast & Lakes Contr. Cor., Union Building, Cleveland, as follows: 75,000 tons stone, 95 cts., and 9500 tons stone, $1.20; pierhead complete, steel cylinder type, $12,000; total $93,007. Totals of other bids: Greiling Bros. Co., Green Bay, Wis., $115,023; Edw. Gillen Dock Dredge & Constr. Co., Racine, Wis., $118,600; Great Lakes Dredge & Dock Co., 1016 Williamson Building, Cleveland, $137,358.

★**Ditch — Marshall, Minn.** — Contracts awarded July 26 by Co. Comrs. for constructing ditches as follows: Ditch 15, to Hector Cashman, Marshall, $9,685; Ditch 16 and Ditch 12 (tile work), to Anderson & Arthur Tracy, at $55,600 and $18,047 respectively; Ditch 12 (open work), to Ajax Dredge Co., Glencoe, at $6,800. E. S. Shepard, Aud.

★**Ditch — Windom, Minn.** — Contracts awarded July 20 by Co. Comrs. (S. A. Brown, Co. Aud.), for constructing ditches as follows: No. 3 to L. P. Axelsen, Clear Lake, Iowa, $110,000; No. 13 to John Pedersen, Clear Lake, Iowa, $3,417; No. 14 to Michels & Sandlin Bingham Lake at $5,145, and Hadley & Flaherty, Fort Dodge, Iowa, $13,841.

★**Levee Enlargement — McGhee, Ark.** — Contract awarded by Comrs. Red Ford Levee Dist. for 345,000 cu. yd. levee enlargement, to Dennison & Rodgers Bros., Memphis, Tenn., at 13.75 cts per cu yd.

★**Repairing Wharves—Portland, Ore.**—Contract for enlarging and repairing receiving wharves and tramways and extending jetties at mouth of Siuslaw River, Oregon, bids opened July 12 by U. S. Engineer at Portland, awarded to Miami Quarry Co., Portland, at $176,571. Unit prices in Engineering Record of July 24.

Pier—San Francisco, Cal.—Contract reported awarded July 22 by Bd. State Harbor Comrs. to Tibbitts-Pacific Co., for repairing Pier 32; cost about $60,000.

ELECTRIC RAILWAYS

PROPOSED WORK

Methuen, Mass.—Work about to begin by Bay State Street Ry. Co. for extending Lawler tracks of Bay State Street Ry. Co., Boston.

Hartford, Conn.—Public Utilities Comm. of Connecticut approved application of Connecticut Co. for permission to lay tracks on Myrtle, Grove, Broad, Washington, Lincoln and Farmington and Commonwealth Avenues, distance of 7200 ft.

New York, N. Y.—Public Service Comm. for First District has laid out a new rapid transit route, to be known as Route 61, providing for construction of new tunnel under East River from Seventh Street, Manhattan, to Queensboro Bridge Plaza, Borough of Queens, where it will connect with new rapid transit lines in that borough running to Astoria on the north and to Corona on the northeast. This action was taken in pursuance of resolutions adopted by Bd. of Estimate and Apportionment asking that tunnel route be substituted for original route over Queensboro Bridge. New route is for operation by the New York Municipal Railway Corp. in connection with Broadway subway in Manhattan and the new lines in Queens, over which company will have trackage rights. In December, 1914, the Degnon Contracting Co. proposed change from bridge to the tunnel, and in its proposition to Bd. of Estimate stated that it would submit a bid for construction of the tunnel not to exceed $4,500,000.

Landing, N. J.—Morris County Traction Co. plans to construct an electric railway from Landing to Lake Hopatcong and through Fort Morris to Netcong. H. O. Peckham, Ch. Engr., Morristown.

Salem, N. J.—Plans being considered to construct an electric railway from Salem to Pennsgrove. Among those interested Arthur B. Smith, Harry G. Hart.

Brooksville, Fla.—Work about to begin on construction of electric railway from Brookville to St. Petersburg via Clearwater. James Murphy said to be interested

Clearwater, Fla.—Franchise for constructing an electric railway in Clearwater and vicinity awarded to E. W. Parker, Tampa.

Anniston, Ala.—Anniston Power Co. considering constructing electric railway between Anniston and Blue Mountain City.

Anniston, Ala.—Plans being made by Anniston Electric & Gas Co. to extend lines from Anniston to Blue Mountain.

Cincinnati, Ohio.—Cincinnati, Lawrenceburg & Aurora Electric Street Ry. Co. plans to construct an electric railway from Anderson's Ferry to business section of Cincinnati.

Minneapolis, Minn.—Electric Short Line Ry. Co. contemplates extending lines, in all, about 45 miles.

Corpus Christi, Tex.—Corpus Christi Traction Co. incorporated to construct an interurban railway in and out of Corpus Christi, north, west and south. Capital, $100,000. Among incorporators: J. S. Caswell, San Diego; W. E. Pope, Corpus Christi; and others.

Fallon, Nev.—Work about to begin on constructing Fallon Electric Ry. between Fallon and Sand Springs.

Lewiston, Idaho.—Lewiston-Clarkston Transit Co. plans to extend its lines in Lewiston about 1 mile and in Clarkston about 1 mile.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Long Island City, N. Y.—Following are unofficial totals of bids opened by Public Service Comn., 154 Nassau Street, New York, Aug. 3, for station finish on Route No. 50, the Queensboro Subway extension, and on Sections Nos. 1 and 3 of routes Nos. 26 and 27, the Corona elevated railroad in Queens: Snare & Triest Co., 233 B'way, New York, $611,563; Marble Arch Co., 216th Street and B'way, New York, $750,000.

Bids opened Aug. 4 for station finish on Section No. 2 of Routes Nos. 26 and 27, the Astoria elevated railroad in Queens: Charles Meads, 38 Park Row, New York, $272,000; Snare & Triest Co., New York, $274,296; Simon Russeck, Inc., 261 Broadway, New York, $285,270.

★**New York, N. Y.**—Contracts awarded by Bd. Pub. Service for track materials, to be used on about 230 miles of single track of Dual System, covering all lines not already provided for: track rail splice bars to The Rail Joint Co., 185 Madison Avenue, $197,106; nut locks to Robert F. Horsey, 30 W. 129th Street, $735; anti-creepers, to The Creepcheck Co., 81 Fulton Street, $35,175.

Contracts awarded by Pub. Service Comn. for First Dist. for Section 1, Route 49, part of Culver rapid transit railroad to Post & McCord, 101 Park Avenue, at $877,959 (bids opened July 20). Unit prices in Engineering Record of July 31.

New York, N. Y.—Following are unofficial totals of 4 lowest bids opened Aug. 4 by Public Service Comn. for constructing Forty-fourth Street duct line in connection with the Queensboro Subway, from Lexington Avenue Subway at Forty-fourth Street and extend easterly under Forty-fourth Street to First Avenue, southerly under First Avenue to Forty-second Street, and easterly under Forty-second Street to a connection with shaft of Queensboro Subway between First Avenue and the East River: E. C. Moore, 154 Nassau Street, New York, $35,000; Knight & DeMico, Inc., 4441 Park Avenue, New York, $38,887; Beaver Eng. and Contr. Co., 51 Chambers Street, New York, $38,918; Hanover Contr. Co., 271 W. 125th Street, New York, $39,000.

★**Pottsville, Pa.**—Contract for grading and laying track on Schuylkill Electric Ry. over Broad Mountain awarded to Trexler Contr. Co., Reading.

★**New York, N. Y.**—Following are 4 lowest bids opened July 27 by Bd. Public Service for First District, 154 Nassau Street, for Section 3, Route 12, Eastern Parkway subway, Brooklyn: (a) Rodgers & Hagerty, Inc., 152d Street and Harlem River, New York, $2,170,652 (awarded contract); (b) Charles Cooper, 1251 Bedford Ave., Brooklyn, $2,192,302; (c) T. A. Gillespie Co., 50 Church Street, New York, $2,204,674; (d) Dock Contractor Co., Hoboken, N. J., $2,271,168.

Item			*(a)	(b)	(c)	(d)
1	471,800	cu. yd. earth excavation above mean high water	$1.40	$1.63	$1.50	$1.73
2A	9,100	cu. yd. earth excavation above and below mean high water, sewers	1.75	1.63	1.50	2.00
4GG	146	trees, maintaining, protecting and preserving, per tree	25.00	10.00	10.00	70.00
4HH	21	trees, replacing, per tree	100.00	10.00	50.00	100.00
6	77,500	cu. yd. concrete masonry	7.00	6.50	7.00	6.50
6A	3,450	cu. yd. concrete masonry for reinforced concrete on elevated railroad	8.00	6.50	12.00	12.50
6B	2,530	sq. yd. tooling concrete surface of reinforced concrete on elevated railroad	0.60	0.90	0.50	1.00
7	4,600	cu. yd. protective concrete masonry outside of water pressure	7.00	6.50	7.00	6.50
8	20	cu. yd. rubble stone	3.00	6.50	8.00	7.00
8A	20	cu. yd. dry rubble	3.00	6.50	3.50	7.00
9	35	cu. yd. brick masonry	15.00	12.00	12.00	15.00
9A	3	cu. yd. vitrified brick masonry	30.00	20.00	25.00	35.00
10	50	cu. yd. hollow terra cotta brick or tile masonry	15.00	15.00	12.00	20.00
11	1,000	bbl. grout of Portland cement, per bbl.	1.00	2.50	2.70	1.90
12	1,000	lin. ft. timber piles	0.01	0.01	0.40	0.20
13	2	M ft. timber foundations	20.00	0.01	45.00	40.00
14	20	cu. yd. broken stone or gravel	2.00	2.00	2.20	1.00
15	7,000	sq. yd. (a) waterproofing, 1 ply	0.35	0.50	0.50	0.40
	100	sq. yd. (b) waterproofing, 2 ply	0.60	0.75	0.50	0.70
	33,000	sq. yd. (c) waterproofing, 3 ply	0.75	1.00	0.90	1.00
	100	sq. yd. (d) waterproofing, 4 ply	1.25	1.20	1.00	1.25
	100	sq. yd. (e) waterproofing, 5 ply	1.50	1.40	1.20	1.75
	200	sq. yd. (f) waterproofing, 6 ply	2.00	1.60	1.50	2.00
	100	sq. yd. (i) waterproofing, dry ply	0.35	0.45	0.30	0.20
16	840	cu. yd. brick laid in asphalt mastic	20.00	20.00	18.00	23.00
17	50	lin. ft. (a) 12-in. vitrified drain pipe	0.75	0.70	0.80	1.50
	50	lin. ft. (b) 10-in. vitrified drain pipe	0.65	0.60	0.60	1.30
	50	lin. ft. (c) 8-in. vitrified drain pipe	0.50	0.50	0.40	1.20
	50	lin. ft. (d) 6-in. vitrified drain pipe	0.45	0.40	0.30	1.10
	380	lin. ft. (e) 4-in. vitrified drain pipe	0.40	0.30	0.20	1.50
	50	lin. ft. (g) 6-in. cast-iron drain pipe	1.00	1.00	0.80	1.50
	50	lin. ft. (h) 4-in. cast-iron drain pipe	0.50	0.60	0.60	1.00
	50	lin. ft. (i) 10-in. cast-iron drain pipe	1.75	1.50	1.60	2.00
17A	50	lin. ft. (a) 3-in. cast-iron pipes and fittings (extra heavy)	1.00	1.00	0.60	0.85
	1,950	lin. ft. (b) 4-in. cast-iron pipes and fittings (extra heavy)	1.25	1.25	0.72	1.25
	150	lin. ft. (c) 6-in. cast-iron pipes and fittings (extra heavy)	1.50	1.50	1.10	1.35
	150	lin. ft. (d) 8-in. cast-iron pipes and fittings (extra heavy)	2.50	2.00	1.40	2.00
18	354,600	duct ft. tunnel ducts	0.10	0.09	0.11	0.115
18A	92,200	duct ft. railroad ducts	0.14	0.12	0.30	0.15
19	5,550	tons riveted steel	55.00	48.00	54.00	55.90
20	6,100	tons steel beams and shapes	55.00	48.00	51.00	49.15
21	950	tons. steel rods and bars	55.00	48.00	40.00	44.00
25	40	tons miscellaneous iron castings	60.00	70.00	56.00	30.00
25C	1	ton miscellaneous iron furnishings	100.00	70.00	61.00	100.00
26	200	lb. special wire forms	0.10	0.12	0.12	0.20
27B	14,200	lin. ft. 1¾-in. seasoned oak or ash hand rail	0.30	0.30	0.40	0.22
27C	310	lin. ft. 1½-in. galv. iron pipe railings	0.30	0.70	0.40	0.50
28	8,300	sq. ft. steel gratings for ventilation, including frames	1.50	1.30	1.30	1.40
29	890	sq. ft. vault lights	1.00	1.30	1.30	1.30
30	40	sq. yd. (a) sidewalk restored, incl. curbs	1.50	1.00	1.00	1.00
	50	sq. yd. (d) roadway restored (macadam)	1.00	1.00	0.60	1.00
	1,955	sq. yd. (e) roadway restored (asphalt)	2.50	2.50	2.00	1.50
	6,660	sq. yd. (f) roadway restored (granite blk.)	0.75	2.00	0.25	0.50
	180	sq. yd. (ff) roadway restored (belgian blk.)	0.75	0.80	0.25	1.00
	540	sq. yd. (g) roadway restored (asphalt blk.)	2.50	2.50	3.00	2.00
	100	lin. ft. (i) new bluestone curb	1.00	1.00	1.00	1.00
	100	lin. ft. (k) new 8-in. granite	1.50	1.50	2.00	1.00
	50	sq. yd. (m) roadway restored (brick pavt.)	3.00	2.00	2.00	1.80
	25,000	sq. yd. (n) roadway restored (macadam and asphalt bound)	1.50	1.50	0.75	0.50
31	1,690	sq. yd. park surface restored	0.50	1.20	0.50	1.00
32	4,600	lin. ft. (a) ¾-in. w.-i. electric conduits	0.15	0.20	0.16	0.18
	625	lin. ft. (b) 1½-in. w.-i. electric conduits	0.25	0.40	0.31	0.32
	675	lin. ft. (c) 2-in. w.-i. electric conduits	0.30	0.60	0.38	0.40
	6,075	lin. ft. (d) 1-in. w.-i. electric conduits	0.20	0.30	0.23	0.24
33	700	cast-iron outlet boxes, each	1.00	1.50	0.70	0.50
33A	12	cast-iron pull boxes, each	1.50	1.50	0.70	3.50
34	160	lin. ft. (a) 6-in. c.-i. pipes and fittings (extra heavy) in station	1.50	2.00	0.90	3.00
	125	lin. ft. (b) 3-in. c.-i. pipes and fittings (extra heavy) in station	1.00	1.00	0.40	2.75
37	100	lin. ft. 12-in. vitrified sewer pipe	2.40	3.00	1.20	3.70
39	100	lin. ft. 18-in. vitrified sewer pipe	3.25	4.00	2.00	4.00
41	540	lin. ft. 24-in. vitrified sewer pipe	5.00	5.00	3.80	4.80
42	11	tons c.-i. straight sewer pipe	40.00	40.00	45.00	50.00
43	5	tons c.-i. special sewer pipe	75.00	50.00	65.00	70.00
45	1,030	lin. ft. 3 ft. 6 in. x 2 ft. 4 in. egg-shaped sewer, brick or concrete	6.00	7.00	5.50	5.00
54A	780	lin. ft. 4 ft. 6 in. circular sewer	8.00	10.00	6.50	6.00
75	400	lin. ft. (c) electric overhead trolley	2.00	10.00	6.00	0.50
79	100	lin. ft. 6-in. water pipe	0.05	1.00	1.10	2.00
80	550	lin. ft. 8-in. water pipe	0.05	1.30	1.50	2.00
87	100	lin. ft. 36-in. water pipe	0.05	3.50	5.00	7.00
88A	10	serv. conn. for water pipes (all sizes) each	0.05	20.00	20.00	10.00
90	100	lin. ft. 4-in. gas pipe	0.05	0.60	0.75	0.90
91	700	lin. ft. 6-in. gas pipe	0.05	0.75	1.00	1.00
92	150	lin. ft. 8-in. gas pipe	0.05	1.00	1.25	1.15
94	2,840	lin. ft. 12-in. gas pipe	0.05	1.50	1.50	0.75
98	100	lin. ft. 30-in. gas pipe	0.05	3.00	3.00	4.00
99A	450	lin. ft. (a) 6-in. w.-i. by-passing pipe upon or below street surface	0.05	3.00	2.00	1.00
	2,435	lin. ft. (d) 12-in. w.-i. by-passing pipe upon or below street surface	0.05	5.00	3.15	1.50
99B	300	lin. ft. (a) 12-in. w.-i. by-passing pipe on trestle	0.05	5.00	4.00	1.50
	150	lin. ft. (d) 24-in. w.-i. by-passing pipe on trestle	0.05	12.00	6.00	3.00
	390	lin. ft. (f) 6-in. w.-i. by-passing pipe on trestle	0.05	3.00	2.75	1.00
	600	lin. ft. (h) trestle to support by-passing pipes	0.05	4.00	3.00	1.50
99D	10	service conn. for gas pipes (all sizes) each	0.05	20.00	15.00	10.00
100	10	tons new c.-i. hub and spigot pipe (straight)	20.00	50.00	35.00	45.00
101	10	tons new c.-i. hub and spigot pipe (special)	40.00	70.00	70.00	70.00
127	3,300	duct ft. electric ducts and conduits	0.05	0.50	0.65	0.90
127A	1,300	lin. ft. (f) 2-in. Edison w.-i. electric ducts and conduits	0.05	1.00	0.50	0.60
	200	lin. ft. (g) 2½-in. Edison w.-i. electric ducts and conduits	0.05	1.00	0.65	0.80
	100	lin. ft. (h) 3-in. Edison w.-i. electric ducts and conduits	0.05	1.00	0.65	1.00
127C	10	serv. conn. for electric ducts, each	0.05	20.00	10.00	25.00
127D	600	duct ft. wooden electric ducts and conduits	0.05	0.50	0.65	0.60

Brooklyn, N. Y.—Following are unit prices of four lowest bids opened July 28 by Bd. Public Service Comn., 154 Nassau Street, New York, for Section 2, Route 29, Nostrand Avenue subway, Brooklyn: (a) Dock Contractor Co., Hoboken, N. J., $1,692,371; (b) Donegan Co., 5904 Fourteenth Avenue, Brooklyn, $1,849,286; (c) T. A. Gillespie Co., New York, $1,879,999; (d) Newman & Carey, 215 Montague Street, Brooklyn, $1,953,097.

Item			(a)	(b)	(c)	(d)
1	262,800	cu. yd. earth excav. above M.H.W. (Ex. S. & D.)	$1.73	$1.80	$2.20	$1.90
2	19,000	cu. yd. earth excav. below M.H.W. (Ex. S. & D.)	1.73	2.25	2.20	3.50
2-A	46,200	cu. yd. earth excav. above and below M.H.W., S. P. & D.	1.73	2.00	2.20	1.90
4-a	80	lf. ft. underpin'g bldgs. under 7 stories	85.00	20.00	50.00	60.00
4-E	1,000	lf. ft. maintain., protect, & secur. bldgs.	69.00	20.00	10.00	20.00
6	53,000	cu. yd. concrete masonry in place	6.25	7.00	7.00	7.50
7	8,100	cu. yd. concrete masonry outside of waterproofing	6.25	7.00	7.00	6.50
8	50	cu. yd. rubble stone masonry	6.00	6.00	8.00	10.00
8-A	50	cu. yd. dry rubble masonry	5.50	6.00	3.50	10.00
9	60	cu. yd. brick masonry	14.00	18.00	14.00	20.00
9-A	2	cu. yd. vitrified brick masonry	20.00	25.00	25.00	50.00
10	60	cu. yd. hollow terra cotta brick or tile masonry	12.00	15.00	15.00	15.00
11	1,000	barrel grout of Portland cement	1.00	2.00	2.70	2.65
12	1,000	lin. ft. timber piles, in place and prepared	0.20	0.60	0.40	0.60
13	2	M ft. timber foundations placed and fastened	45.00	40.00	45.00	60.00
14	50	cu. yd. broken stone or gravel in place	1.00	3.00	2.20	3.00
15-a	36,100	sq. yd. waterproofing, one-ply	0.33	0.45	0.50	0.40
15-b	100	sq. yd. waterproofing, two-ply	0.57	0.85	0.50	0.85
15-c	28,600	sq. yd. waterproofing, three-ply	0.80	1.00	0.90	1.20
15-d	100	sq. yd. waterproofing, four-ply	1.04	1.40	0.98	1.60
15-e	100	sq. yd. waterproofing,five-ply	2.28	1.80	1.20	1.90
15-f	100	sq. yd. waterproofing, six-ply	2.52	2.10	1.50	2.30
15-i	100	sq. yd. waterproofing, dry-ply	0.19	0.40	0.30	0.25
16	5,400	cu. yd. brick in asphalt mastic	19.00	23.00	20.00	30.00
17-a	50	lin. ft. drain pipe, 12-in. vitrified	0.70	0.80	0.80	0.60
17-b	50	lin. ft. drain pipe, 10 in. vitrified	0.65	0.60	0.60	0.50
17-c	50	lin. ft. drain pipe, 8 in. vitrified	0.60	0.50	0.40	0.45
17-d	50	lin. ft. drain pipe, 6 in. vitrified	0.55	0.40	0.30	0.40
17-e	50	lin. ft. drain pipe, 4 in. vitrified	0.50	0.40	0.20	0.30
17-g	50	lin. ft. drain pipe, 6 in. cast iron	0.85	0.75	0.80	1.00
17-h	50	lin. ft. drain pipe, 4 in. cast iron	0.55	0.50	0.60	0.90
17-i	50	lin. ft. drain pipe, 10 in. cast iron	1.25	1.50	1.60	2.20
17-A-a	100	lin. ft. 3 in. cast iron pipe and fittings, "extra heavy"	0.75	0.50	0.60	0.75
17-A-b	100	lin. ft. 4 in. cast iron pipe and fittings, "extra heavy"	1.00	0.75	0.72	1.20
17-A-c	200	lin. ft. 6 in. cast iron pipe and fittings, "extra heavy"	1.10	1.00	1.10	1.60
17-A-d	200	lin. ft. 8 in. cast iron pipe and fittings, "extra heavy"	1.60	1.20	1.40	2.00
18	254,800	duct ft. tunnel ducts	0.10	0.11	0.11	0.12
19	1,650	ton riveted steel, painted and erected	55.50	54.00	58.00	65.00
20	4,050	ton steel beams and shapes	48.00	54.00	55.00	55.00
21	410	ton steel rods and bars built in concr.	38.00	50.00	40.00	47.00
25-b	35	tons miscellaneous iron castings	50.00	70.00	55.00	75.00
25-c	10	ton miscellaneous iron furnishings	60.00	70.00	60.00	75.00
26	300	pound special wire forms, in place	0.09	0.30	0.12	0.30
27-B	9,670	lin. ft. 1¾ in. seasoned oak or ash hand rail	0.22	0.30	0.40	0.30
28	9,080	sq. ft. steel gratings for ventilation	1.22	1.50	1.30	1.60
29	525	sq. ft. vault lights, in place	0.90	1.50	1.30	1.30
30-a	3,290	sq. yd. sidewalks restored	0.90	1.50	1.00	3.00
30-e	1,700	sq. yd. asphalt pavement	1.50	2.50	1.70	2.50
30-f	23,800	sq. yd. granite block	0.42	1.00	0.25	1.00
30-ff	12,100	sq. yd. Belgian block	0.42	1.00	0.25	0.40
30-i	100	lin. ft. new bluestone curb	1.00	1.00	1.00	1.50
30-k	100	lin. ft. new 8 in. granite curb	1.00	2.00	2.00	2.50
32-a	12,000	lin. ft. ¾ in. w.i. electric conduits	0.14	0.20	0.16	0.19
32-b	600	lin. ft. 1½ in. w.i. electric conduits	0.26	0.40	0.31	0.30
32-c	350	lin. ft. 2 in. w.i. electric conduits	0.33	0.50	0.38	0.45
32-d	3,500	lin. ft. 1 in. w.i. electric conduits	0.19	0.30	0.23	0.25
33	1,000	each c.i. outlet boxes, in stations	0.25	1.00	0.70	1.00
33-A	6	each c.i. pull boxes, in stations	1.50	2.00	0.70	1.25
34-a	260	lin. ft. 6 in. "extra heavy" c.i. pipe and fittings, in stations	1.00	2.00	0.90	1.60
34-b	200	lin. ft. 3 in. "extra heavy" c.i. pipe and fittings, in stations	0.75	1.00	0.40	0.75
37	1,850	lin. ft. sewer pipe, 12 in. vitrified	2.26	1.25	1.50	2.40
38	3,570	lin. ft. sewer pipe, 15 in. vitrified	2.56	1.50	2.00	2.75
39	1,150	lin. ft. sewer pipe, 18 in. vitrified	3.00	2.00	2.00	3.20
40	2,110	lin. ft. sewer pipe, 20 in. vitrified	3.30	2.25	2.50	3.50
40-A	775	lin. ft. sewer pipe, 22 in. vitrified	3.70	2.50	3.00	3.75
41	440	lin. ft. sewer pipe, 24 in. vitrified	4.05	3.00	3.80	4.15
42	66	ton c.i. sewer pipe (straight)	38.00	50.00	45.00	50.00
43	11	ton c.i. sewer pipe (special)	55.00	75.00	65.00	100.00
45	50	lin. ft. egg-shaped brick or concrete sewer, 3 ft. 6 in. x 2 ft. 4 in.	5.40	5.00	5.50	5.00
53	410	lin. ft. circular-brick or concrete sewer, 4 ft. diameter	5.70	10.00	6.50	6.00
54-A	610	lin. ft. circular-brick or concrete sewer, 4 ft. 6 in. diameter	7.50	14.00	6.50	7.50
55	2,625	lin. ft. circular-brick or concrete sewer, 4 ft. 9 in. diameter	8.50	15.00	7.25	8.25
56-A	1,010	lin. ft. circ. brick or concrete sewer, 5 ft. 3 in. diameter	9.30	18.00	8.00	9.00
61	970	lin. ft. circ. brick or concrete sewer, 6 ft. 3 in. diameter	11.00	20.00	9.50	11.00
74-B	2	each 14 in. special sluice gates with spigots	75.00	75.00	90.00	75.00
74-C	2	each 8 in. special sluice gates with spigots	60.00	50.00	35.00	50.00
74-F	2	each 20 in. special sluice gates with spigots	100.00	100.00	175.00	125.00
75-c	13,500	lin. ft. for support, etc., of electric (overhead trolley) R. R., 1 track	2.28	2.00	1.00	2.25
78	150	lin. ft. water pipe, 4 in.	0.50	0.30	0.75	0.35
79	1,650	lin. ft. water pipe, 6 in.	0.60	0.50	1.10	0.35
80	600	lin. ft. water pipe, 8 in.	0.75	0.60	1.50	0.50
83	450	lin. ft. water pipe, 16 in.	1.00	1.20	2.00	0.85
84	6,200	lin. ft. water pipe, 20 in.	1.00	1.50	3.00	1.20
88-A	100	each service connections for water pipes, all sizes	20.00	15.00	20.00	12.00
89	200	lin. ft. gas pipe, 3 in.	0.40	0.30	0.50	0.35
90	50	lin. ft. gas pipe, 4 in.	0.60	0.30	0.75	0.35
91	800	lin. ft. gas pipe, 6 in.	0.75	0.60	1.00	0.35
92	1,150	lin. ft. gas pipe, 8 in.	0.80	0.80	1.25	0.50
93	900	lin. ft. gas pipe, 10 in.	1.00	1.00	1.50	0.60
94	50	lin. ft. gas pipe, 12 in.	1.25	1.25	1.75	0.75
99-A-a	8,380	lin. ft. 6 in. w.i. by-pass. pipe, upon or below street	1.20	1.25	2.00	1.20
99-A-b	4,800	lin. ft. 8 in. w.i. by-pass. pipe, upon or below street	1.45	2.00	2.75	1.50
99-A-h	350	lin. ft. 4 in. w.i. by-pass. pipe, upon or below street	1.05	1.00	1.00	1.40
99-B-a	120	lin. ft. 12 in. w.i. by-pass. pipe, on trestle	5.00	3.00	4.00	3.50
99-B-f	120	lin. ft. 6 in. w.i. by-pass. pipe, on trestle	2.75	2.00	2.75	1.70
99-B-k	270	lin. ft. 18 in. w.i. by-pass. pipe, on trestle	6.00	5.00	6.00	5.50
99-B-l	200	lin. ft. catenary for over 16 in. by-passing pipe	5.50	2.00	3.00	2.25
99-B-j	180	lin. ft. catenary for 16 in. and under by-passing pipe	5.50	2.00	3.00	2.25
99-D	250	lin. ft. service connec. for gas pipes	10.00	10.00	20.00	6.25
100	75	ton new c.i. hub and spigot "straight pipe"	45.00	40.00	35.00	35.00
101	50	ton new c.i. hub and spigot "special pipe"	70.00	70.00	70.00	80.00
127	2,300	duct ft. electric ducts and conduits, in place	0.60	0.50	0.65	0.40
127-A-a	100	lin. ft. 2½ in. w.i. pipe, elec. conduits	0.80	1.00	0.65	0.35
127-A-b	100	lin. ft. 3 in. w.i. pipe, elec. conduits	0.90	1.00	0.65	0.40
127-A-c	100	lin. ft. 3½ in. w.i. pipe, elec. conduits	1.00	1.00	0.65	0.50
127-A-d	100	lin. ft. 4 in. w.i. pipe, elec. conduits	1.10	1.00	0.65	0.75
127-A-e	100	lin. ft. 4½ in. w.i. pipe, elec. conduits	1.20	1.00	0.65	1.00
127-A-f	100	lin. ft. 2 in. Edison conduit	0.60	1.00	0.65	0.35
127-A-g	100	lin. ft. 2½ in. Edison conduit	0.80	1.00	0.65	0.35
127-A-h	100	in. ft. 3 in. Edison conduit	1.00	1.00	0.65	0.40
127-C	20	each service connec. for elec. ducts	15.00	20.00	10.00	10.00
127-D	300	duct ft. wooden electric ducts and conduits	0.60	0.70	0.65	0.25

★**New York, N. Y.**—Following are unit prices of four lowest bids opened July 27 by Bd. Public Service for First Dist., for Sect. No. 3, Routes 4 and 36, Broadway subway, Manhattan: (a) Holbrook, Cabot & Rollins Cor., 52 Vanderbilt Avenue, New York, $3,740,913 (awarded contract); (b) Rodgers & Hagerty, Inc., New York, $3,755,118; (c) Smith, Hauser & McIsaacs, 18 East Forty-first Street, New York, $3,814,808; (d) Oscar Daniels Co., Woolworth Bldg., New York, $3,953,416.

Item			(a)	(b)	(c)	(d)
1	107,400	cu. yd. earth excav. above M.H.W.	$3.25	$5.25	$5.45	$3.80
2A	3,570	cu. yd. earth excav. for sewers, pipes, etc.	3.25	5.25	5.45	3.80
3		Rock excavation:				
(a)	195,400	cu. yd. sta. 210x60 to 219x75 and 223x00 to 243x80	5.25	5.25	5.45	7.00
(b)	26,300	cu. yd. sta. 219x75 to 223	5.30	12.00	9.50	10.00
3A	9,600	cu. yd. rock excav. for sewers, pipes, etc.	5.50	6.00	8.00	8.00
4		Underpinning Buildings:				
(a)	1,785	lin. ft. less than seven stories	100.00	15.00	50.00	60.00
(b)	915	lin. ft. from 7 to 12 stories, inclusive	175.00	15.00	60.00	90.00
(c)	100	lin. ft. over 12 stories	250.00	150.00	100.00	100.00
4E	1,025	un. ft. maintaining, protect, etc., bldgs	50.00	15.00	45.00	25.00
4II		do Knickerbocker Hotel, lump sum.				
4JJ		do Times Bldg., lump sum.				
4KK		do Longacre Bldg., lump sum.				
4LL		do Comfort Station, lump sum.				
5A	4,000	cu. yd. tunnel excav. for sewers	15.00	12.00	8.00	8.00
6	44,300	cu. yd. concrete masonry	9.00	10.00	8.25	9.50
7	5,600	cu. yd. protective concrete	8.00	10.00	8.25	9.50
8	3,200	cu. yd. rubble stone masonry	6.50	7.00	7.50	5.00
8A	50	cu. yd. dry rubble stone masonry	4.00	5.00	7.50	4.00
9	110	cu. yd. brick masonry	15.00	15.00	25.00	15.00
9G		Placing column C-27, lump sum.				
10	50	cu. yd. hollow terra cotta masonry	15.00	15.00	25.00	15.00
11	4,000	bbl. Grout of Portland cement	4.00	3.00	3.50	2.50
11A	500	sq. yd. resurfacing concrete	1.50	2.00	2.00	0.40
12	100	lin. ft. timber piles	2.00	0.25	1.00	0.50
13	2	M. ft. B.M. timber foundations	80.00	40.00	100.00	40.00
14	50	cu. yd. broken stone or gravel	2.75	3.00	3.00	1.60
15(a)	13,000	sq. yd. waterproofing, 1-ply	0.32	0.40	0.50	0.30
(b)	100	sq. yd. waterproofing, 2-ply	0.50	0.65	0.70	0.60
(c)	27,300	sq. yd. waterproofing, 3-ply	0.75	0.90	1.00	1.00
(d)	100	sq. yd. waterproofing, 4-ply	1.00	1.25	1.20	1.30
(e)	100	sq. yd. waterproofing, 5-ply	1.50	1.60	1.50	1.60
(f)	600	sq. yd. waterproofing, 6-ply	1.75	2.00	1.75	1.80
(i)	100	sq. yd. waterproofing, dry-ply	0.20	0.40	0.50	0.30
16	1,800	cu. yd. brick in asphalt mastic	25.00	25.00	25.00	27.00
17(a)	100	lin. ft. 12 in. vitrified pipe	0.70	0.85	1.50	1.00
(b)	100	lin. ft. 10 in. vitrified pipe	0.65	0.75	1.50	0.80
(c)	3,800	lin. ft. 8 in. vitrified pipe	0.55	0.60	1.25	0.60
(d)	100	lin. ft. 6 in. vitrified pipe	0.50	0.50	1.00	0.60
(e)	100	lin. ft. 4 in. vitrified pipe	0.45	0.45	1.00	0.30
(g)	100	lin. ft. 6 in. c.i. pipe	0.70	1.25	1.25	1.25
(h)	4,000	lin. ft. 4 in. c.i. pipe	0.75	0.60	1.00	0.50
(i)	100	lin. ft. 10 in. c.i. pipe	1.25	2.50	1.60	1.50
17A(a)	50	lin. ft. 3 in. c.i. pipe, ex. heavy, spec.	1.00	1.25	1.50	1.00
(b)	100	lin. ft. 4 in. c.i. pipe, ex. heavy, spec.	1.25	1.50	1.60	1.25
(c)	150	lin. ft. 6 in. c.i. pipe, ex. heavy, spec.	1.50	1.75	1.75	2.00
(d)	50	lin. ft. 8 in. c.i. pipe, ex. heavy, spec.	2.00	3.00	2.00	2.25
18	229,200	duct. ft. tunnel ducts	0.10	0.12	0.15	0.08
19		Riveted steel				
(a)	2,630	ton sta. 210x60 to 219x75 and 223x00 to 243x80	80.00	60.00	65.00	60.00
(b)	470	ton sta. 219x75 to 223x00	90.00	70.00	100.00	60.00
19(c)	75	ton cutting removal and disposal old steel	50.00	100.00	100.00	12.00
20		Steel beams and shapes.				
(a)	2,740	ton sta. 210x60 to 219x75 and 223x00 to 243x80	75.00	55.00	57.50	55.00
(b)	470	ton sta. 219x75 to 223x00	85.00	65.00	100.00	55.00
20A	1,000	hole drilling holes in steel	1.00	1.00	1.50	.50
21	120	ton steel rods and bars	90.00	60.00	85.00	60.00
25	30	ton miscellaneous iron castings	75.00	70.00	100.00	50.00
25(c)	2	ton miscellaneous iron furnishings	75.00	100.00	100.00	50.00
26	1,000	lb. special wire forms	.10	.10	.15	.20
27B	5,200	lin. ft. 1¾ in. oak or ash handrail	.25	.30	.50	.25
28	10,000	sq. ft. steel gratings	1.50	2.00	1.50	1.40
29	4,300	sq. ft. vault lights	2.00	1.75	1.50	1.10
30(a)	6,300	sq. yd. street surface restored within curbs	2.00	2.50	2.50	2.00
(e)	24,000	sq. yd. street surface asphalt	2.50	2.50	3.50	3.00
(f)	850	sq. yd. street surface granite block	2.00	2.00	3.50	2.00
(i)	100	lin ft. street surface new blue st. c'b.	1.00	1.00	1.50	2.00
(k)	100	lin. ft. street surface 8 in. granite c'b.	1.50	1.50	2.50	2.00
32(a)	7,150	lin. ft. w. i. elec. conduit, ¾ in.	.20	.20	.20	.20
(b)	800	lin. ft. w. i. elec. conduit, 1½ in.	.25	.30	.45	.35
(c)	450	lin. ft. w. i. elec. conduit, 2 in.	.30	.35	.55	.40
(d)	6,800	lin. ft. w. i. elec. conduit, 1 in.	.25	.25	.35	.30
33	980	each c. i. outlet boxes	1.00	1.50	1.00	1.00
33A	12	each c. i. pull boxes	1.50	2.00	2.00	2.00
34(a)	450	lin. ft. extra heavy c. i. pipe and fittings, 3 in.	2.00	1.75	2.00	1.75
(b)	150	lin. ft. extra heavy c. i. pipe and fittings, 3 in.	1.50	1.25	1.50	1.00
37	375	lin. ft. 12 in. vitr. pipe sewer	3.00	2.75	2.00	3.00
38	1,720	lin. ft. 15 in. vitr. pipe sewer	3.00	3.00	3.00	3.50
39	100	lin. ft. 18 in. vitr. pipe sewer	3.00	3.50	3.50	4.00
41	100	lin. ft. 24 in. vitr. pipe sewer	4.70	5.50	5.00	4.50
42	12	ton c. i. sewer pipe, straight	40.00	50.00	60.00	70.00
43	4	ton c. i. sewer pipe, special	80.00	80.00	100.00	80.00
45	1,800	lin. ft. egg-shaped sewer, Br. or Con., 3 ft. 6 in. x 2 ft. 4 in.	4.50	7.00	8.00	6.00
47	1,440	lin. ft. egg-shaped sewer, Br. or Con., 4 ft. x 2 ft. 8 in.	6.00	8.00	10.00	7.00
50A	25	lin. ft. egg-shaped sewer, Br. or Con., 5 ft. x 3 ft. 4 in.	7.50	9.00	20.00	8.00
52C	60	lin. ft. circular sewer, Br. or Con. or R. Con, 3 in.	4.00	8.00	10.00	7.00
53	220	lin. ft. circular sewer, Br. or Con. or R. Con, 4 ft.	5.00	9.00	12.00	8.00
55	1,100	lin. ft. circular sewer, Br. or Con. or R. Con., 4 ft. 9 in.	7.00	10.00	12.00	9.00
57	70	lin. ft. circular sewer, Br. Con. or R. Con., 5 ft. 6 in.	10.00	11.00	20.00	10.00
75(a)	7,120	lin. ft. st. surface R.R., undergd'd trol.	20.00	12.00	20.00	17.00
76M	L'mp sum	support, etc., M. B. R. T. R. R.				
79	830	lin. ft. 6 in. water pipe	.75	.50	1.50	1.00
81	100	lin. ft. 10 in. water pipe	2.00	.75	2.00	1.25
82	650	lin. ft. 12 in. water pipe	2.25	1.00	2.50	3.00

(Continuation of Section 3, Routes 4 and 36, Broadway Subway, Manhattan.)

83	182	lin. ft. 16 in. water pipe	3.00	1.50	5.00	3.50
84	1,000	lin. ft. 20 in. water pipe	4.35	2.00	6.00	4.00
85	200	lin. ft. 48 in. water pipe	16.00	5.00	15.00	5.00
85A	50	cast service connections, water	25.00	25.00	20.00	20.00
86	100	lin. ft. 4 in. gas pipe	.50	.25	.50	.80
87	870	lin. ft. 4 in. gas pipe	.65	.35	1.00	1.00
91	2,400	lin. ft. 6 in. gas pipe	1.15	.60	1.50	1.50
92	800	lin. ft. 8 in. gas pipe	1.25	.75	1.60	1.75
93	350	lin. ft. 10 in. gas pipe	2.00	1.00	1.80	2.00
94	300	lin. ft. 12 in. gas pipe	2.75	1.00	2.50	2.50
95	150	lin. ft. 18 in. gas pipe	3.50	1.50	5.00	3.00
96	150	lin. ft. 20 in. gas pipe	4.35	2.00	5.00	4.00
98	100	lin. ft. 30 in. gas pipe	9.00	3.50	7.00	6.00
99A(b)	6,650	lin. ft. 8 in. w.-i. by-pass pipe	3.50	3.50	6.00	3.00
(e)	100	lin. ft. 18 in. w.-i. by-pass pipe	9.00	5.00	10.00	8.00
(f)	100	lin. ft. 20 in. w.-i. by-pass pipe	10.00	6.00	12.00	10.00
(g)	150	lin. ft. 24 in. w.-i. by-pass pipe	12.00	7.00	15.00	13.00
99B(b)	200	lin. ft. 16 in. w.-i. by-pass pipe above street surface	9.00	5.00	10.00	9.00
(c)	300	lin. ft. 20 in. w.-i. by-pass pipe above street surface	10.00	6.00	15.00	11.00
(g)	250	lin. ft. 8 in. w.-i. by-pass pipe above street surface	4.00	3.00	7.00	3.00
(h)	250	lin. ft. trestle for w.-i. by-pass pipe..	2.00	5.00	8.00	4.00
(i)	500	lin. ft. cable suspension, 16 in. pipes and over	7.50	5.00	8.00	2.00
(j)	200	lin. ft. cable suspension for 16 in. pipes and less	7.50	5.00	8.00	2.00
99C(a)	100	lin. ft. 4 in. w.-i. gas pipe	2.00	0.75	1.00	1.00
(b)	100	lin. ft. 6 in. w.-i. gas pipe	3.00	1.25	1.50	1.50
(c)	100	lin. ft. 8 in. w.-i. gas pipe	4.00	2.50	1.60	2.00
(d)	370	lin. ft. 10 in. w.-i. gas pipe	5.00	3.00	1.80	2.50
(e)	100	lin. ft. 12 in. w.-i. gas pipe	6.00	4.00	2.50	3.00
99D	50	service connections, gas, each	15.00	25.00	25.00	15.00
100	105	new c.-i. hub and spigot str. pipe, ton	30.00	30.00	50.00	60.00
100A(a)	100	lin. ft. new standard weight w.-i. gas pipe, 4 in.	0.75	0.75	0.50	0.80
(b)	100	lin. ft. new standard weight w.-i. gas pipe, 6 in.	1.00	1.25	0.70	1.00
(c)	100	lin. ft. new standard weight w.-i. gas pipe, 8 in.	1.25	2.50	1.00	1.25
(d)	100	lin. ft. new standard weight w.-i. gas pipe, 10 in.	1.50	2.00	1.50	2.25
(e)	100	lin. ft. new standard weight w.-i. gas pipe, 12 in.	2.00	4.00	2.00	2.75
101	45	new c.-i. hub and spigot spc. pipe, ton	60.00	65.00	100.00	75.00
101A	100	new m.-i. fittings for gas pipe, lb.	0.10	0.20	0.25	0.50
102	200	lin. ft. 8 in. high-pressure water pipe.	1.95	1.00	2.00	2.50
103	660	lin. ft. 12 in. high-pressure water pipe.	3.50	1.50	3.00	3.00
104	100	lin. ft. 16 in. high-pressure water pipe.	6.35	2.00	4.00	3.50
106	740	lin. ft. 24 in. high-pressure water pipe.	10.00	3.00	5.00	4.50
107	25	new c.-i. hub and spigot str. high-pressure water pipe, ton	30.00	40.00	50.00	50.00
108	20	new c.-i. hub and spigot spc. high-pressure water pipe, ton	75.00	60.00	100.00	70.00
121	100	lin. ft. 6 in. air pipe, in place	0.30	1.00	2.00	1.50
123	50	lin. ft. 6 in. air pipe, new	1.00	1.50	2.00	1.00
125	100	lin. ft. 8 in. mail tube, in place	5.00	1.50	3.00	4.00
126(a)	20	lin. ft. 8 in. mail tube, new, straight	10.00	2.50	8.00	6.00
(b)	30	lin. ft. 8 in. mail tube, new, special	25.00	5.00	10.00	12.00
127	23,000	duct ft. electric ducts and conduits	0.75	0.75	1.00	0.10
127A(a)	6,000	lin. ft. w.-i. pipe electric ducts and conduits, 2½ in.	0.60	0.75	0.50	0.10
(b)	46,000	lin. ft. w.-i. pipe electric ducts and conduits, 3 in.	0.70	0.75	0.60	0.10
(c)	400	lin. ft. w.-i. pipe electric ducts and conduits, 3½ in.	0.75	0.75	0.90	0.10
(d)	100	lin. ft. w.-i. pipe electric ducts and conduits, 4 in.	0.80	0.75	1.25	0.10
(e)	100	lin. ft. w.-i. pipe electric ducts and conduits, 4½ in.	0.90	0.75	1.75	0.10
(f)	100	lin. ft. w.-i. pipe electric ducts and conduits, 2 in. Edison	1.00	0.75	0.50	0.10
(g)	200	lin. ft. w.-i. pipe electric ducts and conduits, 2½ in. Edison	1.25	0.75	0.50	0.10
(h)	300	lin. ft. w.-i. pipe electric ducts and conduits, 3 in. Edison	1.50	0.75	0.60	0.10
(k)	100	lin. ft. w.-i. pipe electric ducts and conduits, 1¼ in. Edison	0.90	0.75	0.50	0.10
(n)	200	lin. ft. w.-i. pipe electric ducts and conduits, 2 in.	0.50	0.75	0.50	0.10
127C	90	lin. ft. service connections, electric	25.00	25.00	20.00	10.00

RAILROADS

PROPOSED WORK

Erie, Pa.—The City, the Pennsylvania R. R. Co. and New York Central R. R. Co. contemplate elimination of railroad grade crossings, including track elevation, subway (including opening of Division Street and closing a number of streets. City's share of expense about $550,000. B. E. Briggs, City Engr.

Olympia, Wash.—Public Service Commission reports 12 grade crossings to be eliminated lying east of Raymond on the line of the Chicago, Milwaukee & St. Paul Ry., known as the Puget Sound & Willapa Harbor Ry.

Port Townsend, Wash.—Reported C. J. Erickson, Downs Block, Seattle, will build standard gauge railroad from his mills at MacDonald Creek, near Sequin, 5 miles back into his timber holdings.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Mountain Home, Ark.**—Contract reported awarded to Blodgett Constr. Co., Kansas City, Mo., for building 17 miles of railroad between Mountain Home and Rothville, for the Ozark Ry. Co.

★**Riverside, Ore.**—Contract reported awarded to Twomey Bros., Portland, for construction of 30-mile extension to lines of the Oregon-Washington Railroad & Navigation Co., from Riverside westerly to Crane Creek Gap; cost estimated at $1,500,000.

Youngstown, Ohio.—City officials and railroad engineers have agreed on plans for elimination of Hubbard Street grade crossing in that city. Plans call for a new bridge to cost $400,000 and remodeling of Federal Street bridge. It will be necessary to build Lake Shore freight station and rearrange Lake Shore tracks.

PUBLIC BUILDINGS AND SCHOOLS

PROPOSED WORK

New Bedford, Mass.—Plans prepared by James S. McIntyre, Clifford Building, for three-story brick central fire station, to be erected at Pleasant and North Streets.

Brooklyn, N. Y.—Plans being prepared by Lewis F. Pilcher, State Archt., Albany, for two new buildings for the Long Island State Hospital for Insane on Clarkson Street. Dr. Elbert M. Somers, Supt. of Hospital.

Syracuse, N. Y.—Common Council appropriated $394,500 for schools as follows: For construction, Lancaster Avenue School, $100,000; Jefferson School, $75,000; Franklin School, $65,000; Madison School, $45,000; Prescott School, $65,000; Webster School, $12,500.

Langhorne, Pa.—Work is about to begin on erecting buildings for Charles E. Ellis College for Fatherless Girls; about $3,000,000 bequeathed to college.

Philadelphia, Pa.—Central Free Library of Philadelphia is to be erected at Nineteenth and Vine Streets, at cost of about $3,000,000. Henry R. Edmunds, Pres. Bd. Trustees Free Library.

Sharon, Pa.—Plans prepared by Charles F. Owsley, Youngstown, Ohio, for Kimberley Nurses' Home for C. H. Buhl Hospital. To be two-story brick; cost about $40,000.

West Chester, Pa.—Plans being prepared by Furness, Evans & Co., Provident Building, Philadelphia, for 2-story building costing $70,000 for Chester County Hospital.

Wilkes-Barre, Pa.—School Directors decided to purchase site on East North Street for new school.

Newark, Del.—Plans being prepared by Frank Miles Day, Philadelphia, Pa., for buildings for Delaware College.

Wheeling, W. Va.—Plans reported selected by Bd. Educ. for Madison School; estimated cost nineteen-room brick structure 196 x 140 ft., $92,635 and seventeen-room $84,437.

Durham, N. C.—Milburn, Heister & Co., 710 Fourteenth Street N. W., Washington, D. C., will complete plans about Sept. 1 for county court house.

Atlanta, Ga.—City and County Bd. Education and the city and county contemplate erecting university high school.

Miami, Fla.—Plans being prepared for erection of city hospital, to cost about $100,000.

Orlando, Fla.—Plans prepared by Murry S. King for brick 114 by 97 ft. building to be erected at E. Central Avenue and Main Street, for Bd. Trade, cost $35,000.

Columbus, Ind.—Bonds amounting to $100,000 for erecting county public hospital for Bartholomew County sold by County Auditor.

Ann Arbor, Mich.—Plans accepted for the Michigan Union Building to be erected at Univ. of Michigan. Probable cost, $1,000,000.

Lake Linden, Mich.—Bonds for $100,000 for high school, will be sold by Dr. George W. Orr, Secy. Bd. School Dist. No. 1 of Schoolcraft and Torch Lake Townships, advertised in Engineering Record.

Milwaukee, Wis.—Brick school is to be erected at Oklahoma Avenue and Fifth Avenue, cost about $75,000.

Alta, Iowa.—J. Jay Parker, Secy. Bd. Educ., writes proposed school will be 2 stories, of brick and stone, 70 x 130 ft., and cost $45,000. Architect not yet selected.

Hays, Kan.—Plans of C. H. Chandler, State Architect, Kansas City, approved for erecting 3-story concrete building at Ft. Hays, Kansas Normal School, cost about $100,000.

Kansas City, Mo.—A 2-Story concrete and brick building is to be erected at Independence and Woodland Avenues for Mercy Hospital; cost about $200,000. Porter Graves said to be interested.

Beaumont, Tex.—Plans being completed by Sanquinett, Staats & Gottlieb, Houston, for two brick additions, 65 x 90 ft., each 2 stories, to South Park School; cost $43,000. L. P. Pietzsek, Supt. South School Park Bd.

Dallas, Tex.—Plans being prepared by William B. Ittner, St. Louis, Mo., for erecting Winnetka School; also for the Oak Cliff School.

Seattle, Wash.—Reported plans about completed by Port Comrs. (J. R. West, Ch. Engr.), for a 4-story reinforced concrete L and U-shaped addition to Hanford Street terminal buildings on Railroad Avenue and Hanford Street; cost, $140,000.

Winters, Cal.—The Union High School recently destroyed is to be rebuilt, cost about $50,000.

Toronto, Ont.—City Council approved plans for a new dormitory at the Women's Industrial School; estimated to cost $40,000.

BIDS DESIRED.

Wrentham, Mass.—Until Aug. 10 by State Bd. Insanity, State House Boston (Michael J. O'Meara, Chmn.), for erecting a brick dormitory, farmer's cottage and frame building for employees, at Wrentham, also for heating and plumbing same. Kendall, Taylor & Co., 93 Federal St., Boston, Archts.

Gouverneur, N. Y.—Until Sept. 10 by James A. Wetmore, Acting Superv. Archt., Washington, D. C., for construction, complete (including mechanical equipment, interior lighting fixtures and approaches), U. S. Post Office, Gouverneur.

Syracuse, N. Y.—Later official reports state bids desired until 1.30 p. m. Aug. 9 by Bd. Contract and Supply (R. D. Roney, Secy.), for furnishing material and erecting the Delaware School; also separate bids for ventilating and heating; plumbing and electric work. Probable cost, $225,000.

East Orange, N. J.—Until Aug. 9 by Bd. Educ. (Warren A. Clapp, Secy.), for alterations to Eastern School, also plumbing. Guilbert & Betelle, Archts., 665 Broad Street, Newark.

Irvington, N. J.—Until Aug. 10 by Essex County Park Comn., 810 Broad Street, Newark, for erecting a field house in Irvington Park, Irvington, including general construction, heating, plumbing, etc. F. S. & S. E. Sutton, Archts. 817 Union Building, Newark.

Lambertville, N. J.—Until Aug. 13 by Bd. Educ. (Thomas Thorne, Secy.), for erecting a nine-room addition and alterations to Third Ward School; also separate bids for plumbing; ventilating and heating and electric wiring. Klemann & Fowler, Archts., First National Bank Building, Trenton.

Fort Mifflin, Pa.—Until Aug. 28 at the Bureau Yards and Docks, Navy Dept., Washington, D. C. (William M. Smith, Ch.), for a shell house, a fixed ammunition storehouse, a magazine and an extension to reforming plant at the U. S. Naval Magazine, Fort Mifflin. Specification 2184. Appropriation available, $68,000.

Upper Darby, Pa.—Until Aug. 16 (readvertisement) by Bd. School Directors (William H. Jones, Pres.), for erecting a school at West Chester Pike and Kelly's Lane, Highland Park, Upper Darby. Shore & Dodge, Archts., 608 Chestnut Street, Philadelphia.

Baltimore, Md.—Until Aug. 31, by James A. Wetmore, Acting Superv. Archt., Washington, D. C., for the mechanical equipment (except elevators, lift and dumb waiter) of U. S. Immigration Station, Baltimore, advertised in Engineering Record.

Catonsville, Md.—Until Aug. 11 by Bd. Awards, Baltimore (John Hubert, Acting Pres.), for erecting a building at the Parental School, Catonsville.

Indian Head, Md.—Until Aug. 28 at the Bureau of Yards and Docks, Navy Dept., Washington, D. C. (William M. Smith, Acting Ch.), for a corrugated steel cotton storehouse at the Naval Proving Ground, Indian Head, as per Spec. 2180.

Parkersburg, W. Va.—Until Aug. 11, according to press reports by School Bd., for erecting a fireproof high school, three-stories, 240 x 180 ft. Frank L. Packard, Archt., New Hayden Building, Columbus, Ohio.

Shepherdstown, W. Va.—Until Aug. 23 by State Bd. Control, Charleston (J. S. Lakin, Pres.), for erecting a 2-story brick dormitory at Shepherd College. H. Rus Warne, Archt., Charleston.

Charlotte, N. C.—Until Sept. 7 (readvertisement) by James A. Wetmore, Acting Superv. Archt., Washington, D. C., for clearing site and constructing, complete (including mechanical equipment and approaches) U. S. Post Office, Charlotte.

Port Royal, S. C.—Until Aug. 28 at the Bureau Yards and Docks, Navy Dept., Washington, D. C. (William M. Smith, Acting Ch.), for buildings and incinerator at the Naval Disciplinary Barracks, Paris Island, Port Royal, as per Spec. 2181.

Mississippi City, Miss.—Until Aug. 9, by S. R. Coon, Secy. School Trus., at office of Mooney & Brown, Jordan Building, Gulfport, for erecting an eight-room and auditorium school at Mississippi City.

Cincinnati, Ohio.—See "Miscellaneous."

Columbus, Ohio.—Until Aug. 27 by Bd. Trus., Ohio State Univ., Columbus, for furnishing material and constructing the following:

Roadway, Neil Avenue, approximately 4600 sq. yd.

Tunnel, brick and concrete, 6 ft. 6 in. x 6 ft. 6 in. and 430 ft. long.

Homeopathic Hospital building; also Home Economics building. Joseph N. Bradford, University Archt.

Melrose, Ohio.—Reported desired until Aug. 16 by Bd. Educ., for erecting a 2-story and basement, 70 x 66 ft. school. F. L. Packard, Archt., New Hayden Building, Columbus.

Ostrander, Ohio.—Until Aug. 20 by Bd. Educ. (Odell Liggett, Clk.) for furnishing material and erecting a high school. Charles L. Inscho, Archt., Brunson Bldg., Columbus.

Woodsfield, Ohio.—Until Aug. 26, by Bd. Educ., Woodsfield City School Dist. (F. W. Pollock, Clk.), for furnishing material and erecting a fireproof high school; also ventilating, heating, gas fitting and sewerage. Howard & Merriam, Archts., 8 E. Broad St., Columbus.

Chicago, Ill.—Until Aug. 11 by 2d Regt. Armory Comn. (Col. J. J. Garrity, Pres.), at the office of James B. Dibelka, State Archt., Room 1002, 130 N. Fifth Avenue, for erecting an addition to the 2d Infantry Regiment Armory now under construction. Bids will be received on the general work, heating, plumbing, etc.

Illinois.—Until Aug. 16 by Bd. Administration, Capitol Building, Springfield, for improvements at following institutions:

Tank and pumping system at Illinois Industrial Home for Blind, 1900 Marshall Boulevard, Chicago.

Chimney clamp and reinforcement and brick work on boilers at Illinois School for Blind, Jacksonvillle.

One ton ice machine at Peoria State Hospital South Bartonville, also repaair work, floors, etc., at said Hospital.

Septic tank (without filter beds) at Anna State Hospital, Anna.

Upper Alton, Ill.—Until Aug. 23 by Bd. Administration, Springfield (Frank D. Whipp, Fiscal Supervisor), for erecting a power house building at Alton State Hospital near Upper Alton. James B. Dibelka, State Archt., 130 N. Fifth Street, Chicago.

Luana, Iowa.—Until Aug. 28 by Henry Palar, Pres. Consolidated Independent School Dist. for erecting a consolidated school, also for heating, plumbing, etc., in same. Alban & Lockhart, Archts., 347 Endicott Building, St. Paul, Minn.

Breckenridge, Minn.—Reported desired until Aug. 16 by City Clerk, for erecting a 2-story and basement, 50 x 100 ft. jail and fire station. Probable cost, $25,000. C. E. Bell, Security Bank Building, Minneapolis.

Granite Falls, Minn.—Reported desired until Aug. 18 by State Bd. Control, St. Paul, for erecting a 2-story and basement, tuberculosis sanatorium at Granite Falls. Probable cost, $40,000. Sund & Dunham, Archts., Essex Building, Minneapolis.

St. Paul, Minn.—Until Aug. 12 at office of G. A. Sandberg, Purchasing Officer, University of Minnesota, Minneapolis, for erecting two animal buildings at University Farm, St. Anthony.

Verndale, Minn.—Until Aug. 13 by W. N. Morell, Clk. School Bd., for furnishing material and erecting a school, including ventilating, heating, etc. F. C. W. Kuehn, Archt., Huron, S. D.

Schuyler, Neb.—Later official reports state bids desired Aug. 30 (change of date) by Bd. Educ. (Otto Zuelow, Secy.), for erecting a high school; also separate bids for plumbing and heating same. Grave & Helleberg, Archts., Columbus, Neb.

Sykeston, N. D.—Until Aug. 24 by H. O. McCann, Clk. Hebron School Dist. No. 1, R. F. D., Sykeston, for erecting a 2-story and basement school on the southeast corner of Section 16; also separate bids for warm air heating and ventilating system. Gilbert R. Horton, Archt., Citizen's National Bank Building, Jamestown.

Fulton, Mo.—Until Sept. 7, by Jas. A. Wetmore, Acting Superv. Archt., Washington, D. C., for construction, complete (including mechanical equipment, lighting fixtures and approaches), for the U. S. Post Office at Fulton.

Beaumont, Tex.—Reported desired until Aug. 14 by School Bd., South Park Independent School Dist., for erecting additional buildings at South Park School, to cost $40,000. Manguinet, Setts & Gottlieb, Archts., Houston.

Gainesville, Tex.—Until Aug. 15 by Patrick Henry, Chmn. Bd. Trus., Girls Training School, for erecting 5 brick buildings each 2-stories, to cost a total of about $100,000. Architect, Ernest E. McAnelly of Dallas.

San Antonio, Tex.—Until Aug 10 by James R. David, Co. Judge, for furnishing material and erecting a fireproof County and City Hospital and Nurses' Home. Reutee & Harrington, Archts., Frost Building.

Edmond, Okla.—Reported desired until Aug. 12 by State Bd. Pub. Affairs, Oklahoma City (J. M. Aydelotte, Chmn.), for erecting a Central Normal School at Edmond. Layton & Smith, Archts., Oklahoma City.

Ringling, Okla.—Later official reports state until Aug. 15 by Bd. Educ. (G. L. Tyson, Clk.), for erecting a 2-story 8-room brick school.

Huntington Beach, Cal.—Reported desired until Aug. 14 by Bd. Trus. (Charles R. Nutt, Clk., 559 Walnut St.) for erecting a manual training school building on the grounds of the high school. John C. Smith, Archt., 325 H. W. Hellman Bldg., Los Angeles.

Los Angeles, Cal.—Until Aug. 12 by Bd. Trus., Garvey School Dist. (L. A. Moffett, Clk.), for furnishing material and erecting a grammar school; also separate bids for plumbing; ventilating and heating; electric wiring, etc. Oliver P. Dennis and Henry Harwood Hewitt, Archts., Los Angeles.

Until Aug. 12 by William A. Sheldon, Secy. Bd. Educ. for erecting Amelia Street School.

Fort Rosecrans (P. O. San Diego), Cal.—Until Aug. 26 by Constructing Quartermaster, for constructing a concrete storehouse at this post.

Redondo, Cal.—Reported desired until Aug. 16 by Trus. Grammar School Dist. (E. C. Thomas, Clk.) for erecting a 1-story brick school. L. B. Pemberton, Archt., 900 Auditorium Bldg., Los Angeles.

Toronto, Ont.—Until Aug. 10 for erecting a public library building on Queen Street E., Kew Beach Park, to be known as the Beaches Branch; also one on Wright and Roncesvalles Avenue, to be known as High Park Branch. Eden, Smith & Sons, Archts., 190 Yonge Street. For further information address the Chief Librarian, Reference Library, College and St. George Street.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Albany, N. Y.—Following are lowest bids opened July 27 by Lewis F. Pilcher, State Archt., Albany, for remodeling and placing an addition to State Hall for use of Court of Appeals: General construction, Feeney & Sheehan Co., Albany, $162,000; heating, John R. Feehan, Schenectady, $13,911; plumbing, Edward Joy, Syracuse, $4,500; electric elevators, Otis Elevator Co. New York, $6,500.

Buffalo, N. Y.—Lowest bid opened July 24 by Robert North, Archt., 1314 Prudential Building, Buffalo, for erecting a concrete and brick school at Orchard Park for Union Free School Dist. No. 6, East Hamburg, submitted by Metz Bros. Co., Builders Exchange, Buffalo, at $42,800.

★**Ithaca, N. Y.**—Contract for erecting dormitory at Cornell Univ. awarded Matthews Constr. Co., Princeton, N. J. at $170,000; structural steel contract awarded American Bridge Co.

Perth Amboy, N. J.—Following bids opened by Bd. Educ. July 19 for constructing high school; Fred Christensen Constr. Co., Perth Amboy, $86,453; Hans Greisen & Son, Perth Amboy, $68,850; A. K. Jensen, Perth Amboy, $79,585; J. C. Fowler, Perth Amboy, $70,104.

Muncy, Pa.—Following are 3 lowest bids opened July 23 by Dept. State Bd. Charities, Harrisburg, for erecting administration building and 3 cottages at Muncy for Industrial Home for Women; Metzger & Fisher, Philadelphia, $153,826; Conners Bros. Co., New York City, $154,198, and F. Roe Searing, Philadelphia, at $154,736.

Weston, W. Va.—Following are 4 lowest bids opened July 27 by State Bd. of Control, Charleston (J. S. Lakin, Pres.), for erecting congregate dining hall, kitchen, etc., at Weston State Hospital, from plans of H. Rus Warne, Charleston: Dawson Constr. Co., Pittsburgh, Pa., $66,870; Rose & Beaman, Goldsboro, N. C., $71,500; J. F. Barbour & Sons, Roanoke, Va., $74,000; Acme Constr. Co., Charleston, $79,495.

New Orleans, La.—Following are bids opened July 21 by Bd. Comrs. Port New Orleans (Ernest M. Loeb, Pres.) for constructing reinforced concrete buildings for cotton warehouses and terminal, from plans of Ford, Bacon & Davis, 921 Canal Street.: James Stewart & Co., St. Louis, Mo., $1,113,700; Jefferson Const. Co., New Orleans, $1,147,474; Gilsonite Const. Co., St. Louis, Mo., $1,125,000; J. A. Zimmerman & Sons, Inc., New York, $1,109,000; Selden-Breck Const. So., St. Louis, Mo., $1,136,000; Durolithic Company, Buffalo, N. Y., $1,234,000.

★**New Bloomington, Marion County, Ohio.**—Contract awarded July 27 by Bd. Educ. at County Superintendent's office, Marion, for erecting fireproof high and grade school to W. C. Handshy & Son, Zanesville. Howard & Merriam, Archts., 8 E. Broad Street, Columbus.

★**Kenosha, Wis.**—Contract for erecting Lincoln School on Collins Street awarded to Gottlieb Schaffer, Kenosha, at $100,000.

★**Milaca, Minn.**—Contract for erecting high school awarded to Stromberg & Samuelson, Milaca, at about $40,000.

★**Minneapolis, Minn.**—Contract for erecting addition to South High School awarded Spaldy, Albee & Smith, at $173,545.

★**Great Falls, Mont.**—Contracts awarded as follows, July 20, for erecting 2-story and basement reinforced concrete, 75 x 150 ft. building for Tribune Properties: General contract to Ness-Theisen Constr. Co., Great Falls, $69,975; plumbing and heating to Collins Plumbing & Heating Co., Great Falls, $11,400; electrical work, Page, McKenny & Co., Seattle, $2,550.

★**Dallas, Tex.**—Contract for erecting 5-story brick and stone addition to St. Paul's Sanitarium awarded to H. J. Curtis, 1514 Main Street. Cost complete about $200,000. J. E. Overbeck, Archt., Dallas.

★**Dallas, Tex.**—Contract for erecting Lamar School at Gould and Corinth Streets awarded to Buchanan & Gilder, Fort Worth, at $41,211.

PRIVATE BUILDINGS

PROPOSED WORK

Waltham, Mass.—St. Charles R. C. Parish to build $60,000 brick and stone church. Rev. P. J. Walsh, Pastor.

Albany, N. Y.—Plans being prepared by Marcus T. Reynolds, 100 State Street, for a 6-story office building to be erected at 124 State Street for Municipal Gas Co.; cost, $200,000.

Brooklyn, N. Y.—Plans being prepared by N. Serracino, 1170 B'way, New York, for hotel and restaurant which Felis Miserocchi, owner of Hotel Roversi of Manhattan and Sea Gate, will erect on the Ocean Parkway and Neptune Avenue, Brighton Beach.

Plans filed for 6-story brick store and tenement to be erected on Union and Meserole Streets by Paul Herring, 208 Wilson Street, at a cost of $55,000. Sass & Springsteen, Archts., 32 Union Square, New York, two 3 and 6-story warehouses and factories at Eighteenth Street and Third Avenue for R. H. Comey Co.; cost, $100,000. William Higginson, 21 Park Row, New York.

New York, N. Y.—Plans filed for following buildings: 12-story fireproof apartment house at Park Avenue and East Sixty-second Street for Akron Bldg. Co.: cost, $360,000. Emery Roth, Archt., 119 W. Fortieth Street; two 5-story brick tenements at Boston Road and Charlotte Street for Avenue St. John and Fox Street Corporation; cost, $125,000. Andrew J. Thomas, Archt., 2526 Webster Avenue; two 5-story brick tenements at Clinton Avenue and Jefferson Place, for Camdur Realty Co., Inc., cost $95,000; Goldner & Golberg, Archts., 391 E. 149th Street; 6-story brick tenement at Jackson Avenue and 158th Street for Wick Realty Co., cost $55,000; Lucian Pisciotta, Archt., 391 E. 149th Street; two 5-story brick tenements at Marmion Avenue and 176th Street for Kerwin Bldg. Co., cost $115,000; Tremont Architectural Co., Archts., 401 Tremont Avenue.

Rochester, N. Y.—Plans being prepared by Gordon & Madden, and William G. Kaelber, 300 Sibley Blk., for 3-story dental dispensary to be erected on Main and Alexander Streets for Rochester Dental Society and city of Rochester. Cost, $250,000.

Syracuse, N. Y.—Site purchased at W. Willow and N. Salina Streets for erection of 4-story mercantile building for William Rubin; cost about $40,000.

Philadelphia, Pa.—Plans being prepared by Ballinger & Perot, 1211 Arch Street, for erection of granite and limestone edifice at Fifty-eighth Street and Springfield Avenue for Methodist Episcopal Congregation; cost $60,000. George P. Beck, Pastor.

Norfolk, Va.—Plans prepared for 3-story brick store building to be erected at Bank and William Streets for Woodhouse Electric Co. (J. Woodhouse, Pres.); cost about $30,000.

Wheeling, W. Va.—Plans being prepared for 6 story brick and concrete warehouse to be erected by Wheeling Corrugating Co.; cost about $300,000.

Key West, Fla.—A 5-story concrete hotel is to be erected at South Beach for Burbridge & Blackford; cost about $150,000.

Chattanooga, Tenn.—The Volunteer State Life Insurance Co. in which W. A. Sadd, 549 Vine Street, and H. S. Probasco, 218 High Street, are interested, intends erecting a 10-story office building at Georgia Avenue and Ninth Street; costing, $400,000.

Cincinnati, Ohio.—Residence for Mrs. Fred J. Flach is to be erected at Madison Road and Beechwood Drive in Walnut Hills, at cost $50,000.

Chicago, Ill. — Three-story fireproof building is to be erected at E. Ninety-first Street and Baltimore Avenue for Robert T. Newberry, cost about $120,000.

Apartment house is to be erected at Forty-sixth Street and Greenwood Avenue for Edw. L. Bloom, cost about $225,000.

Madison, Wis.—Union Transfer Storage & Building Co. is to erect a 6-story 95 x 160-ft concrete storage building on E. Wilson Street; cost about $120,000.

St. Louis, Mo.—Plans being prepared by J. M. Dunham Co., 1018 Chemical Building, for 5-story fireproof steel and reinforced concrete building to be erected at 410 Washington Avenue by Joseph K. Foster; cost, $73,000.

Beaumont, Tex.—Plans approved for 3-story concrete and brick warehouse to be erected on Travis Street for S. P. Kelley; cost about $60,000.

Galveston, Tex.—Site purchased at Tremont and Postoffice Streets for erection of 8-story fireproof hotel for George E. Robinson.

San Antonio, Tex.—Plans being prepared by Adams & Adams, Gibs Building, for erecting brick edifice at Avenue D and Fifth Street, for Congregation of First Church of Christ Scientist; cost about $30,000.

Seattle, Wash.—P. S. Coombs & Son, Seattle, engaged to prepare plans for a 4-story 500 x 100 ft. brick and frame construction warehouse to be built on First Avenue S. for the Carstens Packing Co., Seattle. Cost, $50,000.

Bebb & Gould, Denny Building, engaged by Times Publishing Co. to prepare plans for Times Building, to be erected on Times Square, Stewart and Olive Streets and Fourth Avenue; cost about $500,000.

Spokane, Wash.—Reported the McClintock Trunkey Co., Washington and Stevens Streets, have ordered plans prepared for 5 -story concrete wholesale building to be erected on Stevens Street; cost$ $50,000

International Harvester Co., Monroe and Lincoln Streets, have ordered plans prepared for machinery warehouse to be erected at a cost of $75,000.

San Francisco, Cal.—Plans prepared by William Beasley, 127 Montgomery Street, for Sanguinetti Market, 275 x 550 ft., to be erected at Eighth and Market Streets. S. Sanguinetti, Front Street, said to be interested.

BIDS DESIRED.

Fort Dodge, Iowa.—Until Aug. 16 by Rev. Edmond Heelan, for erecting certain portions of a church building for the Sacred Heart Roman Catholic Church. Probable cost of edifice, complete, $100,000.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Brattleboro, Vt.**—Contract for erecting station for Central Vermont R. R. awarded H. Wales Lines Co., Meriden, Conn., at about $75,000.

★**Brooklyn, N. Y.**—Contract awarded to Turner Constr. Co., 11 Broadway, New York, for a manufacturing building of irregular shape, 11 stories and basement, 134 x 177 x 100 ft., for Sperry Gyroscope Co. Building to be located at Flatbush Avenue and Concord Street, Brooklyn, and is to be of reinforced concrete construction. Architect, Frank J. Helmle, 190 Montague Street.

★**Long Island City, L. I., N. Y.**—Contract for pile foundations of barrel storage warehouse at the Pratt Works of Standard Oil Co. awarded MacArthur Concrete Pile & Foundation Co., 11 Pine Street, New York. Turner Constr. Co., New York, N. Y., General Contractors.

★**New York, N. Y.**—Contract reported awarded John McKeefrey, 1416 B'way for erecting 6-story office and apartment house at 414 Madison Avenue for David Dows; Cross & Cross, Archts., 10 E. Forty-seventh Street.

★**Louisville, Ky.**—Contract for erecting 4-story Speed Building on Fourth Street awarded Alfred Struck Co., Louisville. Cost, about $200,000.

★**Springfield, Ohio.**—Contract awarded Concrete Steel Constr. Co. for erecting for R. C. Bancroft and George H. Limbocker a 5 or 7-story fireproof hotel on East High Street. Cost complete about $200,000. W. K. Shilling, Archt., Bushnell Bldg.

★**Lewistown, Mont.**—Contract reported awarded by Link & Haire, Archts., Bank of Fergus County Building, to Stanton & Smith of Lewistown for construction of St. Leo's Catholic Church, at $45,789.

★**Vancouver, B. C.**—Contract for erecting 4-story 45 x 60 ft. steel frame, concrete and brick building in Grandview for Canadian Bank of Commerce awarded Baynes & Horie, 836 Howe Street. Cost, about $100,000.

NEW INDUSTRIAL PLANTS

PROPOSED WORK

East Springfield, Mass.—Westinghouse Electric & Mfg. Co. to erect 4 new factory additions to local plant, to cost $250,000.

North Tonawanda, N. Y.—Plans completed for addition, brick and steel, to plant of Buffalo Bolt Co.; company taking bids for the 300 tons of structural steel required.

Schenectady, N. Y.—A 50 x 100 ft. addition is to be erected to plant of Bland Adjustable Display Frame Co., 110 S. Church Street. Philip G. Horwitz, Pres.

Seneca Falls, N. Y.—Seneca Falls Mfg. Co. having plans prepared for factory to be erected on new site.

Syracuse, N. Y.—Plans being prepared for additions to plant of Globe Malleable Iron & Steel Co. to consist of addition to present foundry, 90 x 50 ft., stock rack building, 60 x 150 ft. 1-story, sand blast and pickling building, 1-story 60 x 90 ft., diesinking building, 1-story 40 x 90 ft.; dry storage building, 1-story 40 x 90 ft.; shipping room and superintendent's office, 1-story 35 x 90 ft.; all reinforced concrete and a power house, 40 x 60 ft. 1-story reinforced concrete and steel; cost, $150,000.

Green Bay, Wis.—Carr & Walsh, Green Bay, preparing plans for 3-story factory of reinforced concrete and hollow tile construction, for A. McQuire Co. of Green Bay.

Medford, Ore.—W. H. Gore, Medford, and F. D. Bramwell of Portland reported interested in construction of beet sugar factory.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**New Haven, Conn.**—Contract awarded H. Wales Lines Co., Meriden, for erecting 5-story office and factory for Kolynos Co. Approximate cost, $100,000.

★**Brooklyn, N. Y.**—Contract for erecting 7-story, 100 x 168-ft. reinforced concrete extension to plant of A. Segrader's Son, Inc., at Vanderbilt and Atlantic Avenues, awarded Turner Constr. Co., 11 Bway, New York. Timmis & Chapman, Archts., 315 Fifth Avenue, New York.

★**Buffalo, N. Y.**—Contract awarded by Buffalo Copper and Brass Rolling Mill Co. to Buffalo Structural Steel Co., 166 Dart Street, for structural steel and erection of same; also masonry to Hartland Furnace Constr. Co., Buffalo, for 2 additional buildings 250 x 600 ft. and 250 x 400 ft. respectively at plant on Military Road and N. Y. Central R. R. Contracts for 1-story laboratory on Sayre Street awarded masonry to J. N. Byers & Son, Buffalo, and steel Buffalo Structural Steel Co., 166 Dart Street. Total cost, $212,000.

★**North Tonawanda, N. Y.**—Contract awarded by Buffalo Belt Co. to Morris & Allen, Builders Exchange, Buffalo, for erecting addition to plant including rolling mill, 1-story 80 x 400 ft., and a heating building, 1-story 48 x 112 ft.; cost, $250,000.

★**Bloomfield, N. J.**—Contract for erecting 1-story 185 x 525 ft. powder warehouse for International Arms & Fuse Co. on Bloomfield Avenue and Grove Street awarded American Concrete Steel Co., Essex Building, Newark, and for steel work to Hedden Constr. Co., 30 Church Street, New York. Cost, about $100,000. Francisco & Jacobus, Archts., 200 Fifth Avenue New York.

MISCELLANEOUS

BIDS DESIRED.

Repairs to Statue of Liberty, Ft. Wood, N. Y.—Until Aug. 21 by Quartermaster, Ft. Wood, N. Y., for repairs to Statue of Liberty and foundation, advertised in Engineering Record.

Elevators—Baltimore, Md.—Until Aug 21, by James A. Wetmore, Acting Supvy. Archt., Washington, D. C., for the installation, complete, of an electric elevator plant in the U. S. Immigrant Station, Baltimore.

Rock Excavation, Etc., Palm Beach, Fla.—By Florida East Coast Hotel Co. at Palm Beach for 3,000 to 15,000 cu. yd. rock excav., 25,000 to 35,000 cu. yd. muck and sand excav., 165,000 cu. yd. hydraulic sand fill (section work). For information apply to J. R. Brooks Engr., in charge, Palm Beach.

Grading School Site—Cincinnati, Ohio.—Until Sept. 1 by Samuel Hannaford & Sons, Archts., Hulbert Blk., Cincinnati, for grading site for new Medical College on Eden Avenue, advertised in Engineering Record. E. L. Kennedy, Secy. Medical College Bldg. Comm.

Steel Barges—Cincinnati, Ohio.—Until Aug 31 by U. S. Engineer for 4 steel fuel flats and steel barges, advertised in Engineering Record.

Tunnel—Columbus, Ohio.—See "Public Buildings."

Elevator Work—Madison, Wis.—Until Aug. 24 by Capitol Comm. of Wisconsin (Lew P. Porter, Secy.), Madison, for furnishing material and labor for elevator work in North Wing of Wisconsin State Capitol now building. George B. Post & Sons, Archts., 101 Park Avenue, New York.

Elevators—Amarillo, Tex.—Until Aug. 21 by James A. Wetmore, Acting Supervg. Archt., Washington, D. C., for installing an elevator in U. S. Public Building at Amarillo.

Municipal Improvements—Monroe, Iowa.—Surveys being made for municipal improvements by W. G. Kirkpatrick, Birmingham, Ala., and M. L. Culley, Jackson, Miss. H. D. Apgar, Mayor.

Track Turnouts, Etc.—Panama.—Until Aug. 13, at office of Maj. F. C. Boggs, Corps Engrs., U. S. A., Genl. Purchasing Officer, Panama Canal, Washington, D. C., for track turnouts, steel rail, lamp-posts, electric cable, lumber, paving brick, etc.

Steel Reinforcing Bars, Etc.—Panama— Until Aug. 20 by Major F. C. Boggs, Corps Engrs., U. S. A., Gen'l. Purchasing Officer, Panama Canal, Washington, D. C., for Cir. 958—Steel reinforcing bars, lumber, etc.

Elevators—Pearl City, Hawaii—Until Aug. 28 at the Bureau Yards and Docks, Navy Dept., Washington, D. C., for three hydro-pneumatic freight elevators, installed, complete, at Naval Station, Pearl Harbor, as per Spec. 2179.

PRICES AND LETTINGS.

★Indicates award of contract.

★Plaza Work—Philadelphia, Pa.—Contract for Southern Boulevard Plaza work reported awarded by city to E. H. Vare, Lincoln Building, at $122,000. Work includes elevation of area between Oregon Avenue and Bigler Street, and Thirteenth and Fifteenth Streets, construction of lakes, walks, water basins, fountains and planting trees and sodding.

★Stone Wall—Ford City, Pa.—Contract awarded to Foundation Co., Woolworth Building, New York, for 3000 ft. of stone wall on Allegheny River for Pittsburgh Plate Glass Co.

Steel — Panama.—Following are bids opened July 23 by Purchasing Officer, Panama Canal, Washington, for 3,250,000 lb. structural steel for decking of the reloader wharf, Balboa: Belmont Iron Works, Philadelphia, Pa., 2.625 cts., delivery 75 to 105 days; McClintic-Marshall Constr. Co., Pittsburgh, Pa., 2.6 cts.; 130 to 155 days; Penn Bridge Co., Beaver Falls, Pa., 2.41 cts. (delivered and erected), 90 to 180 days; Pennsylvania Steel Co., Steelton, Pa., 2.22 cts., 90 to 120 days; Ritter-Conley Mfg. Co., Pittsburgh, Pa., 2.288 cts., 75 to 95 days; U. S. Steel Products Co., 30 Church Street, New York, 2.197 cts., 125 to 125 days, or 2.61 cts. (delivered and erected), 120 to 150 days; Mackenzie Bros., 17 Battery Place, New York, 2.41 cts., 100 to 120 days.

Proposals

For Proposals Advertised, see Pages 46, 47 and 48.

WATERWORKS.

Bids Close.		See Eng. Record.
Aug. 9	Waterworks Choteau, Mont.	July 31
Aug. 10	System, Warrenton, N. C. Adv. July 17 to 21.	July 17
Aug. 10.	Pipe, etc., Washington, D. C.	July 24
Aug. 10.	Contr. 165, Boring, Etc., New York, N. Y.	July 24
Aug. 12.	Pipe, Etc., Philadelphia, Pa.	July 31
Aug. 13.	Water Works, Ord, Neb.	July 24
Aug. 13.	Reservoir, St. Louis, Mo.	July 31
Aug. 13.	Filters, State Sanatorium, Minn.	Aug. 7
Aug. 13.	Reservoir, St. Louis, Mo.	Aug. 7
Aug. 14.	Water Works, Fromberg, Mont.	July 24
Aug. 14.	Mains, Rock Island, Ill.	Aug. 7
Aug. 16.	System, Watervliet, N. Y. Adv. July 17 to Aug. 7.	July 17
Aug. 16.	Waterworks, Drumheller, Alta.	July 31
Aug. 16.	Mains, Hatfield, Pa. Adv. Aug. 7.	Aug. 7
Aug. 17.	Pipe, Intake, etc., Beaumont, Tex.	July 24
Aug. 19.	Water Wks., Syracuse, Neb.	Aug. 7
Aug. 20.	Water Wks., Brewster, Ohio	Aug. 7
Aug. 20.	Water Wks., Windsor, Conn. Adv. Aug. 7.	Aug. 7
Aug. 25.	Hydrants, reservoir, piping system, etc., Wellsville, N. Y. Adv. July 31.	July 31
Aug. 26.	Mech. Equip. of Pump. Engine, Galveston, Tex.	Aug. 7
Sep. 6.	Pump. Unit. Regina, Sask.	Aug. 7

SEWERAGE AND SEWAGE DISPOSAL.

Aug. 9.	Steamboat Springs, Col. Adv. July 31.	July 31
Aug. 10.	Warrenton, N. C. Adv. July 17 to Aug. 7.	July 17
Aug. 10.	Greenville, S. C. Adv. July 31.	July 31
Aug. 10.	Logan, Utah	Aug. 7
Aug. 10.	Argenta, Ark.	Aug. 7
Aug. 11.	Chicago, Ill.	Aug. 7
Aug. 11.	Cincinnati, Ohio	Aug. 7
Aug. 13.	Madison, Wis.	Aug. 7
Aug. 16.	Watertown, S. D.	July 31
Aug. 16.	Poplar Bluff, Mo.	Aug. 7
Aug. 17.	Long Island City, L. I., N. Y.	Aug. 7
Aug. 17.	Toronto, Ont.	Aug. 7
Aug. 18.	Lebanon, Pa. Adv. July 24 and Aug. 7.	July 24
Aug. 18.	East Gardner, Mass. Adv. Aug. 7.	Aug. 7
Aug. 18.	Cleveland, Ohio Adv. Aug. 7.	Aug. 7
Aug. 19.	Chardon, Ohio Adv. Aug. 7.	Aug. 7
Aug. 20.	Beeville, Tex.	July 31
Aug. 23.	Dallas, Tex. Adv. July 24.	July 24
Aug. 23.	Sandstone, Minn.	Aug. 7
Aug. 31.	Newark, N. J. Adv. July 17 to Aug. 7.	July 10
Sep. 1.	Sand Springs, Okla.	July 31
Sep. 7.	Albany, N. Y. Adv. Aug. 7.	Aug. 7

BRIDGES.

Aug. 9.	Woonsocket, R. I. Adv. July 31.	July 31
Aug. 10.	Westport, Conn. Adv. July 31, Aug. 7.	July 31
Aug. 10.	Pittsburgh, Pa.	Aug. 7
Aug. 10.	Oroville, Cal.	Aug. 7
Aug. 10.	Quincy, Mass.	Aug. 7
Aug. 10.	Trenton, N. J.	Aug. 7
Aug. 10.	Hartford, Conn.	Aug. 7
Aug. 11.	Harrisburg, Pa.	July 31
Aug. 11.	Girard, Kan.	July 31
Aug. 11.	Illinois.	Aug. 7
Aug. 12.	Illinois.	Aug. 7
Aug. 16.	Marysville, Ohio	July 31
Aug. 16.	Colma, Cal.	July 31
Aug. 16.	Visalia, Cal.	July 31
Aug. 16.	Lawrence, Mass.	Aug. 7
Aug. 16.	Salem, Ore.	Aug. 7
Aug. 16.	Bakersfield, Cal.	Aug. 7
Aug. 16.	Illinois.	Aug. 7
Aug. 16.	Placerville, Cal.	Aug. 7
Aug. 17.	Athens, Ga. Adv. July 31.	July 31
Aug. 17.	Illinois	Aug. 7
Aug. 18.	Girard, Kan.	Aug. 7
Aug. 20.	Greenwich, N. Y. Adv. Aug. 7.	Aug. 7
Aug. 21.	Kennett, Cal.	July 31
Aug. 23.	Maynardsville, Tenn. Adv. July 24, 31.	July 24
Aug. 23.	San José, Cal.	Aug. 7
Aug. 23.	Dunsmuir, Cal.	Aug. 7
Aug. 26.	Tulsa, Okla. Adv. July 31, Aug. 7.	July 31
Aug. 23.	Los Angeles, Cal.	Aug. 7
Sep. 8.	South Amboy, N. J.	Aug. 7

PAVING AND ROADS.

Aug. 9.	Keyport, N. J. Adv. July 24, 31.	July 24
Aug. 10	New Orleans, La.	July 17
Aug. 10.	Washington, D. C. Adv. July 17.	July 17
Aug. 10.	Pennsylvania.	July 31
Aug. 10.	Wilmington, Del.	July 31
Aug. 10.	Galion, Ohio, Adv. Aug. 7.	July 31
Aug. 10.	Mitchell, S. D.	July 31
Aug. 10	Logan, Ohio	July 31
Aug. 10.	Kansas City, Mo.	Aug. 7
Aug. 10.	Philadelphia, Pa.	Aug. 7
Aug. 10.	Wilmington, Del.	Aug. 7
Aug. 10.	Rockville, Md.	Aug. 7
Aug. 11.	Belton, Tex.	Aug. 7
Aug. 11.	Brooklyn, N. Y.	Aug. 7
Aug. 11.	Chicago, Ill.	Aug. 7
Aug. 11.	Goldsboro, N. C.	Aug. 7
Aug. 11	Illinois	Aug. 7
Aug. 12.	Newark, N. J.	July 31
Aug. 12.	Mount Carmel, Ill. Adv. July 31, Aug. 7.	July 31
Aug. 12.	Roseland, N. J.	Aug. 7
Aug. 13.	Hagerstown, Md.	Aug. 7
Aug. 14.	Lincoln, Neb.	July 24
Aug. 14.	Goshen, Ind.	July 31
Aug. 14.	Tacoma, Wash.	July 31
Aug. 14.	Indiana	July 31
Aug. 14.	Woodstock, Ill.	Aug. 7
Aug. 16.	Bowling Green, Ohio.	July 24
Aug. 16.	Louisiana,	July 31
Aug. 16.	St. Petersburg, Fla.	July 31
Aug. 16.	Connecticut	Aug. 7
Aug. 16.	Zanesville, Ohio	Aug. 7
Aug. 16.	Kansas City, Mo.	Aug. 7
Aug. 16.	Indiana	July 31
Aug. 16.	Hackensack, N. J.	Aug. 7
Aug. 16.—	South Bethlehem, Pa. Adv. Aug. 7.	Aug. 7
Aug. 17.	Memphis, Tenn.	July 17
Aug. 17.	Watelville, Wash.	July 31
Aug. 17.	Uhrichsville, Ohio	Aug. 7
Aug. 17.	Howell, Mich.	Aug. 7
Aug. 17.	Fort Meade, Fla.	Aug. 7
Aug. 17.	Columbus, Ohio	Aug. 7
Aug. 18.	South Bend, Ind.	July 24
Aug. 18.	Marion, Ohio	July 31
Aug. 18.	Lincoln, Neb.	July 31
Aug. 18.	Belding, Mich.	Aug. 7
Aug. 19.	Pittsburgh, Pa.	Aug. 7
Aug. 23.	Toledo, Ohio,	July 31
Aug. 24.	Albany, N. Y. Adv. Aug. 7.	Aug. 7
Aug. 25.	Irvington, N. J.	Aug. 7
Aug. 25.	Scarsdale, N. Y. Adv. Aug. 7.	Aug. 7
Aug. 26.	Albany, N. Y. Adv. Aug. 7.	Aug. 7
Aug. 27.	Columbus, Ohio	Aug. 7
Aug. 30.	Denver, Col.	July 24

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS.

Aug. 9.	Pier, Philadelphia, Pa. Adv. July 10, 17.	July 10
Aug. 9.	Dredging, Philadelphia, Pa. Adv. July 10, 24 and 31	July 10
Aug. 9.	Drainage, Monté Vista, Col.	July 24
Aug. 9.	Pivot pier addition, Camden, Ark. Adv. July 31.	July 31
Aug. 9.	Drainage, New Albany, Miss.	July 31
Aug. 10.	Riprap Work, New London, Conn. Adv. July 24 to Aug. 7.	July 24
Aug. 10.	Bulkhead, Charleston, S. C.	Aug. 7
Aug. 11.	Dredging, Boston, Mass. (2 Props.) Adv. July 31.	July 31
Aug. 11.	Drainage Pump, Louisville, Ky.	Aug. 7
Aug. 12.	Irrigation, Saco, Mont.	July 24
Aug. 12.	Canal, Selmer, Tenn.	July 31
Aug. 12.	Ditch, Redwood Falls, Minn.	Aug. 7
Aug. 13.	Irrigation Work, Saco, Mont. Adv. July 17.	July 17
Aug. 14.	Dredging, Bremerton, Wash.	July 10
Aug. 14.	Ditches, Tekamah, Neb.	July 31
Aug. 15.	Dredge Work, Rosseau, Minn.	Jun. 26
Aug. 16.	Dredging, Portland, Me. Adv. July 17 to Aug. 7.	July 17
Aug. 16.	Dredging, etc., Philadelphia, Pa.	July 31
Aug. 16.	Ditch, Mankato, Minn.	July 31
Aug. 16.	Lake Shore Protection, Evanston, Ill. Adv. Aug. 7.	Aug. 7
Aug. 16.	Drainage, East St. Louis, Ill.	Aug. 7
Aug. 17.	Dredging, Chicago, Ill. Adv. July 24, 31.	July 24
Aug. 17.	Levee, Greenville, Miss.	July 24
Aug. 17.	State canal work, Albany, N. Y.	July 31
Aug. 17.	Ditch, Kankakee, Ill.	July 31
Aug. 17.	Filling in of Pond, Toronto, Ont.	Aug. 7
Aug. 18.	Reclamation Work, St. Ignatius, Mont.	July 24
Aug. 20.	Steel Lock Gates, etc., Pittsburgh, Pa. Adv. July 24 to Aug. 7.	July 24
Aug. 20.	Stone for jetties, Wilmington, Del.	July 31
Aug. 21.	Wharf, San Francisco, Cal.	July 31
Aug. 21.	Drainage, Corinne, Utah. Adv. Aug. 7.	Aug. 7
Aug. 24.	Dredger, Adelaide, Australia	Jun. 19
Aug. 26.	Trestles, etc., for dam, Pittsburgh, Pa. Adv. July 31, Aug. 7.	July 31
Aug. 27.	Irrigation, Newell, S. D. Adv. July 31.	July 31
Aug. 30.	Lock Gates, Etc., Pittsburgh, Pa.	Aug. 7
Sep. 8.	Irrigation, Malta, Mont. Adv. July 31.	July 31
Sep. 17.	Drainage, Palmetto, Fla.	July 24
Sep. 18.	Pier, Pearl City, T. H.	July 10
Sep. 22.	Piers, Honolulu, Hawaii. Adv. Aug. 7.	Aug. 7
———	Dredging, New York, N. Y. Adv. Aug. 7.	Aug. 7

PUBLIC BUILDINGS AND SCHOOLS.

Aug. 10.	Madison, W. Va.	July 31
Aug. 10.	Detroit, Mich.	July 31
Aug. 10.	Athens, Ohio.	July 31
Aug. 10.	Harrisburg, Pa.	July 31
Aug. 10.	Laramie, Wyo.	July 31
Aug. 10.	Buffalo, Minn.	July 31
Aug. 10.	Pittsburgh, Pa.	July 31
Aug. 10.	Hastings, Minn.	July 31
Aug. 10.	San Antonio, Tex.	Aug. 7
Aug. 10.	Toronto, Ont.	Aug. 7
Aug. 10.	Irvington, N. J.	Aug. 7
Aug. 10.	Wrentham, Mass.	Aug. 7
Aug. 11.	Wellsburg, W. Va.	July 10
Aug. 11.	Worthington, Minn.	July 31
Aug. 11.	Chicago, Ill.	Aug. 7
Aug. 11.	Catonsville, Md.	Aug. 7
Aug. 11.	Parkersburg, W. Va.	Aug. 7
Aug. 12.	North Attleboro, Mass.	July 10
Aug. 12.	Somers, Iowa	July 24
Aug. 12.	Gardiner, Me.	July 31
Aug. 12.	Miles City, Mont	July 31
Aug. 12.	Davenport, Iowa.	July 31
Aug. 12.	Edmond, Okla.	Aug. 7
Aug. 12.	St. Paul, Minn.	Aug. 7
Aug. 12.	Los Angeles, Cal.	Aug. 7
Aug. 13.	Gardiner, Me.	July 10
Aug. 13.	Halfa, Iowa	July 24
Aug. 13.	Lambertville, N. J.	Aug. 7
Aug. 13.	Verndale, Minn.	Aug. 7
Aug. 14.	Warnock, Ohio	July 24
Aug. 14.	West Alexandria, Ohio.	July 24
Aug. 14.	Huntington Beach, Cal.	Aug. 7
Aug. 15.	Schuyler, Neb.	July 17
Aug. 15.	Ringling, Okla.	Aug. 7
Aug. 15.	Gainesville, Tex.	Aug. 7
Aug. 16.	Baltimore, Md. Adv. Jun. 26 to July 3.	Jun. 26
Aug. 16.	Westmont, Johnstown, Pa.	July 24
Aug. 16.	Schuyler, Neb.	July 31
Aug. 16.	Gratis, Ohio.	July 31
Aug. 16.	Forest City, Iowa.	July 31
Aug. 16.	Melrose, Ohio	Aug. 7
Aug. 16.	Breckenridge, Minn.	Aug. 7
Aug. 16.	Illinois	Aug. 7
Aug. 16.	Upper Darby, Pa.	Aug. 7
Aug. 14.	Beaumont, Tex.	Aug. 7
Aug. 16.	Redondo, Cal.	Aug. 7
Aug. 17.	Cherokee, Iowa	July 31
Aug. 18.	Lincoln, Neb.	July 31
Aug. 18.	Morenci, Mich.	July 31
Aug. 18.	School, Larimer, Pa.	July 31
Aug. 18.	Granite Falls, Minn.	Aug. 7
Aug. 19.	Blackwell, Okla.	July 17
Aug. 20.	Ypsilanti, Mich.	July 24
Aug. 20.	Camden, Ohio.	July 31
Aug. 20.	Ostrander, Ohio	Aug. 7
Aug. 21.	Terre Haute (R. D. Urbanna), Ohio.	July 31
Aug. 23.	Toledo, Ohio	July 31
Aug. 23.	Sheperdstown, W. Va.	Aug. 7
Aug. 23.	Upper Alton, Ill.	Aug. 7
Aug. 24.	Grand Junction, Col.	July 24
Aug. 24.	Sykeston, N. D.	Aug. 7
Aug. 25.	Pittsburgh, Pa. Adv. July 31 to Aug. 7.	July 31
Aug. 26.	Woodsfield, Ohio	Aug. 7
Aug. 26.	Fort Rosecrans, Cal.	Aug. 7
Aug. 27.	Palatka, Fla.	July 31
Aug. 27.	Columbus, Ohio	Aug. 7
Aug. 28.	Indian Head, Md.	Aug. 7
Aug. 28.	Port Royal, S. C.	Aug. 7
Aug. 28.	Luana, Iowa	Aug. 7
Aug. 28.	Fort Mifflin, Pa.	Aug. 7
Aug. 30.	Schuyler, Neb.	Aug. 7
Aug. 31.	Little Falls, N. Y. Adv. Aug. 7.	Aug. 7
Aug. 31.	Baltimore, Md. Adv. Aug. 7.	Aug. 7
Sep. 1.	Hartford City, Ind.	July 31
Sep. 1.	Wisner, Neb.	July 10
Sep. 7.	Charlotte, N. C.	Aug. 7
Sep. 7.	Fulton, Mo.	Aug. 7
Sep. 10.	Gouverneur, N. Y.	Aug. 7
Sep. 30.	Washington, D. C. Adv. July 24, 31.	July 24

PRIVATE BUILDINGS.

Aug. 9.	Chillicothe, Tex.	July 31

MISCELLANEOUS.

Aug. 12.	Steel Barges, Vicksburg, Miss. Adv. July 10 to 31.	July 10
Aug. 12.	Track Elevation Work, Fort Wayne, Ind.	July 31
Aug. 13.	Track, Turnouts, Etc., Panama	Aug. 7
Aug. 16.	Towing Locomotives, etc., Panama.	Jun. 26
Aug. 16.	Subway Work, Philadelphia, Pa.	July 10
Aug. 16.	Found. and Piers for El. Ry., Philadelphia, Pa. Adv. July 17, 24.	July 17
Aug. 17.	Filling and Grading, Trenton, N. J. Adv. Aug. 7.	Aug. 7
Aug. 18.	El. Ry. Supplies, Etc., Long Island City, N. Y.	July 24
Aug. 18.	El. Ry. work, New York, N. Y.	July 31
Aug. 20.	Steel Reinforcing Bars, Panama	Aug. 7
Aug. 21.	Air Compressors, etc., Pittsburgh, Pa. Adv. July 24 to Aug. 7.	July 24
Aug. 21.	Repairs to Statue of Liberty, Ft. Wood, N. Y. Adv. Aug. 7.	Aug. 7
Aug. 23.	Derrick boat, Washington, D. C. Adv. July 31, Aug. 7.	July 31
Aug. 24.	Elevator, Madison, Wis.	Aug. 7
Aug. 27.	Tunnel, Columbus, Ohio.	Aug. 7
Aug. 28.	Elevator, Pearl City, Hawaii	Aug. 7
Aug. 31.	Elevators, Amarillo, Tex.	Aug. 7
Aug. 31.	Steel Barges, Etc., Cincinnati, Ohio Adv. Aug. 7.	Aug. 7
Aug. 31.	Elevators, Baltimore, Md.	Aug. 7
Sep. 1.	Grading School Site, Cincinnati, Ohio Adv. Aug. 7.	Aug. 7
Sep. 18.	Ry. at Naval Station, Pearl Harbor, Hawaii.	July 10

CONTRACTING NEWS

Of Special Interest to Engineers, Contractors, Builders and Manufacturers of Engineering and Building Supplies

DOMESTIC STOCKS of merchandise of all kinds are low, and domestic buying has been light, according to the report of a committee of the Chamber of Commerce of the United States. The tendency seems to be to wait until the results of the crops are known before increasing stocks to normal. As the crops promise to be exceptionally good, the result of this tendency in the near future should be increased buying, both for resale and to return stocks to normal. The facts brought out in the report are such as to improve still further the position of general manufacturers, who are large clients of contractors. The next few months should see such lines of business as have not profited directly by the country's growing export trade in a position to undertake improvements.

Structural steel orders for last week are estimated at 98,000 tons—considerably more than the total business of any month in the early part of the year. Railroad buying formed a good part of the orders. The stock markets of the country have again proved their solidity against pressure from several directions in a way which proves that public confidence in the business of the country is growing. It is even thought that the prices of steel shares, which heretofore have run ahead of actual conditions in times of increasing prosperity, will be more than justified before the end of the year.

Returns from sixty-seven railroads of the country tabulated by the Interstate Commerce Commission indicate that net operating revenues increased to $406 a mile for the month of June. This is $98 more than the average for May, and $49 greater than that for June, 1914. When the complete returns for June are tabulated, it is expected that the position of the railroads will show marked improvement.

Buildings

Contracts awarded at Washington for the new building for the Department of the Interior total nearly $2,000,000. It is reported that the $1,253,000 contract for the Oklahoma State capitol has been awarded and signed. A $92,000 theater has also been contracted for at Oklahoma City. A building contract has been awarded at Niles, Ohio, at $240,000, and a storage building contracted for at Madison, Wis., will cost $120,000. It is reported that bids are desired at Seattle for a $500,000 newspaper building. Plans have been filed in New York City for a $200,000 church and for a $500,000 apartment house. It is reported that a $500,000 addition to a steel plant will be erected at South Bethlehem, Pa. Plans have been filed for a $250,000 factory at Cleveland. It is reported that a contract will soon be let for a $150,000 gymnasium at Bloomington, Ind. A $150,000 theater is being planned in Chicago.

Bridges and Roads

Bids on four bridges costing from $12,000 to $68,000 have been opened at Philadelphia. A contract for constructing the floor of the Clark Avenue Viaduct at Cleveland has been awarded at $78,000. The Lake Washington bridge at Seattle has been contracted for at $242,000. It is reported that bids are desired Sept. 1 for rebuilding the Belle Isle bridge at Detroit. Bids are desired for two bridges to cost $55,000 at Green Bay, Wis. Bids are desired for a highway bridge containing five 145-ft. truss-steel spans at St. Paul, Neb. Bids will be received Oct. 6 for constructing a concrete arch bridge across the Kaw River at Lawrence, Kan. The Chinese Government is asking bids on 845 tons of steel bridge work. Plans have been prepared for a $290,000 bridge over the Schuylkill River at Reading, Pa. It is reported that the $96,000 bridge over the Miami River at Hamilton, Ohio, on which bids were opened recently, will have to be relet. The Board of Aldermen of St. Louis have voted to build a viaduct costing $200,000 over the tracks of the Missouri-Pacific and St. Louis & San Francisco railroads at Tower Grove.

Low bids opened Aug. 3 for paving work in New York City total $107,000. A $50,000 paving contract has been awarded at Meriden, Conn., and State highway contracts awarded in Connecticut total about $65,000. A $58,000 paving contract has been awarded at McKinney, Tex. Bids are desired in Brooklyn, N. Y., for 25,000 square yards of asphalt pavement. Bids are desired at Ottawa, Ont., for paving work which will cost $220,000. The State of Ohio desires bids Aug. 20 on another long list of highway contracts. Bids are desired at Tacoma, Wash., for roadwork which will cost $70,000. The Washington State Highway Department is reported to have called for bids on seventeen miles of roadwork.

It is reported that the Borough of Manhattan, New York City, will pave about eighteen city blocks during September. A contract is about to be let for building five roads to cost $372,000 at Tazewell, Tenn. It is reported from Dayton, Ohio, that the County Commissioners will spend $700,000 for road construction. The State Highway Commission of New Mexico will spend $500,000 for road improvements. Paving work proposed at Wallace, Idaho, will cost $100,000. Contracts soon to be let at Seattle for paving and roadwork will total $258,000.

Waterworks and Sewers

A contract for a dam and reservoir to cost $357,000 has been awarded at Hartford, Conn. A contract has been awarded for the intake and crib noted recently at Kenosha, Wis. Chariton, Iowa, desires bids for a filter plant and waterworks system. Plans have been completed for a $100,000 reservoir at Tamaqua, Pa. Dayton, Ohio, has sold waterworks extension bonds totaling $135,000.

An $88,000 contract for a sanitary sewer system has been awarded at Maywood, N. J. Sewer extension contracts just awarded at Philadelphia total $146,000. A sewer system to cost $61,000 has been contracted for at Cincinnati, Ohio. Sewer work contracted for at Salt Lake City will cost about $300,000. Bids are desired for constructing a 7-ft. diameter reinforced concrete sewer in Long Island City, N. Y. Oswego, N. Y., desires bids on sewer work which will be subdivided into several contracts. Bids are desired for constructing a sewage disposal plant at Lebanon, Pa. Bids are asked for constructing about four miles of sewers at Sellersville, Pa., and bids are also desired for constructing a sanitary sewer system at Ocala, Fla. Plans are being prepared for a $125,000 sewer system and disposal plant at Rockville, Md.

Miscellaneous

Bids have been opened by the Corps of Engineers, U. S. A., for 5,260,000 cu. yd. of dredging at Philadelphia. Contracts awarded in connection with the new wharf at Houston, Tex., total $196,000. It is reported that forty-five miles of railroad have been contracted for at Gila Bend, Ariz. Bids are desired for bridge and harbor work costing about $100,000 on the New York State Barge Canal. The New York Central Railroad, Harlem branch, has been ordered by the New York State Public Service Commissions to build a new station and eliminate grade crossings at 241st Street, New York City. Wilkes-Barre, Pa., has voted $300,000 for eliminating grade crossings. Government permits have been issued for constructing wharves with over 6000 ft. of frontage at Jacksonville, Fla. Plans for a $160,000 dike have been approved by county commissioners at Cathlamet, Wash. The final report of the Board of Flood Control Engineers, filed at Los Angeles, estimated the cost of flood protection for the county at $16,208,900. It is reported that the Government of the Republic of Panama desires to interest foreign capital in constructing several hydroelectric developments for supplying interior towns of the Republic.

WATERWORKS

PROPOSED WORK

Johnstown, Pa.—Johnstown Water Co. reported to have decided to construct 800,000,000-gal. reservoir on Laurel Run.

Tamaqua, Pa.—Water Comn. reported to have completed plans for reservoir of 357,000,000 gal. capacity; cost, about $100,000.

Maryland.—Among permits issued by Maryland State Department of Health during July, were the following: (Robert B. Morse, Ch. Engr., 16 W. Saratoga Street, Baltimore):

Annapolis—Annapolis Water Co., installation of liquid chlorine plant.

Bloomington — Piedmont Waterworks Co., installation of liquid chlorine plant at Bloomington.

Apex, N. C.—Town has granted Municipal Service Cor. a franchise to construct and operate an electric lighting plant, water works and sewer system; cost estimated at $40,000. Engineer, John Bray of Raleigh.

Dayton, Ohio.—Bonds for $135,000 sold, to be used for water works extensions and improvements.

Shelby, Iowa.—J. H. Mayne, of Council Bluffs, preparing plans for water works.

Manitowoc, Wis.—City about to install two pumps, one of 3,000,000 gal. against 65 lb. pressure, the other of 3,000,000 gal. against 125 lb. pressure.

Pleasanton, Neb.—Citizens voted $9,000 bonds for constructing water works from plans of E. H. Morey, of Kearney, City and Co. Engr.

Chinook, Mont.—Reported City Council will install a filtration plant; cost estimated between $8,000 and $10,000.

Lockhart, Tex.—Citizens Light & Water Co. reported formed by John T. Storey, J. W. Swearingen, J. W. Karbach and others to construct water works, electric light plant and ice plant.

Marshall, Okla.—City proposes issuing $25,000 bonds for water works and an electric light plant.

Bremerton, Wash. — Citizens Aug. 4 voted bonds to purchase and improve the local water system about $44,000 will be used in betterments.

Hillyard, Wash.—Sawyer Bros., White Building, Seattle, engaged to prepare plans for a reservoir for city; cost about $8,000.

La Grande, Ore.—Engineers and City Water Dept. reported to have completed survey for new dam at intake on Beaver Creek, 18 miles distant in the mountains.

Portland, Ore.—City Council reported to have voted to install water meters on all service connections where consumers have petitioned for them. Reported several hundred will be purchased and installed at once. A. L. Barbur, City Aud.

Hill City, Idaho.—Reported H. Scruggs, of Hill City, will install water works, to include wells, reservoir and pipe lines.

Hollister, Idaho. — Townsite Co., in which R. E. Shepherd is interested, will instal water works to consist of reservoir, tank, water mains, pumping station and tower.

Pocatello, Idaho.—Reported city has decided to install municipal water works and distribution system, and engineer will be employed to supervise installation. Water to be taken from big springs located four miles from Pocatello near Portneuf. It is said no additional steps will be taken to purchase local plant.

BIDS DESIRED.

South Braintree, Mass.—Until Aug. 21 by Water Comrs. (James T. Stevens, Chmn.), Box 53, for furnishing c.-i. water pipe, hydrants, gates, special castings, etc., excavating in both earth and ledge and for laying said pipe and castings as an extension to water system in Liberty Street. W. E. Maybury, Supt.

Gloucester City, N. J.—Until Aug. 20 (readvertisement) for furnishing and installing boilers, stacks, tank serving pumps, air compressors, together with deep well, air lifts, etc. A. Blatchley, Engr., 1052 Drexel Building, Philadelphia, Pa. J. F. Lenny, City Clk.

Brewster, Ohio.—Until Aug. 20 by L. S. Lash, Village Clk., for furnishing material and constructing municipal water works. The W. J. Sherman Co., Engrs., Toledo.

Cleveland, Ohio.—Until Aug. 20 by A. R. Callow, Comp. Purchases and Supplies, for furnishing material, excavating test pits and making borings for the proposed Kirtland filter plant.

Cleveland Heights, Ohio.—Until Sept. 7 by H. H. Canfield, Village Clk., for laying 6-in. and 8-in. water main in Derbyshire Road, and 6-in. main in Lenox Road. F. A. Pease Engineering Co., Engrs., Marshall Building, Cleveland.

Newark, Ohio.—Until Aug. 20 for 33 tons Class A c.-i. pipe and 34½ tons specials. Address C. H. Wells, City Engr.

Berwyn, Ill.—Until Aug. 17 by Oscar N. Lindahl, Secy. Bd. Local Improv., for constructing c-i. water supply pipe in Twenty-second and other streets.

Chicago, Ill.—Until Aug. 20 by W. R. Moorhouse, Comr. Pub. Wks., for furnishing material and constructing a chlorinating plant for treatment of water pumped at Twenty-second Street Pumping Station.

Monticello, Ill.—Until Sept. 7 by City Clerk, for furnishing and installing a steam driven deep well pump in a 12-in. well, and two 750 gal per minute Underwriter steam pumps.

Sparta, Ill.—Until Aug. 24 by J. F. Swain, City Clk., for reconstructing water works, advertised in Engineering Record.

Chariton, Iowa.—Until Aug. 24 by W. H. Hassebolder City Clk., for an earth dam of 25,000 cu yd embankment, pump house, gravity filter plant pumps, motors, engines, and 125,000 ft. 10-in. force main. Engineer, M. G. Hall, Centerville.

Luverne, Minn.—Until Aug. 24 by S. C. Rea, City Recorder, for furnishing materials and constructing a reinforced concrete reservoir, advertised in Engineering Record.

Milligan, Neb.—Until 10 a. m., Aug. 24, by City Clerk, for constructing water works, to cost $9,800. Marts Eng. Co., Engrs., Lincoln.

Vallejo, Cal.—Until Sept. 7 at Bureau Supplies and Accounts Navy Dept., Washington, D. C., for schedule—Miscellaneous c.-i. pipe and fittings delivered at Navy Yard, Mare Island.

Burlington, Ont.—Until Aug. 22 by James A. Allen, Secy. Bd. Water Comrs., for constructing a reinforced concrete gallery and connections thereto. Chapman & Powers, Engrs., Mail Building, Toronto.

PRICES AND LETTINGS.

★Indicates award of contract.

Ilion, N. Y.—Following bids opened Aug. 3 by Bd. Water Comrs. (George R. Russell, Secy.) for about 3½ miles 10-in. c.-i. pipe and constructing a concrete diverting dam, intake chamber and gate house: R. F. Reilly, Utica, $12,759; C. A. Chatham, Syracuse, $12,832; George & Bove, Rome, $14,302; A. M. Harper, Inc., Newburgh, $13,588; J. D. Ringwood, City Engr.

Lockport, N. Y.—Following are bids opened Aug. 5 by Bd. Water Comrs. (William G. Spalding, Clk.), for construction of a 10 and 12-in. water pipe in Market and Mill Streets: C. B. Whitmore Co., Lockport, $15,890; F. J. L. Valley, Lockport, $16,680; C. N. Stathorpe & Co., Lockport, $17,350.

★New York, N. Y.—Following are unofficial totals of four lowest bids opened Aug. 10 by Water Bd. for Contract 165—Making six borings through rock, each over 500 ft. deep, at East Shaft of Hudson Siphon, of Catskill Aqueduct, town of Fishkill, Dutchess County: Sullivan Machinery Co., 122 S. Michigan Avenue, Chicago, Ill., $12,145 (awarded contract); Harper Machinery Co., 50 Church Street, New York, $12,669; Sprague & Henwood, Inc., New York Street and Monsey Avenue, Scranton, Pa., $13,041; Pennsylvania Drilling Co., 30 Carson Street, Pittsburgh, Pa., $13,343.

★Covington, Ky.—Contract for excavating and filling trenches in which emergency main will be laid from reservoirs at Fort Thomas to Licking River opposite Latonia reported awarded by City Comrs. to Ben Vastine & Co., at about $26,000.

★Cleveland, Ohio.—Contract awarded by Bd. of Control to Babcock & Wilcox Boiler Co., New York, for five 500 hp. Stirling type boilers with superheater, soot blower and brick work complete, at $43,495 (bids opened July 28).

★Kenosha, Wis.—Later official reports state contract has been awarded to Greiling Bros. Co., 124 N. Adams Street, Green Bay, for 42-in. c.-i. intake, a submerged intake crib and a 24-in. main under harbor (bids opened July 26) at following detailed bid: 4700 ft. c.-i. pipe, per ft. $13.75; 60 clow joints, $300; submerged crib, $6,000; 24-in. main under harbor, $6,750; diver, extra per day, $75; diving equipment, per day, $350; special joints, ea. $25. E. C. Brennan, Supt. Water Dept.

★Wibaux, Mont.—Contract awarded to Haggert Constr. Co., Fargo, N. D., for constructing water works, at $24,500.

SEWERAGE AND SEWAGE DISPOSAL

PROPOSED WORK

Marlboro, Mass.—City Council passed loan order of $20,000 for an auxiliary sewer. T. S. O'Holloran, Mayor.

Buffalo, N. Y.—City Council has ordered construction of 9 ft. x 5 ft. 6 in. brick sewer in Texas Street, and a 6-ft. reinforced concrete sewer in Babcock Street between Prenatt Street and Buffalo River.

Rochester, N. Y.—City Council considering construction of Dalmaine Crescent sewer, walks and grading, cost $7,000; Clinton Avenue North, sanitary and storm water sewer, $17,000; Hollenbeck Street storm water and sanitary sewer, $8,500.

Delmar, Md.—Town of Delmar ordered to submit plans and specifications for a sewer system and sewage disposal plant.

Maryland.—Among permits issued by Maryland State Department of Health during July, were the following: (Robert B. Morse, Ch. Engr., 16 W. Saratoga Street, Baltimore):

Chestertown.—Lateral sewer extensions and extension of water distribution system.

Takoma Park.—Lateral sewer extensions.

Maryland Agriculture College (College Park).—Sewage disposal plant.

Maryland State Normal School (Towson).—Sewage disposal plant.

Preston.—Lateral sewer extensions.

Betterton.—Sewerage system and disposal plant.

Ocean City.—Permit to issue $12,000 worth of bonds for sewerage construction.

Rockville, Md.—Commissioners of Montgomery County having plans prepared for sewer system and disposal plant in the Little Falls Branch drainage area; preliminary estimated cost, $125,000.

Silver Spring, Md.—See "Water Works."

Towson, Md.—A sewer system and sewage disposal plant are proposed at Towson. The preliminary estimated cost is about $40,000.

Parkersburg, W. Va.—Bonds for $200,000 will be sold by City Clerk Aug. 19 to be used for sanitary sewers, brick and concrete paving.

Salem, Ill.—Caldwell Eng. Co., Jacksonville, engaged to prepare plans and superintend construction of sewer system; cost $50,000.

Springfield, Ill.—In about 30 days bids will be received by Mayor for construction of a 10 x 12-ft. reinforced concrete extension to town branch sewer, about 1000 ft. long; estimated cost $16 per ft. Wade S. Seeley, City Engr.

Elliott, Iowa.—Theo. S. De Lay, of Creston, reported to be making preliminary survey for a sewer system.

Anoka, Minn.—Plans and specifications are wanted for municipal improvements. It is proposed to engage a consulting engineer this month to prepare plans and estimates for a system of sewers and also for paving. Address, Henry Lee, City Manager.

Elko, Nev.—Citizens voted $40,000 bonds for construction of sewer system.

Seattle, Wash.—Council has ordered sewers constructed in Stroud Avenue, also a main trunk sewer system in Seaview Avenue from Sixtieth to Market Streets. H. W. Carroll, City Clk.

Bd. Public Works has approved plans for sewers in N. and W. Forty-eighth Streets, to cost $12,000, and sewers in Sixth Avenue N. W., at a cost of $90,000.

Enterprise, Ore.—City Council reported to have passed ordinance providing for construction of lateral sewers, to cost $25,000.

Richfield, Utah.—Bonds for $25,000 for sewers, will be sold Aug. 19, advertised in Engineering Record. Address Annie H. Bean, City Record.

Vancouver, B. C.—A. G. Dalzell, Asst. City Engr., writes no contracts yet let for Hastings Park trunk sewer and outfall; may be constructed by day labor by the Joint Sewer and Drainage Board.

BIDS DESIRED.

Rochester, N. H.—Until Aug. 31 by Water and Sewer Com. (F. Hussey, Clk.), for 8100 ft. 8 to 12 in. sewer pipe, etc., advertised in Engineering Record.

Boston, Mass.—Until Aug. 18 by Metropolitan Water & Sewerage Bd. (Frederick D. Smith, Engr. Sewerage Wks.) for 170 tons 84-in. bell and socket c. i. pipes, and 140 tons special c. i. pipes ranging from 48 to 84 in. to be delivered at Boston Harbor.

Woonsocket, R. I.—Until Aug. 24 by Bd. Sewer Comrs. (Frank E. Holden, Chmn.) for constructing about 4400 ft. 8-in. and about 500 ft. 15-in. sanitary sewers and appurtenances, advertised in Engineering Record. Frank H. Mills, City Engr.

Brockport, N. Y.—Until Aug. 25 by F. E. Reynolds, Village Clk., for constructing sewage disposal plant, from plans of Charles C. Hopkins of Rochester, advertised in Engineering Record. Bonds to be sold Aug. 26.

Long Island City, L. I., N. Y.—Until Aug. 19 (readvertisement) by Maurice E. Connolly, Pres. Boro. Queens, for constructing sewer in portion of Atlantic Avenue about 1270 lin. ft. 7-ft. reinforced concrete sewer, 877 lin. ft. 4-ft. concrete sewer, 132 M ft. timber for sheeting and bracing, etc. Security, $24,000.

Oswego, N. Y.—Until Aug. 20 by Dept. Wks. for sewer construction about 9722 ft. 8 to 22-in. vitr. tile sewer, 3956 ft. 24, 27, 30, 36 and 42-in. reinforced concrete or vitr. tile sewer, 312 Y branches, etc., advertised in Engineering Record. Charles W. Linsley, Comr. Wks.

Yorktown Heights, N. Y.—Until Aug. 31 by William B. Osgood Field, Pres. Bd. Mgrs, State Training School for Boys, for sewerage and sewage disposal plant at this school, advertised in Engineering Record. Lewis F. Pilcher, State Archt., Albany.

Nutley, N. J.—Until Aug. 16, at 8 P. M., by Bd. Town Comrs. for vitr. pipe sewer in Franklin Avenue, about 13,856 lin. ft. 6 to 12 in. pipe, 33 manholes, etc.; also for main trunk vitr. pipe sewer with brick manholes from Franklin Avenue and Harrison Street northerly through Franklin Avenue to Stager Street, in Stager, Spring and other streets, about 15,371 ft. 6 to 12 in. pipe, 36 manholes, 480 c. i. curb markers, etc. Frank T. Shepard, Town Engr.

Lebanon, Pa.—Until Aug. 25 (extension of date from Aug. 18) for furnishing material and constructing a sewage disposal plant, advertised in Engineering Record. James H. Fuertes, Engr., 140 Nassau Street, New York. T. R. Crowell, City Engr.

Sellersville, Pa.—Until Aug. 30 by H. J. Zane, Boro. Secy., 376 N. Main Street, for constructing approximately 22,640 ft. 8, 10 and 12-in. sewers, advertised in Engineering Record. Bascom & Sieger, Engrs., Room 505, Allentown National Bank Building, Allentown.

Westchester, Pa.—Reported desired until Aug. 24 by City Clerk, for constructing sewage and pumping station, complete, including four 4-in. vertical motor-driven centrifugal pumps and 1500 ft. 8-in. c. i. force mains. Remington & Vosbury, Engrs., Camden, N. J.

Ocala, Fla.—Until Sept. 14 by H. C. Sistrunk, City Clk., for constructing a sanitary sewerage system, to include furnishing material and constructing 121,203 ft. 6 to 18 in. sewer pipe, 231 manholes, 51 automatic flush tanks, 37 hand flush tanks, necessary Y branches and a sewage disposal plant. The J. B. McCrary Co., Engrs., Third Natl. Bank, Atlanta, Ga.

Akron, Ohio.—Until Aug. 21 by Bd. Control, for constructing sewers in portions of LaCroix, Gertrude, Abel and other streets, in all about 3600 ft. 8 in. and 1800 ft. 10 in. sewers. C. P. Parker, Dir. Pub. Service.

Canton, Ohio.—Until Aug. 17 by Director Public Service for constructing Shivers Run Storm water sewer with laterals.

Cleveland, Ohio.—Until Aug. 19 by A. R. Callow, Commissioner Purchases and Supplies, for constructing sewers in portions of Bessemer Avenue, E. Sixty-fifth, East Ninety-third, East Ninety-fourth and E. Ninety-fifth Streets.

Cleveland Heights, Ohio.—Until Sept. 7 by H. H. Canfield, Village Clk., for constructing sewers in portions of Derbyshire and Lenox Roads. Engrs. F. A. Pease, Engineering Co., Marshall Building, Cleveland.

Fenton, Mich.—Reported desired by City Clerk Aug. 16 for construction of sanitary sewer.

Berwyn, Ill.—Until Aug. 17 Oscar N. Lindahl, Secy. Bd. Local Improv., for constructing vitr. tile pipe sewers in Twenty-second and other streets.

Green Bay, Wis.—Reported desired until Aug. 17 by Com. on Sewers and Common Council for constructing a steel outlet for the terminus of the Cedar Street sewer to the Fox River. A. Braun, City Engr.

Cedar Rapids, Iowa.—Until Aug. 20 by L. J. Storey, City Clk., for constructing 8 and 6-in. sanitary sewers in portions of C Avenue, Seventeenth Street and several alleys.

Stillwater, Minn.—Until Aug. 17 by City Clerk for constructing sewer in Churchill and South Fourth Streets, 752 ft. 24-in., 490 ft. 12-in., 918 ft. 8-in. and 318 ft. 6-in. vitr. clay pipe, 9 manholes, 6 catch-basins and 1 flush tank. Lewis W. Clarke, City Engr.

Thorold, Ont.—Until Aug. 25 by D. J. C. Munro, Town Clk., for furnishing material and constructing a system of sanitary sewers in St. Andrews Ward, comprising about 14,225 lin. ft. pipe laying; also constructing a sewage pumping station. Chipman & Powers, Engrs., Mail Bldg., Toronto.

PRICES AND LETTINGS.

★Indicates award of contract.

★Pittsfield, Mass.—Contract awarded by Bd. Pub. Wks. to R. W. Emerson, Pittsfield, for building seventeen new filter beds at sewage disposal plant at $21,544 (bids opened Aug.4).

★Wallingford, Conn.—Contract awarded Aug. 3 for tile pipe sewers and completion of low level trunk sewer to O'Neil Bros., Hartford, at $5,647. W. A. Mackenzie, City Engr.

★Maywood, N. J.—Contract awarded July 26 by Borough Council (Charles Stass, Clk.) for constructing sanitary sewer system to Martin, Miller & Pizzimenti of Caldwell at $87,912. Alexander Potter, Engr., 50 Church Street, New York.

★Philadelphia, Pa.—Contracts for short extensions to the city's main sewer system to connect with sewage disposal plants reported awarded as follows: Adams Avenue to Robert Higgins, $20,185; Gunner's Gun Relief sewer in Indiana Avenue to Frank Mark Contr. Co., $56,352; Lincoln Avenue to Hartwell Lane to O'Neill & Co., $4,497; Thirty-fourth Street to Philadelphia Paving Co., $28,334; Venango Street, to Emilio Pascuzzi, $14,651; temporary sewage pumping station, Sixty-ninth Avenue, north of Old York Road, to Francis J. Boas, $9,055; force main in Sixty-ninth Avenue north, to Daniel J. Lynch, $3,675; Albanus Street, to McCool Co., $9,500.

★Cincinnati, Ohio.—Contract for constructing sewers in Madisonville Sewer Dist. awarded by Bd. Pub. Service to Thomas P. Strack, Cincinnati, at $61,756 (bids opened July 12).

★Hamilton, Ohio.—Contracts awarded by Bd. of Control for sanitary sewers in District 1 to Charles F. Smith Co., Dayton, at $21,389, and District 2 to John L. Walker Co., Hamilton, at $22,507.

★Markle, Ind.—Contract for constructing sewer system, requiring approximately 7300 ft. 12 to 30-in. pipe, etc., awarded to Thomas McGovern, Wabash, at $11,510. Next 3 lowest bids: R. P. Hipskind, Wabash, $11,721; D. E. Knipp, Flora, Ill., $12,120; Keefer & Bailey, Huntington, $12,313. T. J. Yoos, Town Clk. Engineer, Thomas Ruggles, Huntington.

★Beaver Dam, Wis.—Contract awarded by Bd. Pub. Wks. for constructing sanitary sewers and appurtenances in East Sewerage Dist. to Sykes Co., Minneapolis, Minn., at $29,119. Next three lowest bids: J. B. Sheets Co., Pittsburgh, Pa., $29,832; F. E. Kaminski, Watertown, $31,309; G. W. Mulholland, Kaukauna, $32,381. Work includes approximately 13,473 ft. 8 to 24-in. pipe, 1700 lin. ft. 6-in. pipe, risers, etc. E. P. Parsons, Engr., Watertown.

★Aberdeen, S. D.—Contract awarded July 27 by City Comrs. for completion of First Avenue sewer, to Arthur A. Dobson Co., Lincoln, Neb., at $24,027.

★Hartford, Conn.—Following are unit prices of 4 lowest bids opened August 2 by Bd. Water Comrs. (C. M. Saville, Ch. Engr., Pilgard Building) for constructing Richards Corner Dam, compensating reservoir, Contract 10—(a) C. W. Blakeslee & Sons, New Haven, $357,766 (awarded contract); (b) Larkin & Sangster, Seneca Falls, N. Y., $396,999; (c) Winston & Co., New York, N. Y., $399,540; (d) Coleman Bros., Chelsea, Mass., $414,546:

	*(a)	(b)	(c)	(d)
25 acres clearing and grubbing	$125.00	$125.00	$100.00	$150.00
26,600 cu yd earth excav in cut-off trench below excavation 20	0.67	0.80	1.15	2.00
140,000 cu. yd. earth excav. for dam and highway	0.35	0.40	0.40	0.40
3,900 cu. yd. rock excav. for conduit and under core-wall and waste weir	2.15	3.00	3.00	3.00
26,000 cu yd rock excav	1.48	1.60	1.40	1.50
2,500 sq yd special preparation of rock surfaces	0.50	0.45	0.40	0.50
85,000 cu yd refill and embankg of soil	0.62	0.55	0.54	0.45
180,000 cu. yd. refill and embankg. of gravelly matter and rock	0.27	0.40	0.47	0.37
37,000 cu. yd. refill and embankg. of cofferdams	0.20	0.20	0.10	0.49
5,000 cu. yd. surface dressing and grassing	0.70	0.80	0.60	0.50
15,700 cu yd concrete masonry, Class A	3.90	3.90	3.50	3.80
2,000 cu. yd. concrete masonry, Class B	3.95	5.50	5.00	5.50
2,000 cu. yd. concrete masonry, Class C	4.20	5.50	6.00	5.50
100 cu yd concrete masonry, Class D	5.60	9.50	9.00	7.00
1,500 sq ft finish concrete surfaces by scrub. and wash. with acid	0.08	0.08	0.10	0.10
25 cu. yd. brick masonry	14.50	20.00	20.00	16.00
200 connections from machines to grout pipes	0.50	2.00	0.35	1.00
200 cu yd grout	4.75	4.00	5.00	5.00
3,000 lin. ft. drilling holes in rock and masonry	0.35	0.50	0.40	0.40
25,000 bbl Portland cement	1.71	1.65	1.60	1.50
900 cu. yd. paving and dry rubble masonry	2.25	3.00	2.50	2.50
1,600 sq yd riprap	1.30	2.00	1.25	2.00
5 ton furnish and lay c.-i. pipe and special castings	50.00	55.00	35.00	60.00
1,000 lb. round steel	0.03	0.06	0.04	0.05
40,000 lb. metal for reinforcing concrete and water stops	0.04½	0.04	0.04	0.03
35,000 lb. misc. cast iron, wrought iron and steel	0.04½	0.04½	0.05	0.05
200 lb. bronze and copper	0.75	0.45	0.60	0.30
15,000 lb. receive, haul, store and place metal work, furnished by Bd	0.03	0.02	0.02	0.01
200 lin. ft. vitr pipe, 5 in. or less in diameter	0.55	0.40	0.50	0.50
100 lin. ft. vitr. pipe, 10 to 15 in. in diameter	1.25	0.85	1.00	0.70
2,500 sq. yd. grave surface for highways	0.58	0.50	0.75	0.40
1,000 lin. ft. wooden guard rails	0.30	0.25	0.25	0.30
200 cu. yd. gravel and broken stone	2.10	1.50	1.00	2.00
100 lin. ft. test borings	4.50	8.00	5.00	4.00
Grading machines and equipment (lump sum)	300.00	500.00	350.00	400.00
Care and maintenance of highways (lump sum)	500.00	500.00	200.00	500.00

★**Wibaux, Mont.**—Contract reported awarded to Haggert Constr. Co., Fargo, N. D., for constructing sewer system at $12,998.

★**Salt Lake City, Utah.**—Contract awarded for constructing sewers in Sewer Extension 354, about 23,632 ft. (bids opened Aug. 4) to Gibbons Bros., Reed & Roche, 1018 Lake Street, Salt Lake City. This company bid for monolithic construction types B, C, D and E $303,540, $296,511, $299,791, $298,471 respectively, and for reinforced concrete pipe Type A, $338,790. Sylvester Q. Cannon, City Engr.

BRIDGES

PROPOSED WORK

Binghamton, N. Y.—Citizens July 30 voted $30,000 bonds for constructing bridge over Noyse Island and one over Pierce Creek. Plans will be ready and bids asked for about Sept. 15. J. A. Giles, City Engr. D. W. Foster, City Clk.

Whitesboro, N. Y.—A steel bridge is to be constructed over Erie Canal at Clinton Street; cost about $11,000.

Reading, Pa.—Preliminary plans completed by county engineer for constructing concrete bridge over Schuylkill River and canal at Bingaman St., cost about $290,000.

Cocoa, Fla.—R. N. Andrews, Clk. of City Council writes that preliminary survey now being made for bridge to be constructed across Indiana River, between Cocoa, Fla., and Merritt Island. Engineer, C. M. Rogers, Daytona, Fla.

Elizabethtown, Ky.—J. S. Irwin of Elizabethtown writes bids will be received in October for constructing a steel bridge on concrete foundation over Rolling Fork River at Woolbridges Ferry; cost $17,500. To be constructed jointly by Comrs. of Bullett and Hardin counties.

Hamilton, Ohio.—Press reports state that the County Comrs. have been enjoined from signing contract reported awarded in June to A. Yawger Co., Indianapolis, Ind., to construct Columbia Bridge over Miami River at Wood Street, a concrete bridge, 730 ft. long, to have seven piers; cost about $96,000. New bids will probably be called for.

St. Louis, Mo.—Bd. Aldermen voted to construct a viaduct over Missouri Pacific and 'Frisco R. R. tracks at Tower Grove Ave., cost $200,000.

Eureka Springs, Ark.—See "Paving and Roads."

Port Lavaca, Tex.—See "Paving and Roads."

Challis, Idaho.—County Clerk writes bonds for $35,000 reported sold, to be used for the construction of bridges.

BIDS DESIRED.

Woonsocket, R. I.—Competitive plans desired by Bd. Aldermen (George H. Emmott, Chmn.), for constructing 2 bridges on Hamlet Ave. and one on Fairmount St., advertised in Engineering Record. Frank Mills, City Engr.

West Chester, Pa.—Until Aug. 23 by Co. Comrs. for steel girder highway bridge across Muddy Run, Upper Oxford Township, advertised in Engineering Record. Isaac Y. Ash, Co. Compt.

Columbus, Miss.—Until Sept. 6 by Supervisors of Lowndes County, for one steel bridge 40 ft., one steel bridge 80 ft., a steel bridge 100 ft. and a concrete arch bridge 50 ft. Engineer, Gus E. Hauser, Columbus.

Fremont, Ohio.—Reported desired until Aug. 21 by Co. Comrs. for construction and repair of 5 county bridges.

Marietta, Ohio.—Reported desired until Aug. 17 by W. P. Alexander, Co. Aud., for constructing concrete bridge over Middle Hawk Creek.

Mount Gilead, O.—Reported desired until Aug. 20 by G. O. Higgins, Co. Aud., for constructing Beatty Bridge, 124 ft. long, 16 ft. roadway and block floor.

Richmond, Ind.—Reported desired until Aug. 21 by County Comrs., for constructing several concrete bridges and culverts.

Detroit, Mich.—Local press reports state bids desired until Sept. 1 by Comr. Pub. Wks., for building the Belle Isle Bridge. Probable cost, $100,000.

Illinois.—By State Highway Comn., Springfield, for constructing bridges as follows:

Until Aug. 16, at Washburn, Garber Bridge, reinforced concrete, 16-ft. span, roadway 56 ft. Engineer's estimate, $1,650. A. B. Hurd, Co. Supt. Highways, El Paso.

Until Aug. 17, at Broughton, steel bridge, reinforced concrete abutments, 50-ft. span. Engineer's estimate, $2,950; Gregg Garrison, Co. Supt. Highways, Garrison; also at Scottsville, Sitton Bridge, steel structure, reinforced concrete abutments, 100-ft. span. Engineer's estimate, including piles, $6,450. O. B. Conlee, Co. Supt. Highways, Carlinville.

Until Aug. 18, at Watseka, Bridges Nos. 4 and 10, reinforced concrete structures, each 60-ft. span. Engineer's estimate, $6,575. Benjamin Jordan, Co. Supt. Highways, Watseka; also at the Langenfeld Hotel, Centralia, Bierman Bridge, reinforced concrete, 15-ft. span. Engineer's estimate, $545. J. A. Davenport, Jr., Co. Supt. Highways, Nashvillle.

Until Aug. 19, at Germantown, Hankap Bridge, reinforced concrete box culvert, 8-ft. span, 18-ft. roadway. J. T. Goldsmith, Co. Supt. Highways, Carlyle.

Until Aug. 23 at Hollerand House, Fulton, a reinforced concrete bridge, known as Ward Bridge, 30-ft. span, 16-ft. roadway; engineer's estimate, including piles, $1,500. V. N. Taggett, Co. Supt. Highways, Morrison; also at Glenn Hotel, Ashley, for Ashley Bridge No. 1, reinforced concrete, 20-ft. span, 16-ft. roadway; engineer's estimate $710. J. A. Davenport, Jr., Co. Supt. Highways, Nashville.

Green Bay, Wis.—Reported desired until Aug. 30 by Com. on Streets and Bridges, for constructing a Strauss bascule bridge over East River at Main Street and a swing bridge. Probable cost, $55,000. A. Braun, City Engr.

Lake Geneva, Wis.—Until Aug. 17 for one concrete reinforced bridge, 35 ft. span, 2 abutments, supported on 56 piles; estimated cost $2,300. Frank Briegel, City Clk. J. G. Skeels, City Engr.

Guthrie Center, Iowa.—Until Aug. 24 by County Aud. for constructing following bridges: Bridge No. 8-20, Baker Township, a 60 ft. pony truss steel bridge with concrete abutments and concrete floor; Bridge No. 8-52, Thompson Township, over Beaver Creek, a 32 ft. I beam steel bridge on concrete abutments, concrete floor; Bridge No. 8-54. Thompson Township, a 10x10x20 ft. reinforced concrete box culvert with retaining walls and handrail of concrete.

Mankato, Minn.—Until Aug. 18 by C. L. Kennedy, Co. Aud., for constructing a concrete arch bridge, 120-ft. span, 18-ft. roadway, in Shelby Township.

Wadena, Minn.—Reported desired until Aug. 23 by County Comrs. for constructing Bridge 1551 at Twin Lakes two 60-ft. spans, 18-ft. roadway, concrete piers and foundation.

Lawrence, Kan.—Until Oct. 6 by Herman Broeker, Co. Clk., for constructing a reinforced concrete bridge over Kansas River, at Lawrence. advertised in Engineering Record. Hedrick & Cochrane, Engrs., Kansas City, Mo. Plans and specifications on file at New York office Engineering Record.

Oskaloosa, Kan.—Reported desired until Aug. 19 by L. P. Sheldon, Co. Clk., for constructing 13 reinforced concrete and steel bridges, also repairs to various bridges.

St. Paul, Neb.—Until Sept. 3 by K. D. Bahensky, Co. Clk., St. Paul, for construction of bridge across Loup River about 2 miles south of St. Paul. Bids will be received on a high truss steel bridge composed of five 145-ft. spans, with 16-ft. roadway resting on concrete piers and wood-piling with concrete floor.

Hudson, S. D.—Until Sept. 7 by D. H. Wissink, Co. Aud., Canton, for constructing bridge across Sioux River about 2 miles south of Hudson, to consist of a structural steel span of 120 ft. with concrete floor and 18 ft. roadway, concrete pier under each end of main span and two 70-ft. pile approaches.

Terrell, Tex.—Reported desired until Aug. 26 by Permanent Road Comrs. (W. M. Raley, Secy.) for constructing culverts and bridging, creosoted timber bridging, concrete headwalls, etc. Bartlett & Ranney, Engrs., San Antonia.

Kingfisher, Okla.—Reported desired until Aug. 16 by County Comrs., for constructing seventeen steel and concrete bridges. Probable cost, $21,500. Wm. G. Newer, Co. Clk.

Ventura, Cal.—Until Aug. 25 by County Bd. Superv., Ventura, for constructing the south abutment and approach to the Saticoy Bridge, Saticoy, requiring approximately 11,500 cu. yd. of embankment, 500 cu. yd. concrete in abutment, 19,100 lb. reinforcing steel in abutment, 725 sq. ft. steel sheet piling, 20 concrete piles, 35 ft. long; 1328 lin. ft. guard fence, etc.; also constructing Conejo Bridge, near Camarillo, to consist of 8 spans, each 30 ft. long. J. R. McCloskey, Co. Clk.

Pocatello, Idaho.—Reported desired until Aug. 16 by County Comrs., Pocatello, for dismantling of present bridge and constructing a new steel highway bridge across Snake River at Aught's Ford, near Triden.

St. John, N. B.—Until Aug. 18 by John Morrissey, Minister Pub. Wks., Fredericton, for dismantling the old suspension bridge at St. John. Specifications may be seen at the office of the Structural Eng. Co., Ltd., New Birks Building, Montreal, Que.

Ottawa, Ont.—Until Aug. 26 by F. C. Askwith, Acting City Engr., for constructing substructure Pretoria Avenue bridge.

Hankow, China.—Until Sept. 25 by Robert W. Hunt & Co., Consulting Engrs., Monongahela Bldg., Pittsburgh, Pa., for supply of about 845 tons steel bridges for Chinese Hankow-Seechuan Government Ry., Hankow Ichang Section, advertised in Engineering Record.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Montpelier, Vt.**—Contract awarded Aug. 2 for constructing steel girder bridge to James E. Cashman, Burlington, at $16,805. Next 3 lowest bids: Penn Bridge Co., Beaver Falls, Pa., $19,319; R. H. Howes Constr. Co., Boston, Mass., $19,683; Spaulding Constr. Co., Suffield, Conn., $22,400. George A. Reed, City Engr.

Philadelphia, Pa.—Following are totals of four lowest bids opened Aug. 2 and Aug. 4 by Dept. Pub. Wks. (M. L. Cooke, Dir.) for constructing bridges:

Cambria and A Streets Bridge: James D. Dorney, 1204 E. Montgomery Street, $46,335; T. F. Reilly, 1616 Thompson Street, $61,700; Carl R. Camp, $51,349; C. P. Bower, Bulletin Bldg., $55,500.

Holme Avenue Bridge, Philadelphia: McNichol Paving & Constr. Co., Betz Bldg., $67,856; J. E. Brenneman, 1523 S. Front Street, $75,994; Peoples Bros., Inc., 2508 Callowhill Street, $79,242; Richard Walsh & Sons, Inc., $108,340.

Whitby Avenue Bridge: F. J. Boas, 201 N. Broad Street, $34,731; Richard Walsh & Sons, Inc., $41,925; Thomas F. Reilly, $38,815.50; Monaghan & Losse, $40,568.65.

Front Street Bridge, Philadelphia: Philadelphia Paving Co., $11,792; Frank Mark Contracting Co., 2816 N. Twenty-first Street, $12,515; Daniel J. Lynch, $12,074; Richard Walsh & Sons, Inc., $12,-900.

★**Pittsburgh, Pa.**—Contract for constructing bridge over Deer Creek in Harner Township awarded by County Comrs. July 30 to John F. Howley & Co., Pittsburgh, at $6,687.

★**Calvin, Ky.**—Contract for constructing steel bridge over Cumberland River awarded by Fiscal Court, Pineville, to Vincennes Bridge Co., Vincennes, Ind., at $7,060.

★**Austin, Tex.**—Contracts awarded by Co. Comrs. on bids opened July 28 as follows: New steel approach and removal and erection of 2 spans of old Colorado River bridge upon concrete piers, including all work incidental to complete bridge: Onion Creek, Moore Crossing, to Austin Bros., Dallas, at $4,600; Cameron Road, Bakers Place, concrete bridge, to Uneeda Bridge Co. Austin, $599; Dessau Causeway, a reinforced concrete causeway to Metcalfe Eng. & Contr. Co., Austin, $473.

★**Seattle, Wash.**—Following are unit prices of Hans Pederson, Madison Block, Seattle, successful bidder, for constructing substructure and superstructure complete of Lake Washington Bridge, at Fifteenth Avenue N. W. (bids opened July 23 by Bd. Pub. Wks.). (F. A. Rapp, Structural Engr.):

5,200 cu. yd. excavation	$5.80
2,700 cu. yd. Class "A" concrete deposited under water by tremie, 1:2:4 mixture	6.60
4,600 cu. yd. Class "C" concrete in piers above water, 1:3:5 mixture	7.00
850 cu. yd. Class "B" concrete 1:2:4 mixture	12.00
127,000 lb. reinforcing steel	0.028
300,000 lb. furnish, place and paint structural steel grillages and anchor bolts, in substructure, including grouting	0.036
2 fir bumping logs	25.00
4,200 lin. ft. peeled piles in protection works	0.20
8 M ft. timber in protection works	25.00
325 lin. ft. chains on dolphins	0.30
560 sq. ft. surface treatment of panels	0.03
400 sq. ft. brick pattern work	0.20
16 pendants of 1 part cement to 3 parts sand	10.00
4 test piles	25.00
8 eye bolts in shafts of anchor piers	2.00
750 cu. yd. extra excav. below elevation —35	2.00
750 cu. yd. extra excav., Class "A" concrete, in unwatered foundation	5.00
230,000 lb. furnish and erect machinery	0.09
1,900,000 lb. furnish and erect structural steel	0.043
390 cu. yd. furnish, place and adjust gravel concrete counterweight	8.00
280 cu. yd. furnish, place and adjust cinder concrete counterweight	8.00
1 cu. yd. furnish and weigh gravel concrete test blocks	15.00
1 cu. yd. furnish and weigh cinder concrete test blocks	15.00
890 sq. yd. roadway floor on movable leaves	4.90
410 sq. yd. roadway floor, including reinforcement on fixed portion	3.90
265 sq. yd. sidewalk floor on movable leaves	0.60
130 sq. yd. sidewalk floor on fixed portion	1.00
90 sq. yd. concrete floor, including reinforcement, on machinery platforms	3.50
10,000 lb. reinforcing bars in concrete counterweight	0.028
Electric equipment (lump sum)	13,000.00
4 operators' houses and 2 toilet rooms complete (lump sum)	940.00
Meneely fog bell in place (lump sum)	100.00
2 copper ball vessel signals in place	100.00
80 lin. ft. iron pipe hand rails below deck of bridge	1.00
Wooden steps and railings (lump sum)	100.00
4 double arm roadway gates	200.00
14 oak buffer blocks	10.00
Total	$242,620

★**Seattle, Wash.**—Following are unit prices of successful bids opened July 23 by Bd. Pub. Wks. for constructing steel bascule bridge on concrete foundations over Lake Washington Canal on Fremont Avenue (F. A. Rapp, Structural Engr.):

★Substructure of Fremont Avenue bridge, over Lake Washington Canal, awarded to Pacific States Constr. Co., Burke Building, as follows:

Remove existing structures and debris (lump sum)	$2,000.00
15,000 cu. yd. excavation	2.00
3,500 cu. yd. Class "A" concrete deposited under water by tremie, 1:2:4 mixture	7.00
3,200 cu. yd. Class "C" concrete in piers above water, 1:3:5 mixture	6.65
1,100 cu. yd. Class "B" concrete, 1:2:4 mixture	10.00
300 cu. yd. Class "D" mortar, 1:2 mixture	20.00
155,000 lb. reinforcing steel	0.03
305,000 lb. place and paint structural steel, grillages and anchor belts, including grouting	0.0075
2 fir bumping logs	23.00
7,000 lin. ft. peeled piles in protection works	0.20
9 M ft. timber in protection works	25.00
570 lin. ft. chains on dolphins	0.30
4 test piles	18.00
1,200 cu. yd. extra excav. below elevation —32	1.50
1,200 cu. yd. extra Class "A" concrete below elevation —32	6.00
8 eye bolts in shafts of anchor piers	2.50
Total	$112,651.00

★Superstructure of Fremont Avenue bridge awarded to Beers Bldg. Co., Pittock Building, Portland, Ore., as follows:

260,000 lb. furnish and erect machinery	$0.1245
2,650,000 lb. furnish and erect structural steel	0.0423
305,000 lb. furnish structural steel, erected by contractor for substructure	0.0325
700 cu. yd. furnish, place and adjust gravel concrete counterweight	5.00
10 cu. yd. furnish, place and adjust cinder concrete counterweight	7.00
1 cu. yd. furnish and weigh gravel concrete test blocks	10.00
1 cu. yd. furnish and weigh cinder concrete test blocks	10.00
1,010 sq. yd. roadway floor on movable leaves	2.85
400 sq. yd. roadway floor, including reinforcement on fixed portion	2.40
490 sq. yd. sidewalk floor on movable leaves	0.50
172 sq. yd. sidewalk floor on fixed portion	1.25
20,000 lb. reinforcing bars in concrete counterweight	0.0275
Electrical equipment complete (lump sum)	13,288.00
4 operators' houses and 2 toilet rooms complete (lump sum)	600.00
Meneely fog bell in place (lump sum)	100.00
2 copper ball vessel signals	15.00
4 double arm roadway gates complete	300.00
Wooden steps and railings and angle iron bracket supports (lump sum)	200.00
2 pairs steel ladders providing access to counterweight pit sumps	60.00
2 pit pumps complete	425.00
2 iron gratings over counterweight pit sumps	20.00
60 lin. ft. black iron pipe railings on stairways and platforms below deck	0.50
2 machinery houses complete	300.00
130 lin. ft. galv. iron pipe railings at sides and rear of anchor piers	0.50
14 oak buffer blocks	3.00
Total	$154,601.00

★**Cleveland, Ohio.**—Following are lowest bids opened July 29 for constructing reinforced concrete floor of Clark Avenue viaduct: (a) Edw. A. Weiland, Cleveland, $78,682 (awarded contract); (b) Manson Co., Cleveland, $91,053; (c) C. A. White Co., Conneaut, $96,672; (d) Walsh Constr. Co., Davenport, $99,440; (e) M. P. Platten, Cleveland, $101,230. (F. D. Richards, Bridge Engr.)

	*(a)	(b)	(c)	(d)	(e)
7,500 cu. yd. 1:2:4 concrete	$6.95	$8.10	$9.12	$9.40	$8.90
1,050,000 lb. reinforcing bars	0.0225	0.026	0.0248	0.025	0.03
40,000 sq. ft. asphaltum coating	0.0675	0.07	0.05	0.06	0.06
580 lin. ft. 3½-in. Mason safety treads	0.40	0.35	0.40	0.50	1.00

★**Portland, Ore.**—Contract awarded by Comm. of Public Works to Brayton Eng. Co., Portland, for construction of warehouse B and concrete viaduct at west end of slip, at $88,500. Work includes filling for floor foundation and constructing warehouse with appurtenances, using a reinforced concrete pile foundation under northerly wall of warehouse, preparing roadbed and laying trackes in rear of warehouse and excavating and constructing reinforced concrete viaduct paved with standard wood block pavt. at Front Street end of slip adjoining Municipal Dock No. 1. Next three lowest bids on this proposition Palmer-Ellison Constr. Co., $87,[illegible]; Beers Bldg. Co., $87,274; Anton Teller, $88,784.

PAVING AND ROADS

PROPOSED WORK

★**Meriden, Conn.**—Contract for paving Hanover Street with concrete and wood block awarded by Bd. Pub. Wks. to Leonardo Suzio, Meriden, at about $5,000.

Buffalo, N. Y.—City Council voted to pave Bailey Avenue, Erb, Ganson, Milnor, Potter, Pratt, Rees, Skillen, W. Ferry and Virgil Streets.

New York, N. Y.—Following is list of streets to be paved during September, in borough of Manhattan (Marcus M. Marks, Pres.) Granite on Madison Street, from Roosevelt Street to New Chambers Street, and sheet asphalt on Forty-fourth Street, from Madison Avenue to a point about 124 ft. E. E. C. L.; Forty-eighth Street, Broadway to Eighth Avenue; Fiftieth Street, Madison Avenue to a point averaging 325 ft. E. E. C. L.; Sixty-sixth Street, Park to Fifth Avenue; Seventy-sixth Street, Lexington to Park Avenue; 104th Street, Central Park West to Manhattan Avenue; Broadway, Forty-seventh Street to Columbus Circle, from curb to rail (granite between tracks).

Rockaway Beach (P. O. Far Rockaway), L. I., N. Y.—Contract will be let in fall for repaving Boulevard, cost about $80,000. Maurice E. Connolly, Pres. Boro. Queens, Long Island City.

Rochester N. Y.—Council considering paving with asphalt of Ellicott Street, to cost $20,000; Granger Place, $13,000; Suter Terrace, $3,400 and Norton Street, $66,500.

★**Yonkers, N. Y.**—Contracts for improving streets awarded by Bd. Contract & Supply as follows (bids opened Aug. 2) to William Hopper, Yonkers, for Chase Avenue and Tibbets Road at $23,536, to O'Rourke Contr. Co., 12 Broadway, Yonkers, for Morsemere and Park Avenues and Adams and Wilson Places at $22,904.

New Brunswick, N. J.—Contract about to be let by Bd. Freeholders, New Brunswick, for paving road from Weston's Mill to Commercial Avenue.

Farrell, Pa.—Bonds for $40,000 street improvement will be sold Aug. 17 by John J. Nolan, Boro. Secy.

Scranton, Pa.—City Council voted to pave Wyoming and Monsey Avenues and construct sidewalks on Brook Street; cost about $20,000.

★**Baltimore, Md.**—P. Flanagan & Sons, Baltimore, recommended for award of contract for paving Gold and Hillen Streets with asphalt at $1.09 and $1.18 per square yard respectively; total cost about $20,000.

★Contract for improving Reisterstown Road awarded by County Comrs. to American Paving & Contr. Co., Philadelphia, Pa., at $31,700.

Parkersburg, W. Va.—See "Sewerage and Sewage Disposal."

Jackson, N. C.—C. A. Moore, Secy. Bd. Road Comrs. Jackson Township, writes that new bids for constructing 8 or 10 miles of clay-gravel and sandstone roads recently rejected will not be called for until the spring.

Greenwood, S. C.—Citizens voted $100,000 permanent street paving bonds.

Tazewell, Tenn.—Contract is about to be let by County Comrs. for constructing five roads in Claiborne County, at cost about $[illegible],000.

Carrollton, Ky.—Citizens Aug. 5 voted $50,000 bonds for improving county roads. Wm. Buchanan, Co. Clk.

Bexley, Ohio.—Bonds for $63,000 for Cassady and Drexel Avenue street improvements will be sold by Chester A. Miller, Village Clk., Sept. 4.

Coshocton, Ohio.—City Council voted to pave Main Street, cost, about $9,563.

Dayton, Ohio.—About $700,000 is to be spent by County Comrs. for constructing Tarvia macadam, brick and concrete roads.

Findlay, Ohio.—Bonds for $86,000 for Main Street improvement will be sold, it is reported, Sept. 4, by Richard O. Munngen, City Aud.

Montville, Ohio.—Citizens voted $30,000 bonds for constructing roads.

New Washington, Ohio.—Bonds for $11,000 for paving portions of various streets will be sold Aug. 23 by O. C. Tobin, Village Clk.

Carlinville, Ill.—Bd. Local Improvements voted to pave First North Street; estimated cost, $20,591.

Jacksonville, Ill.—Bd. Local Improvements voted to pave W. State St. with brick, cost $53,467.

Council Bluffs, Iowa.—Council has adopted resolution providing for paving 10 streets and 3 alleys, mostly with concrete and some brick.

Anoka, Minn.—See "Sewerage and Sewage Disposal."

Anaconda, Mont.—City Council voted to pave Hickory Street and Park Avenue; cost, $60,000.

Eureka Springs, Ark.—County Court has ordered a road improvement district, and it is expected the district will sell $50,000 bonds for construction of a macadamized highway and a steel bridge between Eureka Springs and Seligman. J. A. Brulzford, Chmn. County Road Com.

Victoria, Tex.—Bonds for $100,000 will be sold Aug. 30 by C. A. Wertheimer, City Secy., as follows: $30,000 bridge and street improvement; $30,000 fire station; $40,000 electric light.

Santa Fe, N. Mex.—About $500,000 is to spent by State Highway Comn. for road improvements.

Cathlamet, Wash.—Plans completed and contracts will be let by State Highway Comn., Olympia, in near future on 2 sections of State Road No. 19 in Wahkiakum County.

Seattle, Wash.—Contract about to be let by Bd. Pub. Wks. for paving E. Columbia Street, brick pavement on Mill Street, concrete walks on Stroud Avenue.

City Engineer estimates cost of paving Hamlin and Shelby Streets at $18,173 and resurfacing First Street with asphalt at $22,000.

Contract about to be let by Bd. Pub. Wks. for paving Popular Place, cost $10,000; paving south side Market Street, cost $25,000, and for filling and planking Ninth Avenue south, $107,000.

Contract is about to be let by County Comrs. for road improvements as follows: grade and gravel, 6 miles highway between Franklin and Black Diamond, cost $56,000; grade and gravel, 6 miles highway between Black Diamond and Maple Valley, cost $60,000, and crushed rock surface on highway through Issaquah, cost $10,000.

Astoria, Ore.—City Council voted to pave Eleventh Twelfth and Franklin Streets with brick and asphaltic concrete, also Niagara, Seventh, Olney and Fifteenth Streets with Warrenite.

Baker, Ore.—County Comrs. considering constructing hard surface road from Baker to Halfway; cost about $150,000.

The Dalles, Ore.—Comrs. Wasco County contemplate constructing 25-mile road from Wards Mill near Dufur to Government Camp.

San Mateo, Cal.—Contract about to be let by Bd. Trus. for resurfacing streets with asphalt; cost about $150,000.

Wallace, Idaho.—Geo. W. Walker, City Clk., writes it is proposed to pave Bank, Cedar, Pine and River Streets about 52,000 sq. yds. bitulithic or Bitu-Mass, 15,000 lin. ft. concrete curb and gutter, foundation of rubble; probable cost $100,000. Engineer, R. S. Merriam of Wallace.

BIDS DESIRED.

Brooklyn, N. Y.—Until Aug. 18 by L. H. Pounds, Boro. Pres., for regulating, grading, curbing and paving portions of Eighty-third Street, W. Fifteenth, Sackman, Union, Sixty-sixth Streets, Kings Highway and Lincoln Place, in all 25,341 sq. yd. asphalt pavement, etc.

Buffalo, N. Y.—Until Aug. 18 by Francis G. Ward, Comr. Pub. Wks., for paving Seventh and Sprenger Streets and Stewart Avenue and repaving Peckham and North Streets.

Long Island City, L. I., N. Y.—Until Aug. 19 by Maurice E. Connolly, Pres. Queens Boro., for granite block pavement on portion of Grand Street, 7300 sq. yd. Security, $15,000.

New York, N. Y.—Until Aug. 18 by Park Comrs. (Cabot Ward, Pres.), for following: 75,000 gal. refined coal tar; 75,000 gal. tar road oil, 5500 cu. yd. trap rock screening, 3000 cu. yd. grits.

Yonkers, N. Y.—Local press reports state bids desired until Aug. 16 by Bd. Contract and Supply, for paving.

New Brunswick, N. J.—Until Aug. 23 by County Bd. Chosen Freeholders, New Brunswick, for constructing the South Amboy-Keyport Road, from South Amboy city line to the Monmouth County line at Whale Creek in two sections, Section 1 to be paved with vitr. brick on concrete base and Section 2 with bituminous concrete on the old macadam base. Alvin B. Fox, Co. Engr., Perth Amboy.

Pittsburgh, Pa.—Until Aug. 16 at the office of the City Controller, for grading, curbing and paving portions of Travella Boulevard, Stanford Road, Mina, Crombie and several other streets. Bids desired on sheet asphalt, block stone and vitr. brick.

Bel Air, Md.—Until Aug. 16 by County Comrs. (W. A. Wheeler, Clk.) for building a section State aid highway, upon or along the Norrisville and Lancaster Road, between Norrisville and Pennsylvania line, about 1.3 miles.

Hagerstown, Md.—Until Aug. 17 by County Comrs., Hagerstown (Harry M. Hartle, Clk.), for constructing a section of State aid highway through the town of Fiddlersburg, about 1 6/10 miles; also on road leading from Cearfoss to Fairview, about one mile; also on road leading from St. Paul's Church to McLaughlin Schoolhouse, about one mile.

Princess Anne, Md.—Until Sept. 7 by County Comrs., Princess Anne (John F. Holland, Clk.), for constructing a section of State aid highway along the Eden Rd. between Allen and Eden, about 2.01 miles.

Tallahassee, Fla.—Until Sept. 9 by A. H. Williams, City Clk., for furnishing material, grading, curbing, paving and storm drainage work. Isham Randolph & Co., Engrs., Heard Building, Jacksonville.

Akron, O.—Until Aug. 27 by County Comrs. for grading, curbing and paving Section No. 2, Norton Center Road, from the westerly terminus to the present improvement on said road to the county line, between Medina and Summit counties.

Until Aug. 21 by Bd. Control, for paving Bank Alley, Federal, Perkins, E. North Streets and Home Avenue; paving and walks on Margaret, W. North and Beardsley Streets; in all about 25,500 sq. yds. brick paving on 4-in. concrete base. C. P. Parker, Dir. Pub. Service.

Bowling Green, Ohio.—Until Aug. 16 by Joint Bd. County Comrs., Wood and Sandusky counties, at Bowling Green, for grading, draining and macadamizing a road petitioned by H. J. Kaemming, and others, about 1½ miles.

Cadiz, Ohio.—Until Aug. 27 (extension of date from Aug. 9) by W. H. Lucas, Village Clk., for paving with brick, 8512 sq. yd. on Park, St. Clair, Charleston and Grant Streets.

Canton, Ohio.—Until Aug. 17 by Z. W. Kent, Dir. Pub. Service, for paving and improving Tenth Street, N. W., and Eighth Street, S. W.; improving Fourteenth Street, N. E., and constructing Shriver Run storm water sewer.

Canton, Ohio.—Until Aug. 17 by Director Public Service for grading and surfacing portions of Meyer Park, Park Avenue and other streets; also paving several streets.

Chillicothe, Ohio.—Until Aug. 23 by Robert E. Alexander, Co. Aud., for furnishing material, reflooring Kilgore Bridge over Scioto River, Scioto Township, with a kreodone floor.

Cleveland Heights, Ohio.—Until Sept 7 by H. H. Canfield, Village Clk., for paving with brick, asphalt or macadam portions of Derbyshire Road and Cedar Road. F. A. Pease, Engineering Co., 804 Marshall Building, Cleveland, Engr.

Columbus, O.—Until Aug. 23 by County Comrs. for improving and macadamizing Manhattan Avenue Road, and grading, draining, curbing and paving Mock Road, both in Clinton Township; grading, draining and macadamizing John Karl Road, Sharon Township; grading, draining and macadamizing McDonald Road and Grove Avenue Road, Truro Township.

Eaton, Ohio.—Until Aug. 30 by Earl Dalrymple, Village Clk., for 3800 sq. yd. pavement on W. Main Street. Bids desired on brick, asphaltic concrete, reinforced concrete and bituminous concrete.

Marion, Ohio.—Until Aug. 20 by County Comrs., for improving Ruehrmund Free Turnpike Rd., requiring 7797 sq. yd. rolled stone macadam.

Newark, Ohio.—Until Aug. 20 for paving Buena Vista Street 3200 sq. yds.; Killer Avenue, 2500 sq. yds.; Hoover Street, 6000 sq. yds., and Charles Street, 3500 sq. yds. All kinds of paving material considered—brick preferred. Address C. H. Wells, City Engr.

Ohio.—Until Aug. 20 by Clinton Cowen, State Highway Comr., Columbus, for improvements on following roads (work in all counties includes bridges and culverts, grading roadway and paving):

Adams County, Section "B" of West Union-Sinking Springs Road, Meigs and Franklin Townships, paving with waterbound macadam (single course); length 15,833 ft.; cost $16,300.

Athens County, Section "G" of Athens-McArthur Road, Alexander Township, paving with brick; length 7605 ft.; cost $36,083.

Clinton County, Section "D" of Cincinnati-Chillicothe Road, Jefferson, Washington and Clark Townships, paving with waterbound macadam; length 31,055 ft.; cost $48,531.

Clinton County, Section "C" of Cincinnati-Chillicothe Road, Marion Township, paving with waterbound macadam (single course); length 15,500; cost $18,549.

Fayette County, Section "J" of Hillsboro-Washington C. H. Road, Union Township, paving with brick; length 3000 ft.; cost $9,045.

Fayette County, Section "H" of Springfield-Washington Road, Union Township, paving with brick; length 2800 ft.; cost $8,917.

Fayette County, Section "I" of Washington-London Road, Paint Township, paving with brick; length 5740 ft.; cost $18,679.

Fulton County, Section "H" of Toledo-Angola Road, Royalton Township, paving with waterbound macadam; length 13,312 ft.; cost $23,226.

Fulton County, Section "J" Archbold-Fayette Road, German Township, paving with surface treated macadam; length 5285 ft.; cost $7,492.

Fulton County, Section "I" of Toledo-Angola Road, Chesterfield Township, paving with waterbound macadam; length 5300 ft.; cost $9,032.

Guernsey County, Section "L" of Cambridge-Caldwell Road, Cambridge and Jackson Townships (two sections). Contract 1, paving with bituminous macadam; length 11,500 ft.; cost $30,219. Contract 2, grading roadway; length 6643 ft.; cost $9,725.

Guernsey County, Section "L" of Cambridge-Caldwell Road, Jackson Township, constructing superstructure at station 61+10; cost $1,802.

Guernsey County, Section "L" of Cambridge-Caldwell Road, Cambridge Township, arch over Wills Creek; cost $11,549.

Henry County, Section "D" of Wauseon-Napoleon Road, Freedom and Napoleon Townships, paving with surface treated macadam; length 29,333 ft.; cost $54,956.

Highland County, Section "I" of Hillsboro-Waverly Road, Liberty Township, paving with waterbound macadam; length 12,416 ft.; cost $18,400.

Highland County, Section "L" of Hillsboro-Washington Road, Penn Township, paving with waterbound macadam; length 4400 ft.; cost $4,935.

Jackson County, Section "J" of Jackson-Pomeroy Road, Lick and Milton Townships, paving with waterbound macadam; length 11,284 ft.; cost $15,742.

Lucas County, Section "H" of Toledo-Napoleon Road, Providence Township, paving with waterbound macadam; length 11,140 ft.; cost $23,782.

Mahoning County, Section "O" of Akron-Canfield Road, Berlin Township, paving with waterbound macadam; length 11,587; cost $18,603.

Portage County, Section "Q" of Akron-Youngstown Road, Palmyra Township, paving with bituminous macadam; length 5508 ft.; cost $13,542.

Sandusky County, Section "I" of Lima-Sandusky Road, Riley Township, paving with surface treated macadam; length 16,962 ft.; cost $40,502.

Sandusky County, Section "H" of Lima-Sandusky Road, Townsend Township, paving with waterbound macadam; length 5572 ft.; cost $10,562.

Seneca County, Section "L" of Findlay-Tiffin Road, Hopewell Township, paving with waterbound macadam; length 16,155 ft.; cost $22,808.

Vinton County, Section "J" of Chillicothe -McArthur Road, Richland Township, paving with bituminous surface treated macadam; length 5985 ft.; cost $11,620.

Williams County, Section "K" of Bryan-Pioneer Road, Pulaski and Jefferson Townships, paving with waterbound macadam; length 16,800 ft.; cost $30,581. Alternative bids for paving with bituminous macadam; cost $37,747.

For Bureau of Maintenance and Repair:

Lorain County, Section "M" of Oberlin-Elyria Road, Camden Township, paving with bituminous macadam; length 9067.7 ft.; cost $11,788.

Lorain County, Section "N" of Oberlin-Norwalk Road, Camden Township, paving with bituminous macalam; length 3472 ft.; cost $4,985.

Seneca County, Section "K" of Tiffin-Bellevue Road, Clinton and Pleasant Townships, paving with gravel macadam and reinforced concrete; length 18,419 ft.; cost $28,202.

Delaware County, Section "G" of Columbus-Sandusky Road, Liberty Township, reshaping roadway and resurfacing with waterbound macadam; length 7613 ft.; cost $9,102.

Marion County, Section "J" of Waldo-Marion Road, Pleasant Township, resurfacing roadway with waterbound macadam; length 5675 ft.; cost $10,448.

Salem, Ohio.—By Director Public Service for paving with brick Goshen Avenue and Tenth Street, about 5297 sq. yd., 4570 ft. 5 x 22-in. stone curb, etc.

Sandusky, Ohio.—Until Aug. 17 by County Comrs. (Hayes M. Adams, Clk.) for macadamizing Strecker Road, Milan and Oxford Townships, about 2½ miles.

Toledo, Ohio.—Until Sept. 3 by Charles J. Sanzenbacher, Co. Aud., for furnishing material and constructing a creosoted wood block floor and painting bridge over Maumee River at Grand Rapids, Wood and Lucas Counties.

Winamac, Ind.—Until Sept. 7 by County Surveyor for constructing the Reinholdt gravel road, Tippecanoe Township; length 3 miles; cost $9,721.

Deerfield, Mich.—Until Aug. 19 by Heman A. Pool, Township Clk., for 12½ miles of macadam road. Clarence Mun-

son of Deerfield, is Township Highway Comr. Engineers, Colman & Tyler, Kresge Building, Detroit.

Amboy, Ill.—Until Aug. 16 by Bd. Local Improv. for approximately 3950 sq. yd. brick paving and 2990 ft. combined concrete curb and gutter; also 185 lin. ft. 10 in. vitr. clay storm sewer, including catch basin connections, etc.

Aurora, Ill.—Until Aug. 16 (readvertisement) for S. River Street Improvement, about 4800 ft. combined curb and gutter, 10,000 yd. brick pavt., and 800 ft. storm sewers, advertised in Engineering Record. M. J. Tarble, City Engr.

Champaign, Ill.—Reported desired until Aug. 17 by Bd. Local Improv. (F. C. Lohman, Secy.), for 11,200 sq. yds. brick pavement.

Chicago, Ill.—Until Aug. 17 by Bd. Local Improv. (Edward J. Glackin, Secy.), for improving portions of Wentworth Avenue, W. Forty-seventh, E. Eighty-seventh and several other streets. Bids desired on vitr. brick, granite blocks and other pavement.

★Until Aug. 17 by W. R. Moorhouse, Comr. Pub. Wks., for furnishing and delivering f.o.b. cars, City side track, Marshall Boulevard, Municipal Plant, approximately 750,000 paving brick

Until Aug. 18 by Bd. Local Improv. (Edward J. Glackin, Secy.), for paving with asphalt on portions of various streets including Argyle, W. Congress, Byron Streets, Calumet, N. Hamlin, and other Avenues.

Until Aug. 20 by Bd. Local Improv. (Edward J. Glackin, Secy.), for paving with asphalt portions of several streets, including Mango, Princeton, West End Avenues, Monroe, Rice and other streets.

Illinois.—Until Aug. 18 at office of State Highway Comr., Springfield, for the following proposed State Aid Work (all cement to be furnished by the state): Livingston Co., Section C, nearest P. O. Dwight, approximate length 7838 ft. Engineer's estimate $17,974.

Milwaukee, Wis.—Until Aug. 18 for grading, paving with cement concrete from city limits of Milwaukee to South Fond du Lac road about 7500 sq. yds. H. J. Kuelling, Co. Highway Comr.

Dubuque, Iowa.—Reported desired until Aug. 19 by J. J. Shea, City Recorder, for 7430 sq. yds. brick pavement on Third Street; also 2644 sq. yds. brick pavement on Main Street and several small contracts for asphaltic pavement.

St. Paul, Minn.—Reported desired until Aug. 16 by August Hohenstein, Purchasing Agent, for grading, curbing and improving various streets.

Shakopee, Minn.—Reported desired until Aug. 23 by A. J. Mayer, Co. Aud., for three jobs on State Road No. 13 requiring grading and graveling; cost $14,000.

Neodesha, Kan.—Until Aug. 18 by J. J. Carroll, City Clk., for approximately 10,700 sq. yds. brick paving.

Bozeman, Mont.—Until Aug. 19 (readvertisement) by C. A. Spieth, City Clk., for paving and curbing in Special Improvement Dist. Nos. 94, 96 and 97, includes 5056 sq. yd. paving, etc.

Auburn, Wash.—Reported desired until Aug. 18 by James F. Lemar, City Clk., for paving, probably with asphalt, Silver, Cedar, Main, Maple and Walnut Streets, about 14,662 sq. yd. on concrete foundation and 1193 lin. ft. curb; cost $30,000.

Everett, Wash.—Reported desired until Aug. 23 by Mae Weatherbee, Co. Aud., for constructing Permanent Highways Nos. 19 and 20 near town of Pilchuck and Beverley Park, respectively, including clearing, excav., grading and graveling. Hans Munn, Jr., Co. Engr.

North Yakima, Wash.—Until Aug. 23, according to reports by Co. Comrs. for constructing Selah Heights Road and Pleasant Hill Road involving about 49,000 cu. yd. common excavation, hard surfacing, etc. O. E. Brashears, Co. Engr.

Tacoma, Wash.—Reported desired until Aug. 21 by Co. Comrs. for paving 5 miles of county road at a cost of $70,000. Bitulithic, bitucrete, warrenite, asphalt concrete, asphalt highway brick, wood block and two and one course concrete will be considered. D. H. White, Co. Engr.

Washington.—Reported desired until Aug. 30 by William R. Roy, State Highway Comr., Olympia, for clearing, grading and draining about seven miles of National Park Highway between Nema and Nasel River, Pacific Co.; also graveling about 10 miles National Park Highway between Mineral and Morton, Lewis Co

Reported desired until Aug. 30 by William R. Roy, State Highway Comr., Olympia, for clearing, grading and draining about three miles Inland Empire Highway from Union Flat Creek south in Whitman County. Probable cost, $10,000.

Ottawa, Ont.—Until Aug. 24 by F. C. Askwith, Acting City Engr., for paving Preston Street with asphalt and stone block; estimated cost $100,000, and Gilmore Street with asphalt, cost $120,000.

PRICES AND LETTINGS.

★Indicates award of contract.

★**Massachusetts**—Following are lowest bids opened Aug. 3 by the Massachusetts Highway Comn., for state highway work:

★Ashburnham, gravel road, awarded to Alco Contr. Co., 178 North Street, Boston, at $8,168. Next two lowest bids: Perini Constr. Co., Ashland, $8,211; D. H. Damon, Ashby, $10,009.

★Chelmsford, macadam road awarded to Jas. E. Watkins, Amesbury, at $12,093. Next two lowest bids: Philpot Contr. Co., Melrose, $12,454; Small & Ingalls, Bar Harbor, Me., $12,542.

★**Connecticut**—Contracts have been awarded by Charles J. Bennett, State Highway Comr., Hartford, as follows:

Vernon, about 2675 ft. of bituminous native stone macadam road on Vernon Avenue to A. D. Bridges Sons, Inc., Hazardville, at $4,843.

Ashford, about 14,960 ft. of graded road on Warrenville Road, to Connecticut Good Roads & Constr. Co., New Britain, at $21,765.

Waterford, reinforced concrete slab bridge over Jordon Brook, to Fred D. Miller, Norwich, at $1,140.

★**Buffalo, N. Y.**—City Council awarded contracts for repaving Eagle, Austin and Bridgman Streets with asphalt to German Rock & Cement Co., D. S. Morgan Building, at $46,140.

New York, N. Y.—Following are 4 lowest bids opened Aug. 3 by Pres. Borough of Bronx, for repaving with redressed granite blacks on a concrete foundation the roadway of Webster Avenue, from Claremont Parkway to E. 178th Street: (a) S. S. Davis, $47,696; (b) Cornelius Vanderbilt, $50,647; (c) Burnside Contr. Co., $52,448; (d) Lawrence Contr. Co., $54,430.

	(a)	(b)	(c)	(d)
16,150 sq. yd. redressed granite block pavt. on concrete foundation laid with cement grout joints, outside railroad area	$1.22	$1.14	$1.30	$1.30
8800 sq. yd. redressed granite block pavt. on concrete foundation with cement grout joints, in railroad area	1.00	1.12	1.30	1.25
4360 cu. yd. Class B concrete	3.56	4.25	3.80	4.25
3800 lin. ft. new curb	0.76	0.80	0.80	0.85
2700 lin. ft. old curb	0.29	0.30	0.15	0.25

New York, N. Y.—Bids were opened Aug. 3 by President Bronx Boro., for paving as follows:

Repaving with sheet asphalt and redressed granite blocks on concrete foundation Mott Avenue, from E. 138th Street to bridge over tracks of N. Y. C. & H. R. R. North of E. 151st Street: Lowest bidder Asphalt Constr. Co., as follows: 13,100 sq. yd. sheet asphalt pavement (medium traffic mixture) $1.02; 390 sq. yd. redressed granite block outside railroad area, $1.19; 180 sq. yd. redressed granite block in railroad area, $1.19; 2490 cu. yd. Class B concrete, $3.25; 1000 lin. ft. new curb, 75 cts.; 2910 lin. ft. old curb, 30 cts.; total $23,756. Other bids: Uvalde Contr. Co., $25,217; Sicilian Asphalt Co., $26,462; Barber Asphalt Paving Co., $26,953.

Repaving with granite block and sheet asphalt on concrete foundation portions of White Plains Road, from E. 227th Street to E. 241st Street. Lowest bidder, Rodgers & McManus, as follows: 1900 sq. yd. sheet asphalt pavement (medium traffic mixture), 90 cts.; 7060 sq. yd. granite block pavement, $2.91; 1430 cu. yd. Class B concrete, $4; total, $27,948. Other bids: Asphalt Constr. Co., $29,192; Uvalde Contr. Co., $29,800.

Regulating, grading, setting curb, flagging, laying crosswalks, building approaches and erecting fences where necessary in Victor Street. Lowest bidder: T. Tenore, at $7,740.

★Contracts awarded by President borough of Manhattan to Sicilian Asphalt Paving Co., 31 Park Row, for repaving with sheet asphalt: Twenty-fifth Street, Seventh to Eighth Avenue; Fifty-fifth Street, Third to Park Avenue; Fifty-fifth Street, Sixth to Seventh Avenue; Sixty-fourth Street, Fifth to Park Avenue; Eightieth Street, Fifth to Lexington Avenue; Eighty-fifth Street, First to Park Avenue; Sixty-seventh Street, Fifth to Park Avenue; in all about 25,040 sq. yd., at a total of $61,724.

★**Rochester, N. Y.**—Contract for paving Culver Road with asphalt awarded by Bd. Contract and Supply to Whitmore, Rauber & Vicinus, 279 South Avenue, at $35,676.

★**Utica, N. Y.**—Contract for constructing parkway westerly from Genesee Street awarded by Bd. Contract & Supply to Harry W. Roberts & Co., Utica, at $14,952 for bitulithic.

★**Trenton, N. J.**—Contract awarded July 28 for paving six streets with asphaltic concrete to Newton Paving Co., Trenton, at $45,913 and repaving State Street with brick to Antonio D'Lucia, Trenton, at $5,673. H. F. Harris, Asst. City Engr.

Pennsylvania. — Following are lowest bids opened by State Highway Dept., Harrisburg (Robert J. Cunningham, State Highway Comr.), for state aid road construction:

★Stroudsburg, 4871 ft., 22 to 57 ft. wide: Franklin Contr. Co., 52 Vanderbilt Building, New York, $45,623 (awarded contract); Philadelphia Paving Co., Philadelphia, $47,669; Frank P. Meckus, Long Pond, $47,796; Jacob Stem, Stroudsburg, $49,465.

★Muncy, 5843 ft., 16 ft. wide: Dwyer & Co., Philadelphia, $41,877 (awarded contract); B. H. Coryell, Williamsport, $42,-603; E. H. Brua, Hollidaysburg, $43,117; Belle-Bockel Co., Inc., Altoona, $43,942.

★Milton, 4940 lin. ft., 16 ft. wide: Fogel & Co., Hollidaysburg, $28,144 (awarded contract); E. H. Brua, Hollidaysburg, $28,910; Dwyer & Co., Philadelphia, $29,-513; Curwensville Constr. Co., Curwensville, $30,049.

★**Pittston, Pa.**—Contracts awarded by City Comrs. for paving Parsonage and Railroad Streets with brick to Joseph Newcomb, Pittston, at $14,865, and to O'Brien Bros., Avoca, at $8,076.

★**Georgetown, Del.**—Contracts for the first two sections of the Du Pont Boulevard awarded as follows: First section, from Millsboro to Frankford, 4 miles, to Ernest Palmer, Wallingford, Pa. (bids opened July 31), and second section, also 4 miles, from Georgetown to Stockley, awarded Aug. 9, to Utility Constr. Co., New Brunswick, N. J. Second section to cost $35,544. Roads to be of reinforced concrete. C. M. Upham, Engr., Georgetown.

★**Tacoma Park, D. C.**—Contract awarded to Harper & Voight Co., 717 Fourteenth Street N. W., Washington, D. C., at $2.45 per running foot on a 20-ft. roadway, 5 in. thick, with 6 x 12 ft. curb (bids opened July 26). Ben. G. Davis, City Clk. and Treas.

★**Staunton, Va.**—Contract awarded for macadamizing about 4 miles roads in Middle River Dist. to Sands, Kline & Co., Staunton, at $15,885 (bids opened Aug. 6).

★**Kissimmee, Fla.**—Contract for paving 3 miles roadway, from Orange County Line to city limits of Kissimmee, with brick awarded by County Comrs. to Alabama Paving Co., Birmingham, Ala., at $28,000.

★**Dyersburg, Tenn.**—Contract for paving Depot, Market, Finley and Sampson Streets awarded by Bd. Mayor and Aldermen to Memphis Asphalt & Paving Co., Memphis.

★**Ashley, Ohio.**—C. W. Riddle, Delaware, secured a $65,000 paving contract in Ashley.

★**Ashtabula, Ohio.**—Contract awarded July 29 by Director Pub. Service (Lulu Rennick, Clk.), for grading, draining and paving portions of Starkweather and Grove Avenues, Spencer, Todd and Booth Streets, to T. P. Fitzgerald of Ashtabula.

★**Cincinnati, Ohio.**—Contract for macadamizing Marshall Avenue awarded by Bd. Control to C. N. Danenhower, 414 Elizabeth Street, at $11,427.

★**Delaware, Ohio.** — Contract awarded July 31 for grading and macadamizing .56 miles to Baker Constr. Co. of Centerberg.

★**Lima, Ohio.**—Contract awarded July 29 for 35,186 sq. yd. concrete pavement to Henry Erick, Lima, at $45,536. H. J. Lowlor, Co. Aud.

★**Steubenville, Ohio**—Contract for constructing Yellow Tree Turnpike 6.2 miles awarded to H. W. McDonald, Steubenville, at $49,500. John L. Means, Co. Aud.

★**Xenia, Ohio.**—Contract for 17,200 sq. yd. on Church and King Streets awarded to Weil-Roth Co., Cincinnati, at about $47,000 (bids opened July 20).

★**Franklin, Ind.**—Contract awarded by County Comrs. for constructing three gravel roads (bids opened Aug. 2) as follows John M. Murphy, Greenwood, $9,420; Byers & Byers, Trafalgar, $7,975, and Frank Myers, Greenwood, $7,300. H. L. Knox, Co. Aud.

★**Goshen, Ind.**—Contract awarded by Co. Comrs. Aug. 3 to Henry Cripe of Goshen for constructing Goshen and Elkhart Road at $44,025.

★**Jasper, Ind.**—Contract awarded Aug. 2 for constructing three gravel roads in Boone Township to Trayler & Krempp of Jasper.

★**Rochester, Ind.** — Contracts awarded Aug. 3 for constructing stone and gravel roads as follows: Stone roads to Freemont Wilson, Marion, at $16,853, and gravel to F. J. Williams, Macy, at $19,194. W. C. Miller, Co. Aud.

★**Tipton, Ind.**—Contract awarded Aug. 2 for constructing concrete road to Madison Constr. Co., Anderson, at $7,450. Oscar Vanness, Co. Aud.

★**Fulton, Ill.**—Contracts for paving have been awarded by Bd. Local Improvement (J. C. Snyder, Secy.) as follows (bids opened Aug. 2): Lincoln Way, about 12,963 sq. yd. vitr. brick to T. J. McCarthy, Davenport, Iowa, at $1.71 per sq. yd. Next three lowest bids: A. E. Rutledge, Rockford, $1.77; Thos. Carey & Sons, Clinton, Iowa, $1.79; Central Engineering Co., Davenport, Iowa, $1.80.

Fifteenth Avenue, concrete paving, 12,-520 sq. yds. to Central Eng. Co., Davenport, Iowa, at $1.139. Next three lowest bids T. J. McCarthy, Davenport, Iowa, $1.24; Canterbury Bros., Peoria, $1.36; Kelly Bros., Morrison, $1.37.

★**Rockford, Ill.**—Contract for paving with brick Latham Street awarded to A. E. Rutledge, Rockford, at about $25,600.

★**Janesville, Wis.**—Contract for paving (bids opened by City July 27) awarded to Gund-Graham Co., Waukesha, for paving Wisconsin and S. Bluff Streets, about 6444 sq. yd., with asphalt macadam, at $6,714; and Morton Avenue, with Purington block, at $12,490.

★**Centerville, Iowa.**—Contract for 19,500 sq. yd. concrete pavement awarded to D. E. Keeler Co., Davenport, at $1.32 per sq. yd.

★**Mt. Gregor, Iowa.**—Contract awarded Aug. 2 for paving Main Street, from Front to Center Streets, to James F. Lei of Dubuque, as follows 19,353 sq. yds. brick block paving, $2.14; 1297 cu. yds. extra grading, 40 cts.; 1420 lin. ft. straight curb, 35 cts.; eight catch basins, each, $25; 460 lin. ft. 15-in. inlet sewer, 99 cts.; 250 lin. ft. 12-in. inlet sewer, 85 cts. F. C. Sloane, City Clk

★**Fort Scott, Kan.**—Contract for paving three miles on Coleman Road with macadam awarded to C. A. Simons, Fort Scott, at $9,490. N. J. Rose, Co. Clk.

★**College View, Neb.**—Contract for paving Districts 1 and 2 awarded to Abel & Roberts, Lincoln, at $48,203 and $44,939 respectively. (Bids opened Aug. 2). J. E. Winter, Mayor.

★**Kearney, Neb.** — Contract awarded Aug. 3 for brick and stone auditorium for the State Normal School, including heating, plumbing, general construction and electric wiring to W. F. Crossley, Kearney. J. H. Craddock, Archt., Omaha.

★**Lincoln, Neb.**—Contract for paving highway between Lincoln and University Place awarded by University Place Commercial Club to Abel & Roberts, Lincoln, at $2.18 per sq. yd.; total cost about $35,000.

★**Lewistown, Mont.**—Contract for paving alleys in business district with brick and Fifth Avenue with bitulithic awarded by City Council to J. C. McGuire, Lewistown, at $38,514.

★**Missoula, Mont.**—Contract awarded to J. A. Maguire, Butte, for 6660 sq. yd. standard bitulithic pavt. on 5-in. concrete base, at $21,252 (bids opened Aug. 3). Other bids: G. H. Nash & Co., Missoula, $22,328, and Rohn Constr. Co., Butte, $23,592. L. E. Harris, City Clk.; E. S. Hathaway, City Engr.

★**Missoula, Mont.**—Contract awarded Aug. 3 for 7000 sq. yd. standard bitulithic pavement to J. C. Maguire of Butte, at $21,252. Other bids: Nash & Co., Missoula, $22,328, and Rohn Constr. Co., Butte, $23,572. L. E. Harris, City Clk.

★**McKinney, Tex.** — Contract awarded July 29 for 23,000 yd. asphalt pavt., 7000 sq. yd. brick pavt. and 1700 ft. curb and gutter awarded to Levy & Levy, Dallas, at $58,605. Other bids: Kaw Paving Co., Topeka, Kan., $59,600; Roach-Manigan Paving Co., Fort Worth, $61,015. Chas. Schultz, City Engr.

★**San Antonio, Tex.**—Contracts for paving (bids opened July 15) awarded as follows:

To Rushmore & Gowdy, 1115 E. Commerce Street, for paving S. Flores Street with 3-in. vert. fiber brick, 5-in. cement base, 14,600 sq. yd., at $2.533 per yd.; $37,989; Marlet Street, 3½-in. wood block, 5590 sq. yd., $3.11, $17,511; E. Houston Street, 3-in. wood block, 11,320 sq. yd., $2.95, $33,400.

To Texas Granitoid Co., Frost Building, Presa Street from G. H. & S. A. Ry. crossing to Mitchell Street, 13,600 sq. yd., $2.40, $32,882; S. Flores Street with granitoid, 13,110 sq. yd. $2.32, $34,743; S. Presa Street, Mitchell Street to City Limits with granitoid, 9980 sq. yd., $2.41, $24,196.

Western Paving Co., Oklahoma City, Okla., River Avenue, 2-in. asphalt concrete, 5-in. Trinidad cement base, 13,772 sq. yd., $1.95, $27,004; Josephine Street, 2-in. asphalt concrete, 5-in. cement asphalt base, 5850 sq. yd., $1.95, $11,490.

O. C. Chapin, Hall Building, Kansas City, Mo., Grayson Street, reinforced concrete bitulithic top, 10,540 sq. yd., $1.87, $19,821.

Roach-Manigan Paving Co., 219 Gunter Building, Houston Street, 3½-in. creosoted pine block, 17,770 sq. yd., $2.92, $52,086; Navarre Street, 3½-in. wood block, 3530 sq. yd., $3.12, $11,091.

Uvalde Rock Asphalt Co., asphalt, 5-in. cement base, 12,520 sq. yd., $2.04, $25,737.

Eureka Paving Co., Houston, Tex., San Pedro Avenue, 2½-in. asphalt concrete, 15,320 sq. yd., $2.20, $33,973.

Bellingham, Wash.—Lowest bids opened by City Council for 7700 sq. yd. pavement on Elk Street submitted by Independent Asphalt Paving Co., Northern Bank Building, Seattle, at $11,287 for asphalt, and Petersen, Webel & Hawkins, Bellingham, at $12,637 for concrete.

★**Seattle, Wash.**—Contract for constructing 8 miles Permanent Highway No. 7B between Issaquah and Fall City, awarded by County Comrs. Bids opened Aug. 21 to M. P. Zimbart, Alaska Bldg., Seattle, at $23,810 for crushed rock surface.

★Contract for constructing concrete bridge and paving with concrete Permanent Highway No. 11, between Buckley and Enumclaw, awarded by County Comrs. to Albina Engineering Co., American Bank Bldg., Seattle, at $40,328.

★Contract for paving Massachusetts Street awarded by Bd. Pub. Wks. to Ferguson Constr. Co., White Bldg., Seattle, at $24,502.

★**Astoria, Ore.**—Contract for paving [illegible] sq. yd. on Eleventh, Twelfth, Fourteenth and Franklin Streets with Hillside brick and asphalt awarded by City to William H. Oller, Seattle, Wash., at $22,528.

★**Astoria, Ore.**—Contract for paving Twelfth and Eleventh Streets, about 11,000 sq. yd., with asphaltic concrete, and Hillside brick on 6-in. concrete foundation, awarded to William M. Oller, Seattle, at $24,529.

Eugene, Ore.—Following bids opened by City Council for paving 11 blocks on Adler Street: Clarke-Henry Constr. Co., Portland, $34,728, and Warren Constr. Co., Portland, at $32,915.

★**McMinnville, Ore.**—Contract for improving about 3½ miles road known as Sandpiper Cut-Off awarded to Tillamook Bay Constr. Co. of Bay City, at $18,863. Bids opened July 24. J. C. Halden, Co. Clk.

Portland, Ore.—Following lowest bids opened by County Comrs. for paving sections of St. Helens Road with bituthitic (a) 13,350 sq. yd. in Section A and (b) 4080 sq. yd. in Sections B, C, H. and L., Warren Constr. Co., Portland (a) $20,615, and Oskar Huber, Portland, $9,036.

★**Orange, Cal.**—Contract for paving 5.7 miles Santiago Boule awarded by Bd. Supervisors to Fred Hoffman, Los Angeles, at $19,498.

Sanger, Cal.—Lowest bid opened for macadamizing 2 miles streets submitted by J. W. Haynes, Oakland, at $19,953.

STREET CLEANING AND GARBAGE DISPOSAL

PROPOSED WORK

Cincinnati, Ohio.—We are informed that no estimates have yet been prepared for the garbage incinerating plant. It is merely a tentative proposition. F. S. Krug, Ch. Engr. Bd. Pub. Service.

BIDS DESIRED.

Columbus, Ohio.—Reported desired until Aug. 15 by George A. Barden, Dir. Pub. Service, for ten 16 cu. yd. rubbish wagons, six 4 cu. yd. dump wagons, four sprinkling wagons and one horse drawn power pressure flusher.

Decatur, Ill.—The Geo. Alix Garbage Co., 117 Bridge Street, Peoria, desires bids for an incinerator, and are under bond to city of Decatur to have same completed within 6 months; this company has contract to collect garbage, refuse and ashes for 3 years.

Ottawa, Ont.—Until Aug. 26 by Chairman and Members, Bd. Control, for an incinerator. Estimated cost $50,000. F. C. Askwith, Acting City Engr.

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS

PROPOSED WORK

Power Development—Rutland, Vt.—Harriman Power Co. reported as being formed by Irving M. Ernst, Gryphon Building, and others, for extensive power development in northern section of Rutland County.

Bulkhead and Pier—Eddystone, Pa.—Baldwin Locomotive Works, Philadelphia, has petitioned Commissioners of Delaware Co. for permission to construct a bulkhead and pier on the Delaware River at Eddystone, to be constructed concrete 500 ft. long and 125 ft. wide, with rail equipment for handling freight, especially locomotives.

Wharves—Jacksonville, Fla.—Government permits have been received, and contracts will soon be let for construction of about 5054 lin. ft. of wharves at Commodores Point on St. Johns River, Jacksonville, for the Commodores Point Terminal Co., Herbert D. Mendenhall, Consulting Engr., 218 Parker Street, Jacksonville. Wharves will be of continuous longitudinal type, paralleling channel. Improvement includes 394 ft. wooden cross construction, 700 lin. ft. Steel Sheet Pile construction, and about 5070 lin. ft. Concrete-steel construction. All frontage will be filled in solid to 4 ft. above Mean Low Tide with sand dredged from river; channel will be dredged to 30 ft. along face of wharves and to 12 ft. in slips at either end.

Canal—Ocala, Fla.—Robert F. Rogers, Pres. Bd. Trade, writes that proposed municipal and U. S. Government canal, to be constructed from Silver Springs to Ocala, will cost $300,000. Awaiting U. S. Government survey.

Drainage—Gueydan, La.—Warren B. Reed, Reclamation Engineer, Morgan City, reported making a survey of Eighth Ward drainage project, to reclaim 65,000 acres of land at a cost of about $200,000. Bond issue will soon be voted.

Drainage—Cruger, Miss.—Surveys underway by M. L. Culley, of Jackson, for Abaca Drainage District; J. L. Lundy, Comr.

Drainage—Fort Madison, Iowa.—Plans reported completed by Edmund T. Perkins, Chicago, Ill., for construction of drainage district for Green Bay Township bounded by Mississippi and Skunk River, estimated cost $348,000 for establishment of drainage district, levees, drains, etc., and $47,000 for building pumping station.

Ditch—Duluth, Minn.—A. E. Dyer, County Road Engr., for Range District, has filed with County Auditor a report on County Ditch No. 4, to be constructed in townships 52, 53 and 54 along Alborn branch of the Duluth, Missabe & Northern Railroad, and estimates cost at $120,000.

Docks and Warehouse—St. Louis, Mo.—President Kinsey of the Bd. of Pub. Service has been authorized to complete plans for municipal dock and warehouse at Chain of Rocks, to cost about $250,000.

Dike—Cathlamet, Wash.—County Comrs. reported to have approved plans for diking District 1, as prepared by G. A. Kyle of Portland, to include construction of dike, installation of pumps, etc.; cost about $160,000.

Bulkhead, Etc.—Seattle, Wash.—Reported County Comrs. (Byron Phelps, Clk.) have approved plans for filling and bulkheading East Marginal Way; approximate cost $50,000.

Flood Protection—Los Angeles, Cal.—Final report of Bd. of Flood Control Engineers, has been filed with Bd. of Co. Supervisors, estimates probable cost of providing flood protection in Los Angeles County at approximately $16,000,000. Of this $4,000,000 is figured as cost of conservation work and $12,000,000 to construct channels throughout county.

Power Plant—Panama.—It is reported that plans being considered by Government of Republic of Panama for development of water falls in the interior, for manufacture of electric light and power. It is proposed to invite foreign capital to undertake the lighting of several important interior towns in the vicinity of which ample water power exists.

BIDS DESIRED.

State Canal Work—Albany, N. Y.—Until Sept. 8 by W. W. Wotherspoon, State Supt. Pub. Wks., for following work: Contract L, Cayuga and Seneca Canal, constructing substructure, superstructure and approaches to highway bridge at Gorham Street, Waterloo, and Kingdon Road Bridge, between Waterloo and Seneca Falls; Engineer's estimate, $71,469; Terminal Contract No. 40, constructing harbor and dockwall on north side of Mohawk River, east of highway bridge, at St. Johnsville; Engineer's estimate, $27,963.

Dredging—Baltimore, Md.—Until Sept. 15 by U. S. Engineer's Office for dredging certain rivers and harbors on east shore Chesapeake Bay, advertised in Engineering Record.

Dam—Toccoa, Ga.—Until Aug. 30 by H. J. Cox, City Clk., for furnishing material and constructing a sectional concrete-wood dam. H. M. Nabstedt, Engr.

Locks and Dams—Tallahassee, Fla.—Until Aug. 24 by Bd. Comrs. Everglades Drainage Dist., Tallahassee, for constructing 3 locks and dams in said Dist., advertised in Engineering Record. F. C. Elliot, Ch. Drainage Engr.

Levee Work—New Orleans, La.—Reported desired until Aug. 19 by State Bd. Engineers, for levee work as follows: Cottonwood levee, 125,000 cu. yds., riverside enlargement; Salem Levee, 350,000 cu. yds., riverside enlargement; Hermitage levee, 150,000 cu. yds., Stoicup levee, 350,000 cu. yds. of earth work; Harris to Rapp levee, 17,000 cu. yds.; Pointe Maicre levee, 45,000 cu. yds.; Jeansonne Point levee, 50,000 cu. yds.; Cross levee, 300,000 cu. yds.; Diamond Island levee, 59,000 cu. yds. excav.

Drainage—Selmer, Tenn.—Reported desired until Aug. 16 by Directors Cypress Creek Drainage Dist., Selmer, for constructing canal in two sections. First section 11,400 ft. long with cross section of 18 x 12 x 6 ft. Second section, 10,900 ft. long with cross section of 20 x 13 x 7 ft. drain; 850 acres on Cypress Creek, Dredge-host excav. in sandy loam. H. P. Wood, Attorney for Dist.

Ditch—New Philadelphia, Ohio.—Until Sept. 1 by Joint Bd. Comrs. Holmes and Tuscarawas Counties, at office of County Comrs. for constructing a Joint County Ditch. R. H. Nussdorfer, Co. Aud., Secy. Joint Bd.

Ditch—Winamac, Ind.—Until Aug. 28 by C. E. Paul, Co. Surveyor, for constructing the Stoller tile ditch, about one mile, 10 to 14-in. tile.

Retaining and Sea Wall—Chicago, Ill.—Until Aug. 16 by W. R. Moorhouse, Comr. Pub. Wks., for constructing a retaining and sea wall at the east end of Montrose Avenue.

Ditch—Breckenridge, Minn.—Reported desired until Aug. 18 by P. E. Truax, Co. Aud. for digging and constructing ditch No. 6; estimated cost, $12,364.

Ditch—Montevideo, Minn.—Reported desired until Aug. 18 by J. J. Stennes, Co. Aud. for constructing County Ditch No. 18 (tile and open work). Cost, $25,850.

Irrigation Work—Fort Laramie, Wyo.—Until Sept. 8 by U. S. Reclamation Service, Tramway Building, Denver, Col., for earthwork on about 10 miles of main canal, Fort Laramie Unit, North Platte Project, Nebraska-Wyoming, involving excavating of about 1,206,000 cu. yd. material.

Dredging—San Francisco, Cal.—Until Aug. 31 at U. S. Engr. Office, San Francisco, for dredging.

Drainage Bonds—Corinne, Utah.—$175,000 drainage bonds will be sold Aug. 23, according to press reports, by Co. Bd. Superv. Corinne Drainage Dist. (C. G. Adney, Clk.). Bids for this work will be opened Aug. 21.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Dredging—New York, N. Y.—Following are the bids opened Aug. 2, for dredging (a) Hempstead Harbor: (b) Huntington Harbor (price given per cu. yd.): John and Joseph McSpirit, 118 Wayne Street, Jersey City, N. J., (a) 28 cts.; (b) 24 cts.; Maritime Dredging Co., 80 Broad Street, New York, (a) 39.5 cts.; (b) 24.5 cts.; P. Sanford Ross, Inc., Jersey City, N. J., (a) 24.2 cts.; (b) 20.5 cts.

★**Dredging—Hackensack, N. J.**—Later official reports state that contract for dredging Hackensack River has been awarded to Maryland Dredging & Contr. Co., Produce Exchange, New York, at 12.45 cts. per cu. yd. (bids for this work were opened July 15 by Col. F. V. Abbot, Corps Engrs. U. S. A., 39 Whitehall Street, New York).

★**Dredging—Tuckerton, N. J.**—Contract for dredging Tuckerton and Absecon Creek reported awarded to Hill Dredging Co., Atlantic City, at $9,107.

Dredging—Philadelphia, Pa.—Following are bids opened Aug. 9 by Col. George A. Zinn, Corps Engrs., for dredging in Delaware River on Bellevue and Cherry Island lighthouse ranges, about 30 miles below Philadelphia: (a) Section F, 1,555,000 cu. yd., (b) Section G, 1,875,000 cu. yd., (c) Section H, 1,830,000 cu. yd. (per cu. yd.): Atlantic, Gulf & Pacific Co., New York, (a) and (b) 11.4 cts.; Home Dredging Co., Mobile, Ala., (a) and (b) 12 cts.; Bowers Southern Dredging Co., Galveston, (a) 11.7 cts.; American Dredging Co., Philadelphia, (a) 9.25 cts., (b) 10.45 cts., (c) 9.95 cts.; P. Sanford Ross, Inc., Jersey City, N. J., (b) 12.4 cts.; Maryland Dredging & Contr. Co., Baltimore, Md., (b) 10.4 cts.; Eastern Dredging Co., Boston, Mass., (a), (b) and (c) 12.6 cts.

Dredging—Norfolk, Va.—Following are bids opened Aug. 4 by U. S. Engineer, Norfolk, for dredging in Inland Waterway from Norfolk, Va., to Beaufort, N. C. (price given per cu. yd): P. Sanford Ross, Inc., Jersey City, N. J., 14 cts.; Coastwise Dredging Co., Norfolk, 15¼ cts.; Bowers Southern Dredging Co., Galveston, Tex., 16 cts.; Norfolk Dredging Co., Norfolk, 19.65 cts.

★**Dredging—Jacksonville, Fla.**—Contract for dredging and rock removal, St. Johns River (bids opened July 24) awarded to Standard American Dredging Co., Oakland, Cal., at $179,065.

★**Levee Work—Greenville, Miss.**—Contract reported awarded to Bondurant Constr. Co., Hickman, Ky., for levee work at Greenville, at about $400,000.

Drain—Sturgis, Mich.—Following are 4 lowest bids opened July 27 by Drainage Com. Township of Florence (H. W. Kelley, Chmn.) for constructing Hallwood drain: Smith & Nickelson, Sturgis, $15,500; H. L. Deneen, Montpelier, Ind., $16,000; Hedge & Tyler, Coldwater, $16,948; Anais Lipe, Nappanee, Ind., $17,000.

Breakwater—Chicago, Ill.—Following are bids opened Aug. 3 for constructing rubble mound breakwater at Chicago Harbor (price given per ton of 2000 lb.): Greiling Bros. Co., Green Bay, Wis., $1.75; Great Lakes Dredge & Dock Co., Chicago, $1.29; Byrne Bros. Dredging & Eng. Co., Chicago, $1.51; Edw. Gillen Dock, Dredge & Constr. Co., Racine, Wis. (2 bids), $1.44½ (granite) and $1.40 (limestone).

Dams and Shore Protection—Rock Island, Ill.—Following are lowest bids opened July 31 by U. S. Engineer, P. O. Building, for construction and repair of dams and shore protection as follows: Buena Vista to Spechts Ferry, Iowa, Kirchner Contr. Co., Dubuque, Iowa; Montpelier to Fairport, Iowa, Builders Sand & Gravel Co., Davenport, Iowa; Quincy, Ill., to Hannibal, Mo., A. V. Fetter Co., Quincy, Ill.; Capau Gris, Mo., to Grafton, Ill., J. W. McMurry Contr. Co., Kansas City, Mo. (Contracts not yet awarded.)

★**Levee—Hannaberry, Ark.**—Contract reported awarded to Halleck & Thom, Little Rock, for constructing Farrelly Lake levee, about 4 miles in length in vicinity of Reydel and Hannaberry; cost, about $35,000.

★**Earth Work—Austin, Tex.**—Contract awarded July 31 for 360,000 cu. yd. earth work in levees, to Charles Nordstrom, Bryan, at 18.85 cts. per cu. yd. J. L. Nagle, Improv. Engr.

★**Wharf, Etc.—Houston, Tex.**—Contract reported awarded as follows on bids opened July 23: Wharf, cotton sheds and track, to Horton & Horton, Houston, $139,000; dredging, to L. T. Gaylord, $50,000; 2 elevated tanks at turning basin, to Southern Engine & Pump Co., $7,000. E. E. Sands, City Engr.

Ditch—North Yakima, Wash.—Bids were opened July 31 by J. O. Greenway, Drainage Engr., Sunnyside, for construction work in Drainage Dist. No. 25, Schedules 1 and 2:

★Schedule 1—Awarded to E. M. Moore, 524 Sheridan Ave., Tacoma, as follows: 126,520 cu. yd. excav., 11 cts.; lumber, $27, $30 and $35 per M. ft.; 90 piles, 7.68 M. ft., $19; driving 90 piles, ea., $3.50; 8 cu. yd. concrete drops and outlets, $12; wooden drop str., 611 ft., per M. ft., $75; waste water inlets, 630 ft. per M. ft., $75; total, $16,063. Next two lowest bids: Carlson, Chindahl & Anderson, Fernwell Bldg., Spokane, $16,982; Hans Pederson, Madison Blk., Seattle, $17,305.

★Schedule 2—Awarded to G. L. Cline, Mabton, Wash., as follows: Pipe, 1963 ft. 12-in., 69 cts.; 1322 ft. 10-in., 61 cts.; 4970 ft. 8-in., 50 cts.; 3317 ft. 6-in., 42 cts.; 20 surface inlets, ea., $6; 10 8-in. irrigation inlets, ea., $8; 5 10-in. irrigation inlets, ea., $10; gravel per cu. yd., $1.50; cradles per M. ft., $40; total, $6,630. Next two lowest bids: E. M. Moore, 524 Sheridan Ave., Tacoma, $7,053; Dunn & Hogan, North Yakima, $7,148.

★**Dam—Quebec.**—Contract awarded by Quebec Streams Comn. to St. Maurice Constr. Co. of Montreal, Que., for construction of St. Maurice storage dam, to impound 160,000,000,000 cu. ft.; its object is to improve power conditions of St. Maurice River. Fraser, Brace & Co., Ltd., Power Building, Montreal, will supervise the construction. The dam will involve 70,000 cu. yd. of concrete.

Dredging—Pearl Harbor, Hawaii.—Following are bids opened July 31 by Bureau of Yards and Docks, Navy Dept., Washington, D. C., for dredging about 72,000 cu. yd. at naval station, Pearl Harbor (per cu. yd.): Hawaiian Dredging Co., Ltd., 116 Merchant Street, Honolulu, 44 cts.; Lord Young Eng. Co., Ltd., 12 Campbell Blk., Honolulu, 43.5 cts.

ELECTRIC RAILWAYS

PROPOSED WORK

Schenectady, N. Y.—Public Service Comn. of Second Dist. authorized extension of Schenectady Rys. Co.'s lines from terminus at Nott Street and Wendall Avenue, Schenectady, along Nott Street, to Grand Boulevard, at East Alley, along Grand Boulevard, in Niskayuna, to Van Antwerp Road. Common Council, Mayor and Bd. Estimate approved franchise.

Pottsville, Pa.—Pottsville & St. Clair Electric Ry. Co. secured franchise from City Council to construct electric railway from Pottsville to St. Clair, distance 3 miles.

Petersburg, Va.—R. H. Mann and S. W. Zimmer received franchise to construct electric railway from Petersburg to City Point.

Jackson, Miss.—Jackson and Eastern Ry. Co. incorporated to build a steam or electric railway from Jackson to Union. Incorporators: S. A. Neville, R. W. Harris and C. J. Currie, Meridian.

Dayton, Ohio.—Dayton & St. Mary's Traction Co. incorporated to construct electric railway from Dayton to St. Mary's. Capital $10,000. Among incorporators: Dennis Dwyer, Dayton; Julius Boesal and others.

Detroit, Mich.—Detroit United Ry. Co. contemplates 14 miles of city track reconstruction in Detroit and a new crosstown line, including ¾ mile of double track and 1 mile of single track in Flint, Mich. In addition, the company will double track 7500 ft. of the Michigan Avenue line in Detroit and extend the Kercheval Avenue line 4500 ft.

San Francisco, Cal.—Work is about to begin by Oakland Terminals Ry. Co. on improving road bed on Adeline Street and Bramcroft Way; cost about $28,000.

Long Island City, N. Y.—Following are unit prices of bids opened by Public Service Comn., 154 Nassau Street, New York, Aug. 3, for station finish on Route No. 50, the Queensboro Subway extension, and on Sections Nos. 1 and 3 of routes Nos. 36 and 37, the Corona elevated railroad in Queens: (a) Snare & Triest Co., 233 Broadway, New York, $609,885; (b) Marble Arch Co., 216th Street and Broadway, New York, $735,933.

Item		(a)	(b)
750	5,000 lin. ft. stairways, wood (a) street to mezz	$1.00	$0.50
	5,700 lin. ft. (b) mezz. to platform	1.00	0.50
	3,400 lin. ft. stairways, iron (c) mezz. to platform	2.70	1.00
751	1,350 sq. ft. stair landings, wood (a) straight (street to mezz.)	0.90	0.40
	320 sq. ft. (b) offset (street to mezz.)	1.10	0.40
	1,250 sq. ft. (c) mezz. to platform	1.10	0.40
	650 sq. ft. (d) straight or offset steel plate with checkered (mezz. to platform)	1.90	1.00
752	31 tons steel columns, hangers, etc., supporting stairs	85.00	100.00
753	1,300 sq. ft. (a) concrete street landings	0.90	0.40
	40 cu. yd. (b) concrete foundations for columns	15.00	12.00
	25 each (c) concrete or brick manholes	54.00	30.00
	15 cu. yd. (d) rock excavations	10.00	4.00
754	9,600 lin. ft. oak handrails	0.55	0.80
755	6,800 sq. ft. (a) canopies over stairways	0.68	0.60
	30 each (b) canopies over street landings	75.00	60.00
	67,400 sq. ft. (c) canopies over side train platform	0.36	0.60
	48,600 sq. ft. (d) canopies over island train platform	0.34	0.60
	36,100 sq. ft. (e) special canopies over side platform (concrete station)	0.38	0.70
756	2,000 lin. ft. (a) type A railing, stairs, street to mezz	3.75	3.50
	900 sq. ft. (b) type B grille railing on stairs	1.10	1.30
	150 lin. ft. (c) type C railing	3.30	4.00
	50 lin. ft. (d) type D railing	3.80	4.00
	2,500 lin. ft. (e) type E railing around stair wells	4.50	4.00
	1,050 lin. ft. (f) type F low level railing	4.30	4.00
	5,800 sq. ft. (g) type G high railing	0.85	1.25
	3,550 lin. ft. (h) type K train platform railings	4.40	4.00
	70 each (i) additional high posts 2½ in. tubing	10.50	10.00
	360 lin. ft. (j) pipe railings	1.10	2.00
	40 each (k) metal screens for stove recesses	12.00	10.00
	325 lin. ft. (l) type L bevel railings	3.40	4.00
	1,500 lin. ft. (m) type M service railings	4.30	4.00
	6,300 lin. ft. (n) type N railings on concrete structures	1.60	4.00
757	4,700 lin. ft. (a) wind screen drop sash on train platform	4.70	8.00
	320 sq. ft. (b) wind screen fixed or swing sash enclosing stairways	0.80	1.00
	10,800 sq. ft. (c) wind screen drop sash alongside track Queensboro Bridge Plaza	1.65	1.50
760	235 each (a) standards on railings on train platforms	20.00	30.00
	25 each (a) free standing standards on island train platform	32.00	40.00
	12 each (c) standards on concrete railings on train platform	27.00	30.00
761	132,200 sq. ft. (a) wood floors on train platforms	0.19	0.30
	12,800 sq. ft. (b) 8-in. con. slab floor, including w.p., etc.	0.57	0.70
	230 sq. ft. (c) 11½-in. con. slab floor including w.p., etc.	0.80	1.00
	100 cu. ft. (d) con. encasing columns, beams and girders	1.00	1.00
	280 cu. ft. (e) concrete copings	0.90	1.00
	250 sq. ft. (f) additional cement finish on concrete as required Sec. 148	0.20	0.12
	1,725 lin. ft. (h) plat. edge con'tion supported on st. angles	0.80	1.00
	350 lin. ft. (i) plat. edge con'tion supported on wood facia	0.80	1.00
	100 sq. ft. (j) w.p. pro'tive con., wood, etc., existing con. slabs	0.40	1.00
762	2,700 sq. ft. (a) asphalt floor, including wood floor	0.30	0.50
	4,140 sq. ft. (b) 18-in. con. slab, 3-in. finish	0.55	0.50
	100 sq. ft. (c) 11½-in. con. slab, 3-in. finish	0.70	0.70
	7,800 sq. ft. (d) cement wainscoting or base	0.20	0.25
	27,500 sq. ft. (e) con. track floor over mezz., including w.p. rods, etc.	0.44	0.50
	250 sq. ft. (f) flooring for passageways	0.22	0.60
	300 each (g) ferrules for mezz. roof, including flanges	2.20	3.00
	20 each (h) trap doors or scuttles	20.00	15.00
	(z) Con. and w.p. mezz. and track floor w. side sta., as prov. Sec. 295, lump sum	8,900.00	6,000.00
762A	80,000 sq. ft. 3-in. cement floor finish	0.12	0.15
763	29,000 sq. ft. (a) ex. walls of mezz. and stairways encl. cop. fin. ex. oak int.	0.90	1.50
	9,200 sq. ft. (b) ex. walls of mezz. and stairways encl. cop. fin. ex., tile fin. int.	0.85	1.00
764	20,000 sq. ft. (a) wood partitions, including doors, windows and sheathing	0.55	1.00
765	1,000 lin. ft. (a) copper gutters	0.90	1.00
766	330 lin. ft. (a) low sliding gates	9.00	8.00
	85 lin. ft. (b) high sliding gates	13.00	10.00
	15 lin. ft. (c) folding gates	11.00	8.00
	15 lin. ft. (e) high swing gates	11.00	10.00
	18 each (f) exit turnstiles	240.00	150.00
	30 each (g) gate controls	25.00	10.00
	55 pair (h) cast iron gate posts and cross frames	28.00	30.00
	10 each (i) floor boxes (additional)	9.00	5.00
	800 lin. ft. (f) 11¼-in. galv. wrought iron pipe for gate ropes	0.30	0.20
	500 lin. ft. (k) 1-in. square steel tubing incl. cast iron fixtures, hangers, pulleys	0.60	0.20
767	3,650 sq. ft. (a) roof over mezz. and passageways ext. beyond main structure	0.62	1.00
768	6,600 lin. ft. (a) 3-in. corrugated galv. iron leaders	0.28	0.30
	240 lin. ft. (b) 3-in. cast iron leaders in place	0.60	0.30
	90 lin. ft. (c) 3-in. wrought iron leaders in place	0.80	0.50
	1,800 lin. ft. (d) 3½-in. wrought iron leaders in place	0.85	0.60
	460 lin. ft. (e) 3-in. copper leaders in place	0.55	0.50
769	1,650 lin. ft. (a) smoke flue from stove recesses in place	0.60	0.50
770	215 lin. ft. (a) smoke flue protectors on platforms	1.00	0.60
772	2 tons (a) steel framing shapes, connections	90.00	100.00
	15 tons (b) riv. st. girders, cols. and brac	74.00	100.00
	450 lb. (c) steel for expansion joints st. con. stas	0.10	0.10
	200 lin. ft. (d) steel ladders	1.50	2.00
	60 sq. ft. (e) steel ladder platforms	1.00	1.00
773	7,000 each (a) drill holes in steel exist. structure	0.25	0.15
774	350 sq. ft. (a) frames for enameled signs on mezz	1.60	3.50
	4 each (b) frames and refl'ts type A illd. sign on brkts. att'd to col.	50.00	25.00
	940 each (c) sign frames on train platform railings	1.30	3.00
	50 each (d) sign suspended from canopies	16.00	20.00
	25 each (e) sign frames illd. N. T. Island train platform incl. seat	170.00	20.00
	4,600 sq. ft. (f) enameled sign plates	0.35	0.50
	20 each (h) frame and refl's type B illd. sign on brkts. attd. con. str.	45.00	20.00
	26 each (l) sign frames illd. N. T. Is. plat. incl. shields	165.00	20.00
775	7,000 sq. ft. (a) non-slip treads without wood blocks and anchors	0.90	0.80
	3,000 sq. ft. (b) non-slip treads with wood blocks and anchors	0.95	1.00
776	1,350 sq. ft. (a) stamped sheet steel in booths on mezz	0.14	0.20
777	50 sq. ft. (a) metal lath without steel furring	0.14	0.10
	3,200 sq. ft. (b) metal lath with steel furring	0.20	0.10
778	2 each (a) type B ticket booths in place	420.00	1,000.00
	6 each (b) type BB ticket booths in place	775.00	1,000.00
	5 each (c) type D ticket booths in place	520.00	1,000.00
	4 each (d) type E ticket booths in place	520.00	1,000.00
	4 each (e) type G ticket booths in place	260.00	1,000.00
	4 each (f) type KK ticket booths in place	260.00	1,000.00
778A	2 each (a) type A news stands in place	300.00	700.00
779	475 lin. ft. (a) oak seats in waiting rooms	3.00	2.00
	70 pair (b) oak doors type GG for toilet stalls	12.00	10.00
780	200 each (a) hardware doors to toilet room, waiting room and closets	20.00	10.00
	25 each (b) hardware doors permanent enclosures between stations	8.00	10.00
	270 each (c) double hung sash	3.00	4.00
	675 each (d) casm't sash in mezz. except in T. B. encl. and enl. bet. sta.	4.60	4.00
	100 each (e) casm't sash in T. B. encl. and enclosure between stations	4.00	4.00
	320 each (f) sliding sash	1.00	3.00
	2,750 each (g) drop sash	1.00	2.00
	220 each (h) hinged sash (top and bottom)	2.50	2.00
	62 pair (i) toilet stall doors, type GG	10.00	5.00
	69 each (k) doors to panel boards and switchboard boxes	2.00	5.00
	40 each (m) vent doors	2.00	5.00
	10 each (n) on swing doors for transformer clo. under T. P.	2.00	5.00
781	110 each (a) additional hardware door checks	3.30	4.00
	100 each (b) door stops	1.55	2.00
	60 each (c) rubber covered chains	1.20	1.00
	60 each (d) push plates	1.85	3.00
	60 each (c) door pulls	2.55	4.00
	100 pair (f) kick plates	6.00	7.00
	100 each (g) push bars	4.50	1.00
	130 each (h) casement sash adj. for single sash	2.30	5.00
	120 each (i) casement sash adj. for gang of 2 sash	8.60	8.00
	10 each (j) casement sash adj. for gang of 3 sash	11.00	10.00
	20 each (k) casement sash adj. for gang of 4 sash	13.50	12.00
	20 each (l) casement sash adj. for gang of 5 sash	16.00	13.00
	35 each (m) casement sash adj. for gand of 6 sash	18.40	14.00
	45 each (n) window guard rods	1.40	20.00
782	4,670 sq. yd. (a) plaster coat on masonry and second coat on metal lath	0.90	0.50
	1,850 sq. yd. (b) first or scratch coat on metal lath	0.50	0.40
	2,500 sq. yd. (c) stucco fin. on soffits and sides of stairways at con. sta.	1.50	1.00
783	290 cu. ft. (a) common brick	0.40	1.00
	13,300 cu. ft. (b) hollow terra cotta tile	0.37	0.50
784	36 each (a) con. stove recess incl. all appurt. ex. met. screen	32.00	50.00
786	3,830 sq. ft. (a) ⅝-in. glass wainscoting and trim on walls	1.30	2.00
	775 sq. ft. (b) ¾-in. glass pipe chamber partitions	1.60	2.00
	85 sq. ft. (c) ¾-in. glass shelves	1.60	2.00
	1,470 sq. ft. (d) ¾-in. stall partitions	1.50	2.00
	230 sq. ft. (e) 1-in. glass floor slabs	2.50	2.00
	760 lin. ft. (f) curved corners and angles of glass	1.50	2.00
	60 sq. ft. (g) soapstone wainscoting and trim on walls	1.10	1.00
	280 sq. ft. (h) soapstone pipe chamber partitions	1.30	1.00
	50 sq. ft. (i) soapstone shelves	1.30	1.00
	190 sq. ft. (j) soapstone stall partitions	1.20	1.00
	20 sq. ft. (k) soapstone floor slabs	1.50	1.00
	30 lin. ft. (l) curved corners and angles of soapstone permn't encl. bet. stations	1.00	1.00
787	8,650 sq. ft. (a) copper covered walls incl. windows and doors	0.90	1.00
	10,000 sq. yd. (b) crimped galv. iron on walls and ceilings	0.12.5	0.10
	140 sq. ft. (d) galv. wire screens	0.50	0.20
	3,650 sq. ft. (e) con. fl. with cement finish	0.40	0.50
	10 each (f) galv. iron roof vents	12.00	10.00
	4,000 sq. ft. (g) roof	0.50	0.60
	200 lin. ft. (h) copper gutters	0.90	1.00
	875 sq. ft. (i) partition walls	0.60	0.40
	180 sq. ft. (j) wood floor	0.30	0.25
788	23,000 cu. ft. (a) portable enclosures between stations	0.21	0.25
788A	600 sq. ft. (a) wood flooring passys ad't to encl. bet. stations	0.20	0.50
	50 each (b) wood ladders end of platforms	2.50	10.00
789	71 each (a) plumbing fixtures water closet bowels	57.00	20.00
	50 each (b) lavartories in stations	41.00	20.00
	6 each (c) lavatories in enclosures bet. stations	38.00	20.00
	54 each (d) urinals	86.00	100.00
	28 each (e) slop sinks	63.00	30.00
	8 each (f) floor drains	15.00	10.00
790	(a) Rough plumbing work complete, all stations, lump sum	22,000.00	13,000.00
791	(a) Rough plumbing work complete, all encl. bet. stations, lump sum	1,500.00	6,500.00
792	170 each (a) c.i. wk. in toilet rooms and port. clo.-posts.	15.00	10.00
	420 lin. ft. (b) top rails	1.00	1.00
	10 each (c) wall flanges	1.50	1.00
	40 each (d) reg. faces and frames in pipe chamber part	10.00	5.00
	15 each (e) c.i. vent. louvres in walls of port. clo.	15.00	5.00
793	7,500 per lb. (a) glass and soapstone steel supports	0.07	0.20
794	75 each coat and hat hooks in toilet rooms	1.00	0.20
795	52,100 lin. ft. (a) electric conduits ¾ in.	0.14	0.20
	5,600 lin. ft. (b) electric conduits 1 in.	0.17	0.25
	6,400 lin. ft. (c) electric conduits 1½ in.	0.20	0.30
	1,970 lin. ft. (d) electric conduits 2 in.	0.30	0.40
	100 lin. ft. (e) electric conduits 2½ in.	0.40	0.50
	100 lin. ft. (f) electric conduits 3 in.	0.51	0.70
	1,750 lin. ft. (g) ¾-in. flexible conduit	0.20	0.20
795A	5 each (a) place porc. fer. in ext. (encl.) masonry walls	1.00	5.00
	10 each (b) place porc. fer. in ext. (encl.) other than masonry walls	1.00	5.00
796	4,250 each (a) cast iron outlet boxes	1.00	1.00
797	38 each (a) 6-in. x 6-in. x 6-in. c.i. pull boxes	3.00	4.00
	12 each (b) 12-in. x 12-in. x 6-in. c.i. pull boxes	7.50	6.00
	18 each (c) 18-in. x 12-in. x 6-in. c.i. pull boxes	9.50	9.00
	2 each (d) 24-in. x 18-in. x 6-in. c.i. pull boxes	18.50	15.00
	75 each (e) 6-in. x 6-in. x 4-in. c.i. pull boxes	2.60	1.00
	15 each (f) 13-in. x 20-in. x 4-in. c.i. pull boxes	13.80	15.00
798	20 each (a) c.i. heater boxes	14.00	15.00
799	2 each (a) 25-in. x 60-in. x 5⅛-in. steel panel board box	16.00	20.00
	31 each (b) 25-in. x 48-in. x 5⅛-in. steel panel board box	14.00	20.00
	22 each (c) 25-in. x 36-in. x 5⅛-in. steel panel board box	12.00	20.00
	12 each (d) 25-in. x 24-in. x 5⅛-in. steel panel board box	11.00	20.00
800	2 each (a) steel switchboard boxes	15.00	50.00
801	184,400 sq. ft. (a) painting 2-coat wk. on plaster and cement surface	0.01¼	0.02
	(b) painting steel of exist. struc. as re. Sec. 291, lump sum	5,500.00	13,000.00
802	8,600 sq. ft. (a) straight white glazed 3 in. x 6 in.	0.55	0.50
	1,090 sq. ft. (b) 1-in. radius (comb)	1.10	1.50
	240 sq. ft. (c) 2½-in. radius (comb)	1.10	1.50
806	31,700 sq. ft. (a) H.M. tile 3-in. x 6-in. straight	1.00	1.00
	1,130 sq. ft. (b) H.M. tile 1-in. radius (comb)	1.00	1.50
	2,500 sq. ft. (c) H.M. tile 2½-in. radius (comb)	1.00	1.50
807	8,800 sq. ft. (a) H.M. tile 4¼-in. x 4¼-in. straight	1.00	1.00
	1,740 sq. ft. (b) H.M. tile 1-inch radius (comb)	1.00	1.50
	820 sq. ft. (c) H.M. tile 2½-in. radius (comb)	1.00	1.50
	35 sq. ft. (d) H.M. tile 20-in. radius	1.00	2.00
814	970 sq. ft. mosaic bands in color	1.20	1.10
815	90 so. ft. mosaic tablets in color	1.20	1.30
818	12 each (a) doors in masonry type AA	30.00	80.00
	12 pair (b) doors in masonry type BB copper cover	65.00	130.00
	2 pair (c) doors in masonry type CC	55.00	100.00
	1 each (d) doors in masonry type DD transformer clo	40.00	75.00
	30 each (e) doors in masonry type DD	28.00	75.00
	25 each (f) doors in masonry type EE	28.00	70.00
	5 each (h) doors in masonry type KK	32.00	70.00
	1 each (l) doors in masonry type LL	32.00	70.00
	2 each (j) doors in masonry type MM, copper covered	55.00	90.00
	10 each (k) doors in masonry type NN, copper covered	55.00	90.00
	14 each (l) doors to panel and switchboard boxes	32.00	50.00

Continuation of Secs. 1 and 3, Routes 36 and 37, Corona Elevated R. R. in Queens:)

815	300	sq. ft.	(a) windows in masonry walls fixed sash	1.50	1.00
820	50	sq. ft.	(a) windows in masonry walls exterior D H S	1.70	1.50
	750	sq. ft.	(b) window casement sash	1.10	1.50
	12,100	sq. ft.	(c) windows fixed and sliding sash	1.40	1.00
821	30	each	(a) sewer connections, Sec. 257	160.00	30.00
	27	each	(b) water connections, Sec. 257	80.00	30.00
850D	30,000	cu. ft.	construction of recreation bldg. Albertis Av.		

Long Island City, N. Y.—Following are unit prices of bids opened Aug. 4 by Public Service Comm., New York, for station finish on Section No. 2 of Routes Nos. 36 and 37, the Astoria elevated railroad in Queens—(a) Charles Meads, 38 Park Row, New York, $265,102. (b) Snare & Triest Co., New York, $274,096; (c) Simon Russeck, Inc., 261 Broadway, New York, $285,350:

Item			(a)	(b)	(c)
730	2,300	lin. ft.	stairways wood, (a) street to mezz.	$1.60	$1.00	$1.40
	3,700	lin. ft.	stairways wood, (b) mezz. to plat.	1.60	1.00	1.40
731	415	sq. ft.	stair landings wood (a) straight, street and mezz.	1.60	1.20	1.40
	460	sq. ft.	stair landings wood (b) offset, street and mezz.	1.60	1.20	1.40
	740	sq. ft.	stair landings wood (c) mezz. to plat.	1.60	1.20	1.40
732	10	tons	stair supports, cols., hangers, etc., per ton	90.00	90.00	97.00
733	430	sq. ft.	(a) street landings, concrete	1.00	0.90	0.40
	2,200	cu. yd.	(b) col. foundations	6.00	4.00	13.70
	20		(c) brick or concrete manholes, each	50.00	55.00	55.00
	6	cu. yd.	(d) rock excavation	10.00	10.00	10.00
734	2,500	lin. ft.	hand rails	0.50	0.55	0.70
735	3,200	sq. ft.	canopies (a) stairs, st. to mezz.	0.70	0.70	0.85
	13		(b) street landings, each	40.00	80.00	53.00
	36,800	sq. ft.	(c) train platforms (side)	0.44	0.40	0.38
	18,200	sq. ft.	(d) train platforms (island)	0.44	0.35	0.38
736	840	lin. ft.	railing (a) Type "A"	3.00	4.00	4.90
	570	sq. ft.	railing (b) Type "B"	1.00	1.20	1.20
	120	lin. ft.	railing (c) Type "C"	3.00	3.50	5.70
	10	lin. ft.	railing (d) Type "D"	3.00	4.00	4.90
	1,100	lin. ft.	railing (e) Type "E"	3.60	4.70	4.00
	700	lin. ft.	railing (f) Type "F"	3.60	4.50	4.90
	2,910	sq. ft.	railing (g) Type "G"	0.80	0.90	0.95
	2,340	lin. ft.	railing (h) Type "K"	3.00	4.50	3.90
	2	(i)	additional posts, each	15.00	20.00	4.00
	140	lin. ft.	(j) pipe railing	1.00	1.20	1.90
	24	(k)	metal screens for stove recess, each	10.00	12.00	12.00
737	2,450	lin. ft.	(a) wind screen with drop sash on train platforms	5.00	5.00	7.00
740	185	(a)	standards on railings on train platform, ea.	16.00	23.00	7.60
	50	(b)	free standing standards on island train platform, each	35.00	34.00	24.00
761	79,200	sq. ft.	(a) wood floors on train platforms	0.28	0.20	0.28
	5,340	sq. ft.	(b) 3-in. concrete w. p. and wood	0.70	0.65	0.60
	3,730	sq. ft.	(c) 11½-in. concrete w. p. and wood	0.80	0.75	0.70
	1,060	lin. ft.	(h) platform edge supported on steel angles	0.80	0.90	0.82
762	23,200	sq. ft.	(a) asphalt floor, incl. wood floor	0.45	0.32	0.35
	2,450	sq. ft.	(b) 3-in. concrete slab, 2-in. finish	0.60	0.50	0.60
	1,500	sq. ft.	(d) cement wainscot and base	0.20	0.22	0.12
	12,630	sq. ft.	(e) con. track floor over mezz. w. p. rods, etc.	0.60	0.45	0.50
	300	sq. ft.	(f) flooring for passageways	0.50	0.25	0.20
	175	(g)	ferrules for mezz. roof, each	3.00	2.40	3.00
763	12,700	sq. ft.	(a) ext. walls of mezz. stair'y encl. cop. ext. int. wood	1.20	0.95	0.95
	600	sq. ft.	(b) ext. walls of mezz. cop. ext. tile int.	1.40	0.90	0.90
764	18,160	sq. ft.	wood partition walls incl. door, win's, etc.	0.70	0.60	0.75
765	1,750	lin. ft.	copper gutters in place	1.00	0.90	0.90
766	55	lin. ft.	(a) low sliding gates	10.00	10.00	11.00
	110	lin ft.	(b) high sliding gates	12.00	14.00	14.50
	12	(g)	gate controls, each	20.00	25.00	5.00
	24	(h)	cast-iron gate posts and cross frame, pair	40.00	30.00	42.00
	715	lin. ft.	(k) 1-in. sq. steel tubing for gate ropes, etc.	0.50	0.60	1.00
767	9,570	sq. ft.	roof over mezz. e. pass'ys beyond m. structure	0.60	0.60	0.60
768	4,840	lin. ft.	(a) 3-in. corrugated galv. iron leaders	0.30	0.30	0.30
	10	lin. ft.	(b) 3-in. cast-iron leaders	1.00	0.60	0.60
	540	lin. ft.	(c) 3-in. wrought-iron leaders	0.50	0.75	0.70
	540	lin. ft.	(d) 3½-in. wrought iron leaders	0.60	0.85	0.80
	20	lin. ft.	(e) 3-in. copper leaders	1.00	0.60	0.70
769	930	lin. ft.	smoke flues from stove recesses	0.40	0.60	0.55
770	180	lin. ft.	smoke flue protectors on platforms	1.00	1.20	2.50
771	1,880		cast-iron fenders for structural col's, per lb.	0.10	0.05	0.05
772	41	tons	(a) steel framing and shapes, per ton	70.00	70.00	75.00
	80	tons	(b) riveted steel girders, cols. and bracing, per ton	80.00	70.00	80.00
	25	lin. ft.	(d) steel ladders	2.00	2.00	2.50
	10	sq. ft.	(e) platforms	2.00	1.00	1.20
773	1,050		drilling holes in steel (exist. struct'e), per hole	0.40	0.30	0.40
774	185	sq. ft.	(a) frames for en'led sign on mezz.	1.60	1.60	2.30
	2	(b)	fr's and reflectors for ill'd signs on br'ts to col's att'd, each	40.00	45.00	30.00
	660	sq. ft.	(c) sign frames on train platform railing	0.70	1.20	1.15
	24	(e)	sign fr's ill'd n.t's on island platforms, seat, each	60.00	170.00	130.00
	1,700	sq. ft.	(f) enameled sign plates	0.30	0.40	0.25
	5	(j)	sign frames for ill'd n.t's on is'l'd pl'm, seat, each	40.00	170.00	70.00
775	2,500	sq. ft.	(a) non-slip treads without wood blocks and anchors	0.80	0.95	0.70
	400	sq. ft.	(b) non-slip treads with wood blocks and anchors	1.00	1.00	0.80
776	980	sq. ft.	stamped sheet metal in booths on mezz.	0.20	0.15	0.20
777	50	sq. ft.	(a) metal lath without steel furring	0.40	0.14	0.10
778	1	(a)	Type "B" ticket booths, each	400.00	450.00	400.00
	2	(b)	Type "B-B" ticket booths, each	700.00	800.00	700.00
779	240	lin. ft.	(a) oak seats in waiting rooms	4.00	3.00	3.50
	1	pair	(b) Type "G-G" oak doors, toilets	12.00	13.00	12.00
780	55		hardware doors to toilet rooms, waiting rooms and closets, per door	12.00	22.00	19.00
	55	wind.	(c) double hung sash	3.00	3.00	3.00
	440	wind.	(d) casement sash in mezzanines	4.00	5.00	4.00
	44	wind.	(e) casement in t.r's and inclosure between stations	4.00	4.00	3.80
	470	(g)	drop sash, each	2.00	1.20	1.40
	140	(h)	hinged sash (top or bottom), each	2.00	2.80	1.80
	24	pair	(j) for toilet stall doors, Type "G-G"	10.00	12.00	10.00
	37	(k)	doors p. boards and s. board boxes, each	2.00	2.00	2.00
	4	(l)	sliding doors to transformer closets, each	10.00	7.50	6.00
	16	(m)	seat Cleats, each	3.00	2.50	2.00
781	24	(a)	additional hardware, door checks, each	6.00	3.50	3.50
	76	(b)	door pulls, each	2.00	1.50	1.50
	20	(c)	door chains, each	2.00	1.20	1.50
	25	(d)	door bolts, each	2.00	2.00	2.00
	28	(e)	door pulls, each	2.00	2.50	2.50
	73	(f)	door stops, per pair	8.00	6.00	6.00
	52	(g)	door bolts, each	6.00	4.50	4.20
	44	(h)	for casement sash adjuster for single sash, each	4.00	2.50	2.30
	4	(i)	for casement sash adjuster for gang of two, each	10.00	8.50	8.50
	6	(j)	for casement sash adjuster for gang of three, each	12.00	11.00	11.00
	9	(k)	for casement sash adjuster for gang of four, each	16.00	13.50	13.00
	40	(l)	for casement sash adjuster for gang of five, each	16.00	16.00	16.00
	35	(m)	for casement sash adjuster for gang of six, each	20.00	18.40	18.00
782	16	sq. yd.	(a) plaster coat on m'ry sur's and for second coat on metal lath	1.00	1.50	0.70
	30	sq. yd.	(b) first or scratch coat on metal lath	1.00	1.50	0.50
783	470	cu. ft.	(a) common brick	0.80	0.50	0.50
	100	cu. ft.	(b) hollow terra cotta tile	0.80	0.50	0.45
784	24		for con. e. stove, except metal screens in pc. recesses, includ. all appur's, each	30.00	35.00	4.50
786	2,150	sq. ft.	(a) ⅝-in. gl. wains'g and trim on walls	1.20	1.50	1.30
	280	sq. ft.	(b) ⅝-in. gl. pipe chamber partitions	1.40	1.60	1.60
	40	sq. ft.	(c) ¾-in. gl. shelves	2.00	1.60	1.60
	600	sq. ft.	(d) ¾-in. gl. stall partitions	1.60	1.70	1.60
	100	sq. ft.	(e) 1-in. floor slabs	2.00	2.70	2.50
	435	lin. ft.	(f) curved corners and angles of glass	1.40	1.60	2.50
	20	sq. ft.	(g) soapstone wains'ing and trim on wall	1.00	1.50	1.00
	300	sq. ft.	(h) soapstone pipe chamber partitions	1.00	1.30	0.90
	75	sq. ft.	(i) soapstone shelves	1.50	1.40	1.00
	75	sq. ft.	(j) soapstone stall partitions	1.50	1.40	1.00
	20	sq. ft.	(k) soapstone floor slabs	1.00	1.50	1.10
	50	lin. ft.	(l) curved corners and angles of soapstone	1.00	1.20	1.00
788	24,050	cu. ft.	portable enclos's between stations	0.18	0.22	0.23
788A	20		(b) wooden ladders, each	6.00	2.50	11.00
789	28		(a) water closet bowls, each	45.00	60.00	47.00
	24		(b) lavatories in stations, each	30.00	44.00	29.00
	3		(c) lavatories in enclosure between stations, each	30.00	40.00	27.00
	28		(d) urinals, each	75.00	85.00	80.00
	13		(e) slop sinks, each	60.00	64.00	62.00
790			Rough plumbing work complete for all stations (lump sum)	6,400.00	10,600.00	7,000.00
791			Rough plumbing work complete between stations for all enclos. (lump sum)	1,000.00	706.00	1,240.00
792	90		(a) posts (in toilet rooms), each	6.00	15.00	9.80
	180	lin. ft.	(b) top rails (in toilet rooms)	1.00	1.20	1.00
	8		(c) wall flanges (in toilet rooms), each	1.00	1.50	2.00
	12		(d) register faces and fr's in pipe chamber part., each	10.00	12.00	3.50
	12		(e) cast-iron vent louvres in walls of port's clos., each	10.00	18.00	4.50
793	3,700	lb.	glass and soapstone steel support, per lb.	0.10	0.08	0.07
794	30		coat and hat hooks in toilet rooms, each	2.00	1.50	0.50
795	24,275	lin. ft.	(a) ¾-in. electric conduits	0.12	0.14	0.14
	6,000	lin. ft.	(b) 1-in. electric conduits	0.15	0.17	0.17
	2,400	lin. ft.	(c) 1½-in. electric conduits	0.20	0.22	0.21
	250	lin. ft.	(d) 2-in. electric conduits	0.30	0.30	0.30
	200	lin. ft.	(e) 2½-in. electric conduits	0.40	0.40	0.43
	100	lin. ft.	(f) 3-in. electric conduits	0.60	0.55	0.60
	750	lin. ft.	(g) ¾-in. flexible conduit	0.16	0.20	0.20
795A	6		(b) placing ferrules in walls other than masonry walls, each	5.00	1.00	1.00
796	1,575		cast-iron outlet boxes, each	1.00	1.20	1.00
797	25		(a) cast-iron pull boxes, 6 x 6 x 6 in., each	4.00	3.00	3.10
	6		(b) cast-iron pull boxes, 12 x 12 x 6 in., each	8.00	7.50	8.00
	6		(c) cast-iron pull boxes, 18 x 12 x 6 in., each	10.00	9.50	10.00
	1		(f) 18 x 20 x 4 in. boxes, hinges, covers and locks, each	20.00	14.00	15.00
798	12		cast-iron heater boxes, each	15.00	14.00	15.00
799	16		(a) steel panel boxes, 25 x 60 x 5½ in., each	20.00	16.00	17.00
	6		(b) steel panel boxes, 25 x 48 x 5½ in., each	20.00	14.00	15.00
	12		(c) steel panel boxes, 25 x 36 x 5½ in., each	20.00	12.00	14.00
800	3		steel switch boxes, each	20.00	15.00	15.00
801	17,700	sq. ft.	(a) painting two coat work on plaster and cement surfaces	0.03	0.02	0.02
			(b) painting st'c of existing structures, as required by Sec. 291 (lump sum)	1,500.00	3,200.00	700.00
802	6,900	sq. ft.	(a) tile, 3 x 6 in., straight	0.40	0.60	0.50
	400	sq. ft.	(b) tile, 1-in. radius	0.80	1.20	1.00
	700	sq. ft.	(c) tile, 2½-in. radius	1.00	1.20	1.20
821	26		(a) sewer and water con'ns, sec. 257 sewer, ea.	80.00	200.00	80.00
	10		(b) sewer and water con'ns, sec. 257 water, ea.	80.00	100.00	80.00
850A			Wires, cables, poles, trees, Secs. 13 and 295 (lump sum)	7,000.00	10,500.00	3,500.00
850C	44,160	cu. ft.	recreation blk. at Ditmars Ave. Sta., sec. 295	0.125	0.20	0.15

San Jose, Cal.—Reported San Jose, R. R. has applied to Council for franchise to construct a line on Alum Rock Avenue.

PRICES AND LETTINGS.

★Indicates award of contract

★San Francisco, Cal.—Contract for furnishing and delivering track special work Contr. No. 7, Section E, Municipal Ry. awarded by Bd. Pub. Wks. to United States Steel Products Co.

RAILROADS

PROPOSED WORK

New York, N. Y.—Public Service Commissions of New York State First and Second Districts, have adopted joint order for removal of grade crossings and other obstructions on lines of the New York and Harlem Railroad (New York Central) and New York, New Haven & Hartford Railroad near 241st Street, Borough of Bronx. It also orders a shifting of tracks and construction of a viaduct to carry street. New York and Harlem Co. is ordered to construct a new station at 241st Street to take place of present structure. Entire cost, except that of construction of new viaduct, will be paid by railroad companies, cost of viaduct being apportioned according to provisions of Railroad Law.

Wilkes-Barre, Pa.—Citizens Aug. 3 voted $300,000 for eliminating grade crossings of the Pennsylvania Railroad and for street improvements.

Bellingham, Wash.—Reported that surveys are about to be started by J. E. Stiley, for Bellingham, Mount Baker & Spokane Railroad, a line 228 miles in length, to be built from Bellingham to Spokane, and which will be a part of the transcontinental line from Port Nelson on Hudson Bay. Arrangements for construction of road have been completed by owners of the charter of the railroad and Capt. E. J. Fader, contractor and promoter of New Westminster, B. C., who will have an office in Bellingham.

Astoria, Ore.—Dubois Lumber Co. preparing to construct railroad into timber holdings in Clatsop and Tillamook Counties.

Los Angeles, Cal.—Industrial Terminal Railway Co., of Los Angeles, has filed application with Railroad Comm. for authority to issue capital stock of $50,000. The company intends to build a railroad 2 miles long, in Los Angeles, from Alameda Street to Alhambra Avenue and the Los Angeles River.

PRICES AND LETTINGS.

★Indicates award of contract.

★Gila Bend, Ariz.—Contract for building Tucson, Cornelia and Gila Bend Railroad from Gila Bend to properties of the C. & A. at Ajo, about 45 miles, has been awarded to James H. Maxey of Yuma, Ariz. R. H. Jones, Ch. Engr., Gila Bend.

PUBLIC BUILDINGS AND SCHOOLS

PROPOSED WORK

Brookline, Mass.—A committee appointed to consider the enlarging of the high school has recommended an appropriation of $100,000 for said purpose.

Feeding Hills, Mass.—Co. Comrs., Springfield, selected site here on which to erect county truant school. Probable cost, $75,000.

Nahant, Mass.—Citizens voted $38,600 bonds for erecting brick school. William Waters, Town Clk.

Burrillville, R. I.—Walter F. Fontaine, 285 Main Street, Woonsocket, preparing plans for a tuberculosis hospital to be erected here by State; cost reported to be $120,000. Engineers, R. D. Kimball & Co., Providence; Gilbert P. Parker, Providence, Secy. Bd. State Control.

New York, N. Y.—Plans filed for sixteen-story fireproof court house and jail to be erected by City of New York at

Thirtieth Street and Seventh Avenue, at a cost of $365,000; Griffin & Wynkoop, Archts., 30 Church Street.

Rochester, N. Y.—Council considering issue of $100,000 bonds for school construction and equipment purposes.

Elizabeth, N. J.—Bd. Educ. contemplates erecting a school on S. Fifteenth and Spencer Streets; cost, $69,000.

Jersey City, N. J.—Bonds as follows sold: $500,000 county jail, $300,000 Hudson County Park, and $250,000 turnpike bonds.

Philadelphia, Pa.—Reported Library Trus. will in the fall let contract for erecting central building of the free library on the Parkway.

Washington, D. C.—Sketch plans prepared by Snowden Ashford, Municipal Archt., for municipal hospital to be erected on Fourteenth and Upshur Streets, N. W., to consist of a group of twelve buildings; cost reported to be $500,000.

Parkersburg, W. Va.—City contemplates erecting hospital costing $100,000.

Triadelphia, W. Va.—Site selected for the high school, and bonds amounting to $125,000 sold for said purpose. Address Bd. Educ.

Macon, Ga.—Co. Bd. Educ. intends asking Macon architects to submit plans for the Vineville School; cost $40,000.

Hornbeck, La.—Citizens voted $40,000 bonds to erect a school.

Johnson City, Tenn.—Reported court house and market building costing $75,000 to be erected here. Address Co. Comrs.

Memphis, Tenn.—The erection of an additional wing at the Baptist Memorial Hospital, and costing $100,000, is under consideration.

Cleveland, Ohio.—Reported erection of a 2-story and basement brick laundry building, costing $40,000, is under consideration at Cleveland State Hospital in Newburg.

Midvale, Ohio.—Citizens voted $35,000 bonds to erect a school for combined districts of Midvale, Plains and Barnhill.

New Philadelphia, Ohio.—Citizens of Goshen Township voted $135,000 bonds for school to be erected between Barnhill and Midvale.

Rootstown, Ohio.—Citizens voted $30,000 bonds to erect combination school.

Bloomington, Ind.—Reported contract soon to be let by Trus. Indiana Univ. for erecting men's gymnasium, to cost $150,000.

Ann Arbor, Mich.—Plans being prepared by Albert Kahn, Lafayette Building, Detroit, for erecting stone or brick library for University of Michigan. Cost, $350,000.

Detroit, Mich.—Andrew Carnegie has approved plans prepared by Cass Gilbert, New York, for the central library. Address Library Bd.

Lake Linden, Mich.—J. D. Chubb, Chicago, Ill., engaged to prepare plans for the high school; bonds for $100,000 for this school are now offered for sale.

Aurora, Ill.—Citizens of West Aurora voted $45,000 bonds for erecting addition to Galena Boulevard School.

East St. Louis, Ill.—High School bonds for $300,000 for an addition to the high school, have been sold.

Monmouth, Ill. — Plans prepared by Temple & Burrows, Davenport, Iowa, for new city hall have been accepted; cost $50,000.

Springfield, Ill.—Bonds for $400,000 for high school building will be sold Aug. 10 by Bd. Educ. (Eleanor Matheny, Secy.).

Milwaukee, Wis.—Louis G. Widule, Co. Clk., writes site for proposed new court house has not been selected as yet.

Grundy Center, Iowa.—Citizens voted $85,000 bonds to erect a school.

Rockwell City, Iowa.—State Bd. Control, Des Moines, selected site in this city for Women's Reformatory.

Hiawatha, Kan.—Citizens voted $75,000 bonds July 20 for erecting high school, from plans of J. H. Felt & Co., Grand Avenue Temple, Kansas City, Mo.

Austin, Tex.—Plans for high school to be prepared by Dannis R. Welch, Littlefield Building. He will also prepare plans for improvements to the ward school buildings.

Palestine, Tex.—Plans being prepared by Sanguinett & Staats, First National Bank Building, Fort Worth, for high school; cost reported to be $100,000. City Comrs. will let contract for this building.

Victoria, Tex.—See "Paving and Roads."

Vancouver, Wash.—State Bd. Control, Olympia, approved plans of Julius Zittel, Spokane, for administration building at State School for Blind.

Portland, Ore.—Working plans about completed by J. Andre Fouilhoux, Portland, and Friedlander & Seymour, New York, N. Y., Assoc. Archts., for the auditorium, and bids for construction will be asked soon. Cost, $600,000. Address City Clerk.

Portland, Ore.—School Bd. has accepted offer of S. Benson, to give to Board $100,000 for first unit of new school of trades for boys and girls on condition that the Board spend a similar sum during 1916 in the construction of the second unit.

Calipatria, Cal.—Bonds in the sum of $34,000 will be sold Aug. 16 by County Supervisors for the erection of a brick and concrete school. Contract not yet let for school.

BIDS DESIRED.

Fitchburg, Mass.—Until Aug. 30 by Park Comn. (D. S. Woodsworth, Chmn.), for erecting pavilion at North of Mirror Lake in Coggshall Park. H. M. Francis & Sons, Archts., Wallace Building.

Medfield, Mass.—Until Aug. 19 by State Bd. Insanity (Michael J. O'Meara, Chmn.), Boston, for erecting a dispensary building, including heating, plumbing, etc. James H. Ritchie, Archt., 8 Beacon Street, Boston.

North Grafton, Mass.—Until Aug. 16 by State Bd. of Insanity, Boston, for erecting dining room and service building at Grafton Colony, North Grafton; also separately for plumbing, heating and electric wiring. Fuller & Delano Co., Archts., 44 Front Street, Worcester.

Brooklyn, N. Y.—Until Aug. 23 by C. B. J. Snyder, Supt. School Bldgs., New York, for general construction; also plumbing and drainage of additions to and alterations in School 89, borough of Brooklyn. Security $15,000 and $1,800 respectively.

Little Falls, N. Y.—Until Aug. 31 (extension of date from July 28) by City Clerk for construction of municipal building. William Neil Smith, Archt., 101 Park Avenue, New York.

Salamanca, N. Y.—Until Aug. 25 by Bd. Pub. Instruction for erecting school in Ward One, including ventilating and heating, plumbing and electric wiring. George H. Elliott, City Clk.

Sing Sing, N. Y.—Until Aug. 20 by John B. Riley, Supt. State Prisons, Albany, for plumbing and drainage in new power house at Sing Sing Prison, advertised in Engineering Record. Lewis F. Pilcher, State Archt., Albany.

White Plains, N. Y.—Reported desired until Aug. 31 by Westchester County Bldg. Comn., for erecting court house. It is also reported bids for erecting the penitentiary and workhouse will be opened latter part of September.

Pittsburgh, Pa.—Until Aug. 24 duplicate bids, one at the office of Hyatt M. Cribbs, County Controller and one at office of City Controller, for the cut stone work and setting, and architectural terra cotta work and setting entering into the construction and completion of the new City and County Building, Grant and Diamond Streets.

★Until Aug. 17 by George W. Gerwig, Secy. Bd. Educ., Fulton Building, for erecting Bailey High School, Ruth and Secane Streets, South Hills, Pittsburgh.

Pittsburgh, Pa.—See "Miscellaneous."

Washington, D. C.—Until Aug. 18 at the Dept. of the Interior, Washington, D. C. (E. J. Ayers, Asst. Secy.), for replacing wood frame windows in monitors and gables of the Pension Office building with metal sash and frame and wired glass, together with electric operating devices for the new windows.

Marion, Ohio.—Reported desired until Aug. 24 by Bd. Educ., Grand Prairie Township Rural School District (W. D. Heller, Clk.), for erecting a brick and stone school. Separate bids desired for ventilating and heating, plumbing, gas fitting and sewerage. Howard & Merriam, Archts., 8 E. Broad Street, Columbus.

Sugar Grove, Ohio.—Until Aug. 24 by Bd. Educ. for erecting a school; cost $30,000. E. S. Matheny, Archt., Harrison Building, Columbus.

Tippecanoe City, Ohio.—Until Sept. 3 by Township Trus., Monroe Township (S. O. Mitchell, Clk.) for erecting a Township Building at Main and Third Streets. Schenck & Williams, Archts., Arcade Building, Dayton.

Hammond, Ind.—Until Sept. 1, readvertisement, by School Trus. (A. J. Dreesen, Pres.), for erecting Hammond Industrial High School, advertised in Engineering Record. Architects, J. T. Hutton & Son, Hammond Bldg.

Lebanon, Ind.—Reported desired Sept. 10 by Bd. Trus. of F. J. Witham Memorial Hospital for erecting said hospital, 3-story brick and stone; amount available $30,000.

Belleville, Ill.—Until Aug. 24 according to press reports by Bd. Educ. for erecting Township High School, Dist. No. 201, to consist of the main school and administration building, manual training building and cafeteria.

East Dubuque, Ill.—Until Aug. 16 by Bd. Educ. (C. F. Small, Secy.), for erecting a two-story addition to East Dubuque School. Thos. T. Carkeek, Archt., Lincoln Building, Dubuque, Iowa.

Sullivan, Ill.—Until Aug. 20 by C. W. Green, Co. Clk., for erecting a jail and sheriff's residence. J. W. Royer, Archt., Urbana.

Ames, Iowa.—Reported desired until Aug. 19 by State Bd. Educ., Des Moines (W. H. Gemmill, Secy.), for erecting a science building; also women's building No. 2, Iowa State College, Ames. Separate bids heating, plumbing and electric wiring. Proudfoot, Bird & Rawson, Archt., 810 Hubbell Building, Des Moines.

Charter Oak, Iowa.—Reported desired until Sept. 7 by Bd. Educ. for erecting 2-story and basement brick and stone school; cost $45,000.

Elwood, Iowa.—Reported desired until Aug. 23 by O. P. Cornish, Secy. School Dist., for erecting school in Elwood Dist. John Morrell & Son, Archts., Clinton.

Forest City, Iowa.—Until Aug. 25 (extension of date from Aug. 16) by Independent School Dist. (Dr. H. R. Irish, Pres.), for erecting a high and grade school, including heating, plumbing, electrical work and fixtures. Alban & Lockhart, Archts., Endicott Building, St. Paul, Minn.

Austin, Minn.—Reported desired until Aug. 18, Independent School Dist. for erecting a grade school, 7-story and basement 96 x 155 ft. Probable cost, $40,000. Kinner & Macomber, Archt., Minneapolis.

Lake Park, Minn.—Until Aug. 23 by State Bd. Control, St. Paul, for erecting a tuberculosis sanitarium at Lake Park for counties of Becker and Clay, including plumbing, heating, etc. Sund & Dunham, Essex Bldg., Minneapolis, and A. J. Fridlund, Moorhead, Assoc. Archts.; Rose & Harris, Minneapolis, Engrs.

Minneapolis, Minn.—Until Aug. 16 by G. A. Sandberg, Purchasing Officer, Univ. of Minnesota, for erecting additions and making alterations to Veterinary Pathology Plant at Univ. of Minnesota.

Rochester, Minn.—Reported desired until Aug. 20 by Capt. F. C. Ormond, Third Infantry M. N. G., for erecting armory; cost $30,000.

Sisseton, Minn.—Until Aug. 24 by Library Bd. (R. F. Sonstegard, Secy.) for erecting Carengie Library. Geo. Issenhuth, Archt., Huron, S. D.

Winfield, Kan.—Reported desired until Aug. 16 by State Bd. Control, Topeka (J. W. Howe, Secy.), for erecting a dining hall and kitchen building at the State Home for Feeble Minded, Winfield. Charles H. Chandler, State Archt., Topeka.

San Antonio, Tex.—Reported desired until Aug. 20 by County Judge, for erecting a fireproof City and County Hospital and Nurses Home. A. B. Ayres, Archt., Bedell Building.

Tulsa, Okla.—Until Sept. 27 by James Wetmore, Superv. Archt., Washington, D. C., for construction, complete (including mechanical equipment and approaches), U. S. Post Office and Courthouse, Tulsa.

Bremerton, Wash.—Until Sept. 11 at Bureau Yards & Docks, Navy Dept., Washington, D. C., for furnishing material and constructing steel frame shell house with plastered walls and two brick magazines with steel roof trusses at the Naval Magazine, Puget Sound, Wash. Specification No. 2185.

Portland, Ore.—Until Sept. 2 by James A. Wetmore, Superv. Archt., Washington, D. C., for construction, complete (including mechanical equipment, lighting fixtures and grading), steerage barracks storehouse for U. S. Quarantine Station, Portland.

Los Angeles, Cal.—Until Aug. 19 by Bd. Educ. (William A. Sheldon, Secy.) for furnishing material and erecting school on South Park Avenue.

Toronto, Ont.—Until Aug. 17 by W. C. Wilkinson, Secy-Treas., for all trades for enlargement of Eglinton School, Eglinton Ave.; also heat regulation and sundry trades in other schools.

Calgary, Alta.—Reported desired until Aug. 16 by Dir. Contracts, Militia Headquarters, Ottawa, Ont., for constructing a standard magazine at Calgary.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Beverly, Mass.—C. S. Cunningham & Sons, Boston, submitted lowest bid for erecting the Municipal Library at Beverly Farms, at $23,700.

★**Medford, Mass.**—Contract awarded July 22 by Charles B. Dunham, Archt., 6 Beacon Street, Boston, for erecting 2-story and basement school as follows: General construction, M. M. Dyer, Medford; heating and ventilating, W. W. Campbell & Son Co., Malden; and plumbing, W. P. Kane, 40 Charles Street, Boston. Cost reported to be about $45,000.

Olneyville, R. I.—E. K. Watson submitted lowest complete bid for erecting school on S. Main Street at $39,469.

★**Warren, R. I.**—Contract for erecting eight-room school on S. Main Street, awarded Eastern Constr. Co., Woonsocket, at $30,973. Burritt S. D. Martin, Archt., Providence.

★**Warren, R. I.**—Contract awarded July 26 by School Com. (H. W. Watyen, Chmn.), for erecting an 8-room, 2-story and basement, 64 x 94 ft. brick school to Eastern Constr. Co., at $44,873.

Scarsdale, N. Y.—Following are four lowest bidders for erecting high school (bids opened Aug. 2): George T. Kelly, Yonkers, $52,400; Lincoln Steele Fleming, New York, $53,223; John M. Voss, Yonkers, $53,440; Barzahl Vought, New York, $55,225. Guy Lowell, Archt., 225 Fifth Avenue, New York.

★**Syracuse, N. Y.**—Contract for erecting engine house for No. 1 awarded Hueber Bros. & Minikelm, Syracuse, at $29,700.

★**Highland Park, Pa.**—Contract for erecting 2-story brick and stone school reported awarded Daniel McNames, 1621 N. Fifteenth Street, Philadelphia, at $46,900. Shore & Dodge, Archts., 608 Chestnut Street, Philadelphia.

★**Hollidaysburg, Pa.**—Contract for erecting high school awarded F. W. Finn, Altoona, at $30,250.

★**Lock Haven, Pa.**—Contract for erecting 3-story brick, stone and terra cotta nurses' home at Lock Haven Hospital awarded Thomas M. Seeds, Jr., Philadelphia. Cost about $30,000. Harris & Rush, Archts., Philadelphia.

★**Oil City, Pa.**—Contracts awarded as follows for erecting junior high school: General construction to H. E. Sherwood, Oil City, $96,500; heating and ventilating, James A. Langdon & Sons, Pittsburgh, $13,684; plumbing, James Reidy, Oil City, $6,713.

★**Washington, D. C.**—Contracts for erecting Interior Department building reported awarded John H. Parker, 315 Fourth Avenue, New York, at $1,622,487; mechanical work, William Gordon, New York, $237,213; elevators, Otis Elevator Co., Washington, $49,949.

Quitman, Ga.—Following are four lowest bids opened July 29 by Supervising Architect, Washington, D. C., for constructing complete U. S. Post Office: (a) limestone, (b) sandstone: Westchester Eng. Co., White Plains, N. Y., (a) $38,891, (b) $41,000; Richardson Eng. & Constr. Co., Bainbridge, Ga., (a) $40,670, (b) $41,500; Colonial Constr. & Supply Co., Charlottesville, Va., (a) $39,998, (b) $40,409; Algernon Blair, Montgomery, Ala., (a) $38,939, (b) $39,200.

★**Lowell, O.**—Contract for erecting ten-room fireproof school awarded Gates Bldg. Co., Wheeling, W. Va.

★**Niles, O.**—Contract for erecting McKinley Memorial Building awarded John H. Parker Co., New York, at $240,000.

★**Xenia, O.**—Contract for erecting school awarded by Cedarville Township Bd. Educ. to Nolton & Brenig Co., Athens, at $51,360; heating and plumbing to Columbus Heat & Ventilating Co., Columbus, at $6,300.

★**Youngstown, Ohio.** — Contract for erecting Peter L. Kimberly Nurses' Home in connection with Buhl Hospital, awarded Wallis & Carley Co. of Youngstown, at about $60,000. C. H. & C. F. Owsley, Archt., Youngstown.

★**Ewen, Mich.**—Contract for erecting three-story fireproof high school awarded Owens & Nieuwenkamp of Ironwood, at $23,925.

★**Peoria, Ill.**—Contract for erecting addition and remodeling Kingman School in Averyville suburb awarded Conrad Iber, Peoria, at $24,065; heating to John O'Neill & Sons, 208 Main Street, and plumbing, Dailey & O'Brien, 322 S. Jefferson Street.

★**Roland, Iowa.**—Contract for erecting school for consolidated school district awarded W. O. Jensen Co., of Omaha, Neb., at $36,474, and for heating and plumbing to Schollman Bros., Omaha, Neb., at $11,015.

★**Bemidji, Minn.**—Contract awarded by State Bd. Control to W. M. Murphy & Son, St. Paul, for erecting tuberculosis sanitarium here at $29,651.

Ft. Atkinson, Kan.—Following are four lowest bids opened Aug. 2 by Supervising Architect, Washington, D. C., for constructing complete U. S. Post Office, (a) limestone, (b) sandstone: Geo. A. Shaul, Seneca, (a) $42,662; W. G. Carter Co., Chicago, Ill. (b) $43,395; Clark Constr. Co., Danville, Ill., (a) $39,350, b) $41,100; Daniel B. Danielson, Milwaukee, Wis., (a) $42,432, (b) $43,432; Callahan Mandl Co., Chicago, Ill., (a) $40,700, (b) $42,000.

★**Howard, Kan.** — Contract reported awarded Aug. 3 by Bd. Educ. (G. K. Reid, Secy.) for erecting a two-story and basement, 65 x 85 ft. school, to E. D. Russell of Fredonia, at $21,996.

★**Fulton, Mo.**—Contract for erecting gymnasium and swimming pool at William Woods College, awarded W. R. Odor of Canton; cost, $30,000.

★**Richmond, Mo.**—Contract awarded July 28 by Bd. Educ. for furnishing material and erecting high school and two grade schools, including ventilation, heating and plumbing to Butts & Dickerson of Wichita, Kan.

Webb City, Mo.—Following are 4 lowest bids opened July 26 by Superv. Archt., Washington, D. C., for construction of U. S. Post Office (a) limestone; (b) sandstone; George A. Shaul, Seneca, Kan. (a) $50,742; Algernon Blair, Montgomery, Ala. (a) $51,408; W. H. Fissell & Co., New York, N. Y. (a) $53,000, (b) $56,000; Hiram

Lloyd Bldg. & Constr. Co., St. Louis, Mo. (a) $53,176; (b) $53,176; Callahan Mandl Co., Chicago, Ill., (b) $54,855; Colonial Constr. & Supply Co., Charlottesville, Va., (b) $54,999.

★**Olliton, Okla.**—Contract for erecting school on the Hackney addition awarded J. J. Rooney, Muskogee, at $22,500.

★**Oklahoma City, Okla.**—Contract reported signed as awarded to James Stewart Co., Inc., New York, for erecting capitol at $4,754,000. (Bids opened June 7 by State Capitol Comm., Ira Mitchell, Secy.) Layton & Smith, Archts., 701 Majestic Building.

Monmouth, Ore.—State Normal School Bd., Salem, opened bids Aug. 1 for erecting Normal Training School building and following are four lowest bids: Bingham & Shelby, Portland, $39,497; Southwick & Hemstreet, Salem, $39,741; Snook & Travers, Salem, $40,965; E. B. White, Portland, $41,286.

Portland, Ore.—See "Bridges."

Portland, Ore.—Following are four lowest bids opened July 27 by Port Comm. for constructing warehouse B at Municipal Dock No. 1 and appurtenances (a) including filling, erection of building and appurtenances and using concrete piles in north wall; (b) same as A, but including in addition road bed and track, excavating, reinforced concrete viaduct paved with wood blocks: Anton Teller (a) $76,-533; (b) $88,684; Palmer-Ellison Co. (a) $78,[illegible]; (b) $87,133; Brayton Eng. Co. (a) $74,[illegible]; (b) $87,225; Beers Bldg. Co. (a) $75,974; (b) $87,474. Bidders of Portland.

San Diego, Cal.—Lowest bid opened July 24 by Bureau Yards and Docks, Navy Dept., Washington, D. C., for constructing seven buildings at U. S. Naval Radio Station, was submitted by Jacobs Constr. Co., 518 Hellman Building, Los Angeles, Cal., at $41,010.

San Pedro, Cal.—Lowest bid received for erecting Fifth Street school submitted by Cresmer Mfg. Co., Riverside, at $92,000.

Guantanamo, Cuba.—Following are two bids opened July 31 by Bureau Yards & Docks, Navy Dept., Washington, D. C., for constructing buildings at this post: Snare & Triest Co., 232 Broadway, New York, $49,291; Henry Monk, 314 W. Belmont Street, Pensacola, Fla., $57,040.

PRIVATE BUILDINGS

PROPOSED WORK

Holyoke, Mass.—Plans prepared by George P. B. Alderman & Co., Holyoke, for theater and apartment house to be erected for James H. Baker on Maple and Appleton Streets; cost, $60,000.

Springfield, Mass.—Permit issued New England Westinghouse Co. for erecting 1-story storage building; cost, $37,000.

Springfield, Mass.—Dickinson Realty Trust Co. has had plans prepared for a brick apartment house and garage to be erected on N. Main Street; cost, $65,000.

Worcester, Mass.—Barnard Press, 1 Granite street, having plans prepared by Edwin T. Chapin, State Mutual Building, for 4-story store and apartment house to be erected on Pleasant and Sever Streets; cost, $[illegible].

Providence, R. I.—Plans completed by William R. Walker & Sons, Custom House Street, for 6-story brick business building to be erected on Mathewson Street by Lederer Realty Co.

Little Falls, N. Y.—Plans completed by W. L. Stoddart, 9 E. Fortieth Street, New York, for bank and office building to be erected at Main and Ann Streets for Herkimer County National Bank; cost $[illegible].

New York, N. Y.—Plans being prepared by J. E. S. Carpenter, 6 E. Sixty-sixth Street for 12-story apartment house to be erected at Seventy-second Street and Park Avenue, south corner, by Wells Bros., Chicago, Ill.

New York, N. Y.—Plans for residence of Morton F. Plant at Fifth Avenue and Eighty-sixth Street, to be prepared by Guy Lowell, 565 Fifth Avenue.

Plans completed by Walter Cook, 3 W. Twenty-ninth Street, for church to be erected at Amsterdam Avenue and Ninety-second Street, for Central Baptist Church. Cost $200,000. Rev. Frank Goodchild, Pastor.

Plans filed for following buildings: Five-story brick tenement at 414 West 21[illegible] Street, for [illegible] Street Corporation, cost $[illegible]; William Koppe, Archt., 820 West Tenth Avenue; six-story brick apartment house at 160th Street and Broadway, for Hudson View Constr. Co., cost $[illegible]; Young & Wagner, Archts., 347 Fifth Avenue; six-story fireproof private dwelling at 9 E. Sixty-ninth Street, for Edwin C. Jameson, cost $60,-[illegible]; Grosvenor Atterbury, Archt., 20 W. Forty-third Street; twelve-story fireproof [illegible] at 328 West End Avenue, for Lillian M. Sorrel, cost $[illegible]; R. M. Partington, Archt., 345 Fifth Avenue; two five-story brick tenements at Crotona Avenue and 187th Street, for Cosenzo Bldg. Co., cost $90,000; Lucian Pisciotta, 391 E. 149th Street two five-story brick tenements at Ryder Avenue and 183d Street, for Valhalla Corporation, cost $100,000; Moore & Landsiedel, Archts., Third Avenue and 148th Street; five-story brick tenement at Southern Boulevard and 179th Street, for Park Hill Constr. Co., cost $70,000, Goldner & Goldberg, Archts., 391 E. 149th Street; five-story brick tenement at Valentine Avenue and 192d Street, for Louis C. Fries Constr. Co., cost $50,000, H. T. Howell, Third Avenue and 149th Street; five-story brick stores and tenements at 180th Street and Prospect Avenue, for St. John and Fox Street Corporation, cost $65,000; Chas. B. Meyers, 1 Union Square, Archt.; five-story brick tenement at Vyse Avenue and Freeman Street, for William Sinnott Co., cost $55,000, Kreymborg Architectural Co., Archts., 1029 E. 163d Street; two-story brick theater at Fordham Road and Morris Avenue, for H. N. Singhi, cost $100,000, J. C. Cocker, Archt., 2017 Fifth Avenue.

Paterson, N. J.—Plans being prepared by Charles E. Sleight, 136 Washington Street for 4-story store, office and lodge building to be erected at 131 Ellison Street for I. O. O. F. Cost, $50,000.

Phillipsburg, N. J.—Accho Lodge of Odd Fellows will erect a $25,000 building on S. Main Street.

Bedford, Pa.—Corle House of which Corle H. Smith is Mgr., it is reported, is to be enlarged at a cost of $60,000.

Dothan, Ala.—Central Warehouse & Gin Co. will erect a bonded warehouse costing $75,000, and the Farmers Union Warehouse Co. a similar building costing $75,000.

New Orleans, La.—Permit issued for a passenger station to be erected by Texas & Pacific R. R. Co. at a cost of $250,000. C. H. Chamberlin, Ch. Engr., Dallas, Tex.

Paris Ky.—J. H. Stivers of Paris, reported interested in company which intends erecting loose leaf warehouse, costing $100,000.

Columbus, Ohio.—Plans being prepared by D. Riebel & Sons, New First Natl. Bank Building, for convent to be erected for St. Mary's Church, Third and College Streets; cost, $30,000.

Plans being prepared by Richards, McCarthy & Bufford, Hartman Bldg., for a clubhouse for Scioto Country Club; cost $50,000.

Youngstown, Ohio.—Plans being prepared by Knox & Elliott Co., Rockefeller Building, Cleveland, for 5-story theater, hotel and store building to be erected on site of the old Tod House.

Crawfordsville, Ind.—Methodist Church considering plans for an addition; cost, $25,000.

Chicago, Ill.—Henry L. Newhouse, 4630 Prairie Avenue, reported architect for store and theater building which Ascher Bros. will erect at 3947 Drexel Boulevard; cost $150,000.

Plans prepared by Alfred S. Alschuler, 28 E. Jackson Boulevard, for 4-story brick and stone department store building to be erected on Forty-seventh Street and Ashland Avenue for Julius Oppenheimer.

Cedar Rapids, Iowa.—Bohemian Catholic Church preparing plans for a school. Address J. A. Victor, 87 Sixteenth Avenue, Cedar Rapids.

Muscatine, Iowa.—Plans being prepared by Fred. Bowman, Muscatine, for 2-story reinforced steel and concrete building to be erected on Front and Sycamore Streets.

Minneapolis, Minn.—Zuhrah Temple, Nobles of the Mystic Shrine, will erect on Franklin and Lyndale Avenues a temple costing $100,000.

Permit issued for 3-story brick and concrete telephone exchange building to be erected at Third Avenue and Sixth Street S. by the Tri-State Telephone & Telegraph Co.; cost $80,000.

Wichita, Kan.—Peoples Mausoleum Co. of Waterloo, Iowa, will erect in Highland Cemetery a mausoleum costing $60,000.

York, Neb.—Plans submitted to Bd. Directors of New York County Commercial Club for remodeling LeGrand Hotel; cost, $30,000.

Kansas City, Mo.—Frank Josephson, 1721 W. Ninth Street, intends erecting at 1114 Baltimore Avenue a 9-story hotel, brick, steel and concrete construction.

Richmond, Mo.—All bids opened July 26 at office of S. L. Bay, Richmond Trust Co., for erecting edifice for M. E. Church South have been rejected. No time set for receiving new bids. Eckel & Aldrich, Archts., Corby-Forsee Building, St. Joseph.

St. Louis, Mo.—Mercantile Trust Bldg. Co. reported contemplates erecting $500,-000 addition.

Houston, Tex.—Moores & Dunford, 10 S. La Salle Street, Chicago, Ill., are reported architects and engineers for the 8-story reinforced concrete, firsproof warehouse to be erected at Main and Fannin Streets on the north side of the Ship Channel. Cost, $800,000. Building is to be equipped with 14 modern high-speed freight elevators and two large passenger elevators.

San Antonio, Tex.—Plans about completed by Adams & Adams, Gibbs Building, for church to be erected by First Church of Christ (Scientist) on Avenue D and Fifth Street. Ira L. Rupley, Chmn. Bldg. Com.

Seattle, Wash.—Plans filed for concrete, brick and steel auditorium to be erected by Metropolitan Building Co. at Fifth Avenue and Seneca Street.

Plans completed by C. W. Saunders, Alaska Building, for 3-story and basement brick apartment house to be erected at 1809 Bway.; cost, $60,000.

BIDS DESIRED.

Gaylord, Minn.—Until Aug. 19 by St. Paul Lutheran Congregation for erecting brick church. Kirby T. Snyder, Archt., 643 Plymouth Bldg., Minneapolis; Charles Wallin, Secy. Bldg. Com.

West Concord, Minn.—Until Aug. 17 by C. D. Simpson, Counsellor for Citizens Hotel for erecting 2-story brick hotel, including heating and plumbing. H. E. Erickson, Archt., 321 American Natl. Bank Bldg., St. Paul.

Cayuga, N. D.—Until Aug. 20 by Bldg. Com. Roman Catholic Church (J. C. Miesen, Secy.) for erecting brick church. Haxby & Gillespie, Archts., Fargo, N. D.

Denver, Col.—Reported desired until Aug. 16 by Moores & Dunford, Engrs., 10 S. LaSalle Street, Chicago, Ill., for erecting a 4-story warehouse for Turner Co.

Seattle, Wash.—Reported desired until Sept 15 by Bebb & Gould, Archts., Denny Building, for erecting 5-story, Class A fireproof building for "The Times" at Stewart Street, Westlake and Third Avenues. Probable cost, $500,000.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**New York, N. Y.**—Contract awarded William J. Taylor Co., 5 E. Forty-second Street, for erecting nine-story fireproof hotel for Hotel Des Artistes, Inc.; cost $800,000. George Mort Pollard, Archt., 127 Madison Avenue. C. J. Jeppesen, 127 Madison Avenue, Structural Engr.

★**Syracuse, N. Y.**—Contract for steel work on Masonic Temple awarded Smith & Caffrey, Syracuse, at about $25,000.

★**Troy, N. Y.**—Contract for erecting addition to Albany Garage awarded W. S. Hamill Co. of Troy; cost, $40,000.

★**Harrison, N. J.**—Contract awarded David Henry Bldg. Co., 207 Market Street, Newark, for erecting 2-story brick shipping warehouse on Railroad Avenue for H. J. Heinz Co., 1062 Main Street, Pittsburgh, Pa. Cost, $50,000 George Bippus, Care of Owner, Pittsburgh, Archts.

★**Morristown, N. J.**—Contract for erecting 3-story museum and residence for Theodore N. Vail awarded Marc Eidlitz Co., 30 E. Forty-second Street, New York, at about $100,000. William Welles Bosworth, Archt., 527 Fifth Avenue, New York.

★**Philadelphia, Pa.**—Contract for erecting two-story brick and reinforced concrete school on Hutchinson and Cambria Streets for St. Bonaventura R. C. Church awarded Melody & Keating, Philadelphia, at about $40,000.

★Contract reported awarded by Pennsylvania R. R. Co. to John W. Gill & Co., Heed Building, for erecting 1-story brick immigrant station on Front Street and Washington Avenue at $82,339. A. C. Shand, Ch. Engr., Broad Street Station.

★**Baltimore, Md.**—Contract for erecting 2-story fireproof addition to Drovers & Mechanics Bank at Eutaw and Fayette Streets awarded B. F. Bennett Bldg. & Constr. Co., 123 S. Howard Street, at about $159,000. Joseph Evans Sperry, Archt., Calvert Building.

★Contract for erecting two buildings at Ramsay and Scott Streets for Bartlett-Hayward Co. awarded to J. Henry Miller, Baltimore. One building to be 2-story, 422.4 x 71.4 ft., fireproof construction, and cost $50,000, the other 1-story, 337.5 x 171 ft., cost $118,000.

★**New Orleans, La.**—Contract awarded Lionel Favret, New Orleans, for remodeling and improving building of Citizens Bank & Trust Co.; cost $50,000.

★**Johnson City, Tenn.**—Contract for erecting 3-story brick Elks Home awarded Beaumont Constr. Co. of Johnson City at about $25,000.

★**Dayton, Ohio.**—Contract for erecting fireproof home for Aerie No. 321 Fraternal Order of Eagles, awarded Structural Concrete Co., Dayton, at $36,100, plumbing and heating to Fromm & Jacobs, at $3,095.

★**Martins Ferry, Ohio.**—Contract for erecting Fenray Theater on S. Fourth Street awarded Charles D. Keyser, Bellaire, at about $35,000.

★**Grand Rapids, Mich.**—Contracts in connection with Commercial Savings Bank awarded as follows: granite work to Woodbury Granite Co. of Vermont; steel work, American Bridge Co., Detroit, Mich.; terra cotta work, S. A. Morman Co., Grand Rapids.

★**Madison, Wis.**—Contract awarded N. E. Brede, Chicago, Ill., for erecting six-story reinforced concrete building for Union Transfer & Storage Co.,; cost $120,000.

★**Kansas City, Mo.**—Contract for erecting Ridge Arcade building on Walnut Street awarded Fuller Constr. Co., Chicago, Ill., at about $100,000. Smith, Rea & Lovitt, Finance Building, Archts.

★**San Antonio, Tex.**—Contract awarded to Walsh & Burney, San Antonio, for erecting theater at W. Houston Street for Max Oppenheimer, at $35,000; to be of reinforced concrete brick and terra cotta front. Architects, Alfred Giles Co., of San Antonio.

★**Oklahoma City, Okla.**—Contract awarded by Leonard H. Bailey, Archt., Colcord Building, for erecting a theater on Robinson Street, to Reinhart & Donovan, Oklahoma City, at $92,000. (Bids opened July 31).

★**Quebec, Que.**—Contract awarded MacArthur Concrete Pile & Foundation Co., Montreal, for pedestal concrete piles for the union station and power house for Canadian Pacific Ry., Downing Cook Co., Ltd., General Contractors, Montreal.

NEW INDUSTRIAL PLANTS

PROPOSED WORK

Saco, Me.—Reported Sears, Roebuck Co., Arthington and Homan Avenues, Chicago, Ill., will erect a shoe factory here.

Bridgeport, Conn.—Plans prepared for a one-story addition to plant of Bridgeport Brass Co.,; cost $70,000.

★**Buffalo, N. Y.**—Turner Constr. Co., Buffalo, reported to have contract for erecting 10-story cold storage reinforced concrete building as an addition to plant of Buffalo Cold Storage Co. in Perry St.

Greensburg, Pa.—Pittsburgh Engineering Co., it is reported, contemplated erecting an addition to the plant.

South Bethlehem, Pa.—Reported Bethlehem Steel Co. will erect an addition to plant costing $500,000.

Fayetteville, Tenn.—J. E. Sirrine, Greenville, S. C., reported engineer for addition which Elk Cotton Mills intends erecting; cost $90,000.

Cleveland, O.—Plans filed for 4-story concrete factory which Richman Bros. Co., 1289 W. Ninth Street, will erect at E. Fifty-fifth Street and Luther Avenue at a cost of $250,000.

Granite City, Ill.—National Enameling & Stamping Co. (George W. Niedringhaus, Vice-Pres. and Gen. Mgr.), it is reported, intends erecting plant for manufacture of coke and reduction of iron ore.

Milwaukee, Wis.—Plans being prepared for $40,000 building which Phoenix Knitting Co. will erect on Jackson and Chicago Streets.

Newport, Minn.—Reported Farmers Terminal Packing Co. of St. Paul intends erecting a plant here costing $1,000,000. Ira M. J. Chryst of Hudson, Wis., president of company.

Tacoma, Wash.—Later reports state that improvements to be made by the Tacoma Smelting & Refining Co., to their plant will cost several million dollars, and include doubling the smelting capacity and the refining capacity, also erection of 4 steel buildings, large ore bunkers, a refinery, and nine additional furnaces.

Wallula, Wash.—Reported Pacific Fruit Co. in connection with Pacific Ry. Co. will erect a $25,000 ice house and storage plant.

Gold Hill, Ore.—The Beaver Portland Cement Co. of Portland (J. C. Burch, Mgr.) intends completing plant here.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Portchester, N. Y.**—Contract reported awarded Sullivan & McNally Co., First National Bank Building, Paterson, for erecting addition to factory of Wilford Hall Laboratories, Fox Island Road; cost, $60,000.

★**West Sand Lake, N. Y.**—Contract awarded by McLaren Knitting Co. to J. J. Finn & Sons, 9 Cuyler Avenue, Albany, for erecting 3-story factory 66 x 110 ft. to cost $60,000. C. G. Ogden, Archt., 159 State Street, Albany.

★**Trenton, N. J.**—Contract for erecting three-story concrete and brick hosiery mill for William F. Taubel awarded Harrison C. Rea Co., Philadelphia, Pa.

★**Cleveland, O.**—General contract awarded Masters & Mullen Constr. Co., 454 Rose Bldg., for erecting 4-story 66 x 120-ft. steel, concrete and brick addition to plant of Elwell-Parker Electric Co.; approximate cost, $50,000. Geo. S. Rider & Co., Consulting Engrs., 512 Century Building.

★**Oakland, Cal.**—Contract for concrete pile foundation and walls of the coal bunkers, trackways for coal-handling bridge, etc., at plant of Western Fuel Co. awarded MacArthur Concrete Pile & Foundation Co., 11 Pine Street, New York. H. S. Howard, Engr., San Francisco, Cal.

★**The Dalles, Ore.**—Reported contract awarded by Oregon-Washington R. R. & Navigation Co. to Netfleton, Bruce & Eachbach, American Bank Building, Seattle, Wash., for erecting a roundhouse, machine shop, etc., at The Dalles and Pilot Rock. Cost, $95,000.

MISCELLANEOUS

PROPOSED WORK

Pier—Baltimore, Md.—Tentative plans reported being prepared by Baltimore & Ohio Railroad Co. (F. L. Stuart, Ch. Engr., Baltimore) for a coal pier on Curtis Bay; cost approximately $1,000,000.

Coal Bunker—Seattle, Wash.—J. R. West, Chief Engr. of Port Comn., preparing plans for construction of coal bunkers on Puget Sound, at Smith's Cove improvement of Port; to be of steel and frame construction, and cost about $25,000.

BIDS DESIRED.

Freight Shed—Brooklyn, N. Y.—Until Aug. 23 for Contr. 1465—Furnishing material and erecting a freight shed with appurtenances on the pier near the foot of Twenty-ninth Street, borough of Brooklyn. Security $42,000.

Fence—New York, N. Y.—Until Aug. 19 by Park Bd. (Cabot Ward, Pres.), for furnishing material and erecting a wrought-iron fence and setting artificial granite gate posts around Morningside Park. Security $7,000.

Steel Inspection and Cement Testing—Pittsburgh, Pa.—Until 11 a. m. Aug. 16 for duplicate bids, one to be opened in office of City Controller and one in office of County Controller, for the mill and shop steel inspection and cement testing service, entering into the construction of the new City and County building, Grant and Diamond Streets.

Light Station—New Orleans, La.—Until Sept. 10 at office of Lighthouse Inspector, New Orleans, for constructing a light station and five lighted beacons for the Atchafalaya entrance channel.

Steel Reinforcing Bars—Cleveland, Ohio.—Until Aug. 18 by A. R. Callow, Comr. Purchases and Supplies, for steel reinforcing bars for the Dept. Pub. Utilities, Div. of Water.

Locomotive Crane—Lincoln, Neb.—Until Aug. 18 by Theodore H. Berg, City Clk., for furnishing and installing an electric locomotive crane at the City Water and Light Plant. Engineer's estimate, $4,500.

Weatherstripping and Screens—Fort Bliss, Tex.—Until Sept. 2 by Dept. Quarter Master, El Paso, for screening and weatherstripping approximately thirty-five quarters and barracks at Fort Bliss, advertised in Engineering Record.

Elevator—Medford, Ore.—Until Aug. 31 by James A. Wetmore, Superv. Archt., Washington, D. C., for installing, complete, an electric passenger elevator in P. O. and Court House Building, at Medford.

Steel Castings, etc.—Panama.—Until Aug. 27 by Maj. F. C. Boggs, Corps Engrs., U. S. A., Genl. Purchasing Officer, Panama Canal, Washington, D. C., for Cir. 959—Malleable iron castings, steel castings, car repair parts, copper wire, pipe fittings, etc.

Proposals

For Proposals Advertised, see Pages 47, 48 and 49.

WATERWORKS.

Bids Close.		See Eng. Record.
Aug. 16.	System, Watervliet, N. Y. Adv. July 17 to Aug. 7.	July 17
Aug. 16.	Mains, Hatfield, Pa. Adv. Aug. 7, 14.	Aug. 7
Aug. 17.	Pipe, Intake, etc., Beaumont, Tex.	July 24
Aug. 17.	Pipe, Berwyn, Ill.	Aug. 14
Aug. 19.	Water Wks., Syracuse, Neb.	Aug. 7
Aug. 20.	Water Wks., Brewster, Ohio	Aug. 7
Aug. 20.	Water Wks., Windsor, Conn. Adv. Aug. 7.	Aug. 7
Aug. 20.	Pumps, Etc., Gloucester, N. J.	Aug. 14
Aug. 20.	Borings for Filter, Cleveland, Ohio	Aug. 14
Aug. 20.	Pipe, Newark, Ohio	Aug. 14
Aug. 20.	Chlorinating Plant at Pump. Station, Chicago, Ill.	Aug. 14
Aug. 21.	Water Wks., South Braintree, Mass.	Aug. 14
Aug. 23.	Concrete Gallery, Burlington, Ont.	Aug. 14
Aug. 24.	Reservoir, Luverne, Minn. Adv. Aug. 14.	Aug. 14
Aug. 24.	Dam, Etc., Charlton, Iowa	Aug. 14
Aug. 24.	Water Wks., Milligan, Neb.	Aug. 14
Aug. 24.	Waterworks, Sparta, Ill. Adv. Aug. 14.	Aug. 14
Aug. 25.	Hydrants, reservoir, piping system, etc., Wellsville, N. Y. Adv. July 31.	July 31
Aug. 26.	Mech. Equip. of Pump. Engine, Galveston, Tex.	Aug. 7
Aug. 29.	Water Wks., Brewster, Ohio	Aug. 14
Aug. 31.	Contract 154, New York, N. Y. Adv. Aug. 14.	Aug. 14
Sep. 6.	Pump. Unit, Regina, Sask.	Aug. 7
Sep. 7.	Mains, Cleveland Heights, Ohio	Aug. 14
Sep. 7.	C.-I. Pipe, Vallejo, Cal.	Aug. 14
Sep. 7.	Well pump and service pumps, Monticello, Ill.	Aug. 14

SEWERAGE AND SEWAGE DISPOSAL.

Aug. 16.	Nutley, N. J.	Aug. 14
Aug. 17.	Long Island City, L. I., N. Y.	Aug. 7
Aug. 17.	Toronto, Ont.	Aug. 7
Aug. 17.	Berwyn, Ill.	Aug. 14
Aug. 17.	Green Bay, Wis.	Aug. 14
Aug. 17.	Stillwater, Minn.	Aug. 11
Aug. 17.	Canton, Ohio.	Aug. 14
Aug. 18.	East Gardner, Mass. Adv. Aug. 7.	Aug. 7
Aug. 18.	Cleveland, Ohio Adv. Aug. 7, 14.	Aug. 7
Aug. 18.	Boston, Mass.	Aug. 14
Aug. 19.	Chardon, Ohio Adv. Aug. 7.	Aug. 7
Aug. 19.	Long Island City, N. Y.	Aug. 14
Aug. 19.	Cleveland, Ohio	Aug. 14
Aug. 19.	Richfield, Utah. Adv. Aug. 14.	Aug. 14
Aug. 20.	Beeville, Tex.	July 31
Aug. 20.	Cedar Rapids, Iowa	Aug. 14
Aug. 20.	Oswego, N. Y. Adv. Aug. 14.	Aug. 14
Aug. 23.	Dallas, Tex. Adv. July 24.	July 24
Aug. 23.	Sandstone, Minn.	Aug. 7
Aug. 24.	Woonsocket, R. I. Adv. Aug. 14.	Aug. 14
Aug. 24.	Westchester, Pa.	Aug. 14
Aug. 25.	Thorold, Ont.	Aug. 14
Aug. 25.	Lebanon, Pa. Adv. July 24 to Aug. 14.	July 24
Aug. 25.	Brockport, N. Y. Adv. Aug. 14.	Aug. 14
Aug. 30.	Sellersville, Pa. Adv. Aug. 14.	Aug. 14
Aug. 31.	Newark, N. J. Adv. July 17 to Aug. 7.	July 10
Aug. 31.	Yorktown Heights, N. Y. Adv. Aug. 14.	Aug. 14
Aug. 31.	Rochester, N. H. Adv. Aug. 14.	Aug. 14
Sep. 1.	Sand Springs, Okla.	July 31
Sep. 7.	Albany, N. Y. Adv. Aug. 7, 14.	Aug. 7
Sep. 7.	Cleveland Heights, Ohio.	Aug. 14
Sep. 14.	Ocala, Fla.	Aug. 14

BRIDGES.

Aug. 17.	Athens, Ga. Adv. July 31.	July 31
Aug. 17.	Illinois	Aug. 7
Aug. 17.	Illinois	Aug. 14
Aug. 17.	Lake Geneva, Wis.	Aug. 14
Aug. 17.	Marietta, Ohio.	Aug. 14
Aug. 18.	Girard, Kan.	Aug. 7
Aug. 18.	Illinois	Aug. 14
Aug. 18.	St. John, N. B.	Aug. 14
Aug. 18.	Mankato, Minn.	Aug. 14
Aug. 19.	Illinois	Aug. 14
Aug. 19.	Oskaloosa, Kan.	Aug. 14
Aug. 20.	Greenwich, N. Y. Adv. Aug. 7, 14.	Aug. 7
Aug. 20.	Mount Gilead, Ohio.	Aug. 14
Aug. 21.	Kennett, Cal.	July 31
Aug. 21.	Fremont, Ohio	Aug. 14
Aug. 21.	Richmond, Ind.	Aug. 14
Aug. 23.	Maynardsville, Tenn. Adv. July 24, 31.	July 24
Aug. 23.	San José, Cal.	Aug. 7
Aug. 23.	Dunsmuir, Cal.	Aug. 7
Aug. 23.	Los Angeles, Cal.	Aug. 7
Aug. 23.	West Chester, Pa. Adv. Aug. 14.	Aug. 14
Aug. 23.	Wadena, Minn.	Aug. 14
Aug. 23.	Illinois	Aug. 14
Aug. 24.	Guthrie Center, Iowa	Aug. 14
Aug. 25.	Ventura, Cal.	Aug. 14
Aug. 26.	Tulsa, Okla. Adv. July 31 to Aug. 14.	July 31
Aug. 26.	Terrell, Tex.	Aug. 14
Aug. 26.	Ottawa, Ont.	Aug. 14
Aug. 30.	Green Bay, Wis.	Aug. 14
Sep. 1.	Detroit, Mich.	Aug. 14
Sep. 8.	St. Paul, Neb.	Aug. 14
Sep. 6.	Columbus, Miss.	Aug. 14
Sep. 7.	Hudson, S. D.	Aug. 14
Sep. 8.	South Amboy, N. J.	Aug. 7
Sep. 25.	Hankow, China. Adv. Aug. 14.	Aug. 14
Oct. 6.	Lawrence, Kan. Adv. Aug. 14.	Aug. 14
———	Woonsocket, R. I.	Aug. 14

PAVING AND ROADS.

Aug. 16.	South Bethlehem, Pa. Adv. Aug. 7.	Aug. 7
Aug. 16.	Aurora, Ill. Adv. Aug. 14.	Aug. 14
Aug. 17.	Memphis, Tenn.	July 17
Aug. 17.	Cherokee, Iowa	July 31
Aug. 17.	Waterville, Wash.	July 31
Aug. 17.	Uhrichsville, Ohio	Aug. 7
Aug. 17.	Howell, Mich.	Aug. 7
Aug. 17.	Fort Meade, Fla.	Aug. 7
Aug. 17.	Columbus, Ohio	Aug. 7
Aug. 17.	Sandusky, Ohio	Aug. 14
Aug. 17.	Chicago, Ill.	Aug. 14
Aug. 17.	Hagerstown, Md.	Aug. 14
Aug. 17.	Canton, Ohio	Aug. 14
Aug. 17.	Champaign, Ill.	Aug. 14
Aug. 17.	Canton, Ohio	Aug. 14
Aug. 18.	South Bend, Ind.	July 24
Aug. 18.	Marion, Ohio	July 31
Aug. 18.	Lincoln, Neb.	July 31
Aug. 18.	Belding, Mich.	Aug. 7
Aug. 18.	Brooklyn, N. Y.	Aug. 14
Aug. 18.	Chicago, Ill.	Aug. 14
Aug. 18.	Neodesha, Kan.	Aug. 14
Aug. 18.	Buffalo, N. Y.	Aug. 14
Aug. 18.	New York, N. Y.	Aug. 14
Aug. 18.	Washburn, Wash.	Aug. 14
Aug. 18.	Illinois	Aug. 14
Aug. 18.	Milwaukee, Wis.	Aug. 14
Aug. 19.	Pittsburgh, Pa.	Aug. 7
Aug. 19.	Bozeman, Mont.	Aug. 14
Aug. 19.	Long Island City, N. Y.	Aug. 14
Aug. 19.	Deerfield, Mich.	Aug. 14
Aug. 19.	Dubuque, Iowa.	Aug. 14
Aug. 20.	Ohio	Aug. 14
Aug. 20.	Newark, Ohio	Aug. 14
Aug. 20.	Marion, Ohio	Aug. 14
Aug. 20.	Chicago, Ill.	Aug. 14
Aug. 21.	Tacoma, Wash.	Aug. 14
Aug. 21.	Akron, Ohio	Aug. 14
Aug. 22.	Toledo, Ohio.	July 31
Aug. 23.	Chillicothe, Ohio	Aug. 14
Aug. 23.	New Brunswick, N. J.	Aug. 14
Aug. 23.	Columbus, Ohio	Aug. 14
Aug. 23.	North Yakima, Wash.	Aug. 14
Aug. 23.	Shakopee, Minn.	Aug. 14
Aug. 23.	Everett, Wash.	Aug. 14
Aug. 24.	Albany, N. Y. Adv. Aug. 7, 14.	Aug. 7
Aug. 24.	Ottawa, Ont.	Aug. 14
Aug. 24.	Greenville, Tenn. Adv. Aug. 14.	Aug. 14
Aug. 25.	Irvington, N. J.	Aug. 7
Aug. 25.	Scarsdale, N. Y. Adv. Aug. 7.	Aug. 7
Aug. 26.	Albany, N. Y. Adv. Aug. 7, 14.	Aug. 7
Aug. 27.	Columbus, Ohio	Aug. 7
Aug. 27.	Cadiz, Ohio	Aug. 14
Aug. 27.	Akron, Ohio	Aug. 14
Aug. 30.	Denver, Col.	July 24
Aug. 30.	Eaton, Ohio	Aug. 14
Aug. 30.	Washington	Aug. 14
Aug. 30.	Washington	Aug. 14
Sep. 3.	Toledo, Ohio	Aug. 14
Sep. 7.	Princess Anne, Md.	Aug. 14
Sep. 7.	Cleveland Heights, Ohio.	Aug. 14
Sep. 7.	Winamac, Ind.	Aug. 14
Sep. 9.	Tallahassee, Fla.	Aug. 14

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS.

Aug. 16.	Dredging, Portland, Me. Adv. July 17 to Aug. 7.	July 17
Aug. 16.	Lake Shore Protection, Evanston, Ill. Adv. Aug. 7.	Aug. 7
Aug. 17.	Dredging, Chicago, Ill. Adv. July 24 to Aug. 14.	July 24
Aug. 17.	Levee, Greenville, Miss.	July 24
Aug. 17.	State canal work, Albany, N. Y.	July 31
Aug. 17.	Ditch, Kankakee, Ill.	July 31
Aug. 17.	Filling in of Pond, Toronto, Ont.	Aug. 7
Aug. 18.	Reclamation Work, St. Ignatius, Mont.	July 24
Aug. 18.	Ditch, Montevideo, Minn.	Aug. 14
Aug. 18.	Ditch, Breckenridge, Minn.	Aug. 14
Aug. 19.	Levee work, New Orleans, La.	Aug. 14
Aug. 20.	Steel Lock Gates, etc., Pittsburgh, Pa. Adv. July 24 to Aug. 14.	July 24
Aug. 20.	Stone for jetties, Wilmington, Del.	July 31
Aug. 21.	Wharf, San Francisco, Cal.	July 31
Aug. 21.	Drainage, Corinne, Utah. Adv. Aug. 7.	Aug. 7
Aug. 24.	Dredger, Adelaide, Australia	Jun. 19
Aug. 24.	Docks and Dams, Tallahassee, Fla. Adv. Aug. 14.	Aug. 14
Aug. 26.	Trestles, etc., for dam, Pittsburgh, Pa. Adv. July 31 to Aug. 14.	July 31
Aug. 27.	Irrigation, Newell, S. D. Adv. July 31.	July 31
Aug. 28.	Ditch, Winamac, Ind.	Aug. 14
Aug. 30.	Lock Gates, Etc., Pittsburgh, Pa.	Aug. 7
Aug. 30.	Dam, Toccoa, Ga.	Aug. 14
Aug. 31.	Dredging, San Francisco, Cal.	Aug. 14
Sep. 1.	Ditch, New Philadelphia, Ohio	Aug. 14
Sep. 8.	Irrigation, Malta, Mont. Adv. July 31.	July 31
Sep. 8.	Irrigation, Fort Laramie, Wyo.	Aug. 14
Sep. 8.	State Canal Wk., Albany, N. Y.	Aug. 14
Sep. 15.	Dredging, Baltimore, Md. Adv. Aug. 14.	Aug. 14
Sep. 17.	Drainage, Palmetto, Fla.	July 24
Sep. 18.	Pier, Pearl City, T. H.	July 10
Sep. 22.	Piers, Honolulu, Hawaii. Adv. Aug. 7, 14.	Aug. 7
———	Dredging, New York, N. Y. Adv. Aug. 7.	Aug. 7

PUBLIC BUILDINGS AND SCHOOLS.

Aug. 16.	Baltimore, Md. Adv. Jun. 26 to July 3.	Jun. 26
Aug. 17.	Pittsburgh, Pa.	Aug. 14
Aug. 17.	Toronto, Ont.	Aug. 14
Aug. 18.	Lincoln, Neb.	July 31
Aug. 18.	Morenci, Mich.	July 31
Aug. 18.	School, Larimer, Pa.	July 31
Aug. 18.	Granite Falls, Minn.	Aug. 7
Aug. 18.	Washington, D. C.	Aug. 14
Aug. 18.	Austin, Minn.	Aug. 14
Aug. 19.	Blackwell, Okla.	July 17
Aug. 19.	Ames, Iowa	Aug. 14
Aug. 19.	Medfield, Mass.	Aug. 14
Aug. 19.	Los Angeles, Cal.	Aug. 14
Aug. 20.	Ypsilanti, Mich.	July 24
Aug. 20.	Camden, Ohio.	July 31
Aug. 20.	Ostrander, Ohio	Aug. 7
Aug. 20.	San Antonio, Tex.	Aug. 14
Aug. 20.	Sullivan, Ill.	Aug. 14
Aug. 20.	Sing Sing, N. Y. Adv. Aug. 14.	Aug. 14
Aug. 20.	Rochester, Minn.	Aug. 14
Aug. 21.	Terre Haute (R. D. Urbanna), Ohio.	July 31
Aug. 23.	Toledo, Ohio	July 31
Aug. 23.	Sheperdstown, W. Va.	Aug. 7
Aug. 23.	Upper Alton, Ill.	Aug. 7
Aug. 23.	Elwood, Iowa	Aug. 14
Aug. 23.	Brooklyn, N. Y.	Aug. 14
Aug. 23.	Lake Park, Minn.	Aug. 14
Aug. 24.	Grand Junction, Col.	July 24
Aug. 24.	Sykeston, N. D.	Aug. 7
Aug. 24.	Sugar Grove, Ohio.	Aug. 14
Aug. 24.	Marion, Ohio	Aug. 14
Aug. 24.	Pittsburgh, Pa.	Aug. 14
Aug. 24.	Sisseton, Minn.	Aug. 14
Aug. 24.	Belleville, Ill.	Aug. 14
Aug. 25.	Pittsburgh, Pa. Adv. July 31 to Aug. 14.	July 31
Aug. 25.	Forest City, Iowa.	Aug. 14
Aug. 25.	Salamanca, N. Y.	Aug. 14
Aug. 26.	Woodsfield, Ohio	Aug. 7
Aug. 26.	Fort Rosecrans, Cal.	Aug. 7
Aug. 27.	Palatka, Fla.	July 31
Aug. 27.	Columbus, Ohio	Aug. 7
Aug. 28.	Indian Head, Md.	Aug. 7
Aug. 28.	Port Royal, S. C.	Aug. 7
Aug. 28.	Luana, Iowa	Aug. 7
Aug. 28.	Fort Mifflin, Pa.	Aug. 7
Aug. 30.	Schuyler, Neb.	Aug. 7
Aug. 30.	Fitchburg, Mass.	Aug. 14
Aug. 31.	Little Falls, N. Y. Adv. Aug. 7.	Aug. 7
Aug. 31.	Baltimore, Md. Adv. Aug. 7, 14.	Aug. 7
Aug. 31.	White Plains, N. Y.	Aug. 14
Sep. 1.	Hartford City, Ind.	July 31
Sep. 1.	Wisner, Neb.	July 10
Sep. 1.	Hammond, Ind. Adv. Aug. 14.	Aug. 14
Sep. 2.	Portland, Ore.	Aug. 14
Sep. 5.	Tippecanoe City, Ohio.	Aug. 14
Sep. 7.	Charter Oak, Iowa.	Aug. 14
Sep. 7.	Charlotte, N. C.	Aug. 7
Sep. 7.	Fulton, Mo.	Aug. 7
Sep. 10.	Gouverneur, N. Y.	Aug. 7
Sep. 10.	Lebanon, Ind.	Aug. 14
Sep. 11.	Bremerton, Wash.	Aug. 14
Sep. 27.	Tulsa, Okla.	Aug. 14
Sep. 30.	Washington, D. C. Adv. July 24, 31.	July 24
———	Lake Linden, Mich. Adv. Aug. 7, 14.	Aug. 7

PRIVATE BUILDINGS.

Aug. 17.	West Concord, Minn.	Aug. 14
Aug. 19.	Gaylord, Minn.	Aug. 14
Aug. 20.	Cayuga, N. D.	Aug. 14
Sep. 15.	Seattle, Wash.	Aug. 14

MISCELLANEOUS.

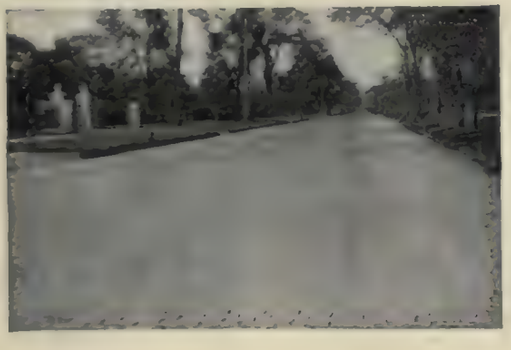
Aug. 16.	Found. and Piers for El. Ry., Philadelphia, Pa. Adv. July 17, 24.	July 17
Aug. 17.	Filling and Grading, Trenton, N. J. Adv. Aug. 7, 14.	Aug. 7
Aug. 18.	El. Ry. Supplies, Etc., Long Island City, N. Y.	July 24
Aug. 18.	El. Ry. work, New York, N. Y.	July 31
Aug. 18.	Steel Reinforcing Bars, Cleveland, Ohio	Aug. 14
Aug. 18.	Locomotive Crane, Lincoln, Neb.	Aug. 14
Aug. 18.	Street Cleaning Machines, Columbus, Ohio	Aug. 14
Aug. 19.	Fence, New York, N. Y.	Aug. 14
Aug. 20.	Steel Reinforcing Bars, Panama	Aug. 7
Aug. 21.	Air Compressors, etc., Pittsburgh, Pa. Adv. July 24 to Aug. 7.	July 24
Aug. 21.	Repairs to Statue of Liberty, Ft. Wood, N. Y. Adv. Aug. 7, 14.	Aug. 7
Aug. 23.	Derrick boat, Washington, D. C. Adv. July 31 to Aug. 14.	July 31
Aug. 24.	Elevator, Madison, Wis.	Aug. 7
Aug. 25.	Freight Shed, Brooklyn, N. Y.	Aug. 14
Aug. 26.	Incinerator, Ottawa, Ont.	Aug. 14
Aug. 26.	Garbage Disposal, Ottawa, Ont.	Aug. 14
Aug. 27.	Tunnel, Columbus, Ohio.	Aug. 7
Aug. 27.	Steel Castings, Etc., Panama	Aug. 14
Aug. 28.	Elevator, Pearl City, Hawaii	Aug. 7
Aug. 31.	Elevators, Amarillo, Tex.	Aug. 7
Aug. 31.	Steel Barges, Etc., Cincinnati, Ohio Adv. Aug. 7, 14.	Aug. 7
Aug. 31.	Elevator, Medford, Ore.	Aug. 14
Aug. 31.	Elevators, Baltimore, Md.	Aug. 7
Sep. 1.	Grading School Site, Cincinnati, Ohio Adv. Aug. 7.	Aug. 7
Sep. 2.	Weather Stripping and Screens, Fort Bliss, Tex. Adv. Aug. 14.	Aug. 14
Sep. 10.	Light Station, New Orleans, La.	Aug. 14
Sep. 18.	Ry. at Naval Station, Pearl Harbor, Hawaii.	July 18



Chillicothe Street
Portsmouth, Ohio
Pitch filled
1895



Main Street
Butler, Pa.
Paved
1891



Euclid Avenue
Cleveland, Ohio
Laid
1883 or 1884



East Rich Street
Columbus, Ohio
Pitch filler finished June 22,
1892



West 4th Street
Newport, Ky.
Paved
1894

Barrett's PAVING PITCH

It lasts as long as the pavement

THESE brick pavements are pretty old, but the original Barrett's Paving Pitch in the joints is still on duty and is still maintaining a perfect seal against the intrusion of water and frost.

It still clings to the blocks in every kind of weather regardless of the expansion or contraction.

Chemically the pitch in these joints is just as good as it ever was and if it could be taken out, it could be melted up and used over again in a new pavement.

In none of these old pavements is to be found a single crack, for every joint is an expansion joint.

The pavements are much quieter than if the joints were filled with cement and the footing for horses is better because a shallow groove is left at the top of each joint.

From the viewpoints of satisfaction and economy, no other filler is equal to Barrett's Paving Pitch.

We point to the illustrations herewith, and to many other streets all over the country with similar records of efficiency, to demonstrate the truthfulness of our claims.

Booklets free on request

BARRETT MANUFACTURING CO.

New York Chicago Philadelphia Boston St. Louis
Cleveland Cincinnati Pittsburgh Detroit Birmingham
Kansas City Minneapolis Salt Lake City Seattle
THE PATERSON MFG. CO., Limited: Montreal Toronto
Winnipeg Vancouver St. John, N. B. Halifax, N. S. Sydney, N. S.

New Blasting Machine May Be Carried in Coat Pocket

To meet the needs of contractors and others, who, having but a few charges to fire, have hitherto been compelled to carry a heavy battery long distances, then return it again, the E. I. du Pont de Nemours Powder Company of Wilmington, Del., has developed and placed



MACHINE CAN FIRE FIVE CAPS

on the market a blasting machine capable of firing three to five blasting caps, yet so small as to be easily slipped into a man's side coat pocket without making an unreasonably large bulge. It weighs, but 4½ lb. and cannot be operated without a key, hence, is practically foolproof. In operating it is not necessary to find a level spot on which to stand it. The machine is held in the left hand, the right hand grasping the key. A quick, sharp twist of the latter generates the current and fires the shot. After use the key is removed. The machine is 4½ in. high, 3⅝ in. wide and 3⅛ in. thick, and has rounded edges. The manufacturer states that it is very substantially built and is perfectly moisture proof.

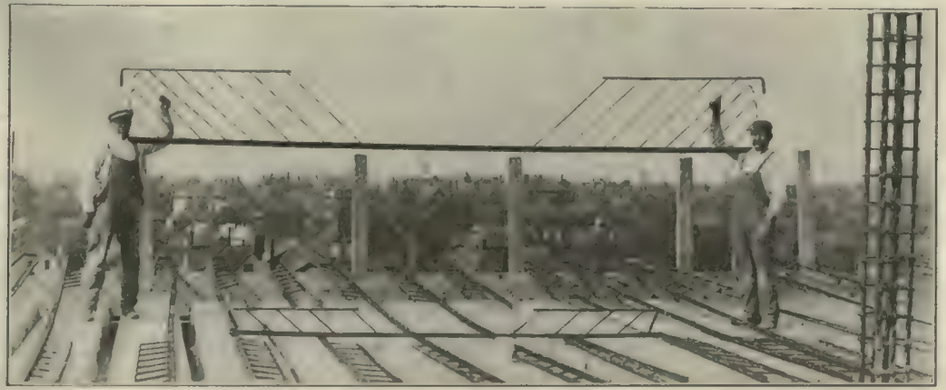
Shop-Fabricated Unit Reinforcement Has Rivet Grip

Mechanical bond and rigidly attached web members allowing flexible control over built-up units in concrete reinforcement are furnished by a new system of reinforcing recently placed on the market. A rigid one-piece frame, with no loose parts, can be fabricated to withstand the most severe field handling. In this system the auxiliary reinforcing members, such as diagonal tension and shear members, tie rods for walls, columns, etc., can be fastened to the main reinforced members rigidly, safely and at a very low cost. The standard bar of this system is a troughed section, as can be seen on the accompanying photograph. The upper or troughed part of the bar is a constant, and increased area is developed by making the section deeper as required. The bar used as auxiliary is practically a standard 9/16 x ¼-in. flat rolled, however, with knobs or corrugations on each edge.

Fabrication is effected by placing a portion of the auxiliary flat, properly bent, within the trough and with a bulldozer or other pressure machine squeezing the wings of the main bar, gripping the knobs of the flat, and practically riveting the auxiliary bar to the main section. Repeated tests, which have been carried on at the Case School of Applied Science, it is claimed, demonstrate that this rivet grip, as it is called, is greater than the ultimate strength of the auxiliary member.

While this system has been used only for beams and girders and on some special bank-vault work up to the present, it practically means that universal fabrication is offered through the simple means of rolling the bar in this section. The fabrication is claimed to be adaptable, economical and very efficient.

This material, which is known as shop-fabricated reinforcement, has been used on high school and hospital work in Cleveland. It was invented by Armen Tashjian, consulting engineer with Walker & Weeks, architects, Cleveland. It is being marketed by the Shop-Fabricated Reinforcement Company, Cleveland, of which Charles S. Beardslee is general manager.



RIGIDLY ATTACHED WEB MEMBERS FURNISHED BY THIS SYSTEM OF REINFORCING

Business Notes

J. O. Hobby, Jr., has been appointed treasurer of the American Locomotive Company, 30 Church Street, New York City.

William B. Dixey, who was connected with the sales department of the Blaw Steel Construction Company, 165 Broadway, New York City, for many years, died at Westfield, N. J., Aug. 11.

The Walter A. Zelnicker Supply Company of St. Louis has purchased the good will and stock of the Bintliff Supply Company, which did a general railroad, mill and factory supply business and specialized in railroad track tools.

William S. Porter, former vice-president and general manager of the Associated Oil Company of California, died in San Francisco on Aug. 10, aged 52 years. Mr. Porter was formerly assistant Pacific Coast manager of the Crane Company, Chicago.

The Marion-Osgood Company of Marion, Ohio, manufacturer of steam shovels, dipper dredges, ballast unloaders and kindred machinery, has changed its corporate name to The Osgood Company of the same address. The change was made to conform to the company's trade name "Osgood" so as to connect the two in the mind of the trade.

The Hartford Machine Screw Company of Hartford, Conn., expects that the recent additions to its plant will be completed and running to full capacity by Sept. 1. These consist of a 6-story structure, 206 ft. long by 46 ft. wide, and a large 2-story building with a convenient railroad siding. Machinery and equipment of the latest type is being installed as rapidly as possible.

The Pacific Tank & Pipe Company, manufacturer of tanks and wood pipe, of Portland, Ore., has organized the National Tank & Pipe Company, a separate company, to take over its business in the Northwest. The plant of the latter company is located at Kenton Station and occupies a tract of 12 acres, served in the front by rail and at the back end by water. Its office is at 275 Oak Street, Portland, Ore.

The Goulds Manufacturing Company, manufacturer of pumps and hydraulic machinery, of Seneca Falls, N. Y., has opened an office in the Henry W. Oliver Building, Pittsburgh. A. H. Henderson, who has been representing the company in northern West Virginia and southeastern Ohio, will have charge of the new office. E. C. Wayne, formerly of the main office at Seneca Falls, will be assistant manager. A change in the management of the sales organization of the company has taken effect. Instead of having the entire organization in charge of a single executive, the work has been divided and is now directed by R. E. Hall, formerly manager of the Boston office, and W. E. Dickey, former manager of the New York office, both of whom are vice-presidents of the company. A. H. Whiteside, the former sales manager, has resigned. Mr. Hall is located at Seneca Falls and has charge of the general work of the department. He also looks after the export business and the business in all the Northern, Central West and Northern Pacific States, including the territories of the Boston, Seneca Falls and Chicago offices. Mr. Dickey is located, as hitherto, at 17 Murray Street, New York City, and has charge of all business in Southern, Southwestern and Southern Pacific States, including the territories of the New York, Pittsburgh, Atlanta and Houston offices. W. H. Hopper, who has been with the company for over twenty years, succeeds Mr. Dickey as New York manager. C. W. Fulton, formerly works manager, has been appointed manager of the Boston office.

Trade Publications

The following companies have recently issued trade literature:

Buff & Buff Mfg. Company, Jamaica Plains, Boston, Mass. Booklet, 5¼ x 7 in., 32 pages, illustrated. A discourse on practical and important points about transits and levels. It covers the telescope, levels, graduations and the centers of instruments and explains Buff & Buff's method of manufacture.

Asbestos Protected Metal Company, Pittsburgh. Three booklets, 3½ x 6¼ in., 16 pages each, illustrated, entitled, "Asbestos Steel for Roofs and Walls," "Asbestos Protected Metal in the Coal Field" and "Asbestos Protected Metal for Roofing and Siding." Describe and illustrate asbestos lath adaptabilities and protection of equipment with asbestos-protected metal in mining and manufacturing plants.

Orton & Steinbrenner Company, 608 S. Dearborn Street, Chicago. Catalog 11, 6¼ x 9½ in., 44 pages, illustrated. Describes in detail the principal features of the standard locomotive crane manufactured by this company, illustrates various types in use, also two makes of clam shell and one of orange peel buckets and contains specifications for standard, 10, 15, 20, 25 and 30-ton cranes and clam shell buckets.

Orenstein-Arthur Koppel Company, Koppel, Pa. Catalog 911, 6 x 9 in., 28 pages, illustrated. The economy and efficiency of industrial railway equipment on road building is the principal subject of this publication. It involves descriptions of actual cases where Koppel equipment has been successfully used, and the equipment in detail. It contains such information for road builders as is generally deemed useful; for instance, a table showing estimated quantities of materials in a given mile of road, classified according to feet and definitions of road terms.

CONTRACTING NEWS

Of Special Interest to Engineers, Contractors, Builders and Manufacturers of Engineering and Building Supplies

THE Interstate Commerce Commission recently granted a small part of the increases in freight rates asked by the Western railroads. Disappointment at the smallness of the increase granted is partly overshadowed by the admission on the part of the commission of the principle that, where freight rates are unjustly low, the carriers are entitled to an increase which will at least support their business. The decision of the same commission in cutting heavily the rates on coal in force on several Eastern roads is not regarded with alarm. These roads own a large share of the mines affected, and the decision simply takes money out of one pocket and puts it into another. The effect of the cut was also lessened by a recommendation that the roads charge more for the use of their storage and handling facilities at terminals.

It is again stated on good authority that the foreign exchange situation will be relieved by the floating of a large loan here on the part of Great Britain. On the strength of this news, the price of exchange sterling has ceased to drop. Indeed, no great anxiety has been felt over the exchange situation for some time, since it became apparent that the low rates were not resulting in a flood of selling foreign-held American securities.

Structural-steel contracts were booked during July at the rate of 86 per cent of the entire capacity of the country, according to returns tabulated by the Bridge Builders & Structural Society. Structural work is still active, 51,000 tons having been contracted for last week in addition to the record business for the first week in August. Many additional inquiries are in sight, the increase in steel building work being noteworthy.

The opening of bids for the first sections of Philadelphia's new rapid-transit lines marks the beginning of another construction undertaking involving many million dollars.

Buildings

A railroad station to cost $150,000 has been contracted for at Mount Vernon, N. Y. In New York City a sixteen-story office building and a twelve-story apartment house were contracted for last week. The lowest bid submitted for erecting schools at Binghamton, N. Y., was $154,000. Bids are desired for foundation work on a $175,000 hospital building at Minneapolis. Bids are also desired for a $100,000 courthouse at Perry, Okla., and for alterations to the State House at Cheyenne, Wyo., to cost $150,000. Plans have been filed in New York City for three apartment houses, costing $800,000, $450,000 and $375,000 respectively, and for a $230,000 loft building in Long Island City. It is reported that a $400,000 bank building will be erected in Boston.

School bonds in the sum of $232,000 have been sold at Florence, S. C. Architects have been selected to prepare plans for a $1,000,000 building for the University of Michigan at Ann Arbor. Plans have been completed for a $175,000 apartment house at Indianapolis. It is reported from St. Paul that a $250,000 apartment house and a $150,000 grain elevator will be built there. Plans have been prepared for a $200,000 hotel at Butte, Mont. Plans are being prepared for a $550,000 hospital at San Francisco for the University of California.

Bridges and Roads

A highway bridge to cost $101,000 has been contracted for at Westport, Conn. A $45,000 bridge contract has been awarded at Antlers, Okla. All bids opened at Bridgeport, Conn., for constructing the reinforced-concrete bridge noted recently, have been rejected and new bids are called for. Bids are asked for constructing a reinforced-concrete bridge at Hartford, Conn. Bids are desired Sept. 7 for constructing a concrete bridge over the Arkansas River at Ellinwood, Kan. Plans have been prepared for a $500,000 viaduct at Dallas, Tex.

Bids have been opened in Philadelphia for one paving contract to cost $212,000, and for several smaller contracts totaling more than $235,000. Contracts for 14 miles of road construction have been awarded at Huntington, W. Va. Bids have been opened by the State of Ohio on road work which will cost $217,000. The State of Illinois has awarded several additional road contracts. A $200,000 highway has been contracted for at Waverly, Tenn., and a 26-mile macadam highway has been contracted for at Russellville, Ark. Corpus Christi, Tex., has awarded a $257,000 paving contract.

Bids are desired for grading and surfacing with macadam 30 miles of road at Tazewell, Tenn. It is reported that Maryville, Mo., will soon let a contract for 40,000 sq. yd. of paving. Bids are desired at Tacoma, Wash., for paving 5½ miles of road. County commissioners at New Bern, N. C., voted to improve 22 miles of highways. A company has been incorporated at Louisville, Ky., to build a $150,000 speedway. West Palm Beach, Fla., will sell $750,000 road bonds early in September. It is reported that $150,000 is to be spent near Vernon, Ala., for road construction. Taylor, Tex., will soon spend $300,000 for paving. A like sum is to be spent for constructing State-aid highways near Eureka, Cal. The State engineering department of California has been directed to begin additional road improvements for which $176,000 is available.

Waterworks and Sewers

The lowest bid received Aug. 16 by Watervliet, N. Y., for constructing new waterworks was $424,670. South Charleston, Ohio, has contracted for a $85,000 waterworks system. A waterworks contract amounting to $61,000 has been awarded at Powell, Wyo. Bids are desired for constructing 3½ miles of water mains at St. Charles, Ill. The construction of a $125,000 municipal waterworks system is being considered at Attica, N. Y. Plans have been prepared for a $100,000 filtration plant at Oshkosh, Wis. Bonds totaling $500,000 have been sold for extending the waterworks of Aberdeen, Wash., and it is reported that the work will be begun at once by day labor.

Baltimore has awarded a sanitary sewer contract at $96,000. Bids were opened on a $45,000 sewer contract at Paducah, Ky. The lowest bid opened Aug. 4 for constructing the sewer at Salt Lake City was $296,500. A $71,000 sewer contract has been awarded at Sacramento, Cal. Bids are desired for constructing nearly 7 miles of sewers at Clinton, Iowa. Plans are to be prepared for an $83,000 sewer system at Rockville, Md. It is reported that the construction of a $100,000 sewer has been decided on by Kenosha, Wis. Austin, Tex., has sold $725,000 bonds, part of which will be spent for improvements to the sewer system. Plans have been prepared for a sewer system and disposal plant to cost $90,500 at Forest Grove, Ore.

Miscellaneous

The lowest bid opened at Philadelphia for constructing the City Hall section of the Broad Street subway was $1,700,000. The lowest bid for constructing foundations for more than four miles of elevated road was $142,590. The city of Philadelphia has awarded a $516,000 contract for constructing a pier in the Delaware River. It is reported that a $400,000 railroad contract has been awarded at Fairmont, W. Va. It is reported from Concord, N. C., that the Southern Railway has awarded construction contracts totaling $1,428,000. The pier at Redondo, Cal., has been awarded at $108,000.

Bids are solicited at Crawfordsville, Ark., for constructing drainage ditches involving more than 5,000,000 cu. yd. of excavation. Bids are desired for constructing more than 7 miles of street railways by the receivers of the Metropolitan Street Railway Company at Kansas City. Irrigation work involving 1,200,00 cu. yd. of excavation will be let Sept. 8 at Fort Laramie, Wyo. Plans for eliminating a grade crossing at Sloan, N. Y., at a cost of $329,000 have been filed by the Delaware, Lackawanna & Western Railroad. It is reported that a St. Louis company has contracted to use the city's dock and belt-line facilities on condition of the company's erecting a 1,000,000-bu. elevator. A charter has been granted to a company which intends to build 125 miles of railroad near La Kemp, Okla.

WATERWORKS

PROPOSED WORK

Warren, Mass.—Town meeting Aug. 4 reported to have defeated propositions to appropriate $18,000 for new water works; question may come up again later.

Attica, N. Y.—Village Trustees reported considering construction of municipal water works; cost about $125,000.

Madrid, N. Y.—Bonds for $22,000 will be sold Aug. 22 by the town for construction of water works. E. J. Watson, Town Clk.

East Orange, N. J.—[illegible] water distributing system bonds will be sold Aug. 23 by City Treasurer and Finance Com. of City Council.

Silver Spring, Md.—State Bd. of Health (Hunt. R. Morse, Ch. Engr., Baltimore) has issued an order requiring Comrs. of Montgomery County at Rockville to install public water supply and sewer systems at Silver Spring.

Fairmont, W. Va.—City reported considering construction of water works and sewer system. Ira L. Smith, Comr. Water Works and Sewers.

Lumberton, N. C.—$25,000 water and light bonds will be sold Sept. 2 by G. T. Page, City Treas.

Salisbury, N. C.—Citizens voted $200,000 bonds Aug. 7 for constructing water works, sewers, street improvements and schools. W. H. Woodson, Mayor.

Bamberg, S. C.—Reported to be a movement here looking to extension of water works and construction of sewer system.

Cartersville, Ga.—Citizens voted Aug. 14 to issue $86,000 bonds for water works.

Gretna, La.—Council reported to have decided to construct water works. Frank T. Payne, City Engr.

Lima, Ohio.—City will engage engineer to prepare plans and recommend best location for a reservoir. W. E. McCrate, City Clk.

Marion, Ohio.—Marion Water Co. reported to have decided to issue $12,500 bonds for 11,961 ft. main extensions.

Middletown, Ohio.—Citizens Aug. 10 voted $120,000 bonds for water works improvements.

Kewaunee, Wis.—T. W. Gray of Manitowoc reported to have completed plans for water works to cost $30,000.

Oshkosh, Wis.—Engineer Henry A. Allen of Chicago, Ill., submitted to Commission Council plans for installation of filtration plant, and estimates cost at about $100,000.

Nekoosa, Wis.—Citizens reported to have voted bonds for the construction of water works.

Anamosa, Iowa.—State Bd. of Control, Des Moines, reported considering construction of water works at Reformatory. State Legislature appropriated $18,000 for this work.

Charlton, Iowa.—City will soon let contracts for water works improvements. Engineer, M. G. Hall of Centerville.

Spearville, Kan.—Citizens voted $25,000 bonds for construction of water works.

Cortland, Neb.—Village will soon vote on issuing $11,000 bonds for water works. Grant & Fulton, Engrs., Lincoln, Neb.

Walnut Ridge, Ark.—City Council passed ordinance creating Waterworks and Sewerage Dist. No. 1; the district covers entire town. Estimated cost $60,000. W. E. Beloate, W. M. Ponder and W. E. Lane appointed commissioners.

Mart, Tex.—Citizens voted $21,000 bonds for water works improvements.

Mission, Tex.—City Council reported to have granted Mission Ice, Light & Power Co. franchise for water works and electric light plant.

Port Lavaca, Tex.—H. C. Innis, Mayor, writes that city would grant franchise for water works.

Marshall, Okla.—Benham Eng. Co., Oklahoma City, preparing plans for water works; cost $25,000. G. F. Ingle, Mayor.

Santa Rosa, N. M.—Plans reported being prepared by Burns & McDonnell, Scarritt Building, Kansas City, Mo., for municipal electric light plant and water works.

Aberdeen, Wash.—P. T. Clark, City Clk., writes it is proposed to extend water works, and city will do it by day work. Bonds voted Aug. 7 in the sum of $500,000 have been sold.

Stanwood, Wash.—City Council reported to have decided to construct an auxiliary water system for fire protection from plans of Coast Eng. Co., White Building, Seattle; cost $7,000 to $10,000.

Portland, Ore.—City Comn. reported to have authorized Comr. Daly, Dept. of Pub. Utilities, to make preliminary investigations with a view to supplying St. Johns, recently annexed to Portland, with a water system. City considering purchase of plant of St. Johns Water Co. and improvement of same or construction of a new system.

BIDS DESIRED.

Anson, Me.—About Aug. 23 by Anson Water District for constructing gravity system of water works; cost $120,000. Engineers, Hanscom Constr. Co., 70 Kelby Street, Boston, Mass.

Boston, Mass.—Until Aug. 23 by D. Frank Doherty, Supt. Supplies, for furnishing 25 tons 4-in. and 500 tons 8-in. pipe.

East Orange, N. J.—Until Aug. 26 by A. A. Reimer, Secy. Water Bd., for valves.

Cedar Grove, N. J.—Until Aug. 26 by County Bd. Chosen Freeholders, Newark, for furnishing material and installing addition to water supply system and changes in plumbing fittings in ward buildings of Essex County Hospital at Overbrook. Separate bids desired on wells, pump, piping, etc.; electrical work; plumbing work.

Newark, N. J.—Until Aug. 26 by Bd. Street and Water Comrs. (Morris R. Sherred, Ch. Engr.), for erecting 1-story gate house at Eighth Avenue and Factory Street.

Washington, D. C.—At Bureau Supplies and Accounts, Navy Dept., Washington, D. C., for furnishing at the Navy Yards and Naval Stations supplies as follows: Until Sept. 7, Philadelphia, Pa., Sch. 8705—Miscellaneous composition pipe fittings. Washington, D. C., Sch. 8699—4200 ft. wrought pipe and 450 lb. copper wire. Until Sept. 14, Mare Island, Cal., Sch. 8708—Miscellaneous composition pipe fittings. Applications for proposals should designate the schedules desired by number.

Farmersville, Ohio.—Until Sept. 1 by A. F. Gilbert, Village Clerk, for water works, advertised in Engineering Record.

Maumee, Ohio.—Reported desired until Aug. 25 by Trus. Pub. Affairs, for water works, including deep well pumps, force pumps, reinforced concrete reservoir, elevated steel tank, about 43,000 ft. 4 to 14 in. pipe.

Silverton, Ohio.—Until Aug. 28 by A. A. Sprague, Village Clk., for furnishing material and constructing 6-in. water mains in portions of Alta Avel, Montgomery Road, Waite and several other streets.

Miller, Ind.—Until Aug. 30 by Carl Alander, Town Clk., for constructing water works, from plans of W. J. Fulton, of Gary.

St. Charles, Ill.—About Sept. 1 by Bd. Local Improv. for three water pipe line extensions aggregating 3½ miles of trench, to include about 256 tons 6 and 4-in. c. i. pipe, 4.9 tons specials, 32 fire hydrants and 21 4 and 6-in. valves and valve boxes. For further information address John W. Wilson, 51 West Main Street, St. Charles.

Jefferson, Wis.—Until Aug. 30 by Water & Light Dept. (John J. Angel, Supt.) for constructing two steel tainter gates, each 16 ft. wide and 6½ ft. deep, two gate hoists and B concrete piers, approximately 1000 lb. fabricated steel, 190 yds. concrete, 40 piles and 10 M ft. sheathing. C. B. Stewart, Consulting Engr., Madison.

Wittenberg, Wis.—Until Aug. 26 by John Englund, Village Clk., for furnishing and laying 9205 ft., Class B, 6 and 8 in. c. i. pipe; 3 8-in. and 3 6-in. valves, 15 hydrants, etc., furnish and erect a 40,000 gal. tank on an 80 ft. steel tower and concrete foundation for same. W. G. Kirchoffer, Engr., Madison.

Centerville, Iowa.—Reported desired until Aug. 24 by City Clerk, for constructing an earth dam of 55,000 cu. yds. embankment, pump house, gravity filter system, pumps, motors, engines and 12,800 ft. 10 in. force main. M. G. Hall, C. E., Centerville.

Humboldt, Iowa.—Until Sept. 6 by J. A. Parker, Town Clk., for improvements to water works, including one 600 g.p.m. centrifugal pump, and 75 hp. induction pump motor, one 200 g.p.m. single acting triplex pump and 20 hp. slip ring motor; one switchboard panel, switches and instruments, furnishing and installing all piping necessary for connecting pumps.

Humboldt, Iowa.—Until Sept. 6 by J. A. Parker, Town Clk., for a 200 g.p.m. motor-driven, triplex pump, and a 600 g.p.m. motor-driven centrifugal pump, including piping, valves, etc. Harper & Stiles, Consulting Engrs., 914-15 Grand Avenue, Temple, Kansas City, Mo.

Virginia, Minn.—Until Sept. 6 by Water & Light Comn. (Max Lewis, Secy.), for furnishing and erecting mixed pressure steam turbine; alternate bids being entertained as follows: 1000 kw. mixed pressure steam turbine and alternator with exciters, condensing equipment and switchboard, and on a 1500 kw. turbine. C. T. Harding, Engr.

Arcadia, Cal.—Until Sept. 2 by City Trus. for digging and backfilling approximately 20 miles trenches, for distributing system of water works. George E. Grimes, City Clk.

Saint Maries, Idaho.—Reported desired until Aug. 23 by Charles R. Schulte, City Clk., for constructing waterworks, including concrete and earth dam, laying and re-laying steel and wood water mains and intake pipes, etc.

Markham, Ont.—Until Aug. 23 by M. White, Village Clk., for water works improvements, to cost $14,000 to include a 60,000-gal. standpipe 150 ft. high. Engineers, Loudan & Jones, Toronto.

PRICES AND LETTINGS.

★Indicates award of contract.

Watervliet, N. Y.—Following are reported to be 3 lowest bids opened Aug. 16 by Bd. Water Comrs. (John G. Glute, Pres.), 1555 Broadway, for constructing water works, from plans of Solomon, Norcross & Keis, 1622 Candler Building, Atlanta, Ga.: Lincoln, Steele, Fleming Co., New York, $424,670; Beaver Eng. Co., New York, $441,748; T. F. Shaughnessy Co., Albany, $469,177.

★Washington, D. C.—Contract for furnishing and delivery of c. i. pipe, specials, etc., awarded to Lynchburg Fdry. Co., Lynchburg, Va.

★Shelbyville, Ky.—Contract awarded by Kentucky Utilities Co. to New York Continental Jewell Filtration Co., New York, to instal filter plant at $15,000.

★South Charleston, Ohio.—Contract reported awarded by City to Arthur Geisler, Dayton, for construction of water works at $35,000.

★Ogden, Iowa.—Contract awarded July 30 for water works extension, as follows: To Boone Constr. Co., Boone, for a 100,000-gal. reinforced concrete reservoir, at $2,406, and to Alamo Engine & Supply Co., Omaha, Neb., for 18,006 lin. ft. 4-in. c.-i. mains laid complete, twenty-three 4-in. hydrants, fifteen 4-in. gate valves and boxes, at $9,379. R. B. Reasoner, Engr., Perry.

★Watertown, S. D.—Contract awarded for c.-i. pipe and special castings to American Cast Iron Pipe Co., Birmingham, Ala., at $7,875 (bids opened Aug. 2). F. W. Shreiber, City Engr., Metcalf & Eddy, Consulting Engrs., 14 Beacon Street, Boston, Mass.

★Choteau, Mont.—Contracts for constructing water works from plans of Swearingen & McCulloh, Choteau, awarded as follows: Reservoir and steel pipe line, to F. E. Evans Contr. Co., $31,215; pump house, Andrew Nordahl, $1,370; pumps and motors, H. McCullough, $3,423.

★Roundup, Mont.—Contract awarded by City Council for construction of water mains leading to Nelson's Addition and for installation of additional unit to pumping system, to Security Bridge Co., Billings, at $11,289.

★Powell, Wyo.—Contract for construction of water works reported awarded to J. E. Fisher Co., Denver, Col., at $61,000.

★Kansas City, Mo.—Contract awarded to Badger Meter Mfg. Co., Milwaukee, Wis., for furnishing City with 2000 5/8-in. water meters.

★Arcadia, Cal.—Contract for constructing two 1,000,000 gal. reservoirs (bids opened Aug. 5) awarded to Merchants Realty & Investment Co., Los Angeles, at $12,456. Next three lowest bids: Mesmer & Rice, Los Angeles, $13,710; Munoz & Munoz, Los Angeles, $13,973; Bent Bros., Los Angeles, $14,450.

SEWERAGE AND SEWAGE DISPOSAL

PROPOSED WORK

Worcester, Mass.—Sewer Dept. planning sewers in Chandler Street district to cost $32,000. Matthew Gault, Supt. of Sewers.

Warren, R. I.—At a meeting here Aug. 9 citizens voted to complete sewer system. Engineer, Charles F. Chase, 75 Westminster Street, Providence. Edward Munroe, President Sewer Comn.

Brockport, N. Y.—Official reports state bids will be opened 8 p. m. Aug. 25 by Village Trus. (George B. Harmon, Pres.) for purchase of $30,000 bonds for construction of proposed sewer system.

Farmingdale, L. I., N. Y.—Plans reported completed for construction of sewage disposal plant at the New York State Farm School of Agriculture; cost $35,000. James T. Hoile, Secy. Bd. Trus.

Schenectady, N. Y.—Citizens Aug. 9 voted $80,000 bonds for completing sewage disposal plant and for constructing trunk sewer to connect with intercepting sewer.

Rockville, Md.—Ezra B. Whitman of Baltimore engaged by County Comrs. to prepare specifications and do other preliminary work for construction of a sewer system for a portion of Bethesda district, which is drained by Little Falls Brook, including subdivisions of Friendship Heights, Somerset, Bethesda, Edgewood, Bradley Hills, the Hills and a part of Chevy Chase; cost about $83,000.

Fairmont, W. Va.—See "Water Works."

Salisbury, N. C.—See "Water Works."

Bamberg, S. C.—See "Water Works."

Florence, Ala.—Proposed to construct 2 or 3 miles of 8-in. pipe sewers; cost $40,000. A. G. Negley, City Engr.

New Iberia, La.—Reported to be a movement on foot here for construction of sewer system.

North Chattanooga, Tenn.—Cushman Fairleigh Eng. Co., James Building, Chattanooga, engaged to design and superintend construction of sewer system. Contract to be let in about 2 months.

Mansfield, Ohio—Citizens voted Aug. 10 to issue $110,000 bonds for repairs to sewer system, from plans of F. A. Barbour of Boston, Mass. Hoyt Johns, City Aud.

Mansfield, Ohio.—Citizens voted $110,000 bonds for improvement of sewer system and enlargement of garbage crematory.

Portsmouth, Ohio.—George S. Wilhelm, City Engr., about to prepare preliminary plans for sewering northern and eastern sections of city, extending into Lawsons Run.

Toledo, Ohio.—Bonds for $20,000 will be sold Aug. 31 by County Comrs. for constructing local sanitary sewer No. 20, Main Sewer Dist. No. 6.

Aurora, Ill.—Myron Tarble, City Engr., reported to be preparing plans for septic tanks to be constructed by city at sewer outlets; it is planned to construct one tank each year at a cost of $10,000.

East St. Louis, Ill.—Bd. of Local Improv. (Arthur O'Leary, Secy.) decided to build sewer on Bowman Avenue from First to Sixteenth Streets, connecting at latter point with outlet sewer; estimated cos $40,000.

Appleton, Wis.—A. C. Ramley, City Engr., has completed plans for about 16,000 ft. of trunk sewer; work to be done in four installments. This year's work comprises about 4000 ft. of 5-ft. 6-in. sewer. Specifications call for plain concrete, reinforced concrete, segment block or brick construction.

Kenosha, Wis.—Council reported to have decided to construct sewers in the north and northwest sections of city to cost about $100,000.

Elliott, Iowa.—Plans being prepared by Theodore S. De Lay, Creston, for sewer system.

Anoka, Minn.—City contemplates construction of a sewer system in the spring, and is about to engage engineer, to do preliminary work this fall. Will also do a small amount of paving in the spring Address Henry Lee, City Manager.

Walnut Ridge, Ark. — See "Water Works."

Kaufman, Tex.—State Attorney General has approved bond issue of $22,000 for sewers.

Seattle, Wash.—Bd. of Pub. Wks. approved plans for construction of sewers in North and West Forty-eighth Street, cost $12,000; also sewers in North and West Fiftieth Streets, to cost $53,000.

Astoria, Ore.—City reported to have decided to construct 10-in. salt glazed vitr. sewer in Third Street and an 8-in. lateral sewer on Exchange Street. Olaf Anderson, City Aud.

Forest Grove, Ore. — City Council adopted resolutions providing for installation of sewer system.

Forest Grove, Ore.—Plans, specifications and estimates for construction of sanitary sewers have been completed by R. E. Koon, Bd. of Trade Bldg., Portland, and A. A. Kirkwood, City Engr., and have been approved by City Council and the State Bd. of Health. Work will consist of about 14 miles of pipe sewers and a disposal plant. Disposal plant will consist of an Imhoff tank and sludge bed; estimated cost of complete plant $90,500.

Portland, Ore.—Proposed to construct sewer in East Twenty-eighth Street, between Tillamook and Knott Streets, cost about $12,000.

Elmira, Ont.—J. H. Ruppel, City Clk., writes Council expects to have survey, plans, estimates, etc., prepared in near future, for a sewer system, to be established probably next year.

BIDS DESIRED.

Boston, Mass.—Until Aug. 24 by Edw. F. Murphy, Comr. Pub. Wks., Boston, for sewerage works in Albany Street from Dover Street to Massachusetts Avenue.

Brooklyn, N. Y.—Until Aug. 25 by L. H. Pounds, Boro. Pres., for furnishing material and constructing sewers in portions of Kenmore Place, Rochester and Dumont Avenues, Clara, Fifty-fourth and East Twenty-sixth Streets. Total security, $7,833.

Buffalo, N. Y.—Until Aug. 27 by State Hospital Comn., Albany (E. S. Elwood, Secy.), for renewal of sewer lines at Buffalo State Hospital, Buffalo.

South Orange, N. J.—Until Sept. 7 by Township Comn. (Charles A. Cross, Chmn.) for constructing sanitary sewers in Milburn Avenue Dist., South Orange Township. E. R. Halsey, Township Engr., 164 Market St., Newark.

Wilkinsburg, Pa.—Until Aug. 23 at office of Frease & Sperling, Boro. Engrs., Wilkinsburg, for constructing storm and sanitary sewers in portions of Wood Street, Rebecca and Franklin Avenues, requiring approximately 5218 ft. 6 to 18-in. pipe.

Cleveland, Ohio.—Until Aug. 26 by A. R. Callow, Comr. Purchases and Supplies, for constructing sewer in Dugway Brook, from Superior to Wade Park Avenues.

Chicago, Ill.—Until Aug. 26 by John McGillen, Clk. Sanitary Dist. Chicago, for furnishing and installing two 500-hp. water tube boilers complete at Thirty-ninth Street pumping station in Sanitary Dist., advertised in Engineering Record.

Chippewa Falls, Wis.—Reported desired until Aug. 24 by J. A. Brooks, Chmn. Sewer Com., for constructing sewers in portions of Maynard, Maple, Front and Willow Sts.

Clinton, Iowa.—Until Sept. 14 by Frank W. Leedham, City Clk., for 12,476 lin. ft. vitr. or concrete pipe sewer ranging from 33 in. to 8 in. in diameter in Sewer Dist. No. 2, 5956 lin. ft. segmental block or reinforced concrete sewer ranging from 54 to 30 in. in diameter, 16,856 lin. ft. vitr. or concrete sewer pipe from 24 to 8 in. in diameter, together with manholes, catchbasins and concrete bulkheads, in Sewer Dist. No. 3. J. G. Thorne, City Engr., 317 Howes Block, Clinton, Iowa.

Maquoketa, Iowa.—Until Sept. 1 by E. H. Kullmer, City Clk., for constructing about 3544 ft. 10, 12 and 15-in. vitr. clay pipe sewer, and 8 manholes, advertised in Engineering Record.

Pullman, Wash.—Reported desired until Sept. 7, by Matilda F. Gannon, City Clk., for constructing sanitary sewer in Improv. Dist. 24. Probable cost $12,000. L. V. Edwards, City Engr.

Santa Barbara, Cal.—Until Sept. 16 by City Clerk for constructing vitr. pipe sewers, 6181 lin. ft. 12-in., 8114 lin. ft. 8-in. and 28,125 lin. ft. 6-in.; cost $21,000. A. B. Cook, City Engr.

Salt Lake City, Utah.—Reported desired until Aug. 24 by City Comrs. for constructing sanitary sewers in Second and Third Avenues and Alley and B Street. Karl A. Schied, City Recorder.

PRICES AND LETTINGS.

★Indicates award of contract.

★Yonkers, N. Y.—Contracts reported awarded by Bd. Contracts and Supply Aug. 16 for sewers as follows: McLean and Wakefield Avenues, to John O. Weston, at $8,349; reconstruction of Hawthorne and Warburton Avenue outlet sewers at Wells Avenue, sewer to C. I. Pearsall, at $7,745.

★Baltimore, Md. — Contract reported awarded by Bd. of Awards Aug. 4 to Ryan & Reilly, Union Trust Bldg., for constructing an additional section of sanitary sewers at $96,483.

★Greenville, S. C.—Contract awarded by city to Case & Cothran, Atlanta, Ga., for constructing about 19,000 lin. ft. 8-in. sanitary sewers with 790 cu. yd. rock excav., 357 vert. ft. manholes, 38 vert. ft. drop devices, 63 manhole covers and rings set, 15 flush tanks, etc., at $11,006. Next 3 lowest bids: Dysard Constr. Co., Atlanta, Ga., $11,206; J. R. Lawrence & Son, Greenville, $11,569; Sullivan, Long & Hagerty, Bessemer, Ala., $11,617. C. P. Ballinger, City Engr.

Paducah, Ky.—Following are lowest bids opened Aug. 3 by L. A. Washington, Comr. Pub. Wks., for constructing brick or concrete outfall sewer, Dist. No. 3, Contract No. 1: Yancy & Johnson, Paducah, brick, $49,362, and Winston Bros. Co. of Minneapolis, Minn., concrete, $45,834.

★Toledo, Ohio—Contract for constructing sewers awarded Aug. 4 to Albert Grzybouski, Toledo, at $17,375.

★Galesburg, Ill.—Contract awarded Aug. 6 to D. E. Keeler Co., Davenport, Iowa, by Bd. Local Improv. for constructing sewers in portions of Sanborn, N. Cherry, N. Cedar and several other streets 13,361 ft. 30, 24, 18, and 12-in. double strength vitr. tile sewer pipe at $2.78, $1.83, $1.37 and 88 cts. per lin. ft.; 4220 lin. ft. 10-in. standard vitr. tile sewer pipe, 69 cts. per ft.; 45 manholes, ea., $33; catch basins, ea., $25; total, $25,224. Next three lowest bids: Henry Rees, Quincy, $25,537; A. C. Schreiter, Manitowoc, Wis., $25,993; E. R. Harding Co., Racine, Wis., $27,165. F. M. Connolly, City Engr.

★Wenona, Ill.—Contract awarded for constructing 5 miles of sewers, 8 to 24 in., to Driscoll Bros. & O'Brien, Decatur, at $17,317 (bids opened Aug. 5). Engineers, Melluish & Broyhill, Bloomington.

Mayville, Wis.—Lowest bid received for constructing sewer system, reported submitted by David Van Stelle of Sheboygan, at $30,000.

★West Allis, Wis.—Contract awarded for constructing sewers in various streets, to H. Hohensse, Milwaukee, at 79 cts. per ft. (bids opened Aug. 6). E. C. Orbert, City Engr.

Carroll, Iowa.—Contract for addition to sewage treating plant awarded to Offerman Constr. Co., South Omaha, Neb., at $13,600.

★**Syracuse, N. Y.**—Following are unit prices of 4 lowest bids opened Aug. 4 by Intercepting Sewer Bd. (Harry J. Hamlin, Secy.) for a storm water sewer and brook improvement in northeasterly section of city. Contract 14—(a) Frank S. Sposatto, Syracuse, $24,984 (awarded contract); (b) Frank George, White Plains, $38,984; (c) John C. Schrade, $46,862; (d) Samuel Bonn, Syracuse, $42,419.

	(a)	(b)	(c)	(d)
Clearing (lump sum)	$600.00	$300.00	$500.00	$300.00
11,200 cu. yd. excavation	0.45	0.45	0.55	0.49
167 cu. yd. filling	2.00	2.00	3.00	1.74
1,020 lin. ft. 30-in. reinforced concrete pipe sewer, Section "A"	5.80	8.40	8.50	6.95
1,420 lin. ft. 60-in. reinforced concrete pipe sewer, Section "B"	9.75	11.00	11.50	15.14
210 lin. ft. 15-in. vitrified pipe sewer	0.75	0.65	0.50	0.90
6 lin. ft. manholes	3.00	3.00	5.00	4.75
5 manhole frames and covers	9.00	10.00	10.00	10.00
7 receivers	15.00	20.00	40.00	15.00
50 cu. yd. concrete, Class "A"	7.00	10.00	9.00	8.00
270 cu. yd. concrete, Class "B"	6.75	6.50	8.00	8.00
3,000 lb. metal reinforcement	0.05	0.04	0.05	0.03
40 sq. yd. cobblestone paving	1.00	0.50	1.50	0.90
900 sq. yd. rubble paving	2.00	1.75	2.00	2.25
960 sq. yd. concrete paving	2.00	1.50	2.00	1.55
10 M ft. timber and lumber	40.00	45.00	45.00	49.00
1,000 posts	0.45	0.45	0.30	0.55
1,000 lin. ft. wire fencing fabric	4.00	5.00	2.50	2.39
Midland Avenue Junction (lump sum)	235.00	282.00	500.00	475.00
Horn Avenue Junction (lump sum)	550.00	526.00	500.00	675.00

★**Laporte, Iowa.**—Contract awarded for constructing sewers to consist of 22,160 lin. ft. 8 to 15-in. vitr. pipe sewers, 54 manholes, etc., to Bash & Janes, Joplin, Mo., at $11,761, and for disposal plant to J. O. Hughes, Charles City, Iowa, at $3,198. M. Tscharg & Sons, Engrs.

★**Norton, Kan.**—Contract awarded to Gordon & Taylor, Denver, Col., on bids opened Aug. 2, as follows: Intercepting sewer, $4,250; lateral sewers, $19,655; disposal plant, $11,625; total, $35,822. Other bids: M. W. Holben, Attica, Ind., $32,642; O'Neil Constr. Co., Leavenworth, $34,184; W. W. Cook, Junction City, $35,957; T. M. Torson, Kansas City, $38,443. Worley & Black, Engrs., Reliance Building, Kansas City, Mo.

★**Norton, Kan.**—Contract for constructing main outfall sewer and purification plant, intercepting Sewer Dist. No. 1 lateral sewers in Sewer Dists. Nos. 1 to 12 inclusive awarded Aug. 2 to Gordon-Taylor Constr. Co., Denver, Col., at $32,000. Worley & Black, Engrs., Reliance Bldg., Kansas City, Mo.

★**Wisner, Neb.**—Contract reported awarded to Arthur A. Dobson Co., Lincoln, for constructing sewer system at $14,511.

★**Mitchell, S. D.**—Contract awarded for constructing sewers in various streets to R. J. Barnhart, Mitchell (bids opened Aug. 2). Thomas Eastcott, City Aud.

★**Roundup, Mont.**—Contract reported awarded to Security Bridge Co., Billings, for constructing sewers at $11,000.

★**Argenta, Ark.**—Contract awarded Aug. 11 for two 15,000-gal. sewage pumps and two 60-hp slow speed motors and equipment to Henry R. Worthington, 115 Broadway, New York. J. P. Faucette, Mayor.

★**Steamboat Springs, Col.**—Contract awarded by Town Council to Conrad Weiser of North Platte, Neb., at $55,169 (bids opened Aug. 9). R. G. Bradley, Town Engr.

★**Sacramento, Cal.**—Contract reported awarded by Board Public Works to A. Teichert & Son, Sacramento, for reinforced concrete trunk line sewer, Sections A, C and D, at $71,476.

★**Richfield, Utah.**—Contract for constructing sewer system awarded Aug. 7 to Brown & Kleinschmidt, Salt Lake City, at $25,000. Cunnie H. Bean, City Recorder.

BRIDGES

PROPOSED WORK

Manchester, N. H.—Common Council voted $45,000 appropriation toward cost of constructing steel and concrete bridge at Elm Street.

Nashua, N. H.—Aldermen Aug. 10 voted $[illegible] bonds for new bridge construction. James B. Crowley, Mayor.

Bridgeport, Conn.—All bids opened Aug. 7 for constructing reinforced concrete girder bridge with double leaf bascule channel span and all superstructure and approaches have been rejected and new bids will be received Sept. 4, advertised in Engineering Record. Gardner & Whitman, Engrs., Fidelity Bldg., Baltimore, Md. For further information write Charles C. Brandon, Secy., Stratford Avenue Bridge Comn.

Sloan, N. Y.—See "Railroads."

Elizabeth, N. J.—Freeholders authorized issue of $37,000 bonds for repair of county bridges damaged by floods of Aug. 4th.

New Brunswick, N. J.—Bd. Freeholders voted to issue $6,500 bonds for constructing [illegible] draw bridge over South River.

Portsmouth, Va.—Comn. on Roads and Bridges Norfolk County considering constructing concrete bridge over Tanners Creek, cost about $[illegible].

Charleston, S. C.—Building of a steel and concrete 450 ft. drawbridge over Edisto River at Jacksonboro Ferry reported under consideration by Colleton and Charleston Counties. Reid Whitford, Engr. and Secy. Charleston County Sanitary & Drainage Comn. may be able to give further information.

Oberlin, La.—See "Paving and Roads."

Lexington, Ky.—Bd. City Comrs. approved plans submitted by Louisville & Nashville R. R. Co. (H. C. Williams, Ch. Engr. Constr., Louisville), for five approaches to Jefferson St. and W. Main St. viaducts, cost about $13,000.

Cleveland, Ohio—County Comrs. having plans prepared for bridge over Erie R. R. tracks near North Randall on North Miles Road, cost about $30,000.

Dayton, Ohio—Pennsylvania R. R. Co., Philadelphia, Pa. (Alex. C. Shand, Ch. Engr.), preparing plans for construction of new bridge over Great Miami River at Dayton.

South Bend, Ind.—About $40,000 will be spent for constructing bridge on Lincoln Highway by St. Joseph County. South Bend county seat.

Lansing, Mich.—About $80,000 will be spent by State Highway Dept. for constructing bridges.

Joliet, Ill.—Chicago, Ottawa & Peoria Ry. (F. E. Fisher, Gen. Supt., Joliet) intends constructing two bridges, one having four 43-ft. spans and the other two 35-ft. spans.

Appleton, Wis.—City planning construction of a three 35-ft. span concrete bridge over South Channel of Fox River. A. C. Ramley, City Engr.

Eudora, Kan.—Plans approved for constructing north approach to Kaw River bridge to be constructed by county. Lawrence, county seat.

Montana—Plans completed by State Highway Comn. (George R. Metler, Engr.) Helena, for constructing four bridges in Musselshell County and two in Beaverhead County, to be riveted trusses on concrete foundations; cost $3,500. Bids to be received by Co. Comrs. at Dillon and Roundup early in September.

Dallas, Tex—Stone & Webster Eng. Co., Boston, Mass., completed plans for concrete and steel street car viaduct to be constructed between Dallas and Oak Cliff; cost about $500,000.

Laredo, Tex.—Citizens voted $15,000 bonds for constructing two bridges over arroyos in Laredo.

Aberdeen, Wash.—C. E. Fowler, Central Bldg., Seattle, retained by City Council to prepare plans for rebuilding West Toll Bridge over Chehalis River, cost about $15,000. To have 240 ft. span.

Portland, Ore.—George S. Edmonstone, Asst. City Engr., writes no bids have yet been asked, but will be in a short time for constructing substructures of reinforced girder bridge at Union Avenue, over Peninsular branch of O. W. R. & N. Co. This bridge will have nine 24-ft. 6-in. spans, width 58 ft.; foundation, gravel; cost, complete, $50,000. A. L. Barbur, City Aud.

BIDS DESIRED.

Woonsocket, R. I.—Competitive plans desired by Bd. Aldermen (George H. Emmott, Chmn.), until Sept. 1 for constructing two bridges on Hamlet Ave. and one on Fairmount St. Frank Mills, City Engr.

Hartford, Conn.—Until Aug. 31 by Bd. Contract and Supply (Joseph Buths, Secy.) for constructing reinforced concrete three-span arch highway bridge, 160 x 55 ft., over Park River at Capitol Avenue, advertised in Engineering Record.

Trenton, N. J.—Until Aug. 26 by John J. Powers, Dir. County Freeholders, for reinforced concrete and stone arch bridge over Sanders Creek at Willow Street. Theo. Bobish, Co. Engr.

Wilson, N. C.—Until Aug. 28 by Lawrence Brett, Engr., Bd. Drainage Comrs., Mattamuskeet Drainage Dist., Wilson, for furnishing material and erecting in place ready for operation a single leaf plate girder highway Scherzer rolling-lift bridge. The clear opening will be 40 ft. The bridge is to be built across the outfall canal of the Drainage District in Hyde County.

Wilson, N. C.—Reported desired until Aug. 28 by Lawrence Brett, Engr., Drainage Comrs., Mattamuskeet Drainage Dist., for single leaf plate girder highway Scherzer rolling lift bridge with clear opening of 40 ft. bridge to be built over outfall canal.

New Castle, Ky.—Reported desired until Aug. 24 by Luke Kavanaugh, Co. Judge, for constructing steel bridge with concrete floor over Bourse Branch, 5 miles from New Castle.

Cincinnati, Ohio.—Until Aug. 24 by Philip Fosdick, Dir. Pub. Service, City Hall, to reconstruct the existing bridge on Wehrman Avenue over C., L & N. R.R.

Until Sept. 3 by Bd. County Comrs. (Albert Reinhardt, Clk.) for constructing concrete bridge on Rapid Run Road, west of Neeb Road, in Delhi Township; also for concrete bridge and culvert on Ridgeway Avenue, Springfield Township.

Delaware, Ohio.—Reported desired until Aug. 30 by County Comrs., for constructing the Winter Street Bridge.

Ravenna, O.—Reported desired until Aug. 30 by County Comrs., for constructing a 75-ft. steel bridge with concrete or wood block floor over the North Mahoming River in Charlestown Township.

Illinois—By State Highway Commission, Springfield, for constructing bridges as follows:

Until Aug. 25 at Town Hall, Oakdale, for constructing bridges in Oakdale Township, known as Grannaman, Hood, Kahle, Kane and Kemps Bridges; spans, 25, 22, 20 and 28 ft. respectively. Total estimate, $4,700. J. A. Davenport, Jr., Co. Supt. Highways, Nashville.

Ellinwood, Kan.—Until Sept. 7 at office C. F. Yunkin, City Clk., Great Bend, for constructing a reinforced concrete bridge across the Arkansas River about one mile south of Ellinwood, between Lakin and Comanche Townships, known as the Ellinwood Bridge; the substructure consists of two plain concrete abutments and eight piers supported on 30-ft. wood piles; superstructure is composed of 9 reinforced concrete T-girders, each 44 ft. 6 in. long (overall length of bridge 500 ft. 6 in.), roadway 24 ft.

Dillon, Mont.—Until Sept. 10 by J. S. Baker, Co. Clk., for constructing a steel bridge 170 ft. long across Big Hole River, and one 42 ft. long across slough near Brownes Station.

Canadian, Tex.—Reported desired until Aug. 23 by Co. Comrs., for constructing a bridge over Canadian River. Probable cost, $74,000.

Silver City, N. M.—Reported desired until Aug. 28 by County Clk., Silver City, for constructing a 112-ft. steel bridge, concrete foundations and two wooden approaches over Gila River near Fort West.

Ventura, Cal.—Until Aug. 25 by J. B. McCloskey, Clk. Bd. Superv. for constructing Williams Barranca Culvert, Harkey Culvert, Proctor Culvert and Sudden Culvert, all in Saticoy Road Dist.

Grants Pass, Ore.—Until Aug. 26 (readvertisement) by County Court for constructing bridge across Sucker Creek. New bids call for erection of concrete piers and abutments. Lowest bid opened Aug. 4 was submitted by Albert Anderson & Co., Grants Pass, at $6,942, for one wooden span, one combination span and one steel span, or $9,651 for three steel spans.

PRICES AND LETTINGS.

★Indicates award of contract.

★**Quincy, Mass.**—Contract awarded by Metropolitan Park Comn., 14 Beacon Street, Boston (John R. Rablin, Engr.) to Hugh Nawn Contr. Co., Roxbury, for building concrete bridge, Blacks Creek, Furnace Brook Parkway, Quincy, at $24,900 (bids opened Aug. 10).

★**Woonsocket, R. I.**—Contract awarded by Bd. of Aldermen for building two reinforced concrete bridges on Clinton Street, to G. F. Austin of Providence at $6,670 (bids opened Aug. 9). Frank H. Mills, City Engr.

★**Hartford, Conn.**—Contract awarded by Bd. Contract and Supply to Spaulding Constr. Co., Suffield, for constructing 75-ft. arch bridge over Park River at Trumbull Street, concrete and brownstone, at $15,098. Other bids: C. H. Slocomb & Co., Hartford, $15,793; W. T. Ryan Constr. Co., Hartford, $16,908; Howard J. Cole, Hartford, $17,563; J. E. Goodrich, Hartford, $17,755. R. N. Clark, City Engr.

★**Somerville, N. J.**—Contract for constructing Mine Brook Rd. and bridge at Far Hills awarded by Bd. Freeholders, Somerville, to John L. Le Compte, Lakewood, at $10,876.

★**Harrisburg, Pa.**—Contract awarded for rebuilding county bridge over lines of P. & R. Ry., Nineteenth Street, to be of reinforced concrete, bow string arch, to Ferro Concrete Co., Harrisburg, at $17,866. Other bids: Whittaker & Diehe, Harrisburg, $18,630; H. R. Rennard, Bloomsburg, $18,722; S. W. Shoemaker & Son, Harrisburg, $19,117; Stucker Contr. Co., Harrisburg, $19,430. Henry W. Gough, Co. Controller.

★**Philadelphia, Pa.**—Contracts for constructing two steel and concrete bridges awarded by Dept. Pub. Wks. as follows: Over Philadelphia and Baltimore Central R. R. at Whitby Avenue to F. S. Boas, 201 North Broad Street, at $40,000; over roadway of Philadelphia Hospital for Contagious Diseases on line Front Street to Philadelphia Paving Co., 1345 Arch Street, at $12,000.

★**Lake Charles, La.**—Contract for constructing steel drawbridge over Bayou Chonpique on Lockport-Ged Highway awarded by Police Jury to Vincennes Bridge Co., Vincennes, Ind., at $5,579.

★**Flint, Mich.**—Contract for constructing viaduct at W. Court Street awarded to Illinois Bridge Co., Chicago, Ill., at $12,977. Other bids: Wescott Eng. Co., Chicago, Ill., $12,650; Wyncoop-McGormley Co., Toledo, Ohio, $14,199; Benjamin Douglas Co., Detroit, $22,350. W. R. Deury, Asst. City Engr.

★**Dixon, Ill.**—Contract awarded by County to W. H. Shons, of the Freeport Bridge Co. of Freeport, for reflooring Grand Detour Bridge at $7,759 (bids opened Aug. 7). L. B. Neighbour, Supt. Co. Highways.

★**Paris, Ill.**—Contract for constructing Reservoir Bridge awarded by Co. Comrs. to Alan Jay Parrish of Paris at $7,600 (bids opened Aug. 2). K. J. Barr, Supt. Co. Highways.

★**Mosinee, Wis.**—Contract for constructing steel bridge over Wisconsin River at Mosinee awarded to Wausau Iron Co., Wausau, to be 690 ft. long.

★**Wichita, Kan.**—Contract for constructing 102 ft. concrete bridge over Jester Creek awarded to Canton Bridge Co., Canton, Ohio, at $4,423. Edgar Moore, County Engr.

★**Westport, Conn.**—Following are 4 lowest bids opened Aug. 10 by C. J. Bennett, State Highway Comr., Hartford, for constructing 12-span reinforced concrete girder highway bridge over Saugatuck River—(a) Barzaghi-Vought Co., 299 Madison Avenue, New York; (b) McHarg-Barton Co., 171 Madison Avenue, New York (awarded contract on granite ashlar masonry); (c) Henry E. Fox, 81 E. 125th Street, New York; (d) A. L. Guidone & Co., 162 E. Twenty-third Street, New York:

	(a)	(b)	(c)	(d)
3,000 cu. yd. excav. below elevation zero	$2.75	$1.20	$2.50	$3.50
4,650 cu. yd. excav. above elevation zero	1.00	1.20	1.50	1.25
Piles delivered on work:				
1,800 ft. 10 to 20 ft.	0.12	0.12	0.14	0.11
1,600 ft. 20 to 30 ft.	0.12	0.17	0.14	0.115
12,000 ft. 30 to 50 ft.	0.12	0.17	0.17	0.14
20,000 ft. 50 to 70 ft.	0.17	0.17	0.20	0.20
Piles driven in place:				
1,800 ft. 10 to 20 ft.	0.31	0.15	0.40	0.12
1,600 ft. 20 to 30 ft.	0.16	0.15	0.40	0.12
12,000 ft. 30 to 50 ft.	0.10	0.15	0.40	0.14
20,000 ft. 50 to 70 ft.	0.075	0.10	0.40	0.18
100 tons riprap in place	2.00	1.00	2.00	2.25
590 cu. yd. 1:3:5 concrete	8.00	15.00	7.00	10.00
1,435 cu. yd. granite ashlar masonry.	15.75	24.00	20.50	30.00
1,435 cu. yd. brownst. ashlar masonry	17.50	24.00	22.50	26.00
1,435 cu. yd. granite rubble masonry.	10.25	21.00	12.00	19.50
1.5 M ft. timber fender piling	70.00	55.00	60.00	55.00
2,182 cu. yd. 1:2:4 concrete	10.75	9.00	9.00	9.50
233,300 lb. steel reinforcement	0.03	0.025	0.03	0.03
832 ft. parapet wall	3.00	2.50	6.00	3.00
10,675 sq. ft. concrete walk	0.15	0.18	0.12	0.14
1,625 ft. concrete curb	1.00	0.80	0.40	0.50
100 ft. resetting curb	0.50	0.15	0.30	0.25
1,300 gal. pitch waterproof	0.50	0.25	0.30	0.30
735 cu. yd. fill on bridge	1.00	1.00	1.00	0.20
Remove old bridge (lump sum)	1,000.00	800.00	1,000.00	700.00
Temporary foot bridge (lump sum)	3,000.00	2,500.00	4,000.00	4,500.00
Total granite ashlar masonry	$98,401.00	*$101,162.50	$112,203.50	$120,613.00
Total brownstone ashlar masonry	101,912.25	101,162.50	115,073.50	114,873.00
Total granite rubble	90,508.50	96,857.50	100,006.00	105,545.50

★**Lipscomb, Tex.**—Contract for constructing two pile bridges over Wolfe Creek, one at Lipscomb and one 12 miles east, 430 and 450 ft., awarded to Austin Bros., Dallas, at $10,800. P. O. Boyd, Co. Clk.

★**Antlers, Okla.**—Contract for constructing five county bridges awarded Illinois Steel Co., 208 S. La Salle St., Chicago, at $44,940. Next three lowest bidders: Canton Bridge Co., $45,115; Universal Bridge Co., $46,115, and Missouri Valley Bridge Co., $48,450.

★**Sulphur, Okla.**—Contract for constructing two steel bridges (suspension type), one 150 ft. long, west of Davis, and the other 120 ft. long, south of Davis, reported awarded Western Bridge Co., Ardmore and Sherman.

★**Washington.**—Contract awarded by State Highway Comn. (William R. Roy, Comr., Olympia) for constructing steel riveted truss bridge over Skohomish River on Olympic Highway to Yelverton & Wolf, of Olympia, at $11,253. Other bids. Beer's Bldg. Co., Portland, Ore., $11,777; R. E. Mieth, Portland, Ore., $11,778; J. R. Wood, Seattle, $11,831.

★**Portland, Ore.**—Contract awarded by Park Comn. (Icaac F. Clark, Secy.) to Forgione & Romano, Fidelity Bldg., for constructing Back Bay Boule. bridge, at $21,450. Next three lowest bids: John Gulliver, 120 Exchange Street, Portland, Me., $25,840; Bay State Dredging Co., 247 Atlantic Avenue, Boston, Mass., $27,650; Lorello & Profinno, 12 Ponce Street, Portland, Me., $27,847.

★**Santa Clara, Cal.**—Contract awarded by County Bd. Superv. for constructing concrete bridge over Guadalupe Creek, to R. H. Jamison of Agnew, at $3,439 (bids opened Aug. 2).

PAVING AND ROADS

PROPOSED WORK

Lockport, N. Y.—Lowest bid opened by County Bd. Supervs. for constructing Shawnee Road, 1.91 miles, submitted by Stainthorpe Co., Lockport, at $20,830.

Atlantic City, N. J.—County Bd. Freeholders directed specifications be prepared for paving Meadow Boulevard from Pleasantville to Chelsea.

Long Branch, N. J.—Bd. Freeholders at Freehold voted to resurface Atlantic Avenue, Long Branch.

Harrisburg, Pa.—About $50,000 has been raised by Delaware County as their share of cost of rebuilding and repairing Baltimoke Pike from Philadelphia to Maryland State line. Work to be done by State Highway Department at Harrisburg.

Parkersburg, W. Va.—City Council voted to pave Levee Drive, Ann Street, Murdoch Avenue with brick, Sixteenth, Thirteenth, Covert and other streets with concrete.

Piedmont, W. Va.—H. R. Stotler, City Treas., writes no vote yet taken on issuing $36,000 bonds for street paving. Engineer, Wm. Harvey of Frostburg, Md.

Salisbury, N. C.—See "Water Works."

West Palm Beach, Fla.—$750,000 road construction bonds will be sold Sept. 7 by George O. Butler, Co. Clk.

Birmingham, Ala.—Board of Comrs. decided to pave Clairmont Avenue, Forty-second Street, Tenth Avenue, Thirty-ninth, Fortieth and Forty-first Streets; cost approximately $50,000. Address Julian Kendrick, City Engr.

Vernon, Ala.—About $150,000 is to be spent by Lamar County for constructing road through county.

Oberlin, La.—Bonds for $150,000 for roads and bridges in Road Dist. No. 5, will be sold Sept. 13 by C. Lindsey, Clk. Police Jury.

Lake Charles, La.—Police Jury voted to spend $30,000 for surfacing gravel roads with tarvia concrete.

Louisville, Ky.—Louisville Automobile Speedway Co. incorporated to construct 2 mile motor speedway. Capital $150,000.

Bexley, Ohio.—Bonds for $124,000 will be sold Aug. 26 by Chester A. Miller, Village Clk., for improving portions of Parkview, Columbia, Drexel and Pleasant Ridge Avenues and Town Street.

Carrollton, Ohio.—About $35,000 bonds sold by city for paving Malvern Street.

Defiance, Ohio.—Paving bonds amounting to $89,500 sold by city.

East Liverpool, Ohio.—Bonds will be sold by Trus. of St. Clair Township (J. N. Mahaffie, Clk.), care of First National Bank, East Liverpool, Sept. 1, for following road improvements: $12,810, East Liverpool-Warren Public Road; $11,010, Lisbon-Smith's Ferry Public road, and $16,120, Youngstown and Ohio-Calcutta Road.

Fremont, Ohio—About $60,000 is to be spent by Sandusky County for improving 19 miles Maumee Pike and 4½ miles Fremont-Sandusky Road.

Gates Mills, Ohio.—Bonds for $22,000 will be sold Sept. 11 by Bd. Trus. Mayfield Township (F. J. Wilson, Clk.) for improving Mayfield and So. Center Roads.

Leetonia, Ohio.—Reported bonds for $32,200 for constructing 2.05 miles of Leetonia Franklin Square Road and for $11,000 for constructing 0.73 mile along Leetonia-Washingtonville Road are to be sold Sept. 1 by W. W. Long, Clk. Salem Township, at Leetonia.

Muncie, Ind.—Contract about to be let by Bd. Pub. Wks. for paving Main, Washington, High and Walnut Streets.

Sullivan, Ind.—Comrs. of Sullivan and Greene Counties reported having plans prepared for building road between two counties to include one or two bridges.

Ontonagon, Mich.—Citizens voted $10,000 bonds for improving highways in Ontonagon.

Herrin, Ill.—Citizens voted $75,000 bonds for constructing hard roads in Herrin Township.

Jacksonville, Ill.—Bd. Local Improv. passed resolution for paving E. State Street with asphalt, brick or concrete; estimated cost $20,236.

Mattoon, Ill.—Bd. Local Improvements approved plans for paving S. 18th St., estimated cost $25,848.

Ames, Iowa.—Council voted in favor of paving fifteen of the principal streets and avenues of the city. Bitulithic, asphaltic concrete, vitr. brick block, or creosoted wood blocks may be used.

Anoka, Minn.—See "Sewerage and Sewage Disposal."

Northfield, Minn.—Citizens voted in favor of $19,000 bonds for improvements including $13,500 for paving the bridge square and four blocks of the main business streets.

Bozeman, Mont.—City Council voted to pave S. Third, W. Main and Eighth Avenue, about 32,000 sq. yd.

Missoula, Mont.—It is proposed to pave E. Front Street, 5800 sq. yd., cost $25,000, and Pine Street, 4800 sq. yd., cost $18,000. Brick, wood block, macadam or bitulithic concrete curb and gutter, foundation of concrete. L. E. Harris, City Clk.

Council adopted resolutions to improve Special Improvement Dist. No. 37, by grading, cement sidewalks, curbs and paving 30 ft. wide with either creosoted wood block, standard bitulithic or asphaltic concrete on 4 in. concrete base; cost estimated by City Engineer at between $22,210 and $26,912. L. E. Harris, City Clk.

Maryville, Mo.—C. W. Bennett, City Clk., writes contract will probably be let the latter part of August for paving Twelfth, Thompson, Ninth, Market, Third and Twelfth Streets with bituminous concrete on concrete foundation, about 40,000 sq. yd., with 23,000 ft. cement curb 16 x 18 in. F. L. Flynt, City Engr.

Ingleside, Tex.—Citizens of Ingleside Road Dist. No. 3 voted $75,000 bonds for road improvements.

Port Lavaca, Tex.—Citizens July 27 voted $17,000 bonds for constructing roads and bridges. Bonds to be sold Sept. 1. H. C. Innis, Mayor.

Livingston, Tex.—Citizens voted $17,000 bonds for street improvements.

Taylor, Tex.—About $300,000 will be spent by city for paving. W. E. Dozier of Temple will be engineer in charge of construction.

Temple, Tex.—City Council considering spending about $200,000 on street improvements.

Seattle, Wash.—City Council reported in favor of paving with asphalt portions of Bailey, Vale Streets and Twelfth Avenue S. and with some suitable material Twelfth Avenue N. E., Forty-second and Forty-third Streets.

Council adopted resolution for grading and paving Donald Street, from California Avenue to Forty-fourth Avenue S. W. Contract soon to be let by Bd. Pub. Wks. for paving Twentieth Avenue N. E. Street and Sewer Com. of City Council recommended adoption of resolution providing for paving East and West Green Lake Ways at an estimated cost of about $110,000.

Walla Walla, Wash.—City Council voted to pave and construct concrete sidewalks on Fourth Street; cost about $16,000.

Pendleton, Ore.—Reported contract soon to be let by City Council for paving with gravel bitulithic portion of S. Main Street

Salem, Ore.—About $10,000 is to be spent by the city for paving fair ground road with asphaltic concrete.

Eureka, Cal.—About $300,000 is to be spent for constructing State aid highway through Humboldt County.

Sacramento, Cal.—State Engineering Dept. has been directed to improve highways between Humboldt and Los Angeles. About $176,400 available for the work.

Soda Springs, Idaho.—Reported Council has passed ordinance providing for constructing cement concrete sidewalks on streets in Improvement Dist. No. 2; cost $50,000. Paul Tipton, City Clk.

BIDS DESIRED.

Boston, Mass.—Until Aug. 23 by Edward F. Murphy, Comr. Pub. Wks., for furnishing and laying asphalt or bitulithic pavement on Prince Street, from Pond Street to Arborway, West Roxbury.

Massachusetts.—Until Aug. 24 by State Highway Comn. (W. D. Solner, Chmn.), 15 Ashburton Place, Boston, for surfacing about 19,000 ft. of state highway in towns of Northboro and Shrewsbury.

New Brighton, S. I., N. Y.—Until Aug. 24 by C. D. Van Name, Boro Pres., for regulating and repaving Richmond Terrace, requiring about 6450 sq. yd. granite block pavement, etc.; also regulating and repaving Clove Road, requiring about 6800 sq. yd. bituminous concrete and 1,800 sq. yd. napped granite block pavement, etc.

Elizabeth, N. J.—Until Aug. 26 by Thomas E. Collins, City Engr., for resurfacing Telford Street with 26,000 sq. yd. asphalt concrete and also 8,600 sq. yd. granite block pavement on a 6-in. concrete foundation.

Hackensack, N. J.—Until Sept. 7 by County Road Com. (A. V. Morrison, Chmn.) for grading, guttering, concreting and paving Palisade Avenue, Englewood Cliffs, from Engle Street to entrance of Palisade Park, with hillside brick and asphalt concrete.

Bloomsburg, Pa.—Until Aug. 31 by W. H. Eyer, City Engr., for paving with vitr. brick and concrete foundation, Market Street, about 11,600 sq. yd., advertised in Engineering Record.

Greensburg, Pa.—Until Aug. 30 by John S. Sell, Co. Controller, for constructing sections of highway in Mount Pleasant Township, Trauger-Hurst Schoolhouse Road, Sec. No. 1, about 1½ miles, requiring 150 sq. yd. macadam, 14,080 sq. yd. brick pavement, etc.; Kecksburg-Donegal Road, Sect. No. 1, about 1½ miles, requiring 70 sq. yd. macadam, 14,080 sq. yd. brick pavement, etc.

Ingram, Pa.—Until Aug. 23 by D. H. Hainer, Boro. Clk., 54 McKee Street, for subgrading, curbing and paving Maple Avenue, Sterling Street, Columbia Way and Melrose Avenue.

Wheeling, W. Va.—Until Aug. 27 by Bd. Co. Comrs. for macadamizing roads in Triadelphia, Richland, Liberty and Ritchie Districts, in all about 3375 cu. yd. George W. Steenrod, County Road Engr.

Wheeling, W. Va.—Reported desired until Aug. 25, George W. Oldham, Co. Clk., for resurfacing with bituminous concrete National Rd., also resurfacing with bituminous concrete or penetration method, G. T. & P. Rd.

Louisiana.—Until Sept. 7 by Highway Dept. Bd. State Engrs. (Frank M. Kerr, Ch. Engr.) Rm. 104, New Orleans Court Building, New Orleans, for surfacing with gravel about 5 miles improved highway in Caldwell Parish.

Until Sept. 8, same place as above, for constructing an improved earth highway in Red River Parish, about 8.1 miles.

Tazewell, Tenn.—Reported desired until Sept. 2 by Clunty Road Comrs. for macadamizing the Cumberland-Gap Tazewell Road, 12 miles, and the Powells Valley Road, 18 miles; also grading several roads.

Louisville, Ky.—Until Aug. 26 by Bd. Pub. Wks. (R. G. McGrath, Secy.) for paving with vitr. brick Twenty-third and Dupuy Streets. Approximate cost, $21,000.

Until Aug. 25 by Bd. Pub. Wks. (Roger G. McGrath, Secy.) to reconstruct with vitr. block gutters, granite block stringers and asphalt pavement Walnut Street, from Fourteenth to Sixteenth Streets.

Chillicothe, Ohio.—Reported desired until Aug. 23 by County Comrs. for reflooring with kreodone block Kilgore Bridge over Scioto River, Scioto Township.

Cleveland, Ohio.—Until Aug. 25 by A. R. Callow, Comr. Purchases and Supplies, for grading, draining, curbing, paving with dressed block Medina stone and improving Lorain Ave. from West Seventy-third to West Ninety-eighth Street.

Galion, Ohio.—Until Aug. 26 by A. F. Unckrichm, Dir. Pub. Service, for improving Church Street by paving with brick, asphalt, asphalt block, wood block or treated macadam, about 18,000 sq. yd., advertised in Engineering Record.

Newark, Ohio.—Until Sept. 8 by County Comrs. for furnishing material and surface treating with Tarvia B and screenings, about 10½ miles, Granville, and Croton Pike, known as Sections 2 and 3. J. L. Hursey, Co. Aud.

Rawson, Ohio.—Until Aug. 20 by Charles H. Fetzer, Village Clk., for furnishing material and improving Main Street, from south side of Lot No. 1 to north line of right-of-way of L. E. & W. Ry., with vitr. brick, together with curb, gutters, crosswalks, drainage, etc.

Salem, Ohio—Later official reports state bids desired until Sept. 2 by Director Public Service for paving with brick Goshen Avenue and Tenth Street, about 5297 sq. yd., 4570 ft. 5x22-in. stone curb, etc.

Wooster, Ohio.—Until Sept. 10 by Bd. Pub. Service (Peter C. Given, Clk.) for grading, curbing, draining and paving with vitr. brick North Buckeye Street, between East Bowman and Pearl Street.

Xenia, Ohio.—Until Aug. 31 by C. W. Whitmer, Dir. Pub. Service, for 9900 sq. yd. street paving on Third Street, brick, wood block, sheet asphalt or aspnaltic concrete, 6000 lin. ft. curb and gutter, 3500 cu. yd. excav., 1600 cu. yd. concrete, 1000 lin. ft. 16-in. storm sewer and 6000 lin. ft. 4-in. drain, etc. J. P. Shumaker, City Engr.

Indiana.—By County Commissioners for constructing roads as follows:

Until Sept. 7:

Sullivan, 12,591 ft. gravel road in Hamilton Township. W. S. Bicknell, Co. Aud.

Until Sept. 8:

Shelbyville, a gravel road in Shelbyville Township, 11,800 ft. long, and two in Liberty Township. F. W. Fagel, Co. Aud.

Until Sept. 11:

Washington, a 10-ton road roller and a double cylinder steam engine not less than 18-hp and a tank wagon with sprinkler attached. L. S. Core, Co. Aud.

Jackson, Mich.—Until Sept. 2 for grading approximately three miles park drives in the Ella W. Sharp Park, adjoining city of Jackson, having for the most part 30-ft. base in both cut and fill. Approximate quantity of excavation and borrow will aggregate 23,000 yd. The limit for free haul is 500 ft. Material is all in soil, which is generally sandy loam. Fargo Eng. Co., Engrs, Jackson.

Chicago, Ill.—Until Aug. 25 by Bd. Local Improv. (Edward J. Glackin, Secy.) for improving portions of Winnemac Avenue, S. Whipple, Bingham, Wilcox and a number of other streets, by grading, curbing and paving with asphalt and granite asphaltic concrete.

Elgin, Ill.—Until Aug. 26 by William F. Sylla, City Clk., for constructing 18,763 lin. ft. Portland cement combined curb and gutter.

Illinois.—Until Aug. 25 by State Highway Comn., Springfield, for brick pavt., as follows:

Eager County, Sect. D., Paris nearest P. O., 5300 ft., cost $11,518; Sect. E., 5300 ft.; cost $11,282.

St. Charles, Ill.—Until about Sept. 1 by Bd. of Local Improv. for paving East and West Main Streets, East First Street and other connecting streets and places, including 31,250 sq. yd. vitr. brick pavement, 5 and 6-in. cement concrete foundation, 2-in. sand cushion, joints filled with asphalt filler, surface dressed with sand and subgrade complete: 10,850 lin. ft. cement concrete curb on layer of bank gravel; 400 lin. ft. 10-in. sewer pipe laid; 16 inlets with c. i. covers, set; 91 combined false curbs and gutter crossings, with c. i. plates complete in place and 36 oak headers. For further information address John W. Wilson, Engr., 51 West Main Street, St. Charles.

Boscobel, Wis.—Reported desired until Sept. 2 by W. E. Howe, Mayor, for 6500 sq. yd. concrete paving, etc.

Aitkin, Minn.—Reported desired until Aug. 30 by H. C. Beecher, Co. Aud., for constructing Divisions A, B, C and D of State Rural Highway No. 10, or any one of the divisions. Probable cost, $45,629.

St. Paul, Minn.—Reported desired until Aug. 23 by H. Hohenstein, Purchasing Agent, for grading and paving various streets.

Missoula, Mont.—Until Aug. 25 by L. E. Harris, City Clk., for vitr. brick, standard bitulithic or asphaltic concrete, all on 5-in. concrete base, in Special Improvement Dist. 36, Pine Street, about 4850 sq. yd. E. S. Hathaway, City Engr.

Kansas City, Mo.—Until Aug. 24 by Bd. Pub. Wks. (Edw. F. Webster, Acting Secy.), for paving with asphalt concrete, Campbell Street, sheet asphalt Campbell Street, with vitrical fibre vit. brick block on an alley.

St. Louis, Mo.—Until Aug. 27 by Bd. Pub. Service for improving Marcus Avenue, from Kings Highway to Margretta Avenue, and Florissant Avenue, from Carrie Avenue to Bernays Avenue.

Tacoma, Wash.—Until Aug. 28 by Bd. Co. Comrs. (Thomas N. Norris, Clk.) for improving Pacific Highway, a distance of 5.574 miles, by grading and paving with bitucrete, warrenite, asphaltic concrete, bitulithic asphalt, highway brick, highway block No. 2, paving brick No. 2, paving block, two course concrete, one course concrete or wood block.

Washington.—Until Sept. 8 by William R. Roy, State Highway Comr., Olympia, for surfacing about 3 miles of the National Park Highway between Ashlock and Frances, Pacific Co.

Salt Lake City, Utah.—Reported desired until Aug. 24 by City Comrs. for constructing bitulithic pavement on Ninth S., Fifteenth E., Fairview and Michigan Avenues, paving extension No. 121.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Massachusetts—Following are lowest bids opened Aug. 10 by Massachusetts Highway Comn.:

Northampton, macadam road construction: Philpot Contr. Co., Melrose, $18,571; R. F. Hudson, Melrose, $20,017; Lane Constr. Cor., Meriden, Conn., $21,462.

★**Syracuse, N. Y.**—Contract for paving Maryland and Walnut Avenues with modified Topeka awarded by Bd. Contract and Supply to Schenectady Contr. Co., Schenectady, at $27,897.

★**Keyport, N. J.**—Contract for resurfacing Broad Street with concrete awarded by Town Council to Charles E. Burd, Red Bank, at $11,923.

Newark, N. J.—Four lowest bids opened Aug. 16 for repaving Belleville Avenue with granite on 6-in. concrete: (a) price per sq. yd., city totals Newark Paving Co., (a) $4.100, $4,715; Greenleaf Constr. Co., (a) $3.92, (b) $4.80; Jackson Constr. Co., (a) $3.87, (b) $4.71; Van Keuren & Son, (a) $2.99, (b) $3,750.

★**Roseland, N. J.**—Contract awarded for grading and macadamizing Cortlandt Street to Robert Laverty, 164 Ridge Street, Newark. F. L. Ellsworth, Boro. Engr., 36 Spring Street, Montclair.

★**Fullerton, Pa.**—Contract awarded to Evans Mellinger, Easton, for paving Third Street with macadam, 2½ in. deep, on a 5-in. concrete base, at $1.35 per sq. yd. Engineers, Bussom & Seeger, Allentown Bank Bldg., Allentown.

Philadelphia, Pa.—Lowest bid opened for widening and improving Delaware Avenue from Queen to Vandalia street approaches by McNichol Paving Co., 1723 Cherry Street, at $212,500.

Philadelphia, Pa.—Following are average low bids for street improvements opened Aug. 10 by Dept. Pub. Wks. (William Connell, Chief Bureau of Highways):

Grading, 88,938 cu. yd. Low bidders: Thomas Christy & Son, 1323 Colwyn Street; R. B. Wenner, Wayne & Wyoming Avenue; J. J. Slavin & Co., 7925 Ridge Avenue; J. D. Dewney, 1204 E. Montgomery St.; S. H. Dean, Fox Chase; Claude Hagerstrick, 2763 N. Twenty-fifth Street; average price of 30.1 cts. per cu. yd.; total amount of low bids $40,741.

Asphalt pavement, including 6-in. concrete base. Low bidders: Barber Asphalt Paving Co., Land Title Building; Eastern Paving Co., Penn Square Building; Union Paving Co., Thirtieth and Locust Streets; average price, $1.401 per sq. yd.; total $73,919.

Vitr. block pavt., including 6-in. concrete base. Low bidders: Field, Barker & Underwood, 620 Commercial Building; Cunningham Paving & Constr. Co., 1345 Arch Street; average price of $1.824 per sq. yd.; total $7,060.

Granite block pavt., including 6-in. concrete base. Low bidder: Mack Paving & Constr. Co., 1110 Fidelity Building; average price of $3.29 per sq. yd.; total $11,264.

Asphalt on 6-in. concrete base. Low bidders: Union Paving Co., Thirtieth and Locust Streets; Barber Asphalt Paving Co., Land Title Building; average price of $1.16 per sq. yd., total $13,665.

Vitr. block pavt., including 6-in. concrete base. Low bidders: Estate of David McMahon, Main Street and Chelton Avenue; Cunningham Paving & Constr. Co., 1345 Arch Street; average price, $2.052 per sq. yd.; total $31,733.

Granite block pavt., including 6-in. concrete base. Low bidders: E. H. Vare, Lincoln Building; J. Jos. McHugh, 1430 S. Penn Square; average price, $3.067 per sq. yd., total $11,967.

Bituminous pavt., including 5-in. concrete base. Low bidder: Union Paving Co., Thirtieth and Locust Streets; average price, $1.13 per sq. yd.; total $12,963.

Waterbound macadam, 3-in. on a 5-in. broken stone base; average price, 99.9 cts. per sq. yd., and waterbound macadam, 4-in. on an 8-in. telford base; average price, $1.40 per sq. yd. Low bidders: J. F. Shanley & Co., Commercial Trust Building; Dwyer & Co., 1524 Chestnut Street; P. J. Snyder & Co., 903 Bailey Building; W. J. Hendren & Co., 6736 Ridge Ave.; total cost $22,501.

Waterbound macadam on old base. Low bidders: P. J. Snyder & Co., 903 Bailey Building; Estate David McMahon, Germantown & Chelton Avenues; average price, 46.5 cts. per sq. yd., total $7,324.

★**York, Pa.**—Contract for paving North Newberry, West Philar and West Philadelphia Streets with asphalt awarded by City Council to General Supply & Constr. Co., York, at $1.85 per sq. yd., total $21,-275.

★**Baltimore, Md.**—Contract for constructing 17,000 sq. yd. concrete roads around Susquehanna plant at Lake Montebello awarded by Bd. Awards to Consolidated Engineering Co., 126 Hughes Street, at $14,280.

★Contract reported awarded by Bd. of Awards Aug. 4 to P. Flanagan & Sons, Lexington and Calvert Streets, for paving Hiller, East and Gold Streets with sheet asphalt, at $24,447.

★**Georgetown, Del.**—Contract for constructing section of the Du Pont Boulevard, from Shelbyville to Frankford, 4 miles, awarded June 14 to M. Sweney Constr. Co., Canton, Pa., at $46,817.

Washington, D. C.—Lowest bid opened Aug. 10 by Secy. Bd. Comrs., D. C., Room 500, District Bldg., for laying cement sidewalks in Dist. of Columbia, submitted by Warren & Brubaker Co., 141 Q Street, N. W., at 95 cts. for class A and $1.15 for class B.

★**Huntington, W. Va.**—Contract awarded Aug. 2 for constructing county roads as follows: To George Hinsle, Huntington, for 5 miles, and Brubaker Constr. Co., Huntington, for 9 miles. E. S. Urquhart, Co. Clk.

★**Chattanooga, Tenn.**—Contracts awarded by city to Southern Paving Constr. Co., Chattanooga, for paving with creosoted wood Market Street, Ninth Street to W. & A. R. R., Dist. 181, 8900 sq. yd.; Market Street, W. & A. R. R. to Main Street, Dist. 182, 5540 sq. yds.; East Ninth Street, Market Street to A Street, Dist. 180, 2020 sq. yd. at $2.65 and $2.68 per sq. yd.; totals, $26,315, $25,695 and $6,822 respectively.

★**Waverly, Tenn.**—Contract awarded for constructing Humphreys County Highway to Oliver Hill Constr. Co., Maryville and Knoxville, at about $200,000. G. B. Howard & Co., Engrs., Nashville.

★**Glasgow, Ky.**—Contract for constructing 4 miles rock road from corporate limits to Tompkinsville toward Glasgow awarded by Monroe County Fiscal Court to J. H. Newman, Tompkinsville, and C. S. Davis, Nashville, Tenn., at $13,386.

★**Winchester, Ky.**—Contract for about 13,000 sq. yd. sheet asphalt paving awarded by City Council to Bickel Asphalt Paving Co., Louisville, at $2.34 per sq. yd.

★**Hudson, Ohio.**—Watters & Downs, Akron, secured contract for paving at about $35,000.

Ohio.—Following are lowest bids opened Aug. 6 by Clinton Cowen, State Highway Comr., Columbus, for state highway work:

Champaign County, Section N of Urbana-Sidney Road, Concord Township, constructing bridges and culverts, grading roadway and paving with waterbound macadam; length 5280 ft.; estimated cost $8,401 (no bids received).

Clermont County, Section J of Cincinnati-Chillicothe Road, Goshen Township, paving with waterbound macadam; length 16,178 ft.: Van Camp Bros., Norwood, $15,976.

Clermont County, Section D of Cincinnati-Batavia Road, Union and Batavia Townships, paving with waterbound macadam; length 16,071 ft.: S. M. Tanner, Cincinnati, $18,800.

Fairfield County, Section C of Columbus-Lancaster Road, Violet and Bloom Townships, bridges and culverts: C. L. Hempy, Pickerington, $3,495.

Hocking County, Section I of Logan-Athens Road, Green Township, paving with brick; length 7700 ft.: E. C. Lewis & Co., Rockford, $22,938.

Licking County, Section O of Columbus-Millersburg Road, paving with waterbound macadam; length 14,400 ft.: Lamb & Neel, Thornville, $24,800.

Licking County, Section L of National Road. Lowest bidder: Lamb & Neel, Thornville—Contract 1, Main Market 4, Union Township, paving with concrete, length 4583 ft., $10,233, and Contract 2, Union Township, bridges and culverts, length 4698 ft., $730.

Lorain County, Section D of Milan-Elyria Road, Amherst, Russia and Henrietta Townships, paving with waterbound macadam, length 23,272 ft.: Knopper, Burr & Jackle, Tiffin, $28,500.

Muskingum County, Section O of National Road, Union Township, paving with concrete (reinforced), length 309.7 ft.: Parish & Bales, Dayton, $960; Section P, with concrete (reinforced), length 254.3 ft., $813.

Shelby County, Section C of Sidney-Wapakoneta Road, Clinton and Franklin Townships, paving with waterbound macadam, length 14,520 ft.; John F. Hipskind, Richmond, Ind., $26,900.

Trumbull County, Section P of Youngstown-Sharon Road, Hubbard Township, paving with bituminous macadam, length 19,300 ft.: Evans & Walters, $37,974.

Licking County, Section E of Columbus-Newark Road, Newark Township, paving with bituminous macadam, length 5187.8 ft.; Vogelmeier Bros., Newark, $6,767.

Lawrence County, Section A of Ironton-Miller Road, Upper Township, lining tunnel for approximately 100 ft.: M. E. Murphy Co., Columbus, $2,338.

★**Boonville, Ind.**—Contract for constructing concrete road from south corporation line of Boonville to Maple Grove Cemetery awarded by County Comrs. to Reutzel, Euler & Merritt Constr. Co., Evansville, at $10,440.

Brownstown, Ind.—Following are four lowest bids opened Aug. 9 by Town Council for paving with concrete Main, Spring, Grant and Broadway Streets: George F. Miller, Lebanon, $19,871; H. E. Kattman, Brownstown, $19,931; F. H. Kent Constr. Co., Shelbyville, $21,658, and W. P. Masters, Seymour, $24,058.

★**Goshen, Ind.**—Contract for constructing Concord Township section of Elkhart-Goshen Road awarded by County Comrs. to Amandus M. Smith, Elkhart, at $57,775 for concrete.

★**Indiana**—Contracts for constructing roads awarded by County Comrs. as follows:

Albion, township line road south of Albion to O. J. Simons, Marion, at $17,787.

Huntington, stone road in Jackson township to S. H. Palmer, Huntington, at $10,-287.

★**Indianapolis, Ind.**—Contracts awarded by County Comrs. for constructing 5 concrete roads as follows: To William Coin, Frankfort, for Ayers Road, 27-ft. pavt., 1000 ft. long, $4,146, and Uhl Road, 14-ft. pavt., 2.52 miles, $30,100; to Fisher & Carlos, Indianapolis, for Mankedick Road, 22-ft. pavt., 1700 ft. long, $7,707, and to J. I. Poulson, Greenfield, for Sloan Road, 24-ft. pavt., 1.21 miles long, $22,000. W. W. Southard, Deputy Co. Engr.

★**Peru, Ind.**—Contract awarded Aug. 9 by Co. Comrs. to J. Frank Hunt, Amboy; for constructing gravel roads in Peru and Jackson Townships. F. K. McElheny, Co. Aud.

★**South Bend, Ind.**—Contract for paving Franklin Street with brick awarded by Bd. Wks. to C. H. De Frees, South Bend, at $13,518.

★**Pontiac, Mich.**—Contract for constructing 7150 ft. concrete road awarded by County Road Comrs. to R. D. Baker Constr. Co., Detroit, at $16,355.

Aurora, Ill.—Following bids opened Aug. 2 by Bd. Local Improvements for 10,000 sq. yd. brick pavement and 4800 lin. ft. curb: J. E. Salfisberg & Co., Aurora, $22,-439; H. H. Embody, Aurora, $23,019, and McCarthy Improvement Co., Davenport, Iowa, $25,864.

★**Georgetown, Ill.**—Contract for constructing county hard surface roads in Georgetown and Westville awarded by Comrs. Highways in Georgetown Township to Joseph Sturdyvin & Co., Rantoul, at about $65,000.

★**Glen Ellyn, Ill.**—Contract for paving streets with granite in Glen Ellyn awarded to Illinois Hydraulic Stone & Constr. Co., Elgin, at $74,000.

★**Illinois**—Contracts awarded Aug. 11 by State Highway Commissioner, Springfield, as follows:

Kane County, Section D, to Thomas H. Cutler & Co., Gary, Ind., at $8,949.

Kane County, Section E, to R. A. Medaris Constr. Co., Springfield, at $3,547.

Vermilion County, Section C, to Central States Bridge Co., Indianapolis, Ind., at $11,498.

Vermilion County, Section D, to McCalman Constr. Co., Decatur, at $34,900.

★**Mount Carmel, Ill.**—Contract awarded Aug. 12 for constructing 20 miles gravel roads to Hoffman, Townsend & Parks, Mount Carmel, at $57,020. Other bids: George C. Kroch, Vincennes, Ind., $57,641; Polk, Sproat & Co., Oaktown, Ind., $60,888; Dunlap Dippold Co., Edwardsville, Ill., $61,169. E. E. Seiler, Dist. Clk.

★**Burlington, Iowa**—Contract for paving one mile Agency Road with concrete awarded by Bd. Supervs. to Cameron-Joyce & Co., Keokuk, at about $15,000.

★**Mitchel, S. D.**—Contract awarded for grading, curbing and paving Railroad Street and West Fourth Avenue, approximately 13,793 sq. yd., to C. H. Atkinson, Watertown, at $1.77 per sq. yd. Thomas Eastcott, City Aud.

★**Butte, Mont.**—Contract awarded Aug. 7 by city to J. R. Silver, Butte, for paving Main Street, about 6000 sq. yd. on concrete foundation at $3.25 per sq. yd. including foundation. Otis Lee, Asst. City Clk.

★**Livingston, Mont.**—Contract reported awarded by Council for paving with standard bitulithic on concrete base portion of Main and Second Streets to Warren Constr. Co., Portland, Ore., at $36,102 and $14,840 respectively.

★**Russellville, Ark.**—Contract for constructing 26 miles macadam highway from Arkansas River at Dardanelle north through Russellville to Hector awarded by Comrs. Road Improvement, Dist. No. 1, to W. C. Jucksch, Little Rock, at about $100,000.

★**Corpus Christi, Tex.**—Contract for 88,-000 sq. yd. bitulithic pavement in Corpus Christi awarded by City Council to Texas Bitulithic Co., Dallas, at $257,000.

★**Seguin, Tex.**—Contracts awarded by Co. Comrs. as follows: 7 miles of Zorn-Redweed Road, to W. K. Davis, San Antonio, at about $14,000; five miles of Kingsbury-Staple Road, to J. F. Hamer, Little River, at $8,000.

Seattle, Wash.—Lowest bid opened by Bd. Pub. Wks. for constructing concrete walks on East Forty-first Street submitted by D. H. Traphagen, Alaska Bldg., at $11,590.

Lowest bid opened by Bd. Pub. Wks. for filling, grading, bulkheading, planking, sidewalks, surface drainage on Alki Avenue submitted by Puget Sound Bridge & Dredging Co., Central Bldg., at $92,250.

★**Seattle, Wash.**—Following are unit prices of S. Normile, Lowman Building, Seattle, successful bidder for paving Duwamish Road (bids opened by Co. Comrs. Aug. 9). Lump sum bid $60,071.00:

Clearing per acre	$100.00
Grubbing per acre	150.00
Excav. for roadway proper, per cu. yd.	0.50
Excav. outside roadway proper, per cu. yd.	0.50
Overhaul, 400 ft. free haul, per cu. yd.	0.02
Plain concrete, 1:3:4 mix., per cu. yd.	12.00
Plain concrete, 1:2:4 mix., per cu. yd.	15.00
Steel for reinforcement, per lb.	0.07
Cedar log bulkhead, face logs	0.30
Cedar log bulkhead, tie logs	0.25
Lumber, per M ft.	20.00
Hardware, per lb.	0.10
Piling driven, per lin. ft.	0.30
Cedar mud sills, per lin. ft.	0.35
Riprap, hand placed, per cu. yd.	3.00
Riprap, loose, per cu. yd.	2.50
Embkt. rail, Des. 1, per lin. ft.	0.35
Embkt. rail, Des. 2, per lin. ft.	0.35
Embkt. rail, Des. 3, per lin. ft.	0.40
Wire fence, Des. 1, per lin. ft.	0.35
Wire fence, Des. 2, per lin. ft.	0.35
6-in. porous tile drain, per lin. ft.	0.30
8-in. porous tile drain, per lin. ft.	0.60
8-in. 18-gage corr. metal cuverts, per lin. ft.	1.00
12-in. 16-gage corr. metal culverts, per lin. ft.	1.50
18-in. 16-gage corr. metal culverts, per lin. ft.	2.50
24-in. 16-gage corr. metal culverts, per lin. ft.	3.40
8-in. cast-iron flood gate, ea.	25.00
12-in. cast-iron flood gate, ea.	30.00
18-in. cast-iron flood gate, ea.	40.00
24-in. cast-iron flood gate, ea.	60.00
8-in. sec. grade vitr. tile drain	0.75
12-in. sec. grade vitr. tile drain	1.25
18-in. sec. grade vitr. tile drain	2.25
24-in. sec. grade vitr. tile drain	3.25
30-in. sec. grade vitr. tile drain	4.50
8-in. concrete or cement pipe, per lin. ft.	0.75
12-in. concrete or cement pipe, per lin. ft.	1.25
18-in. concrete or cement pipe, per lin. ft.	2.25
24-in. concrete or cement pipe, per lin. ft.	3.25
30-in. concrete or cement pipe, per lin. ft.	4.25
Gravel for surfacing, per cu. yd.	2.25
Crushed rock surfacing, per cu. yd.	2.25

Seattle, Wash. — Following are unit prices of M. P. Zindorf, Alaska Building, for grading and graveling Enumclaw Franklin Road (bids opened Aug. 9 by County Comrs.). Lump sum bid $34,132:

Clearing per acre	$150.00
Grubbing per acre	150.00
Excav. for roadway proper, per cu. yd.	1.00
Excav. for ditches outside roadway, per cu. yd.	1.25
Overhaul, 400 ft. free haul, per cu. yd.	0.02
Plain concrete, 1:3:4 mix., in place.	11.00
Plain concrete, 1:2:4 mix., in place.	12.00
Steel for reinforcement, per lb.	0.06
Cedar log bulkhead, face logs	0.35
Cedar log bulkhead, tie logs	0.25
Lumber, per M ft.	20.00
Hardware, per lb.	0.06
Piling driven, per lin. ft.	0.50
Cedar mud sills, per lin. ft.	0.50
Riprap, hand placed, per cu. yd.	2.50
Riprap, loose, per cu. yd.	3.50
Embkt. rail, Des. 1, per lin. ft.	0.50
Embkt. rail, Des. 2, per lin. ft.	0.30
Embkt. rail, Des. 3, per lin. ft.	0.30
6-in. porous tile drain, per lin. ft.	0.40
8-in. porous tile drain, per lin. ft.	0.60
8-in. 18-gage corr. metal cuverts, per lin. ft.	1.00
12-in. 16-gage corr. metal culverts, per lin. ft.	1.50
18-in. 16-gage corr. metal culverts, per lin. ft.	2.50
24-in. 16-gage corr. metal culverts, per lin. ft.	4.00
8-in. vitr. tile drain, per lin. ft.	1.00
12-in. vitr. tile drain, per lin. ft.	1.50
18-in. vitr. tile drain, per lin. ft.	2.50
24-in. vitr. tile drain, per lin. ft.	3.50
30-in. vitr. tile drain, per lin. ft.	5.00
8-in. concrete or cement pipe, per lin. ft.	1.00
12-in. concrete or cement pipe, per lin. ft.	1.50
18-in. concrete or cement pipe, per lin. ft.	2.50
24-in. concrete or cement pipe, per lin. ft.	3.50
30-in. concrete or cement pipe, per lin. ft.	5.00
Gravel for surfacing, per cu. yd.	1.75

★**Tacoma, Wash.**—Contract awarded by Co. Comrs. to Washington Paving Co., Savage Scofield Bldg., Tacoma, for improving permanent Highway No. 5A, a distance of about 5 miles, at $76,549, to consist of grading, preparing subgrade, ditches, etc., and paving with 2-in. bitulithic on 5-in. base, 6-in. concrete curb.

★**Walla Walla, Wash.**—Contract for paving with Warren bitulithic First Street reported awarded Warren Constr. Co., Portland, Ore., at $1.42 per sq. yd.; total about $15,098.

★**Washington.**—Contracts awarded by William R. Roy, State Highway Comr. as follows: McLellan Pass Highway, 14 miles, between Natches and Summit, grading, graveling, etc., Rejott, Fobert & Winters, Olympia, $27,536; Inland Empire Highway, between Colville and Spokane, 5 miles, grading, graveling, etc., E. G. Miner, Sandpoint, Idaho, $11,560.

★**Coquille, Ore.** — Contract reported awarded by Co. Comrs. Aug. 5 to S. C. Small of Marshfield, for resurfacing 1 mile in Road Dist. No. 5, at 39 cts. per sq. yd. for waterbound macadam shoulders, and $1.02 per yd. for rock asphalt.

★**Tolo, Ore.**—Contract for extension of Pacific Highway, north from Tolo to Josephine County Line, awarded Chris. Natwich, Medford, at $16,660, to include grading, curbing and culverts.

★**Verdue, Que.**—Contract for paving 32,694 sq. yd. with bitulithic awarded Warner-Quinlan Asphalt Co. at $2.25 per sq. yd.

★**Dunville, Ont.**—Contract awarded Aug. 14 for paving Canal Street E. with 8-in. tarvia, to McRae & Campaigne, Niagara Falls, Ont., at $10,460. J. W. Holmes, Town Clk.

★**Port Coquitlam, B. C.**—Contract reported awarded Columbia Bitulithic Co., Port Coquitlam, for grading and laying bitulithic pavement on Dewdney Trunk Road at about $22,000.

STREET CLEANING AND GARBAGE DISPOSAL

BIDS DESIRED.

Rock Island, Ill.—Until Sept. 1 for constructing 24-ton garbage incinerator. W. Treichler, City Engr.

Galveston, Tex.—Until 5 P. M., Aug. 19, by John D. Kelley, City Secy., for disposal of city garbage, trash and refuse to be delivered by city's garbage and trash wagons at stations designated by Health Physician, and to be hauled therefrom in sanitary conveyances or cars and disposed of in a manner approved by Bd. City Comrs. A. T. Dickey, City Engr.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Augusta, Ga.** — Contract reported awarded by City Council to T. O. Brown & Son, Augusta, for constructing incinerator in Sixth Ward, at $9,000.

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS

PROPOSED WORK

Flood Abatement—Olean, N. Y.—Bonds for $150,000 were sold Aug. 16 to be used as city's share of flood abatement work. E. W. Fitzgerald, Pres. Flood Abatement Comn.

Flood Protection—Erie, Pa.—City plans to issue bonds for reconstruction of Mill Creek in flood area.

Channel Work—Richmond, Va. — City Administrative Bd. reported to have authorized City Engineer to make surveys for widening Shockoe Creek from mouth of creek at James River to Seventh and Hospital Streets; also proposed to replace present arch over Main Street with a reinforced girder bridge.

Wharf—Tuscaloosa, Ala.—George Jacob Davis, Jr., of the University, engaged by City Comn. to prepare plans for a municipal wharf.

Drainage—Abbeville, La.—Citizens of Young's Coulee drainage district reported to have voted $21,000 bonds for drainage of Young's Coulee and Crooked Styx, southeast of Abbeville.

Drainage—Baton Rouge, La.—Major F. M. Kerr, State Engr., at request of the Mayor reported to have made outline of project to improve drainage conditions in Baton Rouge and southern section of parish, and estimates cost at $160,682. He recommends that dike across University Lake be closed up and considerably enlarged and that channels of Ward Creek and its branches be enlarged.

Irrigation—Hardin, Mont.—John J. Harris, Pres. Big Horn Canyon Irrigation & Power Co., writes foundation tests consisting of six 150-ft. diamond drill holes for 220-ft. dam have been completed showing hard satisfactory unfractured limestone, 10 to 17 ft. under the water surface. Prospects for financing power feature are bright; 30 per cent of right-of-way for 32-mile railway to Hardin has been secured and officials hope to have some construction work started this year. A. W. F. Koch, Ch. Engr.

Dock and Elevator—St. Louis, Mo.—Local press reports state that a contract was signed Aug. 9 by Director of Public Utilities and officials of St. Louis Ry. & Dock Co. (W. J. Holbrook, Pres.) for permission to use municipal terminal belt and dock facilities. The contract binds the company to build a fireproof elevator with a capacity of at least 1,000,000 bushels within 3 years on property owned by company a quarter of a mile south of City Water Works at Chain of Rocks.

Drainage Bonds—Crawfordsville, Ark.—$490,000 Drainage Dist. No. 2 bonds will be sold Aug. 23 by L. S. Swepston, Secy. Comrs.

Levee Work—Fort Worth, Tex.—About $50,000 will be spent for completing the levee system. Robert G. Johnson, Chmn. Comn.

Retaining Wall — Seattle, Wash. — We are informed that no contract will be let at present time for constructing concrete retaining wall along Railroad Avenue, on account of unfavorable tides at this season. Work will not be started until next March. Approximate cost $92,083. A. H. Dimock, City Engr.

Beach Esplanade—San Francisco, Cal.—City Engineer reported to have completed plans for beach esplanade; the first section to be constructed near the Cliff House, to cost $50,000. The entire construction is estimated at $1,000,000.

Irrigation — Homedale, Idaho. — Directors of Succor Creek Irrigation Dist. (D. W. Martin, Chmn.) considering Irrigation of 10,000 acres of land on Succor Creek, including construction of diversion dam and distributing system.

Twin Falls, Idaho.—Twin Falls Canal Co., Twin Falls, reported contemplating enlargement of 28 miles of its High Line Canal from 800 sec. ft. capacity to 1200. J. C. Porterfield, Ch. Engr. and Gen. Mgr.

BIDS DESIRED.

State Canal Work—Albany, N. Y.—Until Sept. 14 (extension of date from Sept. 8) by W. W. Wotherspoon, State Supt. Pub. Wks., for following work: Contract L, Cayuga and Seneca Canal, constructing substructure, superstructure and approaches to highway bridge at Gorham Street, Waterloo, and Kingdon Road Bridge, between Waterloo and Seneca Falls; Engineer's estimate, $71,469; Terminal Contract No. 40, constructing harbor and dockwall on north side of Mohawk River, east of highway bridge, at St. Johnsville; Engineer's estimate, $27,963. Advertised in Engineering Record.

Pier Improvement—Philadelphia, Pa.—Until Aug. 30 by John Meigs, Dir. Dept. Wharves, Docks & Ferries, 555 Bourse Bldg., for following work: Schedule "A," composition roofing at Race St. pier, Delaware River; Schedule "B," resurfacing with concrete-gun Delaware Avenue bulkhead wall between Callowhill and South Streets; Schedule "C," resurfacing concrete upper decks of Chestnut and Race St. piers on Delaware River.

Dredging — Wilmington, Del. — Until Sept. 7 by U. S. Engineer, Old Federal Building, for dredging Murderkill and Mispillion Rivers, Del., advertised in Engineering Record.

Lock Gates—Montgomery, Ala.—Until Sept. 20 by U. S. Engineer for furnishing lock gates, advertised in Engineering Record.

Steel Sheet Piling for Dam—Louisville, Ky.—Until Sept. 16 by U. S. Engineer's Office, for furnishing and delivering sheet steel piling for Dam 43, Ohio River, advertised in Engineering Record.

Drainage Work—New Philadelphia, Ohio.—Until Sept. 1 by Comrs. Rolmes and Tuscarawas Counties, at New Philadelphia, for constructing joint county ditch. R. H. Nussdorfer, Secy. Joint Bd.

Levee Work—Mound City, Ill.—Until Sept. 1 by Rivers & Lakes Comn. of Illinois, 905 State Bldg., Chicago (Charles Christmann, Secy.), for levee repairs in Mound City, approximately 20,000 cu. yd. earth, 4500cu. yd. earth crossings, 1110 sq. yd. riprap paving, advertised in Engineering Record. W. H. Moyers, Engr., Mound City.

Cleaning Channel, Glenwood, Iowa.—Until Sept. 7 by R. E. Humphrey, Co. Aud., for cleaning channel and repairing levees on Pony Creek ditch, about 172,000 cu. yds. Seth Dean, Engr., Glenwood.

Ditch—Mankato, Minn.—No bids were opened Aug. 16 for constructing Ditch No. 37, as District Court issued a restraining order, returnable Sept. 11. Probable cost of ditch $11,856. C. L. Kennedy, Co. Aud.

Ditch—Morris, Minn.—Until Sept. 2 by C. R. Wollthan, Co. Aud., for constructing County Ditch No. 15, in all 275,153 cu. yd.; estimate cost, $35,889.

Ditches — Crawfordsville, Ark. — Until Aug. 23 by L. S. Swepston, Secy. Comrs., Drainage Dist. No. 2, Crawfordsville, for constructing thirty-seven ditches, containing approximately 5,022,000 cu. yd. earth. This is all floating dredge work, except about 2 miles of 6-ft. bottom ditch, which will be done with teams.

Reclamation Work—Elephant Butte, N. M.—Until Sept. 2 at U. S. Reclamation Service, Washington, D. C., for furnishing four steel cylinder gates and accessories for the spillway at Elephant Butte dam, Rio Grand Project, New Mexico-Texas.

Canal Work—Peterborough, Ont.—Until Sept. 1, by J. W. Pugsley, Secy. Dept. Rys. and Canals, Ottawa, for sluice pipes, valves, operating machinery and electrical equipment for Swift Rapid Dam, Trent Canal.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Dam—North Gorham, Me.**—Contract awarded by Cumberland County Power & Light Co. to H. P. Cummings Constr. Co., Ware, Mass., for constructing concrete dam over Presumpscot River at North Gorham; cost $40,000.

★**Boston, Mass.**—Contracts awarded by Harbor and Land Comn. for harbor work as follows: To Bay State Dredging Co., Boston, for construction of Vineyard Haven breakwater, at $9,430; to John H. Gerrish Co., 10 Tremont Street, Boston, three dredging contracts, one in Barnstable Harbor at $9,780, another in Nobskussett Harbor at $5,490, and a third in Wellfleet Harbor at $8,151; to Eastern Dredging Co., for 50,000 yd. dredging for a 12-ft. yacht basin in Plymouth Harbor and to A. S. Packard Dredging Co. for 117,000 yd. dredging and filling in Lynn Harbor at $31,000.

★**Riprap—New London, Conn.**—Contract awarded Aug. 10 by U. S. Engineer for furnishing and placing about 2000 long tons riprap for repair of breakwaters at Duck Island Harbor and at mouth of Housatonic River, Conn., to Estate of John Beattie, Lette Island, Conn., at $2,097.

★**Dock—Dunkirk, N. Y.** — Contract awarded by Council to D. L. Taylor Co., Medina, for constructing Sect. 3 of Central Avenue dock. This company now has contract for three sections, to cost in all $75,000.

★**Dredging—New York, N. Y.**—Contract for dredging in Port Chester Harbor, 41,000 cu. yd., awarded to Eastern Dredging Co., East Boston, Mass., at 17.75 cts. per cu. yd.; total $7,277 (bids opened July 30 by U. S. Engineer, 29 Whitehall Street, New York).

★**Pier—Philadelphia, Pa.**—Following are totals of bids opened Aug. 9 by John Meigs, Dir. Pub. Wharves, Docks & Ferries, 555 Bourse Bldg., for pier construction in Delaware River, between McKean Street and Snyder Avenue: Snare & Triest, 233 Broadway, New York, $516,700, to be completed in 18 months (awarded contract); Daniel S. Bader, 1345 Arch Street, Philadelphia, $529,000; A. C. McMullin Co., 149 Broadway, New York, $554,662; American Paving & Constr. Co., 211 South Ninth Street, Philadelphia, $569,000; Underpinning & Foundation Co., 290 Broadway, New York, $584,000; Armstrong & Latta, Land Title Bldg., Philadelphia, $610,000.

Unit prices of Snare & Triest, New York, successful bidder, as follows:

Rip rap for revetting front of sheet piling, per ton of 2,000 lb.	$1.00
Vertical or bearing piles, each	17.00
Inclined or spur piles, each	19.00
12-in. sheet piling, per horizontal lin. ft. driven piling	21.00
8-in. sheet piling	15.00
Sawed timber, dimension sizes above 6 in. thick, per M. ft.	55.00
White oak for fenders, per M. ft.	60.00
No. 1 concrete, per cu. yd.	6.00
No. 2 concrete, per cu. yd.	10.00
Master builders' finish on concrete paving, per sq. yd.	0.60
Cement finish on concrete paving, curbs, etc., per sq. yd.	0.40
Structural steel, per ton	55.00
Reinforcing steel, per ton	55.00
Nails, spikes, bolts, nuts and washers, per lb.	0.03
Cast steel column bases, per lb.	0.03
Mooring posts, complete, each	125.00
Bollards, complete, each	45.00
12-in. drains, c. i., each	7.00
6-in. drains, c. i., each	5.00
Bolt sockets, tackle rings, foot holds and miscellaneous steel work, per lb.	0.05
No. 1 Trus-Con curb bar, complete, per lin. ft.	0.18
No. 2 Trus-Con curb bar, complete, per lin. ft.	0.20
Structural steel curbing, including fastenings, per lb.	0.03
8-in. c. i. drain pipe, per lin. ft.	1.00
Armor plates, complete, including fastenings	1,500.00
Universal safety treads, per lin. ft.	1.00
85-lb. T-rails, per ton	36.00
No. 6 splices for 85-lb. rail, with bolts, nuts and nut locks, each.	2.00
9-in. girder rail, per ton	46.00
Splice bars, complete, for 9-in. girder rail, including bolts, nuts and nut locks, each	3.00
Tie rods with nuts complete, each	0.75
Standard track spikes, per lb.	0.03
White oak ties, 7 x 9 in., sawed or hewn, to be set in stone ballast, each	1.50
White oak sawed ties and switch timber, per M. ft.	40.00
Stone ballast for railway tracks, per cu. yd.	1.75
Iron ladders, each	10.00
6-in. concrete base for granite block paving, per sq. yd.	0.80
Granite block paving with sand cushion, per sq. yd.	2.40
8-in. straight cut granite curb, per lin. ft.	2.00
8-in. curved cut curb, per lin. ft.	2.50
5-in. bluestone curb, per lin. ft.	0.75
No. 3 open-mouth inlet, complete, each	75.00
No. 3 grate-top inlet, complete, each	75.00
12-in. vitr. clay pipe, per lin. ft.	1.00
Concrete sidewalk paving, per sq. yd.	1.10
Cinder filling, per cu. yd.	0.20
Grading for paving, per cu. yd.	0.10
Laborers with tools, including superintendence, per hour	0.35
Mechanics with tools, including superintendence, per hour	0.80

Jetty Work—Wilmington, Del.—Lowest bid opened Aug. 5 by U. S. Engineer for repairs to jetties at mouth of Mispillion River, Del., submitted by C. R. Simpson, New York, at $6,249.

Bulkhead—Charleston, S. C. — Two lowest bids opened Aug. 10 by Lighthouse Inspector, Charleston, to furnish material and construct timber bulkhead at site of new Charleston Lighthouse Depot, Ashley River: Charleston Eng. & Contr. Co., Charleston, $8,745, and Hay & Couch, Charleston, $9,150.

★**Dock and Warehouses—Sanford, Fla.**—Contract reported awarded by Clyde Steamship Co., to S. D. Shinholse of Jacksonville for a dock and warehouse to cost $15,000.

★**Flumes, Etc.—Appleton, Wis.**—Contract reported awarded by Fox River Paper Co. to C. R. Meyer & Sons Co., Oshkosh, for constructing two reinforced concrete and brick settling basins and two reinforced concrete water power flumes; cost about $50,000.

★**Ditch — International Falls, Minn.**—Contract for constructing Judicial Ditch 15 in Koochiching County awarded by Co. Comrs. to Northern Minnesota Drainage Co., Little Fork, at $57,330. The Construction Co., Alworth Bldg., Duluth, bid for this work $66,620.

★**Ditch—Jackson, Minn.** — Contract awarded by P. D. McKellar, Co. Aud., for constructing Judicial Ditch No. 39 (all tile) (bids opened Aug. 6) to Parrish & Sedgley, Worthington, at $9,833. Other bids: James Gerding, Fox Lake, Minn., $9,925; A. A. Hamrey, Forest City, Iowa, $9,950; John Petersen, Lakefield, Minn., $10,140. J. S. Fiddes, Deputy Co. Aud.

★**Drainage—Roswell, N. M.**—Contract reported awarded by Comrs. of the Roswell, Dexter-Greenfield and Hagerman drainage districts to Walter S. Dickey, for the construction of their respective drainage districts.

★**Pier—Redondo, Cal.**—Contract awarded July 26 by City Trustees for constructing reinforced concrete pleasure pier to Leyden-Ortseifen Co., 53 W. Jackson Boulevard, Chicago, Ill., at $108,800.

★**Pier—Redondo, Cal.**—Contract awarded Aug. 2 by City Trus. to Leyden-Ortseifen Co., Chicago, Ill., for constructing reinforced concrete pleasure pier at $108,800 (bids opened Aug. 2). Engineer, George W. Harding, Washington Bldg., Los Angeles.

★**Pier—San Francisco, Cal.**—Contract reported awarded to Tibbitts-Pacific Co., for construction of Pier 22 at Harrison Street at $48,877.

★**Irrigation — Provo, Utah** — Contract awarded to Houser, Sim & Vorkink, Salt Lake City, for construction of Div. 9 of High Lane Canal, Strawberry Valley irrigation project. Work involves approximately 25,000 cu. yd. excav., placing 2600 cu. yd. reinforced concrete; contract price $35,504.

★**Irrigation—Mountain Home, Idaho.**—Contract reported awarded by Mountain Home Co-Operative Co. for irrigation work to Maney Bros., Boise, at $62,000. Work includes tunnel 1504 ft. long, 4100 ft. steel flume, enlarging canal at several points and raising bank.

ELECTRIC RAILWAYS

PROPOSED WORK

Topsham, Me.—Frederick B. Teeling, Litchfield, reported interested in building an electric railway between Topsham and Monmouth, length about 38 miles.

Edmonton, Ky. — Cumberland Traction Co., Edmonton, reported formed and will build a road between Edmonton and Elizabethtown. First section to be constructed is between Edmonton and Hiseville, 16 miles long.

Cleveland, Ohio. — Cleveland & Ohio Central Electric Ry., Cleveland, having surveys made for an electric railway between Cleveland and Wooster.

Decatur, Ind.—Fort Wayne, Decatur & Southern R. R., Decatur, incorporated to build an interurban railway. Incorporators: M. Gerke, C. Oetting and C. Dirkson.

Dallas, Tex.—The Dallas & Southwestern Traction Co. (J. O. Andrewartha, Consulting Engr.) intends building a line from Dallas to Austin; also constructing a system of interurban lines radiating from Austin.

Los Angeles, Cal.—Surveys being made for last link of Pacific Electric Ry. Companies line from Los Angeles to Corona. This company is also considering building a loop in Upland. George E. Pilisbury, Ch. Engr., Los Angeles.

BIDS DESIRED.

Kansas City, Mo.—Until Aug. 25 by John M. Egan, 1500 Grand Avenue, for the Receivers of the Metropolitan Street Railway Company for constructing street car tracks on portions of various streets, advertised in Engineering Record.

South San Francisco, Cal.—Reported desired until Aug. 30 by William J. Smith, City Clk., for franchise as applied for by South San Francisco R.R. & Power Co. to construct and operate a single-track or double-track standard gage railway in South San Francisco.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Brooklyn, N. Y.**—Contract awarded by Bd. Public Service Comn., New York, to Dock Contractor Co., Hoboken, N. J., for Section 2, Route 29, Nostrand Avenue subway, Brooklyn, at $1,692,371 (bids opened July 28). Unit prices in Engineering Record of Aug. 7.

Philadelphia, Pa.—Following reported to be totals of bids opened Aug. 16 by A. M. Taylor, Dir. Dept. City Transit, 754 Bourse Bldg., for constructing Broad Street Subway and Frankford Elevated Railway.

Broad Street Subway: Keystone State Constr. Co., 704 Pennsylvania Bldg., Philadelphia, $1,700,000; Foundation Co., 233 Broadway, New York, $1,720,815; Arthur McMullen Co., 149 Broadway, New York,

$6,250.00; Frederick L. Cranford, Inc., and Smith, Hauser & Melsaac, Inc., New York, $2,500.00; New York & New Jersey Constr. Co., 30 E. Forty-second Street, New York, $2,449.00; Snare & Triest Co., Pier 40, S. Wharves, Philadelphia, $2,753.00.

Frankford Elevated Railway: James D. Dobson, 1304 E. Montgomery Avenue, Philadelphia, $142.50; Robert Lombardi, 6th Lancaster Bldg., Philadelphia, $145.00; Kerrigan Construction Co., 704 Pennsylvania Bldg., Philadelphia, $179.00; Edward Fay & Son, 2 S. Mole Street, Philadelphia, $175.00; A. L. Gardone & Son, Inc., 131 E. Twenty-third Street, New York, $190.00; Oscar Daniels Co., 253 Broadway, New York, $217.00; Peoples & Rech, 257 Commercial Trust Bldg., Philadelphia, $227.50; Millard & Lenton, East Allegheny Avenue and Tulip Street, Philadelphia, $260.00; New York & New Jersey Constr. Co., New York, $262.50; American Paving & Constr. Co., 211 South Ninth Street, Philadelphia, $160.00.

RAILROADS

PROPOSED WORK

Sloan, N. Y.—Delaware, Lackawanna & Western R. R. Co. (G. J. Ray, Ch. Engr., Hoboken, N. J.) submitted to **Public Service Comn. at Albany** plans for elimination of grade crossings at Sloan, and estimates cost at $329,471, including construction of a steel viaduct with brick pavement.

Walterboro, S. C.—Atlantic Coast Line R. R. Co. (E. B. Pleasant, Ch. Engr., Wilmington, N. C.) reported considering construction of a railroad from **St. Stephens to Yemassee.**

Dothan, Ala.—Atlanta & St. Andrews Bay Ry. Co. (A. G. Candler, Vice Pres., **Atlanta, Ga.**) reported to be considering extension of line north from Dothan to Columbus.

La Kemp, Okla.—Charter granted to **La Kemp & Northwestern Railway Co.,** with a capital of $150,000, to build line 126 miles long across northwestern corner of State, connecting with Panhandle division of Santa Fe between Fargo, Okla., and Goodwin, Tex., and running southwest through La Kemp, in Beaver County, and connecting with the Rock Island's El Paso line at Liberal, Kan.

PRICES AND LETTINGS.

**Indicates award of contract.*

***Fairmont, W. Va.**—Contract reported awarded to O. L. Anderson & Bros., Inc., **Altoona, Pa., for construction of Helen's Run extension of Western Maryland Railroad,** at about $400,000, to include grading, masonry and building bridges; the line will be 6 miles long.

***Concord, N. C.**—Contracts reported **awarded by Southern Railway Co. as follows: To H. H. Thrasher, Knoxville, Tenn., for double tracking line from Concord to Bowles Ferry in Cabarrus County, 6 miles; to Carroll Young Co., Greenville, S. C., for double tracking main line from Hayne or Spartanburg Junction to Greer, a distance of 17 miles; and to Morrow Construction Co., Atlanta, for a line from Greer to Greenville, 12 miles,** contracts approximate about $1,428,000.

PUBLIC BUILDINGS AND SCHOOLS

PROPOSED WORK

Fall River, Mass.—Reported that the [illegible] for an almshouse is under consideration. The purchase of the building and the altering of same is estimated at about $125,000.

Lowell, Mass.—Plans for annex to high school are under consideration. Address Bd. Educ.

North Adams, Mass.—City Council has voted an appropriation of $190,000 for erecting new high school.

Medina, N. Y.—Bd. Educ. considering school improvements including new high school.

New York, N. Y.—Plans filed for 16-story brick and stone [illegible] vocational school to be erected on Lexington Avenue and Twenty-second Street by Bd. Educ. (C. B. J. Snyder, Archt.); cost $750,000.

New York, N. Y.—Plans filed for 3-story brick hospital to be erected at Intervale Avenue and 164th Street for Bronx Maternity Hospital; cost $60,000. E. H. & C. N. Wheeler, Archts., Third Avenue and 148th Street.

Riverhead, L. I., N. Y.—Reported that the remodeling of the County Treasurer's office in the court house, at a cost of $25,000, or the erection of an entirely new building, is under consideration by Bd. Superv. Tooker & Marsh, 101 Park Avenue, New York, are preparing preliminary plans for a new building.

Schenectady, N. Y.—Citizens Aug. 9 voted $30,000 bonds for completing, altering and repairing school buildings and for equipment and supervision of the playgrounds.

Atlantic City, N. J.—Plans prepared by Stout & Riebenack, Atlantic City, for a 3-story brick addition to the school; cost $150,000.

Pleasantville, N. J.—S. Hudson Vaughn, Atlantic City, reported preparing plans for a 3-story brick school.

Lebanon, Pa.—Plans completed for the new high school; cost $200,000. Address Bd. Educ.

Nesquehoning, Pa.—Plans to be prepared for high school. Cost $60,000.

Philadelphia, Pa. — Reported contract will be let about end of August for constructing up to second floor of Central Free Library, Nineteenth and Vine Streets. Cost for this work, $825,000; building complete, $3,500,000. Horace Trumbauer, Archt., Land Title Building.

Baltimore, Md. — Reported contracts soon to be let by Bd. Awards for repairs to 11 schools; costing $100,000.

Salisbury, N. C.—See "Water Works."

Greenwood, S. C.—Citizens voted $35,000 school improvement bonds.

Daytona, Fla.—Citizens of School Dist. No. 6 of Volusia County have voted in favor of $75,000 bonds for erecting two schools.

Miami, Fla.—Plans to be prepared by Frohling & De Garmo, Miami, for 4-story court house and jail. Address Co. Comrs.

New Smyrna, Fla.—Plans and specifications accepted by County School Board for proposed 2-story reinforced concrete school. Cost about $30,000.

Cleveland, Ohio.—Reported contract soon to be let by Co. Comrs. for constructing county boys' detention home at a cost of $80,000. William S. Lougee, Archt., Marshall Building.

Conover, Ohio.—Plans being prepared by A. W. Stover, Springfield, for school cost $25,000.

Eaton, O.—Monroe Township Bd. Educ. engaged Rush & Sheets, Cincinnati, to prepare plans for centralized grade and high school; cost $45,000.

Kirkersville, O.—Plans being prepared by Rush & Sheets, Cincinnati, for grade and high school; cost $30,000.

Urbana, O.—Rush & Sheets, Cincinnati, preparing plans for centralized grade and high school for Urbana Township; cost $30,000.

West Liberty, Ohio—Plans being prepared by A. W. Stover & Co., Springfield, for a 2-story and basement brick high school for Union Township; cost $25,000, Address Bd. Educ. of the township.

West Unity, Ohio.—Citizens voted $25,000 bonds for erecting centralized school in Brady Township. Henry Reifel, Clk.

Brazil, Ind.—Erection of high school costing about $75,000 reported under consideration. Address Bd. Educ.

Rockport, Ind.—Co. Comrs. reported to be considering erecting new court house and jail at a cost of $140,000.

Ann Arbor, Mich.—Pond & Pond, Steinway Hall, Chicago, Ill., are architects for proposed Union Building to be erected by University of Michigan; cost reported at $1,000,000.

Kalamazoo, Mich.—Plans prepared by Wernette, Bradfield-Mead, Grand Rapids, for 3-story brick nurses' lodge building to be erected at State Hospital.

Greenfield, Ill.—Maxwell Township School Trus. sold $75,000 building bonds.

Peoria, Ill.—Contract soon to be let for erecting county jail; cost $100,000.

Waverly, Ill.—Deal & Ginzell, Lincoln, preparing plans for brick high school to cost $40,000. E. Etter, Secy. Bd. Educ.

Sparta, Wis.—Citizens voted erecting a high school on Rusk Avenue; cost $75,000.

Two Harbors, Minn.—Citizens voted $30,000 bonds for erecting an addition to high school.

Austin, Tex.—Plans being received for renovating of the state house for which Legislature has appropriated $125,000. Joe Owens, State Supt. Public Bldgs. and Grounds, Austin.

Street improvement, public school and sewer bonds amounting to $725,000 have been sold. Address Mayor.

Galveston, Tex.—Reported plans being prepared for improvements and additions to be erected at the John Sealy Hospital; cost $80,000.

Tahoka, Tex.—Citizens voted in favor of erecting a combined court house and jail. A fireproof building costing $60,000 contemplated. Address Co. Comrs.

Mount Vernon, Wash.—Citizens Aug. 11 voted $60,000 bonds for high school.

Portland, Ore.—Plans for first unit of the 3-story Trades School E. Twelfth and Irving Streets to be prepared by F. A. Naramore, School Archt.; cost $100,000. Address School Bd.

Salem, Ore.—All bids opened July 21 by Cato Sells, Comr. Indian Affairs, Washington, D. C. for addition to brick assembly hall at Salem School rejected; new bids will be received.

Burbank, Cal.—Bonds for $25,000 will be sold Aug. 23 to be used for erection of a school. Lela E. Doan, Clk. School Trus.

San Francisco, Cal.—Plans being prepared by Lewis P. Hobart, Crocker Bldg., for 7-story hospital for the University of California; cost reported to be $550,000.

F. J. Churchill, Secy. Bd. Pub. Wks., writes preliminary sketches being prepared by John Ried, Jr., First National Bank Building, San Francisco, for erecting northeast wing of San Francisco Hospital, Class A construction; cost $300,000.

BIDS DESIRED.

Albany, N. Y.—Until Sept. 8 by Trustees Public Buildings, Capitol, Albany, for alterations to first and second stories of Agricultural Hall; also addition to State House, for the Court of Appeals, plumbing and drainage, both proposals advertised in Engineering Record. Lewis F. Pilcher, State Archt.

Arverne, N. Y.—Until Sept. 15 by Treas. Dept., U. S. Coast Guard, Washington, for moving the Rockaway Coast Guard Station, Arverne, advertised in Engineering Record.

Thiells, N. Y.—Until Sept. 7 by Frank A. Vanderlip, Pres. Bd. Mgrs., Letchworth Village, Room 215, 55 Wall Street, New York, for erecting laundry, service building, etc., at Letchworth Village, Thiells, advertised in Engineering Record. Lewis F. Pilcher, State Archt., Albany.

White Plains, N. Y.—Official reports state bids desired until Aug. 31 by Bldg. Comn., Westchester Co. (Robert S. Brewster, Chmn.), for erecting an addition to the County Courthouse. Separate bids desired for ventilating, heating and plumbing.

Elizabeth, N. J.—Reported desired until Aug. 20 by City Council for remodeling and addition to Home for Aged. Separate bids desired on plumbing, heating, electric elevator and refrigerator work. Oakley & Sons, Archts., 280 Broad Street.

Englewood, N. J.—Reported desired until Sept. 8 by Bd. Educ. for erecting a 3-story and basement high school. Ernest Sibley and J. J. Ferry, Archts., Englewood.

Morris Plains, N. J.—Until Aug. 25 by Bd. of Managers, New Jersey State Hospital, Morris Plains (P. J. Ryan, Pres.) for erecting an extension to the Industrial Building.

Harrisburg, Pa.—Until Sept. 28 by James A. Wetmore, Acting Superv. Archt., Washington, D. C., for extension and remodeling (including mechanical equipment and approaches) of U. S. Post Office and Court House, advertised in Engineering Record.

Washington, Pa.—Press reports state bids will be received until Sept. 6 at Adjutant General's Office, Harrisburg, for erecting armory for Company H. Amount available $30,000.

Hyde Park (P. O. Cincinnati), Ohio.—Reported desired until Sept. 15 by School Trus. for erecting five academic buildings, the bridge and tower for high school, according to plans by Garber & Woodward, Union Central Building, Cincinnati.

Cincinnati, Ohio.—Until about Sept. 11 by Clk. Bd. Educ. for furnishing material and erecting manual training building at Oyler School, Storrs and Burns Sts. C. W. Handman, Business Mgr.

Columbus, Ohio.—Until Sept. 7 by Bd. Educ. (E. B. MacFadden, Clk.) for furnishing material and erecting the foundation of the new East High School on East Broad School site. D. Riebel, Archt., New Natl. Bank Bldg.

Conneaut, Ohio.—Until Aug. 26 by Bd. Educ. (Warren Miner, Clk.) for furnishing material and erecting an eight-room fireproof grade school in Sub-Dist. No. 5, Conneaut Township.

Marion, Ohio.—Reported desired until Aug. 27 by Bd. Educ., Pleasant Township Rural School Dist. (G. E. Waddell. Clk.), for erecting a fireproof school. Marriott, Allen & Hall, Archts., 20 E. Broad Street, Columbus.

Woodsfield, Ohio.—Until Sept. 9 by Bd. Educ. (F. W. Pollock, Clk.) for erecting a fireproof high school; also as a whole or separately heating, plumbing, ventilating, etc. Howard & Merriam, Archts., 8 E. Broad Street, Columbus.

Lebanon, Ind.—Later official reports state that bids will be received by County Auditor until Sept. 10 for erecting the proposed F. J. Witham Memorial Hospital. It will be of brick and stone, and cost $25,000. Architects, D. A. Bohlen & Sons, Majestic Bldg., Indianapolis.

Lebanon, Ind.—Reported desired until Sept. 10 by Bd. Trustees, Witham Memorial Hospital (J. A. Coons, Pres.), Lebanon, for erecting a 3-story brick and stone hospital.

Monmouth, Ill.—About Sept. 15 by Clerk Bd. of Educ. for erecting 3-story brick and concrete city hall 50 x 70 ft., to cost $45,000. Architects, Temple & Burrows, Davenport, Iowa.

Naperville, Ill.—Until Aug. 25 by Bd. Educ. (John B. Cline, Secy.) for erecting high school. J. C. Llewellyn, Archt., First National Bank Building, 38 S. Dearborn Street, Chicago, Ill.

Eau Claire, Wis.—Reported desired until Sept. 1 at office of J. Fennessey, City Clk., for erecting City Hall. George Awsumb, Archt., 14 E. Jackson Boulevard, Chicago, Ill.

Belmond, Iowa.—Reported desired until Aug. 26 by W. C. Ramsay, Mayor, for erecting a City Hall. T. Thorwals Thorson, Archt., Forest City.

Grand River, Iowa.—Reported desired until Aug. 27 by T. T. Beck, Secy. Bd. Educ., for erecting high school. John Q. Bradley, Archt., Excelsior Springs, Mo.

Tipton, Iowa.—Reported desired until Sept. 2 by T. C. Moffett, Co. Aud., for erecting a County House. Probable cost, $50,000. Charles A. Dieman & Co., Archts., Cedar Rapids.

Waterloo, Ia.—Reported desired until Sept. 6 by Independent School Dist. of Orange Township (W. O. Tannreuther, Secy., R. F. D., Waterloo) for erecting 2-story and basement school. Probable cost, $50,000. J. G. Ralston, Archt., Syndicate Building.

Austin, Minn.—Until Sept. 1 by Independent School Dist. No. 27 (C. I. Johnson, Clk.), for erecting 1-story 8-room ward school. Kinney & Macomber, Archts., Minneapolis.

Buffalo, Minn.—Until Sept. 2 by C. S. Hawker, Clk., Independent School Dist. No. 23 for remodeling high school. Kirby T. Snyder, Archt., 643 Plymouth Bldg., Minneapolis.

Crosby, Minn.—Until Aug. 27 by School Bd. Independent School Dist. No. 51 (J. E. McCoy, Clk., Ironton, Minn.), for erecting high school. E. F. Broomhall, Archt., 710 Alworth Bldg., Duluth.

Minneapolis, Minn.—Reported desired until Sept. 1, A. R. Van Dyck, Archt., McKnight Bldg., for erecting three-story, 42½ x 120-ft. brick superstructure, concrete foundation, Maternity Hospital, at 2201 Western Avenue. Probable cost, $50,000.

Rochester, Minn.—Until Aug. 26 by A. F. Wright, City Clk., for erecting power plant building. Charles L. Pillsbury Co., Engrs., 805 Metropolitan Life Bldg., Minneapolis.

St. Cloud, Minn.—Until Aug. 24 by State Bd. Control, St. Paul, for dining hall addition State Reformatory, St. Cloud, including steel and c. i. work, reinforcing steel sash and operators, slating and sheet metal work, etc. C. H. Johnston, Archt., 715 Capital Bank Bldg., St. Paul, Minn.

St. Croix Falls, Minn.—Until Aug. 31 by J. C. Heglund, Village Clk., for erecting auditorium. Hartford & Hausler, Archts., 1611 Pioneer Bldg., St. Paul.

St. Paul, Minn.—Until Aug. 31 by State Bd. Control, Capitol Bldg., St. Paul, for erecting an addition to the Home Economics building at University Farm School, here, including ventilating, heating, plumbing and electrical work.

Sisseton, S. D.—Until Aug. 31 (extension of date) by R. F. Sonstegard, Secy. Library Bd., for erecting Carnegie Library at Sisseton, S. D., not Sisseton, Minn., as previously stated. George Issenhuth, Archt., Huron, S. D.

Cheyenne, Wyo.—Reported desired until Sept. 6 by H. B. Gates, State Treas., for additions and alterations to State House. Probable cost, $150,000. William DuBois, Archt., 1614 Capitol Avenue.

St. Louis, Mo.—Until Sept. 1 by James A. Wetmore, Acting Superv. Archt., Washington, D. C., for new terazzo floors in certain lobbies and corridors of the U. S. Custom House at St. Louis.

Until Aug. 27 by Bd. Pub. Service (William T. Findly, Secy.) for erecting a nurses' dormitory on the grounds of the Robert Koch Hospital; also steel windows for Ward buildings Nos. 1 and 2, Isolation

San Angelo, Tex.—Reported desired until Aug. 25 by Bd. Educ., for erecting 3-story brick high school. Ross & Casson, Archts., Waco.

Copan, Okla.—Reported desired until Aug. 28 by A. B. Sparks, Secy. Bd. Educ., for erecting 2-story and basement, 50 x 76 ft. high school. Probable cost, $25,000. C. A. Henderson, Archt., Coffeyville, Kan.

Perry, Okla.—Until Sept. 13 by W. T. Faris, Co. Clk., for erecting 4-story stone court house, 76 x 98 ft., to cost about $100,000. Architect, J. W. Hawk of Oklahoma City.

Grand Mound, Wash.—It is reported that bids will be received until Aug. 31 by E. S. Emigh, Secy., State Bd. Control, for erecting 2-story concrete or brick school. Appropriation available $60,000 for structure and equipment.

Esperanza, Cal.—Until Aug. 30 by School Dist. Trus. addressed to F. W. Rich, Clk., Lancaster, for erecting a building.

Los Angeles, Cal.—Until Aug. 26 (readvertisement) by Bd. Educ. (William Sheldon, Secy.), for erecting school on Fifth Street, San Pedro. Separate bids for school on Annandale site and school on Thirtieth Street.

PRICES AND LETTINGS.

★Indicates award of contract.

★**Bangor, Me.**—Contract awarded by State Hospital Trus. to Otto Nelson Co., Bangor, for erecting congregate dining room in Building "A" at Bangor State Hospital, at $33,125.

★**Laconia, N. H.**—Contract awarded W. M. Bisson, Laconia, for erecting nurses' home at Laconia Hospital.

★**Amherst, Mass.**—Contract for erecting high school awarded Caspar Ranger Constr. Co., Holyoke, at $73,816.

Providence, R. I.—Lowest bid opened Aug. 4 by Bd. Contract & Supply for erecting Beaufort Street School was submitted by Charles B. Maguire Co., Providence, at $33,279; Gordon E. Hassam, lowest for heating at $14,300.

★**Binghamton, N. Y.** — Contract for erecting New Street and Helen Street schools reported awarded Parsons Constr. Co., Binghamton, at $147,775.

★**Buffalo, N. Y.**—Contract for masonry work on eight-room brick addition to School 54 at Main Street and Leroy Avenue awarded O'Malley Bros., Buffalo, at $42,590.

★**Lockport, N. Y.**—Contract for mason and carpenter work on enlarging county clerk's office awarded Manion Bros. Co., Rochester, at $23,163.

★**New Dorp, S. I., N. Y.**—Contract awarded John J. Hearn Constr. Co., 68 West Forty-sixth Street, New York, for erecting Cottage No. 2 at City Farm Colony, Staten Island, at about $35,000. Sub-bids are desired by the company. C. B. Mayers, Archt., 1 Union Square, New York.

★**Scarsdale, N. Y.**—Contract for erecting high school reported awarded George Kelly, Yonkers, at $52,400.

Utica, N. Y.—Thomas F. Byrnes, Utica, submitted lowest bid on mason and carpenter work on the Kernan School at $91,980.

★**Watertown, N. Y.**—Contract for erect- Arsenal Street School awarded Charlebois Bros., Watertown, at $53,875.

★**Allentown, Pa.**—Following are four lowest bids opened by School Bd. for erecting Mosser School: Ochs Constr. Co., $75,000 (awarded contract); Jacob Nagle, $79,850; Butz & Clader, $86,361, and G. H. Hardner, $86,562, all of Allentown.

★**Harrisburg, Pa.**—Contract for erecting building at State Arsenal awarded Beard Constr. Co., Lancaster. Appropriation $40,000.

★**Parkersburg, W. Va.**—Contract awarded Roche-Bruner Bldg. Co., Cincinnati, for erecting 3-story, fireproof high school. Frank L. Packard, Archt., New Hayden Building, Columbus, Ohio.

Wellsburg, W. Va.—Following are four lowest bids opened Aug. 11 by Superv. Archt., Washington, D. C., for constructing U. S. Post Office: Colonial Constr. & Supply Co., Charlottesville, Va., $41,500; Barnes Bros., Logansport, Ind., $42,400; Thomas W. Cissell, Wooster, Ohio, $42,500; James Devault, Canton, Ohio, $42,600.

★**Rock Hill, S. C.**—Contract for erecting gymnasium at Winthrop College awarded Willard Boggs Co., Spartanburg, and heating and plumbing, L. F. Waldrop, Rock Hill; cost $60,000.

★**Quitman, Ga.**—Contract for erecting U. S. Post Office awarded Westchester Engineering Co., White Plains, N. Y., at $38,891.

★**St. Augustine, Fla.**—Contracts awarded Aug. 9 by State Bd. Control, Jacksonville (P. K. Yonge, Chmn.), for erecting buildings for State School Deaf and Blind, St. Augustine, as follows: General construction, E. J. Masters, St. Augustine, $26,949; heating, D. L. Rathbone, Jacksonville, $1,400. Edwards & Sayward, Archts., Candler Bldg., Atlanta, Ga.

★**Henderson, Ky.**—Contract for erecting city hospital awarded Ernest Ringo Constr. Co., Evansville, at $24,500.

★**Stevens Point, Wis.**—Contract for erecting woman's dormitory at Normal School awarded J. F. Weinberg, Grand Rapids, Wis. Building will cost about $76,000.

★**Davenport, Iowa.**—Contracts awarded by Bd. Educ. (J. D. McCollister, Secy.) for erecting Manual Training School at Eleventh and Main Streets (bids opened Aug. 12) as follows: General construction, Henry Tappendorf, Rock Island, Ill.; plumbing, Ryan Plumbing & Htg. Co., Davenport; heating, C. L. Moore, Davenport; wiring, Electric Constr. & Machy. Co., Rock Island, Ill. Clausen & Kruse, Archts., Davenport.

★**Fontanelle, Iowa.**—Contract for erecting the school awarded Young & Woodward, Creston, at $28,800.

★**Hastings, Minn.**—Contract awarded by State Bd. Control, St. Paul, to W. L. Kingsley, Faribault, for furnishing material and erecting new east wing, main building, Hastings State Asylum, Hastings, including plumbing and electrical work. C. H. Johnston, Archt., Capital Bank Bldg., St. Paul.

★**Kearney, Neb**—Contract for erecting building at State Normal School awarded W. F. Crossley, Kearney, at $57,867.

★**Webb City, Mo.**—Contract for erecting U. S. Post Office awarded George A. Shaul & Sons, Seneca, Kan., at $51,542.

★**Miles City, Mont.**—Contract awarded by School Bd. to Edw. Leesle Co., Billings, at $47,242, for erecting 3-story, 63 x 123-ft. school (bids opened Aug. 12). Next 3 lowest bids: Clearinan & Co., Miles City, $47,450; Horton & Willets, Great Falls, $49,480; N. P. Nelson, Miles City, $51,300. B. Rivenes, Archt., Miles City.

★**Edmonds, Okla.** — Contract awarded Aug. 12 by State Bd. Pub. Affairs for erecting Central Normal School, library and class room to Kreipke & Schafer Constr. Co., El Reno, at $46,500. Other bids: S. O. Campbell Co., Okla. City, $47,600; Holmboe Co., $49,700; Swatek & Parket, Okla. City, $54,990; Reinhart & Donovan, Okla. City, $56,800.

★**Davenport, Wash.**—Contract for erecting high school awarded James Sheridan, Spokane, Wash., at about $40,000; plumbing to Arnold, Evans Co., Spokane, Wash., at $5,700.

★**San Francisco, Cal.**—Contract for erecting second story to Municipal Ry. carhouse at Geary Street and Presidio Avenue awarded by Bd. Wks to James L. McLaughlin, 244 Kearney Street, at $26,747.

PRIVATE BUILDINGS

PROPOSED WORK

Boston, Mass.—Reported Fidelity Trust Co. will erect 11-story bank and office building on State Street; cost $400,000.

Albany, N. Y.—Plans prepared by R. D. MacPherson, 121 N. Pearl Street, for parochial school and convent, 187 x 132 ft., 3 stories and basement, brick and stone, for St. Vincent de Paul's R. C. Church. Rev. William R. Charles, Pastor, Madison Avenue and Patridge Street.

Brooklyn, N. Y.—Plans filed for 7-story brick storage building, concrete roof, at Bridge and Plymouth Streets, for Kirkman & Son, Bridge and Water Streets; cost $100,000. S. A. Moore, Archt., 315 New York Avenue.

Long Island City, L. I., N. Y.—Plans filed for 6-story brick office and loft building to be erected at Hunters Point and Van Alst Avenues for Degnon Constr. Co., cost $230,000. Albert Thompson, Archt., 1133 Bway., New York.

New York, N. Y.—Plans filed for following buildings: 12-story fireproof apartment house at 63 E. Eighty-fourth Street for Fenlo Realty Co., cost $450,000, Emery Roth, Archt., 119 W. Fortieth Street; 13-story fireproof apartment house at Park Avenue and Eighty-first Street for Nine-Thirty Park Avenue Co., cost $375,000, Schwartz & Gross, Archts., 347 Fifth Avenue; 5-story brick tenement at Review Place and 238th Street for 238th Street Constr. Corporation, cost $50,000, Moore & Landsiedel, Archts., Third Avenue and 148th Street.

New York, N. Y.—Plans filed for 17-story brick, limestone and terra cotta apartment house to be erected at Park Avenue and Fifty-fifth Street for 420 Park Avenue Company. Warren & Wetmore, Archts., 16 East Forty-seventh Street. Cost, $800,000.

Coraopolis, Pa. — Plans prepared for Presbyterian Church; cost $75,000.

Pittsburgh. Pa.—Wolverine Supply & Mfg. Co. will erect at Western Avenue and Fontella Street a 3-story fireproof brick building.

Fairmont, W. Va.—Plans prepared by L. J. Dean, Foster Bldg., for 4-story brick apartment house to be erected on Sixth Avenue; cost $40,000.

Huntington, W. Va.—Plans prepared by V. T. Ritter, Huntington, for two additional stories to Valentine Bldg.; cost $35,000.

Louisville, Ky.—Reported plans being being prepared for five-story office and store building to be erected on Fourth and Market Streets by Bankers Realty Co., at a cost of $75,000. George G. Summers, Secy. Inter Southern Insurance Co., reported interested.

Louisville, Ky.—Bankers Realty Co. (George G. Summers, Secy.), is reported planning erection of building, probably five stories high at Fifth and Market Streets; cost, $125,000.

Cleveland, Ohio.—Contract soon to be let for erecting three-story brick and stone fireproof building St. Stephen Hall, for St. Stephen R. C. Church; cost $65,000. E. J. Schneider, Cuyahoga Building, Archt. Rev. J. P. Farrelly, Pastor.

St. Wendelin's Slovak Catholic Church, 2281 Columbus Road S. W., contemplates erecting a group of buildings including church, parish residence, sisters' home and schoolhouse at Columbus Road and Feeman Avenue S. W. costing $175,000. Rev. Augustine Tomasek, Pastor.

Forest City Engineering Co., Hippodrome Bldg., is preparing plans for a warehouse to be erected for Union Paper & Twine Co. at Lakeside Avenue and E. Twenty-second Street.

Cleveland, Ohio. — Reported Superior-Doan Realty Co. intends erecting on site of old car barns of Cleveland Ry. Co. at Superior Avenue and E. 105th Street a commercial building; cost, at least $100,000.

Cleveland, Ohio—George S. Hammond, 4220 Prospect Avenue, is preparing plans for a 13-story addition to Hollenden Hotel on the Vincent Avenue side. Cost, $100,000.

Ironton, Ohio—Weber, Werner & Adkins, Cincinnati, selected to prepare plans for the Masonic Temple, to be 4-story, fireproof.

Columbus, Ind.—Masons soon to have plans prepared for Masonic Temple.

Indianapolis, Ind.—Plans completed by Hampton Court Realty Co. for apartment house to be erected at Sixteenth and Meridian Streets, to cost $175,000.

Chicago, Ill.—Reported Harry W. Rubloff, 10 S. La Salle Street, will erect at W. Sixty-ninth and Green Streets a store, theater, office and hall building; cost, $100,000.

Duluth, Minn.—A Y. M. C. A. building costing $60,000 is to be erected here as a memorial to the late Ward Ames, Sr.

St. Paul, Minn.—Reported contract soon to be let by Mark Fitzpatrick, Archt., 17 W. Ninth Street, for erecting fireproof brick and terra cotta apartment house at 668 Central Park Place for Mrs. Della Filben; cost, $250,000.

Butte, Mont.—Plans being prepared by Wilson & Cutting, Butte, for reinforced concrete theater to be erected at Georgia and Harrison Avenues for the Harrison Avenue Theater Co., in which Nelson & Pederson, local contractors, are interested. Cost $65,000.

Butte, Mont.—Plans prepared by Wilson & Cutting, 325 Electric Bldg., for an 8-story brick and terra cotta apartment house to be erected at West Park and Washington Streets; cost, $200,000.

Galveston, Tex.—Contract soon to be let for erecting 5-story hotel. Steve Sgiticovich, Cotton Exchange Bldg., owner.

Walla Walla, Wash.—Plans to be prepared by George B. Purvis, Northern Bank Building, for a six-story 70 x 120 ft. brick and mill constructed hotel, to be erected by the New Grand Hotel Co., at a cost of $150,000.

BIDS DESIRED.

New Haven, Conn.—Reported desired until Sept. 1 by R. W. Foote, Archt., Chamber of Commerce, for erecting 3-story, 60 x 75 ft., brick and steel garage for Cowles Tolman.

Farrell, Pa.—Until Aug. 23 by Slovak Workingmen's Educational Club (J. M. Matuscak, Secy.) for erecting club house at Spearman Avenue and Federal Street.

Minneapolis, Minn.—Until Aug. 23 by Ruddell Grader Mfg. Co., 2229 University Avenue, for erecting a 2-story and basement office building.

PRICES AND LETTINGS.

★Indicates award of contract.

★**Buffalo, N. Y.**—Contracts for erecting 135 x 47 ft., 3-story and basement, infants' home and mortuary building at S. Park and Ridge Avenues for Our Lady of Victory, R. C. Church, awarded as follows: Structural steel, Progressive Steel Co., Builders Exchange, Buffalo; masonry, E. S. Jordan, Lackawanna City; cut stone, Henry Ellis, Medina. Probable total costs $155,000. A. A. Post, Archt., Brisbane Building.

★**Mt. Vernon, N. Y.**—Contract for erecting station for Harlem Road at West Mt. Vernon awarded Phoenix Constr. Co., 41 Park Row, New York. Approximate cost $150,000.

★**New York, N. Y.**—Contract for erecting 16-story bank and office building at Fifth Avenue and Forty-third Street for the Five Hundred and Eleven Fifth Avenue Corporation awarded Columbus Circle Constr. Co., 15 Columbus Circle. York & Sawyer, Archts., 50 E. Forty-first Street.

★Contract for erecting 12-story apartment house at Park Avenue and Fifty-first Street awarded A. L. Mordecai & Son, Inc., 30 E. Forty-second Street. Warren & Wetmore, Archts., 16 E. Forty-seventh Street.

★**Rochester, N. Y.**—Contract for erecting 2-story brick store and loft building for Dr. Sumner Hayward, at East End Avenue and Scio Street, awarded E. L. Albright, Insurance Bldg.; cost $50,000.

★**Troy, N. Y.** — Contract awarded Charles Crowley & Co., Troy, for erecting brick, steel, granite and marble office building, 53 x 83 ft., for Troy Gas Co. Cost $100,000.

★**Donora, Pa.**—Contract for erecting church and manse for First Presbyterian Church awarded W. F. Blair & Son, Waynesburg, at $24,200.

★**Johnstown, Pa.**—Contract for improvements to St. John's Parochial School awarded George Kepple, Johnstown, at $40,000.

★**Petersburg, Va.**—Contract for erecting 3-story apartment house awarded E. D. Hobbs, Law Bldg. Cost about $100,000.

★**Meridian, Miss.**—Contract for erecting East End M. E. Church awarded F. Hopkins, Meridian. Cost $25,000.

★**Detroit, Mich.**—Contract for erecting Regent Theatre awarded by Paul J. Schloss Amusement Co. of Muskegon to Frank Farrington Co., Detroit, at $55,000. Paul Crane, Detroit, Archt.

★**St. Joseph, Mich.**—Contract for erecting receiving home and headquarters for Michigan Children's Home Society awarded Max W. Stock of St. Joseph. Approximate cost $25,000.

★**Sioux City, Iowa.**—Contract awarded for erecting 1-story and basement edifice for First M. E. Church to Dubel & Anderson, Sioux City, at $65,000. Beuttler & Arnold, Archts., Security Building. Rev. J. Smith, Chmn. Bldg. Com.

Seattle, Wash. — Following are four lowest bids received for erecting a 3-story apartment house and 4-story hotel at Fourth Avenue and Marion Street, for Dr. Lincoln Smith: (a) stone, (b) terra cotta: Finne & Gjarde, Northern Bank Bldg., (a) $68,347, (b) $67,559; MacRae Bros., American Bank Bldg., (a) $69,000, (b) $67,182; Pearson Constr. Co., Seattle, (a) $72,630, (b) $71,887; Martin & Dugan, Northern Bank Bldg., (a) $72,100, (b) $71,300.

★Rendrickson & Co., Globe Block, has contract at $31,044 for 4-story terra cotta hotel, and MacRae Bros., Empire Building, at $32,215. contract for 3-story terra cotta apartment house to be erected at Fourth Avenue and Marion Street for Lincoln Smith of New York, according to plans by W. R. B. Wilcox and Julian Everett, Assoc. Archts., Boston Block.

NEW INDUSTRIAL PLANTS

PROPOSED WORK

Fulton, N. Y.—Plans completed by Hunter Arms Co. for two factory buildings. Estimated cost $30,000.

Lestershire, N. Y.—Endicott, Johnson & Co., Lestershire, will erect a shoe factory here.

New York, N. Y.—Plans filed for 7-story fireproof cold storage and freezing plant to be erected at 88 Gansevoort Street, for Manhattan Refrigerating Co.; cost, $80,000. John C. Clover, Archt., 222 Navy Street, Brooklyn.

Pearl River, N. Y.—Plans being prepared by William E. Austin, 46 West Twenty-fourth Street, New York, and contract will soon be awarded for erecting 3-story addition to antitoxin laboratory of the Lederle Laboratories Co. at Pearl River. Estimated cost $30,000.

Rochester, N. Y.—Two-story and basement addition 54 x 92 ft. for barrel and tank building is to be erected plant of Vacuum Oil Co.; cost $45,000, to be erected by day labor.

Franklin, Pa.—Reported rebuilding of plant of French Creek Foundry Co. recently destroyed by fire, is under consideration.

St. Paul, Minn.—Reported Equity Cooperative Exchange, 209 Pioneer Bldg., intends erecting terminal elevator of 500,000 bu. capacity. Cost about $150,000. J. M. Anderson, Pres., 2170 Marshall Avenue.

PRICES AND LETTINGS.

★Indicates award of contract.

★**Chicopee, Mass.**—An additional contract for another building at the plant of the Fisk Rubber Co. awarded Fred. T. Ley Co., Springfield. Cost $300,000.

★**Bristol, Conn.** — Contract awarded Levering & Garrigues, New York, for erecting brick, steel and concrete building in rear of present plant of New Departure Co. on N. Main Street.

★**Auburn, N. Y.**—Contract to erect 150 x 50 ft. addition to dye house on North Division Street for Nye & Wait Carpet Mfg. Co. awarded E. K. Fenno, Rosenbloom Bldg.

★**St. Johnsville, N. Y.**—Stephen Hines, Herkimer, has received contract for erecting two additional stories to 3-story mill building under construction.

★**Rome, N. Y.**—General contract awarded Parry & Jones, Rome, by Rome Brass & Copper Co. for erecting an addition to casting shop, 140 x 200 ft., 1 story, brick and steel, and for structural steel, to the American Bridge Co., Buffalo.

★**Union, N. Y.** — Contract awarded Mitchell Co., 74 State Street, Binghamton, for erecting 1-story, 115 x 136-ft. brick and steel manufacturing building for Union Forging Co.; structural steel awarded Williams Bridge Co., Syracuse.

★**Utica, N. Y.**—Contract awarded by Oneita Knitting Mills as follows for erecting 1-story addition to 3-story building; cost $25,000; masonry, George W. Shippy, 218 Court Street; carpentry, Henry Kassing, Utica. C. R. Makepeace, Archt., Butler Exchange Bldg., Providence.

★Hackensack, N. J.—Contract awarded Stewart Constr. Co., New York, for erecting plant here for American & British Mfg. Co.; R. D. Wood & Co., Philadelphia, Pa., contract for hydraulic presses and lathes, tools and other equipment. Miles-Bement-Pond Tool Co., Plainfield, N. J.; machinery, Westinghouse, Church, Kerr & Co., New York.

★New Brunswick, N. J.—General contract awarded to John W. Cowper Co., Fidelity Bldg., Buffalo, for 2-story and basement addition, 70 x 100 ft., brick and steel, to plant of Simplex Automobile Co.; steel work to Fergusen Steel & Iron Co., Buffalo.

★Memphis, Tenn.—Contract for erecting five-story flour and corn meal mill on Virginia Avenue and Illinois Central R.R. awarded Knuffler, Hedges & Co., Exchange Building, by John Wade & Sons.

★Canton, Ohio.—Contract for steel work, including stoves for blast furnaces, for United Furnace Co., awarded Variety Iron & Steel Wks. Co., Cleveland.

★Fostoria, Ohio.—Contract for erecting 3-story packing house awarded J. J. Meyer, Lorain, at $31,975.

★Youngstown, Ohio.—Contract awarded Stone & Webster Eng. Co., Boston, Mass., for erecting office building and laboratory for Youngstown Sheet & Tube Co. Cost $300,000

★Youngstown, Ohio. — Contract for erecting laboratory and office building for Youngstown Sheet & Tube Co. awarded Stone & Webster Co., Boston, Mass. Cost, complete, $375,000. Burnham & Co., Chicago, Ill., Archts.

MISCELLANEOUS

PROPOSED WORK

Park Improvement—Zanesville, Ohio.—Citizens voted $26,500 bonds for park improvements.

BIDS DESIRED.

Conduit—Boston, Mass.—Until Aug. 26 by Edward F. Murphy, Comr. Pub. Wks., Boston, for Stony Brook Conduit, Section No. 9, West Roxbury.

Painting Dams—Albany, N. Y.—Until Aug. 31 by W. W. Wotherspoon, Supt. Pub. Wks., Albany, for painting superstructures of movable dams over Mohawk River at Rotterdam, Cranesville, Amsterdam, Tribes Hill, Yost, Cananjoharie and Fort Plain.

Conduit Work—Wards Island, N. Y.—Until Aug. 25 by State Hospital Comn., Capitol, Albany, for conduit work connecting the new 150 patient acute hospital with kitchen building at the Manhattan State Hospital, Wards Island. Lewis F. Pilcher, State Archt., Capitol, Albany.

Elevators—Camden, N. J.—Until Sept. 14 by James A. Wetmore, Acting Superv. Archt., Washington, D. C., for the installation, complete, of an electric elevator in the U. S. Post Office and Custom House, Camden.

Cell Fronts—Atlanta, Ga.—Until Sept. 10 by F. H. Duehay, Supt. Prisons, Washington, D. C., for furnishing and delivering at the U. S. Penitentiary, Atlanta, steel cell fronts and mechanical locking devices for entire cell blocks in main cell wing of said building.

Culverts — Tazewell, Tenn. — Reported desired until Aug. 24 by County Road Comrs. for constructing culverts to be used in constructing various roads, aggregating about 100 miles.

Concrete Steps—Cincinnati, Ohio.—Until Aug. 26, by Philip Pendick, Dir. Pub. Service, for constructing concrete steps and cement walks on Rush Street, from McKenny Avenue to Miami and Erie Canal.

Metal Louvers, Steel Transverse Anchors, Etc.—Panama.—Until Aug. 31 by Major F. C. Boggs, Corps Engrs., U. S. A., Purchasing Officer, Panama Canal, Washington, D. C., for Cir. 960—Metal louvers, wooden cargo-handling booms, with fittings, sheet zinc, etc.; also until Sept. 2 for Cir. 961—Steel transverse anchors for Pier No. 18.

Equipment for Drydock—Panama.—Until Sept. 12, by Maj. F. C. Boggs, Corps Engrs. U. S. A. General Purchasing Officer Panama Canal, Washington, D. C., for motor driven capstan, switchboard, cables and miscellaneous equipment for drydock No. 1, Balboa Terminals.

PRICES AND LETTINGS.

★Indicates award of contract.

★Coal Hoisting Machinery—New York, N. Y.—Contract for coal handling machinery and appurtenances, omitting head house part of coal handling plant for O. H. Perry & Son, Inc., foot of East Nineteenth Street, has been awarded to the Guarantee Constr. Co., New York. Charles H. Higgins, Engr., 39 Church Street.

★Park Work—Austin, Minn.—Contract reported awarded for removal of 71,946 cu. yd. of earth in Horace Austin State Park, Austin, to Great Northern Bridge Co., Minneapolis, at 19.95 cts. per cu. yd. Cost about $15,000.

Proposals

For Proposals Advertised, see Pages 44, 45, 46 and 47.

WATERWORKS.

Bids Close.		See Eng. Record.
Aug. 24.	Reservoir, Luverne, Minn. Adv. Aug. 14, 21.	Aug. 14
Aug. 24.	Dam, Etc., Charlton, Iowa	Aug. 14
Aug. 24.	Water Wks., Milligan, Neb.	Aug. 14
Aug. 24.	Waterworks, Sparta, Ill.. Adv. Aug. 14.	Aug. 14
Aug. 24.	Water Wks., Centerville, Iowa	Aug. 21
Aug. 25.	Hydrants, reservoir, piping system, etc., Wellsville, N. Y. Adv. July 31.	July 31
Aug. 25.	Water Works, Maumee, Ohio.	Aug. 21
Aug. 26.	Mech. Equip. of Pump. Engine, Galveston, Tex.	Aug. 7
Aug. 26.	Water Wks., Wittenberg, Wis.	Aug. 21
Aug. 26.	Valves, East Orange, N. J.	Aug. 21
Aug. 26.	Add. to System in Bldg., Cedar Grove, N. Y.	Aug. 21
Aug. 26.	Gate house, Newark, N. J.	Aug. 21
Aug. 23.	Mains, Silverton, Ohio..	Aug. 21
Aug. 29.	Water Wks., Brewster, Ohio	Aug. 14
Aug. 30.	Gates, Hoists, Etc., Jefferson, Wis.	Aug. 21
Aug. 31.	Contract 154, New York, N. Y. Adv. Aug. 14.	Aug. 14
Sep. 1.	Water Works, Farmersville, Ohio Adv. Aug. 21.	Aug. 21
Sep. 2.	System, Arcadia, Cal.	Aug. 21
Sep. 6.	Pump. Unit, Regina, Sask.	Aug. 7
Sep. 6.	Improv., Virginia, Minn..	Aug. 21
Sep. 6.	Water Works Improv., Humboldt, Iowa	Aug. 21
Sep. 7.	Mains, Cleveland Heights, Ohio	Aug. 14
Sep. 7.	C.-I. Pipe, Vallejo, Cal...	Aug. 14
Sep. 7.	Well pump and service pumps, Monticello, Ill...	Aug. 14
Sep. 7.	Pipe, Washington, D. C..	Aug. 21
Sep. 8.	Pump, Humboldt, Iowa..	Aug. 21
Sep. 14.	Pipe, Washington, D. C..	Aug. 21

SEWERAGE AND SEWAGE DISPOSAL.

Aug. 23.	Dallas, Tex. Adv. July 24.	July 24
Aug. 24.	Woonsocket, R. I. Adv. Aug. 14.	Aug. 14
Aug. 24.	Westchester, Pa.	Aug. 14
Aug. 24.	Chippewa Falls, Wis.	Aug. 21
Aug. 24.	Salt Lake City, Utah.	Aug. 21
Aug. 24.	Boston, Mass.	Aug. 21
Aug. 25.	Thorold, Ont.	Aug. 14
Aug. 25.	Lebanon, Pa. Adv. July 24 to Aug. 14.	July 24
Aug. 25.	Brockport, N. Y. Adv. Aug. 14, 21.	Aug. 14
Aug. 25.	Brooklyn, N. Y.	Aug. 21
Aug. 26.	Chicago, Ill. Adv. Aug. 21.	Aug. 21
Aug. 26.	Cleveland, Ohio	Aug. 21
Aug. 26.	Boston, Mass.	Aug. 21
Aug. 27.	Buffalo, N. Y.	Aug. 21
Aug. 30.	Sellersville, Pa. Adv. Aug. 14, 21.	Aug. 14
Aug. 31.	Newark, N. J. Adv. July 17 to Aug. 7.	July 10
Aug. 31.	Yorktown Heights, N. Y. Adv. Aug. 14, 21.	Aug. 14
Aug. 31.	Rochester, N. H. Adv. Aug. 14, 21.	Aug. 14
Sep. 1.	Sand Springs, Okla.	July 31
Sep. 1.	Maquoketa, Iowa Adv. Aug. 21.	Aug. 21
Sep. 7.	Albany, N. Y. Adv. Aug. 7 to 21.	Aug. 7
Sep. 7.	Cleveland Heights, Ohio.	Aug. 14
Sep. 7.	Pullman, Wash.	Aug. 21
Sep. 7.	South Orange, N. J.	Aug. 21
Sep. 14.	Ocala, Fla.	Aug. 14
Sep. 14.	Clinton, Iowa	Aug. 21

BRIDGES.

Aug. 23.	Maynardsville, Tenn. Adv. July 24, 31.	July 24
Aug. 23.	West Chester, Pa. Adv. Aug. 14.	Aug. 14
Aug. 24.	Guthrie Center, Iowa.	Aug. 14
Aug. 24.	Cincinnati, Ohio	Aug. 21
Aug. 24.	New Castle, Ky.	Aug. 21
Aug. 25.	Ventura, Cal.	Aug. 14
Aug. 25.	Illinois	Aug. 21
Aug. 25.	Ventura, Cal.	Aug. 21
Aug. 26.	Tulsa, Okla. Adv. July 31 to Aug. 14.	July 31
Aug. 26.	Terrell, Tex.	Aug. 14
Aug. 26.	Ottawa, Ont.	Aug. 14
Aug. 26.	Grants Pass, Ore.	Aug. 21
Aug. 26.	Trenton, N. J.	Aug. 21
Aug. 28.	Silver City, N. M.	Aug. 21
Aug. 28.	Wilson, N. C.	Aug. 21
Aug. 30.	Green Bay, Wis.	Aug. 14
Aug. 30.	Delaware, Ohio	Aug. 21
Aug. 30.	Ravenna, Ohio	Aug. 21
Aug. 31.	Hartford, Conn. Adv. Aug. 21.	Aug. 21
Sep. 1.	Detroit, Mich.	Aug. 14
Sep. 1.	Plans, Woonsocket, R. I. Adv. Aug. 21.	Aug. 21
Sep. 2.	St. Paul, Neb.	Aug. 14
Sep. 3.	Cincinnati, Ohio	Aug. 21
Sep. 4.	Bridgeport, Conn. Adv. Aug. 21.	Aug. 21
Sep. 6.	Columbus, Miss.	Aug. 14
Sep. 7.	Hudson, S. D.	Aug. 14
Sep. 7.	Ellinwood, Kan.	Aug. 21
Sep. 8.	South Amboy, N. J.	Aug. 7
Sep. 10.	Dillion, Mont.	Aug. 21
Sep. 25.	Hankow, China. Adv. Aug. 14.	Aug. 14
Oct. 6.	Lawrence, Kan. Adv. Aug. 14, 21.	Aug. 14

PAVING AND ROADS.

Aug. 24.	Albany, N. Y. Adv. Aug. 7 to 21.	Aug. 7
Aug. 24.	Ottawa, Ont.	Aug. 14
Aug. 24.	Greenville, Tenn. Adv. Aug. 14, 21.	Aug. 14
Aug. 24.	Salt Lake City, Utah.	Aug. 21
Aug. 24.	New Brighton, N. Y.	Aug. 21
Aug. 24.	Massachusetts	Aug. 21
Aug. 24.	Kansas City, Mo.	Aug. 21
Aug. 25.	Irvington, N. J.	Aug. 7
Aug. 25.	Scarsdale, N. Y. Adv. Aug. 7.	Aug. 7
Aug. 25.	Missoula, Mont.	Aug. 21
Aug. 25.	Louisville, Ky.	Aug. 21
Aug. 25.	Chicago, Ill.	Aug. 21
Aug. 25.	Cleveland, Ohio	Aug. 21
Aug. 25.	Illinois	Aug. 21
Aug. 26.	Albany, N. Y. Adv. Aug. 7 to 21.	Aug. 7
Aug. 26.	Elgin, Ill.	Aug. 21
Aug. 26.	Gallon, Ohio Adv. Aug. 21.	Aug. 21
Aug. 26.	Louisville, Ky.	Aug. 21
Aug. 26.	Elizabeth, N. J.	Aug. 21
Aug. 26.	Wheeling, W. Va.	Aug. 21
Aug. 27.	Columbus, Ohio	Aug. 7
Aug. 27.	Cadiz, Ohio	Aug. 14
Aug. 27.	Akron, Ohio	Aug. 14
Aug. 27.	Wheeling, W. Va.	Aug. 21
Aug. 27.	St. Louis, Mo.	Aug. 21
Aug. 28.	Tacoma, Wash.	Aug. 21
Aug. 30.	Denver, Col.	July 24
Aug. 30.	Eaton, Ohio	Aug. 14
Aug. 30.	Washington	Aug. 14
Aug. 30.	Greensburg, Pa.	Aug. 21
Aug. 30.	Aitkin, Minn.	Aug. 21
Aug. 31.	Xenia, Ohio	Aug. 21
Aug. 31.	Bloomsburg, Pa. Adv. Aug. 21.	Aug. 21
Sep. 2.	Salem, Ohio	Aug. 21
Sep. 2.	Jackson City, Mich.	Aug. 21
Sep. 2.	Tazewell, Tenn.	Aug. 21
Sep. 2.	Boscobel, Wis.	Aug. 21
Sep. 3.	Toledo, Ohio	Aug. 14
Sep. 7.	Princess Anne, Md.	Aug. 14
Sep. 7.	Cleveland Heights, Ohio.	Aug. 14
Sep. 7.	Winamac, Ind.	Aug. 14
Sep. 7.	Louisiana	Aug. 21
Sep. 7.	Hackensack, N. J.	Aug. 21
Sep. 7.	Indiana	Aug. 21
Sep. 8.	Louisiana	Aug. 21
Sep. 8.	Washington	Aug. 21
Sep. 8.	Newark, Ohio	Aug. 21
Sep. 8.	Indiana	Aug. 21
Sep. 9.	Tallahassee, Fla.	Aug. 14
Sep. 10.	Worcester, Ohio	Aug. 21
Sep. 11.	Road Roller, Indiana.	Aug. 21

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS.

Aug. 24.	Dredger, Adelaide, Australia	Jun. 19
Aug. 24.	Docks and Dams, Tallahassee, Fla. Adv. Aug. 14, 21.	Aug. 14
Aug. 26.	Trestles, etc., for dam, Pittsburgh, Pa. Adv. July 31 to Aug. 21.	July 31
Aug. 27.	Irrigation, Newell, S. D.. Adv. July 31.	July 31
Aug. 28.	Ditch, Winamac, Ind.	Aug. 14
Aug. 30.	Lock Gates, Etc., Pittsburgh, Pa.	Aug. 7
Aug. 30.	Dam, Toccoa, Ga.	Aug. 14
Aug. 30.	Pier Improv., Philadelphia, Pa.	Aug. 21
Aug. 31.	Dredging, San Francisco, Cal.	Aug. 14
Sep. 1.	Ditch, New Philadelphia, Ohio	Aug. 14
Sep. 1.	Canal Work, Peterborough, Ont.	Aug. 21
Sep. 1.	Levee Work, Mound City, Ill. Adv. Aug. 21.	Aug. 21
Sep. 1.	Drainage Work, New Philadelphia, Ohio.	Aug. 21
Sep. 2.	Ditch, Morris, Minn.	Aug. 21
Sep. 2.	Reclamation Work, Elephant Butte, N. M.	Aug. 21
Sep. 7.	Dredging, Wilmington, Del. Adv. Aug. 21.	Aug. 21
Sep. 7.	Cleaning Channel, Glenwood, Iowa.	Aug. 21
Sep. 8.	Irrigation, Malta, Mont.. Adv. July 31.	July 31
Sep. 8.	Irrigation, Fort Laramie, Wyo.	Aug. 14
Sep. 14.	State Canal Wk., Albany, N. Y. Adv. Aug. 21.	Aug. 14
Sep. 15.	Dredging, Baltimore, Md. Adv. Aug. 14, 21.	Aug. 14
Sep. 16.	Steel Piling for Dam, Louisville, Ky. Adv. Aug. 21.	Aug. 21
Sep. 17.	Drainage, Palmetto, Fla.	July 24
Sep. 18.	Pier, Pearl City, T. H.	July 10
Sep. 20.	Lock Gates, Montgomery, Ala. Adv. Aug. 21.	Aug. 21
Sep. 22.	Piers, Honolulu, Hawaii.. Adv. Aug. 7 to 21.	Aug. 7

PUBLIC BUILDINGS AND SCHOOLS.

Aug. 24.	Grand Junction, Col.	July 24
Aug. 24.	Sykeston, N. D.	Aug. 7
Aug. 24.	Sugar Grove, Ohio.	Aug. 14
Aug. 24.	Marion, Ohio	Aug. 14
Aug. 24.	Pittsburgh, Pa.	Aug. 14
Aug. 24.	Sisseton, Minn.	Aug. 14
Aug. 24.	Belleville, Ill.	Aug. 14
Aug. 24.	St. Cloud, Minn.	Aug. 21
Aug. 25.	Pittsburgh, Pa. Adv. July 31 to Aug. 21.	July 31
Aug. 25.	Forest City, Iowa.	Aug. 14
Aug. 25.	Salamanca, N. Y.	Aug. 14
Aug. 25.	Naperville, Ill.	Aug. 21
Aug. 25.	San Angelo, Tex.	Aug. 21
Aug. 25.	Morris Plains, N. J.	Aug. 21
Aug. 26.	Woodsfield, Ohio	Aug. 7
Aug. 26.	Fort Rosecrans, Cal.	Aug. 7
Aug. 26.	Belmond, Iowa	Aug. 21
Aug. 26.	Conneaut, Ohio	Aug. 21
Aug. 26.	Rochester, Minn.	Aug. 21
Aug. 26.	Los Angeles, Cal.	Aug. 21
Aug. 27.	Palatka, Fla.	July 31
Aug. 27.	Columbus, Ohio	Aug. 7
Aug. 27.	Grand River, Iowa.	Aug. 21
Aug. 27.	Crosby, Minn.	Aug. 21
Aug. 27.	St. Louis, Mo.	Aug. 21
Aug. 28.	Indian Head, Md.	Aug. 7
Aug. 28.	Port Royal, S. C.	Aug. 7
Aug. 28.	Luana, Iowa	Aug. 7
Aug. 28.	Fort Mifflin, Pa.	Aug. 7
Aug. 28.	Copan, Okla.	Aug. 21
Aug. 30.	Schuyler, Neb.	Aug. 7
Aug. 30.	Fitchburg, Mass.	Aug. 14
Aug. 30.	Esperanza, Cal.	Aug. 21
Aug. 31.	Little Falls, N. Y. Adv. Aug. 7.	Aug. 7
Aug. 31.	Baltimore, Md. Adv. Aug. 7, 14.	Aug. 7
Aug. 31.	White Plains, N. Y.	Aug. 21
Aug. 31.	Grand Mound, Wash.	Aug. 21
Aug. 31.	Sisseton, S. D.	Aug. 21
Aug. 31.	St. Croix Falls, Minn.	Aug. 21
Aug. 31.	St. Paul, Minn.	Aug. 21
Sep. 1.	Hartford City, Ind.	July 31
Sep. 1.	Wisner, Neb.	July 10
Sep. 1.	Bonds, Lake Linden, Mich. Adv. Aug. 7, 14.	Aug. 7
Sep. 1.	Hammond, Ind. Adv. Aug. 14.	Aug. 14
Sep. 1.	Minneapolis, Minn.	Aug. 21
Sep. 1.	Eau Claire, Wis.	Aug. 21
Sep. 1.	St. Louis, Mo.	Aug. 21
Sep. 1.	Austin, Minn.	Aug. 21
Sep. 2.	Portland, Ore.	Aug. 14
Sep. 2.	Tipton, Iowa	Aug. 21
Sep. 2.	Buffalo, Minn.	Aug. 21
Sep. 3.	Tippecanoe City, Ohio.	Aug. 14
Sep. 6.	Cheyenne, Wyo.	Aug. 21
Sep. 6.	Waterloo, Iowa	Aug. 21
Sep. 6.	Washington, Pa.	Aug. 21
Sep. 7.	Charter Oak, Iowa.	Aug. 14
Sep. 7.	Charlotte, N. C.	Aug. 7
Sep. 7.	Fulton, Mo.	Aug. 7
Sep. 7.	Columbus, Ohio	Aug. 21
Sep. 7.	Thiells, N. Y. Adv. Aug. 21.	Aug. 21
Sep. 8.	Englewood, N. J.	Aug. 21
Sep. 8.	Albany, N. Y. (2 props.) Adv. Aug. 21.	Aug. 21
Sep. 9.	Woodsfield, Ohio	Aug. 21
Sep. 10.	Gouverneur, N. Y.	Aug. 7
Sep. 10.	Lebanon, Ind.	Aug. 14
Sep. 10.	Lebanon, Ind.	Aug. 21
Sep. 10.	Perry, Okla.	Aug. 21
Sep. 11.	Bremerton, Wash.	Aug. 14
Sep. 11.	Cincinnati, Ohio	Aug. 21
Sep. 15.	Hyde Park, Ohio.	Aug. 21
Sep. 15.	Arverne, N. Y. Adv. Aug. 21.	Aug. 21
Sep. 27.	Tulsa, Okla.	Aug. 14
Sep. 28.	Harrisburg, Pa. Adv. Aug. 21.	Aug. 21
Sep. 30.	Washington, D. C. Adv. July 24, 31.	July 24

PRIVATE BUILDINGS.

Sep. 1.	New Haven, Conn.	Aug. 21
Sep. 15.	Seattle, Wash.	Aug. 14

MISCELLANEOUS.

Aug. 23.	Derrick boat, Washington, D. C. Adv. July 31 to Aug. 21.	July 31
Aug. 24.	Elevator, Madison, Wis.	Aug. 7
Aug. 24.	Culverts, Tazewell, Tenn.	Aug. 21
Aug. 25.	Freight Shed, Brooklyn, N. Y.	Aug. 14
Aug. 25.	Conduits, Wards Island, N. Y.	Aug. 21
Aug. 25.	El. Ry., Kansas City, Mo. Adv. Aug. 21.	Aug. 21
Aug. 26.	Incinerator, Ottawa, Ont.	Aug. 14
Aug. 26.	Garbage Disposal, Ottawa, Ont.	Aug. 14
Aug. 27.	Tunnel, Columbus, Ohio..	Aug. 7
Aug. 27.	Steel Castings, Etc., Panama	Aug. 14
Aug. 28.	Elevator, Pearl City, Hawaii	Aug. 7
Aug. 30.	Concrete Steps, Cincinnati, Ohio	Aug. 21
Aug. 30.	El. Ry. Franchise, South San Francisco, Cal.	Aug. 21
Aug. 31.	Elevators, Amarillo, Tex.	Aug. 7
Aug. 31.	Steel Barges, Etc., Cincinnati, Ohio Adv. Aug. 7 to 21.	Aug. 7
Aug. 31.	Elevator, Medford, Ore..	Aug. 14
Aug. 31.	Elevators, Baltimore, Md.	Aug. 7
Aug. 21.	Metal Louvers, Etc., Panama	Aug. 21
Aug. 31.	Painting Dams, Albany, N. Y.	Aug. 21
Sep. 1.	Grading School Site, Cincinnati, Ohio Adv. Aug. 7, 21.	Aug. 7
Sep. 1.	Incinerator, Rock Island, Ill.	Aug. 21
Sep. 1.	Steel Transverse Anchors, Panama	Aug. 21
Sep. 2.	Weather Stripping and Screens, Fort Bliss, Tex. Adv. Aug. 14, 21.	Aug. 14
Sep. 10.	Light Station, New Orleans, La.	Aug. 14
Sep. 10.	Cell Fronts, Atlanta, Ga.	Aug. 21
Sep. 13.	Equipment for Drydock, Panama	Aug. 21
Sep. 14.	Elevator, Camden, N. J..	Aug. 21
Sep. 18.	Ry. at Naval Station, Pearl Harbor, Hawaii..	July 10

CONTRACTING NEWS

Of Special Interest to Engineers, Contractors, Builders and Manufacturers of Engineering and Building Supplies

THE BEHAVIOR of the stock market in the face of events of the past week, which threatened an immediate break in our friendly relations with Germany, was most encouraging. It brought out the fact that confidence in American securities, on which confidence all prospects for construction work depend, was not in the least shaken. The question with investors and speculators alike was not to sell and stand from under, but to await the most favorable moment to buy. The receipt of the first intimation that Germany might disavow the acts which brought on the crisis resulted in a prompt recovery.

Definite steps have been taken to finance the cotton growers until their crop is marketed. While it is true that the $30,000,000 McAdoo loan does not represent one-sixth the value of this year's crop, it must be remembered that the resources of the Southern banks themselves probably amount to much more than this loan, and that perhaps half the crop will find an immediate market. It has been said that all this crop can be sold this year, even if none passes the English blockade. The treasury loan would then cover almost the entire quantity of cotton remaining from last year's over-large crop. As the result of these things the general situation in the South should begin to show improvement.

The advance July report of the Baltimore & Ohio Railroad, whose June report foreshadowed a general increase in gross earnings on most of the big systems, shows a substantial increase over the gross earnings of both July, 1914, and June, 1915.

In the steel market the increase of $1 per ton on plates, shapes and bars, bringing the price up to $27 per ton, Pittsburgh, is becoming general. Railway buying for the first half of 1915 shows an increase almost of 150 per cent over the low figures for the last half of 1914. Railway-equipment business continues very active. Structural-steel business, present and prospective, continues good.

Buildings

Providence, R. I., has awarded a $140,000 contract for a school building. A contract for erecting three factory buildings to cost $500,000 has been awarded at Bridgeport. Contracts awarded at Syracuse, N. Y., for erecting a school building total $282,000. A $600,000 office building has been contracted for at Philadelphia. It is reported from Steubenville, Ohio, that a contract for a $2,000,000 industrial plant has been signed and that a $500,000 bridge across the Ohio River will be built in connection with it. The contract for reinforced-concrete buildings for the New Orleans cotton terminal, bids on which were noted last month, has been awarded at $1,109,000. Bids are desired for school buildings at Cincinnati and at Gainesville, Tex. It is reported from Boston that two automobile warehouses to cost $500,000 and $200,000 respectively are proposed. Plans have been prepared for one $500,000 and one $200,000 apartment house in New York City. It is reported from Syracuse, N. Y., that $590,000 has been appropriated for school improvements. An engineer has been retained to prepare plans for a large industrial plant at Roaring Springs, Pa. It is reported that a $150,000 packing plant will be erected in Evansville, Ind. A $250,000 hospital is being planned at Walla Walla, Wash.

Bridges and Roads

Three concrete bridges to cost $109,000 and two steel bridges to cost $31,000 have been contracted for at Red Bluff, Cal. Bids are desired on a 400-ft. highway bridge over the Alleghany River at Olean, N. Y. It is reported that bids will be received Sept. 11 for constructing a $120,000 bridge at Hamilton, Ohio. It is estimated that bridge work costing about $1,000,000 will be required in connection with the new road system at Baltimore. The mayor of St. Louis has signed an ordinance authorizing the construction of the Chouteau Avenue viaduct at a cost of $200,000. Engineers have been engaged to prepare plans for a $75,000 bridge at Mankato, Minn.

Bids were opened Aug. 24 for thirty-one sections of New York State road work which will cost $1,194,000. The lowest bid received for road work at Zanesville, Ohio, was $129,000. Highway contracts totaling nearly $180,000 have been awarded by the State of Ohio. Chicago has contracted for 95,000 sq. yd. of paving. A contract for paving 2 miles of streets has been awarded at Lincoln, Neb., and bids were opened on another paving contract by the same city, which is reported awarded at $50,000. Bids are desired Aug. 31 for considerable grading and paving work in New York City. Philadelphia will receive bids Aug. 31 for highway work estimated to cost $475,000. New bids will be received at Wilmington, Del., for the 50,000 sq. yd. of pavement on which bids were opened Aug. 10. Bids are desired for surfacing 10 miles of highway at Alexandria, Ohio. Lake Charles, La., will let 6½ miles of road work on Sept. 7. Road bonds amounting to $100,500 have been sold at Columbus, Ohio. Bryan, Tex., has sold road bonds amounting to $400,000, and a number of other large issues are to be voted or are advertised for sale in the Southern States.

Waterworks and Sewers

It is reported that the contract for the Coshocton (Ohio) reservoir has finally been awarded at $40,000. The lowest bid received at St. Louis for the first section of the Compton Hill reservoir was $280,000. Bids are desired for 5 miles of distributing mains and a storage reservoir at Bellville, Ohio. Oberlin, Ohio, desires bids Sept. 10 for constructing a 10,000,000-gal. reservoir. A permit has been issued to the water company at Brownsville, Pa., to construct a filtration plant. It is reported, a $150,000 high-pressure water system is planned in Portland, Ore.

The lowest bids opened Aug. 16 for constructing sewers and a pumping plant at Watertown, S. D., total $86,000. Bids for constructing a $31,000 sewer were opened Aug. 19 in Long Island City, N. Y. The bids received for constructing the Maspeth sewer in the same city were not opened Aug. 17, on account of an error in the specifications. New bids will be called for. The lowest bid received for constructing the outfall sewer at Paducah, Ky., was about $46,000; a contract will not be awarded until November. It is reported that Madison, Wis., will spend $125,000 for a sewage-disposal system. Stockton, Cal., is reported to have sold sewer bonds totaling $550,000.

Miscellaneous

The Public Service Commission in New York City has awarded one station-finish contract at $268,000, and opened bids on another one that total $860,000. At the same time a contract has been awarded in Brooklyn at $320,000 for constructing stations on the Broadway elevated line. The Philadelphia rapid-transit contracts have been awarded. Bids totaling almost $243,000 were opened for dredging in Philadelphia harbor. Contracts will be awarded later. A breakwater to cost $99,000 has been contracted for at Conneaut, Ohio. A preliminary contract has been awarded on the $500,000 drydock at Galveston, Tex. A contract has been awarded for constructing the first 16 miles of the Bellingham, Mount Baker & Spokane Railway in Washington. The United States Government has bought $164,000 worth of track materials for the Alaska railroad.

Bids are desired for about 600,000 cu. yd. of levee work at Alexandria, La. Bids are desired for constructing a 35-mile canal at Twin Falls, Idaho. A company has been incorporated at Nashville, Tenn., to build about 275 miles of interurban electric road, part of which has been surveyed. A company has been incorporated to build an electric road from East St. Louis, Ill., to Mount Carmel, Ill. A company with a capital of $500,000 has been incorporated at Three Forks, Mont., to build a railroad from that point and Yellowstone to Helena. An ordinance for grade-separation work to cost $450,000 has been passed at Seattle, and grade-crossing elimination which will cost $750,000 is being considered at Portland, Ore.

Three large irrigation projects are reported from California, one for which $480,000 bonds have been voted at Anderson, and two proposed—one at Porterville and one at Terra Bella. It is reported from Phoenix, Ariz., that the Department of the Interior has granted permission to conduct preliminary operations looking to the construction of dams in the Grand Canyon of the Colorado River by which 400,000 hp. will be developed. Estimates are to be prepared for two large piers at Cristobal in the Canal Zone.

WATERWORKS

PROPOSED WORK

Fort Williams, Me.—Capt. H. C. Miller, Coast Artillery Corps, Q. M., U. S. A., is desirous of determining a satisfactory method of improving water system at one of the forts in these defenses and has now under consideration two methods: First, submarine water pipe line about 2½ miles long, about 85 per cent being under water, most of it quite shallow, 10-in. pipe; second, salt water condensing plant that will deliver about 75,000 gal. per day. He would like to communicate with material men, also contractors, handling this class of work.

Boston, Mass.—Commissioner of Public Works has petitioned directors of Port of Boston for permission to build and maintain high-pressure fire service pumping station at southerly corner of Dorchester Avenue and Summer Street, in and over tide waters of Ft. Point Channel.

Castleton, N. Y.—Village Trustees reported to have decided to construct a by-pass at reservoir intake; also considering construction of filtration plant.

West Orange, N. J.—Citizens voted Aug. 16 to authorize Town Council to acquire distributing system of West Orange Water Co.

Pennsylvania.—Following are among permits issued from July 15 to Aug. 15 by State Dept. of Health, Harrisburg (Dr. Samuel G. Dixon, Comr.):

Mohnton—Mohnsville Water Co., storage reservoir and extensions to distributing system.

Troy—New storage reservoir and additional supply of water from a drilled well.

Beavertown—Extensions to distributing system.

Brownsville—Brownsville Water Co., filtration plant.

Fleetwood—Gravity supply main and new sources of water supply from springs.

Harrison Township—Natrona Water Co., additions to filtration plant.

Lewistown—Lewistown-Reedsville Water Co., extensions to distributing system.

Ligonier—Gravity supply main.

Philadelphia—Holmesburg & Disston Water Companies, emergency disinfection apparatus using chlorine gas.

Scottdale—Citizens Water Co., auxiliary supply and apparatus for chemical disinfection.

Waynesboro—Waynesboro Water Co., extensions to distributing system.

South Boston, Va.—Bonds for $125,000 water and sewer and $25,000 street improvements will be sold Sept. 1 by Finance Com. (Henry Esaley, Chm.). Engineers, Anderson & Christi, Commercial Bank Building, Charlotte, N. C.

South Boston, Va.—Citizens voted $125,000 bonds for water works and street improvements.

Lumberton, N. C.—Improvements reported contemplated to municipal electric light plant and water works, to cost about $25,000. Gilbert C. White, Engr., Charlotte.

Raeford, N. C.—Citizens voted to construct water works and sewer system; cost about $30,000.

Coolidge, Fla.—Citizens voted to construct water works. S. C. Neswith, City Clerk.

Amite City, La.—City council reported to have engaged Xavier Kramer, of Magnolia, Miss., and M. L. Culley, Jackson, Miss., to prepare plans for water works and a sewer system.

White Castle, La.—Citizens Aug. 19 voted $25,000 bonds for constructing water works and electric light plant from plans of X. V. Kramer of Magnolia, Miss.

Ironton, Ohio.—Bonds for $100,000 will be sold Sept. 23 by Percy W. Dean, City Aud., for constructing water filtration plant.

Middletown, Ohio.—S. G. Pollard of Cincinnati is engineer for proposed water works, for which citizens recently voted $120,000.

Oberlin, Ohio.—Council reported considering construction of an additional reservoir.

Tiffin, Ohio.—Tiffin Water Works Co. reported completed plans for construction

of concrete dam in Sandusky River, above water works pump house, also for new filter to be installed in plant.

Arcadia, Iowa.—Citizens July 27 voted $7,000 bonds for construction of water works, consisting of c-i mains, steel tower and tank, dug well and pumping equipment. Engineer, Lawrence W. Cox, 1544 Eleventh Street, Des Moines.

Attica, Kan.—Citizens voted $30,000 bonds for constructing water works and electric light plant.

Hysham, Mont.—Town Council reported to have engaged Billings Eng. & Constr. Co., Billings, to prepare plans and supervise construction of water works.

Halfway, Ore.—Citizens voted $20,000 bonds for constructing gravity system of water works.

Newport, Ore.—State has granted permit to city to use waters of Spencer Creek for municipal water supply. Improvement will consist of a dam 5 ft. high and 200 ft. long, a pipe line 10 miles in length and a concrete reservoir; estimated cost $24,000.

Portland, Ore.—Reported that a system of high pressure reinforcing fire mains in business district is planned. Cost $150,000. A. L. Barbur, City Aud.

Roseburg, Ore.—Petition being circulated asking City Council to issue $250,000 bonds for construction of water works and electric light system; petition also asks that immediate steps be taken to secure a water right on North Umpqua River.

San Diego, Cal.—City Engineer Geo. Cromwell has submitted to City Manager Lockwood a report on Barrett dam, and estimates that a dam can be built to a height of 125 ft. for about $155,000, as against $75,000 to finish the Pine Creek dam. Engineer Cromwell proposes a rock-filled dam with wooden face.

Council, Idaho.—Election soon to be held to vote $15,000 bonds for constructing municipal water works. Water to be piped from springs 1½ miles from Council; a 100,000 gal. capacity concrete reservoir will be built.

Maillardville, B. C.—Municipal Council of Coquitlam reported to have decided to proceed with installation of a water works; bids will soon be asked for supply of pipes, hydrants, etc. Cost about $10,000.

BIDS DESIRED.

Brooklyn, N. Y.—Until Sept. 14, by Bureau Supplies and Accounts, Navy Dept., Washington, D. C., for furnishing to Brooklyn Navy Yard, miscellaneous gate valves as per Sch. 8715.

Manchester, N. Y.—Until Sept. 15 by Bd. Village Trus. (R. P. Craig, Pres.), for constructing water works, advertised in Engineering Record. Charles C. Hopkins, Engr., Rochester.

Newark, N. J.—Until Sept. 8 by Committee on Pub. Bldgs Common Council (Thomas J. Lee, Jr., Chmn.) for furnishing material and constructing water supply and fire system at New Alms House, Ivy Hill, South Orange Township. George W. Knight Co., Engrs., 784 Broad Street.

Woodbury, N. J.—Reported desired until Aug. 31 by Arthur Starr, City Clk., for improving pumping station, including boilers, pumps, etc. William H. Boardman, Engr., 426 Walnut Street, Philadelphia.

Thomasville, Ala.—City desires to contract for drill deep well and to secure a water supply of 200 gal. per minute, advertised in Engineering Record. Address T. H. Tyson, Mayor.

Bellville, Ohio.—Until Sept. 14 by Glenn L. Shaffer, Village Clerk, for constructing water works, to consist of deep well pumps, gas engines, 5 miles of distributing mains and storage reservoir. Smith & Powley Co., Engrs., Nasby Building, Toledo.

Medina, Ohio.—Until Sept. 15 by Bd. Public Affairs (R. E. Elkard, Clk.) for 12,326 ft. 4-in. pipe, 37 4-in. valves, 15 hydrants and 6500 lb. specials, advertised in Engineering Record.

Oberlin, Ohio—Until Sept. 10 for constructing 1,000,000-gal. reservoir. W. F. Schneider, City Engr.

Shaker Heights, Ohio.—See "Paving and Roads."

Battle Creek, Iowa.—Reported desired until Sept. 1 by J. W. Wellmer, City Clk., for plans for 100,000 gal. tank on steel tower, also for about 1500 ft. 3 in. and 6 in. water mains.

Shenandoah, Iowa.—Reported desired until Sept. 2 by C. M. Conway, City Clk., for constructing 400,000-gal. elevated tank.

Hastings, Neb.—Until Sept. 13 by Light & Water Com. for sinking a 24-in. well, approximate depth 130 ft., advertised in Engineering Record. W. S. Watson, Comr.

Whitehall, Mont.—Until Sept. 23 by F. E. McCall, Town Clk., for constructing water works and sewer system, as advertised in Engineering Record. George E. Baker, Consulting Engr., Whitehall.

Craig, Col.—Until Sept. 1 by E. H. Carr, Town Recorder, for constructing water works system, to include furnishing f.o.b. cars, Craig, c. i. pipe and specials, steel pipe and specials, valves and hydrants, two 250-gal. per minute triplex power pumps and two 30 hp. combustion engines; also furnishing and erecting standpipe, 16 ft. diam., 50 ft. high. Burns & McDonald, Engrs., Scarritt Bldg., Kansas City, Mo.

Myton, Utah.—Until Sept. 20 by R. B. Croix, Town Clk., for constructing water works, advertised in Engineering Record.

PRICES AND LETTINGS.

★Indicates award of contract.

★Ilion, N. Y.—Contract reported awarded by Bd. Water Comrs. (George R. Russell, Secy.), for about 3½ miles 10-in. c-i. pipe and constructing a concrete diverting dam, intake chamber and gate house to C. A. Chatham, Syracuse, at $12,832. J. D. Ringwood, City Engr.

★Coshocton, Ohio.—Contract reported awarded to Kisner & Son, Delaware, for constructing 3,000,000-gal. reservoir at $40,000.

★Clinton, Ill.—Contract awarded by City Council to Davis Ewing Concrete Co., Bloomington, for reservoir, at $6,644. Engineers, Fleming, Enger & Babbet, Champaign.

★Denison, Iowa.—Contract reported awarded by City Council for sinking deep well to W. H. Gray & Co., Chicago, Ill., at $6,000.

★Syracuse, Neb.—Contracts awarded for water works improvements (bids opened Aug. 19) to Chicago Bridge & Iron Works, Chicago, Ill., at $3,999 and Elkhorn Constr. Co., Fremont, at $3,788. William Stanbro, Village Clk. C. A. Martz, Engr., Lincoln.

St. Louis, Mo.—Lowest bid opened Aug. 13 by Bd. Pub. Service (William T. Findly, Secy.) for furnishing material and reconstructing the first section of Compton Hill Reservoir reported submitted by Hiram Lloyd Constr. Co., 816 Olive Street, at $280,188. J. A. Hooke, Dir. of Public Utilities.

SEWERAGE AND SEWAGE DISPOSAL

PROPOSED WORK

Pennsylvania.—Following are among permits issued from July 15 to Aug. 15 by State Health Dept., Harrisburg (Dr. Samuel G. Dixon, Comr.):

Dormont—Additions to sewage treatment works.

Etna—Lateral sewer extensions.

Philadelphia—Lateral sewer extensions. Temporary sewage pumping station and force main.

Brackenridge—Lateral sewer extensions.

South Boston, Va.—See "Water Works."

Reeford, N. C.—See "Water Works."

Amite City, La.—See "Water Works."

Paducah, Ky.—All bids opened Aug. 3 by L. A. Washington, Comr. Pub. Wks., for constructing brick or concrete outfall sewer, Dist. No. 3, Contract No. 1, have been rejected, and further letting will be deferred until outcome of bond issue to be voted at the November election.

Bowling Green, Ohio.—Plans being prepared for construction of sewage disposal plant.

Hillsboro, Ohio.—It is reported that H. L. Maddocks of Newark will prepare preliminary plans for sewer system and disposal plant; also for street paving.

Indianapolis, Ind.—Plans for sanitary sewage interceptor connecting New Warman Avenue sewers with Hardung Street interceptor reported adopted by Bd. Pub. Wks. It will be about 1 mile long and cost about $25,000.

Randolph, Wis.—W. S. Shields of Chicago, Ill., reported to have completed plans for sanitary sewer system.

Ft. Madison, Iowa.—Plans being completed for a large amount of drainage and sanitary sewers. A. P. Brown, Mayor.

Sioux City, Iowa.—Council reported to have authorized City Engineer to prepare plans for extension of Lafayette storm sewer system to Missouri River.

Grand Island, Neb.—Grant & Fulton, Lincoln, reported engaged by City Council to prepare plans and estimates for a sanitary and storm sewer system.

Kearney, Neb.—City Council considering rebuilding and replacing sewers.

Bozeman, Mont.—City Council reported to have decided to construct sanitary sewers on S. Sixth and Church Avenues; cost about $14,000.

Little Rock, Ark.—Council reported to have passed ordinances providing for construction of sewers as follows: Authorizing Bd. of Pub. Affairs to appropriate $5,000 to build a sewer at or near Nineteenth Street viaduct, with laterals south to Fourche; to Nick Peay, to construct and maintain sewer system in southeastern portion of city in Watkins, Capitol Hill and Ferndale additions, and to M. J. Cole, Jr., to construct sewer in Eighth Ward.

Waco, Tex.—Election will soon be called to vote on question of constructing sewage disposal. J. W. Riggnas, Mayor.

Bellingham, Wash.—City Council authorized City Engineer to make surveys, etc., for installation of trunk sewer in Ellis Street; cost estimated at about $10,000.

Stockton, Cal.—Bonds for $550,000 reported sold to be used for sewer construction.

BIDS DESIRED.

Long Island City, L. I., N. Y.—Until Sept. 1 (extension of date from Aug. 17) by Maurice E. Connolly, Boro. Pres., for furnishing material and constructing sewers in portions of Maspeth, Clark, Perry and Maurice Avenues, Rust and Grand Streets. Total security, $154,000.

New York, N. Y.—Until Aug. 31 by Douglas Mathewson, Pres. Boro. Bronx, for constructing sewers in West 254th Street, Kinderman Place, Fieldstone Road, Sacket, Brook and Bronxdale Avenues. Security, $16,800.

Yorktown Heights, N. Y.—Reported desired until Aug. 31 by William S. Field, Pres. Bd. Mgrs. N. Y. State Training School for Boys, for constructing sewers and sewage disposal plant at said school.

Dormont, Pa.—Until Aug. 31 by Borough Council (C. D. Dorning, Clk.) for constructing 3 additional septic tanks, complete, for Dists. Nos. 3 and 4, known as Snyder Disposal Plant. Douglas & McKnight, Boro. Engrs., Union Bank Building, Pittsburgh.

Washington, D. C.—Until 2 p. m., Aug. 30, at office of District Purchasing Agent, for furnishing a centrifugal pump, horizontal side suction, left-hand, 3-in. diam. discharge, 4-in. diam. suction, for sewerage pumping station.

Mansfield, Ohio—Until Oct. 14 by Bd. Pub. Service (O. Hudst, Dir.) for sewage disposal plant.

Port Clinton, Ohio.—Until Sept. 20 by City Clerk for constructing sewer in Madison Street, 2000 ft. 22-in. sewer; cost $4,400.

Shaker Heights, Ohio.—See "Paving and Roads."

Springfield, Ohio.—Until Sept. 3 by Charles E. Ashburner, City Mgr., for furnishing material and constructing sanitary sewer in Edwards Avenue and Gallagher Street.

Brainerd, Minn.—Until Sept. 20 by A. Mahlum, City Clk., for constructing lateral sewers B 3, in Dists. 4 and 7, and B 4, Dist. No. 4.

Chanute, Kan.—Until Aug. 31 (readvertisement) by C. G. Wood, City Clk., for constructing a sewage disposal plant and septic tanks.

Crofton, Neb.—Reported desired until Sept. 3 by Joseph T. Kuhn, Village Clk., for sanitary sewer system, to include 9995 ft. 12 and 8-in. pipe and 1535 ft. 6-in. tile, also disposal plant, to include septic tank, dosing chamber, sand filter, sludge bed and two 8-in. alternating siphons. J. C. Blair Smith, Engr., Harvington.

Whitehall, Mont.—See "Water Works."

Roslyn, Wash.—Reported desired until Sept. 13 by George T. Wake, City Clk., for sewer improvements in Local Improv. Dists. Nos. 1, 2, 3 and 4.

Huntington Beach, Cal.—Reported desired until Sept. 7 by City Clerk for constructing sewers in portions of several streets including Tenth and Eleventh Streets and Arcadia Avenue.

PRICES AND LETTINGS.

★Indicates award of contract.

★Pittsfield, Mass.—Later reports state contract for building 17 new filter beds and sewage disposal plant (bids opened Aug. 4) has been awarded to the Perini Constr. Co., Ashland, at $23,533.

Long Island City, L. I., N. Y.—Lowest bid opened Aug. 19 by Maurice E. Connolly, Boro. Pres., for construction of sewer and appurtenances in Atlantic Avenue and south side of Atlantic Avenue, Fourth Ward, submitted by Angelo Paino, Brooklyn, as follows: 1270 lin. ft. 7-ft. reinforced concrete sewer, $16; 877 lin. ft. 4-ft. concrete sewer, $10.50; 12 manholes, $80; 1 cleaning shaft, $125; 1 junction chamber, Maure and Atlantic Avenues, including manhole, complete, $425; 44 6-in spurs, 24 in. long, on concrete sewers, 25 cts.; 42 lin. ft. 6-in. house connection drains, 50 cts.; 132 M. ft. timber for sheeting and bracing, 1 ct.; 25 cu. yd. class A concrete, $6; 2000 lb. steel reinforcement, 2 cts.; 200 lin. ft. risers for house connection drains, including Y's, 85 cts.; 24 lin. ft. 12-in vitr. pipe sewer, $1.21; total, $31,460. Next two lowest bids: Murphy Bros., Brooklyn, $31,811; Frank Paino, Brooklyn, $32,677.

★Oswego, N. Y.—Contracts awarded as follows on bids opened Aug. 20 by Dept. Wks. for sewer construction, about 9722 ft. 8 to 22-in. vitr. tile sewer, 3956 ft. 24, 27, 30, 36 and 42-in. reinforced concrete or vitr. tile sewer, 312 Y branches, etc.: Contract Q, Samuel Bom, Syracuse, $7,872; Contract R, Ralph Reilly, Utica, $8,793; Contract S, Broderick & Fingerhut, Oswego, $1,734; Contract T, L. Tremiti, Oswego, $2,854; Contract U. Ralph Reilly, Utica, $14,764; Contract V, R. Compo, Oswego, $1,896. Charles W. Linsley, Comr. of Wks.

★Utica, N. Y.—Contract for constructing relief sewer in Jay Street awarded to N. D. Peters & Co., Utica, at $11,874.

★Wildwood, N. J.—Contract for erection of sewage disposal plant reported awarded to Stanley Kalback of Wildwood at $36,044.

★Philadelphia, Pa.—Contract awarded to John McNenamy, 512 Walnut Street, Philadelphia, for reconstruction and relocation of sewer in Buttonwood Street, from Thirteenth to Broad St. (bids opened July 31 by A. M. Taylor, Dir. Dept. City Transit), at a total of $18,052.

Watertown, S. D.—Following are lowest bids opened Aug. 16 for constructing sewers and pumping plant (M. Shreiber, City Engr.):

Sewer system—Offerman Constr. Co., South Omaha, Neb., $79,289; Jackson & Schruth, Fargo, N. D., $84,948; Tanner Bros., St. Paul, Minn., $88,000; Jas. Kennedy, Fargo, N. D., $89,425. Work includes 1558 lin. ft. 15-in. sanitary vitr. sewer pipe, 5004 lin. ft. 18-in., 2114 lin. ft. 30-in. pipe or concrete, 2166 lin. ft. 33-in. pipe or concrete, 1186 lin. ft. 36-in. storm concrete pipe, 3469 lin. ft. 42-in., 5033 lin. ft. 57-in., 55 manholes, 1 flush tank with 2000 ft. 2-in. galv. pipe, 27,450 cu. yd. open ditch excav., 4824 ft. 16-in. c. i. pipe, to haul and lay.

Pumping station—Brickle Constr. Co., Watertown, $6,971; Tanner Bros., St. Paul, Minn., $7,076; Seims-Carey Co., St. Paul, Minn., $9,485. Work includes 260 cu. yd. earth excav. pipe trenches, 10 cu. yd. rock excav., 130 lin. ft. 24-in. pipe, 80 lin. ft. 36-in., 80 lin. ft. laying 6-in. underdrains, 1 pumping station, excluding machinery and piping.

★St. Louis, Mo.—Contract awarded by Bd. Pub. Service (William T. Findly, Secy.) for constructing Florissant Avenue sewer, Extension Nos. 1 and 2, and Florissant Avenue inlet line, to Myers Constr. Co., 506 Olive Street. Work will require approximately 422 ft., 5 ft., 20 ft., 33-in. inside diameter circular brick sewer, 2180 ft. 18, 15 and 12-in. vitr. clay pipe sewer.

★Los Angeles, Cal.—Contract awarded to Lawrence Skochelich for sewer in Myra Avenue, at $25,389.

★Salt Lake City, Utah.—Following are unit prices of Gibbons Bros., Reed & Roche, 1018 Lake Street, Salt Lake City, successful bidders for sewer extension No. 354 (bids opened Aug. 4), to be of reinforced concrete pipe (Meriwether type) (Sylvester Q. Cannon, City Engr.):

132,718	cu. yd. ex. and backfill.	$0.97
699	lin. ft. sewer, 20 in....	2.35
2,437	lin. ft. sewer, 42 in.....	3.75
6,628	lin. ft. sewer, 60 in.....	5.10
8,838	lin. ft. sewer, 66 in.....	6.50
3,706	lin. ft. sewer, 72 in.....	8.00
1,691	lin. ft. sewer, 78 in.....	10.00
4	special manholes, ea...	10.00
61	regular manholes, ea...	61.00
190	M ft. lumber in trench.	33.10
4,000	cu. yd. gravel fill in place	1.92
25	cu. yd. conc., Class A..	8.00
1,000	lb. steel reinforcement.	0.045
100	sq. yd. asphalt pavement	2.40
250	sq. yd. cement sidewalk	0.10
40	lin. ft. concrete pipe, 8 in.	0.27
40	lin. ft. concrete pipe, 10 in.	0.36
40	lin. ft. concrete pipe, 12 in.	0.44
40	lin. ft. concrete pipe, 15 in.	0.59
40	lin. ft. concrete pipe, 18 in.	0.83
40	lin. ft. concrete pipe, 21 in.	1.02
40	lin. ft. concrete pipe, 24 in.	1.31
	Total	$296,510.00

★New York, N. Y.—Following are unit prices of four lowest bids opened Aug. 10 by Water Bd for Contract 185—Making six borings through rock, each over 500 ft. deep, at East Shaft of Hudson Siphon, of Catskill Aqueduct, town of Fishkill, Dutchess County: (a) Sullivan Machinery Co., 122 South Michigan Avenue, Chicago, Ill., $12,145 (awarded contract); (b) Harper Machinery Co., 50 Church Street, New York, $12,600; (c) Sprague & Henwood, Inc., New York Street and Monsey Avenue, Scranton, Pa., $13,041; (d) Pennsylvania Drilling Co., 30 Carson Street, Pittsburgh, Pa., $13,243; (e) E. J. Longyear Co., Minneapolis, Minn., $13,445.

	★(a)	(b)	(c)	(d)	(e)
3,210 lin. ft. drilling holes	$3.65	$3.68	$4.00	$3.85	$4.00
30 cu. yd. earth excav. for drains and manholes....	1.25	5.00	0.20	2.50	0.30
10 cu. yd. rock excav. for drains and manholes....	2.50	6.00	2.00	7.50	2.00
20 cu. yd. masonry in manholes and around drains.	7.50	8.00	5.00	6.00	25.00
1,700 lb. miscell. iron and steel.....	0.035	0.06	0.03	0.20	0.03
150 lin. ft. tile drains	0.25	0.16	0.08	1.50	0.05

BRIDGES

PROPOSED WORK

Berlin, N. H.—Reported work will soon begin on construction of a steel bridge over Androscoggin River at Berlin Mills; cost $30,000.

Baltimore, Md.—Reported State Comn. estimated about $1,000,000 will be needed to construct bridges in connection with the new road system. The bridges include Synepuxent Bay Bridge at Ocean City, $75,000; Pocomoke River Bridge, Pocomoke City, $60,000; at Chesterton, $100,000; Nanticoke River at Vienna, $200,000; Bohemian River, $100,000; Sassafras River, $50,000; Chesapeake City, $50,000; Elk River, $50,000; Principio, $25,000; Western Run, York Road, $25,000; Gunpowder River at Wiseburg York Road, $25,000; Severn River, Annapolis, $275,000; South River, $200,000; Catoctin River, at Middletown, $50,000; Fifteen Mile Creek, Allegany County, $30,000.

Harriman, Tenn.—County Court appointed a committee to investigate the building of a new bridge to replace present Emory River bridge, or to repair the present bridge. Appropriation available, $50,000.

Columbus, Ohio—Bonds for $100,000 for repair and construction of a number of bridges will be sold Sept. 7 by John Scott, Clk. Bd. Co. Comrs.

Lowellville, Ohio—Village Council voted $5,000 toward constructing bridge.

South Bend, Ind.—Reported that St. Joseph County will spend about $40,000 for fill and bridge near county line; it will also sell bonds to extend highway from Mishawaka to Elkhart County line.

Mankato, Minn.—Concrete Steel Engineering Co., Park Row Bldg., New York, engaged to prepare plans for Main Street bridge. A concrete bridge costing about $75,000 is contemplated.

Leavenworth, Kan.—Plans being prepared by W. V. Thomas, Co. Engr., for construction and repair of 20 bridges carried away during the recent flood; probable cost $22,000. In all about 60 bridges were damaged or destroyed.

Fairbury, Neb.—Reported business men of Fairbury and the Co. Comrs. are considering building a bridge across Blue River south of Fairbury.

St. Louis, Mo.—Mayor signed ordinance authorizing construction of Chouteau Avenue viaduct; cost $200,000.

Benjamin, Tex.—Co. Comrs. voted $50,000 bonds for constructing two bridges over Brazos River, one 12 the other 16 miles from Benjamin.

Guthrie, Okla.—County Engineer John A. Rankin estimates cost of repairing bridges at about $40,000.

BIDS DESIRED.

Westport, Conn.—Until Sept. 22 by State Highway Comr., Capitol, Hartford, for constructing a single leaf deck lift bridge over channel of Saugatuck River, Westport, advertised in Engineering Record.

Buffalo, N. Y.—Until Sept. 3 by Dept. Pub. Wks., according to local press reports, for reconstructing Chicago Street viaduct.

Olean, N. Y.—Until Sept. 7 by A. G. Harvey, Supt. Streets, for constructing a highway bridge over Allegany River at Eleventh St., advertised in Engineering Record.

Delanco, N. J.—Until Sept. 1, by Co. Bd. Chosen Freeholders (Harry Hawkins, Jr., Clk.), for repairs to superstructure of Delanco draw bridge across Rancocas River at Delanco and Riverside. James Logan, Co. Engr.

Doylestown, Pa.—Reported desired until Aug. 31 by Co. Comrs. for two concrete bridges, one over Fall Creek and the other over Trout Run.

Easton, Pa.—Reported desired until Sept. 3 by County Comrs. for constructing reinforced concrete bridge No. 1822 over Jacoby Creek, Upper Bethel Township.

Glenolden, Pa.—Until Sept. 9 by County Comrs., Media, for constructing reinforced concrete bridge on Glenolden Avenue over Muckinapatus Creek, Glenolden Boro., and Daily Township. J. Miller Quinn, Dept. Controller.

Nicholasville, Ky.—Until Sept. 7 by County Fiscal Court for constructing steel and concrete bridge on Chrisman Mill Road across Hickman Creek. C. S. Woodward, Co. Road Engr., Nicholasville.

Cincinnati, Ohio.—Until Sept. 17 by Bd. County Comrs. (Albert Reinhardt, Clk.) for constructing two concrete bridges on New Haven and Venice (Willey) Road in Crosby Township as per Spec. No. 811.

Hamilton, Ohio—Press reports state bids will be received until Sept. 11 by County Comrs. for constructing the Columbia bridge, 730 ft. long. Probable cost, $120,000.

Hamilton, Ohio.—Until Sept 13, including plans and specifications by W. W. Crawford, Co. Aud., for bridge over Miami River at Chestnut Street. Steel or concrete construction.

New Philadelphia, Ohio—Reported desired until Sept. 1 by County Comrs. for 100-ft. span steel bridge to be erected over Sugar Creek. Bridge to be paved with wooden block. Edward Stingel, Co. Engr.

Steubenville, Ohio.—Until Sept. 17 by County Comrs. for constructing concrete arch bridge No. 33, Warren Township, known as Weatherson bridge. John L. Means, Co. Aud.

Zanesville, Ohio.—Until Sept. 7 by County Comrs. (Fred. C. Werner, Clk.) for furnishing material and erecting steel superstructure over Turkey Run, known as the Edw. Swingle bridge, in Brush Creek Township, to consist of a span 47 ft. long, c. to c. of end bearings, and 14 ft. roadway.

Indiana.—By County Commissioners for constructing bridges as follows:
Until Sept. 7:
Corydon, 3 steel bridges; J. L. O'Bannon, Aud.
Until Sept. 8:
Peru, concrete arch in Richland Township; F. K. McElheny, Aud.
Until Sept. 9:
Warsaw, 9 bridges; V. D. Mock, Aud.
Jasper, steel bridge in Jackson Township; J. H. Seng, Aud.

Austin, Minn.—Reported desired until Sept. 10 by County Comrs. for constructing 19 bridges. O. J. Simmons, Co. Aud.

Ellsworth, Kan.—Reported desired until Sept. 18 by Co. Comrs. for constructing a 280-ft. reinforced concrete bridge, repairing a 250-ft. steel bridge and constructing eight miles of roads and culverts in Garfield and Empire townships. G. R. Wolf, Co. Engr.

Harrison, Neb.—Reported desired until Sept. 7 by County Comrs. for a 100-ft. standard 15-ton steel bridge.

St. Paul, Neb.—Reported desired until Sept. 8 by County Comrs. (H. D. Bahensky, Clk.) for constructing high truss steel bridge, five 145-ft. spans, 16-ft. roadway, concrete piers and wood piling, with concrete floor, across Loup River, 2 miles south of St. Paul.

Canton, S. D.—Until Sept. 7 (extension of date from Aug. 3) by County Auditor, for constructing superstsructure for structural steel span, 120 ft., concrete floor, 18 ft. roadway.

Worland, Wyo.—Reported desired until Sept. 6 by E. M. Conant, Co. Clk., for constructing bridge over Cotton Wood Creek near Chatham, to be 60 ft. long and 6 ft. above creek bottom.

Walla Walla, Wash.—Reported desired until Sept. 10 for erecting a 102-ft. steel truss span with concrete abutments, or for a concrete reinforced arch bridge. G. C. Cockesy, County Engr.

Aberdeen, Wash.—Reported desired until Sept. 8 by P. F. Clark, City Clk., for constructing a steel bridge, one 260 ft. span and one 118 ft. L. D. Kelsey, City Engr.; C. E. Fowler, Consulting Engr., Central Bldg., Seattle.

Halifax, N. S.—Reported desired until Sept. 1 by Road Comrs. for constructing 161 bridges and culverts of permanent material in Victoria County.

Assiniboia, Man.—Reported desired until Sept. 3 by Frank Ness, Municipal Clk., for constructing traffic bridge over Assiniboine River.

PRICES AND LETTINGS.

★Indicates award of contract.

North Andover, Mass.—Following are four lowest bids opened by Co. Comrs. at Salem for constructing reinforced concrete beam slab bridge across Shawsheen River between North Andover and Lawrence, bridge to be 38 ft. stand in clear and 66 ft. wide: Hyde Park Constr. Co., $13,714; William F. Fitzgibbons, $13,784; Crane Constr. Co. of Wales, $16,929, and Lawlor Bros., Canton, $20,051.

★Watertown, N. Y.—Contract for constructing Eastern Boulevard viaduct over Carthage & Adirondack tracks near eastern limits of city awarded Lou B. Cleveland of Watertown. Span 75 ft. reinforced concrete, steel concrete abutments.

★Lake Charles, La.—Contract awarded Virginia Bridge Co., Vincennes, for constructing steel and concrete bridge over Choupque Bayou at $5,570.

★Schlater, Miss.—Contract for constructing iron bridge across McNutt Lake awarded by Co. Bd. Superv. to W. T. Young Bridge Co., Nashville, at $11,000.

★Marysville, Ohio.—Contracts awarded by Co. Comrs. (bids opened Aug. 16) as follows: Jones Bridge, steel superstructure with block floor, to Ohio Concrete Supply Co., Fremont, at $3,197; Jones Bridge, substructure, to J. T. Reed & L. Gosnell, Richwood, at $1,313; Ford Bridge, superstructure to Capitol Constr. Co., Columbus, $4,675; Ford Bridge, substructure to A. C. Carr, Marysville, $2,124; McCullough Bridge, superstructure, to Richard Turner, Marysville, $2,270; McCullough Bridge, substructure, to John L. Porter, Marysville, $1,899; Temple Bridge, superstructure, to Richard Turner, Marysville, $1,750; Temple Bridge, substructure, to A. C. Carr, $714. Charles A. Morelock, Co. Aud.

★Chicago, Ill.—Contract awarded to Great Lakes Dredge & Dock Co., Chicago, for substructure of Dering bridge of Chicago & North Western Ry., over North Branch of Chicago River. Structure is a 180-ft., 3-track, single-leaf bascule.

★Illinois.—Contracts have been awarded by State Highway Dept., Springfield, for bridges as follows (William J. Marr, State Highway Engr.):
Reservoir Bridge, in Paris Township, Edgar County, to Alan J. Parrish of Paris, at $7,600.
Grand De Tour Bridge, in Dixon and Grand De Tour Townships, Lee and Ogle Counties, to W. H. Shons of Freeport Bridge Co., Freeport, at $7,778.
Mound No. 5, Hood Hollow and Haven Bridges, McDonough and Fulton Counties, to Irwin & Alford, Cuba, Ill., at $2,556.
Nos. 4 and 10 Bridges, in Pigeon Grove Township, Iroquois County, to Joseph S. Klein, Freeburg, at $3,335 and $3,049 respectively.

★Mankato, Minn.—Contract awarded Aug. 18 for reconstructing concrete arch bridge to Elkhart Bridge & Iron Co., Elkhart, Ind., at $2,175.

★Oroville, Cal.—Contract for constructing concrete bridge over Butte Creek on State Highway awarded Edward Sharp, Chico, at $11,723.

★Red Bluff, Cal.—Contract for constructing three concrete bridges reported awarded by Co. Comrs. as follows: one 2000 ft. long, concrete girder arch type, 80-ft. span, to Ross Constr. Co., at $109,000; and two flat girder type bridges 50-ft. span to McClaren & Peterson, at $31,000.

PAVING AND ROADS

PROPOSED WORK

Wilmington, Del.—All bids have been rejected as opened Aug. 10 by Bd. Directors, Street and Sewer Dept. (H. C. Taylor, Secy.), for grading and excavating streets, constructing concrete foundations, concrete and brick gutters, sheet asphalt, asphaltic concrete, bitulithic, Warrenite, asphalt block and vitr. block pavements about 50,000 sq. yd. New bids to be called for.
City Council has authorized a bond issue of $200,000 for improvement of the streets throughout the city. This sum is the last of the $500,000 bond issue authorized some time ago for street work.

Accomack, Va.—Bonds for $30,000 road improvements in Atlantic, Lee and Pungoteague Magisterial Districts will be sold by John D. Grant, Jr., Clk. Co. Bd. Superv., Sept. 7.

South Boston, Va. — See "Water Works."

Gastonia, N. C.—Bonds will be sold Sept. 9 by A. J. Smith, Clk. Co. Comrs., for $150,000 road bonds.

New Bern, N. C.—County Comrs. voted to improve 22 miles Central Highway between Fort Barnwell and New Bern.

Roxboro, N. C.—Bonds for $15,000 street improvements will be sold by C. C. Cunningham, Clk.

Greenwood, S. C.—Bonds for $100,000 for street improvements also $35,000 for school improvements, will be sold Sept. 1 by Town Council, advertised in Engineering Record. J. Williams Watson, Town Clk.

Fort Myers, Fla.—A hard surface road is to be constructed between Fort Myers and Naples and a graded road from Naples to Marco. Citizens recently voted $177,500 bonds for this work.

Kissimmee, Fla.—Citizens voted $12,000 bonds for paving Main Street.

Montgomery, Ala.—City Comrs. will soon sell $152,000 paving bonds.

Russellville, Ala.—Citizens of Franklin County voted $145,000 bonds for building pike roads.

Columbus, Miss.—Reported Comrs. of Lamar County, Ala., and Lownes County, Miss., are considering building road from Columbus to Vernon, Ala.

Magnolia, Miss.—Bonds for $100,000 road improvements, Fourth Supervisor's Dist., will be sold Sept. 6 by Charles E. Brumfield, Clk. Co. Bd. Superv. For further information address Xavier A. Kramer, Engr., Magnolia.

Huntsville, Tenn. — Citizens of the county voted $300,000 road improvement bonds.

Rogersville, Tenn.—Bonds for $250,000 road improvements will be sold Sept. 6 by H. B. Stamps, Chmn. Co. Court.

Madisonville, Ky.—Fiscal Court adopted resolution appropriatinfi $50,000 to be used, provided route of Dixie Bee Line is selected through this county.

Columbus, Ohio.—County Comrs. have sold $100,500 road improvement bonds.

Hillsboro, Ohio.—See "Sewerage and Sewage Disposal."

Lisbon, Ohio.—Bonds for $45,000 will be sold Sept. 1 by Trus. of Elkrun Township (Horace Martin, Clk.), for improving Lisbon, Elkrun, Signal, Rogers and Lisbon Salineville roads.

Mount Vernon, Ohio—Bonds for $15,000 will be sold Aug. 30 by Walter M. Riley, Co. Aud., for improving Sect. H, Columbus-Wooster Road.

Uhrichville, Ohio.—Dawson Street paving bonds amounting to $25,000 sold.

Warren, Ohio—Bonds for $19,800 will be sold Oct. 2 by George T. Hecklinger, City Aud., for improving Homewood Avenue and East Franklin Street.

Woodsfield, Ohio.—Bonds for $20,000 road improvements will be sold Sept. 8 by County Commissioners.

Indianapolis, Ind.—Bd. Pub. Wks. has decided to resurface Capitol Avenue from Indiana Avenue to Tenth Street at a cost of $62,984.

New Albany, Ind.—Reported Co. Comrs. considering building 110 miles of good roads between New Albany and Indianapolis to connect with the Dixie Highway projected from Chicago to Miami, Fla.

New Albany, Ind.—County Engineer E. B. Coolman, has been directed to prepare plans and specifications for the rebuilding the New Albany and Paoli pike through Lafayette and Greenville Townships. Appropriation $41,000.

South Bend, Ind.—See "Bridges."

Chicago, Ill.—A. D. Gash, Pres. State Highway Comn., and George A. Quinlan, County Supt. of Highways, are co-operating on a plan to build at least 41 miles of concrete county roads in Cook County next year.

Edwardsville, Ill.—Proposed to pave with brick and Dolarway Buchanan Streets, to cost $4,500, and Randle Street $34,700, also Centre Street. Frank L. Nash, Clk. Council.

Jacksonville, Ill.—Bd. Local Improv. recommend paving of West St.; cost $50,000. City Council also reported to have voted to pave S. Main St.

Ida Grove, Iowa—Citizens voted $15,000 bonds for paving streets.

Anaconda, Mont.—Council reported to have decided to construct cement sidewalks on Oak, Sixth, Pine, Ash, Third, Park, Fifth and other streets.

Billings, Mont. — Council considering paving N. Twenty-eighth, N. Twenty-ninth and N. Thirtieth Streets, Sixth, Seventh, Eighth, Tenth and Eleventh Avenues with bitulithic on concrete base.

Bozeman, Mont.—Council reported to have adopted following paving resolutions: S. Bozeman Avenue paving, cost $12,000; Storey Street, cement sidewalks, curbs and parking, cost $10,000.

Pine Bluff, Ark.—County Comrs. reported considering building road 23 miles in length on north side of county connecting Sherrill, Tucker and Ferda with Pine Bluff.

McKinney, Tex.—Attorney General has approved issue of $200,000 bonds for County Road Dist. No. 8.

La Conner, Wash.—Council reported to have decided to improve First Street, from north line of Commercial Street to First Street, by paving, 32 ft. wide and construction of 9-ft. concrete sidewalks, curb, etc.; cost about $12,000.

Puyallup, Wash.—G. D. Ball, City Engr., estimates cost of grading and gravelling Fifth Street in Southwest Hill Dist. at $18,050.

Tacoma, Wash. — Reported contract soon to be let by Co. Comrs. for resurfacing Sumner-Buckley Road, 4 miles; approximate cost $30,000. Asphalt, bitulithic, bituminous macadam and bituconcrete under consideration. N. Norris, Co. Aud.

Vancouver, Wash.—Council reported to have passed ordinance for the improvement of Columbia Street by grading and construction of hard surface pavement, cement sidewalks and curb.

Walla Walla, Wash.—City Comrs. voted to pave Howard and Chestnut Streets, cost about $15,000.

Portland, Ore.—Reported Council passed favorably on petitions for hard surfacing Tacoma Avenue, between E Sixth and E. Seventeenth Streets, E. Sixth Street, between Tacoma and Spokane Avenues, and E. Ninth Street, from Tacoma to Spokane Avenue.
City Commissioners reported considering widening and extending of E. Burnside Street, from E. Forty-fourth to E. Sixty-ninth Streets, at a cost of $25,000.

Portland, Ore.—Plans and specifications reported filed with City Commission for paving E. Thirty-ninth and E. Kelly Streets; cost $18,000.

Berkeley, Cal.—Reported City Council plans extensive street improvements, costing, according to reports, about $1,000,000.

San Francisco, Cal.—F. J. Churchill, Secy. Bd Pub. Wks., writes first section of scenic boulevard around Twin Peaks is now being constructed at cost of $28,000. It will be paved with asphalt. The second portion will be constructed later.

BIDS DESIRED.

Boston, Mass.—Until Aug. 30 by Edw. F. Murphy, Comr. Pub. Wks., for furnishing and laying asphalt or bituithic pavement on portions of Rosewood St., Dorchester, and Mackin St., Brighton.

Massachusetts.—Until Aug. 31 by Massachusetts Highway Comn., Boston (William D. Sohier, Chmn.), for constructing sections of State highways in towns as follows:

Ware and Palmer, 13,000 ft.
Chelmsford, 5200 ft.

Catskill, N. Y.—Until Sept. 1 by Bd. Village Trus. (C. F. Travis, Pres.) for 3306 sq. yd. vitr. brick pavement in Upper Main Street. George H. Warner, Village Engr.

Farmingdale, L. I., N. Y.—Until Sept. 8 by James T. Hoile, Secy. Bd. Trus., 16 Court Street, Brooklyn, for constructing concrete walks for N. Y. State School of Agriculture at Farmingdale, advertised in Engineering Record. Lewis F. Pilcher, State Archt., Albany.

New York, N. Y.—Until Aug. 31, by Douglas Mathewson, Pres. Bronx Boro., for paving with bituminous concrete on a cement concrete foundation, portions of St. Lawrence and Haviland Avenues, 2185 sq. yd.; also for 50,800 sq. ft. concrete sidewalks with curbs, etc., on Haviland and Lyre Avenues, East 213th and Mead Streets, 21,600 cu. yd. earth excav., 17,350 cu. yd. rock excav.; also furnishing and delivering 1½-in. broken trap rock stone and broken trap rock stone screening.

Until Aug. 31 by Marcus M. Marks, Pres. Boro. Manhattan, for regulating and repaving portions of East Fiftieth, Exterior, West 104th, Madison, West Forty-ninth, West 212th Streets and Broadway, in all about 7080 sq. yd. granite block, 28,835 sq. yd sheet asphaltic.

Belleville, N. J.—Until Aug. 31 by the Bd. Town Comrs. for paving portions of Belmont and Overlook Avenues and Heckel Street. Bids desired on bituithic, asphalt block and appianite. Frank T. Shepard, Town Engr., Essex Building, Newark.

Jersey City, N. J.—Until Sept. 2 by Bd. City Comrs., for improving Columbia Avenue and paving with bituminous concrete Arlington Avenue. M. I. Fagen, City Clk.

Montclair, N. J.—Until Sept. 13 by Harry Tippett, Town Clk., for constructing 6-in. x 16-in. concrete curb set on concrete base and having metal corner bar, and resetting existing stone curb on concrete base, on either side of Valley Road, approximately 17,000 lin. ft. advertised in Engineering Record.

Newark, N. J.—Until Sept. 2 by Bd. Street and Water Comrs. (Morris R. Sherrerd, Ch. Engr.) for grading, curbing, flagging and paving, with asphalt, on a 6-in. concrete foundation, portions of North Twelfth Street, in all about 3400 sq. yd. pavt., etc.

Until Sept. 20, by Com. on Roads, Assessments and Speedways, Co. Bd. Chosen Freeholders, Newark, for improving Broad Street, town of Bloomfield; Wyoming Avenue, village of South Orange, town of West Orange, and Valley Road, town of Montclair. Frederick A. Reimer, Co. Engr.

Until Sept. 7, by Co. Bd. Chosen Freeholders, Newark, improving Central Avenue, town of East Orange, and Washington Avenue, town of Nutley.

New Brunswick, N. J.—Reported desired until Aug. 30, by Co. Bd. Chosen Freeholders, New Brunswick, for improving portion New Brunswick-Old Bridge turnpike, with bituminous concrete on present base, and Raritan Avenue with bituminous concrete pavement on concrete base. Alvin B. Fox, County Engr., Perth Amboy.

Harrisburg, Pa.—Reported desired until Aug. 30 by W. H. Lynch, Supt. Streets and Pub. Improv., for improving portions of ten streets requiring 8500 sq. yd. sheet asphalt, 4500 sq. yd. bituminous concrete paving, etc.

Marcus Hook, Pa.—Until Sept. 6 by Jesse Lownsbire, Pres. Boro. Council for approximately 7000 sq. yd. paving, 600 sq. yd. concrete gutter, etc., advertised in Engineering Record.

Philadelphia, Pa.—Until Aug. 31 by M. L. Cress, Dir. Dept. Pub. Wks. for improvements to highways as follows: Schedules A to M, William H. Connell, Ch. Bureau of Highways.

Schedule	Character of Work.	Estimated Cost
"A"	—grading	$42,400
"B"	—paving—asphalt	139,000
"C"	—paving—vitrified block	1,000
"D"	—paving—bituminous pavement	12,000
"E"	—repaving—asphalt	54,250
"F"	—repaving—vitrified block	8,600
"G"	—repaving—granite block	52,300
"H"	—repaving—wood block	31,300
"I"	—surfacing—waterbound macadam	52,800
"J"	—surfacing—bituminous macadam	15,210
"K"	—resurfacing—waterbound macadam	5,000
"L"	—resurfacing—bituminous macadam penetration	8,200
"M"	—improvement of Passyunk Avenue	60,000
		$475,000

Pittsburgh, Pa.—Until Aug. 31 by Hyatt M. Cribbs, Co. Controller, for furnishing the Road Dept. with 3000 tons asphaltic concrete mechanical mix along improved Coraopolis and Carnot Roads.

Until Sept. 9, same place as above for improving portions of Elkhorn and Monongahela City Road, a distance of 2.7 miles and Lincoln Way Extension 0.4 mile with brick, Round Hill Road 2.37 miles and Scotia Hollow Road 1.75 miles with macadam.

Denton, Md.—Until Sept. 21 by Co. Comrs., Denton (William H. Anderson, Clk.) for constructing section of State Aid Highway, along Marydel and Templeville Road, about 2.06 miles. Bids desired on shell macadam or concrete. Harry Waldorf, Road Engr.

Wilmington, Del. — See "Proposed Work."

Lake Charles, La.—Reported desired until Sept. 7 by Police Jury at Lake Charles (E. C. House, Clk.) for constructing 6½ miles gravel road south of Sulphur on Highway No. 6, and 5 miles south of Vinton on Highway No. 8.

Memphis, Tenn.—Until Aug. 31 at office of C. C. Pashby, City Clk., for furnishing material and laying on S. Main Street 9200 sq. yds. stone block, brick and other pavement, including sand cushion removed, 9200 sq. yds. creosoted wood block pavement, etc.

Nicholasville, Ky.—Until Sept. 7 by County Fiscal Court for constructing turnpike known as Thomas Beaumont Road, a distance of about 1½ miles. C. S. Woodward, Co. Road Engr., Nicholasville.

Columbus, Ohio. — Until Sept. 7 by George A. Borden, Dir. Public Service, Columbus, for paving Nelson Road and Rhoades Avenue, in connection with elimination of grade crossings along line of Norfolk & Western Ry.; also for portions of Heyl Avenue, by grading, draining, curbing and paving with asphalt or brick.

Grand Rapids, Ohio—Reported desired until Sept. 3 by Co. Comrs., Bowling Green, for constructing creosoted wood block floor and painting bridge over Maumee River, Grand Rapids. C. E. Stinebaugh, Co. Aud.

Lorain, Ohio.—Until Sept. 8 by Director Pub. Service (L. B. Johnston, Clk.) for grading, draining, curbing and paving with vitr. brick or asphalt E. Twenty-eighth Street, in all 15,700 sq. yd. pavement, 6000 cu. yd. excav., and 5000 lin. ft. curb, 5 x 21 in. C. M. Osborn, City Engr.

Portsmouth, Ohio. — Reported desired until Sept. 1 by County Comrs. for creosoted wood block paving on concrete foundation on Scioto River Bridge.

Shaker Heights, Ohio.—Until Sept. 7, by Carl L. Palmer, Village Clk., 2855 Coventry Road, Shaker Heights, for improving by curbing, grading, draining and paving with brick, concrete, asphalt or bituminous macadam, Manchester Road, from Coventry to South Woodland Road, together with sewers and water mains. B. W. Willard, Village Engr., 804 Marshall Bldg., Cleveland.

Toledo, Ohio.—Until Aug. 31 by Dir. Pub. Service (C. B. Nickels, Secy.), for improving portions of Droege, Macomber, Salem and several other streets. Bids desired on asphalt, vitr. brick, concrete, reinforced concrete, macadam or creosoted wood block pavement.

Mount Vernon, Ind.—By County Commissioners until Sept. 7 for constructing 2 gravel roads in Black Township, in all about 15,564 ft. Joseph R. Haines, County Aud.

Bloomington, Ill.—Until Aug. 31 by Bd. Local Improv. (E. E. Jones, Pres.), for repairing E. Second Street with two-course brick resurfaced with 1½ in asphalt advertised in Engineering Record.

Illinois.—Until Sept. 1 by State Highway Comn., Springfield, for constructing State aid work as follows (all cement to be furnished by State):

Kankakee County, Section E, brick type, Kanakee, nearest post office, approximate length 630 ft., Engineer's estimate $2,209.

Stephenson County, Section C, concrete type, Freeport nearest post office, approximate length 2690 ft., Engineer's estimate $2,771.

Peoria, Ill.—Until Aug. 30 by Bd. Local Improv. (Sherman W. Eckley, Pres.) for improving portions of Adams Street requiring about 8780 sq. yd brick pavement, 8780 sq. yd concrete foundation, 5240 lin. ft. sandstone curb, 2500 cu. yd. excavation, etc.

Green Bay, Wis.—Reported desired until Aug. 31 by George J. Cormier, Co. Highway Comr., Green Bay, for constructing about $1,000 sq. yd. concrete road between Green Bay and De Pere.

Until Aug. 30 by Com. on Streets and Bridges (F. Biemeret, Chmn.), for paving with reinforced concrete, Emilie Street from Jackson to Van Buren Streets.

Ellsworth, Kan.—See "Bridges."

Great Bend, Kan.—Until Sept. 1 by City Clerk, for constructing approximately 20,671 sq. yd. asphaltic concrete pavement, 9224 lin. ft. concrete combined curb and gutter and 7690 lin. ft. concrete curb. H. A. Howlan, Engr., McPherson.

Junction City, Kan.—Reported desired until Sept. 6 by County Comrs. (R. M. Moon, Clk.) for constructing 1 mile concrete road, 16 ft. wide. J. E. West, Co. Engr.

Olathe, Kan.—Until Aug. 30 by City Clerk for constructing approximately 3800 sq. yd. vertical fiber brick pavement. Roy Murray, City Engr.

Kansas City, Mo.—Until Aug. 31 by Bd. Pub. Wks. for paving Baltimore Avenue, Forty-fourth and Forty-seventh Streets with cement concrete; Mersington Avenue, asphaltic concrete, and an alley with vertical fiber vitr. brick.

Spokane, Wash.—Reported desired until Sept. 6 by City Comn. for paving in Dist. No. 4, S. First Avenue, from Court House to county bridge.

Stevenson, Wash.—Until Sept. 2 by Charles H. Nello, Co. Aud., for construction of Sect. 2 of Stevenson Carson Road, Skamania County. Work includes removal of rock. Estimated cost, $75,000.

Tacoma, Wash.—Reported desired until Sept. 10 by Thomas N. Morris, County Aud., for improving Permanent Highway No. 7, a distance of 3709 miles, to consist of grading, sub-grade and paving with asphalt, Warrenite, bituithic, bituminous macadam or bitucrete.

Los Angeles, Cal.—Until Sept. 7 by Bd. Superv. (H. J. Lelande, Clk.) for constructing an oil macadam road, including grading with reinforced concrete culvert, and all incidental work on certain streets in Road Improv. Dist. No. 86; also until Sept. 13, separate bids for improving portion of Palmdale-Lancaster Road in Road Dist. No. 5.

Oakland, Cal.—Until Sept. 7 by George E. Gross, Clk. Co. Bd. Superv., for grading and paving with bituithic pavement on a 4-in. base county roads from town line of Livermore to State Highway, Murray Road Dist.

Riverside, Cal.—Until Sept. 8 by Bd. Superv. (A. B. Pilch, Co. Clk.) for grading and paving with concrete 16 ft. wide and 4 in. thick 8.71 miles of Route No. 2 and a portion of Route No. 1 (Riverside to Scully property); also separate bids for 3.57 miles of Routes Nos. 13 and 14, Iowa Avenue from Eighth Street to county line, and Rialto Road from Riverside to county line.

Santa Barbara, Cal.—Reported desired until Sept. 7 by Bd. Superv. for improving about 1 mile of Santa Monica Road in Carpinteria Valley, First Road Dist., about 5259 ft.

Saint Maries, Idaho.—Reported desired until Sept. 3 by Charles R. Schulte, City Clk., for improving certain streets and avenues in Improvement Dist. Nos. 3 and 4, to consist of grading, curbing, cross walks, readjustment of waterpipes, sewer manholes, etc.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Portland, Me.—Following are four lowest bids opened Aug. 13 by Dept. Pub. Wks. for State Road on Auburn Street; prices given are on concrete and bituminous macadam respectively: M. B. Field, $1.10 and 98 cts.; Hassam Paving Co., Worcester, Mass., $1.17 and cost plus 10 per cent; Small & Ingalls, $1.16 and $1.09; Forgione & Romano, $1.27 and $1.25 (bidders of Portland unless otherwise stated).

Albany, N. Y.—Following are lowest bids opened Aug. 24 by State Highway Comn., 55 Lancaster Street, for construction of highways by State aid:

Road 1322, Genesee-Portville, Allegany Co., 7.29 miles: John H. Gordon, Albany, $71,127; Sullivan Constr. Co., Syracuse, $74,584; Greenfield Constr. Co., Hornell, $75,853; Bison City Eng. & Contr. Co., Inc., Buffalo, $77,301.

Road 5241-A, Binghamton - Windsor, Part 4, Broome Co., 3.15 miles: The Lane Constr. Corp., Meriden, Conn., $37,-832; F. P. Meckes, Long Pond, Pa., $38,-254; Port Jervis Constr. Co., Port Jervis, N. Y., $41,723.

Road 1305, Salamanca - Ellicottville, Part 1, Cattaraugus Co., 5.379 miles: Dunkirk Constr. Co., Dunkirk, $75,507.

Road 1310, Seeley Creek-Steuben Co. Line, Chemung Co. 4.02 miles: Sullivan Constr. Co., Syracuse, $40,537; Atlanta Constr. Co., Atlanta, $40,867; F. L. Breeze, Elmira, $41,371; E. W. Walsh, Elmira, $41,382.

Road 1311, Erin-Van Etten-Spencer, Part 1, Chemung Co., 6.87 miles: J. W. Brennan Constr. Co., Inc., Geneva, $78,-420; Peter F. Connelly Co., Horseheads, $78,800; Sullivan Constr. Co., Syracuse, $78,989; Weed & Walsh, Mechanicville, $82,091.

Road 5585, Earlville-Hamilton, Chenango-Madison Co., 6.18 miles: Conroy & Nixdorf, Oneida, $47,814; James Anderson, Menands, $50,472; Mondo Constr. Co., Inc., Syracuse, $50,554; Newport Constr. Co., Herkimer, $50,662.

Road 5574, Hudson City, Columbia Co., 1.17 miles: Belmar Contr. Co., Troy, $31,-786; F. L. Bannin Plumbing, Heating & Contr. Co., Kingston, $33,676; Marks Kearney, Hudson, $34,603; Russell Parker Const. Co., Hudson, $34,762.

Road 1162, Stonehouse - Stormville, Dutchess Co., 5.16 miles: Cairnie-St. George Co., New York, $51,750; DeGraafe & Hogeboom, Kingston, $51,985; Amos D. Bridges Sons, Inc., Hazardville, Conn., $52,066; Gruner & Hallenbeck, Harriman, $53,144.

Road 1163, Putnam Co. Line-Stonehouse, Dutchess Co., 6.18 miles: Ruddy-Saunders Constr. Co., Troy, $78,776; Amos D. Bridges Constr Co., Hazardville, Conn., $82,067; Cairnie-St. George Co., New York, $83,501; Stanley Constr. Co., Buffalo, $84,263.

Road 1235, Fishkill Plains-East Fishkill, Dutchess Co., 5.44 miles: Schunnemunk Constr. Co., Highland Mills, $52,327; S. B. Van Wagonen, Rondout, $53,303; Henry Clinton, Poughkeepsie, $54,572; Samuel Beskin, Beacon, $54,729.

Road 1312, Barrytown-Red Hook-Rock City, Dutchess Co., 6.81 miles: Ruddy-Saunders Constr. Co., Troy, $62,826; Marks Kearney, Hudson, $63,376; Amos D. Bridges Sons, Inc., Hazardville, Conn., $67,739; Juaniata Co., Philadelphia, Pa., $70,271.

Road 1313, Lafayetteville-Pine Plains-Winchell, Part 1, Dutchess Co., 6.86 miles: A. C. Steinberg, Jr., West Hartford, Conn., $64,341; James Anderson, Menands, $68,093; John J. Guinan Contr. Co., Brooklyn, $69,138; John De Michael & Bro., Torrington, Conn., $69,737.

Road 1314, Lafayetteville-Pine Plains-Winchell, Part 2, Dutchess Co., 5.37 miles: Amos D. Bridges Sons, Inc., Hazardville, Conn., $44,956; John Arborio, New Haven, Conn., $45,994; A. C. Steinberg, Jr., West Hartford, Conn., $46,887; Weed & Walsh, Mechanicville, $47,299.

Road 1304, Farnham Village, Commercial Street, Erie Co., 1.17 miles: Shaw & Lakin, Jamestown, $26,878; O. M. Severson, Erie, Pa., $27,736; Dunkirk Constr. Co., Dunkirk, 27,821; William C. Evans, Ambler, Pa., $28,431.

Road 5583, Cairo-Windham, Part 4, Greene Co., 4.77 miles: Catskill Constr. Co., Catskill, $43,833; S. V. Van Wagonen, Rondout, $43,552; Marks Kearney, Hudson, $45,980; George H. McEvoy, Creek Locks, $46,284.

Roads No. 1318 and 1319, Livingston and Monroe Cos., 1.88 miles: Bibstein-Holter Co., Inc., Rochester, $42,565 Whitmore-Rauber & Vicinius, Rochester, $43,-393; Charles O. McComb, Syracuse, $44,-660; Langan Constr. Co., Albany, $45,196.

Road 1321, Conesus-Wayland, Livingston Co., 8.34 miles: Albert Gaffey, Syracuse, $100,840; Atlanta Constr. Co., Atlanta, $109,477; P. H. Murray, Rochester, $116,432; J. M. Ludington Sons, Inc., Rochester, $120,191.

Road 5586, De Ruyter-New Woodstock, Madison Co., 7.91 miles: Sullivan Constr. Co., Syracuse, $64,126; Conroy & Nixdorf, Oneida, $65,491; Boutly & Summers, Huntingdon, Canada, $67,275; Mondo Constr. Co., Inc., Syracuse, $67,918.

Road 5539, Brockport - Spencerport, Monroe Co., 7.31 miles: Newport Constr. Co., Herkimer, $69,481; William H. Madden, Rochester, $70,704; Frank V. Brotsch Co., Rochester, $71,209; P. H. Murray, Rochester, $71,666.

Road 5581, Brockport Village, Main Street, Monroe Co., 0.14 mile: Morrison & Quinn, Inc., Rochester, $10,827; Dodge Constr. Co., Inc., Rochester, $11,160; Whitmore-Rauber & Vicinius, Rochester, $11,211; Public Service Constr. Co., Niagara Falls, $11,327.

Road 5576, Holcomb - Canandaigua, Ontario Co., 4.69 miles: Sweeney & Boland, Rochester, $2,641; Richard Hopkins, Troy, $2,849.

Road 5428, Spring Valley Village, Rockland Co., 0.99 mile: Paul Gsanger, Monsey, $5,371.

Road 5388, Suffern Village, Hillburn Village, Rockland Co., 2.16 miles: Hastings Pavement Co., New York, $15,200; John A. Jova, Inc., Newburgh, 18,995; Schunnemunk Constr Co., Highland Mills, $19,359; Paul Gsanger, Monsey, $20,721.

Bids received same time and place for repair of the following highways:

Repair Contract 850, Cayuga Co., 2.35 miles: Richard Hopkins, Troy, $13,287; J. H. Weidman, Syracuse, $13,374; M. J. Gleason, Syracuse, $13,634; Dana W. Robbins, Inc., New York, $13,987.

Contract 849, Cayuga Co., 3.14 miles: Richard Hopkins, Troy, $21,550; M. J. Gleason, Syracuse, $21,554; Semper Brothers, Watertown, $22,527; W. J. Young, Locke, $22,757.

Contract 846, Columbia Co., 3.81 miles: George Holler, Albany, $8,814; Thomas J. Martin, Beacon, $8,886; William Doyle, Saugerties, $9,135; Richard Hopkins, Troy, $9,578.

Contract 836, Fulton Co., 2.38 miles: Clarence Welch & Co., Gloversville, $12,-134; John P. Dugan & Co., Amsterdam, $12,497.

Contract 845, Nassau Co., 2.50 miles: Evergreen Constr. Co., Long Island City, $8,366; Delta Contr. Co., Inc., Jamaica, $9,146; William Doyle, Saugerties, $9,364; Murray & Gardner, Center Moriches, $9,-708.

Contract 842, Ontario Co., 0.60 mile: J. W. Brennan Constr. Co., Inc., Geneva, $12,284; Connors & Gallivan Co., Elmira, $12,436; Schroder - Hicks Contr. Co., Rochester, $12,632.

Contract 840, Ulster Co., 4.82 miles: John F. Gallivan, Kingston, $18,812; Blankfield & Donovan, Kingston, $20,441; Port Jervis Constr. Co., Port Jervis, $20,-759; L. F. Bannin Plumbing, Heating & Contr. Co., Kingston, $20,871.

Contract 851, Suffolk Co., 3 miles: Murray & Gardner, Inc., Center Moriches, $10,186; Teconic Constr. Co., Port Jervis, $11,880; Municipal Asphalt Co., New York, $9,125.

Long Island City, N. Y.—Lowest bid opened Aug. 19 by Maurice E. Connolly, Boro. Pres., for regulating and repaving with improved granite blocks on concrete foundation, Grand Street, Second Ward, submitted by Henry J. Mullen Contr. Co., Flushing, as follows: 4200 lin. ft. new bluestone curb, 80 cts.; 1210 cu. yd. concrete, $3.75; 8200 sq. yd. improved granite block pavt., including sand bed and bituminous grouted joints, $2.55; total, $28,808. Next three lowest bids: Charles A. Meyers Contr. Co., Brooklyn, $29,157; William J. Scanlon Co., 1 Union Square, New York, $29,244; Clancy & Nuhn Contr. Co., Long Island City, $29,895.

★**New York, N. Y.**—Contract awarded by President Borough of Manhattan to Sicilian Asphalt Paving Co., 41 Park Row, for sheet asphalt paving on Twenty-fifth, Fifty-fifth, Sixty-fourth, Sixty-seventh, Eightieth and Eighty-fifth Streets at a total of about $56,500.

★**Schenectady, N. Y.**—Contracts for paving reported awarded by Bd. Contract and Supply as follows: Watt Street, to Schenectady Contr. Co., Schenectady, at $1.38 per sq. yd.; total $14,641; Union Paving Co., Schenectady, Maplewood and Tenth Avenues, at $1.43 per sq. yd; total $17,997.

★**Syracuse, N. Y.**—Contract reported awarded Schenectady Paving Co., Schenectady, for paving Euclid Avenue at $7,598 and Pine Street, $8,850.

★**Philadelphia, Pa.**—Contract awarded by Dept. Pub. Wks. to McMahon Estate of Germantown for repaving Chelten Avenue at about $23,000. A new concrete foundation is to be laid.

Philadelphia, Pa.—Following are lowest bids opened Aug. 23 by Dept. Pub. Works, Bureau of Highways (W. H. Connell, Chief of Bureau):

Repair and patch asphalt pavement: Lowest bidder, Barber Asphalt Paving Co., Land Title Bldg., as follows: Furnish, deliver and lay asphalt binder course 250 tons, average price of $4.70 per ton; asphalt surface course 500 tons, $8.65 per ton; total, $5,535.

Repair and patch asphalt pavement: Low bidder, Barber Asphalt Paving Co., furnish, deliver and lay asphalt binder course 2500 tons, average price of $4.70 per ton; asphalt surface course 5000 tons, $8.65 per ton; total, $55,762.

★**Georgetown, Del.**—Contract for another section of the DuPont Boul., from Millsboro to Stockley, reported awarded Atlantic Bitulithic Co., Richmond, Va., at $46,057. Next three lowest bidders: Utilities Constr. Co., New Brunswick, N. J., $46,737; Pugh & Hubbard, Philadelphia, Pa., $47,888; and Juniata Paving Co., $48,749.

★**Cecilton, Md.**—Contract for constructing three mile stone road from Warwick to Cecilton awarded by County Comrs. to Juniata Paving Co., Philadelphia, Pa., at $37,000.

★**Charleston, W. Va.**—Contract for paving 11 blocks with asphaltic concrete awarded R. M. Hudson & Co., Atlanta, Ga., at $2.05 to $2.27 per sq. yd.

★**Huntington, W. Va.**—Contracts reported awarded as follows by County Court for grading about 5 to 6 miles at a cost of about $15,000: To U. G. Shipe, Barboursville; Hatfield Constr. Co., Huntington, and Mumow & Ross, Huntington.

★**Clearwater, Fla.**—Citizens Aug. 18 voted $715,000 bonds for building 78 miles of brick highway, contract for which was awarded in July to Edwards Constr. Co. of Tampa.

★**Tampa, Fla.**—Contract for 1½ miles of shell road at Indian Rocks awarded Tampa Sand & Shell Co.

★**Waverly, Tenn.**—County Good Roads Comn. awarded contract for 200 miles of roads to Oliver Hill Co. of Knoxville.

★**Whitesburg, Ky.**—Contract reported awarded by Fiscal Court to M. A. Wheeler at $42,000 for grading and draining the road from Whitesburg to Corbin, 18 miles.

★**Williamsburg, Ky.**—Contract for constructing 18 miles of macadam pike roads between this city and Corbin, Ky., reported awarded M. A. Wheeler, High Cliff, Tenn. H. F. Davis, Co. Road Engr.

★**Bowling Green, Ohio**—Contract awarded Aug. 16 by County Comrs. for grading, draining and macadamizing roads as follows: Snell Road to N. L. Deckard, Bowling Green, $8,943; Minning Road to Otto Brough, Genoa, $8,611; Kearning Joint Road to Thomas Constr. Co., Sandusky, $8,994. C. E. Stinebaugh, Co. Aud.

★**Cincinnati, Ohio**—Contract for improving Morgan Street with brick, reported awarded by Bd. Control to Hennkel & Sullivan, 71 Mercantile Library Bldg., at $9,378.

★Contract awarded by Bd. Pub. Service (Parke S. Johnson, Secy.), to Kirchner Constr. Co., Cincinnati, for improving Rittenhouse Street, by grading, curbing and paving with asphalt, constructing necessary drains and inlets and laying 6-in. water mains at $8,755.

★Contract awarded Aug. 3 by Bd. Pub. Service for paving Herbert Avenue with bituminous macadam to Henkel & Sullivan, Cincinnati, at $5,549.

Logan, Ohio—Following are three bids opened Aug. 11 by Bd. Pub. Service for paving Second Street: Edward Radebaugh, $27,741; Houston & Henderson, $26,259; Barthlow & Son, $25,379.

★**Toledo, Ohio**—Contract awarded by city to Navarre, Harris & Tansey for paving Miami Street at $15,523.

Zanesville, Ohio.—Ayers & Kappes, Zanesville, submitted lowest bid for improving Adamsonville Road, at $128,855 for limestone with tar bituminous treatment.

★**Gary, Ind.**—Contracts for paving awarded by Bd. of Works as follows: To M. D. Heiny, Gary, for resurfacing Washington Street with 3-in. course granite asphalt macadam, at $6,888, and to Gray Constr. Co., Gary, for paving Seventh Street, 3116 sq. yd. 3-in. lug block pavt. on 6-in. concrete base, $2.20 per sq. yd.; 460 sq. yd. concrete pavt., $1.32; 552.7 cu. yd. grading, 50 cts.; 10 gutter inlets, ea. $15; total $8,012.

★**South Bend, Ind.**—Contract awarded Aug. 16 for constructing concrete road in Penn Township to Talur Hullihan & Lynn Bros., Wabash, at $53,936. C. Sedgwick, Co. Aud.

★**Howell, Mich.**—Contract awarded Aug. 17 for paving a portion of Grand River Street, to William H. Ryan, Lansing, for Metropolitan block on concrete foundation, with cement fill at $25,379. Next 3 lowest bids: Victor Sager, Saginaw, $24,652; Harry Vanderveen, Grand Rapids, $25,089; Marsman & Green, Grand Rapids, $26,558. George Champe, Engr., Toledo.

Chicago, Ill.—Following reported to be bids opened Aug. 11 by Bd. Local Improv. for 90,000 sq. yd. paving: American Asphalt Paving Co., $1.75 to $1.81 per sq. yd.; R. F. Conway Co., $1.71 to $1.85; White Paving Co., $1.89 to $1.95; Barber Asphalt Paving Co., $1.91 to $1.99.

★**Champaign, Ill.**—Contract awarded Aug. 17 by Bd. Local Improv. for 11,200 sq. yd. brick pavement to Stipes & Pilcher, Champaign, at $33,000. F. C. Lohman, City Engr.

★**Chicago, Ill.**—Contracts awarded Conway Paving Co. for 40,000 sq. yd. paving, and to American Asphalt Paving Co., 133 W. Washington St., for 55,000 yd. Prices ranged from $1.71 to $1.73 per sq. yd.

Illinois.—Following are 4 lowest bids opened Aug. 18 by State Highway Comr., Springfield, for State Aid Work, 7833 ft. in length (all cement to be furnished by State). L. W. Nelson, Pontiac, $15,600; Charles Upham, Odell, $15,676; Grohne Constr. Co., Joliet, $16,840; John E. Bretz, Springfield, $17,000.

★**Kankakee, Ill.**—Contract for paving with brick on N. Fifth Avenue awarded by Bd. Local Improv. to F. L. Shidler, at $17,944.

★**Peoria, Ill.**—Contract for paving with brick a portion of Frye Avenue awarded A. D. Thompson Co., Peoria; estimated cost $14,321.

★**Lincoln, Neb.**—Contract for paving Sheridan Boulevard awarded by County Comrs. on bids opened Aug. 14 to Abel & Roberts, Lincoln. They bid for 23,231 sq. yd. 4-in. repressed brick block $2.18; or 23,231 sq. yd. 3-in. vertical fiber brick $1.90; 17,945 sq. yd. asphaltic concrete, $1.71; 19,032 lin. ft. 6 x 20-in. concrete curb, 54 cts.; 19,032 lin. ft. 36-in. combined curb and gutter, 87 cts., and 9000 cu. yd. extra grading, 31 cts.; total $63,765, $57,260 or $50,120 respectively. Totals of other bids—(a) repressed block, (b) 3-in. vertical fiber, (c) asphaltic concrete: Robert Malone, Jr., Lincoln, (a) $64,069. (b) $58,767, (c) $56,517; Burke-Cockran Co., Lincoln, (a) $64,949, (b) $57,980, (c) $51,403. Arthur H. Edgren, County Engr.

★**Lincoln, Neb.**—Contract for paving South Street from city limits to Normal, a distance of two miles, awarded Burke Cochrane Co., Lincoln. They bid $1.89 for brick or $1.71 for asphaltic concrete.

★Contract for paving Sheridan Boule. from city limits to College View, awarded Abel & Roberts, Lincoln. They bid for asphaltic concrete $50,120, and for brick blocks about $13,000 higher.

★**Bozeman, Mont.**—Contract awarded by city to Warren Constr. Co., Portland, Ore., for paving and sidewalk contracts as follows: Dist. 94, for grading and paving Koch Street; Dist. 96, sidewalks, curbs and pavement, East Main Street, and Dist. 97, paving Dickerson Street, at a total of $13,531.

★**Dallas, Tex.**—Contract for paving with Uvalde rock asphalt portions of Davis, Haines and Candy Streets awarded Standard Eng. & Constr. Co. at about $35,000, and for paving Fitzhugh Street awarded Texas Bitulithic Co. at $11,854.

★**Bellingham, Wash.**—Contract for asphalt paving on D Street, 7635 sq. yd., awarded to J. Lich, Bellingham, representing Washington Paving Co., Savage-Scofield Building, Tacoma, at $9,384.

★**Colfax, Wash.**—Contract for grading, draining and bridging 11½ miles permanent highway between Colfax and Pullman awarded by Co. Comrs. to W. G. Mulligan & Co., Spokane, at $20,800. Other bids: G. L. Stickler, Davenport, $21,079; Mitchell Bros., Spokane, $22,510; Carlson, Chindahl & Anderson, Spokane, $23,520. J. M. McCaw, Co. Engr.

Seattle, Wash.—Following are lowest bids opened by Bd. Pub. Wks. (L. B. Young, Chmn.) Aug. 13 for paving: Sixteenth Avenue South, P. J. McHugh; Third Avenue North and Mercer Street, $13,572; also Fifth Avenue North, $15,539, and F. McLellan, Globe Block, for Valley Street paving at $29,680.

★Contract for concrete walks on East Forty-fourth Street reported awarded D. H. Traphagen, Alaska Bldg., Seattle, at $11,591.

★**Tacoma, Wash.**—Contract for paving South O Street from Sixth Avenue to South Eleventh Street awarded to McHugh Contr. Co., Tacoma, at $9,989.

Following are unit prices of Washington Paving Co., Tacoma, successful bidder for permanent highway No. 5-A (bids opened Aug. 14 by Co. Comrs.): Excav., including 400 ft. F. H. per cu. yd., 40 cts.; overhaul, over 400 ft., per cu. yd. per 100 ft., 2 cts.; backfill, per cu. yd., 25 cts.; plain concrete, per cu. yd., $6.50; triangle mesh in place, per 100 sq. ft., $4; headwalls, per lin. ft., $1; armor metal, per lin. ft., 15 cts.; headers, per lin. ft., 30 cts.; 2-in. bitulithic paving, including 5-in. base, $1.65; concrete curb, per lin. ft., 10 cts.; monuments in place, ea. $7; gravel shoulders, per cu. yd., $1.25; concrete pipe in place, per lin. ft., 24-in. diameter, $1.75; 21-in., $1.50; 18-in., $1.35; 12-in., 90 cts.; total $76,549. Totals of other bids on 2-in. bitulithic, 5-in. base: Warren Constr. Co., Portland, Ore., $82,230; Erickson & Anderson, Puyallup, $86,000. Engineer's estimate $88,104.

★**Washington.**—Following are unit prices of Rajotte, Fobert & Winters, of Olympia, successful bidders, for improving McClellan Pass highway, Yakima County, from Naches to Summit (bids opened Aug. 9 by State Highway Comn. at Olympia):

38,160 cu. yd. common excav., inc. haul of 400 ft.	$0.18
37,330 cu. yd. loose rock excav., inc. haul of 400 ft.	0.30
6210 cu. yd. solid rock excav., inc. haul of 400 ft.	0.80
2150 cu. yd. overhaul on any of above materials, per each 100 ft.	0.01
4.4 acres clearing	50.00
2.5 acres grubbing	50.00
700 cu. yd. rip rap, hand placed	1.00
1350 cu. yd slope wall	1.00
rubble masonry, per cu. yd	2.50
concrete, first class, per cu. yd.	15.00
concrete, second class, per cu. yd.	12.50
Steel reinforcing bars in place, per lb.	0.06
Guard rail in place, incl. spikes and bolts, per lin. ft.	0.50
Timber and plank in place, inc. spikes and bolts per M ft.	40.00
922 lin. ft. plain concrete, 12 in. diam.	1.20
232 lin. ft. plain concrete, 18 in. diam.	2.40
Reinforced concrete, 18 in. diam, per ft.	3.40
64 lin. ft. reinforced concrete, 24 in. diam., per ft.	4.25
27 lin. ft. reinforced concrete, 30 in. diam., per ft.	5.50
Reinforced concrete, 36 in. diam., per ft.	8.00
Total	$27,536

Portland, Ore.—Lowest bid opened Aug. 11 for resurfacing Washington Street, from Twentieth Street to Washington Park, was submitted by Oregon Independent Paving Co. at 84 cts. per sq. yd.; total $8,782.

★**Montreal, Que.**—Bd. Control awarded contract for about 300,000 sq. yd. asphalted macadam pavt. to Aztec Oil & Asphalt Refining Co. of Canada at $65,651.

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS

PROPOSED WORK

Drain—Buffalo, N. Y.—There is reported to be a movement on foot looking to building a drain in Scayaquada Creek. Capt. George H. Norton, Acting Comr. Pub. Wks.

Retaining Wall—Buffalo, N. Y.—Mayor Fuhrmann signed resolution authorizing bond issue of $50,000 for a retaining wall on Bird Island at foot of Ferry St.

Water Power Plant—Oswego, N. Y.—Committee reported appointed by City Council to engage engineer to prepare plans and supervise construction of water power plant at High Dam on Oswego River.

Jetty Work—Atlantic City, N. J.—Beach front property owners at a recent conference with Mayor Riddle agreed upon erecting two jetties at Iowa and Boston Avenues for protection of the Chelsea Strand.

Dam—Duncannon, Pa.—Frank M. Waring, Tyrone, and R. J. Redick, York, reported interested in construction of a dam across Juniata River, four miles above Duncannon, to be used to operate mill for manufacture of felt roofing paper, etc.

Bulkhead Work—Philadelphia, Pa.—Lowest bid opened by Director Dept. Wharves, Docks and Ferries, for bulkheading banks of Schuylkill River, reported sumbitted by Edwin H. Vare, Betz Bldg., at $65,966.

Steel Pier Work—Philadelphia, Pa.—Contract will probably be let this fall by Dept. Docks and Ferries (Charles W. Staniford, Ch. Engr.) for steel work on pier at West Forty-sixth Street, North River.

Ditch—Defiance, Ohio—County Comrs. reported to have ordered sale of $48,000 bonds for constructing Lost Creek ditch.

Hydro-Electric — Midland, Mich.—Surveys and preliminary work reported completed for hydro-electric development for Tittabawassee Power Co. First dam when completed, it is said, will develop 12,000 hp. Frank I. Wixom, Manager.

Dam—Shawano, Wis.—Electric Light and Water Works Comn. favor calling election to vote on constructing dam on Wolf River to furnish power for electric light plant and water works.

Drainage—Des Moines, Iowa.—Bd. of County Supervisors reported considering construction of drainage system through Polk, Story and Jasper counties.

Drain — Mount Ayr, Iowa.—Ringgold County Board of Supervisors reported to have adopted resolution of necessity providing for drainage of 7952 acres of Platte River.

Drainage—Wichita, Kan.—A Committee including J. J. Jones and A. E. Munch of Wichita, will have charge of forming a company to drain the Big Slough west and south of Wichita; cost $25,000.

Drainage—Bay City, Tex.—Co. Comrs. reported to have engaged E. N. Gustafson as engineer for Drainage District 6 and he will make preliminary surveys for the proposed drainage district which comprises about 10,000 acres.

Drainage—Houston, Tex.—State Attorney General has approved issue of $140,000 Harris County Drainage bonds of Dist. No. 7, northeast of Houston, and includes Humble, Westcott, North Hauston and Aldine. Bonds will be sold at once and proceeds used to drain county in that section.

Irrigation—North Yakima, Wash.—L. O. Janeck and S. D. Saunders, representing the Pomona Heights Irrigation Dist., reported to have filed petition in Superior Court for permission to issue $300,000 bonds.

Canal—Selah, Wash.—Directors of the Selah Canal Co. (W. B. Armstrong, Supt.) reported to have ordered an assessment levied to total $30,000; money to be spent for new steel flumes, concrete ditch work, general repairs, etc.

Wenatchee, Wash.—Reported Directors of Wenatchee Reclamation Dist., preparing to submit to the water users of district, whether $500,000 bonds shall be issued to provide funds for an irrigation system to repair present system, etc.

Irrigation—Anderson, Cal.—H. H. Henderson, Chief Engr. of Anderson-Cottonwood Irrigation Dist., reported to have completed plans and specifications for construction of irrigation system, for which $480,000 bonds have been voted.

Irrigation — Porterville, Cal.—Property owners of the Deer Creek District reported to have approved plans for organization of Deer Creek irrigation district to water upward of 15,000 acres of foothill citrus lands, at cost of about $1,000,000. T. M. Gronen and D. M. Stanley are among directors. Stephen E. Kieffer of San Francisco engineer of construction work.

Irrigation—Terra Bella, Cal.—Citizens of Terra Bella section of Tulare County reported to have formed Terra Bella Irrigation District, including many thousands of acres. Water will be impounded by dam across Deer Creek; project will cost approximately $1,000,000. Directors include T. M. Gronen and J. H. Roder.

Ditch—Phoenix, Ariz.—J. B. Girand, City Engr., completed plans for removal of town ditch which call for carrying ditch under Van Buren Street from Seventh Street to Seventh Avenue, 5400 ft.; three different types of construction are called for in the plans. One calls for concrete conduit, 7 ft. diam., covered 4 ft.; another calls for an ingot iron conduit and the third for wood stave conduit.

Dams—Phoenix, Ariz.—James B. Girand, City Engr., reported to have announced that the Dept. of Interior has granted permission to conduct preliminary operations in connection with establishment of 6 dams, reservoir and power sites, in the Grand Canyon of Arizona, by which it is planned to develop in excess of 400,000 hp. of hydroelectric energy from the waters of the Colorado River. It is proposed to furnish power for railroads in the mountains and mines of the state.

Hydro-Electric Plant—Palmerston, Ont.—City Council reported to have engaged engineer to prepare plans for construction of hydro-electric power plant and distribution system; cost about $75,000.

Pier—Panama.—Engineer of Docks has been directed to prepare estimates of cost of constructing additional 1000-ft. pier at Cristobal, designated as No. 6, on site to northward of Pier 7, toward sea end of

mole from which Piers 7 and 8 extend. Engineer will also prepare estimates of cost of replacing timber Pier 11 and its extension, adjoining east end of Pier 10, with reinforced concrete construction.

BIDS DESIRED.

Shore Protection—Boston, Mass.—Until Aug. 21 by Metropolitan Park Comm., Boston. Cohn B. Rabkin, Engr., for building concrete shore protection from Bath House Shelter to Revere Beach Shelter, Revere Beach Reservation, Revere.

Dredging—Taunton, Mass.—Until Sept. 1 by County Comrs. for dredging and removing bar between old span of old Bedford bridge and the Fairhaven End.

Breakwater—Buffalo, N. Y.—Until Sept. 1 at U. S. Engrs. Office, Buffalo, for furnishing and placing riprap and repairing concrete superstructure of Buffalo breakwater.

Retaining Wall—Washington, D. C.—Until Sept. 20 by Public Buildings and Grounds, Washington, D. C., for constructing retaining wall along west side of Meridian Hill Park, advertised in Engineering Record.

Drainage—Goldsboro, N. C.—Until Sept. 1 by W. W. Peirce, attorney, Goldsboro, for dredging canal 20½ miles, 5 miles open ditches, 2,459 cu. yd. to be excavated, and rights-of-way to be cleared. Contractor must handle bond issue. Cost about $62,150. Engineer, W. K. Allen, Wilmington.

Levees—Alexandria, La.—Reported desired until Sept. 10 by Red River, Atchafalaya and Bayou Boeuf Levee Bd. (H. B. Gist, Secy., Alexandria) for constructing levees as follows: White Place to Wilson Point, 140,000 cu. yd.; Simmsport to Deer Range, 130,000 cu. yd.; Alto Crevasse to Crooked Bayou, 325,000 cu. yd.

Seawall—Waveland, Miss.—Reported desired until Sept. 1 by Bd. Seawall Comrs., Dist. No. 1, Bay St. Louis (Charles W. Shepard, Secy.) for constructing seawall along beach at Waveland, about 8000 ft. long.

Dredging—Norfolk, Va.—Until Sept. 23 by U. S. Engineer's Office, Norfolk, for dredging and rock excavation in James River, Va., advertised in Engineering Record.

Operating Machinery at Dam—Cincinnati, O.—Until Sept. 24 by U. S. Engineer Office, Cincinnati, for furnishing and installing operating machinery, etc., at Dam No. 29, Ohio River, advertised in Engineering Record.

Ditch—Des Moines, Iowa.—Until Sept. 1 by F. J. Alber, Co. Aud., for constructing Drainage Ditch No 17, Clay Township, being a tile drain, approximately 3500 ft. long.

Ditch — Breckenridge, Minn. — Until Sept. 14 (readvertisement), by P. E. Truax, Co. Aud. for constructing ditch No. 6, estimated cost, $12,364.

Ditch—Moorhead, Minn.—Reported desired until Aug. 31 by A. O. Houghium, Co. Aud., for constructing Ditches 34 and 31 (suitable for small floating dredge). Total probable cost $9,696.

Ditch—Morris, Minn.—Reported desired until Sept. 7 by E. R. Wollcham, Co. Aud., for county ditch No. 15, requiring about 274,000 cu. yd. excav.

Ditch Work—Roseau, Minn.—Reported desired until Sept. 3, Edward E. Bertilliud, Co. Aud., for Judicial Ditch No. 61, estimated to cost $315,487, and includes 2,453,-700 cu. yds. excav., 454 acres right of way clearing 153 miles road leveling, 52 highway bridges and 459 corrugated metal culverts. George A. Ralph, Engr. in Charge, 16 Fulton Blk., St. Paul.

Concrete Wall—Kansas City, Kan.—Until Sept. 3 by Bd. Dir. Kaw Valley Drainage Dist. (P. J. Broll, Secy.), Osage Avenue, Kansas City, for constructing 3990 cu. yd. reinforced concrete wall on west bank of Kansas River, from Central Avenue to south line of Kansas Avenue.

Irrigation Work—Newell, S. D.—Until Sept. 16 by U. S. Reclamation Service, Newell, for constructing approximately 22½ lin. ft. 6-in. wood stave pipe for Belle Fourche Project, South Dakota, advertised in Engineering Record.

Irrigation Work—Malta, Mont.—Until Sept. 28 by U. S. Reclamation Service, for earthwork and structures Bowdoin Canal, Milk River Project, advertised in Engineering Record. Work involves about 215,000 cu. yd. excav., 450 cu. yd. reinforced concrete, 420 sq. yd. dry paving, passing about 36,000 lb. steel reinforcement, and placing in wooden structures about 12 M ft. lumber.

Reclamation Work—Malta, Mont.—Until Sept. 15, at office of U. S. Reclamation Service, for pipe line Nelson Reservoir south canal, Milk River Project, involving about 25,000 cu. yd. excav., 1700 cu. yd. concrete, passing 150,000 lb. steel reinforcement, erection of 450 lin. ft. metal flume and about 85 M. ft. lumber. Work situated in vicinity of Saco and Beaverton, Mont., on Great Northern Ry.

Revetment Work—Hartsburg, Mo.—Until Sept. 26 by U. S. Engineer's Office, Kansas City, for about 12,000 ft. standard revetment on Missouri River about two miles from Hartsburg, advertised in Engineering Record.

Dikes, Etc.—Cathlamet, Wash.—Reported desired until Oct. 1, Bd. Comrs. Diking Dist. No. 1 (A. W. Lundquist, Secy.), for constructing system of dikes, including automatic tide gates, pumping station, etc. G. A. Kyle, Engr., Spalding Building, Portland, Ore.

Canal Work—Twin Falls, Idaho.—About Sept. 1 by J. C. Porterfield, Gen. Mgr. Twin Falls Canal Co., for constructing canal, from 25 to 6 ft. wide, 35 miles long, to carry 6 ft. of water at upper end, canal to widen, banks to raise. Bids will be received for both dredge and dry work. W. O. Taylor, Secy.

Dredging — Fort William, Ont.—Until Aug. 21 by R. C. Desrochers, Secy. Dept. Pub. Wks., Ottawa, for dredging required at mouth of Kaministiquia River, Fort William.

PRICES AND LETTINGS.

★Indicates award of contract.

Dredging—Portland, Me.—Following are bids for dredging in St. Croix River, opened Aug. 16, by Maj. F. A. Pope, Corps Engrs., U. S. A. (price given per cu. yd.): Eastern Dredging Co., East Boston, Mass., 53.83 cts.; Coastwise Dredging Co., Norfolk, Va., 54.25 cts.; John H. Gerrish, Boston, Mass., 54.7 cts.; J. S. Packard Dredging Co., Providence, R. I., 66.9 cts; Bay State Dredging Co., Ltd., Boston, Mass., 59 cts.

★Dam—Manchester, N. H.—Contract reported awarded by Manchester Traction, Light & Power Co. to H. Wales-Lines Co., Meriden, Conn., for constructing concrete dam, including spillway across Piscataquog River.

★Dredging—Boston, Mass. — Contract awarded by Directors Fort Boston to J. P. O'Riorden, Charlestown, for dredging 37,300 cu. yd. material from Mystic River (bids opened Aug. 11) at 11⅛ cts. per cu. yd.; total $4,149

★State Canal Work—Albany, N. Y.—Contract reported awarded by W. W. Wetherspoon, State Supt. Pub. Wks., Albany, for Terminal Contract No. 37, constructing a harbor and dockwall on the south side of the Mohawk River, near the outlet of Canajoharie Creek at Canajoharie, to Holler & Shepard of Rochester, at $32,572.

Lowest bid for Contract 46 submitted by Scott Bros., Rome, at $13,658.

★Dredging—Huntington, L. I., N. Y.—Contract reported awarded to P. Sanford Ross, Jersey City, N. J., for dredging in Hempstead and Huntington Harbors, at $15,000.

Jetty Work—Atlantic City, N. J.—Lowest bid opened Aug. 19 by City Comn. for lengthening jetty at foot of Tennessee Avenue by 250 ft. reported submitted by Atlantic City Constr. & Supply Co., at $13,427.

Dredging, Etc.—Philadelphia, Pa.—Following are bids opened Aug. 16 by Dept. of Wharves, Docks and Ferries (John Meigs, Dir.) for dredging in Delaware River Channel opposite Port Richmond coal piers—(a) channel 300 ft. wide and 30 ft. deep, 212,000 cu. yd., per cu. yd.; (b) channel 400 ft. wide and 30 ft. deep, 295,000 cu. yd.; (c) channel 500 ft. wide and 30 ft. deep, 378,000 cu. yd.: Bowers Southern Dredging Co., Galveston, (a, b and c) 27.45 cts. (lowest bidder); American Dredging Co., Philadelphia, (a, b and c) 28.7 cts.; Maryland Dredging Co., Baltimore, Md., (a, b and c) 29.5 cts. Contract will not be awarded until late in September, as additional city legislation will be required to allow contractor to deposit material outside city limits.

★Dredging—Norfolk, Va.—Contract reported awarded by U. S. Engineer, Norfolk, for dredging Inland Waterway from Norfolk, Va., to Beaufort, N. C., to P. Sanford Ross, Inc., Jersey City, N. J., at 14 cts. per cu. yd.; cost about $119,000 (bids opened Aug. 4).

★Retaining Wall—Richmond, Va.—Contract reported awarded by City Administrative Board to Saville & Claiborne for constructing concrete retaining wall and building covered flume over dock from Fourteenth Street to Seventeenth Street. This is the first step in the widening of Dock St.; estimated cost of improvement about $55,000.

★Ditch—Maysville, Ga.—Contract reported awarded by Comrs. of Grove River Dist. to Thompson & Mosley, Greensboro, N. C., for constructing ditch on Grove River and Hickory Level Creek at $21,300.

★Sand Fill—Hillsboro, Fla.—Contract for construction of sand fill at Hillsboro Inlet light station, in Florida, reported awarded to W. W. Lee & Son, of Miami, at 75 cts. per cu. yd.; total, $9,873.

★Levee Work—Greenville, Miss.—Contracts awarded for levee work (bids opened Aug. 17) by Mississippi Levee Comn. (W. L. Thompson, Ch. Engr.) as follows: 486,000 cu. yd. levee enlargement (earth), to R. T Clark & Co., Natchez, 17.05 cts.; 43,000 cu. yd. levee enlargement (earth), to J. A. Burt, Bond & McMurray, Beulah, 14 cts.; 200,000 cu. yd. new levee (earth), to W. T. & E. M. Lowrance & Co., Memphis, Tenn., 14.89 cts., and also to Lowrance Bros., day force contract for repair work on the levee at $4.90 per team per day.

★Temporary Bulkhead—Philadelphia, Pa.—Following are bids opened by Dept. Wharves, Docks and Ferries Aug. 16 for constructing temporary bulkhead, Schuylkill River: (a) J. E. Brennen, 1523 S. Front Street, Philadelphia, $87,212; (b) Peoples Bros., Twenty-fifth and Callowhill Streets, Philadelphia, $83,585; (c) Pugh & Hubbard Co., Witherspoon Building, Philadelphia, $67,015; (d) E. H. Vare, Lincoln Building, Philadelphia, $65,966 (awarded contract).

	(a)	(b)	(c)	*(d)
800 bearing piles	$12.70	$10.50	$8.88	$10.00
1,600 batter piles	12.90	16.00	10.99	10.66
50 pile shoes	1.70	1.00	1.25	1.50
4,000 6-in. shore piles	12.45	10.95	9.42	9.00
67 M ft. yellow pine timber	82.50	45.00	55.00	65.00
4,000 galvanized iron caps	0.14	0.50	0.15	0.10
800 galvanized iron caps, piles	0.55	0.90	0.37½	0.22
Total unit price	21.80	20.90	16.75	16.49

★Drainage — Selmer, Tenn. — Contract awarded by Directors Cypress Creek Drainage Dist. to Swamp Dredge Co., Tupelo, Miss., for constructing canal at 8¼ cts. per cu. yd. First section 11,400 ft. long with cross section of 18 x 12 x 6 ft. Second section, 10,900 ft. long with cross section of 20 x 13 x 7 ft. H. P. Wood, Attorney for Dist. Other bids per cu. yd.: Southern Drainage Co., Paragould, Ark., 9¾ cts. per yd.; N. C. McGinnis & Co., Memphis, 9.38 cts. per yd.

★Ditch — Richmond, Ind. — Contract awarded by Co. Comrs. to Horton & Moseley, Marquette Bldg., Chicago, Ill., for constructing Nettle Crek ditch, about 6½ miles in length, about 176,600 cu. yd. dredge work at $11,390 (bids opened Aug. 5). Other bids: Henry P. Johnson, Sterling, Ill., $12,330; Clyde A. Walb, La Grange, $12,708; Marbaugh Bros., Monterey, $12,360; T. F. Foohey Dredging Co., Ft. Wayne, $12,360. L. C. Peacock, Co. Surveyor.

★Breakwater — Conneaut, Ohio.—Contract reported awarded to the Coast & Lakes Contr. Cor., Cleveland, for constructing pier head and rubble mound breakwater at Conneaut Harbor, at $99,-007 (bids opened July 30).

★Dredging — Chicago, Ill.—Bids were opened Aug. 17 by U. S. Engineer for dredging in Calumet River, and the bid of the Fitz-Simons & Connell Dredge & Dock Co., Chicago, recommended for acceptance, at 14.4 cts. per cu. yd. for dredging in channel (Section 1), 100,000 cu. yd.; in turning basin (Section 2), 10,900 cu. yd.; in channel (Section 3), 27,500 cu. yd.; in channel (Section 4), 81,400 cu. yd.; total cost, $31,651. Other bids—(a) per cu. yd., (b) total: Great Lakes Dredge & Dock Co., Chicago, (a) 16.45 cts., (b) $36,157; Byrne Bros. Dredging & Eng. Co., Chicago, (a) 17 cts., (b) $37,366; Duluth-Superior Dredging Co., Duluth, Minn., (a) 22 cts., (b) $48,356; Greiling Bros. Co., Green Bay, Wis., (a) 21 cts., (b) $54,263.

Lake Shore Protection—Evanston, Ill.—Following are lowest bids opened Aug. 16 by John H. Moore, Comr. Pub. Wks., for lake shore protection work, including construction of 18 wooden piers of crib pattern, with alternative bids for constructing 18 piers of Coignet-Ravier reinforced concrete wing piling: O. L. Olsen, Highland Park, for timber piers, and Standish & Allan, Chicago, for concrete piers.

★Ditch — Montevideo, Minn.—Contracts awarded for constructing County Ditch No. 18 as follows: To Phil Haley, Willmar, for open work, $5,494; to Maynard Tile, Stone & Cement Co., Maynard, for tile, $19,494. J. J. Stennes, Co. Aud.

Ditch—Redwood Falls, Minn.—Following are bids opened by Co. Comrs. Aug. 12 for constructing county ditch 20 to include about 105,000 ft. of tile from 4 to 28 in.: James Girding, Foxlake, $36,957; Kircher Bros., St. Paul, $37,300; Parish & Sedgley, Worthington, $37,525. L. P. Larson, Co. Aud.

★Levee — Tekamah, Neb. — Contract awarded for diversion ditches and levees (bids opened Aug. 14 by Burt-Washington Drainage Dist., J. J. Breckenridge, Secy.) as follows: To W. E. Callahan Constr. Co., Omaha, for 400,000 cu. yd., at 6.45 cts. per cu. yd.; to Edw. Peterson Co., Omaha, 650,000 cu. yd., at 6.48 cts. per cu. yd.

Ditches—Tekamah, Neb.—Following are bids opened Aug. 14 by Burt-Washington Drainage Dist. (J. J. Breckenridge, Secy.) for 1,000,000 cu. yd. diversion ditches and levees (per cu. yd.): W. E. Callahan Constr. Co., Omaha, 6.45 cts.; Edward Peterson & Co., Omaha, 6.48 cts.; Phelan-Shirley Co., Omaha, 6.7 cts. Towl Eng. Co., Engrs., Omaha.

Irrigation — Saco, Mont. — Bids were opened Aug. 12 by U. S. Reclamation Service, Malta, for about 355,000 cu. yd. canal excav., about 3 to 10 miles from Saco, and lowest complete bid was submitted by Winston Bros. Co., Minneapolis, Minn., as follows: Schedule 1, $22,-652; Schedule 2, $19,277; Schedule 3, $8,-652. They bid for excav. Class 1, 13.9 cts. per cu. yd.; excav. Class 2, 35 cts.; excav. Class 3, 75 cts; overhaul 2 cts.

★Levee—Dumas, Ark. — Contract for constructing levees in Linwood and Auburn Levee Dists. awarded to Lannan Bros. & Tansey, Hulburt, at 14.85 cts. per cu. yd.

★Dry Dock—Galveston, Tex.—Contract awarded by J. R. McDonough to John Jacobson, Texas City, for grading, dredging and bulkheading for dry dock to be constructed on Pelican Spit. Total cost about $500,000. Charles N. Crowell, Naval Archt., East Boston, Mass., will supervise construction.

Dredging—Bremerton, Wash.—The only bid opened Aug. 14 by Bureau of Yards and Docks, Navy Dept., Washington, D. C., for dredging at navy yard, Puget Sound, submitted by Erickson Constr. Co., Seattle, at 60 cts. per cu. yd.

★Dredging—Pearl Harbor, Hawaii—Contract for dredging in Pearl Harbor (bids opened by the Bureau of Yards and Docks, Washington, D. C., July 31) awarded to Lord-Young Eng. Co., Honolulu, at 43.5 cts. per cu. yd.

ELECTRIC RAILWAYS

PROPOSED WORK

Burlington, N. C.—Alamance, Durham & Orange Railway & Electric Co. plans to build extension from Burlington to Elon College and Gibsonville and to Altamahaw and Ossipee. Junius Harden, Burlington, reported interested.

Nashville, Tenn.—Tennessee Electric Railroad Co., recently organized to consolidate interests of Cumberland Valley Railroad, Tennessee & Kentucky Railroad and the Nashville, Springfield & Northern Railroad. Rights-of-way of these three projects, two of which have already been surveyed and secured, aggregate 275 miles of road. First step proposed is construction of the Cumberland Valley road, which is to extend from Nashville via Smithville to Sparta. Southern Finance & Constr. Co. reported to have arranged financing of project.

Ashland, Ky.—Ohio Valley Electric Ry. Co., of Huntington, W. Va., plans to build extension from Ashland, Ky., north to Russell.

Waukegan, Ill.—Chicago & Milwaukee Electric R. R. (G. S. Henry, Supt., Highwood) has applied to Council for a franchise.

Snelling, Minn.—Twin City Rapid Transit Co. (J. J. Canfield, Gen. Supt., Minneapolis) plans building double track extension from Snelling-Minnehaha line to new Twin City motor speedway 1¼ miles.

Bonner Springs, Kan.—An extension is to be constructed by Kansas City, Kaw Valley & Western Ry. (O. K. Williamson, Ch. Engr., Bonner Springs), from Bonner Springs to Lawrence.

Aurora, Ill.—Aurora, Mendota & Western Traction Co. received franchise from Council to use highways between southern limits of Aurora near Spring Lake cemetery to Montgomery.

East St. Louis, Ill.—Rapid Transit Co. incorporated to construct electric railway from East St. Louis to Mount Carmel, via St. Clair, Monroe, Randolph, Jackson, Williamson, Saline, Hamilton, White, Edwards and Wabash Counties, with special branch lines to Chester and Murphysboro; capital $100,000. Incorporators: Joseph Vonnhame and M. Harned, East St. Louis, and Louis T. Hooltman, Collinsville.

Webster Groves, Mo.—A 28-year franchise has been granted to United Railways Traction Co. of St. Louis to include improvement of Lakewood Avenue from Summit Avenue to Rock Hill Road, a distance of about one mile; cost approximately $80,000.

Corpus Christi, Tex.—Franchise granted to Corpus Christi Traction Co. to build electric interurban line to connect with county line. Principal terminus of road will be Ward Island, 8 miles south of Corpus Christi, where an amusement park is to be operated in connection with the road. J. H. Caswell, San Diego, is interested.

★Bremerton, Wash.—W. D. Peters, Bremerton, petitioned Councils of Bremerton and Charleston for franchise to construct an electric railway in both towns.

Hamilton, Ont.—Engineers of Hydro-Electric Power Comn., Toronto, reported surveying for electric line from Hamilton to Port Dover and other points on Lake Erie; also for a hydro-radial railway to St. Catherines and all intermediate points, including branch line to Dunnville, Cayuga, etc.

BIDS DESIRED.

New York, N. Y.—Until Sept. 10 by Public Service Commission for First Dist., 154 Nassau Street (Travis H. Whitney, Secy.) for supply of ballast for use in the construction of rapid transit railroads. Portions A and B.

Columbus, Ohio.—Until Sept. 4 by Albert Reinhard, City Clk., for constructing, maintaining and operating, for a period of 25 years, an electric railway on portions of several streets including Hayes Avenue, Hudson Street and other streets.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Brooklyn, N. Y.**—With the approval of Public Service Comn. for First Dist., the New York Municipal Ry. Corp. has awarded to John Thatcher & Son, 60 Park Avenue, Brooklyn, contract for construction of stations in connection with third-tracking work on Broadway elevated line in Brooklyn, at $320,325. Contract calls for construction of stations at Hewes Street, Lorimer Street, Flushing Avenue, Myrtle Avenue and Broadway, Kosciusko Street, Gates Avenue, Halsey Street and Chauncey Street. All these stations are on the Broadway line between Havemeyer Street and East New York, where the third-tracking work is already under way.

★**Long Island City, L. I., N. Y.**—Contract awarded by Pub. Service Comn. for First Dist., New York, for station finish on Section No. 2 of Routes Nos. 36 and 37, the Astoria elevated line in Queens Borough, to Charles Meads & Co., 38 Park Row, New York, at $268,102. (Unit prices in Engineering Record of Aug. 14.)

★**New York, N. Y.**—Contract awarded by Public Service Comn. to Upper Hudson Stone Co., 26 Cortlandt Street, for supply of ballast for use in construction of rapid transit railroads at $78,176 (bids opened Aug. 4).

New York, N. Y.—Following are lowest bids opened Aug. 18 by Public Service Comn.:

Supply of felt pads: The Q. & C. Co., 90 West Street., $9,957.72½.

Tie plates, Types "A" and "D": Herbert W. Lockwood, 260 West Street, $123,975 and $8,239. Type "B" and "C": L. D. Rockwell, $13,267 and $5,140. Types "E-2," "W" and "X": Ramapo Iron Wks., 30 Church Street, $2,901.35.

Cast iron: American Brake Shoe & Foundry Co., 30 Church Street, $10,528.57.

Special Work, Order No. 3: Ramapo Iron Wks., $54,950.

Special Work, Order No. 4: William Wharton, Jr., & Co., 30 Church Street, $41,907.

Malleable iron: Foran Foundry & Mfg. Co., 122 Liberty Street, $36,118.07.

Screw spikes: American Iron & Steel Mfg. Co., Whitehall Building, $25,741.43.

RAILROADS

PROPOSED WORK

Three Forks, Mont.—Helena Southern Ry. Co. reported formed to construct railroad from Helena to Three Forks and Yellowstone; capital $500,000. Incorporators: E. A. Tennis, J. E. Sheaffer and S. H. Rankin.

Bremerton, Wash.—Reported that the Navy Dept., Washington, D. C., has approved plans for construction of a double track railroad through Puget Sound Navy Yard from yard gate to Charleston gate, a distance of about 1½ miles, work to be done by day labor; cost $25,000.

Seattle, Wash.—City Council passed ordinance for grade separation at Argo, to cost $450,000, to be divided between Puget Sound Traction, Light & Power Co., Oregon-Washington Railroad & Navigation Co., Great Northern Ry. Co. and the Chicago, Milwaukee & St. Paul Ry. Co. A concrete tunnel 1700 ft. long is included in improvement. A. H. Dimock, City Engr.

Portland, Ore.—Reported City Council considering general grade crossing elimination along line of Oregon-Washington Railroad & Navigation Co. from head of Sullivan Gulch to city limits; plans involve an expenditure of approximately $750,000. A. L. Barbur, City Aud.

★**New York, N. Y.**—Following are unit prices of 4 lowest bids opened Aug. 18 by Public Service Comn. for station finish, Routes Nos. 16 and 18, being respectively the Jerome Avenue and White Plains Road, elevated lines in Bronx: (a) Altoria Realty & Constr. Co., 3 E. Forty-fourth Street, $860,636 (awarded contract); (b) Snare & Triest Co., 233 Broadway, $908,684; (c) Station Constr. Co., 407 Forty-fifth Street, Brooklyn, $944,347; (d) Marble Arch Co., 216th Street and Broadway, $960,373.

Item			*(a)	(b)	(c)	(d)
750	6,000	lin. ft. stairways-wood (a) street to mezz.	$1.00	$1.00	$0.85	$0.90
	10,800	lin. ft. (b) mezz. to platform	1.00	1.00	0.86	0.90
	8,000	lin. ft. stairways-iron (c) mezz. to platform	2.62½	2.80	2.18	1.90
751	2,000	sq. ft. stair landings-wood (a) straight (street to mezz.)	1.08	1.00	0.85	0.90
	1,400	sq. ft. (b) offset (street to mezz.)	1.08	1.10	0.85	0.90
	1,900	sq. ft. (c) offset (mezz. to platform)	1.13	1.10	0.90	0.90
	2,050	sq. ft. (d) straight or offset with steel checkered platform	2.25	2.00	1.78	1.90
751A	950	lin. ft. concrete stairways (a) self-supporting stairways	2.00	1.10	0.96	3.00
	900	sq. ft. (b) self-supporting stairway landings	0.80	0.80	0.50	0.50
	50	cu. yd. (c) concrete walls under street, Sec. 295	6.00	16.00	18.00	10.00
752	50	ton steel cols., hangers, etc., supporting stairways	88.00	80.00	83.00	70.00
753	2,400	sq. ft. (a) concrete street landings	0.50	0.90	0.75	0.40
	70	cu. yd. (b) concrete foundations for cols.	10.00	16.00	8.00	6.00
	30	(c) concrete or brick manholes, each	36.00	55.00	25.00	150.00
	10	cu. yd. (d) rock excavations	10.00	10.00	10.00	5.00
754	10,600	lin. ft. oak handrails	0.48	0.55	0.40	1.00
755	11,500	sq. ft. (a) canopies over stairways (street to mezz.)	0.65	0.70	0.70	0.80
	48	(b) canopies over street landings, ea.	70.00	75.00	175.00	50.00
	193,000	sq. ft. (c) canopies over side train platforms	0.40	0.37	0.41	0.40
	56,000	sq. ft. (d) canopies over island train platforms	0.40	0.35	0.40	0.30
	15,500	sq. ft. (e) canopies special over side train platforms (concrete sta.)	0.42	0.40	0.44	0.90
756	3,900	lin. ft. (a) Type "A" railings, stairs (street to mezz.)	3.00	4.00	3.91	4.00
	3,500	sq. ft. (b) Type "B" grille railings on stairs	1.00	1.00	1.30	1.10
	200	lin. ft. (c) Type "C" railing	3.00	4.00	2.91	4.00
	350	lin. ft. (d) Type "D" railing	3.00	4.00	3.01	4.00
	3,200	lin. ft. (e) Type "E" railing around stair wells	3.57	4.40	4.51	4.00
	1,000	lin. ft. (f) Type "F" low level railings	3.57	5.00	3.41	4.00
	3,300	sq. ft. (g) Type "G" high railings	0.75	0.90	0.84	1.00
	8,800	lin. ft. (h) Type "K" train platform railings	3.57	4.00	4.51	3.50
	10	(i) additional high posts, 2½-in. tubing, each	8.50	13.00	9.05	20.00
	350	lin. ft. (j) pipe railings	1.10	1.10	1.03	2.00
	40	(k) metal screens for stove recesses, each	10.00	12.00	12.00	15.00
	800	lin. ft. (l) Type "L" bevel railings	3.05	3.75	3.41	3.00
	100	lin. ft. (m) Type "M" service railings	3.57	5.00	4.00	5.00
	350	lin. ft. (o) Type "O" railings, newel posts on street	3.25	4.40	4.16	5.00
	200	lin. ft. (p) Type "P" railings, newel posts on street	3.25	4.40	3.96	5.00
756A	3	(a) grilles at Bedford Park Boulevard station, each	10.00	25.00	50.00	20.00
757	15,000	lin. ft. (a) wind screen drop sash train platform	4.92	4.90	5.10	4.50
760	500	(a) standards on railings on train platforms, each	15.00	16.00	23.20	18.00
	75	(b) free standing standards on island platforms, each	23.00	30.00	28.30	22.00
761	315,000	sq. ft. (a) wood floor for train platform	0.20	0.22	0.20	0.22
	18,300	sq. ft. (b) 8-in. con. slab floor, incl. w. p., etc.	0.58	0.60	0.65	0.70
	14,600	sq. ft. (c) 11½-in. con. slab floor, incl. w. p., etc.	0.68	0.70	0.75	0.75
	100	cu. ft. (d) con. encasing cols., beams and girders	1.00	1.00	0.70	1.00
	200	cu. ft. (e) concrete copings	0.95	0.80	0.55	1.50
	200	sq. ft. (f) additional cement finish, Sec. 148	0.15	0.25	0.15	0.30
	1,600	lin. ft. (h) plat. edge constr'n supported on stl. angles	0.79	0.90	1.72	0.50
	2,000	lin. ft. (i) plat. edge constr'n supported on wood facia	0.20	0.80	1.62	0.50
	5,000	sq. ft. (j) w. p. protive con., wood, existing con. slab	0.41	0.28	0.22	0.40
762	53,000	sq. ft. (a) asphalt floor, includ. wood floor	0.30	0.30	0.23	0.50
	100	sq. ft. (b) 8-in. con. slab, 3-in. finish	0.60	0.60	1.00	1.00
	8,600	sq. ft. (bb) 6-in. con. slab, 3-in. finish	0.45	0.50	0.50	0.50
	100	sq. ft. (c) 11½-in. con. slab, 3-in. finish	0.70	0.70	1.00	0.60
	6,500	sq. ft. (d) cement wainscot or base	0.17	0.22	0.12	0.20
	36,500	sq. ft. (e) con. track fl. over mezz., incl. w. p. rods, etc.	0.45	0.46	0.55	0.52
	1,200	sq. ft. (f) flooring for passageways	0.30	0.25	0.20	0.50
	620	(g) ferrules for mezz. roof, incl. flanges, each	1.80	2.50	2.38	2.00
	30	(h) trap doors or scuttles, each	2.00	20.00	10.00	3.00
762A	54,000	sq. ft. 3-in. cement floor finish	0.12	0.12	0.13½	0.15
763	43,000	sq. ft. (a) ex. walls of mezz. and stairways, encl. copper fin. ex., oak fin. int.	0.95	0.90	0.80	1.00
	8,500	sq. ft. (b) ex. walls of mezz. copper fin. ex. tile fin. int.	0.85	0.90	0.76	0.80
	6,100	sq. ft. (c) ex. walls of mezz. copper fin., ex. unfinished int.	0.80	0.80	0.70	0.80
764	26,000	sq. ft. wood part., incl. doors, windows, sheathing	0.56½	0.60	0.65	0.50
765	2,000	lin. ft. copper gutters	1.00	0.90	1.02	1.00
766	270	lin. ft. (a) slow sliding gates	8.00	9.00	7.91	10.00
	160	lin. ft. (b) high sliding gates	12.00	13.00	14.20	12.00
	20	lin. ft. (c) folding gates	11.00	10.00	3.95	12.00
	15	lin. ft. (d) low swing gates	10.00	8.00	8.10	12.00
	26	(g) gate controls, each	25.00	25.00	15.25	20.00
	66	(h) cast-iron gate posts and cross frames, pair	28.00	25.00	40.60	0.30
	10	(i) floor boxes (additional), each	8.00	8.00	3.50	12.00
	900	lin. ft. (j) 1¼-in. galv. wrought-iron pipe for gate ropes	0.30	0.25	0.31	0.50
	1,000	lin. ft. (k) 1-in. square steel tubing, incl. c.-i. pulleys, fit., hang.	0.57	0.50	0.47	0.60
767	20,000	sq. ft. roofs over mezz. and pass. beyond mn. str. on train plat., roof, wait. rm.	0.55	0.62	0.60	0.50
767A	3,000	sq. ft. (a) roofs over exist. struc. at Woodlawn sta., Sec. 295	0.60	0.35	0.65	0.40
768	14,500	lin. ft. (a) 3-in. corrugated galv. iron leaders	0.25	0.25	0.24½	0.25
	870	lin. ft. (b) 3-in. cast-iron leaders	0.50	0.60	0.37½	0.60
	575	lin. ft. (c) 3-in. wrought-iron leaders	0.55	0.80	0.67½	0.60
	5,100	lin. ft. (d) 3½-in. wrought-iron leaders	0.60	0.85	0.77½	0.60
	1,350	lin. ft. (e) 3-in. copper leaders	0.50	0.60	0.55	0.60
769	2,000	lin. ft. smoke flues from stove recesses	0.38	0.60	0.30	0.50
770	450	lin. ft. smoke flue protectors on platforms	1.00	1.20	1.00	1.00
772	40	ton (a) steel framing shapes connections	70.00	80.00	78.50	70.00
	1	ton (b) riveted stl. girders, cols. and brackets	125.00	80.00	80.00	70.00
	400	lin. ft. (d) steel ladders	1.70	1.25	1.90	2.00
	10	sq. ft. (e) steel ladders, platforms	1.50	2.00	1.08	4.00
773	10,000	drill holes existing structure, hole	0.25	0.30	0.20	0.25
774	150	sq. ft. (a) frames for enameled signs on mezz.	1.50	1.70	2.50	2.00
	1	(b) frame and reflect., Type "A," illd. sign on brkt. att. col., each	100.00	50.00	50.00	0.60
	3,100	sq. ft. (c) sign frames on train platform railings	1.00	1.30	1.50	1.50
	40	(e) sign frames illd. n. t. is. train plat., incl. seat., each	95.00	140.00	200.00	150.00
	8,000	sq. ft. (f) enameled sign plates	0.30	0.35	0.40	0.25
	4,000	vert. in. (g) copper letters for signs	0.12	0.15	0.12	0.15
	4	(h) frames and reflect., Type "B," illd. sign on bracket, att. to con. struc., each	45.00	60.00	45.00	50.00
	34	(i) sign frames, illd., n. t. is. plat., metal panel, each	100.00	120.00	136.00	70.00
	18	(j) sign frames bet. cols. on special canopies, each	12.00	20.00	25.00	25.00
774A	3	(a) marquises over entrance doors, Gun Hill Road sta., each	125.00	110.00	177.00	200.00
	8	(b) marquises over entrance doors, Woodlawn sta., each	220.00	160.00	302.00	200.00
775	13,500	sq. ft. (a) non-slip treads without wood blocks and anchor	0.70	0.90	0.45	0.80
	1,600	sq. ft. (b) non-slip treads with wood blocks and anchor	0.80	1.00	0.62	0.85
776	2,200	sq. ft. stamped sheet metal in booths on mezz.	0.14	0.13	0.15	0.15
777	4,000	sq. ft. (a) metal lath without steel furring	0.09	0.12	0.10	0.15
	1,900	sq. ft. (b) metal lath with steel furring	0.16	0.18	0.20	0.15
	100	sq. ft. (c) special wire forms	0.25	0.20	0.10	0.25
778	11	(a) Type "B" ticket booths, each	440.00	400.00	600.00	400.00
	11	(c) Type "D" ticket booths, each	550.00	500.00	725.00	400.00
	3	(d) Type "E" ticket booths, each	525.00	500.00	720.00	400.00
779	700	lin. ft. (a) oak seats in wait. rooms	3.00	3.00	3.00	3.00
	77	(b) oak doors, Type "CC," for toilet stalls, pair	10.00	12.00	10.00	12.00
780	300	(a) hardware doors to toilets, wait. rooms and closets, each	15.00	15.00	19.50	10.00
	45	(b) hardware permanent enclosures bet. stations, door	8.00	8.00	7.50	10.00
	320	(c) hardware double-hung sashes, window	3.00	3.00	2.75	3.00
	750	(d) cas'm't sash, except t. b. encl. bet. sta., window	4.00	4.60	5.00	4.00
	110	(e) cas'm't sash, t. b. encl. and encl. bet. stations, window	3.80	4.00	3.90	4.00
	2,200	(g) hardware drop sash, each	1.00	1.00	1.40	1.50
	150	(h) hardware hinged sash (top and bottom), each	1.80	2.50	1.75	3.00
	77	(j) hardware toilet stall doors, Type "GG," pair	10.00	10.00	10.00	12.00
	85	(k) hardware doors to panel boards and switch boards, each	2.00	2.00	2.00	3.00
	30	(m) hardware vent doors, each	2.00	2.00	1.90	3.00
781	130	(a) additional hardware door checks, each	3.30	3.00	3.30	4.00
	250	(b) door stops, each	1.50	1.50	1.55	2.00
	60	(c) rubber covered chains, each	1.20	1.00	1.15	2.00
	60	(d) push plates, each	1.85	1.50	1.85	3.00
	60	(e) door pulls, each	2.50	2.00	2.55	3.00
	112	(f) kick plates, pair	6.00	4.00	5.90	7.00
	120	(g) push bars, each	4.00	4.00	4.50	5.00
	65	(h) casement sash adj. for single sash, each	2.30	2.00	2.30	3.00
	50	(i) casement sash adj. for gong, 2 sash, each	7.00	8.00	8.60	10.00
	60	(j) casement sash adj. for gong, 3 sash, each	9.00	11.00	11.00	12.00

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	50	(k) casement sash adj. for gong, 4 sash, each	11.00	13.00	13.45	15.00
	40	(l) casement sash adj. for gong, 5 sash, each	12.00	16.00	15.90	17.00
	10	(m) casement sash adj. for gong, 6 sash, each	13.00	18.00	18.30	20.00
782	3,000	sq. yd. (a) plaster coat on mas. and second coat on met. lath	0.65	1.00	1.15	1.00
	2,200	sq. yd. (b) first or scratch coat on metal lath	0.50	0.60	0.25	1.00
	200	sq. yd. (c) stucco on soffits and sides of stairways at con. sta.	1.50	1.60	1.50	2.00
783	4,900	cu. ft. (a) common brick	0.40	0.40	0.40	0.50
	8,300	cu. ft. (b) hollow terra cotta tile	0.32	0.40	0.50	0.50
784	44	concrete stone recesses, incl. appurt., each	28.00	35.00	25.00	40.00
785	5,200	sq. ft. (a) ⅜-in. glass wainscoting and trim on walls	1.18	1.30	1.17	1.00
	250	sq. ft. (b) ¾-in. glass pipe chamber partitions	1.37	1.80	1.25	2.00
	65	sq. ft. (c) ¾-in. glass shelves	1.60	1.80	1.30	2.00
	1,500	sq. ft. (d) ¾-in. glass stall partitions	1.53	1.60	1.75	1.50
	225	sq. ft. (e) 1-in. glass floor slabs	2.50	2.60	2.60	2.00
	700	lin. ft. (f) curved corners and angles of glass	2.37	1.50	1.25	1.50
	200	sq. ft. (g) soapstone wainscoting and trim on walls	1.00	1.10	1.00	1.50
	785	sq. ft. (h) soapstone pipe chamber partitions	0.95	1.20	1.00	1.00
	150	sq. ft. (i) soapstone shelves	1.66	1.40	0.80	1.50
	400	sq. ft. (j) soapstone stall partitions	1.00	1.20	1.00	1.50
	55	sq. ft. (k) soapstone floor slabs	1.10	1.60	0.80	1.00
	100	lin. ft. (l) curved corners and angles of soapstone	1.00	1.00	0.60	1.50
787	22,300	sq. ft. (a) copper covered walls, incl. doors and windows, permanent encl. bet. stations	0.90	0.80	0.65	1.00
	19,000	sq. ft. (b) crimped gal. iron on walls and ceilings	0.10	0.13	0.14	0.10
	200	sq. ft. (d) galv. wire screens	0.38	0.60	0.43	0.50
	5,400	sq. ft. (e) concrete floor with cement finish	0.38½	0.40	0.60	0.50
	37	(f) galv. iron roof vents, each	9.00	12.00	6.20	12.00
	13,000	sq. ft. (g) roof	0.38	0.40	0.37	0.60
	50	lin. ft. (h) copper gutters	2.00	1.00	0.52	1.00
	850	sq. ft. (i) partition walls	0.34	0.50	0.40	1.00
	1,400	sq. ft. (j) wood floor	0.23	0.40	0.18	0.40
	150	cu. yd. (k) concrete foundations	6.40	12.00	8.00	8.00
788A	400	sq. ft. (a) wood flooring passage-ways ad't to encl. bet. stations	0.42	0.30	0.25	0.50
	100	(b) wood ladders end of platforms, each	2.25	2.50	2.30	5.00
789	90	(a) plumbing fixtures, water closet bowls, each	50.00	55.00	51.00	40.00
	50	(b) lavatories in stations, each	30.00	35.00	32.50	40.00
	14	(c) lavatories in permanent encl. bet. stations, each	30.00	35.00	30.40	40.00
	61	(d) urinals, each	81.00	90.00	90.60	80.00
	28	(e) slop sinks, each	60.00	70.00	69.40	60.00
	11	(f) floor drains, each	16.00	20.00	24.10	10.00
790		Rough plumbing work, complete, all stations, lump sum	19,000.00	27,000.00	36,100.00	30,000.00
791		Rough plumbing work, complete, all encl. bet. stations, lump sum	4,000.00	4,000.00	4,645.00	5,000.00
792	200	(a) c.-i. work in toilet rooms and port. clo. posts, each	9.00	14.00	12.70	10.00
	680	lin. ft. (b) top rails	1.00	1.20	1.28	1.00
	20	(c) wall flanges, each	1.50	1.50	2.05	3.00
	12	(d) register faces and frames in pipe chamber partitions, each	10.00	15.00	10.00	10.00
	40	(e) cast-iron vent louvres in walls of porters' closets, each	10.00	15.00	15.00	10.00
792A	10	cast-iron vent louvres, except in walls of porters' closets, each	10.00	15.00	20.00	15.00
793	10,000	lb. glass and soapstone steel supp'ts	0.15	0.07	0.05	0.10
794	75	coat and hat hooks in toilet rooms, each	1.00	1.00	0.50	1.00
795	100,500	lin. ft. (a) electric conduits, ¾ in.	0.14	0.13	0.08	0.15
	11,000	lin. ft. (b) electric conduits, 1 in.	0.17	0.17	0.10	0.20
	7,500	lin. ft. (c) electric conduits, 1½ in.	0.22	0.20	0.15	0.25
	600	lin. ft. (d) electric conduits, 2 in.	0.30	0.33	0.20	0.38
	100	lin. ft. (e) electric conduits, 2½ in.	0.40	0.48	0.30	0.55
	100	lin. ft. (f) electric conduits, 3 in.	0.50	0.70	0.40	0.70
	1,350	lin. ft. (g) ¾-in. flexible conduits	0.20	0.16	0.10	0.25
795A	3	(a) place porc. fer. in ext. (encl.) masonry walls, each	1.00	1.00	10.00	5.00
	20	(b) place porc. fer. in ext. (encl.) other than masonry walls, each	0.75	1.00	3.00	5.00
796	7,200	cast-iron outlet boxes, each	0.50	0.40	0.35	0.80
797	60	(a) 6-in. x 6-in. x 6-in. cast-iron pull boxes, each	2.90	2.00	1.00	4.00
	25	(b) 12-in. x 12-in. x 6-in. cast-iron pull boxes, each	5.75	5.00	3.65	6.00
	5	(c) 18-in. x 12-in. x 6-in. cast-iron pull boxes, each	8.00	8.00	5.00	8.00
	3	(d) 24-in. x 18-in. x 6-in. cast-iron pull boxes, each	14.00	15.00	9.00	10.00
	60	(e) 6-in. x 6-in. x 4-in. cast-iron pull boxes, each	1.50	3.00	0.73	3.00
	22	(f) 12-in. x 20-in. x 4-in. cast-iron pull boxes, each	12.00	8.00	8.00	10.00
798	50	cast-iron heater boxes, each	14.00	8.00	6.00	15.00
799	3	(a) 25-in. x 60-in. x 5⅛-in. steel panel board boxes, each	16.00	20.00	15.00	25.00
	19	(b) 25-in. x 48-in. x 5⅛-in. steel panel board boxes, each	13.00	14.00	10.00	15.00
	53	(c) 25-in. x 36-in. x 5⅛-in. steel panel board boxes, each	11.00	12.00	8.00	10.00
	4	(d) 25-in. x 24-in. x 5⅛-in. steel panel board boxes, each	7.00	11.00	7.00	10.00
800	3	steel switch board boxes, each	20.00	30.00	20.00	40.00
801	105,000	sq. ft. (a) painting 2 coat wk. on plaster and cement sur.	0.01⅛	0.02	0.02	0.02
		(b) painting steel of exist. struct. as re. Sec. 29, lump sum	10,000.00	4,000.00	12,750.00	23,000.00
802	10,800	sq. ft. (a) straight white glazed tile, 3 in. x 6 in.	0.50	0.60	0.44	0.50
	1,200	sq. ft. (b) 1-in. radius (comb)	1.00	1.10	0.80	1.20
	1,200	sq. ft. (c) 2½-in. radius (comb)	1.00	1.10	1.10	1.50
806	1,700	sq. ft. (a) h. m. tile, 3 in. x 6 in., straight	1.00	1.00	0.68	1.00
	20	sq. ft. (b) h. m. tile, 1-in. radius (comb)	1.00	1.00	0.88	2.50
	100	sq. ft. (c) h. m. tile, 2½-in. radius	1.00	1.00	0.88	3.00
807	28,500	sq. ft. (a) h. m. tile, 4¼ in. x 4¼ in., straight	1.00	1.00	0.88	1.00
	1,200	sq. ft. (b) h. m. tile, 1-in. radius (comb)	1.00	1.00	0.88	1.00
	2,400	sq. ft. (c) h. m. tile, 2½-in. radius (comb)	1.00	1.00	0.88	1.00
	20	sq. ft. (d) h. m. tile, 20-in. radius (comb)	1.00	1.00	0.88	3.00
814	1,000	sq. ft. mosaic bands in color	1.20	1.20	1.15	1.20
815	250	sq. ft. mosaic tablets in color	1.20	1.20	1.15	1.50
817	620	sq. ft. inlaid color tile, weatherproof	1.65	1.50	1.25	1.50
818	8	(a) doors in masonry, Type "AA," each	25.00	35.00	30.00	30.00
	2	(b) doors in masonry, Type "BB," copper covered, pair	55.00	95.00	50.00	75.00
	17	(d) doors in masonry, Type "DD," transformer clos., each	25.00	40.00	40.00	40.00
	28	(e) doors in masonry, Type "DD," each	25.00	35.00	28.00	30.00
	17	(f) doors in masonry, Type "EE," each	25.00	35.00	28.00	30.00
	16	(l) doors to panel and switch board boxes, each	16.00	35.00	25.00	30.00
	170	sq. ft. (m) street doors to concrete ticket houses	1.00	1.50	2.00	2.00
819	750	sq. ft. (e) windows in mas. part. fixed transom sash	0.83	1.20	1.25	1.00
820	735	sq. ft. (a) windows in mas. ext. wall, d. h. sash	1.00	2.00	1.50	1.00
	3,800	sq. ft. (b) windows in mas. ext. wall, casement sash	1.00	1.50	1.20	1.00
	9,000	sq. ft. (c) windows in mas. ext. wall, drop sash	1.00	1.10	1.40	1.00
	100	sq. ft. (g) windows in mas. ext. wall, hinged sash	1.00	1.80	2.00	1.00
821	32	(a) sewer connections, Sec. 257, each	125.00	140.00	95.00	100.00
	33	(b) water connections, Sec. 257, each	80.00	110.00	60.00	100.00
850E		Concrete work, 161st St. station, Sec. 295, lump sum	10,455.00	13,500.00	22,744.00	14,100.00
850F		Concrete work, Gun Hill Road, Sec. 295, lump sum	4,037.00	7,500.00	11,000.00	13,125.00
850G		Concrete work, Bedford Park Boulevard, Sec. 295, lump sum	4,144.00	4,500.00	8,625.00	9,000.00
850H		Brick chimney, Woodlawn station, Sec. 295, lump sum	70.00	200.00	150.00	300.00
850I		Copper covered ceiling, Woodlawn station, Sec. 295, lump sum	125.00	400.00	1,210.00	2,000.00
850J		Enclosed ramp, E. 180th St. station, Sec. 295, lump sum	5,185.00	6,000.00	19,226.00	12,000.00

***Philadelphia, Pa.**—Following are unit prices of 4 lowest bids opened Aug. 16 by Dept. City Transit (A. M. Taylor, Dir.) Bourse Bldg., for Contract 501, Frankford Elevated Railway to include foundations in Front. Street, Kensington Avenue and Frankford Avenue from Callowhill Street to Unity Street: (a) James D. Dorney, 1204 E. Montgomery Ave. (awarded contract); (b) Robt. Lombardi, 600 Lincoln Bldg.; (c) Keystone State Constr. Co., 704 Pennsylvania Bldg.; (d) Edw. Fay & Son, 2 S. Mole St.:

	*(a)	(b)	(c)	(d)
Whole work as shown on plans, lump sum.	$142,590.00	$149,000.00	$179,000.00	$179,400.00
100 cu. yd. excavation	1.90	2.75	2.00	2.50
100 cu. yd. concrete masonry	6.90	5.75	5.00	8.00
1,000 sq. ft. precast reinforced concrete planking	0.10	0.45	0.30	1.00
100 cu. yd. brick masonry	14.50	9 00	15.00	10.00
100 cu. yd. rubble stone masonry	5.50	5.75	5.00	5.25
10 piles, concrete	35.00	35.00	45.00	2.00
1,000 ft. b. m. yellow pine lumber	48.00	35.00	80.00	49.00
1,000 lb. steel work	0.04	0.04	0.04	0.05
1,000 lb. iron castings	0.0325	0.03	0.04	0.10
100 lin. ft. 5-in. or 6-in. vitr. clay pipe	0.30	0.25	0.20	0.70
100 lin. ft. 8-in. or 10-in. vitr. clay pipe	0.40	0.35	0.40	1.00
100 lin. ft. 12-in. vitr. clay pipe	0.50	0.45	0.80	1.30
100 lin. ft. 15-in. or 18-in. vitr. clay pipe	0.75	0.60	1.20	1.75
100 sq. yd. stone block invert lining or sewer paving	2.90	2.00	2.50	4.00
100 sq. yd. vitr. brick invert lining	2.00	2.00	2.00	4.00
10 inlets, taking out existing sewer inlets	15.00	10.00	20.00	20.00
10 inlets, taking out and rebuilding inlets	70.00	50.00	70.00	80.00
10 inlets, building new inlets	75.00	75.00	80.00	100.00
10 lamp posts, moving gas lamps and posts	16.00	6.00	10.00	10.00
100 lin. ft. steel-bound granolithic curb	0.60	1.60	1.00	0.79
100 lin. ft. resetting stone curb	0.25	0.20	0.30	0.25
100 sq. yd. brick and flagstone sidewalk repaving	0.45	2.00	0.50	0.60
100 sq. yd. granolithic sidewalk repaving.	1.40	1.50	1.50	1.50
100 sq. yd. granite block repaving on gravel base	0.45	0.75	0.50	1.50
100 duct ft. terra-cotta conduits	0.15	0.50	0.20	0.45
100 lin. ft. moving and relaying gas or water mains	2.75	1.50	1.00	6.00
100 new curb stop boxes or vent boxes	0.45	0.40	1.00	4.00
$1,000 force account (per cent)	10	10	25	20
Total	$149,235.00	$155,150.00	$185,970.00	$188,278.00

★Philadelphia, Pa.—Following are unit prices of 4 lowest bids opened Aug. 16 by Dept. of City Transit (A. M. Taylor, Dir.) for Contract No. 101 Broad St. subway and station under Filbert St., City Hall and S. Penn Square: (a) Keystone State Constr. Co., 704 Pennsylvania Bldg., Philadelphia (awarded contract); (b) The Foundation Co., 233 Bway., New York; (c) Fredk. L. Cranford, Inc., & Smith, Hauser & MacIsaac, Inc., Mail St. & Bway., New York; (d) New York & New Jersey Constr. Co., 30 E. 42nd St., New York:

	*(a)	(b)	(c)	(d)
Whole work as shown on plans, lump sum	$1,700,000.00	$1,720,815.00	$2,350,000.00	$2,449,000.00
1,000 cu. yd. excavation above elevation zero	3.00	4.00	4.00	5.00
1,000 cu yd. excavation below elevation zero	7.00	10.00	25.00	7.50
100 vt. ft. cast-iron cylinder columns, 4 ft. 6 in. diameter	50.00	100.00	40.00	80.00
10,000 lb. riveted steel columns	0.05	0.06	0.05	0.06
100 cu yd. Class A concrete	12.00	10.00	8.00	12.00
100 cu. yd. Class C concrete	10.00	8.00	7.00	10.00
1,000 sq ft. concrete sheathing	0.50	0.50	0.60	0.20
1,000 cu. yd. backfilling	0.50	0.40	1.00	0.50
100 cu. yd. brick masonry	25.00	16.00	20.00	16.00
100 bbl. grout	5.00	3.60	5.00	3.00
2,000 ft. b. m. yellow pine lumber	100.00	80.00	100.00	50.00
10,000 lb. steel girders	0.03	0.045	0.04	0.05
10,000 lb. steel beams	0.03	0.045	0.035	0.05
10,000 lb. steel rods	0.05	0.035	0.05	0.03
1,000 sq. ft. steel sheathing	1.50	1.00	0.60	0.50
1,000 sq. ft. 1-ply waterproofing	0.10	0.10	0.06	0.04
1,000 sq. ft. 2-ply waterproofing	0.20	0.12	0.09	0.06
100 sq. ft. safety treads	1.00	0.90	1.50	1.00
1,000 lin. ft. 5-in. or 6-in. vitr. clay pipe	0.60	0.50	1.50	0.50
1,000 lin. ft. 8-in. or 10-in. vitr. clay pipe	1.00	0.70	1.50	0.75
1,000 lin. ft. 12-in. vitr. clay pipe	1.20	1.00	1.60	1.00
1,000 lin. ft. 15-in. or 18-in. vitr. clay pipe	1.80	1.20	1.75	1.25
10,000 lb. cast-iron pipe	0.03	0.03	0.03	0.03
1,000 lb. steel gratings	0.15	0.06	0.07	0.08
2,000 sq. ft. vault lights	1.50	2.00	1.50	1.50
1,000 duct ft. electric ducts	0.20	0.20	0.20	0.10
100 sq. yd. wood block paving	4.50	3.50	4.50	3.50
100 sq. yd. asphalt paving	3.50	3.50	4.00	3.00
100 sq. yd. granolithic paving	2.70	2.25	3.00	2.50
500 lin. ft. resetting granite curb	0.20	0.50	0.50	0.60
$10,000 force account (per cent)	30	20	20	18
Totals	$1,737,320.00	$1,763,870.00	$2,404,770.00	$2,486,980.00

BIDS DESIRED.

Greenville, S. C.—Reported desired until Sept. 6 by Southern R. R. Co. (B. Herman, Ch. Engr., Washington, D. C.) for construction of 26 miles of double track between Greenville and Central.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Bellingham, Wash.**—Contract for construction of first 16 miles of railway to connect Spokane and Bellingham has been awarded to Marsh-Hutton-Powers Constr. Co., New Westminster, B. C. Road will connect Bellingham and Port Nelson, Hudson Bay. It will be known as the Bellingham, Mount Baker & Spokane Ry.

★**Alaska.**—Contract reported awarded by C. E. Dole, purchasing agent, Alaska Eng. Comn., L. C. Smith Building, Seattle, Wash., for material for 45 miles of permanent right-of-way to be built in Alaska for U. S. Government as follows: 4950 tons of 70-lb. rails at $148,500 awarded to Colorado Fuel & Iron Co. of Denver; also same company for 14,800 pairs of angle splices at $8,565, and to U. S. Steel Products Co. of California for 350 kegs of track bolts and 2200 kegs of track spikes at $7,420.

PUBLIC BUILDINGS AND SCHOOLS

PROPOSED WORK

Fort Williams, Me.—Capt. H. C. Miller, Coast Artillery Corps, Q. M., U. S. A., at Fort Williams, wants to communicate with one or two manufacturing firms which supply material for construction of light steel buildings. Buildings desired are: One 140 ft. long x 35 ft. wide, one story, and one 160 ft. long x 35 ft. wide, one story. Both having light steel frames with sides and roofs of corrugated iron.

North Adams, Mass.—School Com. has approved plans by Gardner & Gardner, Springfield, for the high school.

East Hartford, Conn.—Plans prepared by Wilson Potter of New York for the high school have been accepted, to be two story, brick and fireproof and cost $75,000.

Poughkeepsie, N. Y.—Public Service Commission, Second District, authorized Central Hudson Gas & Electric Co., to issue bonds to be expended in extensions and improvements, including $58,000 to improve buildings in Poughkeepsie, $175,000 for a new side track and new machinery at electric station; also $20,000 for concrete roof for electric station in Newburgh.

Syracuse, N. Y.—Bd. of Estimate and Apportionment voted $590,000 school improvement bonds, work to include erecting Euclid School, cost $100,000, and for purchase of land and beginning construction of schools as follows: Franklin, $65,000; Webster, $12,500; Prescott, $65,000; Jefferson, $75,000; Madison, $45,000, etc.

Elizabeth, N. J.—Contracts soon to be let for erecting the Madison Avenue and Magie Street schools. Address Bd. Educ.

Du Bois, Pa.—Reported about $40,000 raised for erecting Maple Avenue Hospital. William Menzie, Chmn. Hospital Bd.

Fairview, Pa.—Citizens of Ohio Township reported considering erecting high school.

Lebanon, Pa.—A. A. Richter of Reading preparing plans for proposed high school, to be of brick, 2 stories righ, 198 x 198 ft.

Florence, S. C.—School Dist., street improvement and refunding debt bonds amounting to $232,000 have been sold. A new school is to be erected in Jarrott Park, East Florence, and paving with bitulithic certain roadways and constructing cement sidewalks is contemplated.

Dixon, Ky.—All bids opened recently for erecting high school rejected by School Bd.

Chillicothe, Ohio—Commissioners of Jackson, Fayette, Scioto, Pike, Highland and Ross counties decided to erect tuberculosis hospital at Chillicothe. Cost, $30,000.

Columbus, Ohio.—Reported plans being prepared for State Office building. A committee has been appointed by the Governor to have charge of this work. Senator O. E. Vollenweider is a member.

Lilly Chapel, Ohio.—Bonds for $40,000 will be sold Sept. 8 by Bd. Educ., Fairfield Township, Rural Dist. Lilly Chapel, for purchasing site and erecting an elementary grade and high school.

Newburg, Ohio—Sketches being prepared by Marriott, Allen & Hall, Archts., New Hayden Bldg., Columbus, for State Bd. of Administration, Columbus, for laundry building at Newburg State Hospital, to cost approximately $40,000.

Marquette, Mich.—John D. Chubb, Chicago, Ill., engaged to prepare plans for high school, to be semi-fireproof, brick and reinforced concrete, and cost about $110,000. James D. Reilley, Secy. Bd. Educ.

Clinton, Ill.—Plans prepared by J. W. Royer, Urbana, approved for 2-story, 10-room, fireproof, brick school; estimated cost $30,000.

Rockford, Ill.—See "Prices and Lettings."

Milwaukee, Wis.—Plans prepared by Fernekes & Cramer, 1304 Pabst Bldg., for brick and steel, 1-story, 90 x 200 ft. drill shed addition to armory of Troop A, Natl. Guard, Oakland Avenue. Cost $40,000.

Bridgeport, Neb.—Citizens voted $35,000 bonds for erecting high school.

Walla Walla, Wash.—Robert F. Egan, Morgan Bldg., is architect for hospital for Sisters of St. Mary, 4 stories, 150 x 200 ft., U-shaped, reinforced concrete hollow tile and brick, probable cost $250,000. M. J. Beezer, Northern Bank Bldg., has matter in charge.

BIDS DESIRED.

Boston, Mass.—Until Sept. 15 by Trus. Boston City Hospital (John J. Dowling, M. D., Supt.), for addition and alterations to Administration Building at West Dept., Boston City Hospital, Spring St., West Roxbury.

Until Sept. 14 by James A. Wetmore, Acting Supervising Archt., Washington, D. C., for new partitions, alterations, etc., in U. S. Custom House, Boston, advertised in Engineering Record.

Providence, R. I.—Until about Sept. 1 by Bd. Contract and Supply, for erecting 15-room school at Cole Avenue.

Batavia, N. Y.—Until Sept. 14, by Dr. F. Park Lewis, Pres. Bd. Mgrs. N. Y. State School for Blind, for alterations and additions to hospital building, including heating apparatus, steam piping and plumbing, drainage and electrical work. Lewis F. Pilcher, State Archt., Albany.

Buffalo, N. Y.—Until Aug. 31 by State Armory Comn., Albany (Franklin W. Ward, Secy.), for repairs and improvements to armory of Seventy-fourth Regiment N. G. N. Y. Separate bids desired for masonry, roofing, carpentry, etc.

Syracuse, N. Y.—Reported desired until Sept. 1 by King & Willett, Archts., Gaylord Building, for erecting hospital for King's Daughters. Probable cost, $25,000.

Caldwell, N. J.—Until Sept. 8 by Com. Pub. Bldg. Co. Bd. Chosen Freeholders (August L. Lacombe, Chmn.), Newark, for furnishing material and erecting Warden's residence at Penitentiary at Caldwell, separate bids desired for heating, plumbing, etc. Joseph B. Allen, Archt., 11 Sandford Avenue, Irvington.

East Pittsburgh, Pa.—Until Sept. 2 by James P. Brown, Eastern Hotel, Chmn. Property Com., for erecting 3-story fireproof municipal building. C. F. Hitchens, Archt., Park Building, Pittsburgh.

Philadelphia, Pa.—Until Sept. 6 by Armory Bd., Harrisburg (Benjamin W. Demming, Secy.), for erecting administration building for a squadron armory in Philadelphia. Philip H. Johnson, Archt., Land Title Building, Philadelphia.

Pittsburgh, Pa.—Until Aug. 31 by Dept. Pub. Safety (Chas. S. Hubbard, Dir.), at office of City Comptroller, for remodeling, including plumbing and electric wiring engine houses Nos. 18, 32 and 33 on Ellesmere Street. John P. Brennan, City Archt., Northside Municipal Building.

Smyrna, Del.—Until Sept. 29, by James A. Wetmore, Acting Superv. Archt., Washington, D. C., for erecting (including mechanical equipment, interior lighting fixtures and approaches), 1-story and basement of U. S. post office at Smyrna.

Washington, D. C.—Until Oct. 16 at Bureau Yards and Docks, Navy Dept., Washington, D. C. (William M. Smith, Ch.), for Spec. 2176—Furnishing and installing Piping, pumps, boilers, heaters, buildings and insulations for four fuel-oil storage stations at Bremerton, Wash., Mare Island, Cal., San Diego, Cal., and Norfolk, Va.

Norfolk, Va.—Until Sept 25 at Bureau Yards and Docks Navy Dept., Washington, D. C. (William M. Smith, Ch.), for 3-story and basement marine barracks, steel frame and brick construction at Navy Yard, Norfolk, as per Spec. No. 2175.

Cincinnati, O.—Until Sept. 20 by Bd. Educ. (C. W. Handman, Bus. Man.) for constructing bridge, tower and buildings A, B, C, D and E of the new East Side High School, Madison Road and Erie Avenue, advertised in Engineering Record. Plans and specifications may be obtained from business manager on a deposit of $25, same to be returned if plans and specifications are returned in good condition.

Until Sept. 13 at office of Clk. Bd. Educ. for furnishing material and erecting manual training building at Oyler School, Stoors and Burns Streets. C. W. Handman, Bus. Mgr., 511 W. Court Street.

Columbus, Ohio.—Until Sept. 7 by George A. Borden, Dir. of Public Service, for furnishing material and erecting two public comfort stations, one at Broad and High Streets and one at State and High Streets. J. A. Jones, Archt., Dispatch Annex Building.

Dayton, Ohio—Until Sept. 14, by Bd. Educ. (E. H. Herr, Pres.), for furnishing material and erecting addition to steel high school, Main and Monument Ave. Edward J. Mountstephen, Archt., 803 U. B. Bldg.

Middleburg, Ohio—Until Sept. 14 by Bd. Educ., Zane Township, Rural Dist. (L. L. Irwin, Clk.) for erecting brick school. E. G. McCann, Archt., Marysville

Steubenville, Ohio.—Reported desired until Sept. 20 by W. S. McClausan, Clk. Bd. Educ., for erecting Wells High School annex, 2-story and basement, 48 x 16 ft. Probable cost, $75,000. Peterson & Clark, Archts., National Building.

Kalamazoo, Mich.—Reported desired until Oct. 1 by Kalamazoo State Hospital for erecting 3-story brick building for employees of hospital. Probable cost $56,000. Wernette-Bradfield-Mead Co., Archts., Grand Rapids.

Belvidere, Ill.—Reported desired until Sept. 10 by Miller, Fuller, Wider & Dowling, Archts., 6 N. Michigan Avenue, Chicago, for erecting 3-story and basement, 100 x 165 ft., high school for Bd. Educ. Probable cost, $110,000.

Sheboygan, Wis.—Until Sept. 6 by Bd. Pub. Wks. (C. U. Boley, Chmn.) for furnishing material and erecting City Hall. H. W. Buemming, Archt., 521 Jackson Street, Milwaukee.

Grundy Center, Iowa.—Reported desired until Sept. 11 by Bd. Educ. for erecting 2-story and basement high school gymnasium. Probable cost, $85,000. Alban & Lockhart, Archts., Endicott Building, St. Paul, Minn.

Ogden, Iowa.—Reported desired until Sept. 17 by Bd. Educ. for erecting a 2-story and basement school. Probable cost, $35,000. Alban & Lockhart, Archts., Endicott Building, St. Paul, Minn.

Maynard, Minn.—Until Sept. 2 by Bd. Educ. (O. G. Gjevre, Secy.) for furnishing material and erecting brick high and grade school for Independent School Dist. No. 30. E. F. Broomhall, Archt., Alworth Building, Duluth.

Rochester, Minn.—Until Aug. 30 by E. E. Bratager, Clk. School Bd., for erecting a 4-room and 8-room brick and concrete school in Rochester. Hoffman & Mosse, Archts., Rochester.

Until Aug. 30 by Capt. F. C. Ormond, Third Infantry, M. N. G., for erecting armory. Probable cost, $30,000. Hoffman & Mosse, Archts., Rochester.

Leavenworth, Kan.—Until Sept. 10 at office of F. H. Duehay, Supt. Prisons, Washington, D. C., for furnishing and delivering at U. S. Penitentiary, Leavenworth, reinforcing material structural steel, miscellaneous steel, iron and brass work, steel cell fronts and mechanical locking devices for entire cell blocks of west main cell wing.

Syracuse, Kan.—Reported desired until Aug. 30 (extension of date from Aug. 9) by W. E. Hulse & Co., Archts., First National Bank Building, Hutchinson, for erecting a 2-story and basement school. Probable cost, $28,000.

Kansas City, Mo.—Reported desired until Aug. 30 by Shepard, Farrar & Wiser, Archts., R. A. Long Building, for erecting a 6-story and basement, 44 x 118 ft. and 44 x 122 ft. hospital for German Hospital Assoc. (S. L. Woodell, Mgr., Twenty-third and Holmes Streets.)

Gainesville, Tex.—Patrick Henry, Chmn. Bd. Trus. Girls' Training School, writes bids will not be opened until about Sept. 15 for erecting 5 brick buildings, each 2 stories, to cost a total of about $100,000. Architect, Ernest E. McAnelly of Dallas.

Tulsa, Okla.—Until Sept. 30 by James A. Wetmore, Acting Supervising Archt., Washington, D. C., for installation, complete, of mechanical equipment (except lighting fixtures), U. S. Post Office and Court House, Tulsa.

Bremerton, Wash.—Until Sept. 25 by Bureau Yards and Docks, Navy Dept., Washington, D. C. (William M. Smith, Acting Ch.), for stable at the naval hospital, Navy Yard, Puget Sound, Wash., as per Spec. No. 2186.

Seattle, Wash.—Reported desired until Sept. 1 by Port of Seattle Comn. (C. E. Remsberg, Secy.), for furnishing and laying mastic flooring in new fruit storage building, East Waterway Terminal; also extending fire protection system at Smith Cove improvement.

Vancouver, Wash.—Reported desired about Sept. 1 by State Bd. Control, Olympia (E. S. Emigh, Secy.), for erecting school for blind, Vancouver. Probable cost, $75,000. Julius Zittle, Archt., Spokane.

Los Angeles, Cal.—Until Sept. 2 by Bd. Educ., Los Angeles (William A. Sheldon, Secy.), for furnishing material and erecting an addition to San Pedro High School, San Pedro.

Also same time and place as above for erecting a school on the Lomita school site, Lomita.

Patton, Cal.—Until Sept. 14 by W. F. McClure, State Engr., Forum Bldg., Sacramento, for erecting Cottages "N" and "O," Southern California State Hospital, Patton.

Vallejo, Cal.—Until Sept. 25 at Bureau Yards and Docks, Navy Dept., Washington, D. C. (William M. Smith, Ch.), for erecting at Navy Yard, Mare Island, 3-story and basement marine barracks, reinforced concrete construction, steel rod trusses, as per Spec. 2174.

Douglas, Ariz.—Reported desired until Sept. 3 by Bd. Trus., Douglas School Dist. No. 27 (S. P. Applewhite, Clk.), for erecting two grade schools and an addition to high school. Leschler & Kibbey, Archts., Phoenix.

Flagstaff, Ariz.—Until Aug. 31 by James Osborne Craig, Archt., Flagstaff, for erecting a dormitory building at the Northern Arizona Normal School, Flagstaff. R. J. White, Secy. Bd. Educ., Northern Normal Arizona School.

Hayden, Ariz.—Reported desired until Sept. 1 by J. H. Brown, Clk. School Bd., for erecting a 9-room grammar school at Raymond and Hayden Aves. for School Dist. No. 17. Nels Johnson, Engr., Hayden.

Carleton Point, P. E. I.—Until Sept. 8 by J. W. Pugsley, Secy. Dept. Railways and Canals, Ottawa, Ont., for station, water tank, engine house, etc., at Carleton Point Car Ferry Terminal, Prince Edward Island.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Gardiner, Me.—Following are three lowest bids opened Aug. 13 by Superv. Architect, Washington, D. C., for erecting U. S. Post Office—(a) limestone, (b) sandstone: W. H. Fissell & Co., New York, (a) $55,000, (b) $60,000; E. T. Abbott Constr. Co., New York, (a) $58,920, (b) $61,200; T. P. Morreau & Co., Lewiston, Me., (a) $59,894, (b) $61,674.

Norfolk, Mass.—Following are four bids opened by Kendall, Taylor & Co., 93 Federal Street, Boston, for erecting five cottage buildings at Norfolk State Hospital: R. A. Sherman Sons Co., Westerly, R. I., $38,536; Charles E. Currier, 110 Summer Street, Boston, $36,898; N. J. Magnon, North Attleboro, $30,838, and A. H. Smith, Walpole, $33,975. N. J. Magnon submitted lowest bid for dining room at $11,771.

North Attleboro, Mass.—Following are four lowest bids opened Aug. 12 by Superv. Architect, Washington, D. C., for erecting U. S. Post Office—(a) limestone, (b) sandstone: James A. Munroe, North Attleboro, (a) $47,817, (b) $48,100; W. H. Fissell & Co., New York, (a) $47,990, (b) $48,790; Torbert Constr. Co., Hampton, Va., (a) $50,249, (b) $50,749; Westchester Engineering Co., White Plains, N. Y., (a) $50,700; George Howard & Sons Co., Brockton, Mass., (b) $51,400.

★**Providence, R. I.**—Contract for erecting Beaufort Street school reported awarded by Bd. Contract and Supply to Hope Bldg. Co., Providence, at $140,531.

★**Brooklyn, N. Y.**—Following are totals of bids opened Aug. 23 by C. B. J. Snyder, Supt. School Bldgs., New York City, for general construction of addition to School 89, Newkirk Avenue and E. Thirty-first Street, Brooklyn: H. C. Stowe Constr. Co., 221 Greenpoint Avenue, Brooklyn, $45,645 (awarded contract); J. Kresse Co., 52 Vanderbilt Avenue, New York, $47,850; W. M. Werner, $48,980.

★**Lockport, N. Y.**—Contract awarded Manion Bros., Rochester, for enlarging County Clerk's office, at $23,852.

★**Syracuse, N. Y.**—Contracts for erecting Delaware School awarded Aug. 23 as follows: General construction, King Lumber Co., Charlottesville, Va., $221,225; heating, W. F. Devendorf Co., Rochester, $39,985; plumbing, Buns Bros., Syracuse, $14,239; electric work, E. Joy Co., Syracuse, $7,587.

★**Lambertsville, N. J.**—Contract for erecting 9-room addition to Third Ward School awarded Fred. R. Parker, Trenton, at $23,392.

★**Lansford, Pa.**—Contract for erecting Central High School awarded to United Fireproof Constr. Co., New York, at $112,750.

★**Monongahela, Par.**—Yohe Bros., Monongahela, secured contract for erecting Municipal building. Probable cost, $25,000. C. C. Compton, Archt., Donora.

★**Natrona, Pa.**—Contract for erecting school in Natrona for Harrison Township Bd. Educ. awarded George Schenk & Co., of Butler, at $34,475.

Philadelphia, Pa.—Lowest bid opened for alterations and additions to Germantown High School submitted by W. C. Christy & Son at $49,107. J. Horace Cook, Archt., City Hall.

★**Clintwood, Va.**—Contract for erecting brick court house reported awarded D. J. Kelly, Clintwood, at about $25,000. H. M. Miller, Archt., Roanoke, Va.

★**Wellsburg, W. Va.**—Contract for erecting U. S. Post Office awarded Colonial Constr. Co., Charlottesville, Va., at $41,500.

★**New Orleans, La.**—Contract awarded by Bd. Comrs. Port New Orleans (Ernest M. Loeb, Pres.) for constructing reinforced concrete buildings for cotton warehouses and terminals, from plans of Ford, Bacon & Davis, 921 Canal Street, to Jacob A. Zimmermann & Sons, Inc., 18 East Forty-first Street, New York, $1,109,000 (bids opened July 21),

★**West Alexandria, Ohio.** — Contracts awarded by Ed. Edgc Lanier Township School Dist. (N. L. Paxson, Clk., R. D. No. 2, West Alexandria) for erecting Centralized School, from plans of E. J. Mountstephens, U. R. Building, Dayton, as follows: General construction, to John Boren & Sons Co., Dayton; electric work, to Hatfield Electric Co., Indianapolis; plumbing, to John Arpp Co., Middletown, Ohio.

★**Dayton, Ohio.**—Contract for erecting 2-story reinforced concrete and brick centralized school awarded John Boren Sons Co., Dayton, at $[illegible].

★**Eaton, Ohio**—Contract for erecting central high school in Jefferson Township awarded to W. M. Frye of Piqua at $44,000.

★**Albion, Mich.**—Contract for erecting U. S. Post Office awarded Callahan Mandl Co., Chicago, Ill., at $[illegible].

Rockford, Ill.—We are informed that contract for foundation for Swedish American Hospital 3 stories, 86 x 115 ft., awarded to Gus Holm, Rockford. General contract will not be let until about January, 1913. Architects, Peterson & Johnson, Rockford.

★**Cherokee, Iowa.**—Contracts for erecting high school awarded as follows: General contract, to Laxant & Bass, Faribault, at $[illegible]; wiring, Des Moines Electric Contr. Co., Des Moines, $1,197, and heating and plumbing, Swanson & Betsworth, Cherokee. Architects, Proudfoot, Bird & Rawson, Des Moines.

★**Larned, Kan.**—Contract for erecting cottage and small laundry at Larned State Hospital reported awarded William Foley, Dodge City, at $29,075. C. H. Chandler, State Archt., Topeka.

★**Longview, Tex.**—Contract for erecting U. S. Post Office reported relet to George A. Shaul, Seneca, Kan., at $38,790.

★**Alameda, Cal.**—Contract for pile foundations for Alameda County Infirmary and Infirmary Hospital at Alameda awarded MacArthur Concrete Pile & Foundation Co., Chronicle Building, San Francisco. Clinton Fireproofing Co., General Contractors; Chas. P Weeks, Archt., San Francisco.

★**San Diego, Cal.**—Contract for erecting buildings at the Radio Station awarded Jacobs Constr. Co., Los Angeles, at $39,950.

PRIVATE BUILDINGS

PROPOSED WORK

Boston, Mass.—W. J. McDonald, 95 Milk Street, is interested in syndicate planning erection of an auto garage and warehouse in Brighton to cost $500,000.

Albert Geiger, 87 Milk Street, will erect two buildings on Beacon Street to cost $200,000 and to be occupied by automobile concerns.

Brooklyn, N. Y.—Plans filed for two 6-story brick tenements at Grand Street extension and Keap Street for Williamsburgh Plaza Realty Co., cost $100,000. Shampan & Shampan, Archts., 772 Broadway, Brooklyn.

Plans completed by W. T. McCarthy, 16 Court Street, for two four-story brick apartment houses to be erected by the DeHaven Building Corporation on Avenue C and East Fourth Street at a cost of $90,000.

New York, N. Y.—Plans to be prepared by Gaetan Alaimo, 1 W. Thirty-fourth Street, for a 13-story apartment house to be erected at Riverside Drive and 105th Street by Anthony A. Paterno Constr. Co.

Plans filed for following buildings: 12-story fireproof apartment house at West End Avenue and 103d Street for 385 West End Ave. Corp., cost $[illegible], Gaetan Alaimo, Archt., 1 W. Thirty-fourth Street; 6-story brick tenement at 139th Street and Riverside Drive for West Side Constr. Co., cost $[illegible], George [illegible], Archt., 20 E. Forty-second Street; 6-story brick tenement at 224 W. Twenty-second Street for S. S. Constr. Co., cost $[illegible], Gronenberg & Leopold, Archts., 366 Fifth Avenue; 2-story fireproof public garage and storage building at 225 E. Fifty-fourth Street for Joseph Andersen, cost $[illegible], Ballinger & Perrot, Archts., Marbridge Building; 5-story brick tenement at Reeves Place and 204th Street for Elsie St. Constr. Co., cost $[illegible], Moore & Landsiedel, Archts., Third Avenue and 148th Street; 6-story brick tenement at Creston Avenue and 202d Street for Arcbald Co., Inc., cost $[illegible], Tremont Architectural Co., Archts., 401 Tremont Avenue; 5-story brick tenement at Anthony Avenue and 183d Street for Wolfson Phelps, cost $[illegible], Moore & Landsiedel, Archts., Third Avenue and 149th Street.

Reported Famous Players Film Co., 213 W. Twenty-sixth Street, has secured site at W. 48th Street and Adrian Avenue, Jacobus and Van Cortlandt Places, on which it is proposed erecting motion picture industry, including studios, exposure stages, laboratories and factories for production of films.

Sodus, N. Y.—Plans being prepared by Lees Flurn, Chamber of Commerce Bldg., Rochester, for a 1-story 60 x 175-ft. reinforced concrete storage building for Sodus Fruit Co.

Baltimore, Md.—Joseph Evans Sperry, Baltimore, is preparing revised plans for 5-story Y. W. C. A. building to be erected at Park Avenue and Franklin Street.

Plans being prepared by Louis Levi, Real Estate Trust Building, for alterations and improvements to the five-story brick and stone building to be erected at 217 W. Baltimore Street for Louis Appelfeld.

Norfolk, Va.—Magnolia Camp No. 4 of the Woodmen of the World, County Street, propose erecting a four-story building costing $30,000.

Laurel, Miss. — Plans prepared for Leader Building, to be erected for Laurel Daily Leader.

Louisville, Ky.—Plans being prepared by Brinton B. Davis, Inter-Southern Bldg., for 5-story reinforced concrete, brick and terra cotta fireproof building to be erected at Fourth and Market Streets.

Akron, Ohio—Plans being prepared by Kregilius & Robinson, Leader News Bldg., Cleveland, for 3-story reinforced concrete mercantile building for Hower Co., Akron. Cost, $40,000.

Cincinnati, Ohio.—Contract soon to be let by Howard McClorey, Archt., Gerke Bldg., for erecting parish school for St. Augustine R. C. Church; cost $35,000.

Plans being prepared for 4-story pressed brick and stone fireproof college building for St. Xavier's College to be erected on Dana Avenue and Winding Way; cost $200,000.

Fremont, O.—Masons propose erecting $75,000 temple.

Ironton, Ohio.—Plans being prepared by Weber, Werner & Adkins, Cincinnati, for 4-story terra cotta store, office and fraternal building to be erected by the Masons; cost $75,000.

Ironton, Ohio—Weber, Werner & Adkins, Cincinnati, are architects for the Masonic Temple.

Washington, C. H., Ohio.—Reported Baltimore & Ohio Southwestern (Francis L. Stuart, Ch. Engr., Baltimore, Md.), Cincinnati, Hamilton & Dayton and Detroit, Toledo and Ironton Railway Companies propose erecting a union station costing $45,000.

Evansville, Ind.—The Hotel Bldg. Co. organized to erect 8-story fireproof hotel, to be known as the McCurdy Hotel. Incorporators, D. E. Cadick, Grandview; W. H. McCurdy of Evansville and others.

Detroit, Mich.—Albert Kahn & Ernest Wilby, Lafayette Bldg., have prepared plans for 2-story auditorium and convention hall to be erected on Woodward Avenue and Antoinette Street.

Sturgis, Mich.—W. C. Grobheiser, furniture manufacturer, having plans prepared for business block. Cost, $50,000.

Waterloo, Iowa—Waterloo Overland Co., 102 East Fifth Street, considering erecting 4-story reinforced concrete automobile garage. Probable cost $100,000.

St. Paul, Minn.—Plans being prepared for an 8-story fireproof store building for St. Paul House Furnishing Co. (Joseph Levy, Pres.) to be erected at East Eighth and Cedar Streets.

Mandan, N. D.—Elks have authorized plans prepared for a lodge and theater building costing $35,000.

Anaconda, Mont. — Reported Hanson MacPherson Co., Anaconda, contemplates erecting 3-story apartment house at Washington and Park Streets; cost $200,000.

Kansas City, Mo.—Pierre S. Brown, 2445 Prospect Avenue, will erect an apartment building at Armour Boulevard and the Paseo. Probable cost, $50,000.

St. Louis, Mo.—W. K. Bixby, Century Building, reported interested in corporation which intends erecting 16-story brick hotel at Twelfth and Locust Streets.

Laredo, Tex—Laredo Natl. Bank intends erecting a 2- or 3-story brick and terra cotta fireproof bank and office building on Market Plaza costing $38,000.

Tacoma, Wash. — Reported Luther Twitchell, Savage Scofield Building, has completed plans for a 3-story reinforced concrete, brick and terra cotta addition to Bankers Trust Building, Pacific Avenue; cost $65,000.

Walla Walla, Wash.—Commercial Club (P. H. Weyrauch, Pres.) reported to have appointed committee to devise ways and means to obtain from $10,000 to $15,000 for construction of a 100 x 200 ft. concrete natatorium for city. Bond issue may be voted upon.

Portland, Ore. — Plans completed by Whidden & Lewis, Lewis Building, for a residence to be erected by T. B. Wilcox, about three miles from Portland, on Shattuck Road; cost $[illegible].

Reported wool warehouse of Theodore Bernstein & Co., Twelfth and Kearney Streets, destroyed by fire, is to be rebuilt. Plans being prepared by Camp & Du-Puy, 426 East Alder Street, for a two-story 50 x 100-ft. combination brick and concrete storage plant and warehouse to be erected at East Third and Alder Streets for W. B. Gafke Produce Co.; cost $100,000.

Pocatello, Idaho.—The building occupied by Bistline Grocery Co. and owned by Pierce & Trapp, recently destroyed by fire, is to be rebuilt.

BIDS DESIRED.

Plainfield, Ind.—Reported desired until Aug. 31 by E. B. Mills, Secy. F. & A. M., for erecting 2-story and basement lodge building, 132 x 35 x 54 x 55. Layton Allen, Archt., Lombard Building, Indianapolis.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Syracuse, N. Y.**—Contract for masonry and carpentry work on Masonic Temple awarded Frederick A. Caswell, Watertown, at $97,000.

★**Elizabethtown, Pa.**—Contract awarded by Philadelphia County Members of the Masonic Fraternity to the Pomeroy Constr. Co., 1609 Ramstead Street, Philadelphia, for erecting one of the units of the hospital at the Masonic Village, Elizabethtown, 3 stories, 36 x 60 ft.

★**Freeland, Pa.**—Contract awarded Andrew Breslin, Summit Hill, at $45,000, for erecting St. Joseph's R. C. Church.

★**Philadelphia, Pa.**—Contract for erecting a bank building at 1416 Chestnut Street and a 15-story office building adjoining on Sansom Street awarded Cramp & Co., Denckler Building. Furness, Evans & Co., Philadelphia, and McKim, Mead & White, N. Y., Assoc. Archts. Cost about $600,000.

★**Cleveland, Ohio.**—Contract for erecting St. Catharine's R. C. Church reported awarded Emile Converse of Massillon; cost, $40,000. Rev. James J. Quinn, Pastor.

★**Springfield, Ohio.**—Contract for erecting eight-story hotel, "The Shawnee," reported awarded to Caldwell & Drake of Lafayette, Ind.; cost $300,000.

★**Toledo, Ohio.**—Contract for concrete pile foundation for building at St. Clair and Adams Streets for Castleton Co. awarded MacArthur Concrete Pile & Foundation Co., 11 Pine Street, New York. Mills, Rhines, Bellman & Nordoff, Archts., Ohio Building.

★**Champaign, Ill.**—Contract for erecting five-story store and office building for Jos. & Isaac Kuhn awarded English Bros. of Champaign; cost about $100,000.

★**Fort Dodge, Iowa**—Contract for erecting sections of edifice for Sacred Heart Roman Catholic Church awarded to Jensen Constr. Co., Fort Dodge, at $29,989. Next three lowest bids: H. J. Litterell, Webster City, $30,500; J. B. Evans Constr. Co., Mexico, Mo., $32,485; Schmidt Bros. Constr. Co., Chicago, Ill., $33,900. Rev. Edmond Heaton, pastor.

NEW INDUSTRIAL PLANTS

PROPOSED WORK

Bangor, Me.—F. H. Drummond, Bangor, reported interested in the building of a cold storage plant in this city; cost $100,000.

Worcester, Mass.—The Graton & Knight Mfg. Co. intends erecting a three-story brick, steel and concrete addition to cost $50,000.

Pawtucket, R. I.—Plans being prepared by Jencks & Ballou, Providence, for a 3-story brick mill 100 x 70 ft. for plant of Philips Insulated Wire Co.

Putnam, Conn.—Eclipse Mfg. Co. will erect a brick factory 65 x 145 ft. for manufacture of women's garments.

Buffalo, N. Y.—Kellogg Structural Steel Co. will erect at N. Y. C. & H. R. R. and Bailey Avenue fabrication shop, structural steel, 55 x 185 ft. Similar building will be erected later.

Lehigh Valley R. R. (E. B. Ashby, Ch. Engr., 143 Liberty Street, New York) reported considering plans for constructing a repair shop costing $250,000.

Dunkirk, N. Y.—Plans completed by Empire Axle Co. for additions to plant. Capital has been increased from $20,000 to $100,000 for purpose.

Jamestown, N. Y.—Advertising Mfg. Co. (James Thompson, Pres. and Genl. Mgr.) will erect at factory of Ideal Furniture Co., East Jamestown, one-story reinforced concrete addition, 40 x 200 ft., equipping same with machinery for manufacture of matches.

Seneca Falls, N. Y.—Plans being prepared by Willard Case & Co., 17 Battery Place, New York City, for a factory building, 80,000 sq. ft., to be erected by Seneca Falls Mfg. Co., for manufacture of machine tools.

Camden, N. J.—Plans being prepared by Ballinger & Perrot, 1211 Arch St., Philadelphia, Pa., for brick and concrete addition and alterations to factory of Taylor White Extracting Co.

Peech Sons & Phillips Co. will erect a 3-story brick addition to plant, including erection of a larger power plant.

Kulpmont, Pa.—Plans prepared by W. U. Jury, Archt., Shamokin, for 4-story, 60 x 238 ft. steel frame and hollow tile fireproof mill to be erected on Chestnut Street for Shamokin Silk Mill (James C. Brown, Genl. Mgr.), Shamokin.

Philadelphia, Pa.—Contract soon to be let for four-story reinforced concrete and brick factory 75 x 165 ft., to be erected for J. D. Lit according to plans by Stearns & Castor, Stephen Girard Bldg.

Roaring Springs, Pa.—D. M. Bare Paper Co., Roaring Springs, has retained Richard K. Meade, Chemical, Mechanical and Industrial Engr., 202 North Calvert Street, Baltimore, Md., to prepare plans and to superintend construction of a lime recovery plant for converting the lime waste or sludge, now discarded, into lime of the highest quality. All buildings are to be of steel. Kiln will be revolving cylinder, 6 ft. in diam. and 100 ft. long, and the lime as it falls red hot from this kiln will be automatically cooled and conveyed to lime house.

Baltimore, Md.—Bethlehem Steel Co., it is reported, intends improving the plant of Detrick & Harvey Machine Co. which they recently purchased.

Granite Falls, N. C.—D. W. Warlick, Secy. Dudley Shoals Cotton Mill Co., reported planning organizing company for purpose of constructing cotton mill having 15,000 spindles operated by electric power.

New Orleans, La.—Ford, Bacon & Davis, 921 Canal Street, engineers of the Dock Bd., reported preparing plans for grain elevator to be erected on the river front.

Wheeling, W. Va.—Reported National Tube Co., Wheeling, intends erecting mill adjoining present plant near Benwood line.

Evansville, Ind.—Reported the Evansville Packing Co. will erect packing plant here costing $150,000.

Fort Wayne, Ind.—Frysinger Bros. of the Wayne Overall Co. will erect this fall or early next spring a 3-story and basement brick, 144 x 75 ft., factory on East Wallace Street. Approximate cost, $40,000.

Grand Rapids, Mich.—Grand Rapids Paper Box Co. has had plans prepared by Robinson & Campau, Houseman Bldg., for a 4-story brick and mill constructed factory to be erected on Bond Avenue, N. E., and Fairbanks Street.

Logan, Mont.—Reported plant of Montana Concrete Co., at Moncrete, 2 miles west of this city, recently destroyed by fire, is to be rebuilt. Daniel Morrison, Whitehall, Mont., interested.

North Yakima, Wash.—The abattoir and packing plant of the Independent Meat Packing Co., recently destroyed by fire, is to be rebuilt.

Albany, Ore.—Reported R. Thomas of Albany is interested in project to erect a paper manufacturing plant in this city; cost estimated at $1,000,000.

Welland, Ont.—Canadian Zinc Co. has leased plant of the Quality Bed Co. and will equip same for smelting of zinc ores.

Esquimalt, B. C.—Reported Imperial eight storage tanks, a 2-story concrete and structural steel warehouse, boiler house, brick and steel office building, brick stables, freight elevator, etc.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**East Springfield, Mass.**—Contract awarded Fred. T. Ley, Inc., Springfield, for erecting two buildings for New England Westinghouse Co. One building to be one-story, 45 x 279 ft., brick and wood, the other 150 x 350 ft., one-story saw-tooth roof, brick and steel. Cost $75,000.

★**Bridgeport, Conn.**—Contract awarded T. J. Pardy Constr. Co., 15 Fairfield Avenue, for erecting three factory buildings for Remington Arms Union Metallic Cartridge Co., on Barnum Avenue. Cost $500,000. Two of the buildings will be four-story, 60 x 240 ft., and have ells 48 x 64 ft.; the other will be two-story, 60 x 240 ft.

★**Camden, N. J.**—Contract reported to Turner Concrete Steel Co., Philadelphia, Pa., for erecting 3-story brick and reinforced concrete 100 x 100 ft. factory for E. & R. Preisendanz.

★**Harrison, N. J.**—Contract for erecting six-story 90 x 110 ft. concrete and brick addition to plant of Hyatt Roller Bearing Co. on Middlesex Street, awarded American Concrete Steel Co., Newark.

★**Baltimore, Md.**—Pittsburgh Bridge & Iron Wks., Rochester, Pa., and Sandford & Brooks Co., 24 Commerce Street, secured contract from G. Ober & Sons Co. for erecting fertilizer plant at foot of Hull Street, 2234 x 176 ft., 50 ft. high. Probable cost, $55,000.

★Contract for erecting iron workers' shop at plant of Baltimore Drydocks & Shipbuilding Co. at Locust Point awarded Chesapeake Iron Wks., Baltimore, and contract for crane in said building to Richd. Morton, Equitable Building; cost $100,000.

★Permit issued to G. Ober & Son Co. for erecting one-story steel building at

foot of Hull Street. Sanford & Brooks, Baltimore; Pittsburgh Bridge & Iron Wks., and Asbestos Protective Metal Co., Equitable Building, builders. Cost $55,000.

★**Steubenville, Ohio.**—Contract reported awarded to Koppers Co., Pittsburgh, Pa., for erecting a by-product coking plant on West Virginia side of Ohio River, for La Belle Iron Co., Steubenville. Cost reported at $2,000,000. It is stated that a bridge costing $500,000 is to be erected to connect the plants across the river.

★**Kalamazoo, Mich.**—Contract for erecting four buildings for Rex Paper Mills Co. awarded Hauser-Owen-Ames Co., Grand Rapids; cost about $65,000.

MISCELLANEOUS

PROPOSED WORK

Trap Rock Quarry—Amherst, Mass.—Edward Balf Sales Co., Hartford, Conn., has purchased Bare Mountain, in the southern part of Amherst, for purpose of quarrying trap rock, to be crushed and used principally in building macadam road through western part of Massachusetts.

Park Bonds—Lincoln, Neb.—Bonds for $50,000 for park improvements will be sold Sept. 10 by Theodore H. Berg, City Clk.

BIDS DESIRED.

Power Plants, Etc.—Washington, D. C.—Until Nov. 17 by James A. Wetmore, Acting Superv. Archt., Washington, D. C., for constructing a central heating, lighting and power plant.

Pumps, Etc. for Oil Plants—Washington, D. C.—See "Public Buildings."

Tunnel—Dunning, Ill.—Until Aug. 30 by State Bd. Administration, Springfield (Frank D. Whipp, Fiscal Supervisor), for constructing tunnel and pipe work at Chicago State Hospital, Dunning. Martin C. Schwab, Consult. Engr., Mallers Building, Chicago.

Fire Protection System—Seattle, Wash.—See "Public Buildings."

Crane, Hoist, Etc.—Toronto, Ont.—Until Aug. 31 by T. L. Church, Mayor, Chmn. Bd. Control, for furnishing and erecting an electric crane, hoist and single line clam shell bucket at main sewage disposal works.

Steel Reinforcing Bars, Etc.—Panama.—Until Sept. 10 by Maj. F. C. Boggs, Corps Engrs., U. S. A., General Purchasing Officer, Panama Canal, Washington, D. C., for Cir. 963—Steel Reinforcing bars, sheet brass, bronze bars, yellow metal, babbitt metal, etc.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Boiler Plant—Indian Head, Md.**—Contract for extension and new equipment for Indian Head boiler plant reported awarded to John Danforth of 72 Ellicott Street, Buffalo, N. Y., at $153,931.

Proposals

For Proposals Advertised, see Pages 47, 48 and 49.

WATERWORKS.

Bids Close.		See Eng. Record.
Aug. 30.	Gates, Hoists, Etc., Jefferson, Wis. ..... Adv. Aug. 21, 28.	Aug. 21
Aug. 31.	Contract 154, New York, N. Y. ..... Adv. Aug. 14.	Aug. 14
Aug. 31.	Pumps, Etc., Woodbury, N. J.	Aug. 28
Sep. 1.	Water Works, Farmersville, Ohio ..... Adv. Aug. 21.	Aug. 21
Sep. 1.	System, Craig, Col.	Aug. 28
Sep. 1.	Steel Tower, Battle Creek, Iowa	Aug. 28
Sep. 2.	System, Arcadia, Cal....	Aug. 21
Sep. 2.	Tank, Shenandoah, Iowa.	Aug. 28
Sep. 3.	System at Almshouse, Newark, N. J.	Aug. 28
Sep. 6.	Pump Unit, Regina, Sask.	Aug. 7
Sep. 6.	Improv., Virginia, Minn..	Aug. 21
Sep. 6.	Water Works Improv., Humboldt, Iowa	Aug. 21
Sep. 7.	Mains, Cleveland Heights, Ohio	Aug. 14
Sep. 7.	C.-I. Pipe, Vallejo, Cal...	Aug. 14
Sep. 7.	Well pump and service pumps, Monticello, Ill...	Aug. 14
Sep. 7.	Pipe, Washington, D. C..	Aug. 21
Sep. 8.	Pump, Humboldt, Iowa..	Aug. 21
Sep. 10.	Reservoir, Oberlin, Ohio..	Aug. 28
Sep. 13.	Well, Hastings, Neb..... Adv. Aug. 28.	Aug. 28
Sep. 14.	Pipe, Washington, D. C..	Aug. 21
Sep. 14.	Water Works, Belleville, Ohio	Aug. 28
Sep. 14.	Gate Valves, Brooklyn, N. Y.	Aug. 28
Sep. 15.	Pipes, Valves, Etc., Medina, Ohio ..... Adv. Aug. 28.	Aug. 28
Sep. 15.	Water Works, Manchester, N. Y. ..... Adv. Aug. 28.	Aug. 28
Sep. 20.	Water Works, Myton, Utah. ..... Adv. Aug. 28.	Aug. 28
Sep. 23.	Water Works, Whitehall, Mont. ..... Adv. Aug. 28.	Aug. 28
———	Well, Thomasville, Ala.. Adv. Aug. 28.	Aug. 28

SEWERAGE AND SEWAGE DISPOSAL.

Aug. 30.	Sellersville, Pa. ..... Adv. Aug. 14 to 28.	Aug. 14
Aug. 30.	Washington, D. C.....	Aug. 28
Aug. 31.	Newark, N. J. ..... Adv. July 17 to Aug. 7.	July 10
Aug. 31.	Yorktown Heights, N. Y. Adv. Aug. 14, 21.	Aug. 14
Aug. 31.	Rochester, N. H..... Adv. Aug. 14, 21.	Aug. 14
Aug. 31.	New York, N. Y.....	Aug. 28
Aug. 31.	Dormont, Pa.	Aug. 28
Sep. 1.	Sand Springs, Okla.....	July 31
Sep. 1.	Maquoketa, Iowa ..... Adv. Aug. 21.	Aug. 21
Sep. 3.	Springfield, Ohio.....	Aug. 28
Sep. 8.	Crofton, Neb.	Aug. 28
Sep. 7.	Albany, N. Y..... Adv. Aug. 7 to 21.	Aug. 7
Sep. 7.	Cleveland Heights, Ohio.	Aug. 14
Sep. 7.	Pullman, Wash.	Aug. 21
Sep. 7.	South Orange, N. J.....	Aug. 21
Sep. 7.	Huntington Beach, Cal..	Aug. 28
Sep. 13.	Roslyn, Wash.	Aug. 28
Sep. 14.	Ocala, Fla.	Aug. 14
Sep. 14.	Clinton, Iowa	Aug. 21
Sep. 20.	Brainerd, Minn.	Aug. 28
Sep. 20.	Port Clinton, Ohio.....	Aug. 28
Sep. 23.	Whitehall, Mont. ..... Adv. Aug. 28.	Aug. 28
Aug. 31.	Chanute, Kan.	Aug. 28
Oct. 14.	Mansfield, Ohio	Aug. 28

BRIDGES.

Aug. 31.	Hartford, Conn. ..... Adv. Aug. 21.	Aug. 21
Aug. 31.	Doylestown, Pa.	Aug. 28
Sep. 1.	Detroit, Mich.	Aug. 14
Sep. 1.	Plans, Woonsocket, R. I. Adv. Aug. 21.	Aug. 21
Sep. 1.	New Philadelphia, Ohio..	Aug. 28
Sep. 1.	Delanco, N. J.	Aug. 28
Sep. 1.	Halifax, N. S.	Aug. 28
Sep. 3.	St. Paul, Neb.	Aug. 14
Sep. 3.	Cincinnati, Ohio	Aug. 21
Sep. 3.	Grand Rapids, Ohio.....	Aug. 28
Sep. 3.	Easton, Pa.	Aug. 28
Sep. 3.	Buffalo, N. Y.	Aug. 28
Sep. 3.	Assiniboia, Man.	Aug. 28
Sep. 4.	Bridgeport, Conn. ..... Adv. Aug. 14, 28.	Aug. 21
Sep. 6.	Columbus, Miss.	Aug. 14
Sep. 6.	Worland, Wyo.	Aug. 28
Sep. 7.	Hudson, S. D.	Aug. 14
Sep. 7.	Ellinwood, Kan.	Aug. 21
Sep. 7.	Zanesville, Ohio	Aug. 28
Sep. 7.	Indiana	Aug. 28
Sep. 7.	Zanesville, Ohio	Aug. 28
Sep. 7.	Canton, S. D.	Aug. 28
Sep. 7.	Olean, N. Y. ..... Adv. Aug. 28.	Aug. 28
Sep. 7.	Nicholasville, Ky.	Aug. 28
Sep. 7.	Harrison, Neb.	Aug. 28
Sep. 8.	South Amboy, N. J.....	Aug. 7
Sep. 8.	St. Paul, Neb.	Aug. 28
Sep. 8.	Indiana	Aug. 28
Sep. 8.	Aberdeen, Wash.	Aug. 28
Sep. 9.	Indiana	Aug. 28
Sep. 9.	Glenolden, Pa.	Aug. 28
Sep. 10.	Dillion, Mont.	Aug. 21
Sep. 10.	Walla Walla, Wash.....	Aug. 28
Sep. 10.	Austin, Minn.	Aug. 28
Sep. 11.	Hamilton, Ohio	Aug. 28
Sep. 13.	Hamilton, Ohio	Aug. 28
Sep. 17.	Steubenville, Ohio	Aug. 28
Sep. 17.	Cincinnati, Ohio	Aug. 28
Sep. 18.	Ellsworth, Kan.	Aug. 28
Sep. 22.	Westport, Conn. ..... Adv. Aug. 28.	Aug. 28
Sep. 25.	Hankow, China. ..... Adv. Aug. 14.	Aug. 14
Oct. 6.	Lawrence, Kan..... Adv. Aug 14 to 28.	Aug. 14

PAVING AND ROADS.

Aug. 31.	Xenia, Ohio	Aug. 21
Aug. 31.	Bloomsburg, Pa. ..... Adv. Aug. 21.	Aug. 21
Aug. 31.	Toledo, Ohio	Aug. 28
Aug. 31.	Bloomington, Ill. ..... Adv. Aug. 21, 28.	Aug. 21
Aug. 31.	New York, N. Y.....	Aug. 28
Aug. 31.	Massachusetts	Aug. 28
Aug. 31.	Green Bay, Wis.	Aug. 28
Aug. 31.	Belleville, N. J.....	Aug. 28
Aug. 31.	Philadelphia, Pa.	Aug. 28
Aug. 31.	Columbus, Ohio	Aug. 28
Aug. 31.	Pittsburgh, Pa.	Aug. 28
Aug. 31.	Memphis, Tenn.	Aug. 28
Aug. 31.	Kansas City, Mo.....	Aug. 28
Sep. 1.	Illinois	Aug. 28
Sep. 1.	Long Island City, N. Y..	Aug. 28
Sep. 1.	Bonds, Greenwood, S. C.. Adv. Aug. 28.	Aug. 28
Sep. 1.	Portsmouth, Ohio	Aug. 28
Sep. 1.	Great Bend, Kan.....	Aug. 28
Sep. 1.	Catskill, N. Y.....	Aug. 28
Sep. 2.	Salem, Ohio	Aug. 21
Sep. 2.	Jackson City, Mich.....	Aug. 21
Sep. 2.	Tazewell, Tenn.	Aug. 21
Sep. 2.	Boscobel, Wis.	Aug. 21
Sep. 2.	Newark, N. J.....	Aug. 28
Sep. 2.	Jersey City, N. J.....	Aug. 28
Sep. 2.	Stevenson, Wash.	Aug. 28
Sep. 3.	Toledo, Ohio	Aug. 14
Sep. 3.	Saint Maries, Idaho.....	Aug. 28
Sep. 6.	Junction City, Kan.....	Aug. 28
Sep. 6.	Marcus Hook, Pa. ..... Adv. Aug. 28.	Aug. 28
Sep. 6.	Spokane, Wash.	Aug. 28
Sep. 7.	Princess Anne, Md.....	Aug. 14
Sep. 7.	Cleveland Heights, Ohio.	Aug. 14
Sep. 7.	Winamac, Ind.	Aug. 14
Sep. 7.	Louisiana	Aug. 21
Sep. 7.	Hackensack, N. J.....	Aug. 21
Sep. 7.	Indiana	Aug. 21
Sep. 7.	Mount Vernon, Ind.....	Aug. 28
Sep. 7.	Oakland, Cal.	Aug. 28
Sep. 7.	Shaker Heights, Ohio....	Aug. 28
Sep. 7.	Lake Charles, La.....	Aug. 28
Sep. 7.	Newark, N. J.....	Aug. 28
Sep. 7.	Nicholasville, Ky.	Aug. 28
Sep. 7.	Los Angeles, Cal.	Aug. 28
Sep. 7.	Santa Barbara, Cal.	Aug. 28
Sep. 8.	Louisiana	Aug. 21
Sep. 8.	Washington	Aug. 21
Sep. 8.	Newark, Ohio	Aug. 21
Sep. 8.	Indiana	Aug. 21
Sep. 8.	Lorain, Ohio	Aug. 28
Sep. 8.	Farmingdale, L. I., N. Y. Adv. Aug. 28.	Aug. 28
Sep. 8.	Riverside, Cal.	Aug. 28
Sep. 9.	Tallahassee, Fla.	Aug. 14
Sep. 9.	Pittsburgh, Pa.	Aug. 28
Sep. 10.	Worcester, Ohio	Aug. 21
Sep. 10.	Tacoma, Wash.	Aug. 28
Sep. 11.	Road Roller, Indiana.....	Aug. 21
Sep. 13.	Montclair, N. J..... Adv. Aug. 28.	Aug. 28
Sep. 13.	Los Angeles, Cal.	Aug. 28
Sep. 18.	Ellsworth, Kan.	Aug. 28
Sep. 20.	Newark, N. J.....	Aug. 28
Sep. 21.	Baltimore, Md.	Aug. 28

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS.

Aug. 31.	Dredging, San Francisco, Cal.	Aug. 14
Aug. 31.	Dredging, Fort William, Ont.	Aug. 28
Aug. 31.	Ditch, Moorehead, Minn.	Aug. 28
Aug. 31.	Shore Protection, Boston, Mass.	Aug. 28
Sep. 1.	Ditch, New Philadelphia, Ohio	Aug. 14
Sep. 1.	Canal Work, Peterborough, Ont.	Aug. 21
Sep. 1.	Levee Work, Mound City, Ill. ..... Adv. Aug. 21, 28.	Aug. 21
Sep. 1.	Drainage Work, New Philadelphia, Ohio.	Aug. 21
Sep. 1.	Seawall, Waveland, Miss.	Aug. 28
Sep. 1.	Breakwater, Buffalo, N. Y.	Aug. 28
Sep. 1.	Drainage, Goldsboro, N. C.	Aug 28
Sep. 1.	Ditch, Des Moines, Iowa.	Aug. 28
Sep. 1.	Dredging, Taunton, Mass.	Aug 28
Sep. 2.	Ditch, Morris, Minn.....	Aug. 21
Sep. 2.	Reclamation Work, Elephant Butte, N. M.....	Aug. 21
Sep. 3.	Concrete Wall, Kansas City, Kan.	Aug. 28
Sep. 3.	Ditch Work, Roseau, Minn.	Aug. 28
Sep. 7.	Dredging, Wilmington, Del. ..... Adv. Aug. 21, 28.	Aug. 21
Sep. 7.	Cleaning Channel, Glenwood, Iowa.	Aug. 21
Sep. 7.	Ditch, Morris, Minn.....	Aug. 28
Sep. 8.	Irrigation, Malta, Mont... Adv. July 31.	July 31
Sep. 8.	Irrigation, Fort Laramie, Wyo.	Aug. 14
Sep. 10.	Levee, Alexandria, La..	Aug. 28
Sep. 14.	State Canal Wk., Albany, N. Y. ..... Adv. Aug. 14 to 28.	Aug. 14
Sep. 14.	Ditch, Breckenridge, Minn.	Aug. 28
Sep. 15.	Dredging, Baltimore, Md. Adv. Aug. 14, 21.	Aug. 14
Sep. 15.	Irrigation Work, Malta, Mont.	Aug. 29
Sep. 16.	Steel Piling for Dam, Louisville, Ky. ..... Adv. Aug. 21, 28.	Aug. 21
Sep. 16.	Irrigation Work, Newell, S. D. ..... Adv. Aug. 28.	Aug. 28
Sep. 17.	Drainage, Palmetto, Fla.	July 24
Sep. 18.	Pier, Pearl City, T. H.	July 10
Sep. 20.	Lock Gates, Montgomery, Ala. ..... Adv. Aug. 21, 28.	Aug. 21
Sep. 20.	Revetment Work, Hartsburg, Mo. ..... Adv. Aug. 28.	Aug. 28
Sep. 20.	Retaining Wall, Washington, D. C. ..... Adv. Aug. 28.	Aug. 28
Sep. 20.	Irrigation Work, Malta, Mont. ..... Adv. Aug. 28.	Aug. 28
Sep. 22.	Piers, Honolulu, Hawaii..	Aug. 7
Sep. 23.	Dredging, Norfolk, Va... Adv. Aug. 28.	Aug. 28
Sep. 24.	Operating Machinery at Dam, Cincinnati, Ohio.. Adv. Aug. 28.	Aug. 28
Oct. 1.	Dikes, Etc., Cathlamet, Wash.	Aug. 28

PUBLIC BUILDINGS AND SCHOOLS.

Aug. 31.	Little Falls, N. Y..... Adv. Aug. 7.	Aug. 7
Aug. 31.	Baltimore, Md. ..... Adv. Aug. 7, 14.	Aug. 7
Aug. 31.	White Plains, N. Y.....	Aug. 21
Aug. 31.	Grand Mound, Wash.....	Aug. 21
Aug. 31.	Sisseton, S. D.....	Aug. 21
Aug. 31.	St. Croix Falls, Minn....	Aug. 21
Aug. 31.	St. Paul, Minn.....	Aug. 21
Aug. 31.	Buffalo, N. Y.....	Aug. 28
Aug. 31.	Pittsburgh, Pa.	Aug. 28
Aug. 31.	Flagstaff, Ariz.	Aug. 28
Sep. 1.	Hartford City, Ind.....	July 31
Sep. 1.	Wisner, Neb.	July 10
Sep. 1.	Bonds, Lake Linden, Mich. ..... Adv. Aug. 7, 14.	Aug. 7
Sep. 1.	Hammond, Ind. ..... Adv. Aug. 14 to 28.	Aug. 14
Sep. 1.	Minneapolis, Minn.	Aug. 21
Sep. 1.	Eau Claire, Wis.....	Aug. 21
Sep. 1.	St. Louis, Mo.....	Aug. 21
Sep. 1.	Austin, Minn.	Aug. 21
Sep. 1.	School Bonds, Greenwood, S. C. ..... Adv. Aug. 28.	Aug. 28
Sep. 1.	Syracuse, N. Y.....	Aug. 28
Sep. 1.	Seattle, Wash.	Aug. 28
Sep. 1.	Providence, R. I.....	Aug. 28
Sep. 1.	Vancouver, Wash.	Aug. 21
Sep. 1.	Hayden, Ariz.	Aug. 28
Sep. 2.	Portland, Ore.	Aug. 14
Sep. 2.	Tipton, Iowa	Aug. 21
Sep. 2.	Buffalo, Minn.	Aug. 21
Sep. 2.	Maynard, Minn.	Aug. 28
Sep. 2.	East Pittsburgh, Pa.....	Aug. 28
Sep. 2.	Los Angeles, Cal.	Aug. 28
Sep. 3.	Tippecanoe City, Ohio...	Aug. 14
Sep. 3.	Douglas, Ariz.	Aug. 28
Sep. 6.	Cheyenne, Wyo.	Aug. 21
Sep. 6.	Waterloo, Iowa	Aug. 21
Sep. 6.	Washington, Pa.	Aug. 21
Sep. 6.	Philadelphia, Pa.	Aug. 28
Sep. 6.	Sheboygan, Wis.	Aug. 28
Sep. 7.	Charter Oak, Iowa.....	Aug. 14
Sep. 7.	Charlotte, N. C.....	Aug. 7
Sep. 7.	Fulton, Mo.	Aug. 7
Sep. 7.	Columbus, Ohio	Aug. 21
Sep. 7.	Thiells, N. Y..... Adv. Aug. 21, 28.	Aug. 21
Sep. 7.	Columbus, Ohio	Aug. 28
Sep. 8.	Englewood, N. J.....	Aug. 21
Sep. 8.	Albany, N. Y..... (2 props.) Adv. Aug. 21, 28.	Aug. 21
Sep. 8.	Caldwell, N. J.....	Aug. 28
Sep. 8.	Carleton Point, P. E. I...	Aug. 28
Sep. 9.	Woodsfield, Ohio	Aug. 21
Sep. 10.	Gouverneur, N. Y.....	Aug. 7
Sep. 10.	Lebanon, Ind.	Aug. 14
Sep. 10.	Lebanon, Ind.	Aug. 21
Sep. 10.	Perry, Okla.	Aug. 21
Sep. 10.	Leavenworth, Kan.	Aug. 28
Sep. 10.	Belvidere, Ill.	Aug. 28
Sep. 11.	Bremerton, Wash.	Aug. 14
Sep. 11.	Cincinnati, Ohio	Aug. 21
Sep. 11.	Grundy Center, Iowa.....	Aug. 28
Sep. 13.	Cincinnati, Ohio	Aug. 28
Sep. 14.	Boston, Mass. ..... Adv. Aug. 28.	Aug. 28
Sep. 14.	Milledgeville, Ohio	Aug. 28
Sep. 14.	Dayton, Ohio	Aug. 28
Sep. 14.	Batavia, N. Y.....	Aug. 28
Sep. 14.	Patton, Cal.	Aug. 28
Sep. 15.	Hyde Park, Ohio.....	Aug. 21
Sep. 15.	Arverne, N. Y..... Adv. Aug. 21, 28.	Aug. 21
Sep. 15.	Boston, Mass.	Aug. 28
Sep. 17.	Ogden, Iowa	Aug. 28
Sep. 20.	Cincinnati, Ohio ..... Adv. Aug. 28.	Aug. 28
Sep. 20.	Steubenville, Ohio	Aug. 28
Sep. 25.	Vallejo, Cal.	Aug. 28
Sep. 25.	Norfolk, Va.	Aug. 28
Sep. 25.	Bremerton, Wash.	Aug. 28
Sep. 27.	Tulsa, Okla.	Aug. 14
Sep. 28.	Harrisburg, Pa. ..... Adv. Aug. 21, 28.	Aug. 21
Sep. 29.	Smyrna, Del.	Aug. 28
Sep. 30.	Washington, D. C..... Adv. July 24, 31.	July 24
Sep. 30.	Tulsa, Okla.	Aug. 28
Oct. 1.	Kalamazoo, Mich.	Aug. 28
Oct. 16.	Washington, D. C.....	Aug. 28

PRIVATE BUILDINGS.

Aug. 31.	Plainfield, Ind.	Aug. 28
Sep. 1.	New Haven, Conn.....	Aug. 21
Sep. 15.	Seattle, Wash.	Aug. 14

MISCELLANEOUS.

Aug. 31.	Elevators, Amarillo, Tex.	Aug. 7
Aug. 31.	Steel Barges, Etc., Cincinnati, Ohio ..... Adv. Aug. 7 to 28.	Aug. 7
Aug. 31.	Elevator, Medford, Ore..	Aug. 14
Aug. 31.	Elevators, Baltimore, Md.	Aug. 7
Aug. 31.	Painting Dams, Albany, N. Y.	Aug. 21
Aug. 31.	Crane, Hoist, Etc., Toronto, Ont.	Aug. 28
Sep. 1.	Grading School Site, Cincinnati, Ohio ..... Adv. Aug. 7, 21.	Aug. 7
Sep. 1.	Incinerator, Rock Island, Ill.	Aug. 21
Sep. 1.	Steel Transverse Anchors, Panama	Aug. 21
Sep. 1.	Fire Protection System, Seattle, Wash.	Aug. 28
Sep. 2.	Weather Stripping and Screens, Fort Bliss, Tex. Adv. Aug. 14 to 28.	Aug. 14
Sep. 4.	El. Ry., Columbus, Ohio.	Aug. 28
Sep. 8.	R. R. Work, Greenville, S. C.	Aug. 28
Sep. 8.	Incandescent Lamps, Albany, N. Y. ..... Adv. Aug. 28.	Aug. 28
Sep. 10.	Light Station, New Orleans, La.	Aug. 14
Sep. 10.	Cell Fronts, Atlanta, Ga.	Aug. 21
Sep. 10.	Steel Reinforcing Bars, Etc., Panama	Aug. 28
Sep. 10.	Ballast for El. Rys., New York, N. Y.	Aug. 28
Sep. 13.	Equipment for Drydock, Panama	Aug. 21
Sep. 14.	Elevator, Camden, N. J..	Aug. 21
Sep. 13.	Ry. at Naval Station, Pearl Harbor, Hawaii...	July 10
Oct. 16.	Pumps, Etc., for Oil Plants, Washington, D. C.	Aug. 28
Nov. 17.	Power Plants, Etc., Washington, D. C.....	Aug. 28



The Curtis Publishing Company's New Building

Frank C. Roberts & Company and Lucas P. Porter, Architects and Engineers

Wood Block Floors in a great printing plant—

IN the great printing rooms of the Curtis Publishing plant over 1,500,000 copies of the Ladies' Home Journal are made up and printed every month. Over 2,000,000 copies of the Saturday Evening Post and 500,000 copies of the Country Gentleman are printed weekly.

It can readily be seen what a tremendously heavy traffic must pass over the floors. Thousands of reels of paper are handled monthly, and equally as great are the weights of type and printing plates.

In such places as the printing rooms, shipping rooms, etc., U. S. Creosoted Wood Blocks have been laid on a concrete base. Cement floors in these rooms would have been too brittle. They would have pulverized and produced dust and grime. They would be cold underfoot, necessitating special platforms of wood wherever the workmen stand.

Ordinary wood floors would not have served, either. They would have been splintered and crushed under the weights of hand trucks, making repeated renewals necessary.

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Write for our booklet on U. S. Wood Blocks for shop floors. Mailed on request.

U. S. WOOD PRESERVING COMPANY

165 Broadway, New York

CONTRACTING NEWS

Of Special Interest to Engineers, Contractors, Builders and Manufacturers of Engineering and Building Supplies

REPORTS gathered by the New York *Sun* from officers and directors of the United States Chamber of Commerce, who live all over the country, indicate that the strong upward trend is proving to be general throughout our entire business structure. With the exception of the railroads, whose gross earnings are just beginning to show substantial increases, and the cloth-manufacturing industries, where a shortage of dyes is severely felt, everything is improving. Domestic buying is expected to begin, which will put manufacturers back on a firm basis.

The June summary of our foreign commerce, recently issued, which gives the figures for the past fiscal year, instead of indicating that materials for making war form the basis of our foreign trade expansion, shows that the money is going to the farmer and the manufacturer of peaceful products. These groups are being put in the strong financial position necessary before construction improvements, whether financed by taxation or privately, can go forward. The largest group of exports, breadstuffs, increased 150 per cent to $537,000,000, while the next group, cotton, fell only 40 per cent, to $376,000,000. Exports of meat and dairy products increased 50 per cent, to $220,000,000, and exports of hides and manufactured leather nearly doubled, amounting to $186,000,000. Exports of manufactured iron and steel, one of the large groups, fell off slightly, as heavy deliveries did not begin until last spring. The value of domestic animals exported increased seventeen times, making this one of the large export items for the first time. Manufactured products show good gains, but aside from leather and steel products, the totals are still small compared with the farm products, metals and oils. The strength of our position and the ability of Europe, which took more than 80 per cent of these exports, to pay are unquestioned. Uneasiness has been expressed, however, over the long delay in taking permanent steps to correct the British exchange market, which continues to fall to new low levels, and the effect this delay may have on pending export orders. Our exports for last week reached a high mark of $60,000,000, with a large balance of $33,000,000 to our credit on the week's trade.

Buildings

A club house to cost $150,000 has been contracted for in New York City. Several contracts have been awarded at Baltimore on a plant which is to cost $1,000,000. A hotel annex to contain a theater and cost $600,000 has been contracted for at Cleveland. Toledo, Ohio, has contracted for a $125,000 school building. The contract for a $200,000 hotel has been awarded at Aurora, Ill. Two building contracts totaling $550,000 have been awarded at Detroit. A $2,000,000 hotel has been contracted for at St. Paul. Bids are desired for a $150,000 school building at Atlantic City, N. J.

It is reported from Providence, R. I., that the State Board of Control will make improvements to State institutions to cost $458,000. In New York City, plans have been completed for a $500,000 apartment house, and plans have been filed for two more apartment houses to cost $700,000 and $750,000 respectively. Plans are being prepared for a $200,000 building in Rochester, N. Y. Paterson, N. J., is preparing plans for a $175,000 school building. Plans are being prepared for a $400,000 building for a religious order at Jennings, Mo. At Omaha, Neb., plans are being prepared for a $350,000 bank building. It is reported that a contract for a $125,000 building will soon be let in Seattle.

Bridges and Roads

A bridge to cost $43,000 has been contracted for at Nekoosa, Wis. Bids are desired Sept. 15 for a grade-crossing bridge at Buffalo. Bids are also desired for a 465-ft. steel bridge at Courtland, Va. A contract will soon be let for a $100,000 bridge at Cocoa, Fla. Ordinances providing $338,000 for rebuilding two bridges have been passed at Dayton, Ohio. The construction of a $150,000 bridge is being considered at Lexington, Ky.

The New York State Highway Commission opened Aug. 26 additional bids for road construction and repair totaling $1,338,000. Zanesville, Ohio, has awarded a $127,000 paving contract, and bids have been opened at Chicago on a $150,000 contract. The lowest bids opened for two paving contracts at Seattle total $124,000. San Mateo, Cal., has awarded two paving contracts totaling $148,000. State highway contracts awarded in California total $188,000. Ottawa, Ont., has awarded a paving contract at $103,000. Bids are desired at Linden, Ala., for building 40 miles of road. Bids are also desired for 120,000 sq. yd. of paving at Taylor, Tex.

The City Commission of Dayton, Ohio, has passed an ordinance to provide $457,000 for paving work. Road work to cost $500,000 is being surveyed near Dayton, Tenn., and half of this work will be let about Sept. 15. The Minnesota State Highway Commission has ordered road construction, the State's share of which will be $131,000. Road improvements to cost $161,000 have been decided on by the City Council of Hoquiam, Wash. At Ventura, Cal., bonds totaling $1,000,000 have been voted for highway construction.

Waterworks and Sewers

Waterworks contracts totaling $77,000 have been awarded at Wellsville, N. Y. The contracts for waterworks construction at Watervliet, N. Y., were awarded last week at $418,000. A $50,000 waterworks contract has been awarded at Maumee, Ohio. Bids are desired for constructing a 24-in. pipe line across Licking River at Covington, Ky. Plans have been submitted to Long Branch, N. J., for waterworks to cost $500,000. Citizens at Everett, Wash., have voted to construct a $600,000 pipe line.

Two sewer contracts awarded at Cleveland total $148,000. Columbus, Ohio, has awarded sewer contracts totaling $117,000. Contracts for sewer work amounting to $65,000 have been awarded at Madison, Wis. Watertown, S. D., has contracted for a $79,000 sewer system. Bids are desired for constructing one mile of 6-ft. sewer at Milwaukee. Kenosha, Wis., desires bids on constructing three sections of sewer. The city engineer has submitted to Waterloo, Iowa, plans for sewer construction to cost $61,000.

Miscellaneous

Contracts awarded for track materials for New York City's rapid-transit lines total $1,870,000. The Twenty-ninth Street (Brooklyn) pier shed has been contracted for at $118,000. The contract for a dam to cost $110,000 has been awarded at Hickory, N. C. It is reported that the contract for a $480,000 breakwater has been awarded at Chicago. A $1,000,000 coaling plant at Honolulu, Hawaii, has been contracted for according to reports. A railroad company has been incorporated at Charleston, S. C., to build 85 miles of line. Press reports state that the Pennsylvania Railroad is making plans to enter the city of Detroit at a cost of $20,000,000. It is reported that the Public Service Company of St. Cloud, Minn., will construct a dam and two power houses to cost $700,000.

WATERWORKS

PROPOSED WORK

Broadalbin, N. Y.—The proposed district water works will cost about $60,000. Nothing will probably be done for some time by Town Council.

Atlantic City, N. J.—City Commission will be petitioned to construct high pressure main through the hotel district.

Long Branch, N. J.—Morris R. Sherrerd of Newark has submitted to City Comn. report on municipal water works, and estimates cost at $500,000; the most feasible supply to be from Pine Brook branch of Swimming River above Tinton Falls.

Allentown, Pa.—Bids will probably be called for about Sept. 15 by City Council for new equipment at pumping station; estimated cost at $27,500 to $48,500, according to different types of pumps. Joseph A. Schmidt, City Clk.

Crewe, Va.—Plans being prepared by Anderson & Christie, Commercial Bank Bldg., Charlotte, for construction of water works and sewer system, including pumping station, filter plant, sewage pumping station, sewage disposal plant, etc.; cost $70,000.

Albermarle, N. C.—Bonds for $30,000 will be sold by City Clerk Sept. 5 for sewer improvements. Engineers, Anderson & Christie, Commercial Bank Bldg., Charlotte.

Ayden, N. C.—Citizens voted $10,000 for water works extensions.

Cartersville, Ga.—Local press reports state that the $86,000 bonds for which citizens voted on Aug. 14 will be used for water main extensions, sewer system, street improvements and improved school buildings.

Coolidge, Ga.—Citizens voted $15,000 bonds for water works, to improve and extend electric light plant and erect a school.

Salerno, Fla.—Company reported being organized to construct and operate an electric light plant, water works, etc. B. W. Mulford reported interested.

Pass Christian, Miss.—Citizens reported to favor issuing bonds for water works and electric light plant.

Henderson, Tenn.—Citizens voted to issue bonds for water works, sewer system and electric light plant.

Brewster, Ohio.—All bids opened Aug. 20 for furnishing material and constructing municipal water works have been rejected, and will be readvertised. L. S. Lash, Village Clk. W. J. Sherman Co., Engrs., Toledo.

Wellington, Ohio.—Bonds for $35,000 have been sold for water works improvements.

Shoals, Ind.—Installation of an electric light plant and water works system (combined) reported under consideration.

Milwaukee, Wis.—George H. Benzenberg, former City Engineer, and T. C. Hatton, Ch. Engr. Sewerage Comn., have been selected by Commissioner Simmons as members of the engineering board to determine whether new water intake tunnel shall be extended 2500 ft. or whether it is safer and cheaper to lay four lines of pipe out in the lake, beyond the present location of the crib.

Oshkosh, Wis.—J. C. Walter, Asst. City Mgr., writes that plans will probably be ready in a short time for proposed filtration plant.

Terrill, Iowa.—Town expects to spend about $8,000 for water works to consist of c-i. mains, steel tower and tank, well and pumping plant. Lawrence W. Cox, Engr., 1544 Eleventh Street, Des Moines.

Attica, Kan.—E. T. Archer & Co., Kansas City, Mo., engaged to prepare plans for proposed water works; cost about $30,000. J. C. McCaddon, City Clk.

Manhattan, Kan.—Layne & Bowler Co., Houston, Tex., have completed first well for city water supply, pumping 1½ million gallons in 24 hours, and have begun work on second well which will give city a duplicate system.

Oswego, Kan.—City Council considering question of issuing bonds for constructing settling basins, filtration plant, etc. Engineer not yet selected. J. F. Waskey, City Clk.

Bayard, Neb.—Citizens voted $12,800 bonds for constructing water works. Bids for bonds to be received about Nov. 1 and construction about Dec. 1.

Macon, Mo.—Bonds for $30,000 sold to be used for constructing filtration plant and extend mains, about 18,000 ft. 4-in. pipe with 35 hydrants. Engineer, E. E. Harper, Kansas City. J. L. Martin, City Clk.

Lockhart, Tex.—It is reported that the local electric light, water works and ice plant has been purchased by W. B. Tuttle of San Antonio and associates from J. A. Bachman of Austin and J. E. Jones of Lockhart. Plant will be improved and enlarged. Frank E. Scovill, Mgr.

Everett, Wash.—Citizens Aug. 24 voted favorably on the following three propositions: Proposition 1. To issue $1,100,000 bonds to purchase distributing system and plant of Everett Water Co.; Proposition 2, providing for bond issue of $600,000 to be used in constructing 92-in. pipe line from Sultan basin, a distance of 24 miles, and Proposition 3, authorizing City Council to procure necessary data and information concerning practicability of development and construction of plant for generation of electric current by water power in Sultan River, which will produce 60,000 hp.

Olympia, Wash.—City will soon vote on proposition to issue $120,000 bonds to purchase and improve local water system.

Ridgefield, Wash.—Citizens reported to have voted to install water works to cost $10,000.

Stanwood, Wash.—At recent election citizens defeated proposition to construct auxiliary water system for fire protection from plans of Coast Eng. Co., White Bldg., Seattle; cost $7,000 to $10,000.

Toledo, Wash.—Council considering proposition to purchase water system owned by Toledo Water Co.; if purchased improvements will be made.

Milwaukee, Ore.—Citizens Aug. 21 voted $25,000 bonds for completing municipal water system, upon which $20,000 has been expended. Work will begin at once on pipe laying.

Prince George, B. C.—Citizens voted $80,000 bonds for construction of waterworks.

BIDS DESIRED.

Boston, Mass.—Until Sept. 9 by Edw. F. Murphy, Comr. Pub. Wks., for laying about 11,500 lin. ft. 12 and 16-in. water pipe in Bennington, Lexington, Everett and other streets.

Tarentum, Pa.—Until Sept. 13 by Borough Clk. for a 500 K. W. A. C. steam turbine generating unit, 2 motor-driven centrifugal pumps, surface condensing equipment, etc. Sidney B. Martin, Consulting Engr., 401 Penn Building, Pittsburgh, Pa.

Baltimore, Md.—Until Sept. 15 by Bd. Awards at office of City Register for furnishing and delivering 25 tons of flanged pipe and 32 tons of flanged fittings to the Water Dept. advertised in Engineering Record. Robert L. Clemmitt, Acting Water Engr.

Covington, Ky.—Until Sept. 16 by J. Mason Hawk, Comr. Public Property, for Licking River pipe trenching, advertised in Engineering Record. George Hortung, Consulting Engr., Woolsack Building, Newport, Ky.

Miller, Ind.—Reported desired until Sept. 15 by Town Clerk, for constructing water works to cost about $14,000. W. J. Fulton, Engr., Gary.

Chicago, Ill.—Until Sept. 10 by Dept. Pub. Wks. (W. R. Moorhouse, Comr.) for furnishing and delivering f.o.b. cars Chicago 2000 tons 4, 6, 8 and 12-in. c.-i. water pipe.

Sallx, Iowa.—Until Sept. 15 by J. M. Hugh, Village Clk., for constructing water works, from plans of W. L. Bruce of Yankton, S. D., cost about $10,000.

Spearville, Kan.—Until Sept. 15 by R. E. Wood, City Clk., for constructing water works, to include a 50,000-gal. elevated tank. Engineers, Rollins & Co., Kansas City, Mo.

Bayard, Neb.—See "Proposed Work."

Broken Bow, Neb.—Reported desired until Sept. 6 by City Council, for furnishing material and constructing wells and extensions to water works system and constructing complete electric light plant. Total cost $16,000.

Hastings, Neb.—Until Sept. 27 (extension of date from Sept. 12) by Light and Water Com. for sinking a 24-in. well, approximate depth 130 ft. W. S. Watson, Comr.

Baggs, Wyo.—Reported desired until Sept. 7 at 6 P. M. by Water Wks. Trus. (G. A. Deacon, Clk.), for water works improvements to include oil engine, generator, transformers, centrifugal pump, etc.

Macon, Mo.—Until Sept. 14 by J. L. Martin, City Clk., for furnishing material and constructing a filter plant, furnish pumps, motors, etc., and other work in connection with water works improvements. E. E. Harper, Consulting Engr., Grand Avenue Temple, Kansas City.

Marshall, Okla.—About Sept. 15 by City Clerk for constructing water works and electric light plant, to include 5 miles pipe, standpipe, pumps, etc., total cost $25,000. Engineers, Benham Eng. Co., Oklahoma City.

Chatham, N. B.—Until Sept. 7 by P. J. McIntyre, Town Clk., for constructing storage dam, cost about $20,000. Engineers, R. S. & W. S. Lea, Montreal, Que.

PRICES AND LETTINGS.

★Indicates award of contract.

★Boston, Mass.—Contract awarded Aug. 18 for furnishing 170 tons c.-i. pipe and 140 tons c.-i. specials to U. S. Cast Iron Pipe & Fdry. Co., Philadelphia, Pa., at $16,725. Other bids: R. D. Wood & Co., Philadelphia, Pa., $18,150; Gibby Foundry Co., Boston, $23,619; Davis Foundry Co., Lawrence, $24,800.

★Boston, Mass.—Contract awarded Aug. 23 for furnishing 25 tons 4-in. and 500 tons 6-in. pipe to Standard Cast Iron Pipe & Fdry. Co., Bristol, Pa., at $12,633. Other bids: U. S. Cast Iron Pipe & Fdry. Co., Philadelphia, Pa., $12,640; R. D. Wood Co., Philadelphia, Pa., $12,670; Warren Foundry & Machine Co. $12,695. C. E. Thornton, Clk. Bd. City Supplies.

Windsor, Conn.—Following are lowest bids opened Aug. 20 for water mains, standpipe and pumping equipment (H. R. Tupper, Supt. Bd. Fire Comrs.):

Water mains to include 23,200 ft. 10-in., 6736 ft. 6-in., Class C, c.-i. pipe, sandy loam and clay excav., leadite joints in c.-i. mains, service connection, valves, etc.: Atlantic Lumber, Waterbury, Conn., $34,-540; A. D. Ambrose, Hartford, $34,704; Sykes & Williams, Boston, Mass., $35,372; N. C. Corrigan & Co., Hartford, $37,879.

Standpipe: Tippett & Wood, Phillipsburg, N. J., $12,176; Chicago Bridge & Iron Wks., Chicago, Ill., $12,480; Walsh Boiler Wks., Boston, Mass., $12,362; Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa., $12,[illegible].

Pumping equipment: F. H. Hayes Machine Co., Boston, Mass., $5,217; Gordon Pump Mfg. Co., Seneca Falls, N. Y., $5,3[illegible].

★Centerville Station, N. Y.—Contracts reported awarded as follows for water works: To Abner Harper & Co., Inc., Newburgh, for laying pipe and setting hydrants at $5,278 and R. D. Wood & Co. of Philadelphia, Pa., for pipe, hydrants and specials, at $10,853.

★Watervliet, N. Y.—Contract reported awarded as follows for constructing water works (bids opened Aug. 16): Section 1, construction of dam, pumping station and storage reservoir, to V. R. Porterfield, New York; Section 2, supply main and service reservoir, Lincoln-Steele-Fleming Co., Joseph A. Morrison; Section 3, filter plant and aerator, American Water Softener Co., Philadelphia; Section 4, distribution system in city, Beaver Eng. & Contr. Co., New York; total cost about $418,000. There is also available $207,000 for purchase of lands and other incidentals; total expenditure $625,000. Water will be brought to city from the Normanskill Creek, near French Mills.

Wellsville, N. Y.—Following are lowest bids opened Aug. 25 for water works improvements (Engineer, Charles C. Hopkins, Rochester):

★Valves, valve boxes and hydrants, R. D. Wood & Co., Philadelphia, Pa., $2,395 (awarded contract).

★Storage reservoir, filter, control house, gate house and piping: J. H. Havens, Olean, $36,028; Suburban Eng. Co., New York, $39,955; Knight & Soger, Wellsville, $40,982.

★Piping system, force mains, intake dams, etc.: J. H. Havens, Olean, $39,588 (awarded contract); Suburban Eng. Co., New York, $43,419; John J. Kuhn, Greensburg, Pa., $49,500.

★Gloucester City, N. J. — Contract awarded Aug. 20 for furnishing and installing boilers, stacks, tank serving pumps, air compressors, together with deep well, air lifts, etc., to L. T. Edwards & Co., 18 S. Seventh Street, Philadelphia, Pa., at $22,141 (other bidders all of Philadelphia, Pa.): Redpath & Potter Co., $22,-846; Standard Supply & Equipment Co., $22,952; Jos. L. Smeigard & Co., $23,865; Machold & Riddell, $24,326; John P. Smith, $24,990. J. F. Lenny, City Clk.

East Orange, N. J.—Following are reported to be lowest bids opened Aug. 26 by Water Commissioner for water works improvements: 130,000 lb. pig lead, Bruce & Cook, 190 Water Street, New York, $6,682. construction work, F. N. Lewis, 411 Manhattan Avenue, New York, at $41,911; valves, to Pratt & Cady Co., 259 Canal Street, New York, at $11,346.

★Hatfield, Pa.—Contract awarded Aug. 16 by Town Council (Jonas S. Moyer, Clk.) to Pugh & Hubbard Co., Philadelphia, for about 2 miles of 4, 6 and 8-in. c.-i. mains, etc., at $8,995.

★Phoenix City, Ala.—Contract reported awarded by Water Comrs. to J. S. Schofields Sons Co., Macon, Ga., to erect a 180,000-gal. standpipe for municipal water works, at $5,100.

★Bluffton, Ohio. — Contract reported awarded for water works improvements to Theodore G. Scheid of Lima at $15,523, to include an aerating and storage reservoir of reinforced concrete, capacity 200,-000 gal., with necessary pipe connections, two new 150-hp. return tubular boilers. W. J. Sherman Co., Toledo, Consulting Engr.

★Maumee, Ohio. — Contract reported awarded Aug. 25 by Trus. Pub. Affairs for water works, including deep well pumps, force pumps, reinforced concrete reservoir, elevated steel tank, about 43,000 ft. 4 to 14-in. pipe, to T. C. Brooks & Son of Jackson, Mich., at $49,753.

★Milligan, Neb. — Contracts awarded Aug. 24 for constructing water works as follows: F. B. Bentley, Geneva, laying mains; pipes, hydrants and hose, Fairbanks-Morse; 10-hp. engine, pump and compressor, Omaha Structural Steel Wks., and Milligan Lumber Co., Milligan, Neb., for the building. E. J. Kotos, Village Clk.

★Caddo, Okla.—Contract awarded to F. W. Keeney of Oklahoma City, for construction of a pumping station and filters for city, including two 8 x 10 triplex pumps, two 4 in. centrifugal pumps, two 50 hp. oil engines, one 250,000 gal. per day gravity filter, power house settling basin and clear water well; total cost about $20,000.

★Warrenton, Ore.—Contract reported awarded for supplying wood pipe for water system to National Tank & Pipe Co., Portland, about 126 miles of 14, 12, 10 and 8-in. pipe, at about $150,000. C. H. Green, of Spokane, Wash., has general contract.

★St. Maries, Idaho.—Contract awarded Aug. 22 for constructing water works, including concrete and earth dam, etc., to W. L. Geist, St. Maries, Idaho, at $29,110. Next 3 lowest bids: Security Bridge Co., Minneapolis, Minn, $29,085; Carlson Lindhall & Anderson, Spokane, Wash., $29,394; J. C. Broad, Spokane, Wash., $30,065. Charles R. Schulte, City Clk.

SEWERAGE AND SEWAGE DISPOSAL

PROPOSED WORK

Brooklyn, N. Y. — See "Paving and Roads."

Schenectady, N. Y.—Contract about to be let by Bd. Contract and Supply for construction of a new section of intercepting sewer extending from the main intercepter at Front Street gate of American Locomotive Company's plant up through N. Jay Street, South Avenue, Romeyn Street, Myers Alley, Park Place to Union Street, and thence on to connections with prospective sewers. Edw. H. Prentice, Engr. of Sewers.

Newark, N. J.—Bd. County Chosen Freeholders reported considering improvement of sewage disposal plant at Overbrook County Hospital.

Allentown, Pa.—City Council considering construction of sewer system. Charles D. Weirbach, City Engr.

Philadelphia, Pa.—Bureau of Surveys reported preparing plans for additional sewers for section of Oak Lane, which comes within Philadelphia County line. Estimated cost of changes now proposed is $71,500 for piping and $18,500 for construction of pumping station.

Crewe, Va.—See "Water Works."

Richmond, Va.—Contract about to be let for construction of sewer system in Scott's Addition, annexed territory, to cost about $45,000. Henry P. Beck, Comr., Administrative Board.

Ayden, N. C.—Citizens voted $25,000 bonds for sewer system.

Cartersville, Ga.—See "Water Works."

Macon, Ga.—J. J. Gaillard, City Engr., reported completed plans for sewering Vineville branch.

Henderson, Tenn.—See "Water Works."

Owensboro, Ky.—City Council reported considering sewer in western limits of city property in West Fifth Street to connect with Second Street sewer just west of Walnut Street.

Dayton, Ohio.—See "Paving and Roads."

Springfield, Ohio. — City Commission authorized issue of $6,271 bonds for storm water sewer through Lowry Avenue, from State to Clark Streets.

Kendallville, Ind.—Willis Sawyer, City Engr., estimates cost of constructing sewers on south and west sections of city at about $18,000.

Grand Rapids, Mich.—Bd. Public Works considering construction of sewage disposal plant.

Madison, Wis.—Approximately $125,-000 will be spent for improvements to sewage disposal system, from plans of City Engineer; the plans include new force main, sub-pumping station in Ninth Ward and laying intercepting sewer on Murray Street.

Waterloo, Iowa.—C. A. Roby, City Engr., has submitted to Council report on construction of sewers for Westfield, Galloway, Hagerman and Downing additions and estimates cost at $61,369. Burns & McDonnell, Consulting Engrs., Kansas City, Mo.

Columbus, Mont. — Reported Council plans construction of sewer system; cost $15,000.

Marlow, Okla.—Benham Eng. Co., Colcord Building, Oklahoma City, preparing plans for sanitary sewer system, for which $15,000 bonds were recently sold, subject to election to be held Sept. 15.

Xenia, Ohio.—See "Paving and Roads."

Spokane, Wash.—Creation of a sewer district on North Side and construction of sewers costing approximately $70,000 during the winter being considered by City Council.

Portland, Ore.—Council passed resolution looking to construction of sewer in Water and Mill Streets; estimated cost for vitr. clay or cement pipe, $16,486. A. L. Barbur, City Aud.

Marysville, Cal.—Citizens Aug. 24 voted $18,000 bonds to extend the drainage sewer system.

Visalia, Cal.—See "Public Buildings."

Bonners Ferry, Idaho.—Town Board reported to have engaged Sawyer Bros., Spokane, Wash., for preliminary engineering work on sewer system to be installed this fall. Cost reported at $20,000.

BIDS DESIRED.

Brockport, N. Y.—Until Sept. 17, by Village Trustees (George B. Harmon, Pres.), for construction of sewage disposal works, advertised in Engineering Record. Engineer, Charles C. Hopkins, Cutler Bldg., Rochester.

Cleveland, Ohio.—Until Sept. 9 by A. R. Callow, Comr. Purchases and Supplies, for constructing sewers in W. 110th Street, Parkhurst Drive and Overlook Avenue; also Buckley Boulevard storm sewer, between Twenty-fifth and Twenty-eighth Streets; also until Sept. 8 for outlet drain pipe, approximately 1000 ft. long, at Southerly Sewage Treatment Works.

Kenosha, Wis.—Until Sept. 17 by Street Assessment Com. (M. J. Scholey, Chmn.), for constructing sewers advertised in Engineering Record.

Milwaukee, Wis.—Until Sept. 17 by Dept. Pub. Wks. (Fred. G. Simmons, Comr.), for constructing Lake Street sewer, including tunnel section, shafts, manholes and outfall section, advertised in Engineering Record.

Ogden, Iowa.—Until Sept. 6 between 7 and 9 P. M. by Town Council for constructing a sanitary sewer system and disposal plant including about 41,965 lin. ft. 6 to 15 in. vitr. pipe, 1 septic tank, two filter beds, 106 manholes, 10 flush tanks and 12 lamp holes. R. C. Lutze, Engr., 1404 Paul St., Perry; Joseph Rosen, Town Clk.

Sioux City, Iowa.—Reported desired until Sept. 18 by Paul J. Wells, City Clk., for 15,500 ft. 8-in. pipe and 43 manholes. T. H. Johnson, City Engr.

Centerville, S. D.—Until Sept. 20 by City Auditor for construction of sewer system; cost about $27,000. Bonds to be sold Sept. 7.

St. Louis, Mo.—Until Sept. 14 by Bd. Pub. Service for constructing sewers in Baden Sewer Dist. No. 2.

Forest Grove, Ore.—Reported desired until Sept. 21 by M. R. Markham, City Recorder, for furnishing material and constructing sanitary sewers and sewage disposal plant to consist of 73,033 ft. of 6 to 16-in. pipe, 142 manholes, 52 lampholes, 34 flush tanks, one Imhoff tank unit and sludge bed. A. A. Kirkwood, City Engr.

Berlin, Ont.—Until Sept. 7 by A. H. Millar, City Clk., for constructing sewage disposal works, comprising tanks, filters, sludge beds and pumping station. Chipman & Powers, Consulting Engrs., Mail Building, Toronto. Herbert Johnston, City Engr.

PRICES AND LETTINGS.

★Indicates awarded contract.

Boston, Mass.—Following are 4 lowest bids opened by Comr. of Pub. Wks. for concrete and pipe sewers and drains in Albany Street: William Barrett & Co., $36,414; West Roxbury Trap Rock Co., $37,183; James J. Conway, $37,985; Antony Cefalo, $41,893.

★Woonsocket, R. I.—Contract awarded Aug. 24 by Bd. Sewer Comrs. (Frank T. Holden, Chmn.) for constructing about 4400 ft. 8-in. and about 500 ft. 15-in. sanitary sewers and appurtenances to Eastern Constr. Co., Woonsocket. Frank H. Mills, City Engr.

★Yonkers, N. Y. — Contract for constructing sewer in Woodlawn Avenue reported awarded to John O. Weston at $8,349.

Newark, N. J.—Fourteen bids were opened Aug. 31 by Passaic Valley Sewerage Comrs. (Joseph H. Quigg, Clk.) for constructing superstructure and appurtenances for Newark Bay Pumping Station, part of Section 5 of Passaic Valley Sewerage Wks., ranging from $109,638 to $149,-997. Following are 4 lowest bids: Wm. G. Sharwell & Co., Newark, $109,638; Essex Constr. Co., Newark, $114,289; A. L. Guidone & Sons, Inc., New York, $122,330; D. W. McGee Constr. Co., Newark, $123,383.

★Westchester, Pa.—Contract awarded Aug. 24 for constructing sewage and pumping station, complete, including four 4-in. vertical, motor-driven, centrifugal pumps and 1500 ft. 8-in. c.-i. force mains to M. & T. E. Farrell, of Westchester, at $6,290. Remington & Vosbury, Engrs., Camden, N. J.

★Wilkinsburg, Pa.—Contract awarded Aug. 23 for constructing storm and sanitary sewers in portions of Wood Street, requiring approximately 5218 ft. 6 to 18-in. pipe, to A. V. Purnell, 507 Jackson Street, Allegheny, at $38,890. Frease & Sperling, Boro. Engrs., of Wilkinsburg.

★Chardon, Ohio.—Contract awarded by Council to J. B. Sheets, Pittsburgh, Pa., for constructing 8 miles 8 to 15-in. pipe sanitary sewers at $33,000 (bids opened Aug. 19). R. Winthrop Pratt, Consulting Engr., Hippodrome Building, Cleveland.

★Cleveland, Ohio.—Contract awarded by Bd. of Control to Great Lakes Dredge & Dock Co., Williamson Building, for building submerged pipe to carry treated sewage from W. Fifty-eighth Street disposal plant into Lake Erie at $93,000, and to Lowensohn & Ule for sewer in Dugway Brook, between Superior Avenue and Wade Park, at $55,316.

★Columbus, Ohio.—Contracts reported awarded by City Bd. of Control for construction of sewers on streets as follows: Jackson Street and Cherry Street, to Russell & Jennison Co., at $34,086 and $8,998 respectively; City Boulevard, to H. P. Streicher Co., $26,332; Monroe Street, to Harris & Tansey, $15,735; Camden Street, Asphalt Block Pavement Co., $10,-693; Ogden Avenue, to McKinney Bros., $21,663.

Fenton, Mich.—Following are reported to be lowest bids opened Aug. 16 by City Council for construction of sanitary sewer system: M. J. Meather, Bay City, $15,-031; P. Ryan, Bay City, $17,203; William Saeger, Saginaw, $17,618; William Eddy & Son, Saginaw, $17,856.

★Quincy, Ill.—Contract awarded by Bd. of Local Improv. Aug. 28 for constructing sanitary sewer, including 4406 lin. ft. 10-in. pipe, 1803 lin. ft. 12-in., 3972 lin. ft. 15-in. and 5225 ft. 15-in. pipe in northeast section of city, to Henry Rees, Quincy, at $14,549. Next 3 lowest bids: Hummert & Menke, $15,638; Jos. Eiff & Son, $16,325; Jacob Althause, St. Louis, $16,664.

★Madison, Wis.—Contracts awarded by Council Aug. 27 for sewer work as follows: To Weber & Gay, for new force main for sewage system, at $28,865; to J. W. Mitchell, for pumping station in Greenbush District, at $12,100, and to John F. Icke, to construct intercepting sewer on Murray Street, at $24,700, and to J. F. Icke, to furnish and place crushed stone or filter beds at the new sewage disposal plant. E. E. Parker, City Engr.

Paducah, Ky.—All bids opened Aug. 3 by L. A. Washington, Comr. Pub. Wks., for constructing brick or concrete outfall sewer, Dist. No. 3, Contract No. 1, have been rejected, and further letting will be deferred until outcome of bond issue to be voted at the November election. Bids were received on two classes of construction, concrete and brick, as follows:

Concrete sewer: Winston Bros. Co., Minneapolis, Minn., $45,834; Hickey Bros., St. Louis, Mo., $51,103; Hogeland & Paul, Dayton, Ohio, $52,130; Michael & Minnick Contr. Co., Marion, Ind., $54,533.

Unit prices of Winston Bros., lowest bidder on concrete:

Outlet structure complete, except for concrete piles, including excav., and 106 cu. yd. Class A concrete, 1831 lb. steel reinforcement, and 46 sq. yd. vitr. brick paving	$1,330.25
4380 lin. ft. concrete piles	1.75
Reinforced concrete, horseshoe sewer, 235 lin. ft., 10 x 12 ft., Type A, except concrete piles, including excav., backfill, concrete, steel reinforcement, vitr. brick lining, etc.	40.25
350 lin. ft., 10 x 12 ft., Type B, including necessary excav., backfill	27.05
650 lin. ft., 10 x 12 ft., Type C, including steel reinforcement and vitr. brick lining	25.97
2 concrete manholes, including rings, covers and ladders	54.45
100 lin. ft. standard 6-in. sewer pipe for underdrains	0.40
100 lb. additional steel reinforcement	0.035
10 cu. yd. additional Class A concrete	8.75
10 cu. yd. additional Class B concrete	8.75
10 cu. yd. additional excav.	0.75
10 cu. yd. additional brick masonry	11.50
10 M ft. sheeting	25.00
10 M ft. timber foundation	30.25
10 cu. yd. rock excav.	3.00
Furnish and employ waterproofing compound for 10 cu. yd., per cent	10

Brick sewer: Yancey & Johnson and Paducah Brick & Tile Co., Paducah, $49,362; Hickey Bros., St. Louis, Mo., $52,921; Michael & Minnick Contr. Co., Marion, Ind., $57,305; Jas. Ferry & Son, Baltimore, Md., $57,997; L. W. Hancock & Co., Louisville, Ky., $58,385.

Unit prices of Yancey & Johnson and Paducah Brick & Tile Co., Paducah, lowest bidder for brick sewer:

Outlet structure, except concrete piles, and including excav. and place 106 cu. yd. Class A concrete, 1831 lb. steel reinforcement ,and 46 sq. yd. vitr. brick paving	$1,843.30
4380 lin. ft. concrete piles	1.49
235 lin. ft., 10 x 12 ft., reinforced concrete horseshoe sewer, Type A, except concrete piles, including excav., backfill, concrete, steel reinforcement, vitr. brick lining, etc.	40.55
350 lin. ft., 10 x 12 ft., brick horseshoe sewer, Type D, including excav., backfill, concrete, steel reinforcement, brick masonry, vitr. brick lining, etc.	32.41
650 lin. ft., 10 x 12 ft., brick horseshoe sewer, Type E, including excav., backfill, concrete, steel reinforcement, brick masonry and vitr. brick lining	29.71
2 brick manholes, including rings, covers and ladders	80.00
100 lin. ft. standard 6-in. sewer pipe for underdrains	0.10
100 lb. additional steel reinforcement	0.05
10 cu. yd. additional Class A concrete	6.00
10 cu. yd. additional Class B concrete	5.00
10 cu. yd. additional excav.	0.50
10 cu. yd. additional brick masonry	10.00
10 M ft. sheeting	25.00
10 M ft. timber foundation	25.00
10 cu. yd. rock excav.	1.00
Furnish and employ waterproofing compound for 10 cu. yd. concrete, per cent	20

Superior, Wis.—Lowest bid opened Aug. 19 by Bd. of Pub. Works for construction of main sewer to W. Thirteenth Street and Cadott Avenue, submitted by Pastoret Constr. Co., $6,159.

★**Fort Dodge, Iowa.**—Contract reported awarded by City Comrs. for constructing sanitary sewers as follows: To Benson & Reed for Districts 1, 2 and 4 and for District 3, Leighton addition, to Clouse Kling. The four districts aggregate 5800 lin. ft.

★**Duluth, Minn.**—Contract awarded by city to Pastoret Constr. Co. for constructing 37th Ave. West trunk sewer at $18,-124. Work includes 935 lin. ft. c. i. pipe 16 to 36 in.; 1630 lin. ft. concrete sewer, 32 to 34 in.; 4167 lin. ft. vitr. pipe, 10 to 24 in. and 26 manholes.

★**Sandstone, Minn.**—Contract awarded Aug. 23 for constructing 9025 ft. 10, 8 and 6-in. sewer to Chas. Eklund & Co., Duluth, at $8,289. Chris. Rudisuhle, Village Recorder.

★**Watertown, S. D.**—Contract awarded to Offerman Constr. Co., South Omaha, Neb., for construction of new sewer system (bids opened Aug. 16) at $79,289. Unit prices in Engineering Record of Aug. 28.

Bozeman, Mont. — See "Paving and Roads."

Dallas, Tex.—Following are reported to be totals of bids opened Aug. 23 by J. B. Winslett, City Secy., for (a) Contract 5, north intercepter (concrete portion); (b) Contract 6, pumping station and 36-in. force main, and (c) Contract 7, disposal works, etc.: General Constr. Co., Fort Worth, (a) $119,844; F. B. Horton & Son, Houston and San Antonio, (a) $109,424; Bailey, Reeder & Co., Mobile, Ala., (a) $80,708, (c) $417,058; Tarrant Constr. Co., Fort Worth, (a) $108,373; Winslett-Eldridge Co., Dallas, (a) $119,081; T. A. Garvin, San Antonio, (a) $81,195; Roach-Manigan Co., Dallas, (a) $128,838, (b) $98,434, (c) $515,501; Jas. Stewart & Co., Houston, (a) $131,484, (b) $107,630, (c) $527,269; Mayfield & Shaw, El Paso, (c) $545,988; H. C. Hess, San Antonio, (c) $467,274.

BRIDGES

PROPOSED WORK

Binghamton, N. Y.—Bridge bonds for $30,000 will be sold Sept. 3 by Bd. Estimate and Apportionment.

Pennsylvania — Water Supply Comn., Harrisburg, has approved the following applications Borough of Houtsdale to construct bridge across Armstrong Creek: P., C., C. & St. L. R. R. (Thomas Rodd, Ch. Engr., Pittsburgh), bridge over middle branch of Raccoon Run at Burgettstown; Comrs. of Cambria County, bridge near Bradley Junction; Pennsylvania R. R. (Alexander C. Shand, Ch. Engr., Philadelphia), bridge across Elk Creek at Ridgway; Allegheny County Comrs., bridge across Big Sewickley near Ambridge; Commissioners of Mercer County, bridge across Saw Mill Run at Stoneboro; Tionesta Valley R. R., bridge over Tionesta in Sheffield Boro.; Comrs. of Greene County, bridge over Possum Run, west of Mapleton, and across Ruffs Creek in Washington Township.

Phoenixville, Pa.—Comrs. of Chester and Montgomery Counties are considering the building of a joint inter-county bridge over Schuylkill River between Mt. Clare and Phoenixville. Address Co. Comrs., Westchester.

Washington, D. C.—It is reported that on the recommendation of D. E. McComb, Engr. of Bridges, the Commissioners, D. C., will include in the annual estimate an appropriation of $10,000 for a survey and preparation of plans for a new bridge crossing Rock Creek at Calvert St.

Richmond, Va.—City Engineer reported preparing preliminary plans for steel bridge to be constructed at Grace St. from Taylor's Hill to the rear of the Memorial Hospital.

Jesup, Ga.—See "Paving and Roads."

Cocoa, Fla.—Contract will be let by County Comrs. at Titusville, Fla., for proposed bridge to be constructed across Indian River bet. Cocoa and Merritt Island, to cost about $100,000. Engineer, C. M. Rogers, of Daytona.

Miami, Fla.—B. H. Klyce, City Engr., writes election to be held in September to vote on issuing bonds for proposed 2 bridges to be erected over Miami River from plans of Harrington, Howard & Ash of Kansas City, Mo.

Jamestown, Ky. — See "Paving and Roads."

Lexington, Ky. — Fiscal Courts of Fayette and Madison Counties considering building jointly a bridge across Kentucky River at Clay's Ferry. Cost estimated at $149,000 and $175,000.

Dayton, Ohio.—See "Paving and Roads."

Dayton, O.—Co. Comrs. passed ordinances providing $338,000 for reconstruction of Fifth Street bridge over Miami River and Webster Street bridge over Mad River. Plans have been prepared and provide for arched concrete bridges. Fifth Street bridge cost $200,000 and Webster Street $138,000.

Milton, Ohio—City Engineer has prepared plans for steel bridge known as Shilling's Mill and Fredericksburg Road bridges.

Chicago, Ill.—Reported Trus. of Sanitary Dist. are considering constructing three bridges over Drainage Canal one at Crawford, one at Cicero and one at Harlem Avenues.

Appleton, Wis.—E. L. Williams, City Clk., writes it is proposed to construct concrete bridge over Fox River on rock foundation; cost $3,500. A. C. Remley, City Engr.

Kingfisher, Okla.—William G. Newer, Co. Clk., writes no contract was let Aug. 16 by County Comrs. for constructing 17 steel and concrete bridges. Will be readvertised, bids to be opened in September. Probable cost, $21,500.

Dexter, N. M.—Co. Comrs., Roswell have submitted to the State Engineer plans for concrete and steel bridge to be constructed across Felix River between Dexter and Hagerman.

Corona, Cal.—Bd. Superv. Riverside appropriated $12,000 for constructing a bridge over Santa Ana River on road known as North Main St., leading out of Corona.

Ventura, Cal.—County Engineer directed to prepare plans and specifications for rebuilding Casitas Bridge over Ventura River at Foster Park. It is proposed to use the present abutments and to place a 200-ft. span of wood and steel costing $6,000.

County Engineer preparing plans for steel and concrete bridge, 240 ft. span, to be constructed at Sespe over Santa Clara River to replace bridge washed away by the flood.

BIDS DESIRED.

Westport, Conn.—No bids will be opened Sept. 22 by State Highway Comr., Capitol, Hartford, for constructing a single leaf deck lift bridge over channel of Saugatuck River, Westport, advertised in Engineering Record of Aug. 28, as specifications are being revised. New date to be announced later. For further information address Chas. J. Bennett, State Highway Comr., Hartford.

Buffalo, N. Y.—Until Sept. 15 by Grade Crossing Comn. (Edw. B. Guthrie, Ch. Engr.), 436 Ellicott Square, for constructing a single-span, riveted through truss, in Bailey Avenue, over tracks of Pennsylvania R.R., advertised in Engineering Record.

Bangor, Pa.—Until Sept. 17 by George F. P. Young, Co. Controller, Easton, for constructing reinforced concrete bridge over Martins Creek at Pennsylvania Avenue. H. C. Dilliard, Co. Engr.

Greensburg, Pa.—Until Sept. 28 by John S. Sell, Co. Controller, West Moreland County, Greensburg, for constructing an inter-county plate girder bridge, concrete foundation and floor over Jacobs Creek at West Overton, between Fayette and West Moreland Counties. Also for removal of present bridge.

Berkeley Springs, W. Va.—Reported desired until Sept. 11 by M. S. Harmison, Clk. County Court, for constructing concrete bridge across Sleepy Creek. Alternate bids received for a 90-ft. single span or 2 spans of 50 ft. each, 14-ft. roadway.

Keyser, W. Va.—Until Sept. 14 by J. B. Bell, Clk. County Court, for constructing two reinforced concrete bridges, one 50 ft. over Beaver Dam and the other 30 ft. over George's Run, each to have a 14-ft. roadway.

Dalton, Ga. — Reported desired until Sept. 11 by Co. Comrs. (H. J. Wood, Chmn.) for constructing two-span, 80 x 25 ft. steel and concrete bridge, 12-ft. roadway.

Columbus, Ohio.—Until Sept. 17 by Bd. County Comrs, (John Scott, Clk.) for constructing foot bridge over Scioto River on Mound Street, and paving east approach to Shrocks bridge; also handrail on Agler Bridge, Alum Creek, Mifflin Township.

Marion, Ohio.—Reported desired until Sept. 8 by Co. Comrs. (V. Perle Garfield, Clk.) for a 160-ft. steel bridge over Scioto River in Section No. 19, known as the Clarke Bridge.

Illinois. — By State Highway Comn., Springfield, for constructing bridges as follows:

Until Sept. 7, at office of Village Clk., St. Peter, Platt Bridge, reinforced concrete slab, span 26 ft. Engineer's estimate $1,100. J. V. Waddell, Co. Supt. Highways.

Until Sept. 8, at Park Hotel, New Douglas, Ludwig, Neathammer and Schrumpf bridges, reinforced concrete and steel. Total cost $1,220. R. O. Young, Co. Supt. Highways, Sorento.

Until Sept. 8, at bridge site, La Clede, Handy Bridge, reinforced concrete slab, 28-ft. span. Engineer's estimate $1,080. J. V. Waddell, Co. Supt. Highways, Vandalia.

Until Sept. 10, Town Hall, Broughton, Nipper Bridge, Mayberry Township, 50-ft. steel span. Engineer's estimate $2,950. Gregg Garrison, Co. Supt. Highways, Garrison.

Brainerd, Minn.—Reported desired until Sept. 7 by C. W. Mahlum, Co. Aud., for constructing bridge over Pine River, consisting of three 30-ft. spans on reinforced concrete abutments.

Breckenridge, Minn.—See "Hydraulic."

Alma, Kan.—Until Sept. 7 by County Clerk for constructing following bridges:

Pringle Bridge: Reinforced superstructure of 30-ft. span and 18-ft. roadway, on plain concrete abutments.

Joe Tren Bridge: Reinforced superstructure consisting of two 18-ft. spans of 18-ft. roadway, on a plain substructure.

White Bridge: Reinforced concrete superstructure of 30-ft. span and 16-ft. roadway.

Lawrence, Kan.—Reported desired until Sept. 11 by Herman Broeker, Co. Clk., for constructing stone pier and abutments at Harrison bridge, reinforced concrete abutments on the Spring Creek bridge, removing the Eggert bridge and re-erecting it.

Mankato, Kan.—Until Sept. 14 by County Clerk for following bridge work in Jewel County, Kansas:

Lovewell Bridge: Steel truss superstructure of 110-ft. span and 16-ft. roadway, having a reinforced concrete floor and reinforced abutments.

Richardson Bridge: Low truss steel bridge of 36-ft. span.

Harrison Bridges Nos. 1 and 2: Both bridges to be reinforced concrete superstructures of 20-ft. span and 16-ft. roadway, on plain concrete abutments.

Hellee Bridge: Reinforced concrete superstructure of 10-ft. span and 18-ft. roadway.

Moore Culvert: A 4-ft. x 4-ft. box culvert 54 ft. long. Prices will be received for steel stringers, steel railing, wood flooring and miscellaneous repairs on eleven bridges.

Plans and specifications furnished by W. S. Gearhart, State Highway Engr., Manhattan.

Hill City, S. D.—Reported desired until Sept. 8 by Co. Comrs. for constructing reinforced concrete bridge across Spring Creek. J. G. Hopkins, Co. Aud.

Roundup, Mont.—Reported desired until Sept. 10 by Co. Comrs. for constructing four steel bridges over Musselshell River as follows: A 140 ft. Ryegate; 140 ft. span Delphia; 122½ ft. Gage; 140 ft. span Absher or 175 ft. base with two piers. Ray E. Bushnell, Co. Surv.

Oregon, Mo.—Reported desired until Sept. 10 by John H. Peret, Co. Surv., for constructing bridges and concrete culverts.

Perryville, Mo.—Reported desired until Sept. 7 by Thomas J. Killian, Road and Bridge Comr., for constructing two steel bridges, one with wood floor and stone on concrete abutments, and the other with concrete floor and concrete abutments.

Riverside, Wash.—Reported desired until Sept. 8 by F. A. Brainger, Co. Aud., Conconully, for constructing steel bridge, concrete piers, over Okanogan River at Riverside. Probable cost $10,000. Bowerman & McCloy, Engrs., Mutual Life Building, Seattle.

San José, Cal.—Until Sept. 13 by Bd. Co. Superv. (Henry A. Pfister, Clk.) for constructing a reinforced concrete bridge on Noble Avenue over the Penetencia Creek.

Hailey, Idaho.—Reported desired until Sept. 13 by Bd. County Comrs., Hailey (George A. McLeod, Clk.), for 60-ft. span steel truss bridge over Malad River, near Blaine, and 40-ft. span steel girder bridge across Lost River, near Arco.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Berlin, N. H.**—E. M. McCourt Macy, City Engr., writes contracts have been awarded for constructing bridge across Androscoggin River, above Saw Mill, at Berlin Mills, as follows: Superstructure to Boston Bridge Works, Boston, Mass., and masonry to H. P. Cummings Constr. Co., Boston, Mass.; it will be steel on concrete piers, concrete foundation; cost $25,000. Engineers, Storrs & Storrs, Concord.

★**Providence, R. I.**—Contract awarded by Bd. Contract and Supply to Briggs Eng. & Constr. Co., Providence, to build new Randall St. highway bridge at $11,-636. Other bids: Cruise & Smiley Constr. Co., $12,918; Valley Co., $13,074; Famiglietti Bros., $11,731.

★**Boston, Pa.**—Contract awarded by Co. Comrs. to C. N. Haggart, Pittsburgh, for constructing repairs to county bridge No. 6 over Youghiogheny River at Boston at $18,425. The work includes new approach to bridge, new wood block floor and new street car rails.

★**West Chester, Pa.**—Contract awarded Aug. 23 for a steel girder bridge across Muddy Run to Whitaker & Deal, Harrisburg, and P. J. McCormick & Son, West Chester. Isaac Y. Ash, Co. Controller.

★**Wilmington, Del.**—Baltimore & Ohio R.R. Co. will carry Lancaster Avenue over tracks on a bridge, on concrete foundation, with paved roadway 34 ft. 6 in. wide and sidewalk on each side, making total width of avenue 60 ft., and contract for foundation has been awarded to Jas. F. Brogan Co., Philadelphia, Pa., and for superstructure to King Bridge Co., Cleveland, Ohio.

★**Princeton, Ga.**—Contract awarded by County Commissioners for a bridge at Princeton to East St. Louis Bridge Co. of East St. Louis, Ill.; bridge consists of 2 spans at 73 ft. 9 in. and one span at 105 ft., concrete caps to be placed on present substructure; contract price $4,357.

★**Nekoosa, Wis.** — Contract for constructing four-span 875-ft. bridge across Wisonsin River awarded Wausau Iron Wks., Wausau, at $42,889.

★**Wadena, Minn.** — Contract awarded Aug. 23 for constructing Bridge 1551 to Minneapolis Bridge Co., Minneapolis, at $4,875. Eugene Boss, Co. Aud.

★**Girard, Kan.**—Contract awarded Aug. 18 for constructing bridges as follows: To Concrete Steel & Constr. Co., Joplin, Mo.,

for 4 steel girder bridges concrete floor, at $8,510 also to the Topeka Bridge & Iron Co., Topeka, for one concrete bridge for $1,960. Charles C. Everett, Co. Clk.

★**Manhattan, Kan.**—Contract awarded by State Engineer at Manhattan Aug. 17 to Canton Bridge Co., Canton, Ohio, for constructing Ogden Bridge, Riley County. This company bid for steel joists $10,840 and wood joists $9,697.

★**Fremont, Neb.**—Contract awarded Aug. 24 by County Supervr. to Standard Bridge Co., Omaha, for constructing bridges during year, one 30 and one 40 ft. steel girder, one 40, one 50, one 60, one 70 and one 80 ft. steel truss bridge and such other bridges as may be found necessary. John O'Connor, Co. Clk.

★**California.**—Following are bids opened Aug. 23 by State Highway Comm., Sacramento, for reinforced concrete bridge, about 532 ft. long with one 180-ft. arch and two 114-ft. arches, clear span across Sacramento River, near Dunsmuir: F. H. Green, Eureka, Cal., $22,600 (awarded contract); P. J. Lechner, Alameda, $23,-994; Moffett & Mead, San Francisco, $24,-75; Pacific Coast Constr. Co., Fresno, $27,300. Engineer's estimate $22,267.

★**Santa Barbara, Cal.**—Contract was awarded July 2 to Munoz & Munoz, Los Angeles, for constructing concrete bridge on Carrillo and Castillo Streets, at $18,000. A. B. Cook, City Engr.

Visalia, Cal.—Lowest bid opened Aug. 16 for constructing 400 ft. reinforced concrete bridge across Kings River near Kingsbury submitted by Turner & Co. at $14,223.

★**Tilden, Idaho.**—Contract for constructing bridge and removing old bridge across Snake River at Tilden awarded by Co. Comrs. to Midland Bridge Co., Kansas City, Mo., at $7,250.

★**Winnipeg, Man.**—Contract for constructing two steel and concrete bridges in Swan River Dist., to cost $15,000, awarded as follows (one is to have a 126-ft. span, the other a 75-ft. span): Substructure to S. C. Hill & Co., Winnipeg, and superstructure to Algoma Steel Bridge Co.

PAVING AND ROADS

PROPOSED WORK

Holyoke, Mass.—Bd. Pub. Wks. rejected all bids recently opened for furnishing creosoted planks and wooden paving block.

Smithfield, R. I.—Town Council (George E. Thurber, Pres., Greenville) reported to have instructed highway committee to report on cost of new road machinery.

Brooklyn, N. Y.—Board of Estimate of New York has authorized improvement of sixteen highways and sewers for Brooklyn, to cost $67,000, and three in Queens, to cost $98,700; also preliminary authorizations for Brooklyn, to cost $13,000.

Irvington, N. J.—All bids opened Aug. 20 for paving Lyons Avenue have been rejected by the 121 Chosen Freeholders, Newark.

Jersey City, N. J.—Reported Bd. Chosen Freeholders will soon let contract for repaving Passaic Avenue, and also Paterson Plank Road. Granite block will be used on Passaic Avenue.

Newark, N. J.—Board of Street and Water Comrs. voted to pave Chelsea Avenue with asphalt.

Harrisburg, Pa.—Citizens of Delaware and Chester counties have raised $70,000 toward repair of Baltimore Pike, through those two counties and passing through Philadelphia. The total length of the road from Philadelphia to the Maryland State boundary is approximately 30 miles and it is reported that the state will add $100,-000 to this sum. Address State Highway Commissioner, Harrisburg.

Reading, Pa.—City Council provided $19,000 for additional street paving, including Fifth, Orange, Eighth and other streets.

Baltimore, Md.—Bd. Awards has approved specifications for sheet asphalt on Arunah Avenue and Rosedale Street.

Lovington, Va.—Reported bonds for $25,-000 will be sold Sept. 1 by County Comrs. for constructing and improving roads.

Parkersburg, W. Va.—Bonds for $200,000 for street improvements sold.

Mount Airy, N. C.—Citizens of Westfield and Shoals Townships voted $30,000 bonds for building graded and clay roads.

Cartersville, Ga.—See "Water Works."

Jesup, Ga.—At recent joint meeting between County Comrs. of Wayne and Liberty Counties action for new public road leading from Ludowici in Liberty County to Doctortown in Wayne County was decided upon. This action carries with it plans and specifications for bridge across Altamaha River at Doctortown. Survey, plans of bridge, etc., to be submitted to Commissioners at meeting to be held Sept. 11. For further information address, Ira M. Raybon, Clk. Co. Comrs., Jesup.

Macon, Ga.—Concrete has been selected by Council for paving Montpelier Avenue.

Miami, Fla.—Reported Council has authorized paving with asphalt portions of Avenues B, C, D, G, E and J, the Boulevard, Eighteenth, Twentieth, Seventh, Sixth, Eighth, Tenth and Fourth Streets.

Jackson, Miss.—County Bd. Superv. has appointed a committee, of which J. L. Redfield is a member, to have charge of building gravel roads in the vicinity of Edwards to cost $15,000.

Dayton, Tenn.—Comrs. of Rhea County at Dayton will construct highways to cost $500,000. Engineers are making preliminary surveys and contract for $250,000 worth of work will be let about Sept. 15. This work will include approximately 32 miles of the Dixie Highway and will be completed before any other work is commenced. For information address J. H. Hoskins, Ch. Engr., County Highway Comn.

Maryville, Tenn.—Citizens of the county voted $300,000 bonds for building new pikes and macadamizing those already graded.

Albany, Ky.—Citizens of county voted $50,000 bonds to build Dixie Highway through Clinton County.

Dixon, Ky.—The County Fiscal Court has approved plans and specifications for improving Dixie Providence Road through to Hopkins County line near Yarmouth, a distance of 15 miles, and the Dixon-Sebree Road through to Green River, 16 miles.

Jamestown, Ky.—Citizens Aug. 21 voted $40,000 bonds for constructing bridges and roads. Bonds to be sold about April 1. Contract for construction to be let about May 1. Engineer not yet selected. Address L. G. Bernard, Co. Clk.

Bowling Green, Ohio—Wood County Road improvement bonds amounting to $26,000 sold.

Dayton, Ohio.—City Commission has adopted ordinances providing for issuing of bonds for following purposes: $457,000 city's share for street paving and repair; $130,000 for Fire Department new engine house and equipment; $250,000 for storm sewers; $115,000 for Keowee Street bridge; $50,000 for workhouse farm buildings; $18,000 for condemnation property for streets; $17,000 for improving Central Market House; etc.

Fostoria, Ohio.—Street improvement bonds amounting to $13,290 sold.

Marion, Ohio.—Pike Comrs. have sold $20,500 Kennel Free Turnpike bonds.

Westerville, O.—Bonds for $23,000 Vine, W. Home and Winter St. paving bonds will be sold Sept. 23 by R. D. Bennett, Village Clk.

Xenia, Ohio.—Bonds for $24,000 will be sold Sept. 7 by C. F. Logan, City Aud., for paving, curbing, guttering and constructing sewers.

Frankfort, Ind.—Gravel Road improvement bonds amounting to $31,280 sold.

Goshen, Ind.—Co. Comrs. rejected all bids opened recently for constructing ten miles of concrete pavement connecting Oakland Avenue out of Elkhart with Wakarusa through Concord, Harrison and Olive Townships.

Adrian, Mich.—A seven-mile stone road connecting Adrian with northern Ohio is to be constructed by Fairfield Township; cost $32,000.

Edwardsville, Ill.—City proposes paving Randle, Centre and Buchanan Sts. with brick, on 6-in. concrete and combination curb. Geo. Schaffer, Engr., Bohn Bldg. Frank L. Nash, City Clk.

Jacksonville, Ill.—Bd. Local Improv. considering repaving W. State Street. Majority of property owners favor tarvia re-topping.

Murphysboro, Ill.—Bd. Local Improv. voted to pave Bridge Street with brick, from Eighth to First Street. Contract to be let in December. Engineer's estimate, $10,500. Nineteenth Street will also be paved with brick, from Pine to Gartside Street; estimated cost $20,000.

Quincy, Ill.—Bd. of Local Improv. adopted resolution providing for paving with brick block on concrete foundation 7 blocks on Fourteenth Street, north and south of Main. Public Engineer's estimate of cost $28,737. Construction may be deferred until spring.

Springfield, Ill.—Bd. Local Improv. of Pleasure Driveway and Park Dist. propose paving with asphalt on Grand Boule., cost, $12,600. W. L. Wilson, Park Dist. Engr.

Springfield, Ill.—An ordinance for paving Fourth Street from Monroe to Jefferson with creosoted block being considered by City Commission; estimated cost $16,000.

St. Charles, Ill.—City Council has passed an ordinance providing for paving with concrete foundation with a brick and asphalt filler portions of West Main, West Fourth, West Third and other streets, at a total cost of about $62,496.

Wauwatosa, Wis.—Town Board reported to have decided to open a new macadam road from state fair park, extending 2 miles west.

Ft. Madison, Iowa.—Plans being prepared for about 2¼ miles of brick and cement paving. A. P. Brown, Mayor.

Minneapolis, Minn.—Bonds for $82,000 will be sold about Sept. 9 for street improvements.

Minnesota.—State Highway Comn. has directed completion and construction of highways in the state costing, for state's share, $131,500. About fifty miles of road will be improved, including eighteen and one-half miles of the Yellowstone trail west of Granite Falls, Minn.

Cherryvale, Kan.—City proposes to pave Liberty Street with vertical fiber block, on rolled cinder foundation, combined curb and gutter. Forest C. Barber, City Clk.

Great Bend, Kan.—Proposed to lay about 20,000 sq. yds. asphaltic concrete pavement.

Fremont, Neb.—Contract soon to be let by City Council for paving six districts, including Fourth, Eighth and Ninth Streets, Nye and Military Avenues. Bids will be considered on sheet asphalt, asphaltic concrete, bitulithic, brick, granite, concrete, etc.

Norfolk, Neb.—City contemplates paving 52 blocks including S. 9th St., Pasewalk and Park Avenues, with asphaltic concrete and 4½ miles concrete. Address, P. T. Stafford, City Clk.

Great Falls, Mont.—Reported City Council passed resolution creating special improvement district for paving Fifth Avenue north from Park Drive to Ninth Street, and cross streets from Fifth to Sixth Street alleys north. Estimated cost, creosoted wood block, $63,435; standard bitulithic, $59,842, or gravel bitulithic, $50,134.

Missoula, Mont.—City Council considering paving E. Front Street in Special Improv. Dist. No. 37, with wood block, asphalt or standard bitulithic on 4-in. concrete foundation. L. E. Harris, City Clk.

Kansas City, Mo.—Bd. Pub. Wks. decided to pave McGee Street from Fifteenth to Twentieth Streets with creosoted wood blocks.

Paragould, Ark.—City Council has been petitioned to create a new paving district to include about 10,000 sq. yd. paving.

Bryan, Tex.—Co. Comrs. have sold $400,-000 good road bonds.

Dallas, Tex.—Bd. City Comrs. authorized paving of Victor Street from Renderson to Lowell Streets.

Bellingham, Wash.—Council reported passed resolution to improve Lake Whatcom Road between bridge crossing Lake Whatcom and city limits, by clearing, grading and hardsurfacing 18 ft. wide; also to lay 5-ft. concrete sidewalks on both sides of Humboldt Street, from Lake to Whatcom Streets, with necessary parking strips, and grading, laying 16-ft. pavement on Alabama Street, between Orleans Street and St. Clair Street; cost of latter to be $24,000.

Bremerton, Wash.—Contracts soon to be let for constructing concrete walks on portions of Fourth Street and Burwell Avenue.

Colfax, Wash.—County Commissioners have ordered grading and graveling of 4 miles of highway connecting present highway 2½ miles southeast of Pullman and running southwest from Pullman to Wawawai, on Snake River.

Pasco, Wash.—J. W. Hamilton, Co. Engr., instructed to prepare plans and specifications for macadamizing approximately 10 miles of county highway, about 30,000 sq. yds.

Pullman, Wash.—City Council passed resolution for improvement of Kamiacken Street, by filling, grading, parking and paving; cost about $14,000.

Seattle, Wash.—Plans approved by Bd. Pub. Wks. as follows: Concrete walks, paving, etc., East Valley Street, $11,500; paving Western Avenue, concrete walks on West Dravus Street, etc. A. H. Dimock, City Engr.

City Engr. A. H. Dimock estimated the cost of paving Forty-seventh Street N. E. at $28,206, and Meridian Avenue a $39,299. He has submitted to Bd. Pub. Wks. plans for paving with brick block on Pike Street and for paving Thirty-fifth Avenue S. W. and concrete walks on Vallet Street.

Tacoma, Wash.—County Commissioners authorized L. H. White, Co. Engr., to make survey of 10.6 miles of Mount Rainier National Park Highway and prepare estimates on cost of hardsurfacing this highway from Tea House, the end of present pavement, to top of Chon Hill; tentative estimates of cost $100,000 to $140,000.

Oregon City, Ore.—Council reported to have ordered Seventh and Tenth Streets, from Main Street to Railroad, improved with asphaltic concrete; contract will probably be let in September.

Oregon City, Ore.—County Judge Anderson reported to have announced that county road from Abernathy bridge to Gladstone, a distance of 1½ miles, 16 ft. wide, may be paved this year, following the offer of W. H. Worsick to the County Court to lay a 4-in. asphaltic concrete pavement, with a 10-year guarantee for $1 per sq. yd., or about $12,000.

Oregon City, Ore.—City Council considering paving with asphaltic concrete on portions of Third, Fourth, Fifth, Sixth and other streets.

Pendleton, Ore.—Thos. Fitzgerald, City Recorder, writes that proposed paving of S. Main St. with gravel bitulithic will cost $8,500. Contract to be let at once.

Tillamook, Ore.—City Council passed resolutions to improve Second Avenue, E., by grading, rolling roadway, paving with sheet asphalt, concrete walks, concrete curbs, etc.

Anaheim, Cal.—O. E. Stewart, City Engr., writes about 66,000 sq. yd. paving contemplated on Broadway, East Broadway and West Broadway with sheet asphalt surface, concrete base and concrete foundation, no fill; estimated cost $1.40 per sq. yd. Bids for construction to be received in about three months.

Santa Monica, Cal.—Superior Court has decided in favor of the Co. Comrs. in the mountain boulevard contemplated between the coast, about seven miles from Santa Monica, winding over the mountain, through Las Tunas canyon, to the Topanga post office. Road is to be about seven miles long and 18 ft. wide.

Ventura, Cal.—Citizens Aug. 24 voted $1,000,000 bonds for constructing county highways. J. B. McCloskey, Co. Clk.

Globe, Ariz.—Citizens of county voted $500,000 bonds for good roads.

Coeur D'Alene, Idaho.—E. M. Booth, State Engr., and Co. Comrs. are considering the building of a permanent highway from this city to the Shoshone County line, a distance of 12 miles; cost $24,000.

Cottonwood, Idaho—A. J. Warren, County Surveyor, will make surveys and estimates for paving business section of town.

Cottonwood, Idaho.—Bd. of City Trus. reported to have decided to pave within the next few months the main business streets. Fred Warren, County Engineer, reported to have prepared plans and estimates cost at $12,000 and $18,000, according to type of pavement used.

Emmett, Idaho.—Reported City Council has created improvement district providing for construction of cement sidewalks on 12 blocks; also for cement crossings, laterals and culverts on 14 streets.

Hoquiam, Wash.—Council reported to have adopted resolution providing for improvement of Riverdale Road, including North Hoquiam arterial road, Riverdale Road, etc., by grading, paving, etc. Cost estimated at $161,055.

Kellogg, Idaho.—City Engineer authorized to submit estimate for paving with concrete Main Street, from Wardner line to end of present paving.

Wallace, Idaho.—Ordinance introduced in Council providing for paving entire residence district, including Bank, Cedar, Pine and River Streets, from Fifth Street West to First Street, both inclusive.

Bertie, Ont.—Council intends reconstructing and improving Erie Road at a cost of $15,725.

Prince George, B. C.—Citizens reported voted $15,000 bonds for paving.

BIDS DESIRED.

Boston, Mass.—Until Sept. 7 by Edw. F. Murphy, Comr. Pub. Wks., for furnishing material and laying asphalt or bitulithic pavement on portions of Normandy Street, Dorchester, and Dane Street, West Roxbury.

East Hartford, Conn.—Until Sept. 7 by Bd. Comrs. East Hartford Fire Dist. (Frank S. Forbes, Clk.) for 2500 ft. macadam roads on Central Avenue and Linden Street and about 10,000 sq. ft. concrete walks on Larrabee Street and Burnside Avenue.

Norwalk, Conn.—Until Sept. 14 by Washington Bridge Constr. Com. (A. F. Beard, Chmn.) for furnishing and placing wood block, vitr. block, concrete or amiesite, partly on existing concrete foundations, and partly around tracks which are in process of construction, advertised in Engineering Record.

Albany, N. Y.—Until Sept. 7 by Bd. Contract and Supply (Isidore Wachsman, Secy.), for improving Washington and Slingerland Sts., and repaving Madison Pl. Work to include grading and paving with asphalt or vitr. shale blocks, repaving with redressed granite blocks, constructing concrete walks, laying vitr. pipe sewers, etc.; also grading Sheridan Park.

Franklinville, N. Y.—Until Sept. 6 by R. L. Farnham, Village Clk., for paving Park Square, about 3000 sq. yd., with vitr. brick on concrete foundation.

Jersey City, N. J.—Until Sept. 9 by Bd. City Comrs. for repaving portions of Pine Street and Communipaw and Skillman Avenues. Michael I. Fagen, City Clk.

Newark, N. J.—Until Sept. 16 by Bd. Street & Water Comrs. (M. R. Sherrerd, Ch. Engr.), for grading, curbing, flagging and paving portions of Front Street and Saybrook Place, to include the following: 8970 cu. yd. extra excav.; 4200 sq. yd. new oblong granite block pavt. on 6-in. concrete foundation; 1400 sq. yd. trap rock block pavt. reclipped and paved

on new 6-in. concrete foundations; 150 sq. yd. new brick pavt. and 150 sq. yd. new asphalt pavt., both on 6-in. concrete foundation; 2250 lin. ft. 20 x 6 in. four cut granite curb, set in concrete; 260 lin. ft. cut granite corners; 21,500 sq. ft. 5-in. artificial walk, etc.

Union (P. O. Weehawken), N. J.—Reported desired until Sept. 7 by Town Council for improving and repaving portions of Fulton Street and Bergenline Avenue. Emil Bantz, Town Clk.

Westfield, N. J.—Reported desired until Sept. 7 by Charles Clark, Town Clk., for 9910 sq. yd. macadam, 2700 ft. curb and 9100 yd. excav.

Bethlehem, Pa.—Until Sept. 11 by Milton M. Mitman, Chmn. Street Com., at office of Victor E. Tice, Boro. Secy., South Main Street, for paving with amiesite, on Linden, Broad and Main Streets and Prospect Avenue, approximately 45,000 sq. yd., on 3-in. concrete base. A. M. Cawley, Boro. Engr., First Natl. Bank Building.

Pennsylvania.—Until Sept. 15 by State Highway Dept., Harrisburg (R. J. Cunningham, Comr.), for reconstructing 11,987 lin. ft. of either bituminous or cement concrete pavement, 16 ft. wide, in Kennet and East Marlborough Townships, Chester Co., and 22,999 lin. ft. in Henderson Township, Huntingdon Co.

Pittsburgh, Pa.—Until Sept. 23 by Hyatt M. Cribbs, Co. Controller, for improving Painters Run Rd., Mount Lebanon and Upper St. Clair and Scott Townships, a distance of 4 miles.

Saxonburg, Pa.—Until Sept. 7 by E. L. Rudert, Boro. Clk., for improving Main Street, in all about 7150 sq. yd. paving, 2753 cu. yd. excav. and 4182 lin. ft. sandstone or concrete curbing.

Jacksonville, Fla.—Reported desired until Sept. 9 by City Clerk for grading, draining, curbing and paving Adams, Pensacola and other streets. Isham Randolph & Co., Consult. Engrs., Heard Building.

Linden, Ala.—Reported desired until Sept. 7 by A. L. Rasey, Co. Comr., for about 40 miles sand clay gravel road. S. W. Gaines, Jr., Engr., Selmer.

New Orleans, La.—Until Sept. 21 by Dept. Pub. Finances (A. G. Ricks, Comr.) for erecting an asphalt plant at Perdido and Clark Streets.

Clarksdale, Miss.—Reported desired until Sept. 6 by S. S. Carl, Chancery Clk., for 2 miles gravel road in Supervisors Dist. No. 1.

Bluff City, Tenn.—Until Sept. 20 by Co. Rd. Comrs. (W. D. Lyons, Chmn.) for grading, draining and macadamizing pike roads. C. M. Dulaney, Engr., Blountville.

Cincinnati, Ohio.—Until Sept. 7 by Dir. Pub. Service (Parke S. Johnson, Clk.) for paving portions of Gest Street with asphalt, constructing granite curbing and necessary drains and inlets.

Columbus, Ohio.—Until Sept. 9 by Dir. Pub. Service (Paul B. Kemper, Clk.) for 100,000 standard paving bricks.

Conneaut, Ohio.—Until Sept. 20 by Dir. Pub. Service (L. W. Morgan, Clk.) for grading, draining, curbing and paving with asphalt or shale block State Street, in all 14,400 sq. yd., asphalt or brick pavement, concrete base, 12,000 lin. ft. concrete curb, 2,550 lin. ft. storm sewer, together with manholes, catchbasins, etc.

Elyria, Ohio.—Until Sept. 8 by M. M. Wilcox, Dir. Pub. Service, for furnishing material, grading, curbing, paving and repaving portion of Middle Avenue, together with drains, manholes, catchbasins, etc.

Lagrange, Ohio.—Reported desired until Sept. 8 for grading, draining and resurfacing with bituminous bound slag macadam Lagrange North Center Road, about 10,911 ft.

Ohio.—Until Sept. 10 by Clinton Cowen, State Highway Comr., Columbus, for improvements on following roads (work in all counties includes bridges and culverts, grading roadway and paving):

Allen County, Section "E" of Lima-Delphos Road, Marion Township; paving with surface treated macadam; length 11,330 ft.; estimated cost $30,201.

Butler County, Section "G" of Cincinnati-Hamilton Road, Fairfield Township; constructing steel bridge and remodeling abutments at station, 71 + 40; estimated cost $1,695.

Champaign County, Section "N" of Urbana-Sidney Road, Concord Township; paving with waterbound macadam; length 5280 ft.; estimated cost $8,401.

Delaware County, Section "H" of Columbus-Sandusky Road, Delaware and Liberty Townships; paving with bituminous macadam; length 5520 ft.; estimated cost $14,020; alternate bids, paving with waterbound macadam and reinforced concrete; length 5520 ft.; estimated cost $14,553.

Geauga County, Section "H" of Burton-Bloomfield Road, Burton and Middlefield Townships; paving with concrete; length 15,710 ft.; estimated cost $36,008.

Jefferson County, Section "I" of Ohio River Road, Wells Township; paving with concrete; length 7000 ft; estimated cost $40,458.

Montgomery County, Section "L" of Dayton-Troy Eastern Road, Mad River Township; paving with brick; length 7300 ft.; estimated cost $31,716.

Montgomery County, on Section "K" of the Dayton-Indianapolis Road: Contract No. 1—Main Market 4, Madison and Jefferson Townships; constructing bridges and culverts; length 10,700 ft.; estimated cost $1,378. Contract No. 2—Madison and Jefferson Townships; paving with brick; length 10,700 ft.; estimated cost $40,439.

Van Wert County, Section "E" of Van Wert-Delphos Road, Ridge Township; paving with bituminous macadam; length 5363 ft.; estimated cost $11,187.

Wyandot County, Section "H" of Bucyrus-Upper Sandusky Road, Crane Township; paving with brick; length 5280 ft.; estimated cost $19,166.

Wyandot County, Section "G" of Upper Sandusky-Bellevue Road, Crane Township; paving with brick; length 5280 ft.; estimated cost $18,117.

For Bureau of Maintenance and Repair: Jefferson County, Section "H" of Steubenville-Cambridge Road, Cross Creek, Island Creek, and Steubenville Townships; repairing culverts, grading roadway, and resurfacing with bituminous macadam; length 20,998 ft.; width of roadway 26 ft.; estimated cost $36,408.

Crawfordsville, Ind.—Reported desired until Sept. 7 by Co. Comrs. for a steam roller not less than 10 tons. Bennett B. Engle, Co. Aud.

Greensburg, Ind.—Until Sept. 6 by Bd. Co. Comrs. for constructing wood block floor on two bridges over Clifty Creek, one 60 ft. long, 16 ft. wide; the other 85 ft. long, 16 ft. wide. L. W. Sands, Co. Aud.

Indiana.—Bids desired by County Commissioners for constructing roads as follows:

Until Sept. 6:

Newport, 1 mile brick pavement. Probable cost, $24,150. Roy Slater, Co. Aud.

Jeffersonville, macadam or crushed stone road in Utica Township. George W. Stoner, Co. Aud.

Until Sept. 7:

Delphi, macadam road, Rock Creek Township. M. G. Haun, Co. Aud.

Lafayette, gravel roads in townships as follows: Perry, 1.05 miles; Tippecanoe, about 8 miles; Shelby Township, about 3¾ miles; Washington, 1 mile; Perry and Washington, about 2½ miles; Wabash, 1 mile; Lauramie and Sheffield, about 3 miles. George W. Baxter, Co. Aud.

Until Sept. 9:

Rochester, 4 gravel roads in Henry Township.

Until Sept. 15:

Anderson, concrete road in Anderson Township.

Columbus, Wis.—Reported desired until Sept. 14 by Benjamin Paepke, City Clk., for improving Madison and Otsego Roads with asphalt or tarvia bound macadam, and Broadway with concrete.

Guthrie Center, Iowa.—About Sept. 20 by Seth B. Weeks, City Clk., for about 30 blocks of paving, including State, Fifth, Prairie and Third Streets. Material not yet decided upon. Engineers, Bruce & Standeven of Omaha, Neb.

St. Paul, Minn.—Reported desired until Sept. 7 by August Hohenstein, City Purchasing Agt., for grading and improving Lansing Avenue and repaving University Avenue.

Garnett, Kan.—Until Sept. 7 by F. S. Mitchell, City Clk., for furnishing material and paving portions of Fourth, Fifth and Oak Streets with either vitrified block or vertical fiber block on 4-in. concrete base. Black & Veatch, Engr., Interstate Building, Kansas City, Mo.

St. Louis, Mo.—Until Sept. 7 by Bd. Pub. Service (William T. Findly, Secy.) for improving streets as follows: Skinker Road and Market Street, with treated wood block; Chariton Street, Duncan, Arlington, and Lilburn Avenues, vitr. brick, and Ashland Avenue, with refined asphalt.

Taylor, Tex.—Until Sept. 21 by City Comrs. for all classes of pavt., approximately 120,000 sq. yd. including excav. curbs, gutters, headers, drainage, etc., advertised in Engineering Record. W. E. Dozier, Engr., Taylor; A. V. Hyde, City Clk.

Bremerton, Wash.—Until Sept. 13 by City Clerk for improvement of Fourth Street by concrete sidewalks, wood curb and gutter, grading and retaining walls; estimated cost $13,104; also same improvements on Burwell Avenue, to cost about $10,000. F. S. Hathaway, City Engr.

Pullman, Wash.—Reported desired until Sept. 7 by Matilda F. Gannon, City Clk., for concrete sidewalks in Local Improv. Dist. No. 25, approximately 118,500 sq. ft.

Toronto, Ont.—Until Sept. 7 by T. L. Church (Mayor), Chmn. Bd. of Control, for paving portions of Central and Easton Avenues, Keele, Mavety, Metland and other streets. Bids desired on asphaltic concrete, bitulithic and brick block. Also constructing concrete sidewalks on Ashland, Boston, Bowood Avenues and numerous other streets.

PRICES AND LETTINGS.

★Indicates awarded contract.

★Augusta, Me.—Contract awarded by State Highway Comn. Aug. 26 for construction of waterbound macadam road, 2.1 miles in length, located in Poland, to James McGregor, Rumford, at $11,882.60. Next 3 lowest bids: Marco Lavorgna, Canton, $11,999; R. G. Miller Contr. Co., Hartford, Conn., $13,179; James H. Kerr, Rumford, $13,193.

★Boston, Mass.—Contract awarded Aug. 23 by Edward F. Murphy, Comr. Pub. Wks., to Chas. J. Jacobs Co., 166 Devonshire Street, for asphalt pavement on Prince Street, at $11,580. Next 3 lowest bids: James Doherty, $11,836; A. H. Archer, $12,030; Martino De Matteo, $12,042.

★Massachusetts.—Following are 3 lowest bids opened Aug. 24 by Massachusetts Highway Comn., Boston, for state road work:

Weymouth—Columbus Constr. Co., 16 Foster Street, Boston, $17,745 (awarded contract); H. L. Thomas & Co., Middleboro, Mass., $18,752; W. D. Loud & Son, Quincy, Mass., $17,995.

Marlboro—John A. Gaffey, Medford, $14,881 (awarded contract); R. F. Hudson, Melrose, $15,437; Middlesex Contr. Co., 7 Water Street, Boston, $15,825.

Lincoln—Rowe Contr. Co., Malden, $11,615; Perini Contr. Co., Framingham, Mass., $11,910 (awarded contract); R. F. Hudson, Melrose, $13,141.

Newbury-Shrewsbury—R. F. Hudson, Melrose, $19,180 (awarded contract); Middlesex Contr. Co., 7 Water Street, Boston, $23,047; Joseph McCormack, East Providence, R. I., $24,747.

Following are bids opened Aug. 31 by State Highway Comn. for state highway improvements:

★Chelmsford, 5200 lin. ft.: Herbert L. Thomas & Co., Middleboro, $8,610 (awarded contract); Pollatto & Davis Co., Lowell, $9,364; Perini Constr. Co., Ashland, $9,401.

Ware and Palmer, 13,600 lin. ft.: Perini Constr. Co., Ashland, $16,679; Middlesex Contr. Co., Boston, $17,172; R. F. Hudson, Melrose, $20,838.

Albany, N. Y.—Following are totals of lowest bids opened Aug. 26 by State Highway Comn. at 55 Lancaster Street, for the construction of highways by State aid:

Road 5588, Kaaterskill-Clove Road, Greene Co., 3.95 miles: James M. Hamilton & Co., Gardner, $98,639; St. Lawrence Constr. Co., Inc., Albany, $115,940; Abner M. Harper, Inc., Newburgh, $117,149; James Anderson, Menands, $117,469.

Road 5579, Mohawk-Paines Hollow, Herkimer Co., 6.55 miles: Newport Constr. Co., Herkimer, $63,077; James Anderson, Menands, $63,357; Joseph McCormick, E. Providence, R. I., $67,782.

Road 5584, Paine's Hollow-Jordanville, Herkimer Co., 4.21 miles: Joseph McCormick, E. Providence, R. I., $46,423; Newport Constr. Co., Herkimer, $48,957.

Road 773, Wendellville-Lockport, Part 2, Niagara Co., 2.38 miles: F. J. Mumm Contr. Co., Buffalo, $23,424.

Road 799, Youngstown, Lockport, Part 2, Niagara Co., 4.21 miles: Arthur F. McConville, Ogdensburg, $53,156; Greenfield Constr. Co., Hornell, $54,245; Joseph Brumver, Buffalo, $54,909; Woolsey Constr. Co., Davenport, Iowa, $55,178.

Road 1315, Cambria-Wilson, Niagara Co., 8 miles: Joseph Brumver, Buffalo, $97,340; Serviss & Mackey, Youngstown, $101,902; Thomas F. Shaughnessy, Albany, $104,380; Cold Spring Const. Co., Buffalo, $105,307.

Road 1153, Lockport City, Market Street and Lake Avenue, Niagara Co., 1.27 miles: Greenfield Constr. Co., Hornell, $69,644; Caleb Hyatt, Yonkers, $70,101; Langan Constr. Corp., Albany, $71,184; Public Service Contr. Co., Niagara Falls, $73,694.

Road 5408, Fulton City, East First Street, Oswego Co., 0.36 mile: Oswego Constr. Co., Inc., Fulton, $16,490; William H. Ring Contr. Co., Ogdensburg, $16,495; J. E. Bishop, Syracuse, $16,866; F. P. Meckes, Long Pond, Pa., $17,261.

Road 817, Scotch Church-Blue Corners, Saratoga Co., 3.57 miles: John Arborio, New Haven, Conn., $34,960; Weed & Walsh, Mechanicsville, $35,092; John B. Dower, Ballston Spa, $35,700; Thomas H. Karr, Troy, $36,437.

Road 1320, Mecklenberg-Perry City, Schuyler Co., 2.75 miles: Patrick D. Conley, Ithaca, $25,380; Richard Hopkins, Troy, $26,804; James Rossney, Buffalo, $27,202; John H. Gordon, Albany, $28,267.

Road 5575, Perry City-Trumansburg, Schuyler and Tompkins Cos., 4.12 miles: Patrick D. Conley, Ithaca, $35,160; James Rossney, Buffalo, $36,808; Sullivan Constr. Co., Syracuse, $37,784; Bison City Eng. & Contr. Co., Inc., Buffalo, $38,255.

Road 5577, Middleburg - Breakabeen, Schoharie Co., 7.96 miles: Weed & Walsh, Mechanicsville, $91,046; Newport Constr. Co., Herkimer, $91,697; James Anderson, Menands, $94,459.

Road 5253-E, Jasper-Addison, Steuben Co., 5.52 miles: Kennedy Constr. Co., Albany, $38,796; Greenfield Constr. Co., Hornell, $41,320; John C. Bradley, Corning, $43,573; T. H. Gill Co., Binghamton, $43,710.

Road 1076, Newark Valley-Berkshire, Part 2, Tioga Co., 4.29 miles: Dana W. Robbins Co., Inc., New York, $35,354; T. H. Gill Co., Binghamton, $35,841; Richard Hopkins, Troy, $36,166; Sullivan Constr. Co., Syracuse, $36,190.

Road 1077, Newark Valley-Berkshire, Part 1, Tioga Co., 4.72 miles: Lane Constr. Corp., Meriden, Conn., $36,148; T. H. Gill Co., Binghamton, $39,279; Dana W. Robbins, Inc., New York City, $39,508; Sullivan Constr. Co., Syracuse, $39,559.

Road 1109, Cambridge-Ashgrove, Washington Co., 2.06 miles: William L. Sherrill, Hudson Falls, $16,975; Juniata Company, Philadelphia, Pa., $17,831; Kellogg Boynton, Keeseville, $17,966.

Road 5578, Whitehall-Dresden Center, Part 1, Washington Co., 1.89 miles: William G. Fox, Saratoga Springs, $29,582; Thomas H. Karr, Troy, $31,491; John B. Dower, Ballston Spa, $32,058; Kellogg Boynton, Keeseville, $32,365.

Road 1306, Williams Corners-Scott Corners, Westchester Co., 5.72 miles: The Pierson Eng. & Constr. Co., Hartford, Conn., $66,010; Frank G. Fowler Constr. Co., Mount Kisco, $68,307; Harris-Rose Constr. Corp., New York, $68,619; John De Michael & Bro., Torrington, Conn., $70,904.

Road 1307, Ossining-Millwood, Westchester Co., 1.89 miles: James Ciascia & Vincent Cartesi, Mount Vernon, $22,231; Frank G. Fowler Constr. Co., Mount Kisco, $25,276; H. B. Sproul Constr. Co., Peekskill, $27,428.

Road 1308, Hawthorne - Pleasantville, Westchester Co., 2.15 miles: James Garofano & Son, Mount Vernon, $24,738; James Ciascia & Vincent Cartesi, Mount Vernon, $25,700; John De Michael & Bro., Torrington, Conn., $26,040; Frank G. Fowler Constr. Co., Mount Kisco, $26,109.

Road 1309, Peekskill-Putnam County Line, Westchester Co., 6.63 miles: Henry Clinton, Poughkeepsie, $67,954; Conway Bros. & Kennedy, Eddyville, $71,653; H. B. Sproul Constr. Co., Inc., Peekskill, $73,168; Frank G. Fowler Constr. Co., Mount Kisco, $76,788.

Road 1323, Ossining - Kitchawan - Pine Bridge, Westchester Co., 4.62 miles: Frank G. Fowler Constr. Co., Mount Kisco, $49,183; H. B. Sproul Const. Co., Inc., Peekskill, $51,389; William F. McCabe Const. Co., Inc., White Plains, $58,528.

Road 1325, Thorn Corner-Teed Corner, Westchester Co., 2.81 miles: H. B. Sproul Constr. Co., Inc., Peekskill, $25,795; James Garofano Sons, Inc., Mount Vernon, $25,841; Frank G. Fowler Constr. Co., Mount Kisco, $26,277; Amos D. Bridges Sons, Inc., Hazardville, $26,710.

Road 1324, Whitehall Corner-Wright Corner, Westchester Co., 3.02 miles: H. B. Sproul Constr. Co., Inc., Peekskill, $28,858; Caesar A. Rossi, Horicon, $28,071; Gruner & Hallenbeck, Harriman, $29,120; James Garofano & Son, Inc., Mount Vernon, $29,129.

Bids opened same time and place for repair of following highways by State aid:

Contract 839, Herkimer Co.: J. J. Malloy, Schenectady, $18,797; Huntoon & Ferguson, Hudson Falls, $20,088; Michael O'Brien, Cortland, $20,321; Newport Construction Co., Herkimer, $20,366.

Contract 852, Herkimer Co.: John P. Dugan & Co., Amsterdam, $10,360; Newport Constr. Co., Herkimer, $10,569; Harry W. Roberts Co., Utica, $10,990; Phelan & Sullivan, Utica, $11,242.

Contract 848, Oneida Co.: Harry W. Roberts & Co., Utica, $13,649.

Contract 841, St. Lawrence Co.: Arthur F. McConville, Ogdensburg, $20,561; Kellogg Boynton, Keeseville, $21,878.

Contract 844, Schenectady Co.: J. J. Malloy, Schenectady, $8,706; John P. Dugan Co., Amsterdam, $8,923; Huntoon & Ferguson, Hudson Falls, $8,936; Brown & Lowe Co., Schenectady, $10,196.

Contract 837, Sullivan Co.: George Mesler, Liberty, $4,518; L. F. Bannin Plumbing, Htg. & Contr. Co., Kingston, $4,339.

Contract 843, Sullivan Co.: Armstrong & Trowbridge, Middletown, $41,492; George Mesler, Liberty, $42,327; Jackson Bros., Cuddebackville, $43,376; Port Jervis Constr. Co., Port Jervis, $44,500.

Contract 838, Westchester Co.: Malloy & Murray Contr. Co., Yonkers, $96,243; Lewis Petrillo, Mount Vernon, $97,517; Caleb Hyatt, Yonkers, $98,515; Borough Asphalt Company, Brooklyn, $101,302.

Contract 847, Westchester Co.: James Garofano & Son, Inc., Mount Vernon, $11,359; White & Colligan, Purchase, $11,755; William F. McCabe Contr. Co., Inc., White Plains, $12,576; Miguell Houck, White Plains, $12,687.

★Cohoes, N. Y.—Contract for paving a portion of Garner St. with vitrified brick awarded Thomas F. Gratton Constr. Co., Cohoes, at $1.58 per sq. yd.; total at $21,199. Other bidders: P. W. Mulderry, Albany, $21,708; Joseph Bellatte, Troy, $21,987; Crammond Constr. Co., Albany, $23,335.

★Lockport, N. Y.—Contract for constructing Shawnee County Road in Lockport awarded C. N. Stainthorpe & Co., 126 Main Street, at $20,830.

★Rochester, N. Y.—Contracts awarded by Bd. Contract and Supply to Whitmore, Rauber & Vicinius, Rochester, for asphalt pavement on Marion Street, at $9,251, and Aberdeen Street, at $9,331.

★Contracts awarded Whitmore, Rauber & Vicinus, Rochester, for brick pavt. on Cottage Street at $13,361 and for asphalt pavt. on Granger Place at $7.057 and brick on Cottage Street at $13,361.

Yonkers, N. Y.—Lowest bid for paving with macadam on portion of Park Ave. was from O'Rourke Constr. Co., 12 N. Bway, at $25,887, and from Kearns & Hart, 280 Neperhan Ave., for Palisade Ave., at $17,081.

Irvington, N. J.—Following are four lowest bids opened Aug. 20 by Bd. Freeholders, Newark, for repaving with bitulithic Lyons Avenue: Glenfield Constr. Co., Newark, $58,061; Standard Bitulithic Co., $63,464; Newark Paving Co., $64,769; Van Keuren & Son, $68,811.

New Brunswick, N. J.—Following are four lowest bids opened Aug. 23 by Bd. Freeholders for macadamizing South Amboy-Keyport Road: First Section, from South Amboy city line to N. Y. & L. B. R.R. tracks at Morgan Section, T. H. Rid-

die, New Brunswick, $37,849; Meagher & Smith, Perth Amboy, $39,744; Abraham Keller, New Brunswick, $4,121. Newark Paving Co., Newark, $41,248. Second Section, continuing the road from said railroad tracks to Monmouth County line at White Creek, A. Jess, $40,000; T. F. Duggan, $42,826, Franklin Contr. Co., $41,851, and Utility Constr. Co., New Brunswick, $44,284. Alvin B. Fox, Co. Engr., Perth Amboy.

★**Harrisburg, Pa.**—Contract awarded Aug. 3 for 3,000 sq. yd. sheet asphalt paving and 4,000 sq. yd. bituminous concrete paving to Central Constr. & Supply Co., Harrisburg. Wm. H. Lynch, Comr. of Highways.

★**Pittsburgh, Pa.**—Contract awarded by Co. Comrs. Aug. 19 for constructing highways to William J. Payne, Jr., Co., 7 Beechwood Avenue, Pittsburgh, at $67,-203. Work includes Bethel Road, Upper St. Clair and Bethel Townships, 3.9 miles, Brownsville Extension Road, Snowden Township, 2 miles, Herring Road, Snowden and Baldwin Townships, 3½ mile, Brinworth and Hayesville Road, in Brinworth Borough, 1.7 mi. ft. Troy Hill Extension, No. 3 Road, Ross Township, 1.6 miles, Brackenridge Road, Brackenridge Borough, 924 ft.

★**Reading, Pa.**—Council has awarded paving contracts amounting to $25,000 as follows: Bituminous bound macadam, on Spring St. to John E. Weidner, Reading, at 87 cts.; brick pavt., Orange St., Penn & O Rourke, Reading, at $2.41; asphalt on portions of Walnut, Fifth, Elm, Fourth and Eighth Sts., to Hassam Constr. Co., Worcester, Mass., at $1.54 per sq. yd.

★**Wilkinsburg, Pa.**—Contract awarded Aug. 5 for regrading, curbing and paving Wood, Ridge, Franklin and other streets and Grand Avenue to A. V. Parnell, 507 Jackson Street, Allegheny, Northside, Pittsburgh, at $28,855. Other bids on complete work: Gen. S. White & Co., Jenkins Arcade, Pittsburgh, $40,618; Hall, Harris & Co., Sayre and McClure, Pittsburgh, $42,152; Ridge Bros., Fourth Avenue, Pittsburgh, $43,330. Frease & Sperling, Boro. Engrs.

★**Concord, N. C.**—Contract for paving W. Depot St. from Spring St. to the depot and Church St. from East Corban to West Depot awarded by Bd. Aldermen to R. M. Hudson & Co. of Atlanta, at about $40,000.

★**Fort Meade, Fla.**—Contract awarded Aug. 17 by Road Trustees to Southern Clay Mfg. Co., Chattanooga, Tenn., for 50,000 sq. yd. brick paving with cement grout fill at $1.61 per sq. yd., to include granite curb and storm drainage, total cost $80,500. Totals of other bids—(a) brick paving, (b) asphalt concrete on concrete foundation, (c) rocmoc on concrete: Florida National Vault Co., Lakeland, Fla., (a) $74,115, (c) $69,175. Alabama Paving Co., Birmingham, Ala., (a) $75,907; Edwards Constr. Co., Tampa, (a) $80,000; Southern Asphalt & Constr. Co., Birmingham, Ala., (b) $76,567. Engineers, H. S. Jacobs Eng. Co., Savannah, Ga.

★**Vanceburg, Ky.**—Contract for grading and surfacing river road awarded W. T. Cooper & Co. at $25,121.

★**Greenville, Tenn.**—Contract awarded Aug. 24, Paving Improv. Dists. 2, 3, 4, 5 and 6, with asphaltic paving, to Southern Asphalt & Constr. Co., Birmingham, Ala., at following bids: 41,254 sq. yd. asphaltic concrete, 5-in. concrete base, 2-in. surface, $1.25; 233 cu. yd. 1:2:4 concrete, $5; 7,000 cu. yd. grading, 45 cts.; 25,156 lin. ft. curb and gutter, 44 cts.; 42 catchbasins, ea. $12; 1,800 lin. ft. 8-in. sewer pipe, 32 cts.; 1,400 lin. ft. 12-in. sewer pipe, 45 cts.; 700 lin. ft. 15-in. sewer pipe, 65 cts.; total $63,641. Totals of other bids on this class of paving: Brough & Thompson, $66,445; Nolf Constr. Co., Chattanooga, $66,610; Murray Constr. Co., Knoxville, $65,816. G. W. Click, City Recorder.

★**Akron, Ohio.**—Contract awarded Aug. 27 for paving with brick Kent, E. North Portage Road, to McAlonan Bros. of Akron. C. L. Bower, Clk. Co. Comrs.

★**Columbus, Ohio.**—Contracts awarded by Co. Comrs. as follows: To B. F. Patterson, Columbus, Mock Road, between Fourth Street and Cleveland Avenue, at $19,250. Macadamizing as follows: R. W. McCoy, Washington, Manhattan Road, Canton Township, at $4,135; H. E. Barthman, Canal Road, McDonald Road, Truro Township, $1,067, and extension of Grove Avenue, Truro Township, at $9,049; W. O. Jones, Washington, Karl Road, Sharon Township, $11,867.

★**Dayton, Ohio.**—Contract awarded Aug. 12 for paving Grand Avenue with brick, about 1,000 sq. yd. to Clifton Boulevard, of Dayton, at $13,924. P. O. Buhelburger, City Engr.

★**Marion, Ohio.**—Contract awarded P. Dolan & Sons for constructing ¾ mile of Marion-Bucyrus pike, on Bucyrus.

★**Contract for asphalt and paving Stiner Avenue awarded at $20,000 to Hofstetter & Thomas, Marion, at $19,000.**

★**Miamisburg, Ohio.**—Contract for paving with Cement brick Main on N. Main street awarded to Eagle Bros., Middletown, at $15,000.

★**Middletown, Ohio.**—Contract for paving with asphalt on First Street awarded Andrews Asphalt Co., Hamilton, at $15,-000 and Woodlawn Drive, Middletown, concrete pavt., on Woodlawn Avenue, at $12,000.

Newark, Ohio.—Following are bids received recently for street paving: Concrete, Engineering Service Co., Columbus, $1,128; tar bound macadam, Schilling Bros., Youngstown, $97,531, and asphalt bound macadam, $98,445.

★**Ohio.**—Contracts awarded by Clinton Cowen, State Highway Comr., Columbus, for state highway work as follows (bids opened Aug. 6):

Licking County, Section M of National Road, in Union, Harrison and Etna Townships, Contract No. 1, for grading roadway and paving, length 39,625 ft., and for constructing bridges and culverts, length 39,625 ft., of 7.5 miles, to Shilling Constr. Co., Youngstown, at $97,531; also Licking County, Section N, for grading roadway and paving 37,349 ft. and constructing bridges and culverts, length 37,349 ft., to Gist Bros. Co., Oak Park Ill., at $82,234.

★**Rawson, Ohio.**—Reported contract for paving awarded C. B. Hall, Findlay, at about $9,000.

★**Toledo, Ohio.**—Garrigan Bros., Valentine Building, secured from Co. Comrs. contract to pave with bituminous bond macadam seven miles on Mominee Road, Jerusalem and Oregon Townships, at $67,-988, and Doan & Langenderfer contract for about one mile of Marengo Street, Adams Township, and Lake Street, Washington Township, at $5,679.

★**Zanesville, Ohio.**—Contract for paving with non-bituminous slag macadam, about ten miles, on Adamsville Road, awarded by Co. Comrs. to Ayers & Kappes of Zanesville at $127,099.

★**Brownstown, Ind.**—Contract awarded for paving streets with concrete to H. E. Kattman, Brownstown, at $19,931. A. L. Lucas, Town Clk.

★**Fort Wayne, Ind.**—Co. Comrs. awarded to J. C. O'Connor & Son contract for constructing Corbin Road in Perry Township, 13,036 ft., at $12,385.

★**La Porte, Ind.**—Contract for 10,000 sq. yd. pavement awarded to Frank J. King of La Porte. L. Drew Goddard, City Engr.

★**Belding, Mich.**—Contract awarded by city to A. H. Prange, Grand Rapids, at $39,196, for paving with Metropolitan wire cut lug block on 6-in. concrete foundation, with cement curb and grout fill (bids opened Aug. 18). Next 3 lowest bids for brick paving: Good Roads Constr. Co., Chicago, Ill., $40,358; E. B. Ramsey Co., Lansing, $40,852; Hilding & Rabe, Grand Rapids, $40,922.

★**Deerfield, Mich.**—Contract awarded Aug. 19 for 12½ miles of macadam road to W. H. Knapp Co. of Monroe at $66,010. Engineers, Colman & Tyler, Kresge Building, Detroit.

★**Amboy, Ill.**—Contract for paving Plant Street awarded Henry Zolpher & Sons of Mendota at $9,389. Other bidders: Rink & Schnell, Dixon, $9,623, and Gund Graham Co., Freeport, $9,707.

★**Bloomington, Ill.**—Contract awarded by Bd. Local Improv. for paving Beecher Street and Franklin Avenue to I. D. Lain, Bloomington, at $15,715.

Chicago, Ill.—Lowest bids opened Aug. 18 by Bd. Local Improv. for 102,000 sq. yd. asphalt paving were submitted by American Asphalt Co., 133 W. Washington Street, at $1.44 to $1.78 on 11 of the jobs; R. F. Conway Co., Chicago, on eight at $1.62 to $1.94, and on two by Standard Paving Co., 29 La Salle Street, at $1.60 to $1.82.

Joliet, Ill.—Following are bids opened by Bd. Local Improv. for paving with asphaltic concrete on Raynor Ave.: Globe Constr. Co., Chicago and Kalamazoo, $1.06 per sq. yd.; total, $21,332, and R. F. Conway Co., Chicago, $1.08; total $21,821.

★**Milwaukee, Wis.**—Contract awarded Aug. 18 for 7500 sq. yd. cement concrete pavement on road from city limits to South Fond du Lac to Gunz, Gutknecht & Mussow, M. & M. Bank Building, Milwaukee.

★**Fort Dodge, Iowa.**—Contract for asphalt paving in West Fort Dodge awarded by City Comrs. to Bryant Asphalt Co., Waterloo, at $1.55 per ft.

★**Duluth, Minn.**—Contract for grading and paving Devonshire Street with reinforced concrete has been awarded to Olson & Johnson, Duluth, at $7,661; grading and paving with macadam Colorado Street, awarded to J. Johnson, Duluth, at $9,750.

★**Shakopee, Minn.**—Contract awarded Aug. 23 for work on State Road No. 13 to J. J. Mergius, Excelsior, at $11,400. A. J. Mayer, Co. Aud.

★**St. Paul, Minn.**—Contract for cement for the North Smith Street paving awarded Shakopee Lime & Cement Co., St. Paul, at $1.37 per bbl.

Lincoln, Neb.—Following are bids opened Aug. 18 by Co. Comrs. (H. E. Wells, Clk.) for paving: (a) Abel & Roberts, Lincoln; (b) Burke-Cochrane Co., Lincoln. Estimated total cost, asphaltic concrete, $40,-500; brick block, $50,000; fibre brick, $44,000; 19,802 sq. yd. paving (per sq. yd.):

	(a)	(b)
Vitr. repressed brick blk.	$2.20	$2.19
Vertical fiber brick blk.	1.90	1.89
Asphaltic concrete	1.72	1.71
Concrete curb, 6x20, per lin. ft.	0.55	0.55
Concrete combined curb and gutter, 12-in. flat	0.28	0.28
Extra grading, per cu. yd.	0.40	0.37
Extra concrete, per cu. yd.	7.00	7.00

★**Missoula, Mont.** — Contract awarded Aug. 25 for standard bitulithic paving in Special Improv. Dist. No. 36 to J. C. Maguire, Butte, at $2.37 per sq. yd.; total $13,399. S. Birch & Sons of Great Falls bid for the work $2.45 per sq. yd.; total $14,285. T. S. Hathaway, City Engr.

★**Weston, Mo.**—Contract awarded to Maley & Kelly, Kansas City, for paving Main Street with macadam at $1.15 per sq. yd. for new work and 90 cts. per sq. yd. for surfacing. Terrence Riley, City Clk.

★**Dallas, Tex.**—Contract for paving Fitzhugh Ave. from Grand to East Side awarded Vibrolithic Co. at about $20,000.

★**Vernon, Tex.**—Contract for paving four blocks on Main Street with reinforced concrete macadam awarded Taylor Bldg. Co., Fort Worth, $14,800.

Auburn, Wash.—Following are four bids opened Aug. 18 by City Council for paving with 5-in. concrete base and 1½-in. asphalt top on portions of several streets, in all about 14,660 sq. yd.: Washington Paving Co., Savage Scofield Building, Tacoma, $23,324; Olympic Paving Co., Tacoma, $24,777; Independence Asphalt Co., North Bank Building, Seattle, $26,402, and Western Paving Co., Tacoma, $28,366.

Cheney, Wash. — Following are bids opened recently by W. L. Morgan, City Engr., for paving several streets—(a) pit run gravel, (b) crushed rock: Mitchell Bros. & Payne, Spokane, (a and b) $37,001; Two Miracle Concrete Corporation, Great Falls, Mont., (a) $39,069, (b) $41,230; Carlson Chindahl Co., Spokane, (a) $41,622, (b) $41,931; Langan & Erickson, Spokane, (a) $43,112, (b) $43,853; Brown & Jones, Cheney, (a) $41,081; A. H. Zane, Ritzville, (a) $42,638.

Everett, Wash.—Lowest bid recently received by city for paving Rucker Avenue submitted by Bancroft & Morgan of Everett at $27,328 for a 28-ft. concrete roadway, or $28,921 for a 30-ft. roadway.

★**North Yakima, Wash.** — Contract awarded by County Comrs. for grading and graveling 6½ miles of road in Selah District to Thomas Dingle of North Yakima at $12,703 (bids opened Aug. 23).

★**Port Angeles, Wash.**—Contract awarded by Co. Comrs. to Allie & Charles H. Miller of Port Angeles for constructing a permanent highway No. 3B at $10,773.

★**Seattle, Wash.**—Contracts awarded by Bd. Pub. Wks. as follows: Filling, bulkheading and planking Alki Avenue, from Rhode Island Street to Illinois Street, Puget Sound Bridge & Dredging Co., $93,-250; asphalt pavement on Fifth Avenue North and other streets, P. J. McHugh Paving & Constr. Co., Third Avenue North, $15,538; also Sixteenth Avenue and other streets, $13,572; asphalt, Valley and other streets, F. McLellan, Globe Building, $29,680.

Following are bids opened Aug. 20 by Bd. Pub. Wks. for paving: Rainier Avenue—T. Ryan & Co., Lowman Building, $39,390; B. H. Tetley, 1419 Thirty-seventh Avenue, $41,884; Washington Paving Co., Savage Scofield Building, $41,089; G. Argenyieri & Co., 989 Rainier Avenue, $40,156. Utah Avenue—P. J. McHugh, Third N. and Mercer Streets, $85,113; Krogh & Jessen, 4011 Greenwood Avenue, $86,729; Cascade Constr. Co., Central Building, $85,729; T. Ryan & Co., Lowman Building, $86,290.

★**Waterville, Wash.**—Following are bids opened by Co. Comrs. for constructing Permanent Highway No. 3: Cascade Constr. Co., North Yakima, $18,460 (awarded contract); Mohr Constr. Co., Waterville, $18,500; Bailey & O'Connor, Wenatchee, $20,250. Robert F. Foster, Co. Engr.

★**Portland, Ore.**—Contract for resurfacing with bitulithic on Washington Street awarded Oskar Huber, Electric Building, at $1.10 per sq. yd.; total $10,636.

Portland, Ore.—Lowest bid recently opened by city for street paving reported submitted by Oregon Independent Paving Co., Journal Building, as follows: Portions of E. Thirteenth Street and Bybee Avenue, asphaltic concrete, bituminous or crushed rock base, $1.10 per sq. yd., or asphaltic concrete, $1.35 per sq. yd.; total cost about $24,000; also for E. Thirty-ninth Street and E. Kelly Street, asphaltic concrete, bituminous base, $1.10 per sq. yd.; concrete, $1.20; asphaltic concrete, $1.35; crushed rock base, asphalt concrete, $1.10; concrete pav., $1.20; total cost about $14,000.

★**California.**—Following awards of State highway contracts have been approved by Advisory Board of State Dept. of Engineering, Sacramento:

Tulare County (between westerly boundary and Southern Pacific R.R.), Div. 7, Route 10, Section A, to White & Gaskill, Long Beach, at $14,812.

Tulare County (between Goshen and Visalia), Div. 6, Routes 4 and 10, Sections D and B, to White & Gaskill, Long Beach, at $30,378.

Colusa County (through Arbuckle), Div. 3, Route 7, Section A, to Clark & Henery Constr. Co., Ochsner Building, Sacramento, at $5,579.

Marin County (between Burdell and St. Vincent), Div. 4, Route 1, Section A, to R. B. Markle, Jr., Hearst Building, San Francisco, at $21,255.

Monterey County (between Greenfield and Camphora), Div. 5, Route 2, Section D, to Highway Paving & Constr. Co., 26 Montgomery Street, San Francisco, at $54,507.

San Luis Obispo County (between Atascadero Creek and Paso Robles), Div. 5, Route 2, Section B, to John D. Marsh, P. O. Box 211, Bakersfield, at $67,809.

Santa Barbara County (between Gaviota and Zaca Station), Div. 5, Route 2, Section D, to C. H. Hudson, 509 Trust & Savings Building, Los Angeles, at $62,162.

★**Livermore, Cal.**—Contract reported awarded California Bitulithic Co. for paving 24-ft. strip on East First Street, at $14,226.

★**Los Angeles, Cal.**—Contract awarded to W. A. Farish & Co., 353 S. Hill Street, for macadamizing curbs, walks, reinforced concrete culverts and sanitary sewer in McKinley Avenue at $24,821.

★**San Mateo, Cal.**—City Trus. awarded contracts as follows: To Ransome-Crummery Co., Oakland, for street work in San Mateo Park at $70,850 and to Federal Constr. Co., San Francisco, for similar work in central part of town at $77,800.

★**Ottawa, Ont.**—Contract awarded Aug. 24 for paving with asphalt Preston Street to Ottawa Const. Co., Central Chambers, Ottawa, at $103,000.

STREET CLEANING AND GARBAGE DISPOSAL

BIDS DESIRED.

Toronto, Ont.—Reported desired until Sept. 7 by Street Commissioner, for constructing a brick chimney at incinerating plant.

PRICES AND LETTINGS.

★*Indicates awarded contract.*

★**East Chicago, Ind.**—Contract for constructing garbage disposal plant reported awarded to Chas. F. Walthers of Cincinnati, Ohio, at $12,000.

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS

PROPOSED WORK

Water Development, Etc.—Bethel, Vt.—Arrangements reported completed for consolidation of Gaysville Electric Light & Power Co. of Bethel, and the Hortonia Power Co., with headquarters in Rutland. Plans provide for expenditure of about $500,000 for rebuilding plants already in operation and in developing water privileges already secured. A transmission line will be erected from plant of Hortonia Co. at Brandon over Rochester Mountain to Gaysville, a distance of 28 miles.

Port Improvements—New York, N. Y.—Bd. of Estimate appointed a Port and Terminal Facilities Comn. including Prof. George F. Swain of Harvard University, to investigate question of harbor development, exclusive of the West Side and Brooklyn improvements.

Pumping Plant—Iowa, La.—Plant of the Missouri Canal Co. (H. C. Drew, Pres., Lake Charles, La.), 4 miles north of Iowa, reported destroyed by fire; cost of plant reported at $25,000.

Flood Prevention — Muncie, Ind. — City reported considering plans for improving White River about 4 miles for prevention of floods.

Drain—Adrian, Mich. — County will spend about $85,000 this year to drain lowland in eastern section of county.

Drainage—Des Moines, Iowa.—Harmon Eng. Co., Peoria, Ill., reported selected by County Supervisors to make preliminary survey of reclamation project, by which it is expected to reclaim 23,000 acres of land along Skunk River in Polk, Story and Jasper Counties.

Dam and Power Plant, etc.—St. Cloud, Minn.—The Public Service Co. of St. Cloud (A. G. Whitney, Pres.), has been bonded for $4,000,000 and it is reported that company contemplates construction of power house at east end of present dam with a capacity of 4000 hp.; estimated cost $200,000, building a dam and power house at Sauk Rapids, with capacity of 7500 hp.; estimated cost $500,-000 and extension of transmission lines into all parts of surrounding territory within 60 miles, extension of present system of gas mains to East St. Cloud and Sauk Rapids and extension of street car lines as required. Extension to transmission lines is already under way.

Flood Prevention—St. Louis, Mo.—Preliminary organization reported formed by manufacturers and business men for improvement of River des Peres to prevent overflow in the future; it will also cooperate in a plan of Mayor Kielt to have passed a $4,000,000 bond issue to safeguard banks of River des Peres. D. R. Hatton, Vice-President and General Manager of Laclede Christy Clay Product Co. temporary President.

Harbor and Terminal Improvement—St. Paul, Minn.—Local press reports state that Council is about to start work on new plans for harbor and terminal improvements, and Union Depot Co. is said to be awaiting action of Council to begin its preparation of new drawings.

Water Power Development—Everett, Wash.—See "Water Works."

Drainage—North Yakima, Wash.—L. O. Meigs, City Attorney, instructed by City Council to draw up a resolution for a special election to vote on issuing $80,000 bonds for construction of West Side Drainage Dist.

Bulkheading, Etc.—Seattle, Wash.—County Commissioners reported to have adopted resolution appropriating $175,000 for bulkheading and filling East Marginal Way.

Hydroelectric Plant — South Bend, Wash.—Reported that Willapa Electric Co. of Raymond will begin work soon on construction of first unit of hydroelectric power plant on South Fork.

Power Plant—Los Angels, Cal.—It is reported that surveys and construction work on the Los Angeles Long Valley Power Co. project will soon begin. Budget committee of Council has tentatively agreed to allow about $60,000 the coming year for this work.

Irrigation.—Boise, Idaho.—Utah Construction Co., Ogden, Utah, purchaser of Big Lost River Irrigation Project, purposes to expend a total of $1,650,000 on reclamation of project, providing State approves its plans, and new contract to deliver two acre feet of water to settlers. Company proposes to rebuild Mackay dam, with gate towers and spillway, etc.

Dam and Power Plant—Lewiston, Idaho.—Commercial Club (Robert S. Erb, Pres.) reported discussing proposition to construct municipal dam and power plant on either Snake or Clearwater River.

Esplanade—Sandwich, Ont.—Dr. A. S. Soper has submitted to Town Council an offer to construct an esplanade for one third of a mile along Canadian bank of Detroit River.

BIDS DESIRED.

State Canal Work—Albany, N. Y.—Until Sept. 9 by State Dept. Pub. Wks. (W. W. Wotherspoon, Supt.) for improvement of Three Mile Harbor in Suffolk County, Engineer's estimate $8,500, and dredging Sawyer Creek at North Tonawanda, Engineer's estimate $8,600. Also for furnishing and delivering along line of canal about 2000 M ft. timber and plank, consisting of white oak, white pine, Georgia pine, hemlock and spruce.

Terminal Contracts—Albany, N. Y.—Until Sept. 28 by W. W. Wotherspoon, State Supt. Pub. Wks., Albany, for constructing Terminal Contracts 47 and 49, advertised in Engineering Record.

Jetties—Rockaway Beach, L. I., N. Y.—Until Sept. 9 by Dept. of Parks, borough of Manhattan (Cabot Ward, Pres.), for furnishing material and constructing timber jetties and bulkhead and extending existing jetties to New Penetration on beach at Seaside Park, Rockaway, borough of Queens; security $4,000.

Pier—Jersey City, N. J.—Until Sept. 8, according to press reports, by Penn R.R. Co. (A. C. Shand, Ch. Engr., Philadelphia, Pa.) for constructing 200 x 1000 ft. pier in Greenville, to consist of 150,000 cu. yd. dredging and filling, 65,000 cu. yd. concrete masonry, piles, riprap, etc. William H. Cookman, Archt., Broad Street Station, Philadelphia.

Drainage—Anderson, S. C.—Until Sept. 6 by Bd. Drainage Comrs., Rocky River Drainage Dist. No. 1 (Z. C. Ballentine, Chmn.) at office of Bonham, Watkins & Allen, Beckley Building, for 231,000 cu. yd. excav. and approximately 10 miles ditching.

Retaining Wall — Miamisburg, Ohio.—Until Sept. 11 by Charles H. Pansing, Village Clk., for furnishing material and constructing a piling, retaining and protection wall East Water front of Great Miami River.

Chicago, Ill.—Until Sept. 13 by Bd. Local Improv. (Edw. J. Glackin, Secy.) for constructing brick and tile pipe sewers, together with manholes, catchbasins and concrete bulkhead on portions of West Adams, S. Leavitt Streets, N. Harding, Mora Avenues and other streets.

Drainage—Muscatine, Iowa.—Until Sept. 24 by Central States Engineering Co., Room 402, Hershey Bldg., Muscatine, for constructing three contract sections of drains, located in and about sections 13, 14, 23, 24 and 26, T. 15 N, R, 6 W, Mercer County, Ill., having an aggregate length of about 47 miles, size of tile 6 to 22 in.

South Bend, Wash.—Bonds for $60,000 Diking Dist. No. 2 will be sold Sept. 11 by Bd. Diking Comrs., No. 2 (Sarah Trask, Chmn.).

Storage Dam—Quebec, Que.—Until Sept. 7 by O. Lefebvre, Ch. Engr., Quebec, Streams Comn., Parliament Buildings, Quebec, for storage dam at outlet of Lake St. Francis.

Bulkhead Shed—San Juan, P. R.—Until Oct. 1 by Harbor Bd. (Manuel V. Domenech, Chmn.) for constructing a bulkhead shed at San Juan, advertised in Engineering Record.

PRICES AND LETTINGS.

★*Indicates awarded contract.*

Shore Protection—Boston, Mass.—Following are bids opened Aug. 31 by Metropolitan Park Comn. for building concrete shore protection at Revere Beach: Coleman Bros., Chelsea, $19,853; Middlesex Contr. Co., Boston, $19,970; J. H. Fannon, Somerville, $20,290.

★**Hickory, N. C.**—Contract reported awarded to Elliott Bldg. Co. of Hickory for building dam for Morgantown Light & Power Co., across Catawaba River near Nebo, at $110,000.

★**Bulkhead—Charleston, S. C.**—Contract awarded by Lighthouse Inspector for constructing timber bulkhead on Ashley River to Charleston Eng. & Contr. Co., of Charleston, at $8,745 (bids opened Aug. 10).

★**Breakwater — Chicago, Ill.**—Contract reported awarded to Great Lakes Dredge & Dock Co., Chicago, for constructing rubble mound breakwater at Chicago Harbor at $480,000.

★**Drainage—Jefferson, Iowa.**—Contract reported awarded by Co. Comrs. for drainage of Dist. 101, as follows: The Jefferson Cement Product Co., Jefferson, for tile $58,555; open ditch to R. J. Phelps, Davenport, Iowa, at 11.74 cts. per cu. yd.

★**Irrigation—Fort Shaw, Mont.**—Contracts awarded by U. S. Reclamation Service (Charles P. Williams, Project Mgr., Fort Shaw) for first unit of laterals of Green Fields Distribution System, Sun River Project, Mont., as follows: Schedules 1 to 5 inclusive to J. E. Hilton, Billings; Schedules 6 to 9 inclusive to Hans Pederson and West Constr. Co., Seattle, Wash.; Schedule 10, Threet Bros. & Jolley, Lovell, Wyo.

★**Dredging — Bremerton, Wash.**—Contract for dredging at navy yard, Puget Sound (bids opened Aug. 14) has been awarded to Erickson Constr. Co., Seattle, Wash., at 60 cts. per cu. yd.

Reclamation Work—St. Ignatius, Mont.—Following are the unit prices of J. E. Hilton of Billings, lowest bid opened Aug. 18 at office of U. S. Reclamation Service, for constructing laterals, sub-laterals and appurtenant structures on Flathead Project:

25,700 cu. yd. excav., Class 1...	$0.15
250 cu. yd. excav., Class 2...	0.30
50 cu. yd. excav., Class 3...	1.50
1,000 sq. yd. overhaul...	...
Total Schedule 1...	$4,025.00
2,000 cu. yd. excav., Class 1...	$0.35
100 cu. yd. excav., Class 2...	0.60
5 cu. yd. excav., Class 3...	1.50
140 cu. yd. concrete in struc.	15.90
8,400 lb. placing reinforc. steel.	0.02
1,800 cu. yd. backfilling...	0.25
600 cu. yd. puddling...	0.40
290 sq. yd. grouted paving...	1.86
120 sq. yd. dry paving...	1.10
74 lin. ft. mfg. and lay. 12-in. concrete pipe...	0.85
44 lin. ft. mfg. and lay. 30-in. concrete pipe...	3.61
160 sq. yd. rubble conc. pav..	3.00
21 M ft. erecting lumber in structures...	28.00
Total Schedule 2...	$5,812.64
5,500 cu. yd. excav., Class 1...	$0.35
300 cu. yd. excav., Class 2...	0.60
5 cu. yd. excav., Class 3...	1.50
420 cu. yd. concrete in struc.	15.90
25,100 lb. placing reinforc. steel.	0.02
210 lb. erecting struct'l steel.	0.045
5,000 cu. yd. backfilling...	0.25
1,200 cu. yd. puddling...	0.40
840 sq. yd. grouted paving...	1.86
620 sq. yd. dry paving...	1.10
212 lin. ft. mfg. and lay. 12-in. concrete pipe...	0.85
354 lin. ft. mfg. and lay. 18-in. concrete pipe...	1.33
310 lin. ft. mfg. and lay. 24-in. concrete pipe...	1.80
1,500 sq. yd. rubble conc. pav..	3.00
53 M ft. erecting lumber in structures...	27.00
Total Schedule 3...	$20,416.37
Total of bid...	$30,254.01

ELECTRIC RAILWAYS

PROPOSED WORK

Augusta, Me.—Boise Valley Traction Co., Augusta, incorporated to construct and operate a railway by steam, electric or other motive power. E. L. McLean of Augusta, Clk.

North Andover, Mass.—Bay State Street Ry., R. S. Goff, Vice-Pres. and Gen. Mgr., Boston, received franchise from Council to extend double tracks on Sutton St.

Westborough, Mass.—Worcester Consolidated St. Ry., M. C. Page, Gen. Mgr., Worcester, applied to Council for franchise to relocate tracks on Main St.

Salem, N. J.—The Salem-Pennsgrove Ry., Salem, incorporated for the purpose of constructing an electric railway from Salem to Pennsville and Pennsgrove. Isaac S. Smashey of Salem, is one of the incorporators.

West Point, Va.—Surveys being made for proposed line Richmond, Rappahannock & Northern Ry., Richmond, to be constructed between West Point and Urbana, 17 miles. James Mullin, Secy.

Parkersburg, W. Va.—The Kanawha Traction & Electric Co., M. G. Ambler, Secy., Parkersburg, applied to Council for permission to lay double tracks on Muddock Ave.

Jasper, Ala.—L. B. Musgrove, Jasper, reported interested in constructing an interurban line from Jasper to Birmingham via Ensley.

Lorain, O.—Plans being considered by Lake Shore Electric Ry., Cleveland (L. K. Burge, Gen. Supt., Sandusky) for double tracking line on West Erie Avenue between Ashland Avenue and city limits.

Tulsa, Okla.—Oklahoma & Interstate Ry. Co., Oklahoma City, incorporated to construct a line connecting Tulsa, Miami, Collinsville, Joplin and other points. Incorporators: John R. Rose, J. R. Eldridge, and others, all of Oklahoma City.

Chehalis, Wash.—State Highway Comn. granted to Washington Electric Co., Olympia, right of way, 15 miles southeast of Chehalis in Lewis County.

Ceres, Cal.—Tidewater Southern Ry., J. H. Wallace, Ch. Engr., Stockton, has asked Council for franchise to extend its tracks through Ceres.

Glendale, Cal.—Pacific Electric Ry. (Geo. E. Pillsbury, Ch. Engr., Los Angeles) intends constructing a line from Glendale to Tropico, a distance of 2½ miles.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**New York, N. Y.**—Public Service Cmn., 154 Nassau Street, has awarded contracts for track materials to be used upon various lines of the Dual Rapid Transit System as follows: Untreated ties and timber, J. H. Burton & Co., 45 Broadway, $1,273,857; treated ties and timber, Long Leaf Pine Co., Inc., 80 W. Fortieth Street, $100,362; special work, Order No. 3, Ramapo Iron Works, 30 Church Street, $54,960; special work, Order No. 4, Wm. Wharton, Jr., & Co., 30 Church Street, $41,907; cast iron, American Brake Shoe & Fdry. Co., 30 Church Street, $10,528; screw spikes, American Iron & Steel Mfg Co., Whitehall Building, $25,741; felt pads, Q & C Co., 90 West Street, $9,957; malleable iron, Foran Foundry & Mfg. Co., 122 Liberty Street, $36,118; tie plates, Types A, D, E, F, G and H, to Herbert W. Lockwood, 260 West Street, at $149,353; Types B and C, to L. D. Rockwell, 2 Rector Street, $13,267 and $5,140 respectively; Types E-2, W and X, Ramapo Iron Works, $2,901; cut track spikes, Herbert W. Lockwood, $34,338; bolts and nuts, Oliver Iron & Steel Co., $117,910.

RAILROADS

PROPOSED WORK

Charleston, S. C.—Charleston Southern Ry. Co. reported formed to build and operate railway in Charleston, Colleton, Jasper and Beaufort Counties, from Charleston to Savannah, about 85 miles in length. Incorporators include George, E. Dargan, Bright Williamson and James E. Evans.

Detroit, Mich.—Local press reports state that the Pennsylvania R.R. Co. has decided to enter city of Detroit; the plans are said to call for an expenditure of $20,000,000. W. W. Atterbury, Vice-Pres., Philadelphia, Pa., will have charge of the work.

PRICES AND LETTINGS.

★*Indicates awarded contract.*

★**Chicago, Ill.**—Contract awarded to Raymond Concrete Pile Co., New York and Chicago, for placing concrete piling for abutments and piers at Eightieth Street and Eighty-first Street Subways for Chicago & Western Indiana R.R. Co. E. H. Lee, Chief Engr.

PUBLIC BUILDINGS AND SCHOOLS

PROPOSED WORK

Holyoke, Mass.—Plans prepared by W. J. Howes, 243 High Street, for brick and steel hospital, 2 stories, 37 x 100 ft.; also boiler house and laundry, 25 x 75 ft.

Springfield, Mass.—Bond issue for $30,000 authorized by Bd. Aldermen for securing site for addition to Howard Street School; also voted to have plans prepared for said addition.

Providence, R. I.—State Bd. Control and Supply (Gilbert R. Parker, Secy.), State House, Providence, it is reported, will soon make improvements to State Institutions, including new hospital for tuberculosis. Amount available $458.000. Walter F. Fontaine, Archt., Woonsocket.

Brooklyn, N. Y.—Plans prepared by McKim, Mead & White, New York, for lecture hall and extensions to Horticultural Hall at Brooklyn Botanic Gardens. Cost $150,000.

Rensselaer, N. Y.—Bd. Educ. recommended erecting building to replace School No. 1 at cost of $100,000.

Paterson, N. J.—Bd. Educ. engaged Frederick W. Wentworth, Citizens Trust Co. Bldg., to prepare plans for new school to replace No. 10 at Riverside; cost approximately $175,000.

Johnstown, Pa. — Preliminary steps being taken by School Directors for erecting three schools, one in Eighth Ward, one in Walnut Grove and an administration building on Adams Street.

Philadelphia, Pa.—Revised plans being prepared by Edw. F. Durang & Son. 102 S. Twelfth Street, for 6-story stone and brick hospital to be erected at Fifty-fourth Street and Cedar Avenue for Misericordia Hospital (Sisters of Mercy).

Washington, D. C.—Contract soon to be let by Commissioners D. C. for erecting No. 1 truck house, New Jersey Avenue, near E Street, and No. 28 engine house, Connecticut Avenue and Ordway Street. Snowden Ashford, Municipal Archt.

Selma, N. C.—Bonds for $40,000 will be sold Sept. 30 by T. M. Benoy, Chmn. Bd. Trus. Selma Graded School.

Cartersville, Ga.—See "Water Works."

Macon, Ga.—Alexander F. Blair, Macon, and Edward F. Stevens, Boston, associated, selected by Hospital Comn. to prepare plans for extension and improvement to City Hospital.

Batavia, Ohio.—Robertson & Fahenstock, Cincinnati, engaged to prepare plans for high school, six rooms and auditorium. Estimated cost, $30,000.

★**State Canal Work—Albany, N. Y.**—Following are unit prices of lowest bids opened Aug. 17 by W. W. Wotherspoon, State Supt. Pub. Wks., Albany, for Terminal Contr. No. 37, constructing harbor and dockwall on south side of Mohawk River, near outlet of Canajoharie Creek at Canajoharie: (a) Engineer's estimate, $33,832; (b) Holler & Shepard, Rochester, $32,272 (awarded contract); (c) Lupfer & Remick, Buffalo, $32,940; (d) A. M. Hazell, Inc., New York, $35,994.

	(a)	*(b)	(c)	(d)
24,000 cu. yd. excav...	$0.40	$0.38	$0.30	$0.48
900 cu. yd. embankment...	0.12	0.12	0.12	0.20
4.2 M ft. creosoted lumber...	65.00	65.00	75.00	100.00
1,300 lin. ft. foundation piles...	0.25	0.25	0.30	0.30
5,300 lin. ft. reinforced concrete sheet piles...	2.40	2.30	2.47	2.50
250 cu. yd. first-class reinforced concrete...	13.00	12.00	13.00	11.00
110 cu. yd. second-class reinforced concrete...	9.00	8.00	10.00	8.00
2,400 sq. yd. concrete slab pavement...	1.50	1.50	1.80	1.50
300 cu. yd. third-class riprap...	2.50	2.50	2.50	3.00
21,000 lb. structural steel...	0.04	0.04	0.045	0.04
19,000 lb. metal reinforcement...	0.035	0.025	0.04	0.035
2,700 lb. iron castings—plain...	0.04	0.04	0.04	0.04
420 lin ft. malleable cast-iron nosing...	1.25	1.25	1.25	1.00
65 fender castings, ea...	1.20	1.20	1.20	1.10

★**Canal Terminal—Albany, N. Y.**—Following are unit prices of lowest bids opened Aug. 17 by W. W. Wotherspoon, State Supt. Pub. Wks., for Terminal Contr. No. 46, constructing dockwall and approach on south side of Seneca River, west of Weedsport Bridge: (a) Engineer's estimate, $16,331; (b) Scott Bros., Rome, $13,658 (awarded contract); (c) Chesley, Earl & Heimbach, Inc., Buffalo, $14,695; (d) Robert Provo, Syracuse, $14,887.

	(a)	*(b)	(c)	(d)
3,100 cu. yd. excav...	$0.50	$0.50	$0.48	$0.40
40 M ft. sawed lumber...	50.00	45.00	45.00	50.00
18,900 lin. ft. foundation piles...	0.50	0.38	0.44	0.44
21 M ft. wooden sheet piling...	50.00	45.00	45.00	50.00
200 cu. yd. second-class concrete...	8.00	7.50	8.00	8.00
135 cu. yd. third-class riprap...	3.00	3.00	2.00	3.00
1,200 lb. iron castings—plain...	0.04	0.04	0.04	0.04
160 lin. ft. malleable cast-iron nosing...	1.25	1.25	1.25	1.25
28 fender fastenings, ea...	1.00	1.00	1.00	1.00

Akron, Ohio.—Plans filed for 2-story and basement nurses' home for People's Hospital. Cost about $50,000. George J. Ball, Archt., Crosier Street.

Cleveland, Ohio.—Contract will soon be let by Ohio Bd. of Administration, Columbus, for a laundry building for Newburg State Hospital, from plans of Marriott, Allen & Hall, 20 E. Broad St., Columbus.

Dayton, Ohio.—See "Paving and Roads."

Youngstown, Ohio.—Bd. Educ. contemplates erecting two grade schools.

Zanesville, Ohio.—Plans approved by State Armory Bd., Columbus, for 2 and 3-story, 65 x 93 ft., armory for Co. A and the Seventh Regt. Band. Cost $30,000.

Columbus, Ind.—Proposed to erect three of four fireproof buildings, probably brick, for new county hospital, cost $[illegible]. Address C. M. Keller, Secy. Hospital Bldg Comm.

St. Joseph, Mich.—Citizens voted $100,000 bonds for erecting high school.

Kalamazoo, Mich.—Sisters of St. Joseph rejected all bids opened for erecting hospital on River Road, being considered too high.

Manistique, Mich.—Plans being prepared by Robinson & Campau, Grand Rapids, for high school; cost reported to be about $100,000. F. W. Cluno, Supt. of Schools.

Peoria, Ill.—At the Sept. meeting of Bd. of County Supervisors some action will probably be taken looking to construction of a county jail.

Milwaukee, Wis.—Washington General Hospital Assoc. incorporated to erect 3-story hospital near Washington Park. Incorporators: Dr. E. W. Timm, 803 Hollis Street; Dr. F. W. Hilger, 2614 Vliet Street, and others.

Superior, Wis.—Steps being taken to erect 3-story training school building at Superior Normal School. Appropriation $[illegible]. Address State Bd. Regents, Madison.

Superior, Wis. — City Commissioners taking steps to erect municipal auditorium. Probable cost, $75,000.

Westfield, Wis.—Reported all bids for erecting court house rejected, being considered too high; new bids will be asked.

Jefferson, Ia.—B. S. McCully, Co. Aud., writes contract will probably be let in October for erecting court house from plans of Proudfoot, Bird & Rawson, Des Moines. It will be of stone 80 x 115 ft. and cost $130,000 with $20,000 additional for equipment.

St. Cloud, Minn.—Citizens voted $75,000 bonds for new high school and $25,000 for repair of Union School.

Fulton, Mo.—Citizens Aug. 19 voted $50,000 bonds for erecting high school, and will soon offer bonds for sale. Address, J. W. McIntire, Secy. Bd. Educ.

Jennings, Mo.—Plans prepared by Barnett, Haynes & Barnett, St. Louis, for scholasticate for Jesuit Province of Missouri (Rev. Alex. J. Burrowes, Provincial), to be 3 to 4 stories and contain 300 rooms; cost $[illegible].

Redwood City, Cal.—Bonds for $25,000 for improvements in Hillsborough School Dist sold by Bd. Supervisors.

Visalia, Cal.—City Trustees considering plans for municipal auditorium. Cost, $[illegible].

Bonds for $115,000 have been sold, proceeds to be used for construction of Municipal Auditorium and extensions to system.

BIDS DESIRED.

Boston, Mass.—Until Oct. 8 by James A. Watmore, Acting Supervising Archt., Washington, D. C., for construction (except mechanical equipment) and approaches of 4-story and basement stone and brick-faced fireproof building, 185x[illegible] sq. ft. ground area, also retaining wall for U. S. Appraisers' stores building, Boston.

Until Sept. 15 by Trus. Boston, City Hospital (John J. Dowling, M.D., Supt.), for erecting addition and alterations to superintendent's house, nurses' home, whooping cough pavilion, men's dormitory, scarlet fever pavilion, domestic building and diphtheria pavilion, all at West Dept. of City Hospital, Spring Street. Wells & Dana, Archts., 29 Central Street.

Atlantic City, N. J.—Reported desired until Sept. 5 by H. S. Young, Secy. Bd. Educ., for erection of [illegible], 90 x 114 ft. addition to school. Probable cost $150,000.

Elizabeth, N. J.—Until Sept. 30 by Bd. of Educ. for erection of 2 schools, one at Magie Avenue and Springfield Road, the other at Madison Ave., advertised in Engineering Record. Architect, C. Godfrey Poggi, Julian Place.

Jersey City, N. J.—Until Sept. 9 by County Bd. Chosen Freeholders (W. O'Mara, Clk.) for erecting County Jail, including ventilating, heating, mechanical equipment and electrical work. John T. Rowland, Jr., Archt., 100 Sip Avenue.

Toms River, N. J.—Until Sept. 16 by Bd. Chosen Freeholders (James E. Otis, Dir.) for enlargement and repair of court house, advertised in Engineering Record. J. C. & G. A. Delatush, Archts., 70 Broad Street, Red Bank.

Philadelphia, Pa.—Until Sept. 10 by Com. on Property, Bd. Pub. Educ. (William Dick, Secy.), for erecting addition to McIntyre School, Thirtieth and Gordon Streets; also installing lighting fixtures, erecting stone wall, grading, etc., at various schools.

Bluefield, W. Va.—Until Sept. 7 by Bd. Educ. for erecting grade school in South Bluefield. C. R. Murray, Supt. Schools, Bluefield. Pedigo & Garry, Archts., Kelley & Moyer Building.

Columbia, S. C.—Reported desired until Sept. 8 by A. C. Moore, Chmn. School Comrs., for erecting high school. Urquhart & Johnson, Archts., Palmetto Building.

Atlanta, Ga.—Until Sept. 20 by F. H. Duehay, Supt. of Prisons, Washington, D. C., for furnishing and delivering at U. S. Penitentiary, Atlanta, reinforcing material, structural and miscellaneous steel, iron and brass work for west main cell wing.

Bardwell, Ky.—Until Sept. 20 by Co. Bldg. Comrs. (R. O. Willingham, Jr., Secy.) for erecting a jail.

Lima, Ohio.—Until Sept. 25 by Martin J. Burke, care Dr. Charles H. Clark, Supt. Lima State Hospital, Lima, for erecting superintendent's residence, cow barn and piggery. Frank L. Packard, Archt., New Hayden Building, Columbus.

Marblehead, Ohio.—Until Sept. 21 at office of Treas. Dept., U. S. Coast Guard, Washington, D. C., for construction of boat house, crews' quarters, launchway, etc., at Marblehead, advertised in Engineering Record.

Steubenville, Ohio. — Reported desired until Sept. 16 by Bd. Educ. for 3-story, 48 x 165 ft. addition to Wells High School. Petersen & Clarke, Archts., Steubenville.

Dayton, Ind.—Reported desired until Sept. 16 by W. H. Warren, School Trus., for erecting 2-story and basement high and grade school. J. F. Alexander & Son, Archts., 105 N. Fourth Street, Lafayette.

Owensburgh, Ind.—Reported desired until Sept. 10 by School Trus. Jackson Township (W. H. Radcliff, Trus.) for erecting a grade and high school.

Winchester, Ind.—Reported desired until Sept. 10 by School Trus. for erecting a 2-story and basement brick school.

Belvidere, Ill.—Reported desired until Sept. 9 by Bd. Educ. for erecting high school. Fullenwider & Dowling, Archts., N. Michigan Boulevard, Chicago.

Glenwood, Iowa.—Until Sept. 14 by State Bd. Control, Des Moines (F. S. Troat, Secy.) for erecting a 2-story and basement brick addition to main building at Institute for feeble-minded children at Glenwood. H. F. Liebbe, State Archt., Des Moines.

Iowa City, Iowa.—Until Sept. 14 by W. H. Gammill, Secy. Bd. Educ., Des Moines, for erecting dentistry building for State University of Iowa, Iowa City. Proudfoot, Bird & Rawson, Archts., Hubbell Building, Des Moines.

Luana, Iowa.—Reported desired until Sept. 8 (extension of date from Aug. 28) by Henry Palar, Pres. Consolidated Independent School Dist. for erecting a consolidated school; also for heating, plumbing, etc., in same. Alban & Lockhart, Archts., 347 Endicott Building, St. Paul, Minn.

Dunbar, Neb.—Reported desired until Sept. 9 by Bd. Educ. for erecting 2-story and basement school. Probable cost $25,000. L. D. Willis, Archt., 1119 City Natl. Bank Building, Omaha.

St. Louis, Mo.—Until Sept. 10 by Bd. Pub. Service (Charles E. Swingley, Secy. Pro. Tem.) for erecting a zoological building at Forest Park.

Grand Mound, Wash.—Until Sept. 11 (extension of date from Aug. 31), by State Bd. Control, Olympia (E. S. Emigh, Secy.), for constructing an administration building at State School for Girls at Grand Mound. Cost $50,000.

Metcalf, Ariz.—Reported desired until Sept. 9 by Trus. School Dist. No. 19 (W. H. Scott, Pres.) for erecting 8-room grade school. Duncan McNeil, Archt., Clifton.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Beverly, Mass.**—Contract for erecting branch public library at Beverly Farms awarded C. S. Cunningham Sons Co. of Boston at $22,974.

★**Boston, Mass.**—Executive Council has voted in favor of Vermont marble for the westerly wing of the State House and the Governor has concurred in the decision and signed a contract with William Crane, Boston, at $204,750 for erecting said wing. (Bids opened July 27.)

★**Rochester, N. Y.**—Contract awarded Gordon & Swan Constr. Co., 474 Exchange Place, for erecting foundry and boiler house, 44 x 142 ft., for St. Mary Hospital, on West Main Street. Cost $40,000. F. L. Heughes Co., 190 South Avenue, has contract for steel work.

White Plains, N. Y.—Lowest bid reported opened Aug. 31 by Westchester County Bldg. Comm. for erecting the new court house was submitted by Wells Bros. Co. of New York, 366 Fifth Avenue, at $543,000 for Indiana limestone and $87,500 additional for Mohegan granite.

★**Woodbury, N. J.**—Contract awarded Wilbur Titus, Woodbury, for erecting 2-story, brick, 42 x 68 ft., school for Bd. Educ. Charles R. Peddie, Archt., Philadelphia, Pa.

★**Hanover, Pa.**—Contract for erecting high school awarded O. H. Hostetter, Hanover, at about $85,000.

Marcus Hook, Pa.—Lowest bids opened for erecting the 2-story brick school submitted by A. S. Reed & Co., Wilmington, Del., at $33,973, and James Connor, Philadelphia, $34,340. W. E. Hance, Archt., Wilmington, Del.

★**Pittsburgh, Pa.**—Contracts awarded for erecting Bailey High School, Ruth and Harwood Avenues, Mount Washington, as follows: General contract, Golden & Crick, 3512 Fifth Avenue, $224,950; ventilating and heating, F. E. Geisler & Co., 424 First Avenue, $68,757; plumbing, W. N. Sauer Plumbing Co., 804 Chestnut Street, $16,590; electrical work, G. L. Craig & Co., Ferguson Building, $14,327.

★**Baltimore, Md.**—Morrow Bros., Fidelity Building, submitted lowest bid, at about $65,000, for erecting at Wolf and Madison Streets the 5-story and basement Hunterian Laboratory for Johns Hopkins University. Archer & Allen, Archts., Central Savings Bank Building.

★**Washington, D. C.**—Contract for 6300 tons of steel for frame work on building for Department of the Interior awarded Riter-Conley Mfg. Co., Pittsburgh, Pa.

★**Govans, Md.**—Contract awarded by County School Bd. at Towson to Walter E. Burnham, Baltimore, at $51,337 for erecting 2-story and basement brick school.

★**Roanoke, Va.**—Contract for the jail equipment for new city hall awarded Pauly Jail Bldg. Co. of St. Louis, Mo., at $25,318. Camden Iron Wks. of Roanoke bid $26,800.

★**Conneaut, Ohio.**—Contract awarded Aug. 26 for erecting an 8-room fireproof grade school in Sub. Dist. No. 5 to Salisbury & Fitch, Ashtabula, at $23,351. Warren Miner, Clk. Bd. Educ.

★**Toledo, Ohio.**—Contracts for erecting Mott School (bids opened Aug. 23) awarded by Bd. Educ. (H. C. McClure, Structural Engr.) as follows: General contract, A. Bentley & Sons Co., Toledo, $100,636 (awarded contract). Other bidders: J. Pioch Co., $100,638; H. J. Spieker Co., $101,075, and walls, Bock & Kuhlman, $104,375. Steel sash and casements, Trussed Concrete Steel Co., $6,680; electric wiring, Fowler Electric Co., $1,565; heating, W. H. Conklin Co., Columbus, $15,297 (awarded contract). Other bidders: Shaw Kendall Eng. Co., $16,610; Bryce Htg. & Vent. Co., $16,900; Robt. Raitz Co., $15,874. Automatic temperature regulation, Johnson Service Co., $2,400.

★**Morenci, Mich.**—Contract for erecting Chesterfield Township School awarded Schillinger Bros. Co., Toledo, at $23,153. William H. Nicholas, Archt., 1900 Euclid Avenue, Cleveland, Ohio.

Ypsilanti, Mich.—Following are four lowest bids opened Aug. 20 by Super. Archt., Washington, D. C., for construction complete of U. S. Post Office: (a) limestone, (b) sandstone: J. S. Wahlman, Ishpeming, (a) $49,330, (b) $50,685; Frank L. Johnson & Co., Duluth, Minn., (a) $48,746; Colonial Constr. & Supply Co., Charlottesville, Va., (a) $52,497, (b) $57,409; Chas. W. Gindele Co., Chicago, Ill., (a) $52,500; W. G. Carter Co., Chicago, Ill., (b) $54,450; Callahan Mandl Co., Chicago, Ill., (b) $56,000.

★**Alton, Ill.**—Contract awarded by State Bd. Administration, Springfield, for erecting power and heating plant at Alton State Hospital to J. J. Wuellner & Sons, Alton. The building will cost approximately $54,400.

Belleville, Ill.—Lowest bid submitted by Bauer Bros., Belleville, for erecting the high school at $117,563.

East Moline, Ill.—Following are four lowest bids opened by East Moline Township High School Bd. for erecting high school: F. H. Lorenz, Moline, $63,500; Paulsen Constr. Co., Rock Island, $64,217; Axel Carlson, Moline, $66,700, and J. A. Ream, Galesburg, $65,182.

★**Sullivan, Ill.**—Contracts for erecting jail and sheriff's residence (bids opened Aug. 20) awarded by Co. Comrs. as follows (Charles W. Green Co., Clk.): General contract, to Hagerman & Harshman, Sullivan, $11,406; heating and plumbing, L. T. Hagerman & Co., Sullivan, $4,200; cell work, Pauly Jail Bldg. Co., St. Louis, Mo., $6,395.

Ames, Iowa.—Following are four lowest bids opened Aug. 19 by Iowa State Bd. Educ., Des Moines (W. H. Gemmill, Secy.), for erecting buildings at Iowa State College of Agriculture and Mechanic Arts at Ames:

Science Building: J. B. Evans Constr. Co., Mexico City, Mo., $55,900 (lowest), Benson & Marxer, Des Moines, $57,875; A. H. Newman, Des Moines, $59,843, and L. W. Dumas Constr. Co., Columbia, Mo., $59,900.

★Women's Dormitory: J. B. Evans Constr. Co., Mexico City, Mo., $47,100 (awarded contract); J. C. Mardis, Des Moines, $49,850; L. W. Dumas Constr. Co., Columbia, Mo., $50,900; W. F. Kucharo & Co., Des Moines, $50,980.

★**Minneapolis, Minn.**—Contract awarded Aug. 20 for erecting foundation to private ward for St. Marys Hospital to J. L. Robinson Co., 511 S. Seventh Street, at $10,670 J. H. Wheeler, Archt., N. Y. Life Building, St. Paul.

Rochester, Minn.—Following are bids opened by city Aug. 26 for erecting power plant building: Wm. O'Neil & Son Co., Faribault, $44,934; R. J. Cheney & Co., Minneapolis, $45,486; G. Schwartz & Co., Rochester, $40,900. A. F. Wright, City Clk.

Blackwell, Okla.—Following are four lowest bids opened Aug. 19 by Super. Archt., Washington, D. C., for construction complete of U. S. Post Office: (a) limestone, (b) sandstone: Algernon Blair, Montgomery, Ala., (a) $36,441; George W. Stiles Constr. Co., Chicago, Ill., (a) $36,820; George A. Shaul, Seneca, Kan., (a) $38,693; Dieter & Wenzel Constr. Co., Wichita, Kan., (a) $39,503; The Potters Lumber Co., East Liverpool, Ohio, (b) $40,000; W. H. Fissell & Co., Marbridge Bldg., New York, (b) $41,776; Hiram Lloyd Bldg. & Constr. Co., Odd Fellows Bldg., St. Louis, Mo., (b) $43,313.

★**Copan, Okla.**—Contract awarded Aug. 28 for erecting 2-story and basement high school to A. T. Hingle, Bartlesville. Cost about $25,000. Architect, C. A. Henderson, Coffeyville, Kan. ....

★**Portland, Ore.**—Contract awarded Raymond Concrete Pile Co., New York, for placing concrete piling for warehouse and viaduct in rear of Municipal Dock No. 1.

★**Toronto, Ont.**—Contract for erecting Eglinton School awarded as follows: Masonry and cut stone work, to George T. Coggin, at $24,435; carpentry, Frank Armstrong, $9,431; ventilating and heating, Shepard & Abbott, $3,415; plumbing, Fred Armstrong, $4,625; total cost $54,152.

PRIVATE BUILDINGS

PROPOSED WORK

Albany, N. Y.—Reported plans being prepared for a chapter house to be erected at Lake and Hudson Aves. for the Eastern Star; cost $40,000.

Brooklyn, N. Y.—Plans filed for four-story brick tenement at Park Place and Brooklyn Avenue for Frank Wilson, cost $75,000; Clarence L. Sefert, Archt., 110 W. Fortieth Street, New York.

New York, N. Y.—Plans completed by Neville & Bagge, 105 W. Fortieth Street, for twelve-story apartment house to be erected at 789 West End Avenue, for 789 West End Ave. Company, Inc.; cost approximately $500,000.

Plans being prepared by George and Edward Blum, 505 Fifth Avenue, for nine-story apartment house to be erected at Park Avenue and Seventy-fourth Street for Taylor Constr. Co.

Plans filed for following buildings: Six-story brick tenement at 203 West Ninety-eighth Street for Samuel Borchardt, cost $50,000; William L. Rouse and L. A. Goldstone, Archts., 38 West Thirty-second Street, twelve-story fireproof apartment house at 330 Park Avenue for 330 Park Avenue Co., cost $700,000; Warren & Wetmore, Archts., 16 E. Forty-seventh Street, twelve-story fireproof apartment house at 907 Fifth Avenue for 907 Fifth Avenue Co., cost, $750,000; J. E. R. Carpenter, Archt., 66 East Sixty-sixth Street two five-story brick tenements at Albany, Crescent and Heats Avenues for Phelan Bros. Constr. Co., cost $105,000; Moore & Landsiedel, Archts., Third Avenue and 148th Street; one-story brick church at Tinton Avenue and 155th Street for St. Anselms R. C. Church, cost $90,000; Gustav E. Steinbeck, Archt., 15 E. Fortieth Street.

Montague Flagg, 2d, 109 Broad Street, is architect for the twenty-story office building to be erected at southeast corner of Fifth Avenue and Forty-second Street by the Oceanic Investing Co.

Rochester, N. Y.—Plans being prepared by Foster & Gade, 15 West Thirty-eighth Street, New York, and Claude Bragdon, Cutler Bldg., Rochester, Assoc. Archts., for two-story building for Chamber of Commerce; cost $200,000.

Report contract soon to be let by Claude Bragdon, Archt., 415 Cutler Bldg., for two-story and basement 50 x 80-ft. tapestry brick, terra cotta and steel Y. M. C. A. building; cost, $50,000. James G. Cutler, Chmn. Bldg. Com., Cutler Bldg.

Contract soon to be let by Hutchinson & Cutler, Archts., 310 Cutler Bldg., for erecting three-story brick and steel garage and show room at S. Union Street and Dwyer Alley, for Overland Rochester Co.; cost $60,000.

Schenectady, N. Y.—Plans submitted to Masonic Assoc. for Temple to be erected at 828 State Street; cost approximately $100,000.

Allentown, Pa.—Contract soon to be let for erecting 6-story, brick and stone Y. M. C. A. building. Cost $100,000. Louis E. Jallade, Archt., 37 Liberty Street.

Philadelphia, Pa.—Street & Stackhouse, Drexel Bldg., have completed plans for Reformed Episcopal Church of the Intercession, Twenty-ninth and Fletcher Streets, 60 x 110 ft. Cost about $50,000. Rev. George Worrell, Rector.

Philadelphia, Pa.—Contract soon to be let for alterations and additions to three-story brick and concrete building for Jewish Sheltering Arms. M. Haupt, Archt., Drexel Bldg.

Plans being prepared by Moores & Dunford, 10 S. La Salle Street, Chicago, Ill., for two-story reinforced concrete, 53 x 120 ft. warehouse to be erected at 2715 N. Broad Street, for North Broad Safe Deposit & Storage Co.

Pittsburgh, Pa.—F. J. Osterling, 316 Fourth Avenue, engaged to prepare plans for the seven-story frame fireproof club house for the American Republican Club to cost $150,000.

Barbourville, Ky.—A site in this city has been secured by the Cumberland & Manchester R. R. on which to erect shops and roundhouse.

Cleveland, Ohio.—Contract will soon be let for erecting 2-story and basement, brick and reinforced concrete edifice for Plymouth Congregational Church, Euclid Heights; cost approximately $75,000. H. C. Van Sweringen, Chmn. Bldg. Com.; Charles S. Schneider, Archt., 2448 Euclid Avenue.

Syrian R. C. Church (Rev. Peter Shelala, Pastor) will erect brick edifice on E. Twenty-third Street to cost about $30,000

Reported Hudson-Stuyvesant Motor Co., Cleveland, will erect a three-story fireproof building on Euclid Avenue as an addition to present salesroom; cost $50,000.

Piqua, Ohio.—Contract soon to be let for erecting fireproof office building and laboratory for George H. Rundell Co., according to plans by Schenck & Williams of Dayton.

Portsmouth, Ohio.—Richards, McCarty & Bulford, Hartman Building, Columbus, it is reported, prepared tentative plans for proposed fireproof, reinforced concrete and brick hotel to contain 150 rooms. Irving Drew of Gallia Street, Portsmouth, interested.

Tippecanoe City, Ohio.—Plans being prepared by Schenck & Williams, Dayton, for a fireproof brick and stone theater and office building to seat 1500 people.

Beardstown, Ill.—Methodists contemplate erecting a $35,000 edifice. Rev. A. K. Byrns, Pastor.

East St. Louis, Ill.—Tentative plans being prepared by Newton P. Story, East St. Louis, for 4-story hotel to be erected at Third Street and Broadway for John J. Weis.

Cedar Rapids, Ia.—First Avenue Realty Co. is preparing to erect a five-story store and shop building at First Avenue and Second Street.

Duluth, Minn.—F. G. German, Exchange Building, selected to prepare plans for Pilgrim Congregational Church, to be erected at Twenty-third Avenue and Fourth Street; cost approximately $100,000.

Plans being prepared by F. G. German, Exchange Building, for boys' Y. M. C. A. building, to be erected at Lake Avenue and Second Street. Cost about $50,000.

Minneapolis, Minn.—Chicago, Great Western Ry. Co. (W. C. Harvey, Ch. Engr., Chicago, Ill.), it is reported intends rebuilding freight house in this city.

Omaha, Neb.—Plans being prepared by George B. Prinz, Omaha Natl. Bank Building, for 7-story, fireproof temple for Masonic Assoc., to be erected at Nineteenth and Douglas Streets. Steel, brick and stone construction; probable cost $350,000.

Seattle, Wash.—Reported contract will soon be let for erecting 3-story, brick and terra cotta temple for Masonic Assoc., at Harvard Avenue and Pine Street; probable cost $125,000. George W. Lawton, Archt., Alaska Building.

Spokane, Wash.—Reported plans being prepared by John K. Dow, Spokane, for 6-story, 110 x 110 ft., office and warehouse, to be erected at Wall Street and Northern Pacific tracks for Powell Sanders Co. Probable cost, $50,000.

Portland, Ore.—Loyal Order of Moose will erect a six-story club house on Fourth and Taylor Streets.

Merced, Cal.—It is reported pans have been adopted by the San Joaquin Light & Power Co. for a substation to be constructed at Merced; cost about $65,000.

Edmonds, B. C.—Contract soon to be let by Reitze, Storey & Duffy, Consulting Engrs., Northern Bank Bldg., Seattle, Wash., for erecting the oil depot for the Shell Oil Co. to include wharf, crib work, several steel tanks and a warehouse of about 36,000 gal. capacity; cost $100,000.

PRICES AND LETTINGS.

★Indicates award of contract.

★Herkimer, N. Y.—Contract for erecting building at Main and Mohawk Streets for Daniel F. Strobel and Frank A. Schmidt awarded Jay Gleason, Ilion; cost $50,000.

★Little Falls, N. Y.—Contract for erecting five-story reinforced concrete and granite building at Main and Ann Sts. for David H. Burrill awarded Wells Bros. of Chicago, Ill. W. L. Stoddard of New York, Archt. Building to be occupied by the National Herkimer County Bank.

★New York, N. Y.—Contract for erecting five-story fireproof club house for Friars Club at 106 West Forty-eighth Street awarded John T. Brady & Co., 103 Park Avenue; cost $150,000. Harry Allen Jacobs, Archt., 320 Fifth Avenue.

★Schenectady, N. Y.—Contract for the foundation for addition to Mohawk Hotel awarded Underpinning & Foundation Co., 290 Broadway, New York. Foundation to consist of Standard hercules steel piles.

★Jersey City, N. J.—Contract for erecting four-story reinforced concrete bakery, 179 x 152 x 75 ft., for Great Atlantic & Pacific Tea Co., at Warren, First and Bay Streets, awarded Turner Constr. Co., 11 Broadway, New York. Ballinger & Perrot, Archts., 1701 Arch Street, Philadelphia, Pa.

★Morristown, N. J.—Contract for granite work on new residence of Theo. N. Vail awarded Woodbury Granite Co. of Bethel, Vt., at about $50,000.

★Ronceverte, W. Va.—Contract for erecting brick and concrete 26 x 100-ft. passenger station for Chesapeake & Ohio R. R. awarded J. D. Moore and J. H. Moore of Charleston. Cost $30,000.

★Cleveland, Ohio.—Plans filed for the annex to Hotel Statler and the Stillman Theater, which are to be erected on Euclid Avenue by the Hotel Statler and Stillman Amusement Co. Crowell Lundoff Little Co., Cleveland, contractors for the theater, and George A. Fuller, Cleveland, contractor for the hotel annex; cost $600,000. Geo. B. Post & Sons, New York.

★Billings, Mich.—Piper Constr Co. submitted lowest bid, at $26,994 for erecting Presbyterian Church, Third Avenue N. Only other bidder, Edw. Serle Co., $28,000.

★Detroit, Mich.—Contract awarded Irwin & Leighton, Philadelphia, Pa., for erecting 9-story, reinforced concrete, steel, brick and stone department store for Crowles, Milner Co.; cost $300,000. This is first section of building, which will cost, complete, $2,000,000. Albert Kahn, Archt., Detroit.

★Contract awarded to Irwin & Leighton, Philadelphia, Pa., for erecting 9-story, brick, steel and concrete store building for Peoples Outfitting Co.; cost $250,000. Albert Kahn, Archt., Detroit.

★Aurora, Ill.—Contract for erecting six-story brick and stone 75 x 100 ft. hotel for Island Improvement Co. awarded Caldwell & Drake Co., Chicago. Approximate cost $200,000.

★Chicago, Ill.—Contract for placing concrete piles in foundation of new building for W. E. Wroe, East Illinois and St. Clair Streets, awarded Raymond Concrete Pile Co., New York.

★Hoyleton, Ill.—Contract awarded by Bd. Directors Evangelical Orphanage Home to English Bros., Champaign, at $51,407, for erecting orphanage building.

★Kewanee, Ill.—Contract for erecting hotel for Kewanee New Hotel Co. reported awarded Monmouth - Galesburg Constr. Co., Galesburg. Cost $65,000.

★St. Paul, Minn.—Contract for erecting 12-story brick and stone hotel at Dale Street and Grand Avenue for Booth Hotel Co. awarded Wells Bros., Chicago, Ill.; cost $2,000,000. Mark Fitzpatrick, Archt.

★St. Paul, Minn.—Contract for all steel equipment for the office building of the Great Northern R. R. awarded General Fireproofing Co., Youngstown, Ohio.

★Sioux Falls, S. D.—Contract for erecting three-story brick Odd Fellows Temple on Dakota Avenue awarded Sioux Falls Constr. Co., Sioux Falls. Cost about $25,000.

★St. Louis, Mo.—Contract awarded by Childs Co. to Murch Constr. Co. for two additional stories (brick) to one-story building at 214 N. Seventh Street; cost about $30,000.

★Seattle, Wash.—Contract awarded by Charles Bebb and Charles Gould, Assoc. Archts., Denny Building, to Butler Contr. Co., Central Building, for one-story and basement, 120 x 120 x 133 ft., brick building to be erected at Westlake Avenue and Roy Street for Tucker Hanford Co.

NEW INDUSTRIAL PLANTS

PROPOSED WORK

New Bedford, Mass.—A three-story brick addition is to be erected to plant of J. C. Rhodes & Co., Inc., 123 Front Street. Floors to be of concrete.

Bristol Ferry, R. I.—Plans reported under way to construct a ship-building plant here. Albert S. Chesebrough said to be interested.

Brooklyn, N. Y.—Plans filed for three-story brick factory at Clinton and Park Avenues for Consumers Biscuit Mfg. Co.; cost $100,000. William J. Dilthey, Archt., 1 Union Square, New York.

American Machine & Foundry Co., 200 Fifth Avenue, New York, secured site on Fifty-fifth Street, between First and Second Avenues, on which it is proposed erecting a five-story concrete factory costing $175,000, to include a large power house.

Buffalo, N. Y.—Plans filed for further additions to plant of Curtiss Aeroplane Co., to include shop building, steel construction, and a boiler house; cost $50,000.

Contract soon to be let by Jacob Doll Packing Co. for erecting five-story 100 x 160 ft. beef house at William Street and New York Central R. R. H. P. Henschien, Archt. & Engr., 37 Van Buren Street, Chicago, Ill.

Contract soon to be let by Eli W. Goldstein, Archt., 47 Niagara Street, for alterations; also erecting four-story addition, 35 x 54 ft., to factory at Broadway and Cedar Street, for Frank J. Offerman Mfg. Advertising Novelties, Calendars, etc.; cost $50,000.

Fayetteville, N. Y.—Contract soon to be let by Charles D. Wilsey, Archt., S. A. & R. Bldg., Syracuse, for additions to paper mill, 64 x 80 ft., for McIntyre Bros. & Roundeshush. Inc.

Rochester, N. Y.—Contract soon to be let by Walker, Livingston & Brackett, E. & B. Bldg., for erecting one story 60 x 300-ft. building for plant of the Crothers Motor Co.

Seneca Falls, N. Y.—Contract soon to be let by Williard Case & Co., Engrs., 17 Battery Place, New York, for erecting two-story 60 x 460-ft. factory and one-story 80 x 140-ft. foundry and miscellaneous mill buildings for Seneca Falls Mfg. Co.

Syracuse, N. Y.—Gaggin & Gaggin, Archts., University Block, will soon let contract for erecting one story, 140 x 110 ft. addition to foundry on N. Geddes Street for Syracuse Malleable Iron Wks.

Cape May, N. J.—Bethlehem Steel Co. intends erecting near shell proving grounds at Cape May Point a factory to cost $30,000.

Baltimore, Md.—Kennedy Foundry Co., S. Charles Street, will erect a 3--story addition to its plant.

Ocala, Fla.—Ocala Citrus Growers' Assoc. organized to erect packing house. Directors: J. H. Mathews of Candler, E. L. Carney of Ocala, and others.

Detroit, Mich.—Plans being prepared for factory to be erected by Detroit Battery Co., 607 Fort Street (Sydney W. Weston, Pres. & Gen. Mgr.).

Minneapolis, Minn.—Reported Hewitt & Brown, 716 Fourth Avenue, South, Minneapolis, are architects for four-story fireproof reinforced concrete factory which National Candy Co. will erect at a cost of $150,000.

Minneapolis, Minn.—Reported contract soon to be let for erecting 3-story reinforce concrete factory for Twin City Four-Wheel Drive Motor Co. (Joseph I. Ware, Pres., Minneapolis).

Spokane, Wash.—The Inland Empire Paper Co. (R. S. Talbott, Secy. and Gen. Mgr.), Spokane, reported taking steps to make improvements, including a sulphide plant.

Ford, Ont.—Plans completed for an addition to the Canadian branch plant of the Ford Motor Car Co.; cost $60,000.

BIDS DESIRED.

Philadelphia, Pa.—Press reports state bids desired until Sept. 8 for erecting 6-story concrete, 92 x 251 ft., building for Touraine Motor Co. Address J. C. M. Shirk, Archt., 421 Chestnut Street.

PRICES AND LETTINGS.

★Indicates award of contract.

Boston, Mass.—New England Foundation Co., 70 Kilby Street, Boston, secured following contracts for simplex concrete piles for following buildings: Pattern shop, for Mead-Morrison Mfg. Co., East Boston, Mass.; manufacturing building, for Ashcroft Mfg. Co., Bridgeport, Conn.; apartment house, for Miss L. S. Kimball, Brookline, Mass.; abattoir, Joseph Stern & Co., New York.

★Elmira, N. Y.—Contract awarded Johnston Constr. Co., Newark, N. Y., for erecting a two-story 130 x 150-ft. addition to plant of American LaFrance Co.; cost $40,000.

★Jamestown, N. Y.—Contract awarded McClintic-Marshall Co., Pittsburgh, Pa., for erecting blacksmith shop here, 200 x 200 ft., one-story, concrete and glass, for the Struthers Wells Co., Warren, Pa.; cost $50,000.

★Syracuse, N. Y.—Contract awarded W. J. Burns Co., Syracuse, for erecting a storehouse, 40 x 60 ft. and 30 x 84 ft. to plant of Syracuse Malleable Iron Wks.

★Contract awarded Henry Funda, North Geddes Street, for erecting two-story and basement, 55 x 58-ft. storehouse at Canal and Teall Streets for Syracuse Milling Co.

★Towanda, N. Y.—Contract awarded Morris & Allen, Builders' Exchange, Buffalo, for erecting 90 x 80 ft. addition, brick and concrete, to plant of McKinnon Chair Co. of Buffalo, at Fremont Street, Erie and New York Central R. R.

★Erie, Pa.—Contract awarded by Erie Silk Mills to Henry Shenk Co., Erie, for erecting one-story steel constructed addition to plant on West Twenty-sixth Street, to have saw tooth roof, and cost $90,000.

★Philadelphia, Pa.—Contract awarded Monaghan & Lesse, 214 S. Twelfth Street, for 3 buildings, 1, 2 and 3 stories, reinforced concrete, brick and steel, to be erected at Philip and Cambria Streets for American Ice Co. Cost $100,000.

★Sharpsville, Pa.—Contract awarded by Valley Mound & Iron Co. to McMilar Constr. Co. of Cleveland for erecting steel building, 150 x 75 ft.

★Baltimore, Md.—Contracts awarded by Curtis Bay Distillery Co. as follows for work at the Curtis Bay denatured alcohol distillery: Fabrication and erection of greater portion of structural steel, to Potthoff Constr. Co., Cincinnati, Ohio; all concrete work, Curtiss Woodruff Co., Brooklyn, N. Y.; copper work, Ansonia Copper & Iron Wks., Cincinnati, Ohio; grading and well drilling, William G. Gischel Co., Curtis Bay. Plant complete is to cost about $1,000,000 and is to contain 12 buildings and cover about 10 acres of land.

★Hagerstown, Md.—Contract awarded Consolidated Eng. Co., Baltimore, for erecting 2-story, concrete, steel and brick factory for Pangborn Corp.; cost $60,000. Peuckert & Wunder, Archts., Philadelphia, Pa.

★Portsmouth, Va. — Contract awarded by Seaboard Air Line Ry. (W. D. Faucette, Ch. Engr., Norfolk) to Christian Constr. Co. of Durham, N. C., for additional shop facilities at Portsmouth, Va., consisting of following buildings: Machine and erecting shop, flue shop, blacksmith shop, substation, engine carpenter and paint shop and two toilet wash and locker rooms.

★Contract for the steel work on above shops awarded Virginia Bridge & Iron Co., Roanoke, at about $50,000.

★Winston-Salem, N. C.—Contract for erecting reinforced concrete plant at Hanes Station, about four miles from Winston-Salem, for the Hanes Knitting Mill Co. awarded Travers Wood Co. of Charlotte; cost about $100,000.

★Maysville, Ky.—Contract for erecting 3-story slow burning mill for Maysville Cotton Mills awarded Harding & Simons, Maysville. J. E. Sirrine, Greenville, S. C., Engr.

★Struthers, Ohio.—Contract for concrete piling for new 8 and 12-in. merchant mills of Youngstown Sheet & Tube Co. awarded Raymond Concrete Pile Co., 140 Cedar Street, New York.

MISCELLANEOUS

PROPOSED WORK

Transmission Line—Lexington, Ky.—Within next four months Lexington Utilities Co. expects to erect about 16 miles of 33,000 volt transmission line for a tie line necessary switching apparatus. J. P. Pope, Electrical Engr.

Central Heating Plant—Tacoma, Wash.—Tacoma Central Htg. Co. reported to construct central heating plant and distributing system at South Fifteenth and Dock Streets. Work to be started about Sept. 1. Company plans to spend between $200,000 and $250,000.

BIDS DESIRED.

Elevator—Boston, Mass.—Until Oct. 8 by James A. Wetmore, Acting Superv. Archt., Washington, D. C., for installing, complete, an electric elevator plant in the U. S. Appraisers' stores, Boston.

Mechanical Equipment in Appraisers' Stores—Boston, Mass.—Until Oct. 8 by James A. Wetmore, Acting Supervising Archt., Washington, D. C., for mechanical equipment (except elevators, lighting fixtures, pneumatic tube system and sprinkler system) in U. S. Appraisers' Stores, advertised in Engineering Record.

Hardware for Cottage—Newark, N. Y.—Until Sept. 15 by Mrs. Sarah F. S. Armstrong, Pres. Bd. Trus. N. Y. State Custodial Asylum for Feeble-Minded Women, for furnishing hardware for cottage for 92 inmates and for hospital building at said Asylum, advertised in Engineering Record. Lewis F. Pilcher, State Archt., Capitol, Albany.

Wall—Paterson, N. J.—Until Sept. 8 by C. N. Merritt, Secy. Park Comn., for furnishing material and constructing concrete boundary wall along Passaic River at Pennington Park.

Retaining Wall—Washington, D. C.—Until Sept. 20 by Dept. Pub. Bldgs. and Grounds for furnishing material and constructing retaining wall along west side of Meridan Hill Park.

Road Oil—West Palm Beach, Fla.—Until Sept. 7 by County Comrs. (F. E. Encell, Chmn.) for furnishing 168,000 gal. bituminous road oils for constructing roads.

Cement, Sand and Gravel—New Orleans, La.—Until Sept. 22 by U. S. Engineer, New Orleans, La., for furnishing and delivering cement, sand and gravel for work at Southwest Pass, Mississippi River, advertised in Engineering Record.

Grade Separation — Cleveland, Ohio.— Until Sept. 15 by A. R. Cudlow, Comr. Purchases and Supplies, for foundations and superstructure steel reinforced steel work for Lisbon Avenue grade crossing.

Retaining Wall—Cleveland, Ohio.—Until Sept. 8 by A. R. Cudlow, Comr. Purchases and Supplies, for retaining wall in Rockefeller Park.

Electric Hoist—Chicago, Ill.—Until Sept. 10 by Dept. Park Wks. (W. R. Montgomery, Comr.) for furnishing and delivering a double-drum electric motor-driven hoist for Maytair Pumping Station.

Transmission Line—Elizabeth, Ill.—Until Sept. 15 by Elizabeth Light & Power Co. (A. J. Nichols, Secy.) for furnishing material and constructing three miles of transmission line, substation and distribution system.

Steel Doors at Shed—San Francisco, Cal.—Reported desired until Sept. 15 by Bd. State Harbor Comrs. (Leo V. Metz, Jr., Secy.), Sacramento, for furnishing and installing steel rolling doors on shed at Pier No. 22.

Cables, Ducts, Etc.—Toronto, Ont.—Until Sept. 7 by Comm. Toronto Electrical Comrs. laying cable ducts, building manholes and transformer vaults.

Cables, Steel, Etc. — Panama.—Until Sept. 16 by Maj. F. C. Boggs, Corps Engrs., U. S. A., General Purchasing Officer Panama Canal, Washington, D. C., for Circular 364—Electric cable, steel cable galvanized steel, valves, pipe fittings, etc.

PRICES AND LETTINGS.

★*Indicates awarded contract.*

Conduit—Malden, Mass.—Lowest bids opened Aug. 28 for concrete conduit in Maplewood section: Frank T. Hook, Malden, $4,626; James L. Bryne, 53 State Street, Boston, $4,761; Dan Brandano, Malden, $4,946.

Freight Shed—Brooklyn, N. Y.—Following are four lowest bids opened for Contr. 1467—Furnishing material and erecting a freight shed with appurtenances on the pier near foot of Twenty-ninth Street, borough of Brooklyn: McHarg-Barton Co., 171 Madison Avenue, New York, $115,400; Post & McCord, 101 Park Avenue, New York, $118,000; Snare & Triest Co., Woolworth Bldg., New York, $121,980; Connors Bros. Co., Inc., New York, $123,400.

★**Pier Sheds—Savannah, Ga.**—Contract awarded by Ocean Steamship Company of Savannah to Irwin & Leighton, 126 N. Twenty-fifth Street, Philadelphia, Pa., for freight sheds, exclusive of steel frame and foundations. Area about 490,000 sq. ft. J. G. Basinger, Engr., 52 Broadway, New York.

★**Elevator Equipment, Etc.—Cincinnati, Ohio.**—Contracts reported awarded by New Cincinnati Bldg. Comrs., as follows: Mechanical equipment, to Standard Eng. Co. of Washington, D. C., at $202,350 and elevator equipment to Standard Plunger Elevator Co., Worcester, Mass., at $107,455.

★**Steel Grand Stand—Moline, Ill.**—Contract awarded by City Aug. 29 for constructing steel grand stand for Browning Field Athletic Club, seating capacity 4,000, to La Salle Eng. Co., Chicago, at $7,000. C. V. Johnson, City Clk.

★**Elevators — Madison, Wis.** — Contract for elevator work in north wing of Wisconsin State Capitol (bids opened Aug. 24) awarded to Kraetzer & Hecht Elevator Co. at $10,500. L. F. Porter, Secy. Capitol Comn.

★**Cement—Los Angeles, Cal.**—Contract reported awarded by Harbor Comrs. to California Portland Cement Co. of Los Angeles, for 42,000 bbls. cement, to be used in constructing of 6-story warehouse on Municipal Dock No. 1 at $2.15 per bbl., 40 cts. per bbl. to be allowed for empty sacks returned.

★**Coaling Plant—Honolulu, Hawaii.**—Contract reported closed between Inter-Island Navigation Co. and C. W. Hunt of New York, for construction in Honolulu Harbor of a coaling plant for vessels to have a capacity of 165,000 tons. It is said the plant will represent an investment of $1,000,000.

Proposals

For Proposals Advertised, see Pages 48, 49, 50 and 51.

WATERWORKS.

Bids Close.		See Eng. Record.
Sep. 7.	Mains, Cleveland Heights, Ohio	Aug. 14
Sep. 7.	C.-I. Pipe, Vallejo, Cal.	Aug. 14
Sep 7.	Well pump and service pumps, Merrillville, Ill.	Aug 14
Sep. 7.	Pipe, Washington, D. C.	Aug. 21
Sep. 7.	Dam, Chatham, N. B.	Sep. 4
Sep. 7.	[illegible]	Sep. 4
Sep. 8.	Pump, Haverhill, Iowa	Aug. 21
Sep. 9.	Water Works, Brewster, Ohio	Sep. 4
Sep. 9.	Mains, Boston, Mass.	Sep. 4
Sep. 10.	Reservoir, Oberlin, Ohio.	Aug. 28
Sep. 10.	Pipe, Chicago, Ill.	Sep. 4
Sep 13.	Pumps, Etc., Tarentum, Pa.	Sep. 4
Sep. 14.	Pipe, Washington, D. C.	Aug. 21
Sep. 14.	Water Works, Belleville, Ohio	Aug. 28
Sep. 14.	Gate Valves, Brooklyn, N. Y.	Aug. 28
Sep. 14.	Filter Plant, Macon, Mo.	Sep. 4
Sep. 15.	Pipes, Valves, Etc., Medina, Ohio. Adv. Aug. 28, Sept. 4.	Aug. 28
Sep. 15.	Water Works, Manchester, N. Y. Adv. Aug. 28, Sept. 4.	Aug. 28
Sep. 15.	Water Works, Salix, Iowa.	Sep. 4
Sep. 15.	Water Works, Spearville, Kan.	Sep. 4
Sep. 15.	Pipe and Fittings, Baltimore, Md. Adv. Sep. 4.	Sep. 4
Sep. 15.	Water Works, Miller, Ind.	Sep. 4
Sep. 16.	Pipe Trenching, Covington, Ky. Adv. Sept. 4.	Sep. 4
Sep. 20.	Water Works, Myton, Utah. Adv. Aug. 28, Sept. 4.	Aug. 28
Sep. 23.	Water Works, Whitehall, Mont. Adv. Aug. 28, Sept. 4.	Aug. 28
Sep. 27.	Well, Hastings, Neb. Adv. Aug. 28.	Aug. 28
———	Well, Thomasville, Ala. Adv. Aug. 28.	Aug. 28

SEWERAGE AND SEWAGE DISPOSAL.

Sep. 6.	Ogden, Iowa	Sep. 4
Sep. 7.	Albany, N. Y. Adv. Aug. 7 to 21.	Aug. 7
Sep. 7.	Cleveland Heights, Ohio.	Aug. 14
Sep. 7.	Pullman, Wash.	Aug. 21
Sep. 7.	South Orange, N. J.	Aug. 21
Sep. 7.	Huntington Beach, Cal.	Aug. 28
Sep. 7.	Toronto, Ont.	Sep. 4
Sep. 7.	Berlin, Ont.	Sep. 4
Sep. 8.	Cleveland, Ohio	Sep. 4
Sep. 9.	Cleveland, Ohio	Sep. 4
Sep. 13.	Roslyn, Wash.	Aug. 28
Sep. 13.	Chicago, Ill.	Sep. 4
Sep. 14.	Ocala, Fla.	Aug. 14
Sep. 14.	Clinton, Iowa	Aug. 21
Sep. 14.	St. Louis, Mo.	Sep. 4
Sep. 16.	Santa Barbara, Cal.	Aug. 21
Sep. 17.	Kenosha, Wis. Adv. Sep. 4.	Sep. 4
Sep. 17.	Milwaukee, Wis. Adv. Sep. 4.	Sep. 4
Sep. 17.	Brockport, N. Y. Adv. Sep. 4.	Sep. 4
Sep. 18.	Sioux City, Iowa	Sep. 4
Sep. 20.	Brainerd, Minn.	Aug. 28
Sep. 20.	Port Clinton, Ohio	Aug. 28
Sep. 20.	Centerville, S. D.	Sep. 4
Sep. 21.	Forest Grove, Ore.	Sep. 4
Sep. 23.	Whitehall, Mont. Adv. Aug. 28, Sept. 4.	Aug. 28
Oct. 14.	Mansfield, Ohio	Aug. 28

BRIDGES.

Sep. 7.	Hudson, S. D.	Aug. 14
Sep. 7.	Ellinwood, Kan.	Aug. 21
Sep. 7.	Zanesville, Ohio	Aug. 28
Sep. 7.	Indiana	Aug. 28
Sep. 7.	Canton, S. D.	Aug. 28
Sep. 7.	Olean, N. Y. Adv. Aug. 28.	Aug. 28
Sep. 7.	Nicholasville, Ky.	Aug. 28
Sep. 7.	Harrison, Neb.	Aug. 28
Sep. 7.	Salt Lake City, Utah	Sep. 4
Sep. 7.	Alma, Kan.	Sep. 4
Sep. 7.	Perryville, Mo.	Sep. 4
Sep. 7.	Illinois	Sep. 4
Sep. 7.	Brainerd, Minn.	Sep. 4
Sep. 8.	South Amboy, N. J.	Aug. 7
Sep. 8.	St. Paul, Neb.	Aug. 28
Sep. 8.	Indiana	Aug. 28
Sep. 8.	Aberdeen, Wash.	Aug. 28
Sep. 8.	Marion, Ohio	Sep. 4
Sep. 8.	Riverside, Wash.	Sep. 4
Sep. 8.	Hill City, S. D.	Sep. 4
Sep. 8.	Illinois	Sep. 4
Sep. 9.	Indiana	Aug. 28
Sep. 9.	Glenolden, Pa.	Aug. 28
Sep. 10.	Dillon, Mont.	Aug. 21
Sep. 10.	Walla Walla, Wash.	Aug. 28
Sep. 10.	Austin, Minn.	Aug. 28
Sep. 10.	Illinois	Sep. 4
Sep. 10.	Oregon, Mo.	Sep. 4
Sep. 10.	Roundup, Mont.	Sep. 4
Sep. 11.	Berkeley Springs, W. Va.	Sep. 4
Sep. 11.	Dalton, Ga.	Sep. 4
Sep. 11.	Lawrence, Kan.	Sep. 4
Sep. 13.	Hamilton, Ohio	Aug. 28
Sep. 13.	Hailey, Idaho	Sep. 4
Sep. 13.	San José, Cal.	Sep. 4
Sep. 14.	Mankato, Kan.	Sep. 4
Sep. 14.	Keyser, W. Va.	Sep. 4
Sep. 15.	Buffalo, N. Y. Adv. Sep. 4.	Sep. 4
Sep. 17.	Steubenville, Ohio	Aug. 28
Sep. 17.	Cincinnati, Ohio	Aug. 28
Sep. 17.	Bangor, Pa.	Sep. 4
Sep. 17.	Columbus, Ohio	Sep. 4
Sep. 18.	Ellsworth, Kan.	Aug. 28
Sep. 22.	Westport, Conn. Adv. Aug. 28.	Aug. 28
Sep. 25.	Hankow, China. Adv. Aug. 14.	Aug. 14
Sep. 28.	Greensburg, Pa.	Sep. 4
Oct. 6.	Lawrence, Kan. Adv. Aug. 14 to Sept. 4.	Aug. 14

PAVING AND ROADS.

Sep. 6.	Marcus Hook, Pa. Adv. Aug. 28, Sept. 4.	Aug. 28
Sep. 7.	Princess Anne, Md.	Aug. 14
Sep. 7.	Cleveland Heights, Ohio.	Aug. 14
Sep. 7.	Winamac, Ind.	Aug. 14
Sep. 7.	Louisiana	Aug. 21
Sep. 7.	Hackensack, N. J.	Aug. 21
Sep. 7.	Indiana	Aug. 21
Sep. 7.	Mount Vernon, Ind.	Aug. 28
Sep. 7.	Oakland, Cal.	Aug. 28
Sep. 7.	Shaker Heights, Ohio.	Aug. 28
Sep. 7.	Lake Charles, La.	Aug. 28
Sep. 7.	Newark, N. J.	Aug. 28
Sep. 7.	Nicholasville, Ky.	Aug. 28
Sep. 7.	Los Angeles, Cal.	Aug. 28
Sep. 7.	Santa Barbara, Cal.	Aug. 28
Sep. 7.	Union, N. J.	Sep. 4
Sep. 7.	Steam Roller, Crawfordsville, Ind.	Sep. 4
Sep. 7.	Indiana	Sep. 4
Sep. 7.	Albany, N. Y.	Sep. 4
Sep. 7.	Garnett, Kan.	Sep. 4
Sep. 7.	Linden, Ala.	Sep. 4
Sep. 7.	St. Louis, Mo.	Sep. 4
Sep. 7.	Saxonburg, Pa.	Sep. 4
Sep. 7.	Westfield, N. J.	Sep. 4
Sep. 7.	Boston, Mass.	Sep. 4
Sep. 7.	Toronto, Ont.	Sep. 4
Sep. 7.	East Hartford, Conn.	Sep. 4
Sep. 7.	Cincinnati, Ohio	Sep. 4
Sep. 7.	St. Paul, Minn.	Sep. 4
Sep. 7.	Pullman, Wash.	Sep. 4
Sep. 8.	Louisiana	Aug. 21
Sep. 8.	Washington	Aug. 21
Sep. 8.	Newark, Ohio	Aug. 21
Sep. 8.	Indiana	Aug. 21
Sep. 8.	Lorain, Ohio	Aug. 28
Sep. 8.	Farmingdale, L. I., N. Y. Adv. Aug. 28.	Aug. 28
Sep. 8.	Riverside, Cal.	Aug. 28
Sep. 8.	La Grange, Ohio	Sep. 4
Sep. 8.	Elyria, Ohio	Sep. 4
Sep. 9.	Tallahassee, Fla.	Aug. 14
Sep. 9.	Pittsburgh, Pa.	Aug. 28
Sep. 9.	Jersey City, N. J.	Sep. 4
Sep. 9.	Columbus, Ohio	Sep. 4
Sep. 9.	Jacksonville, Fla.	Sep. 4
Sep. 9.	Indiana	Sep. 4
Sep. 10.	Worcester, Ohio	Aug. 21
Sep. 10.	Tacoma, Wash.	Aug. 28
Sep. 10.	Ohio	Sep. 4
Sep. 11.	Road Roller, Indiana	Aug. 21
Sep. 11.	Bethlehem, Pa.	Sep. 4
Sep. 13.	Montclair, N. J. Adv. Aug. 28, Sept. 4.	Aug. 28
Sep. 13.	Los Angeles, Cal.	Aug. 28
Sep. 13.	Bremerton, Wash.	Sep. 4
Sep. 14.	Columbus, Wis.	Sep. 4
Sep. 14.	Norwalk, Conn. Adv. Sep. 4.	Sep. 4
Sep. 15.	Pennsylvania	Sep. 4
Sep. 15.	Indiana	Sep. 4
Sep. 16.	Newark, N. J.	Sep. 4
Sep. 18.	Ellsworth, Kan.	Aug. 28
Sep. 20.	Newark, N. J.	Aug. 28
Sep. 20.	Conneaut, Ohio	Sep. 4
Sep. 20.	Bluff City, Tenn.	Sep. 4
Sep. 21.	Baltimore, Md.	Aug. 28
Sep. 21.	Asphalt Plant, New Orleans, La.	Sep. 4
Sep. 21.	Taylor, Tex. Adv. Sep. 4.	Sep. 4
Sep. 23.	Pittsburgh, Pa.	Sep. 4

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS.

Sep. 7.	Dredging, Wilmington, Del. Adv. Aug. 21 to Sept. 4.	Aug. 21
Sep. 7.	Cleaning Channel, Glenwood, Iowa.	Aug. 21
Sep. 7.	Ditch, Morris, Minn.	Aug. 28
Sep. 7.	Storage Dam, Quebec, Que.	Sep. 4
Sep. 8.	Irrigation, Malta, Mont. Adv. July 31.	July 31
Sep. 8.	Irrigation, Fort Laramie, Wyo.	Aug. 14
Sep. 8.	Pier, Jersey City, N. J.	Sep. 4
Sep. 9.	Jetties, Rockaway Beach, L. I., N. Y.	Sep. 4
Sep. 9.	State Canal Work, Albany, N. Y.	Sep. 4
Sep. 10.	Levee, Alexandria, La.	Aug. 28
Sep. 11.	Retaining Wall, Miamisburg, Ohio	Sep. 4
Sep. 14.	State Canal Wk., Albany, N. Y. Adv. Aug. 14 to Sept. 4.	Aug. 14
Sep. 14.	Ditch, Breckenridge, Minn.	Aug. 28
Sep. 15.	Dredging, Baltimore, Md. Adv. Aug. 14, 21, Sept. 4.	Aug. 14
Sep. 15.	Irrigation Work, Malta, Mont.	Aug. 28
Sep. 16.	Steel Piling for Dam, Louisville, Ky. Adv. Aug. 21 to Sept. 4.	Aug. 21
Sep. 16.	Irrigation Work, Newell, S. D. Adv. Aug. 28.	Aug. 28
Sep. 17.	Drainage, Palmetto, Fla.	July 24
Sep. 18.	Pier, Pearl City, T. H.	July 10
Sep. 20.	Lock Gates, Montgomery, Ala. Adv. Aug. 21, 28.	Aug. 21
Sep. 20.	Revetment Work, Hartsburg, Mo. Adv. Aug. 28.	Aug. 28
Sep. 20.	Retaining Wall, Washington, D. C. Adv. Aug. 28, Sept. 4.	Aug. 28
Sep. 20.	Irrigation Work, Malta, Mont. Adv. Aug. 28.	Aug. 28
Sep. 22.	Piers, Honolulu, Hawaii. Adv. Aug. 7 to Sept. 4.	Aug. 7
Sep. 23.	Dredging, Norfolk, Va. Adv. Aug. 28.	Aug. 28
Sep. 24.	Operating Machinery at Dam, Cincinnati, Ohio. Adv. Aug. 28, Sept. 4.	Aug. 28
Sep. 24.	Drainage, Muscatine, Ia.	Sep. 4
Sep. 28.	Terminal Contr. 17 and 49, Albany, N. Y. Adv. Sep. 4.	Sep. 4
Oct. 1.	Dikes, Etc., Cathlamet, Wash.	Aug. 28
Oct. 1.	Bulkhead Shed, San Juan, P. R. Adv. Sep. 4.	Sep. 4

PUBLIC BUILDINGS AND SCHOOLS.

Sep. 7.	Charter Oak, Iowa	Aug. 14
Sep. 7.	Charlotte, N. C.	Aug. 7
Sep. 7.	Fulton, Mo.	Aug. 7
Sep. 7.	Columbus, Ohio	Aug. 21
Sep. 7.	Thiells, N. Y. Adv. Aug. 21 to Sept. 4.	Aug. 21
Sep. 7.	Columbus, Ohio	Aug. 28
Sep. 7.	Bluefield, W. Va.	Sep. 4
Sep. 8.	Englewood, N. J.	Aug. 21
Sep. 8.	Albany, N. Y. (2 props.) Adv. Aug. 21, 28.	Aug. 21
Sep. 8.	Caldwell, N. J.	Aug. 28
Sep. 8.	Carleton Point, P. E. I.	Aug. 28
Sep. 8.	Luana, Iowa	Sep. 4
Sep. 8.	Columbia, S. C.	Sep. 4
Sep. 9.	Woodsfield, Ohio	Aug. 21
Sep. 9.	Metcalf, Ariz.	Sep. 4
Sep. 9.	Atlantic City, N. J.	Sep. 4
Sep. 9.	Dunbar, Neb.	Sep. 4
Sep. 9.	Belvidere, Ill.	Sep. 4
Sep. 9.	Jersey City, N. J.	Sep. 4
Sep. 10.	Gouverneur, N. Y.	Aug. 7
Sep. 10.	Lebanon, Ind.	Aug. 14
Sep. 10.	Perry, Okla.	Aug. 21
Sep. 10.	Leavenworth, Kan.	Aug. 28
Sep. 10.	Belvidere, Ill.	Aug. 28
Sep. 10.	Owensburg, Ind.	Sep. 4
Sep. 10.	Winchester, Ind.	Sep. 4
Sep. 10.	Philadelphia, Pa.	Sep. 4
Sep. 10.	St. Louis, Mo.	Sep. 4
Sep. 11.	Bremerton, Wash.	Aug. 14
Sep. 11.	Grundy Center, Iowa	Aug. 28
Sep. 11.	Grand Mound, Wash.	Sep. 4
Sep. 13.	Cincinnati, Ohio	Aug. 28
Sep. 14.	Boston, Mass. Adv. Aug. 28, Sept. 4.	Aug. 28
Sep. 14.	Milledgeville, Ohio	Aug. 28
Sep. 14.	Dayton, Ohio	Aug. 28
Sep. 14.	Batavia, N. Y.	Aug. 28
Sep. 14.	Patton, Cal.	Aug. 28
Sep. 14.	Glenwood, Iowa	Sep. 4
Sep. 14.	Iowa City, Iowa	Sep. 4
Sep. 15.	Hyde Park, Ohio.	Aug. 21
Sep. 15.	Arverne, N. Y. Adv. Aug. 21, 28.	Aug. 21
Sep. 15.	Boston, Mass.	Aug. 28
Sep. 15.	Boston, Mass.	Sep. 4
Sep. 16.	Dayton, Ind.	Sep. 4
Sep. 16.	Steubenville, Ohio	Sep. 4
Sep. 16.	Toms River, N. J. Adv. Sep. 4.	Sep. 4
Sep. 17.	Ogden, Iowa	Aug. 28
Sep. 20.	Cincinnati, Ohio Adv. Aug. 28.	Aug. 28
Sep. 20.	Steubenville, Ohio	Aug. 28
Sep. 20.	Bardwell, Ky.	Sep. 4
Sep. 20.	Atlanta, Ga.	Sep. 4
Sep. 21.	Marblehead, Ohio Adv. Sep. 4.	Sep. 4
Sep. 25.	Vallejo, Cal.	Aug. 28
Sep. 25.	Norfolk, Va.	Aug. 28
Sep. 25.	Bremerton, Wash.	Aug. 28
Sep. 25.	Lima, Ohio	Sep. 4
Sep. 27.	Tulsa, Okla.	Aug. 14
Sep. 28.	Harrisburg, Pa. Adv. Aug. 21, 28.	Aug. 21
Sep. 29.	Smyrna, Del.	Aug. 28
Sep. 30.	Washington, D. C. Adv. July 24, 31.	July 24
Sep. 30.	Tulsa, Okla.	Aug. 28
Sep. 30.	Elizabeth, N. J. Adv. Sep. 4.	Sep. 4
Oct. 1.	Kalamazoo, Mich.	Aug. 28
Oct. 8.	Boston, Mass.	Sep. 4
Oct. 16.	Washington, D. C.	Aug. 28

PRIVATE BUILDINGS.

Sep. 15.	Seattle, Wash.	Aug. 14

MISCELLANEOUS.

Sep. 7.	Cable Ducts, Etc., Toronto, Ont.	Sep. 4
Sep. 7.	Road Oil, West Palm Beach, Fla.	Sep. 4
Sep. 7.	Chimney at Garb. Plt., Toronto, Ont.	Sep. 4
Sep. 8.	Incandescent Lamps, Albany, N. Y. Adv. Aug. 28.	Aug. 28
Sep. 8.	Wall, Paterson, N. J.	Sep. 4
Sep. 8.	Retaining Wall, Cleveland, Ohio	Sep. 4
Sep. 10.	Light Station, New Orleans, La.	Aug. 14
Sep. 10.	Cell Fronts, Atlanta, Ga.	Aug. 21
Sep. 10.	Steel Reinforcing Bars, Etc., Panama	Aug. 28
Sep. 10.	Ballast for El. Rys., New York, N. Y.	Aug. 28
Sep. 10.	Electric Hoist, Chicago, Ill.	Sep. 4
Sep. 10.	Steel doors at shed, San Francisco, Cal.	Sep. 4
Sep. 13.	Equipment for Drydock, Panama	Aug. 21
Sep. 13.	Transmission Line, Elizabeth, Ill.	Sep. 4
Sep. 14.	Elevator, Camden, N. J.	Aug. 31
Sep. 15.	Hardware for Pub. Bldg., Newark, N. Y. Adv. Sep. 4.	Sep. 4
Sep. 16.	Grade Separation, Cleveland, Ohio	Sep. 4
Sep. 16.	Cable, Steel, Etc., Panama	Sep. 4
Sep. 18.	Ry. at Naval Station, Pearl Harbor, Hawaii	July 10
Sep. 20.	Retaining Wall, Washington, D. C.	Sep. 4
Sep. 20.	Cable Ducts, Etc., Toronto, Ont.	Sep. 4
Sep. 22.	Cement, Sand and Gravel, New Orleans, La. Adv. Sep. 4.	Sep. 4
Oct. 8.	Mechanical Equipment in Appraisers' Stores, Boston, Mass. Adv. Sep. 4.	Sep. 4
Oct. 8.	Elevator, Boston, Mass.	Sep. 4
Oct. 16.	Pumps, Etc., for Oil Plants, Washington, D. C.	Aug. 28
Nov. 17.	Power Plants, Etc., Washington, D. C.	Aug. 28

CONTRACTING NEWS

Of Special Interest to Engineers, Contractors, Builders and Manufacturers of Engineering and Building Supplies

THE month of August was a good one for the steel industry. Indications of buying for delivery next year seem to insure capacity operation for the first half of 1916. Structural steel business continues more active, and prices have advanced slightly. Fabricators are now getting $1.40 Pittsburgh, $1.59 New York and $1.54 Chicago.

New municipal bond issues put out last month totaled $21,500,000, which is within $3,500,000 of the highest August offerings for the past ten years, and compares with $9,213,000 put out in the dull month of August, 1914. Sales of municipal bonds in the past eight months have exceeded in volume sales of like securities in the same period of any year on record.

According to a recent report of the Southern Pine Association, unfilled orders on Aug. 28 at the mills of members of the association totaled more than 17,000 cars, showing a good demand. Shipments for the last week of August exceeded those for the same week of 1914 by 10 per cent. Yellow-pine and hemlock scantlings and small joists were quoted last week $22 at $26 per 1000 ft. at Chicago.

Buildings

Bids were received and contracts awarded on a number of large building projects last week. At Troy, N. Y., a $200,000 college building has been contracted for. The lowest bids for the new county courthouse at White Plains, N. Y., total $573,000. A concrete elevator to cost $525,000 has been contracted for at Milwaukee, and the first unit of a $1,500,000 building contract has been awarded in the same city. A hotel to cost $300,000 has been contracted for at Dayton, Ohio. The lowest bid received for constructing an apartment house in St. Paul was $250,000. The lowest bid received for erecting a hospital at San Antonio was $246,000. A contract for building a $135,000 hotel has been awarded at Seattle.

Bids are desired for public buildings to cost $200,000 at Medical Lake, Wash. Two buildings to cost $158,000 will be let Sept. 21 at Sedro-Woolley, Wash. The erection of a $400,000 school building is planned at Camden, N. J. A 1,000,000-bu. grain elevator and a $200,000 industrial plant are planned at Chicago. Plans are being prepared at Cleveland for a $150,000 hospital, and plans have been filed in the same city for a school to cost the same sum.

Plans have been completed for a $100,000 office building at Hastings, Neb. Improvements proposed for the Illinois Central Railroad shops at Waterloo, Iowa, will cost $180,000.

Bridges and Roads

A contract for constructing a $41,000 bridge has been awarded at Greenwich, N. Y. The contract for constructing the bridge over the Arkansas River at Tulsa, Okla., has been awarded at $167,986. The lowest bid received at Detroit for constructing a temporary bridge to Belle Isle was $43,000. The lowest bid received at Green Bay, Wis., for constructing a bascule bridge was $57,000. Bids will be received about Oct. 1 for constructing the $70,000 concrete bridge at Mankato, Minn. The construction of a $120,000 concrete bridge is being considered at Petersburg, Va. Santa Barbara County, California, has voted $350,000 bonds for constructing highway bridges.

State highway contracts awarded in Connecticut total $51,500. Paving contracts totaling $321,000 have been awarded at Philadelphia. Toledo, Ohio, has awarded paving contracts totaling $117,000. Paving contracts amounting to more than $140,000 have been awarded in Chicago. Salt Lake City has contracted for paving work to cost $48,000. Paving contracts awarded at Portland, Ore., amount to $40,000. A $79,000 paving contract has been awarded at Tacoma, Wash. Bids are desired for 34,000 sq. yd. of asphalt pavement at Brooklyn. Illinois will open bids Sept. 16 on road work to cost $55,000. Bids are desired on 23,000 sq. yd. of wood-block paving and other work at St. Paul. An association has been formed at Chicago for promoting the construction of a $20,000,000 highway from Mexico to Canada. Clarksville, Tex., will sell road bonds totaling $100,000 on Sept. 28. An expenditure of $154,000 for paving improvements have been approved at Seattle.

Waterworks and Sewers

Windsor, Conn., has let contracts for water improvements totaling $51,000. A $28,000 waterworks contract has been awarded at Wellington, Ohio. Four contracts awarded out of five on which bids were opened Aug. 24 for improvements at Charlton, Iowa, totaled $53,000. Bids are desired for constructing a reservoir at Tamaqua, Pa. The towns of Wilson and Ayden, N. C., will soon sell water bonds amounting to $95,000 and $50,000 respectively. Waterworks improvements to cost $100,000 are being considered at Ridgefield, Wash.

Bids opened Sept. 1 for constructing three sewers in Long Island City, N. Y., total $236,000. Bids are desired at Lyle, Mich., for constructing 12,000 ft. of sewers, and at Red City, Mich., for constructing 19,500 ft. of sewers. Plans are to be prepared for a $1,500,000 concrete trunk sewer in Montreal. Plans are being prepared for a $130,000 sewer system for Briarcliff Manor, N. Y. The sale of bonds for constructing a $150,000 sewer system at Daytona, Fla., has been provided for. Bonds to be sold Sept. 15 by the city of Boston will provide $600,000 for sewerage work.

Miscellaneous

The award of a $440,000 elevated railway contract in Brooklyn has been approved by the New York Public Service Commission. Three drainage contracts amounting to $380,000 have been awarded at Marion, Ark. Bids are desired Sept. 17 for constructing the shed at the Thirtieth Street pier in Brooklyn. It is reported that a contract for building 25 miles of railroad has been awarded at Three Forks, Mont. Bids are desired at Bemidji, Minn., for constructing drainage ditches to cost nearly $300,000. Additional bonds for the Dorchester tunnel in Boston amounting to $1,750,000 will be sold Sept. 15.

Press reports from Norfolk, Va., state that the Seaboard Air Line Railway contemplates improvements and new construction which will cost in excess of $1,600,000. The construction of a $250,000 municipal dock has been recommended at St. Louis. A power plant to cost $750,000 is proposed at Denison, Tex. The Department of the Interior has granted a permit to begin work on a hydroelectric development near Needles, Cal., for which a series of dams on the Colorado River are proposed. Surveys are being completed and construction will soon begin on a $1,000,000 drainage project at Grand Junction, Col.

WATERWORKS

PROPOSED WORK

Collingswood, N. J.—Borough Council reported considering construction of municipal water works.

Madrid, N. Y.—Bonds for $22,000 will be sold Sept. 14 by E. B. Watson, Town Clk., for construction of water works, from plans of Engineer Brownell of Carthage.

Reynoldsville, Pa.—Citizens voted $100,000 bonds Aug. 24 for purchase or construction of water works.

Ayden, N. C.—Citizens, Aug. 20, voted $50,000 bonds for constructing water works. Bids for bonds to be received Sept. 15. J. H. Coward, City Clk.

Wilson, N. C.—Water bonds for $95,000 will be sold sept. 20 by Theodore A. Hinnant, Clk. Bd. Town Comrs.

Amite, La.—M. L. Culley, Jackson, Miss., making surveys for proposed water and sewer systems. J. W. Gaines, City Clk.

Kosciusko, Miss.—Citizens voted bonds for water and light plant and have selected M. L. Culley, Jackson, to make appraisals of present plants to determine advisability of purchasing or whether to construct new plants, for which preliminary estimates are also to be prepared. W. G. Campbell, Mayor.

Wesson, Miss.—M. L. Culley, Jackson, retained to make appraisal of present small water plant, and to prepare plans for new light and water systems. P. L. Burke, City Clk.

Mount Blanchard, Ohio.—Plans reported approved by State Bd. of Health, Columbus, for a water supply system.

Attica, Kan.—Plans being prepared by E. T. Archer & Co., Kansas City, Mo., for water works and electric light plant; cost $30,000. J. C. McCaddon, City Clk.

Galveston, Tex.—Council reported considering construction of a new submerged main across the bay.

Ridgefield, Wash.—Plans being prepared by Gilbert & Hall, Portland, Ore., for construction of the proposed water works, to include 500-gal. pump, 200,000-gal. reservoir and wood pipe; cost $100,000; to be voted on this fall. J. W. Blackburn, Town Clk.

Seattle, Wash.—Council decided to lay water mains on Thirteenth Avenue; also in Wyoming and Fourteenth Avenues N. W. A. H. Dimock, City Engr.

San Rafael, Cal.—Citizens of Marin County voted to issue $3,000,000 water district bonds, which will be sold to purchase plants of North Coast Water Co. and Marin Water & Power Co.

Huntsville, Utah—D. D. McKay of Huntsville, Pres. of Ogden Valley Commercial Club, reported interested in con-

Salt Lake City, Utah.—City Comn. authorized City Engineer to prepare specifications and call for bids for dam to be built in Parley's canyon for storing flood water. When completed reservoir will hold 1,002,000,000 gals.; first unit will be 105 ft. high and 300 ft. long and will cost about $100,000. Later the height will be raised to 145 ft. and dam will be extended to a total width of 600 ft., at total cost of about $150,000. Bids will call for three types of construction, Ambursen type, multiple arch type, and plain concrete type.
struction of water works.

Albion, Idaho.—Bonds for constructing distribution system will be sold Sept. 25 by Thomas E. Harper, Village Clk.

Chatham, Ont.—City proposes to install at waterworks two electrically driven centrifugal pumps of 2,000,000 and 3,000,000 gal. capacity; estimated cost $4,000.

Galt, Ont.—Citizens reported to have voted $40,000 water works bonds.

BIDS DESIRED.

Jamestown, N. Y.—Until Sept. 23 by Bd. Water and Light Comrs., City Hall, for ten 11-in. driven wells, advertised in Engineering Record.

New York, N. Y.—Until Sept. 28 by Bd. Water Supply, Municipal Building, New York, for furnishing, delivering and installing electric operating equipment for gang-driven valves and sluice gates, at Ashokan, Kensico, Hill View, and Silver Lake reservoirs, Contract 161.

Philadelphia, Pa.—Until Sept. 30 by Dept. Pub. Wks. for turbo centrifugal pumps, Shawmont Pumping Station, stokers' equipment, and bed plate, Queen Lane Pumping Station, etc.

Tamaqua, Pa.—Until Oct. 5 by John M. Harris, Secy. Comrs. Water Wks. for constructing a reservoir on Owl Creek, Rahn Township, advertised in Engineering Record. J. H. Lance, Engr., 30 N. Franklin St., Wilkesbarre.

Washington, D. C.—Until Sept. 30 by Comrs. D. C. (Oliver P. Newman, Chmn.) for furnishing and delivering 350 low-pressure fire hydrants for use in Water Dept.

Bellville, Ohio.—Until Nov. 9 (extension of date from Sept. 14) by Glenn L. Shaffer, Village Clerk, for constructing water works, to consist of deep well pumps, gas engines, 5 miles of distributing mains and storage reservoir. Smith & Boulay Co., Engrs., Nasby Building, Toledo.

Wilberforce, Ohio—Until Oct. 1 by Bd. Trus. Combined Normal and Industrial Dept., Wilberforce University (W. A. Galloway, Pres.), for improving water system at said university, to consist of 80,000 gal. steel tank and tower; 8-in. well complete, 60 ft. deep; two steam pumps; a hot water storage heater; water softening plant, plumbing, steam fitting, water mains, etc. Richards Eng. Co., Engrs., 37½ East Long Street, Columbus.

Amboy, Ill.—Until Sept. 27 by F. A. Flack, City Clk., for constructing steel water tank, using present steel tower.

Chicago, Ill.—Until Sept. 15 by Bd. Local Improv. (Edw. J. Glackin, Secy.) for water supply pipes in portions of Stony Island, N. Mason and Lafayette Avenues, E. Eighty-fourth, E. Eighty-fifth and several other streets.
Until Sept. 16, by Bd. Pub. Wks. (W. R. Moorhouse, Comr.), for furnishing and delivering at Pipe Yard "B" South Ashland Avenue, 1500 Buffalo Boxes, 500 28-in. and 200 36-in. extensions.

Glenview, Ill.—Until Sept. 14 by Thomas A. Larecy, Village Clk., for drilling and casing an artesian well, depth approx. 1300 ft., more or less, diam. 10 to 5 in. Ætna Eng. Co., Engrs., 17 N. LaSalle St., Chicago, Ill.

Hankinson, N. D.—Until Sept. 13 at 2 p. m. by George W. Rennix, City Aud., for constructing system of water works, including wells, steel tower and tank, standard c. i. mains, together with hydrants, specials and pumping machinery.

Leslie, Ark.—J. B. McCrary Co., Atlanta, Ga., reported selected by City Comrs. to supervise construction of water works to cost $30,500. It is reported that bonds will be sold and material purchased by City Comrs. Sept. 15.

PRICES AND LETTINGS

★Indicates awarded contract.

★**Windsor, Conn.**—Contracts awarded by Water Dept. for improvements as follows; bids opened Aug. 20: Water mains, to include 12,250 ft. 12-in., 6750 ft. 6-in. Class C, c.-i. pipe, sandy loam and clay excav., lead joints in c.-i. mains, service connections, valves etc., to Anaconda Lumber, Waterbury Conn., $54,500; standpipe 50 x 150 ft., Tippett & Wood, Phillipsburg, N. J., $42,175; pumping equipment, F. H. Hayes Machine Co., Boston, Mass., $8,217.

★**Manhasset, L. I., N. Y.**—Contract reported awarded by Carle Park Water Comrs., Manhasset, to install a water system in that district, to W. G. Fritz Co., Newark, N. J., at $24,422.

★**Macon, Ga.**—Contract reported awarded by Water Comrs. for erection of 1,500,000-gal. standpipe to Schofield Iron Works of Macon, at $5,160.

★**Miamisburg, Ohio.**—Contract awarded by Bd. Pub. Affairs to W. C. Kerchner Co., Dayton, for constructing water main extensions on Bennett Street and West Side, at $9,426.

★**Wellington, Ohio.**—Contract for construction of a dam and other water works improvements at Herrick Gulch, reported awarded by Bd. of Pub. Affairs, to Gaugle & Harbaugh of Akron, at $28,000.

★**Chariton, Iowa.**—Contracts for water works improvements (bids opened Aug. 24) awarded as follows: Reservoir to Maley & Kelley, at $37,255, to J. W. Turner & Co. of Des Moines, for filter building, settling tank, and pump house, $11,000, and same company for pipe line from pump house to city, at $18,699, for filter plant equipment to Pittsburgh Filter Co., Pittsburgh, Pa., at $4,537.

★**Chariton, Iowa.**—Contracts for constructing water works. Contracts 1 to 5 awarded as follows (bids opened Aug. 24) (Engr. M. G. Hall, Centerville):

Contract 1 to Maley & Kelley, Kansas City, Mo., as follows: 5000 cu. yds. stripping soil from dam site, 25 cts.; 5000 cu. yds. place soil from spoil banks on embankment, 30 cts.; 1½ acres seeding, $50; 5,000 cu. yds. earth excav. moved embankment, 25 cts.; 25,000 board ft. tongue and grooved sheet piling, $20; 850 cu. yds. reinforced concrete in curtain wall, $15; 500 cu. yds. riprap, $2,786; gate house complete, $1,225; 200 ft. 16-in. c.-i. pipe outlet and supply pipe, $2.25, 150 ft. 12-in. intake pipes, $1.50; 400 ft. 24-in. vitr. pipe outlet pipes, $1.50; manhole A complete, $120; manhole B complete, $75; total, $18,886.

Contract 2, pump house and filter plant complete to J. W. Turner Improv. Co., Des Moines, at $11,000.

Contract 3 to Pittsburgh Filter Co., Pittsburgh, Pa., filter equipment complete liquid chlorine, $4,625; power-driven blower complete for air wash, $630; hypochlorite plant (sub. for liquid chlorine), $100.

Contract 4, engines, motors and pumps (not yet awarded).

Contract 5 to J. W. Turner Improv. Co. as follows: 9,240 ft. 10-in. Class C pipe 385 tons, per ton $25.45, 4000 ft. 10-in. Class B pipe, 127.5 tons, per ton, $26.45; 500 ft. 6-in. Class B pipe, 10.6 tons, per ton, $27.45; 5 ft. 10-in. valves, ea., $27.50; 3 ft. 4-in. valves, ea., $8; 10 valve boxes, ea., $4; [illegible] special castings, 3 cts.; 5 1-in. pepper air valves, $20; 5 hydrants, ea., $26; 12,800 ft. 10-in. pipe to lay, 45 cts.; 100 ft. 4-in. pipe to lay, 25 cts.; 5 setting hydrants, $5; total, $18,699.

★**Norfolk, Neb.** — Contract reported awarded to Elkhorn Contr. Co., Fremont, for water works extension.

★**Judith Gap, Mont.**—Contract reported awarded by Town Council for construction of water and sewer system to C. H. Kelley of Judith Gap, at $12,855.

★**West Linn, Ore.**—Contract reported awarded by City Council to J. W. Moffatt of West Linn, for constructing water works, at $15,000.

SEWERAGE AND SEWAGE DISPOSAL

PROPOSED WORK

Boston, Mass.—Bonds for $3,500,000 will be sold Sept. 15 by Dept. of Finance as follows: Leominster Tunnel, $1,750,000; drainage system, Hamilton Brook, $250,000; Ward 15 pumping station, $100,000; Roman Park improvement, $100,000; sewers, $600,000.

East Gardner, Mass.—All bids opened Aug. 1 for sewer and drainage, Room 36, State House, Boston, rejected. J. O'Meara, M. D., Comrs. for sewerage system for Gardner State Colony at East Gardner have been rejected, as all exceeded appropriation; work to be done by superintendent.

Southington, Conn.—Citizens Sept. 1 voted $35,000 bonds to complete sewer system.

Briarcliff Manor, N. Y.—Clyde Potts, 20 Church St., New York, preparing plans for sewer system, tanks and sand filters, to cost $136,000.

Port Washington, L. I., N. Y.—Surveys completed by Engineer Watson, of Great Neck, for proposed sewer system. Henry Seaman, Chmn. Sewer Comn.

Sunbury, Pa.—Plans reported approved by State Health Dept. for constructing sewers to cost $500,000.

Richmond, Va.—H. P. Beck, Comr. Administrative Bd., writes with reference to sewers in Scotts Addition, that the letting of this work is likely to be postponed until sufficient appropriations are available. If any of this work is undertaken it will be only a very small portion.

Daytona, Fla.—Council has passed ordinance providing for a sale of $150,000 bonds for construction of proposed sewer system.

Miami, Fla.—Street and Sewer bonds amounting to $100,000 sold by Council.

Austin, Tex.—City Commission considering issue of following bonds: $50,000 sewer system; $250,000 school buildings; $425,000 street and bridges.

Beaumont, Tex.—Attorney General approved following bond issues: $100,000 wharf and dock; $40,000 sewer; $85,000 permanent street improvements.

Cushing, Okla.—City will soon call election to vote $30,000 bonds for a system of main intercepting sanitary sewers. Surveys and estimates have been prepared by Benham Eng. Co., Oklahoma City, who will also supervise construction work.

Marlow, Okla.—Election soon to be held to vote on issuing $15,000 bonds for sewer system.

Weleetka, Okla.—Citizens Aug. 24 voted $37,000 bonds for construction of sanitary sewer system.

Seattle, Wash.—Council considering improvement of Block 69 Mount Baker Park by constructing sewers. A. H. Dimock, City Engr.

Reported Street & Sewer Com. of Council will hold a hearing on Oct. 11 on construction of Ballard Trunk Sewer on Shilshole Avenue.; cost, approximately $450,000.

Mountain Home, Idaho.—Village Trustees reported to have authorized Village Attorney to prepare ordinance providing for construction of a sewer system; estimated cost $12,000.

Montreal, Que.—Council has been asked to appropriate $10,000 to be used for preparation of plans for the proposed trunk sewer to cost $1,500,000 to $2,000,000.

BIDS DESIRED.

Boston, Mass.—Until Sept. 17, by Bd. Pub. Wks. (Edw. F. Murphy, Comr.), for constructing pipe sewers and drains in Lanark Rd. and Telford Street Outlet in Brighton.

Linden, N. J.—Reported desired until Sept. 20 by City Clerk for constructing sewer system in portions of Roselle, Price and Thirteenth Streets, Ziegler, Maple and Elizabeth Avenues.

Nutley, N. J.—Until Sept. 13 at 8 p. m. by Town Council for vitri. pipe sanitary sewers and storm water sewers in Park and Myrtle Aves. and Como St., in all about 7258 lin. ft. 10 to 24 in. vitri. pipe 882 lin. ft. 36 in., 775 lin. ft. 42 in. and 1730 lin. ft. 48 in. lock joint cement pipe, manholes, sidebasins, etc.

Seaside Park, N. J.—Until Sept. 24 by Boro. Council for constructing sanitary sewers and a disposal plant, advertised in Engineering Record. Remington & Vosburg, Consulting Engrs., 501 Market Street, Camden; Frank Brockway, Boro. Clk.

Betterton, Md.—Until Sept. 15 by Commissioners (A. H. Suplee, Secy.) for constructing 900 ft. 12 to 20 in. storm water drains, advertised in Engineering Record. Kastenhuber & Anderson, Engrs., Easton, Md.

Cleveland, Ohio—Until Sept. 15 by A. R. Callow, Comr. Purchases and Supplies, for constructing two reinforced concrete tanks, including approximately 1500 yds. earth excav., 400 cu. yd. concrete and appurtenances.

Medina, Ohio.—Until Sept. 15 by George L. McNeal, Village Clk., for $811 ft. pipe laying, manholes, siphons, etc., advertised in Engineering Record.

Ann Arbor, Mich.—Until Sept. 22 by Bd. Pub. Wks. for approximately 17,500 lin. ft. 8 to 12-in. sewer, 2500 lin. ft. 15 to 36-in. sewers, 1200 lin. ft. concrete culvert. Manley Osgood, City Engr.

Reed City, Mich.—Until Sept. 14 by Village Sewer Com. (M. W. Brown, Chmn.) for constructing a system of sanitary sewers about 19,500 ft. 6 to 18 in. pipe, and manholes, also reinforced concrete settling tank, and sludge filter, also for 3186 ft. 5 to 18 in. storm sewers, with inlet basins and connections. Advertised in Engineering Record. W. G. Potter, Engr., 1201 Hartford Bldg., Chicago.

Chicago, Ill.—Until Sept. 17, by Bd. Local Improv. (Edward J. Glackin, Secy.) for constructing tile pipe, and brick and tile pipe sewers with manholes and catch basins on portions of Bernice, Drake, Maynard Avenues, and other streets.

Chicago, Ill.—Until Sept. 15 by Bd. Local Improv. (Edw. J. Glackin, Secy.) for constructing drains in S. Ashland Avenue, S. Robey, W. Harrison and several other streets.

Appleton, Wis.—Reported desired until Sept. 23 by City Clerk for constructing approximately 2300 ft. 66 and 72 in. sewers of vitr. segment block or concrete in tunnel. A. C. Bemley, City Engr.

Ames, Iowa.—Until Sept. 20, by A. B. Maxwell, City Clerk, for constructing storm sewers in portions of Seventh, Eighth, Ninth and numerous other streets, in all about 20,000 ft. sewer, 60 manholes, and 170 catch basins; also 10,527 ft. vitl. clay, pipe sewers 8 to 12-in., 22 manholes and 17 flush tanks, in Graber, Cessna, and several other streets.

Lyle, Minn.—Until Sept. 27 by Village Council for constructing 12,246 ft. of 8 to 15-in. sewers in portions of Fourth, Elm, Pine and other streets. G. A. Martin, Village Recorder.

Richfield, Utah—Until Sept. 17 by A. H. Bean, City Recorder, for constructing sewer and drainage systems and septic tank. Brown & Kleinschmidt, Engrs., Dooly Block, Salt Lake City.

Toronto, Ont.—Reported desired until Sept. 14 by the Mayor, Chmn. Bd. Control, for constructing sewers in portions of Weston Road, Cairns and Pullman Avenues and several other streets.

PRICES AND LETTINGS.

★Indicates awarded contract.

Rochester, N. H.—Lowest bid opened Aug. 31 by Water and Sewer Com. (F. Hussey, Clk.) for constructing sewers submitted by C. W. Fass Co. at following bid: 15-in. pipe sewers, 73 cts. per ft.; 12-in., 83 cts.; 10-in., 69 cts.; 8-in., 59 cts.; 6-in., 39 cts.; 15-in. c. i. pipe, $3.63; manholes and catchbasins, ea., $35; rock excav., $3 per cu. yd.; total, $8,254.

Long Island City, L. I., N. Y.—Following are totals of 4 lowest bids opened Sept. 1 by Maurice E. Connolly, Pres. borough of Queens, for construction of sewer in Perry and Maurice Avenues, Second Ward: William Stanton, $78,837; Joseph L. Segretto, $83,000; Murphy Bros., $83,956; Leo. E. Kelly, $84,056.

Unit prices of William Stanton, lowest bidder:

653 lin. ft. 8 ft. x 7 ft. double-barrel reinforced concrete sewer, including spurs	$48.50
963 lin. ft. 11 ft. x 7 ft. reinforced concrete sewer, including spurs	35.50
11 manholes	40.00
1 increasing chamber at Betts Avenue and Perry Avenue, complete	350.00
1 junction chamber at Maurice Avenue and Perry Avenue, complete	600.00
1 single receiving basin at Clark Avenue and Perry Avenue, complete	100.00
61,000 lin. ft. wooden piles, below caps, furnished, driven and cut off	0.01
10 M ft. timber for sheeting and bracing	25.00
115 M ft. timber for foundation	30.00
16,000 lb. structural steel, including bolts, washers, nuts, etc	0.04
3,000 lb. reinforcing steel, not shown on plan	0.02
100 cu. yd. Class A concrete	4.00
2,600 cu. yd. excav. for sewer embankment	0.40
11,000 cu. yd. displaced material for sewer embankment	0.35
3,000 lin. ft. fence	0.30
60 lin. ft. 18-in. Nestable corrugated culvert pipe	1.50
100 lin. ft. 24-in. Nestable corrugated culvert pipe	2.00

Long Island City, L. I., N. Y.—Following are 4 lowest bids opened Sept. 1 by Maurice E. Connolly, Pres. borough of Queens, for construction of a dry weather flow sewer in Maspeth Avenue and Rust Street and a storm water sewer from Rust Street to Creek Street, in the easement to be acquired by the city of New York, and a combined sewer in Clark Avenue, Second Word: (a) Kingsbridge Contr. Co., 30 E. Forty-second Street, New York, $81,542; (b) J. F. Cogan Co., 233 Broadway, New York, $105,748; (c) Ward & Tully, West Twentieth Street, Brooklyn, $105,771; (d) United States Drainage & Irrigation Co., 17 Battery Place, New York, $106,914.

		(a)	(b)	(c)	(d)
193	lin. ft. 8-ft. x 7-ft. double-barrel reinforced concrete sewer, not including foundation piling under railroad bridge over Maspeth Creek	$40.00	$75.00	$37.35	$72.00
154	lin. ft. 24-in. c.-i. pipe drain, including reinforced concrete cradle, not including foundation piling under railroad bridge over Maspeth Creek	12.00	6.00	16.80	7.00
103	lin. ft. 24-in. vitr. salt-glazed pipe drain, including reinforced concrete cradle	6.00	3.50	6.75	6.00
1,150	lin. ft. 3-ft. 9-in. reinforced concrete sewer, including spurs, underpinning and piling under Long Island R.R. tracks in Maspeth Avenue	16.00	16.00	21.70	17.50
1,040	lin. ft. 4-ft. reinforced concrete sewer, including spurs	15.00	15.00	14.80	13.00
1,040	lin. ft. 4-ft. 9-in. reinforced concrete sewer, including spurs	17.00	16.00	21.40	13.00
218	lin. ft. 5-ft. reinforced concrete sewer, including spurs	18.00	20.00	26.30	15.00
30	manholes	50.00	55.00	60.00	45.00
1	breast wall and concrete apron on 24-in. pipe drain	150.00	50.00	20.00	50.00
1	junction chamber at Rust Street and Clark Avenue	3,000.00	3,500.00	1,000.00	7,000.00
131	lin. ft. of risers for house connections, including Y's	2.00	1.50	0.50	2.00
100	M ft. timber for sheeting and bracing	1.00	0.01	1.00	10.00
79	M ft. timber for foundation	25.00	20.00	40.00	40.00
54,000	lin. ft. wooden piling, below caps	0.01	0.20	0.25	0.29
750	lin. ft. sectional steel piles, Hercules or equivalent, below caps	2.50	6.00	2.00	3.50
25,000	lb. structural steel, including bolts, nuts, washers, spikes, etc	0.04	0.03	0.03	0.06
24	lin. ft. 10-in. c.-i. pipe (57 lb. per lin. ft.), furnished and laid	2.50	1.70	2.00	5.00
4,100	lin. ft. of fence	0.50	0.30	0.25	0.70
110	cu. yd. riprap	2.00	2.00	3.50	2.00
11,000	cu. yd. fill for sewer embankment	0.10	0.80	0.20	0.30
50	cu. yd. mud, excav. and removed	4.00	1.00	2.00	3.00
200	cu. yd. Class A concrete	8.00	7.50	6.00	7.50
3,000	lb. reinforcing steel	0.04	0.04	0.03	0.04

Long Island City, L. I., N. Y.—Following are 4 lowest bids opened Sept. 1 by Maurice E. Connolly, Pres. borough of Queens, for construction of sewer and appurtenances in Rust Street, from Clark Avenue to Grand Street, from Rust Street to Clermont Avenue, Second Ward: (a) Clancy & Van Alst, $73,656; (b) Joseph L. Sigretto, $74,070; (c) Ward & Tully, $77,754; (d) Murphy Bros., $78,775.

		(a)	(b)	(c)	(d)
1,931	lin. ft. 7-ft. 6-in. x 7-ft. reinforced concrete sewer	$28.29	$21.90	$25.00	$26.20
238	lin. ft. 3-ft. 6-in. circular concrete sewer	6.20	7.10	8.70	7.00
643	lin. ft. 3-ft. circular concrete sewer	5.10	6.20	8.25	6.50
107	lin. ft. 18-in. vitr. salt-glazed pipe sewer	2.70	2.20	4.35	1.75
21	lin. ft. 15-in. vitr. salt-glazed pipe sewer	2.10	2.20	5.00	1.25
1,083	lin. ft. 12-in. vitr. salt-glazed pipe sewer	2.00	1.90	3.45	1.45
28	manholes, complete	56.00	50.00	40.00	40.00
1	cleaning shaft, complete	200.00	100.00	100.00	150.00
1	junction chamber at Charles Street and Rust Street, complete	132.00	200.00	200.00	350.00
1	junction chamber at Grand Street and Rust Street, complete	250.00	200.00	250.00	450.00
9	single receiving basins, complete	120.00	145.00	100.00	100.00
1	double receiving basin, complete	190.00	145.00	200.00	180.00
390	lin. ft. 12-in. vitr. salt-glazed pipe for basin connections	1.00	0.90	125.00	1.00
20	lin. ft. 10-in. vitr. salt-glazed pipe for basin connections	1.00	0.90	1.00	0.75
3	relief drains on L. I. R.R. drains, complete	57.00	35.00	70.00	40.00
16,400	lin. ft. wooden piles, below caps, furnished, driven and cut off	0.25	0.25	0.25	0.25
4,750	lin. ft. reinforced concrete piles, below caps	...	2.00	1.25	2.00
101	M ft. timber for sheeting and bracing	...	30.00	1.00	0.01
55	M ft. timber for foundation	30.00	30.00	40.00	30.00
7,500	lb. structural steel, including bolts, nuts, washers, etc	0.045	0.03	0.03	0.03
396	lin. ft. 6-in. vitr. salt-glazed pipe for house connection drains	0.90	0.60	0.75	0.60
111	6-in. spurs, 24 in. long, on concrete sewers	0.50	0.30	0.60	0.30
2	6-in. spurs on 18-in. vitr. salt-glazed pipe sewer	2.00	1.16	1.10	0.75
63	6-in. spurs on 12-in. vitr. salt-glazed pipe sewer	1.00	0.50	0.60	0.50
1,300	cu. yd. excav. for sewer embankment	0.40	0.35	0.60	0.40
400	cu. yd. displaced material for sewer embankment	0.35	0.25	0.20	0.40
3,000	lb. reinforcing steel	0.03	0.03	0.03	0.025
50	cu. yd. Class A concrete	7.50	6.00	6.00	5.00
300	lin. ft. fence	0.25	0.30	0.25	0.30

★**Philadelphia, Pa.**—Contract for constructing sewer in Broad Street from Sixty-eighth to Sixty-ninth Streets awarded R. P. Bennis Constr. Co., Philadelphia, at $18,500.

Sellersville, Pa.—Following are totals of 4 lowest bids opened Aug. 30 for constructing sanitary sewer system, from plans of Bascom & Sieger of Allentown: Dwyer & Co., 1524 Chestnut Street, Philadelphia, Pa., $20,621; Cantrell Constr. Co., Twenty-first and Sedgley Avenues, Philadelphia, $25,971; G. W. Ensign, Inc., Room 18, Harrisburg National Bank Building, Harrisburg, $26,698; Antonio Celentino, 509 Bridge Street, Trenton, N. J., $27,832.

Unit prices of Dwyer & Co., lowest bidder:

11,035 ft. 8-in. sewer, not over 6 ft. deep	$0.47
8,895 ft. 8-in. sewer, between 6 and 8 ft. deep	0.55
753 ft. 8-in. sewer, between 8 and 10 ft. deep	0.97
492 ft. 10-in. sewer, between 6 and 8 ft. deep	0.59
366 ft. 10-in. sewer, between 8 and 10 ft. deep	0.77
250 ft. 12-in. sewer, not over 6 ft. deep	0.45
185 ft. 12-in. sewer, between 6 and 8 ft. deep	0.65
260 ft. 12-in. sewer, between 8 and 10 ft. deep	1.03
220 ft. 12-in. sewer, between 10 and 12 ft. deep	1.89
35 manholes, not over 6 ft. deep	30.00
12 manholes, between 6 and 8 ft. deep	32.00
5 manholes, between 8 and 10 ft. deep	40.00
1 manhole, between 10 and 12 ft. deep	50.00
20 lampholes (Type A), not over 6 ft. deep	16.00
10 lampholes (Type A), between 6 and 8 ft. deep	20.00
1 lamphole (Type A), between 8 and 10 ft. deep	25.00
Lampholes (Type A), between 10 and 12 ft. deep	27.00
Lampholes (Type B), not over 6 ft. deep	7.00
Lampholes (Type B), between 6 and 8 ft. deep	8.00
Lampholes (Type B), between 8 and 10 ft. deep	9.00
Lampholes (Type B), between 10 and 12 ft. deep	9.00
450 4-in Y branches and plugs	0.40
6-in. Y branches and plugs	0.50
Inverted siphon complete	1,400.00
1,300 cu. yd. rock excavation, not over 6 ft. deep	1.10
1,400 cu. yd. rock excavation, between 6 and 8 ft. deep	1.65
250 cu. yd. rock excavation, between 8 and 10 ft. deep	2.50
50 cu. yd. rock excavation, between 10 and 12 ft. deep	3.00

★**Asheville, N. C.**—Contract reported awarded to Reed & Wells of Asheville for constructing 2 miles of sewer and 2 miles of sidewalks and to grade Main Street, at about $20,000.

★**Cleveland, Ohio**—Contract awarded by Bd. of Control to Brookside Constr. Co. for sewer in Bessemer Avenue S. E. (East Sixty-fifth Street, East Seventy-fifth Street) at $17,529; and to Manson Co. for sewer in East Sixty-fifth Street (Euclid Avenue, Hough Avenue N. E.) Plan B at $67,272 (bids opened Aug. 19).

★**Chanute, Kan.**—Contract for constructing sewage disposal plant and septic tank awarded to Southern Contr. Co., Wichita, at $23,917. Other bids: W. W. Cook, Junction City, $25,489; J. W. Pratt, Chanute, $24,297; Perry Taylor, Chanute, $25,262. C. G. Wood, City Clk.

★**Crofton, Neb.**—Contract awarded by Village Trustees to Schreiber & Peterson, Bee Building, Omaha, for constructing sanitary sewers at following bid: 1881 ft. 12-in. sewer, 52 cts.; 8114 ft. 8-in., 40 cts.; 1535 ft. 6-in. tile subdrain, 13 cts.; disposal plant, $1,350; total $6,553. Engineer, J. D. C. Smith, Hartington, Neb.

★**Norfolk, Neb.**—Contract reported awarded to Norfolk Bridge & Constr. Co., Norfolk, for constructing storm sewers, at about $15,000.

BRIDGES

PROPOSED WORK

Holyoke, Mass.—City Engineer authorized by Bd. Pub. Wks. to prepare plans for bridge to be constructed to replace foot bridge at foot of Dwight Street Hill. Probably a concrete bridge will be constructed.

Springfield, Mass.—John L. Bates, Brookline, Joseph H. O'Neill, Boston, and Joseph R. Worcester, Waltham, were appointed to serve as commissioners for erection of Springfield-West Springfield Bridge.

Woonsocket, R. I.—Bd. Aldermen approved plans of Frank H. Mills, City Engr. for constructing 3 bridges, one over Blackstone River at Fairmount Street, one over trench at the Hamlet, and another over Blackstone River at the Hamlet.

Fort Edward, N. Y.—Concrete Steel Eng. Co., Park Row Building, New York, engaged to prepare plans for a concrete-steel arch bridge over Hudson River at Fort Edward. Date for receiving bids not yet decided upon.

Newark, N. J.—Contract about to be let by the Public Service Co., Newark, for construction of a steel viaduct about 500 ft. long over Central R.R. tracks, in connection with its Carteret and Chrome extension.

Petersburg, Va.—Reported Council is considering overhead bridge to replace Bishop Bridge connecting Petersburg with Chesterfield County, probably concrete construction. Probable cost $120,000.

Hinton, W. Va.—See "Paving and Roads."

Covington, Ky.—George Hornung, Wool Sack Building, Newport, preparing specifications for a bridge over Licking River, as an alternative plan for carrying the supply main into city of Covington.

Peoria, Ill.—Reported steps being taken to construct a viaduct at S. Adams Street. Frank Funk, Chmn. Public Utilities Comn., may be able to give further information.

Leavenworth, Kan.—Contracts soon to be let by Co. Comrs. for constructing 26 bridges recently washed away by heavy rains. W. V. Thomas, Co. Engr.

Llano, Tex.—Citizens Aug. 24 voted $34,000 bonds to construct 4 concrete bridges. Three bridges are to be built at once, one across Llano River about 700 ft., one over Creek about 400 or 500 ft., and the other across creek 250 ft. long. Louis H. Bruhl, Co. Judge. Engineer, James Powers, Dallas.

Santa Barbara, Cal.—Citizens Santa Barbara County voted $350,000 bonds for constructing bridges along State Highways.

Ventura, Cal.—Charles W. Petit, Co. Engr., writes the proposed Casitas bridge over Ventura River, at Foster Park, will be of combination wood and steel 200 ft. long and 20 ft. wide, to be constructed on present foundation; cost, $8,000.

BIDS DESIRED.

Media, Pa.—Until Sept. 13 by County Comrs., Media, for constructing reinforced concrete bridge on Michigan Ave., Riley Township.

Pottsville, Pa.—Until Sept. 15, by J. E. Kantner, County Controller, for constructing Bridge No. 28, steel and concrete over Swatara Creek: No. 77, plate girder bridge with concrete floor over Mahony Creek; No. 78, concrete and steel over Mahony Creek, and repairing bridge No. 90 over Schuylkill River.

Cleveland, Ohio.—Until Sept. 22 by Bd. Co. Comrs. (E. G. Krause, Clk.) for constructing concrete bridge per report 3576. W. A. Stinchcomb, Co. Surv.

Hamilton, Ohio.—According to local press reports, a resolution has been passed by Council authorizing withdrawing of call for bids to have been opened Sept. 13 for constructing bridge over Miami River at Chestnut Street.

Massillon, Ohio.—Until Sept. 24 by Bd. County Comrs. for reconstructing new floor system Cherry Street bridge; work to consist of 31,007 lb. steel beams, channel plates and clips, painting, etc.

St. Clairsville, Ohio.—Until Sept. 20, by Emerson Campbell, Co. Aud., for furnishing material and constructing steel truss bridge with concrete abutments on Glenns Run, Pease Township, and reinforced concrete culvert on Barnesville and Somerton Roads, Somerset Township.

Youngstown, Ohio.—Until Sept. 14 by Director Pub. Service (H. C. Fox, Clk.) for furnishing material and constructing steel bridge at Fredericksburg; also moving and erecting old Carson Bridge at Shillings Mill; both over Mahoning River, Mifflin Township.

Illinois.—By State Highway Comn., Springfield (William W. Marr, Ch. State Engr.), for constructing bridges as follows:

Until Sept. 15 at bridge site, Pilot Knob Township, for Locust Branch Bridge, reinforced concrete girder, 35-ft. span, 18-ft. roadway; cost $1,780. J. A. Davenport, Jr., Co. Supt. Highways, Nashville.

Until Sept. 17, at Benton, for constructing bridges as follows:

★Dunn Prairie Bridge, Ewing Township reinforced concrete or steel 55-ft. span. Cost of concrete bridge $2125; steel bridge, $2,000; Dillon Bridge, between Benton and Eastern Townships, steel, 70-ft. span; cost, $2,980. Sneakout Bridge, Cave Township, reinforced concrete or steel, 50-ft. span; cost of concrete bridge, $2,160; steel bridge, $1,930. Dial Bridge, between Six-Mile and Tyron Townships, reinforced concrete, 30-ft. span; cost, $900. All bridges to have reinforced concrete abutments. George F. Hampton, Co. Supt. Highways, Benton.

Mankato, Minn.—About Oct. 1 by City Clerk for constructing concrete bridge on concrete foundation across Minnesota River at Main Street, to have five 100-ft. spans; cost $70,000. H. F. Blomquist, City Engr.

Elkhart, Kan.—Until Sept. 13 by Taloga Township Trustees, for constructing Point of Rocks Bridge across Cimarron River, a low water bridge, to consist of forty-one 14-ft. spans, 16 ft. roadway, reinforced concrete slabs on forty-two concrete piers. Estimated cost, $8,000. W. S. Gerhart, State Highway Engr., Topeka.

Tekamah, Neb.—Reported desired until Sept. 18 by Bd. Directors Burt Washington Drainage Dist. (S. S. Breckenridge, Secy.) for constructing seven 100-ft. steel bridges and other smaller bridges. Towl Eng. Co., Drainage Engrs., 1122 City National Bank Building, Omaha.

Kansas City, Mo.—See "Paving and Roadmaking."

Columbus, Ont.—Reported desired until noon Sept. 13 by William Purves, Clk., East Whitby Township, Columbus, for constructing nine bridges (reinforced concrete and steel) in East Whitby Township.

PRICES AND LETTINGS.

★*Indicates awarded contract.*

Maine.—Lowest bid opened by State Highway Comn., Augusta, for constructing Milo concrete bridge submitted by Cyr Bros., Waterville, at $4,900.

Buffalo, N. Y.—Following bids opened by Common Council for re-constructing Chicago Street Viaduct: (Bids opened Sept. 3) (a) complete in 6 months' time, and (b) in 9 months, Lackawanna Bridge Co., Buffalo (a) $211,000, (b) $209,500; Lupfer & Remick, Buffalo (a) $198,500, (b) $197,500; American Bridge Co., Buffalo (a) $204,500 and (b), $202,900 Strobel Steel Constr. Co., Chicago, Ill. (a) $184,700 and (b) $183,000.

★**Greenwich, N. Y.**—Contract awarded N. R. Porterfield, 17 Battery Place, New York, for building 3 concrete-steel arch bridges over Battenkill River, between Greenwich and Easton. Contract price $41,000. Plans and supervision furnished by Concrete Steel Eng. Co. Park Row Bldg., New York.

★**Trenton, N. J.**—Contract for constructing concrete bridge over Sanhican Creek at Willow Street awarded by Bd. Freeholders to Whittaker & Diehl at $8,176. Next three lowest bidders: F. W. Schwiers, Jr., Co., $8,300; Foster Constr. Co., $8,873; Reese Taylor Co., $9,018.

Philadelphia, Pa.—Contracts for constructing bridge on line of Holme Avenue over Pennypacker Creek awarded by City to McNichol Paving & Constr. Co., 1723 Cherry St., at $72,000.

★**Wilson, N. C.**—Lawrence Brett, Engr., Drainage Comrs., Mattamuskeet Drainage Dist., writes contract for single leaf plate girder highway Scherzer rolling lift bridge with clear opening of 40-ft. bridge to be built over outfall canal (bids opened Aug. 28) has been awarded to Champion Bridge Co., Wilmington, Ohio.

★**Delaware, Ohio.**—Contracts for constructing bridge over Olentangy River at Winter Street awarded by County Comrs. as follows: sub-structure to Fitz-Rumer-Cooke-Grant Co., Columbus, at $7,223 for furnishing iron for superstructure to Delaware Bridge Co., Delaware, at $2.75 per 100 lb. and for cretone block floor to Elkhart Bridge Co., Elkhart, Ind., at $1.75 per sq. yd.

★**Mount Gilead, Ohio.**—Contract awarded by County Comrs. for constructing Beatty Bridge to E. M. Scully of Columbus (bids opened Aug. 20). C. O. Higgins, Co. Aud.

★**New Philadelphia, Ohio.**—Contract awarded Sept. 1 to Massillon Bridge & Structural Co., Massillon, for a 100-ft. span steel bridge to be constructed over Sugar Creek. Bridge to be paved with wooden block. Edw. Stingel, Co. Engr.

★**Warren, Ohio.**—Contract for constructing a concrete bridge over Mahoning River at Summit Street reported awarded Hackedorn Contr. Co., Indianapolis, Ind., at $29,308.

Detroit, Mich.—Lowest bid opened Sept. 2 by Bd. Pub. Wks. for constructing temporary bridge to replace Belle Isle bridge reported submitted by Bohland Structural Steel Co., Detroit, at $43,075.

★**Grand Rapids, Mich.**—Contract for constructing concrete bridge over Grand Trunk tracks at College Avenue, N. E. awarded by Bd. Public Works to D. W. Boyes, at $16,051.

★**Joliet, Ill.**—Contract awarded by Chicago, Ottawa & Peoria R. R. Co. (W. F. Carr, Engr., Ottawa) to Joliet Bridge & Iron Co., Joliet, to construct two bridges, one bridge to be five-span deck girder, 34 ft. 8 in., over Buscan Creek, the other bridge a two-span deck girder, concrete floor, with 24-ft. roadway, for highway and railway, over Little Vermillion River.

Green Bay, Wis.—Following are 4 lowest bids opened Aug. 30 for constructing a Strauss Bascule Bridge over East River at Main St.: Grelling Bros., Green Bay, $56,815; Adolph Green, Green Bay, $58,400; Worden Allen, Milwaukee, $58,500; Selmscarey, St. Paul, Minn., $65,900. A. Braun, City Engr.

★**Altus, Okla.**—Contract for constructing 390-ft. steel bridge over Salt Fork near Altus awarded by County Comrs. to Kansas City Constr. Co., Kansas City, Mo., at $8,400.

★**Oklahoma City, Okla.**—Contract for constructing bridge over South Canadian River, for city and South Canadian Territory, awarded to Baker Mfg. Co., Sweetwater, Tex., at $30,000.

★**Tulsa, Okla.**—Contract awarded Aug. 26, for constructing bridge over Arkansas River at Tulsa to Missouri Valley Bridge & Iron Co., Leavenworth, Kan., at $157,986. Next three lowest bids: Joseph Lantry, Tulsa, $164,422; Winston Bros., Minneapolis, Minn., $165,984; H. C. Gass, Fort Worth, Tex., $185,297. Engineers, Harrington, Howard & Ash, Kansas City, Mo.

★**Silver City, N. M.**—Contract awarded by County Aug. 28 for constructing a 112-ft. steel bridge over Gila River near Fort West to El Paso Bridge & Iron Co., El Paso, Tex., at $15,747. Other bids: Levy Constr. Co., Denver, Col., $16,960, and Midland Bridge Co., Kansas City, Mo., $16,974. E. B. Venable, Co. Clk.

★**Grants Pass, Ore.**—Contract awarded Aug. 26 for constructing bridge across Sucker Creek (concrete piers and abutments) to A. J. Green of Grants Pass at $2,240. E. L. Coburn, Co. Clk.

★**Visalia, Cal.**—Contract for constructing first 400-ft. span of King River Bridge awarded by Bd. Supervs. to Johnson Bros., Kingsbury, at $15,680.

★**Ventura, Cal.**—Contract awarded Aug. 25 by County Bd. Supervisors, to A. Pefley, Ventura, at $4,700, for constructing south abutment and approach to Saticoy Bridge, Saticoy, requiring approximately 11,500 cu. yd. embankment, 500 cu. yd. concrete in abutment, 19,100 lb. reinforcing steel in abutment, etc. J. R. McCloskey, Co. Clk.

Ottawa, Ont.—Following are four lowest bids opened Aug. 27 by Bd. Control for constructing substructure and piers of Ottawa East Bridge over canal at Pretoria Avenue: Doran & Devlin, Ottawa, $26,794; Thomas McLaughlin, Ottawa, $27,191; R. Brewder, Ottawa, $28,059, and T. L. McBain, Montreal, $31,131.

★**Ottawa, Ont.**—Contract awarded by city to R. Brewder, 217 Lyon Street, for constructing substructure of Pretoria Avenue bridge (bids opened Aug. 26).

★**Alberta, Man.**—Contract for constructing bridge over Smoky River for Edmonton Duvegan & British Columbia Ry. awarded Dominion Bridge Co., Ltd., Winnipeg. Bridge is to consist of two 85-ft. deck plate girder approach spans, six 128-ft. deck truss spans, as well as one 125-ft. through truss span. About 1100 tons of steel required.

PAVING AND ROADS

PROPOSED WORK

Boston, Mass.—See "Sewerage and Sewage Disposal."

Baltimore, Md.—John L. Sanford, Acting Pres. for Comrs. for Opening Streets, submitted to Bd. Estimate cost for grading and paving Ellicott Driveway from Frederick Avenue to Franklin Road, at $69,100.

Hinton, W. Va.—Citizens Talcott and Greenbrier Dists. voted $250,000 bonds for constructing roads and bridges in said districts.

Parkersburg, W. Va.—Paving bonds amounting to $200,000 sold.

Pineville, W. Va.—Citizens voted $550,000 bonds for constructing roads in Wyoming County.

Newbern, N. C.—Craven County Bd. Comrs. voted to spend $100,000 for constructing 20 miles county gravel roads coated with tarvia.

Miami, Fla.—See "Sewerage and Sewage Disposal."

St. Petersburg, Fla.—Citizens voted $715,000 bonds for constructing 78 miles of brick highways.

Tallahassee, Fla.—Election soon to be held by county to vote $200,000 bonds for road improvements.

Winnfield, La.—Citizens voted $50,000 bonds for construction of and maintenance of good roads.

Louisville, Ky.—Contracts soon to be let by Bd. Pub. Wks. for street work involving about $75,000 including portions of Main, Fifteenth, Eighteenth, Kentucky and other streets.

Lisbon, Ohio—About $194,000 bonds sold for road improvements in Columbiana County.

Madison, Ind.—City will soon let contract for paving about ¾ mile of street. John W. Moore, Engr., 607 Merchants Bank Bldg., Indianapolis.

Chicago, Ill.—The International Paved Way Assoc. reported formed for the purpose of promoting an automobile highway from the Mexican to the Canadian border, about 2200 miles long, paved with concrete or brick, and cost $20,000,000.

Illinois.—Governor Dunne of Springfield, to confer with committee from Centralia Commercial Assoc., on question of issuing $10,000,000 bonds to construct concrete roads in Illinois. Centralia Assoc. has asked the Springfield Commercial Assoc. to co-operate in the movement. Proposed road to be 1000 miles long, running through center of the state, north and south, with two laterals across State.

Minneapolis, Minn.—See "Street Cleaning and Garbage Disposal."

Kansas.—Plans and estimates prepared by W. S. Gearhart, State Highway Engr., for street improvements as follows:

Altoona—City contemplating construction of 6400 ft. reinforcement curb and gutter. Paving probably later on.

St. Marys—City contemplating construction of 15,000 ft. combination curb and gutter. Paving probably later on.

Jewell City—Survey made for street improvements.

Plains—Survey made for street improvements.

Maryville, Mo.—Citizens Aug. 24 voted $30,000 bonds for constructing county roads. Fred J. Yeomans, Co. Clk.

Austin, Tex.—See "Sewerage and Sewage Disposal."

Beaumont, Tex.—See "Sewerage and Sewage Disposal."

Clarksville, Tex.—Bonds for $100,000 to construct and maintain gravel, macadamized or paved roads and turnpikes in Road Dist. No. 1 will be sold Sept. 28 by George Morrison, Chmn. Road Comrs.

Hondo, Tex.—Bonds for $40,000 Road Dist. No. 2 will be sold Sept. 13 by R. J. Norman, Co. Judge.

Port Lavaca, Tex.—Bonds for $17,000 will be sold Sept. 22 for street improvements. Address A. A. Ames, City Clk.

Victoria, Tex.—Bridge and paving bonds amounting to $250,000 have been approved by State Attorney General.

Oklahoma City, Okla.—About $140,000 is to be spent by county for road improvements.

Anacortes, Wash.—Reported City Council will soon let contract for paving Commercial Avenue in connection with county road. City Engineer estimates cost of paving with asphalt $12,526 or with 2-course concrete $11,522.

Everett, Wash.—All bids for paving Rucker Avenue with concrete reported rejected and new bids will be called for. Bennett & Morgan, Everett, lowest bidder, at $28,921. Louis Lesh, City Clk.

Hoquiam, Wash.—City Comrs. passed a resolution providing for paving, curbing and guttering of Simpson Avenue with either wood block, or brick, bitulithic, asphalt, asphaltic concrete or concrete at a cost of $47,672.

Seattle, Wash.—City Council authorized improvement of Fifty-first Avenue and other streets by grading, at an estimated cost of $54,394.

Street and Sewer Com. of Council approved $154,000 for paving Stone Avenue [illegible] improvement of Thirty-second Avenue N. E.

A. H. Dimock, City Engr., submitted to Bd. Public Wks. estimates of cost for paving streets as follows: Forty-seventh Avenue N. E., $27,562; First Avenue, $20,539, and for grade and concrete curbs on Eddie Terrace at $16,676.

Contract about to be let by Bd. Pub. Wks. for paving as follows: Warren and Summit Avenues resurfacing with asphalt Harrison Street and construct concrete sidewalks on First and Seventeenth Avenues.

Walla Walla, Wash.—Council passed resolution providing for paving of South Second street from end of present pavement to the city limits, cost $12,000.

Pomona, Cal.—Council reported to be considering street and park improvements costing $50,000.

Salt Lake City, Utah.—Co. Comrs. have decided to construct a concrete highway on State Street from the southern limits of the city to Murray city line.

Burley, Idaho.—John Stoddard, Albert Jaeger and Dick Anderson, all of Burley, were appointed as commissioners for road improvements in Burley Highway Dist., estimated cost $35,000.

BIDS DESIRED.

Boston, Mass.—Until Sept. 16, by Bd. Pub. Wks. (Edward F. Murphy, Comr.), for paving with bitulithic in Montebello Road, West Roxbury.

Brooklyn, N. Y.—Until Sept. 15 by L. H. Reynolds, Boro. Pres., for improving portions of Allenwood Road [illegible], E. Sixteenth, Broadway and other streets, in all about 22,542 sq. yd. asphalt, and 4186 sq. yd. wood block pavement; 12,146 cu. yd. excav.; 31,700 sq. ft. sidewalks, etc.

Buffalo, N. Y.—Until Sept. 16, by Dept. Pub. Wks. (George H. Norton, Acting Comr.), for paving portions of Spaulding and Jersey streets, E. Woodlawn, Prontenac, and Lynchurst Avenues.

Glens Falls, N. Y.—Until Sept. 15 by Lucius F. Goodman, City Clk., for laying approximately 1,500 sq. yds. concrete pavement, 600 lin. ft. curb and gutter. Engineering Record, E. Wilbur Smith, City Engr.

New York, N. Y.—Until Sept. 15 by Marshall M. Block, Boro. Pres., for regulating and repaving portions of E. Forty-fourth, E. Sixty-second, E. Sixty-sixth, W. Eighty-fourth streets and Haven Avenue, in all about 73,000 sq. yd. sheet asphalt, with all necessary curbs, manholes, etc.

Walden, N. Y.—Until Sept. 15 by Village Clk., for 1400 sq. yds. concrete street paving and 1600 sq. ft. concrete sidewalks. Advertisement in Engineering Record. F. W. Tupper, Village Engr.

Elizabeth, N. J.—Reported desired until Sept. 13 for constructing 4 miles amiesite road. J. L. Bauer, Co. Engr.

Madison, N. J.—Until Sept. 13 by Borough Street Com. (J. E. Pierson, Chmn.) for 3000 sq. yds. paving on Waverly Pl.; bids on amiesite, warrenite and Morris County Hydraulic Stone Co.'s block will be considered.

Montvale, N. J.—Until Sept. 17, by J. Ernest Thier, Mayor, and Council, at School No. 2, Montvale, for improving Magnolia and Grand Avenues, about 3000 sq. yd. asphalt macadam, 5000 sq. ft. concrete gutter. H. G. Hering, Jr., Boro. Engr., Hillsdale, N. J.

Pittsburgh, Pa.—Until Sept. 14 by Bd. Pub. Wks. (Robt. Swan, Dir.) for grading, curbing and paving Saline, Kathleen and Melvin Sts., repaving Hazlewood and Greenfield Aves., paving roadway and sidewalks and grading temporary roadway at North abutment of Sylvan Ave. Bridge.

Paving—Baltimore, Md.—Until Sept. 15, by Bd. Awards (John Hubert, Acting Pres.), for furnishing, erecting and laying complete waterproofing and paving deck of Broadway Pier, Thames Street. O. F. Lackey, Harbor Engr.

New Orleans, La.—Until Sept. 21 by Dept. Pub. Finances (A. G. Ricks, Comr.) for erecting an asphalt plant at Perdido and Genois Streets.

Greenup, Ky.—Until Sept. 13 for traction engine with roller combined; a road grader and scrapers. Address J. G. Prichard, Clk.

Louisville, Ky.—Until Sept. 15 by Bd. Pub. Wks. (Roger C. McGrath, Secy.), for paving portions of Thirty-second, Dupuy, Preston, Brooks and other streets. Samples of vitri. block, wood block and granite blocks must be submitted with bid.

Marion, O.—Until Sept. 17 by Co. Comrs. (V. Perle Garfield, Clk.) for resurfacing with stone macadam about 4½ miles Morral Pike, and about 18,020 lin. ft. on Williamack Pike, including 97 lin. ft. bridge floor; also scarifying and resurfacing Marion and Agosta Pike.

Xenia, Ohio.—Until Sept. 17 by County Comrs. (George W. Kendall, Clk.) for reconstructing floor systems and laying thereon, cresote or other type of block floor, on bridge over Shawnee River, West Second Street, Xenia City, 1657 sq. ft., and on bridge over Caesar Creek, Caesar Creek Township, 2080 sq. ft.

Chicago, Ill.—Also until Sept. 15 by Bd. Local Improv. (Edw. J. Glackin, Secy.), for grading, curbing and paving portions of N. Leamington, S. Campbell and Lowe Avenues, W. Forty-fourth, West Sixty-fourth and a number of other streets. Bids desired on granite asphaltic concrete, asphalt, Portland cement concrete and vitr. brick pavement.

Illinois.—Until Sept. 16 by State Highway Comn., Springfield (William W. Marr, Ch. State Engr.), for State Aid work as follows: Kane Co., nearest post office Algonquin, Section F, earth road, 3390.4 ft., cost $8,704 (cement to be furnished by contractor); Kane Co., South Elgin, Section G, concrete road, 7400 ft. long, cost $14,146; Piat Co., Monticello, Section B, brick road, 16,200 ft., cost $22,559. All cement to be furnished by State except as noted.

St. Charles, Ill.—Until Sept. 20 by Bd. Local Improv. for improving East and West Main Sts. and parts of connecting streets, advertised in Engineering Record. John W. Wilson, Engr. of Bd.

St. Paul, Minn.—Reported desired until Sept. 13 by August Hohenstein, Purchasing Agent, for repairing University Ave., requiring 22,775 sq. yds. 2½ in. long leaf yellow pine creosoted blocks, etc.; also paving Linwood Ave., grading, repairing and macadamizing Wheelock Pkwy.

Cherryvale, Kan.—Until Sept. 14 by F. C. Barber, City Clk., for paving Liberty Street with vertical fiber block, on cinder foundation, to include 6570 lin. ft. concrete curb and 3000 cu. yd. excav. H. K. Hubbard, City Engr.

Bozeman, Mont.—Reported desired until Sept. 16 by C. A. Speith, City Clk., for constructing 12,240 sq. ft. 5 ft. concrete walks, 4600 sq. yds. standard bitulithic pavt., curbing, etc., in Special Improv. Dist. 107 and 101 and 104.

Kansas City, Mo.—Until Sept. 28 Park Comrs., for grading Meyer Boule., also grading the Paseo, including construction of bridge near Seventy-seventh Street.

Santa Barbara, Cal.—Reported desired until Sept. 20 by Bd. County Supervisors (C. A. Hunt, Clk.) for paving Booths Point Road; probable cost $17,689; also paving 2782 lin. ft. of East Boulevard.

PRICES AND LETTINGS.

★Indicates awarded contract.

★Connecticut. — Contracts have been awarded by State Highway Comr., Charles J. Bennett, Hartford, for state highway work as follows:

Danielson, about 2590 ft. amiesite pavement in Killingly, on Main Street, to Connecticut & R. I. Co., Meriden, at $8,825.

Durham, section of 2-in. bituminous macadam pavement on Middlefield Road to P. A. Arrigoni & Bro., Middletown, at $7,360.

Southington, about 6200 ft. 2 in. bituminous pavement on Meriden Avenue to Leonardo Suzio, Meriden, at $8,506.

Waterford, a section of native stone macadam road to Framingham Constr. Co., South Framingham, Mass., at $8,684.

North Haven, about 4950 lin. ft. of trap rock macadam road on Mount Carmel highway to A. D. Bridge's Sons Co., Hazardville, at $6,413.

Newtown, a section of native stone macadam road on Lower Road to Kellogg & Gregory Co., Danbury, at $7,878.

Marlborough, section of graded road and construction of reinforced concrete bridge to Goodman & Trumbull Co., Litchfield, Conn., for approximately $3,827.

★Catskill, N. Y. — Contract awarded Sept. 1 for 3,306 sq. yds. vitr. brick pavement in Upper Main Street to Catskill Constr. Co., at $1.34 per sq. yd., exclusive of brick. Geo. H. Warner, Village Clk.

New York, N. Y.—Lowest bid opened Aug. 31 by President borough of the Bronx, for regulating, grading, setting curb, flagging sidewalks, laying crosswalks, building approaches and erecting fences in Dyre Avenue from Boston Road to City Line, submitted by J. B. Malatesta, 3169 Jerome Avenue, at following bid: 24,100 cu. yd. earth excav., 40 cts.; 4400 cu. yd. rock excav. above subgrade of street, $1.40; 50 cu. yd. rock excav. in trenches, $2; 5100 lin. ft. new curb, 70 cts.; 24,700 sq. ft. concrete sidewalk (including maintenance for 1 year), 11 cts.; 2950 sq. ft. new bridgestone, 40 cts.; 300 cu. yd. dry rubble masonry, $1; 5 cu. yd. Class B concrete, $8; 150 lin. ft. 12-in. vitr. pipe, $1; 650 lin. ft. 15-in. vitr. pipe, $3; 7 manholes, $50; 3 receiving basins, Type B, $150; 97 spurs for house connections, $1; total $26,715. Next 3 lowest bids: Di Menna & Del Balso, $29,795; Burnside Contr. Co., $29,898; Harris-Rose Contr. Co., $29,971.

Lowest bid opened same time and place, for regulating, grading, setting curb, laying sidewalks and crosswalks, building approaches and erecting fences in E. 213th Street from White Plains Road to Paulding Avenue; also submitted by J. B. Malatesta, at following bid: 4000 cu. yd. earth excav., 30 cts.; 7500 cu. yd. rock excav., $1.60; 4770 lin. ft. new curb, 70 cts.; 21840 sq. ft. concrete sidewalk (including maintenance for one year), 11 cts.; 1250 sq. ft. new bridgestone, 40 cts.; 440 cu. yd. dry rubble masonry, $2.50; 25 cu. yd. Class A concrete, $8; 20 lin. ft. 12-in. vitr. pipe, $1; 1800 lin. ft. guard rail, 15 cts.; 2600 lb. steel reinforcement bars, 5 cts.; 6 cu. yd. brick masonry, $10; total $21,221. Next 3 lowest bids: J. Di Menna, $21,670; F. M. Palladino, $22,676; Burnside Contr. Co., $23,039.

★Syracuse, N. Y.—Contract for paving Westcott Street with asphalt awarded by Bd. Contract & Supply to Schenectady Constr. Co., Schenectady, at $9,271.

★Philadelphia, Pa.—Contracts awarded by city to McNichol Paving & Constr. Co., 1723 Cherry Street, for opening Emerald Street under tracks of P. & R. R.R. between Lehigh Avenue and Somerset Street at $100,000, and constructing sewers and grading and paving Delaware Avenue from Reed to Queen Streets at $221,000.

★Baltimore, Md.—Contract awarded by City Paving Comn. to P. Flanigan & Sons of Baltimore, for Contract 121, paving Hillen, East and Gold Streets at following bid: 7200 sq. yd. sheet asphalt, 1½-in. top, 1½-in. binder, 6-in. concrete base, $1.45; 5250 sq. yd. on 5-in. concrete base, $1.36; 200 sq. yd. vitr. block pavt., 5-in. concrete base, cement fill, mortar cushion, $1.70, and 260 sq. yd. on 6-in. concrete base, cement fill, mortar cushion, $1.81 520 sq. yd. granite block pavt., 6-in. concrete base, asphalt fill, mortar cushion, $3.27, and 2000 sq. yd. cement fill, mortar cushion, $3.17 1120 sq. yd. sheet asphalt, 1½-in. top, 1½-in. binder, 6-in. concrete base (railway area), $1.45; 430 sq. yd. vitr. block gutters and crossings, 5-in. concrete base, cement fill, mortar cushion, $1.70; 4600 lin. ft. armored concrete curb and circles in place, 50 cts.; 3200 lin. ft. old stone curb and circles redressed and reset, 30 cts.; 1960 cu. yd. grading, city area, 40 cts.; 700 cu. yd. grading, railway area, 60 cts.

★Sarasota, Fla.—Contract for paving in Sarasota awarded to Southern Asphalt & Constr. Co., Birmingham, Ala., at about $70,000.

★New Orleans, La.—Contract awarded by State Highway Dept. (Frank H. Kerr, Ch. Engr.), New Orleans, to S. A. Gano, Jackson, Miss., at $37,735, for 26 miles of highway in Road Dist. No. 1 (bids opened Aug 18). Next three lowest bids: Nicholson Co. & Jones, Tallulah, $41,038; Boyd & Bradshaw, Columbia, Miss., $42,234; N. McCarthy, Jr., New Orleans, $48,332.

★Port Allen, La.—Contract for constructing 28 miles of road in West Baton Rouge Parish reported awarded by the Bd. State Engineers to S. A. Gans of Jackson, Miss.

★Columbia, Tenn.—Southern Asphalt & Constr. Co., Birmingham, Ala., secured contract for paving with sheet asphalt in Columbia, at about $50,000.

★Akron, Ohio.—Contracts for pavement awarded on Sept. 8 as follows, to include stone curb and wire cut lug block, grout fill, 4-in. concrete: Bank Alley paving, also E. North Street and Home Avenue., to E. McShaffrey & Son, Akron, at $23,448; Beardsley Street, to C. H. Watters, Akron, $10,203; W. North Street, to Daniel O'Mara, Akron, $8,243; Federal and Perkins Streets, to J. M. Davidson, Akron, $16,696. J. A. Gehres, City Engr.

★Cadiz, Ohio.—Contract awarded Aug. 27 for paving Park, St. Clair Sts., to Coss & Meyer, Wheeling, W. Va., at following bid: 8 inlets, ea., $15; 90 ft. 12-in. sewer, 40 cts.; 5861 lin. ft. concrete curb, 6 x 20-in., 36 cts.; 80 ft. headers (old stone redressed), 30 cts.; 8512 sq. yd. brick pavt., $1.52; 8512 sq. yd. sand fill, 6 cts.; total, $14,621. Other bids: John O. Bates, Steubenville, $15,047; Patterson & Grafton, Wellsville, $15,104; G. B. Brode Co., New Comerstown, $16,648. Engineer's estimate, $15,035.

★Canton, Ohio.—Contracts for brick paving (bids opened Aug. 17 by Bd. Public Service awarded as follows: Eighth Street, to George Garraux, at $29,895, and Tenth Street, N. W., to Smith & Krabill, at $20,947.

★Columbus, Ohio.—Contracts awarded by Director Bd. Public Service as follows: Como Avenue, from High Street west, brick, Monarch Constr. Co., $15,-959; New York Avenue, Cleveland Avenue to west terminus, asphalt, and Sheldon Avenue, Seventh Street to Parsons Avenue, asphalt, both to Andrews Asphalt Paving Co., Columbus Saving & Trust Co. Bldg., at $9,460 and $13,365 respectively; Kent Street, Kimball Place Avenue to Kelton Avenue, brick, Wall Street, Engler to College Street, brick, both to A. W. Burns & Co., at $8,590 and $10,423 respectively; Main Street, Parsons Avenue to Allen Street, asphalt, Cleveland Trinidad Paving Co., Cleveland, $8,114; Forrest Street, Parsons Avenue to Lockbourne Road, asphalt, A. G. Pugh, Union Natl. Bank Bldg., $44,547; Starr Avenue, from Cleveland to the west terminus, brick, A. W. Burns & Co.

★Eaton, Ohio.—Contract awarded Aug. 30 for 3800 sq. yd. tarvia pavement on W. Main Street to H. W. Curry & Co., Eaton, at $6,200. Earl Dalrymple, Village Clk.

★Lisbon, Ohio.—Contract for paving Hephner Hollow Road with brick awarded by Township Trustees to McLane & Hepburn, Lisbon, at about $35,276.

★Portsmouth, Ohio.—Contract awarded Sept. 1 for creosoted wood block paving on concrete foundation on Scioto River Bridge to Weathers & Coldgrove of Portsmouth.

★Toledo, Ohio. — Contracts for street paving awarded by Bd. Pub. Service as follows: Jackson Street, St. Clair to Thirteenth Streets, Russell & Jennison Co., 313 Huron Street, $34,086; City Boulevard, Cherry to Blanchard Streets, H. P. Stretcher Co., $26,331; Cherry Street Summit to bridge, Russell & Jennison Co., $8,998; Monroe Street, Auburn to city line, Harris & Tansey, Toledo, $15,-735; Camden Street, East Broadway to Varland, Asphalt Block Pavt. Co., Ohio Bldg., $10,692; Ogden Avenue, Arlington to South Street, McKinney Bros., Wayne Bldg., $21,663.

★Angola, Ind.—Contract awarded W. S. Gordon & Son, Liberty Center, Bluffton, for constructing thirteen miles gravel roads in Steuben County as follows: Swaidner Road, $11,922; Croxton Road, $14,563; Robertson Road, $3,267; Glad Henry Road, $9,400.

★Bloomington, Ill.—Contract awarded Aug. 31 for repairing East Street pavement to Barber Asphalt Co., at $1.85 per sq. yd. E. H. Packard, City Engr.

Chicago, Ill.—Following are reported to be the lowest bids opened Aug. 25 by Bd. Local Improv. for paving with asphaltic concrete on portions of several streets: Thirty-second Place, Stave and Whipple Streets, R. F. Conway Co., Chicago, $1.61, $1.68 and $1.76 per sq. yd.; Turner and Wilcox Avenues, Standard Paving Co., Chicago, $1.74 and $1.76 per sq. yd.; Waveland and Winnimac Avenues and Ainslee System, Robey Street to Lincoln Avenue, White Paving Co., $1.39 and $1.65 per sq. yd.

★Reported contract awarded White Paving Co. for three paving contracts amounting to about $140,000. The R. F. Conway Co. and American Asphalt Paving Co. and Standard Paving Co. secured other paving contracts. In all about 36 contracts awarded. Contractors of Chicago.

★Elgin, Ill.—Contract awarded by city to L. V. Barcus & Co., La Porte, Ind.; for constructing curb and gutter in Ryerson Ave., and other streets, at following bid: 18,763 lin. ft. curb and gutter, 48 cts.; 214 lin. ft. gutter, 22 cts.; 76 sidewalk headers, $1.50; 76 gutter plates, $3; 9 catch basins, $24; 200 lin. ft. 8-in. sewer, 40 cts.; adjusting catch basins, $40; total, $8,605. Next 3 lowest bids: Peter Larson, Elgin, Ill., $8,750; General Eng. & Constr. Co., Rockford, $8,999; Albin Carlson & Co. Chicago, $9,110.

★Peoria, Ill.—Contract for paving N. Adams Street with brick awarded by Bd. Local Improvements to Canterbury Bros., Peoria, at about $17,157.

★Great Bend, Kan.—Contract awarded Sept. 1 by City Council to Watts & Amerman of Salina for constructing approximately 20,671 sq. yds. asphaltic concrete pavement, 9,224 lin. ft. concrete combined curb and gutter and 7,690 lin. ft. concrete curb. H. A. Howland, Engr., McPherson.

★**Washington.**—Following are 4 lowest bids opened by State Highway Comr., Olympia, for constructing National Park Highway, Pacific County, from Nemah to Nasel River: (a) Burnett Constr. Co., 909 Second Avenue, Seattle, $36,954 (awarded contract); L. H. Goerig, 1027 Bellevue Court, Seattle, $37,428; Elliott Contr. Co., 302 McKay Building, Portland, Ore., $39,304; Martin Woldson, 541 Peyton Building, Spokane, Wash., $42,096.

	*(a)	(b)	(c)	(d)
98,100 cu. yd. common excav., including haul of 400 ft..	$0.20	$0.235	$0.26	$0.23
3,500 cu. yd. loose rock excav., including haul of 400 ft..	0.50	0.40	0.45	0.65
800 cu. yd. solid rock excav., including haul of 400 ft..	1.25	0.70	0.80	1.25
76,000 cu. yd. overhaul on any of above materials, per each 100 ft.	0.0125	0.015	0.02	0.015
34 acre clearing	165.00	125.00	100.00	175.00
19 acre grubbing	140.00	125.00	150.00	200.00
200 cu. yd. guard rail in place, including spikes and bolts	0.30	0.20	0.25	0.40
11.6 M ft. timber and plank in place, including spikes and bolts	25.00	25.00	25.00	25.00
240 lin. ft. fir piling driven, below cut-off	0.65	0.50	0.40	0.35
2,800 lin. ft. logs for culverts, in place	0.22	0.20	0.20	0.35
370 lin. ft. porous tile drains in place, 6-in. diameter	0.50	0.50	0.20	0.40
1,412 lin. ft. plain concrete pipe in place, 12-in. diameter	1.10	1.00	0.75	1.15
136 lin. ft. plain concrete pipe in place, 18-in. diameter	1.90	2.00	1.50	1.90
370 lin. ft. reinf. concr. pipe in place, 18-in. diameter	2.75	2.25	1.70	2.40
36 lin. ft. reinf. concr. pipe in place, 24-in. diameter	4.50	3.00	3.50	3.00
610 lin. ft. reinf. concr. pipe in place, 12-in. diameter	1.60	1.25	1.10	1.40
270 lin. ft. logs for bridge stringers, 16-in. diameter..	0.30	0.25	0.20	0.20

★**Olathe, Kan.**—Contract awarded Aug. 30 for constructing approximately 3800 sq. yds. vertical fiber brick to J. H. Cosgrove, Olathe, at $7,613. Other bids: D. M. Boddington, Kansas City, Kan., $8,700; E. F. Wilcox, Kansas City, Mo., $9,204. Roy Murray, City Engr.

★**Bozeman, Mont.**—Contracts reported awarded by City Council for paving and storm sewers in Dist. 98 and 99, to Warren Constr. Co., Journal Bldg., Portland, Ore., at $42,302 and $33,218 respectively. Pavement to be of standard bitulithic.

★**Auburn, Wash.**—James Lemar, City Clk., writes contract awarded Aug. 26 for 14,662 sq. yd. paving to Washington Paving Co., Savage-Scofield Building, Tacoma, at $24,979.

★**Seattle, Wash.**—Contracts awarded as follows by Bd. Pub. Wks. for brick paving: Utah Avenue, P. J. McHugh Paving & Constr. Co., Third N. and Mercer Streets, at $85,112; Ranier Avenue, T. Ryan & Co., Lowman Building, at $39,390. Contract for filling Oxbow Dist. awarded Holt & Jeffery, Seattle, at $67,135.

Lowest bid opened by Bd. Public Wks. for grading and curbing Stroud Ave. submitted by Coluccio & Bressi, 1642 Lane Street, at $10,422.

★**Tacoma, Wash.** — Contract awarded Aug. 28 by Co. Comrs. to Washington Paving Co., Tacoma, for improving Pacific Highway south from County Club to Dupont, 5.574 miles, at $79,375 for 2-in. bitulithic on 5-in. concrete base.

★**Washington.**—Contract awarded by State Highway Comn., Olympia, to H. C. Root, 525 Madison St., Spokane, for constructing Inland Empire Highway from Whitman County Colfax, South, at following bid: 31,100 cu. yds. common excav. inc. haul of 400 ft., 16 cts.; 16,000 cu. yds. on any of above material, 1.5 cts.; 100 cu. yds. riprap hand placed, $2.25; 48 cu. yds. concrete, first class, $13; 44 cu. yds. concrete, second class, $12; 750 lbs. steel reinforcing bars in place, 5 cts.; 60 lin. ft. plain concrete pipe, 12-in. diam., 80 cts.; 376, 18-in., $1.45; 160, 24-in., $2.20; 52, 30-in., $3.45; total, $7,783.

★**Portland, Ore.**—Contracts for paving awarded by City Comn. as follows: E. Thirty-ninth Street. and E. Kelly Streets with bitulithic on crushed base to Clark & Henery Constr. Co., Portland, at $15,280; and E. Thirteenth Street with asphaltic concrete to Oregon Independent Paving Co., Journal Bldg., Portland, at $24,819.

★**Martinez, Cal.**—Contract for constructing link of Lafayette Road awarded to T. H. Hoare, San Francisco, at $35,000.

★**Salt Lake City, Utah.** — Contract awarded Aug. 24 for constructing bitulithic pavement on Ninth, Fifteenth E. Streets, Extension 121, to P. J. Moran of Salt Lake City, at $48,025; Strange Maguire Paving Co. bid for this $48,117. Nael A. Scheid, City Recorder.

★**Salt Lake City, Utah.**—Contract for paving extension 121 awarded by City Commission to P. J. Moran, 152 W. Second Street, at $48,025.

STREET CLEANING AND GARBAGE DISPOSAL

PROPOSED WORK

Americus, Ga.—City reported to be considering constructing an odorless incinerating plant.

Minneapolis, Minn.—Reported Council will be asked to appropriate $500,000 for street cleaning and repairs, and $750,000 for new pavements.

Marble Falls, Tex.—R. E. Johnson, Mayor, writes city will let contract in about 60 days for an incinerator for approximately 2 tons night soil and 1 ton garbage per week; also wish design submitted; cost about $2,000.

BIDS DESIRED.

Greystone Park, N. J.—Until Sept. 22 at office of O. M. Bowen, Warden, New Jersey State Hospital, Greystone Park, for installing incinerator plant.

PRICES AND LETTINGS.

★*Indicates awarded contract.*

Rock Island, Ill.—Bids were opened Sept. 2 by City Council for constructing an incinerating plant, and the bid of the Sparks Crematory Constr. Co., Memphis, Tenn. is said to be favored at $12,200.

Ottawa, Ont.—Following are reported to be lowest bids opened Aug. 27 by Bd. of Control for an incinerator: General Supply Co. of Canada, $30,076; Laurie & Lamb, Montreal, Que., $36,033; John F. Egan, Ottawa, $37,500; Atlas Constr. Co., Montreal, Que., $45,000. The Ottawa Cartage Co., submitted a proposition to build at own expense, and collect and destroy the city refuse at a price per head of population to be agreed upon.

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS

PROPOSED WORK

Steel Work on Pier—New York, N. Y.—Contract will probably be let this fall for steel work for Forty-sixth Street pier, North River. Address Charles W. Staniford, Ch. Engr. Dept. of Docks, Pier A, North River.

Dredging—Philadelphia, Pa.—All bids opened Aug. 9 by the U. S. Engineer, Philadelphia, for dredging in Delaware River, on Bellevue and Cherry Island lighthouse ranges, have been rejected as excessive.

Levee—Augusta, Ga.—City Council has decided to sell $250,000 flood protection bonds to finish levee.

Ditch—Urbana, Ohio.—County Commissioners have granted petition for construction of Blacksnake Ditch, in Jackson Township, to cost about $10,000.

Dock—St. Louis, Mo.—The Mayor's Commission on river terminals has voted to recommend to Board of Aldermen an appropriation of $250,000 for construction of a municipal river dock.

Power Plant — Denison, Tex. — Texas Power & Light Co. (P. A. Rogers, Mgr.) contemplates constructing power plant on Red River; cost about $750,000.

Drain—Grand Junction, Col.—Landowners of Grand Valley have voted to accept proposition of federal government for construction of drainage system affecting about 50,000 acres of land. Work upon the project will start as soon as government has completed surveys and other preliminary work; estimated cost $1,000,000.

Drainage—Raywood, Tex.—L. C. Smith, Box 1324, Houston, reported to have completed surveys for a drainage system for Raywood.

Flood Protection—Los Angeles, Cal.—County Supervisors reported to have engaged James W. Reagan as engineer for county flood district, to investigate and prepare plans, with cost, of conserving waters and protecting harbor from floods.

Power Plant—Needles, Cal.—Dept. of Interior has granted permit to K. B. Girard to begin preliminary work of installing power plant on Colorado River near mouth of Diamond Creek canyon. A series of dams are proposed for hydroelectric purposes.

Canal—Oroville, Cal.—It is reported that the Great Western Canal will construct this fall the second unit of its western canal; to be 6 or 7 miles in length.

Beach Esplanade—San Francisco, Cal.—City Engineer O'Shaughnessy has completed design of ocean beach esplanade and bids will soon be invited for construction of first unit, which is to be built along beach for 650 ft. from a point near terminus of Cabrillo Street. An appropriation of $50,000 has been made by City Supervisors for first section. The intention is to build an additional section each year. Chamber of Commerce, which initiated the project, figured cost of esplanade for whole length of beach at $1,000,000.

Irrigation—Susanville, Cal.—Dept. of Interior, at Washington, D. C., reported to have granted C. J. Young a reservoir site in Pete Valley, and construction of an irrigation system will soon be commenced to water approximately 400,000 acres of land in Lassen County, Cal., and Washoe County, Nevada.

Irrigation — Terra Bella, Cal.—Terra Bella Irrigation Dist. will spend about $1,000,000 for irrigation work. Address E. R. Clemens, Secy.

Irrigation—Boise, Idaho—Engineers of the Federal Reclamation Service are reported authorized to survey Black Canyon lands in Fayette-Boise Valley, Idaho, and report on feasibility of an irrigation project.

BIDS DESIRED.

Wharf Addition — Fort Constitution (P. O. New Castle), N. H.—Until Sept. 25 by Lieut. A. G. Frick, Q. M., U. S. A., for wharf addition at this post.

Pier Work—Baltimore, Md.—See "Paving."

Dredge.—Jacksonville, Fla.—Until Nov. 8 by U. S. Engineer's Office, Jacksonville, for constructing and delivering a steel hull 3½ and 7 yard dipper dredge, or for leasing such machine, subject to purchase, advertised in Engineering Record.

Pile Foundations—New Orleans, La.—See "Public Buildings."

Levee Repairs—Shawneetown, Ill.—Until Sept. 15 by River and Lakes Comn., State Building, Chicago (Arthur W. Charles, Chmn.), for levee repairs at Shawneetown, about 12,000 cu. yd. earth, advertised in Engineering Record.

Drainage—Bemidji, Minn.—Until Sept. 13 at 10 a. m. by J. L. George, Co. Aud., for constructing Judicial Ditch 30, about 165 miles long, and estimated at about 1,656,560 cu. yds., cost $244,142; Judicial Ditch 32, length four miles, excavating 82,825 cu. yds., cost $7,174; and Judicial Ditch 31, 27 miles long, about 250,397 cu. yds. excav., cost $48,223.

Ditch—Slayton, Minn.—Until Sept. 21 by E. V. O'Brien, Co. Aud., for constructing ditches 40, 42, 43, 10 and 11. Total approximate cost, $122,020.

Ditches—Windom, Minn.—Reported desired until Sept. 16 by S. A. Brown, Co. Aud., for constructing tile and open work, Judicial Ditches Nos. 15 and 40. Probable cost, $13,440 and $5,733 respectively.

Worthington, Minn.—Reported desired until Sept. 25, by Gus. Swanberg, Co. Aud. for constructing ditch No. 12. Probable cost, $23,073.

Drainage—Otterville, Ont.—Until Sept. 13 at 2 p. m. by Alexander McFarlanem, Township Clk., Otterville, for constructing the Bauslaugh Creek Drain near village of Otterville, about 5100 ft. tile drain and 9500 lin. ft. open ditch, 6864 cu. yds., also bids for necessary tile. F. J. Ure, Township Engr., Woodstock.

PRICES AND LETTINGS.

★*Indicates awarded contract.*

★**Dredging — Portland, Me.** — Contract for dredging St. Croix River, Maine, (bids opened Aug. 16), has been awarded to the Eastern Dredge Co., East Boston, Mass., at $37,250.

★**Shore Protection—Boston, Mass.**—Contract awarded by Metropolitan Park Comn. to Coleman Bros., Chelsea, for building concrete shore protection at Revere Beach, at following bid (bids opened Aug. 31): 4000 cu. yd. earth excavation, 50 cts.; 600 cu. yd. concrete masonry in wall, $6; 4500 sq. yd. concrete ramps, $3; 260 lin. artificial stone coping, $2.13; 200 sq. yd. granolithic floors, $1; total, $19,854. Next three lowest bids: Middlesex Contr. Co., Boston, $19,970; James H. Fannon, Somerville, $20,290; A. G. Tomasello, Dorchester, $20,590.

Breakwater Work—Buffalo, N. Y.—Lowest bid opened Sept. 1 by U. S. Engineer for furnishing and placing riprap and repairing concrete superstructure of Buffalo breakwater submitted by Coast & Lakes Contr. Cor., 41 Broad Street, New York, at following bid: 6000 tons furnish and place large riprap, $1.44; 660 cu. yds. 1:3:6 concrete in place, $6.50; 100 cu. yds. 1 1/3:3:6 concrete in place, $6.50; 50 hours derrick hire, per hour $9.50; total $14,055. Other bids: Great Lakes Dredge & Dock Co., 1100 D. S. Morgan Bldg., Buffalo, $22,870; H. S. Kerbaugh, Inc., Telephone Bldg., Buffalo, $14,605; Lake Shore Contr. Co., 1115 Hippodrome Bldg., Cleveland, Ohio, $22,280.

Steel Lock Gates, Etc., Pittsburgh, Pa.—Following are lowest bids opened Aug. 20 by Lieut.-Col. Francis R. Shunk, Corps Engrs., U. S. A., for furnishing and erecting steel lock gates and furnishing valves and lock operating machinery at Lock 6, Monongahela River: Section A, Thomas Carlins' Sons Co., Pittsburgh, $7,600; Section B, Union Fdy. & Machine Co., Pittsburgh, $13,557.

★**Drainage—Goldsboro, N. C.**—Contract awarded for dredging canal 23½ miles to A. V. Wills & Sons, Pittsfield, Ill., at following bid: 656,193 cu. yd. floating dipper dredge excav., 7⅛ cts.; 29,425 cu. yd. hand ditches, 21.31 cts.; 23½ miles right-of-way clearing, lump sum $3,805; total $56,844. Other bids: W. R. Ewing, Inc., Chicago, $56,399; Southern Drainage & Constr. Co., Kinston, N. C., $57,530; Thompson & Mosely, Greensboro, N. C., $57,621. W. K. Allen, Engr., Wilmington, N. C.

★**Wharf—Charleston, S. C.** — Contract awarded to Charleston Eng. & Contr. Co., Charleston, for construction of a 520-ft. creosoted timber wharf for new lighthouse depot on Chisholm Mill site., at $46,418.

★**Dam—Toccoa, Ga.**—Contract for constructing sectional concrete dam awarded by City Council to J. G. Phillips & Co., of Cornelia, at $5,799 (bids opened Aug. 30).

★**Dam—Toccoa, Ga.**—Contract awarded Aug. 30 by City to J. G. Phillips & Co., Cornelia, for furnishing material and constructing a sectional concrete wood dam, at $5,799. H. J. Cox, City Clk. H. M. Nabstedt, Engr.

★**Ditch—New Philadelphia, Ohio.**—Contract for constructing Joint County Ditch, located in Tuscarawas and Holmes Counties, has been awarded to W. A. Shire, Ashland, at 9 cents per cu. yd. R. H. Nussdorfer, Co. Aud.

★**Ditch—Des Moines, Iowa.**—Contract awarded Sept. 1 by Co. Comrs. (F. J. Alber, Aud.) for constructing Drainage Ditch No. 17, Clay Township, being a tile drain, approximately 3500 ft. long, to John Atwood, Mingo, at following bid: 12-in. tile, $4 per rod; 10-in., $3 per rod; 6-in., $2 per rod.

★**Ditch — Moorehead, Minn.** — Contract awarded Aug. 31 for constructing ditches 34 to C. E. Greenawatt, Topeka, at $7,283. A. V. Houghlinn, Co. Aud.

★**Drainage—Marion, Ark. — Contract** awarded by Comrs. of Drainage Dist. No. 2 of Crittenden County to C. H. Williams & Co., Chicago, Ill., for 5,022,000 cu. ft. of ditches at 7.59 cts. per cu. yd.

★**Jetty Work—Kelso, Wash.**—Contracts for construction of a 400-ft. jetty in front of Hill mill bar reported awarded to Interstate Constr. Co., Portland, Ore., for driving piling, and to Albert Burcham, Kelso, for furnishing piling. Jetty will extend from McLane shingle mill down stream 400 ft.

Irrigation—Lakeview, Ore.—Goose Lake Valley Irrigation Co. (Kenneth A. Heron, Ch. Engr.), recently took over irrigation system of Oregon Valley Land Co. and will extend it and complete distribution system to water all irrigable lands in Goose Lake Valley; first unit of 15,000 acres will be placed under laterals this fall.

Oakland, Cal. — Following are bids opened Aug. 31 by U. S. Engineer's Office, San Francisco, for dredging Oakland Harbor, about 520,000 cu. yd. dredging, place meas.; price given per cu. yd. covers cost of removal and disposition of all material encountered, except ledge rock and wrecks: San Francisco Bridge Co., 14 Montgomery Street, San Francisco, 9.87 cts.; Standard American Dredging Co., Oakland, 11⅝ cts.; American Dredging Co., 23 California Street, San Francisco, 12.5 cts.; C. E. Cotton, 16 California Street, San Francisco, 14.9 cts.

★**Wharf—San Francisco, Cal.**—Contract for constructing extension to wharf at naval training station, San Francisco (bids opened by Bureau of Yards and Docks, Navy Dept., Washington, Aug. 21), awarded to Hyde, Harjes & Co., San Francisco, at $9,341.

ELECTRIC RAILWAYS

PROPOSED WORK

Springfield, Mass. — Springfield Street Ry. Co. plans to relocate its tracks in Springfield between the North End bridge and Plainfield Street bridge; relocation of tracks and removal of poles and wires will cost about $20,000.

Mayville, N. Y.—Columbus & Mayville R.R. Co. reported to have received franchise to construct railway through Columbus Township; this is part of a plan to build a line from Jamestown to Clymer. C. P. Northrup, Pres., Corry, Pa.

Burkesville, Ky.—It is reported plans are being made to construct electric railway from Burkesville to Edmonton, about 22 miles. Information may be obtained from the Cumberland Traction Co., which is building a line from Edmonton to Elizabethton.

Canal Dover, Ohio.—Plans being made to begin work on Dover, Millersburg & Western Ry., from Canal Dover to Millersburg, via Sugar Creek. F. F. Phillips, Canal Dover, is interested.

Cincinnati, Ohio.—West End Rapid Transit Co. incorporated to construct electric railway from Anderson's Ferry to Third and Vine Streets, Cincinnati, its object being to furnish an entrance into the city for Cincinnati, Lawrenceburg & Aurora Electric St. R.R. Capital $10,000. Among incorporators: J. C. Hooven, C. E. Hooven, L. E. Voorhies and Stanley Shaffer.

Cleveland, Ohio.—Lake Shore Electric Ry. Co. plans to construct a cut-off between Toledo and Cleveland, shortening the distance between the two cities by 5 miles.

Aberdeen, S. D.—Aberdeen R.R. Co. incorporated to construct electric railway. Capital $25,000. Incorporators: Charles A. Howard, S. C. Hedger and Charles N. Harris.

Hermosa Beach, Cal.—Chamber of Commerce taking steps to obtain a 3-mile right-of-way to build railway to connect with the line of the Pacific Electric Ry. at Belvidere, thus leading into Los Angeles over Gardena route. It is the intention of the Chamber of Commerce, in case it is successful, to donate right-of-way to Pacific Railway for building line. Proposed road would give two direct lines from Hermosa Beach into Los Angeles.

Oakland, Cal.—Oakland, Antioch & Eastern Ry. Co. reported considering plans to build extension to Martinez.

PRICES AND LETTINGS.

★Indicates awarded contract.

★Brooklyn, N. Y. — Public Service Comm., 154 Nassau Street, New York, **has authorized the New York Municipal** Railway Corp. to award contract for **erection of steel for additional tracks on** Broadway Elevated Railroad in Brooklyn, between Myrtle Avenue and Aberdeen Street, to Johnson-Gifford Co., 30 E. Forty-second Street, New York, at about $440,441. Company will furnish materials and contractor will do the work. The time limit is twelve months.

★Winsted, Minn.—Electric Short Line Ry. Co. awarded a contract to H. F. Balch & Co., Minneapolis, for construction of its 45-mile extension from Winsted to Hutchinson, via Silver Lake.

RAILROADS

PROPOSED WORK

Norfolk, Va.—Press reports state that improvements are being planned by the Seaboard Air Line Ry. (S. Davies, Warfield, Pres., Baltimore, Md.) to include erection of new car shop at Norfolk, to cost about $500,000, also $1,100,000 for betterments along line of old Seaboard Company; it is also proposed to construct new line from Charleston to Savannah.

Macon, Ga.—Central of Georgia Ry. Co. (C. K. Lawrence, Engr., Savannah) considering construction of underpass in Pine Street.

Detroit, Mich.—We are informed that **there is no truth in recent report that the Pennsylvania R.R. Co. contemplates** entering the city of Detroit. Alexander **C. Shand, Ch. Engr., Philadelphia, Pa.**

Great Falls, Mont.—Great Falls & Southwestern Ry. Co. incorporated to construct a railroad 60 miles long, from Ulm, eleven miles east of Great Falls on Great Northern Ry., to Hound Creek.

Denver, Col.—Press reports state the Great Northern R.R. Co. (A. H. Hogeland, Ch. Engr., St. Paul, Minn.) is considering construction of a new line from Sioux Falls, S. D., to Denver.

Olympia, Wash. — Oregon-Washington R.R. & Navigation Co. (J. R. Holman, Ch. Engr., Portland, Ore.), it is reported, will construct a line seven miles long, from Olympia to Plum Station, to connect with water grade line of Northern Pacific Ry. Terminals will be constructed at Fourth and Adams Streets, Olympia.

Tacoma, Wash. — Reported Oregon-Washington R.R. & Navigation Co., Portland (J. P. Holman, Ch. Engr., Portland, Ore.), will construct a line between Point Defiance Line and Olympia, cost $500,000.

Portland, Ore.—Reported final plans will be filed and proceedings started at once for elimination of grade crossings along main line of Oregon-Washington Railroad and Navigation Co., from head of Sullivan's Gulch to city limits, project involving total expenditure of $750,000, part of which will be borne by city of Portland, part by property owners and largest portion by railroad.

PRICES AND LETTINGS.

★Indicates awarded contract.

★Three Forks, Mont.—Contract reported awarded Clifton, Applegate & Co., Hutton Building, Spokane, Wash., for constructing 25 miles of railroad from Three Forks to Radersburg, Mont., for Chicago, Milwaukee & St. Paul R.R.

PUBLIC BUILDINGS AND SCHOOLS

PROPOSED WORK

Nashua, N. H.—Bd. Aldermen voted $50,000 for erecting school on Spring Street.

Danvers, Mass. — Reported all bids opened recently by Trus. Essex County Independent Agricultural School for erecting three-story brick school building have been rejected as the bids exceeded funds. Plans are to be modified and new bids asked.

North Adams, Mass.—High School bonds for $190,000 have been sold.

Bristol, R. I.—School Com. selecting site on which to erect $40,000 school.

Albany, N. Y.—Plans being prepared by Obenaus-Nichols Co. for fire alarm building to be erected at Delaware Avenue and Morris Street; cost $35,000.

Camden, N. J.—Bd. Educ. appointed a committee to have charge of the $400,000 high school to be erected at Park Boulevard and Baird Avenue.

Carbondale, Pa.—Plans being prepared by E. H. Davis, Scranton, for two-story brick, stone and concrete high school; cost about $100,000.

Selma, N. C.—School bonds for $40,000 will be sold Sept. 30 by T. M. Benoy, Chmn. Bd. Trus., Selma Graded School.

Johnson City, Tenn.—Citizens Sept. 2 voted $37,500 bonds for court house and $25,000 for market house. S. E. Miller, Mayor.

Knoxville, Tenn.—Bd. Educ. has approved plans for John Bell Brownlow School, purchase and repair at Hampden Sydney School, addition to Rose Avenue School.

Cincinnati, Ohio.—Reported steps being taken by Co. Comrs. to enlarge the Longview Hospital.

Cleveland, Ohio.—Plans being prepared by William C. Jansen, O'Brien Building, for four-story brick, fireproof and concrete addition to St. Alexis Hospital, Broadway and McBridge Avenue, for Sisters of St. Francis; cost $150,000.

Plans filed for three-story Almira Avenue school to be erected by Bd. Educ. on Almira Avenue and W. Ninety-eighth Street at a cost of $150,000.

Findlay, Ohio.—Bonds for $100,000 for constructing County Infirmary building will be sold Sept. 15 by J. C. Copeland, Co. Clk.

Lakewood, Ohio.—Plans to be prepared by O. N. Chamberlain, Schofield Building, Cleveland, for three-story sanitarium to be erected by Dr. Alvah S. McClain; cost

Madison, Ohio.—Plans for two-story brick and stone fireproof high school for Bd. Educ. of Madison Township, to be prepared by Franz Warner, Hippodrome Bldg., Cleveland. Cost $50,000.

Old Fort, Ohio.—Plans being prepared by H. C. Millett, Sandusky, for two-story brick and concrete centralized school to be erected by Bd. Educ.; cost $45,000.

Perry, Ohio.—Plans to be prepared by Kaufman Architectural Co., Rose Building, Cleveland, for two-story sanitarium costing $50,000.

Brazil, Ind.—Sketches and preliminary plans submitted for the proposed high school. Address Bd. Educ. $30,000.

St. Joseph, Mich.—Bonds for $100,000 for erecting school will be sold Sept. 18 by George B. Pixley, Secy. to School Bd.

Davenport, Iowa.—Trustees College of St. Ambrose intend erecting addition to college to cost approximately $100,000.

Minneapolis, Minn.—Reported all bids opened recently for erecting the Economics building at Univ. of Minnesota have been rejected as being too high; appropriation $45,000.

St. Louis, Mo.—Bd. Public Service is considering plans prepared for a new house of detention, to cost $120,000.

Austin, Tex.—Plans prepared for the auditorium to be erected at the Deaf and Dumb Inst.; cost $30,000. G. A. Endress, Chmn. Bd. Mgrs.

Reported contract will soon be let for erecting State Inst. for Blind. Address Governor.

Austin, Tex.—See "Sewerage and Sewage Disposal."

Johnson City, Tex.—Plans completed by Henry T. Phelps for court house; cost $30,000.

Lytle, Tex. — School Trus. engaged Henry T. Phelps of San Antonio to prepare plans for the high school.

Mountain Home, Idaho.—Citizens Aug. 10 voted to erect court house from plans of Wayland & Fennell of Boise. Bids for bonds to be received Sept. 21. F. M. Hobbs, Co. Aud.

Toronto, Ont.—City Property Com. taking steps to erect on Sydenham Street a school costing approximately $200,000.

BIDS DESIRED.

West Pownal, Me.—Until Sept. 18 by Bd. Trus. State Hospitals, care of Dr. Carl J. Hedin, Supt. Maine School for Feeble-Minded, West Pownal, for erecting a brick kitchen building, including heating, plumbing, etc., for said school. Harry S. Coombs, Archt., Lewiston. A. B. Fels, Engr., Portland.

Naugatuck, Conn.—Until Oct. 13 by James A. Wetmore, Acting Superv. Archt., Washington, D. C., for construction, complete (including mechanical equipment, lighting fixtures and approaches) of U. S. Post Office, Naugatuck.

New York, N. Y.—Until Sept. 20 by C. B. J. Snyder, Supt. School Bldgs., borough of Manhattan, for general foundation work; also sewers and water mains for Manhattan Trade School for Girls, Lexington Avenue and E. Twenty-second Street. Security $10,000 and $3,000 respectively.

Tompkinsville, N. Y.—Until Sept. 30 by J. T. Yates, Lighthouse Inspector, Tompkinsville, for furnishing material and erecting third story and permanent roof of reinforced concrete on carpenter's shop at General Lighthouse Depot, Tompkinsville.

Wards Island, N. Y.—Until Sept. 24 by State Hospital Comn. (E. S. Elwood, Secy.), Albany, for constructing addition to power house including heating plumbing, etc., also for coal and ash conveying equipment at Manhattan State Hospital, Wards Island, advertised in Engineering Record. Lewis F. Pilcher, State Archt., Albany.

Wildwood, N. J.—Reported desired until Sept. 14 for erecting 3-story brick school. Clyde S. Adams, Archt., 1233 Arch Street, Philadelphia.

Claysville, Pa.—Plans reported desired until Sept. 15 by School Bd. (F. L. Knox, M. D. Secy.) for fireproof school, to consist of four rooms, basement and auditorium.

Norton, Va.—Until Oct. 19 by James A. Wetmore, Acting Supervising Archt., Washington, D. C., for constructing, complete (including mechanical equipment and approaches), U. S. Post Office at Norton.

Wilkesboro, N. C.—Until Oct. 14 by James A. Wetmore, Acting Superv. Archt., Washington, D. C., for construction, complete (including mechanical equipment and approaches), of U. S. Post Office and Court House, Wilkesboro.

Wilmington, N. C.—Until Oct. 7 by James A. Wetmore, Acting Superv. Archt., Washington, D. C., for construction, complete (including mechanical equipment), of Medical Officers' Quarters at U. S. Marine Hospital, Wilmington.

New Orleans, La.—Until Sept. 15 by Bd. Comrs., Port of New Orleans, for furnishing and installing pile foundations for workhouse, annex, drier house, boiler and transformer house and connections of public grain elevator, to be located on Mississippi River at foot of Bellecastle Street. Ford, Bacon & Davis, Engrs., 921 Canal Street.

Cleveland, Ohio.—Until Sept. 27 by Clerk Bd. Educ. for furnishing material and erecting school at W. Ninety-eighth Street and Elmira Avenue S. W. Bids desired as a whole or separately for the following: Masonry, carpentry, iron and steel, sheet metal work, roofing, asphaltic rock mastic, sanitary floors, ventilating and heating, plumbing, sewerage and gas fitting, electric wiring, etc. Bids on labor and material must be stated separately. Frank G. Hogen, Dir. Schools.

Logan, Ohio.—Until Oct. 14 by James A. Wetmore, Acting Superv. Archt., Washington, D. C., for construction, complete (including mechanical equipment and approaches), of U. S. Post Office, Logan.

Richwood, Ohio.—Local press reports state bids desired until Sept. 13 by G. M. Howard, Clk. Bd. Educ., for erecting 2-story, 8-room school. Probable cost $40,000. Paul T. Cahill, Archt., 1900 Euclid Avenue, Cleveland.

Toledo, Ohio.—Until Oct. 1 by A. W. Stowe, Pres. Bd. Dir. Toledo University for furnishing material and erecting addition to University Building at Illinois and Eleventh Streets. Schriber & Beelman, Archts., Second National Bank Building.

Milwaukee, Wis.—Reported desired until Sept. 15 for erecting 3-story, brick and stone addition to West Division School; probable cost $50,000. Van Ryn & Gelleke, Archts., 726 Caswell Block.

Haifa, Iowa.—Reported desired until Sept. 15 by Consolidated School Dist. (Peter Tornell, Pres.) for erecting high and grade school. Alban & Lockhart, Archts., 347 Endicott Building, St. Paul, Minn.

St. Paul, Minn.—Reported desired until Sept. 13 by August Hohenstein, Purchasing Agent, for furnishing and delivering structural steel, cast iron and wrought iron for Randolph Heights School.

Nome, N. D.—Reported desired until Sept. 13 by School Dist. No. 83 (Hans Skramstad, Clk.) for erecting a central school, Separate bids for heating and plumbing.

Lincoln, Neb.—Until Sept. 25 by J. S. Dale, Secy. Bd. Regents University Nebraska, Station A, Lincoln, for erection, including heating, plumbing, ventilating, etc., botany-zoology building; cost approximately $180,000.

Wisner, Neb.—Until Sept. 17 by Dr. R. H. Morse, Secy. Bd. Educ., for erecting high school, including heating and ventilating. John Latenser & Sons, Archts., Omaha.

Wood River, Neb.—Until Sept. 17 by School Board Dist. 8 (R. R. Root, Secy.) for erecting 2-story brick school, 68 x 114 ft.; cost about $40,000. Berlinghof & Davis, Archts., Lincoln.

Medical Lake, Wash.—Reported desired until Sept. 21 by State Bd. Control, Olympia (E. S. Emigh, Secy), for erecting for State Institution for Feeble-Minded, Medical Lake, Class "A," fireproof, 3-story administration building, custodian building, two ward buildings, a laundry building and power house; also separately for plumbing and drainage; ventilating and heating; electric wiring and fixtures. Cost, not including equipment, $200,000. Julius Zittel, Archt., Jamieson Building, Spokane.

Sedro-Woolley, Wash.—Reported desired until Sept. 21 by State Bd. Control, Olympia (E. S. Emigh, Secy.), for erecting for Northern State Hospital, Norlum, near Sedro-Woolley, Class "A," fireproof, auditorium and two ward buildings. Cost, $30,000 and $128,000 respectively; also separately for plumbing and drainage; ventilating and heating; electric wiring and fixtures. Heath & Gove, Archts., National Realty Building, Tacoma.

Fort Frances, Ont.—Reported desired until Sept. 15 by Duncan C. Scott, Deputy Supt. Genl. of Indian Affairs, Ottawa, for erecting a combined school and teachers' residence at Manitou Rapids, Indian Reserve, Fort Frances Agency.

PRICES AND LETTINGS.

★Indicates awarded contract.

★Gardiner, Me.—Contract for erecting post office awarded W. H. Fissell & Co., 1138 Broadway, New York, at $55,000.

★North Grafton, Mass. — Contract awarded by State Bd. of Insanity, Boston, to J. P. Keating, Westboro, for erecting dining room and service building at Grafton Colony, North Grafton, at $30,900 (bids opened Aug. 16). Next 3 lowest bids: L. Rocheford, Worcester, $38,000; John J. Power, Worcester, $39,000; W. L. Mellen, $39,898. Fuller & Delano Co., Archts., 44 Front Street, Worcester.

★Wrentham, Mass.—Contract awarded by State Bd. Insanity, State House, Boston (Michael J. O'Meara, Chmn.) to P. Bonplams & Co., Boston, for erecting brick dormitory, at Wrentham, at $33,279 (bids opened Aug. 12). Kendall, Taylor & Co., 93 Federal Street, Boston, Archts.

★Binghamton, N. Y. — Contract for erecting Central Fire Station awarded M. I. Ford Co. of Binghamton at $32,500; heating, Runyon & Ogden, Binghamton, $1,498.

★Troy, N. Y.—Contract for erecting dining hall and seven sections of dormitory at Rensselaer Polytechnic Inst. awarded A. E. Stephens, 101 Park Avenue, New York; cost $200,000.

White Plains, N. Y.—Following are totals of lowest bids opened Aug. 31 by Bldg. Comn., Westchester Co. (Robt. S. Brewster, Chmn.) for erecting addition to County Courthouse (Benjamin Morris, Archt., 101 Park Avenue, New York)

General construction: Wells Bros. Constr. Co., New York, $543,000; John H. Parker Co., New York, $547,695; J. T. Brady Co., New York, $548,840; Norcross Bros., New York, $556,500.

Plumbing: P. F. Kenny Co., Yonkers, $11,830; William Gordon, $12,137; John J. Kenny Co., New York, $12,273; Wells Newton Co., New York, $12,457.

Heating: Teran Mahoney Muroe, $18,000; Adams Britz Co., $18,237; Volk & Chambers, $18,300; A. B. Barr, Yonkers, $18,390.

Farview, Pa.—Lowest bid opened Sept. 8 by Trus. State Hospital, Criminal Insane, Philadelphia, for erecting two-story brick and stone building at said hospital at Farview submitted by P. J. Hurley, Philadelphia, at about $185,000. J. C. M. Shirk, Archt., 421 Chestnut Street, Philadelphia..

★Fort Mifflin, Pa.—Contract for erecting four magazines at Fort Mifflin awarded Charles Gilpin, 913 Harrison Building, Philadelphia, at about $60,000.

★Larimer, Pa.—Contract awarded by School Bd. for erecting a 6-room brick school at Larimer to McDowell & King, of Pitcairn (bids opened Aug. 18). W. G. Sloan, Archt.

★Marcus Hook, Pa. — Contract for erecting school awarded A. S. Reed & Bro. Co., Wilmington, at about $35,000.

Baltimore, Md.—Following are four lowest bids opened Aug. 31 by Supervising Architect, Washington, D. C., for construction, complete, except wharf, of the U. S. Immigrant Station: William Dall Co., Morton Building, Chicago, Ill., $267,688; A. L. Guidone & Son, 131 E. Twenty-third Street, New York, $277,000; M. Yeager & Son, Danville, Ill., $279,893; Morrow Bros., Baltimore, $284,100. Lowest bid for constructing the wharf submitted by Norcross Bros., Worcester, Mass., at $6,000.

★Danville, Va.—Contract for erecting Stonewall Jackson School awarded Lonzo B. Flora, Danville; cost complete about $35,000.

Madison, W. Va.—Following are four lowest bids opened by Co. Comrs. for erecting court house: P. Q. Shrake & Son, $86,200; Pete C. Minnotti Logan, $99,875; King Lumber Co., $118,400, and Longest & Tessier Co., $120,000.

Port Royal, S. C.—Following are four lowest bids opened Aug. 28 by Bureau of Yards and Docks, Navy Dept., Washing-

ton, D. C., for construction of naval disciplinary barracks at Port Royal: A. S. Bacon & Son, 2 Bay Street, Savannah, Ga., $41,075; Algernon Blair, Montgomery, Ala., $38,685; Newport Contr. & Eng. Co., Newport News, Va., $34,676; Cox & Doke, 303 Thirty-fourth Street, Savannah, Ga., $35,152.

★**Jacksonville, Fla.**—Contract awarded by Bd. Port Comrs. for erecting cotton compress and warehouse to Hillyer & Sperring Co., Jacksonville, at $31,000.

Palatka, Fla.—Following are four lowest bids opened Aug. 27 by Superv. Archt., Washington, D. C., for constructing, complete, U. S. Post Office—(a) limestone, (b) sandstone: Westchester Engineering Co., White Plains, N. Y., (a) $30,652, (b) $42,500; J. L. Crouse, Greensboro, N. C., (a) $40,935, (b) $41,600; George Becking, Chattanooga, Tenn., (a) $41,000; W. H. Fissell & Co., Marbridge Building, New York, (b) $44,800; Dabbs & Wetmore, Meridian, Miss., (a) $40,589, (b) $41,339.

★**Boyles, Ala.**—Contract for erecting first unit of two-story brick County High School awarded Jesse L. Burns, Birmingham, at about $30,000.

★**Columbus, Ohio.**—Contracts awarded by Bd. Trus. of Ohio State Univ. as follows: To R. H. Evans & Co., Columbus, for Home Economics Building, at $116,000, and homeopathic hospital at $45,000. Building 500-ft. tunnel on campus to H. C. McCall of Worthington at $3,500. Huffman Conklin Co., Columbus, heating and ventilating and plumbing in home economics building at $22,000.

★**Marion, Ohio.**—Contract awarded by Bd. Educ. Pleasant Township for erecting school to John Zachman of Marion at $24,701.

★**Melrose, Ohio.**—Contract for erecting two-story brick and reinforced concrete school awarded Willing Bros., Bellevue, Ohio; cost $25,000.

Tippecanoe City, Ohio.—Lowest bid opened Sept. 3 for erecting Township building submitted by A. Bentley Co., Dayton, at $30,026. Architects, Schenck & Williams, Arcade Building, Dayton. D. D. Mitchell, Township Clk.

Hartford City, Ind.—Lowest bids opened by Co. Comrs. for erecting brick building at county infirmary submitted by G. W. Heinzmann & Son, Indianapolis, at $21,687.

★**Chippewa Falls, Wis.**—Contract awarded W. J. Kingsley, Faribault, Minn., for erecting Rutledge Charities office, Bridge and Columbia Streets, at $41,350.

★**Fort Atkinson, Wis.**—Contract for erecting U. S. Post Office awarded Clark Constr. Co., Danville, Ill., at $39,350.

★**Minneapolis, Minn.** — Contract for erecting one-story reinforced concrete faced school and boiler room reported awarded H. N. Leighton Co., Minneapolis; cost $25,000. Donald A. Blake, Archt., Minneapolis.

★**Omaha, Neb.**—Contract awarded Selden Breck Co., St. Louis, Mo., for erecting three-story Creighton University Gymnasium on Burt Street, 94 x 265 ft. Probable cost $85,000. J. M. Nachtigall, Archt., Paxton Building.

★**Schuyler, Neb.**—Contract awarded by Bd. Educ. to Harry Ohlsen & Son, David City, for erecting high school, at $36,285 (bids opened Aug. 16). Grabe & Helleberg, Archts., Columbus, Neb.

★**Corpus Christi, Tex.** — Contract for erecting post office awarded Barnes Bros., Logansport, Ind., at $119,000.

★**Cuero, Tex.**—Contract for erecting U. S. Post Office awarded Richardson Eng. & Constr. Co., Bainbridge, Ga., at $53,470.

San Antonio, Tex.—Following are four lowest bids opened Aug. 20 by City and County Comrs. for erecting Robert Green Memorial Hospital: H. N. Jones Constr. Co., 216 Avenue C., $246,000; American Constr. Co., Houston, $248,800; Gilsonite Constr. Co., $249,950; Western & Groeger, $250,000. A. B. Ayres, Archt., Bedell Building.

Grand Junction, Colo.—Following are four lowest bids opened Aug. 24 by Super. Archt., Washington, D. C., for construction complete of U. S. Post Office: (a) limestone, (b) sandstone: King Lumber Co., Chaarlottesville, Va., (a) $96,140, (b) $100,000; Dieter & Wenzel Constr. Co., Wichita, Kan., (a) $106,821; Campbell Bldg. Co. of Utah, Salt Lake City, Utah, (a) $107,500, (b) $112,500; George A. Whitmeyer & Sons, Ogden, Utah, (a) $108,006; M. Yeager & Son, Danville, Ill., (b) $112,943; Norman Ker Co., New York, (b) $128,000.

★**Los Angeles, Cal.**—Contract for erecting brick and concrete South Park School at Manchester and S. Park Avenues awarded F. O. Engstrum Co., Los Angeles, and Amelia Street School, to G. W. Gilbreth & Co., Los Angeles.

★**Toronto, Ont.**—Following are some of contracts awarded in connection with Dovercourt Public School, which is to cost $53,539: Masonry, Albert Webb, $23,000; carpenter work, Frank Armstrong, $10,264; heating and ventilating, Bennett Wright Co., $4,188.

PRIVATE BUILDINGS

PROPOSED WORK

Worcester, Mass.—Burgess, Lang & Co., Worcester, will erect at Federal Street and Allen Court a seven-story office and commercial building costing, including site, $150,000.

Albany, N. Y.—Contract soon to be let for erecting six-story and basement office building, 57 x 234 ft., on State Street, for Municipal Gas Co.; cost $40,000. M. T. Reynolds, Archt., 100 State Street.

Brooklyn, N. Y.—Plans approved for the parochial school to be erected by Our Lady of Solace Church, Coney Island (Rev. Walter Kerwin, Pastor); cost $80,000.

Plans filed for following buildings: Four-story brick tenement at Dorchester Road and East Twenty-first Street for Lancaster Realty Co., cost $60,000; Shampan & Shampan, Archts., 772 Broadway, Brooklyn; six-story brick tenement at Rodney Street and Lee Avenue, for Aaron Segal, cost $60,000; Sass & Springsteen, Archts., 32 Union Square, New York.

New Rochelle, N. Y.—Knights of Columbus intend erecting fireproof clubhouse at Relyea Place and Central Avenue; cost $30,000.

New York, N. Y.—Churches are to be erected in the Bronx Boro. as follows: For St. Rita Parish (Rev. James P. O'Brien, Pastor) at College Avenue and 145th Street cost $70,000; Church of Our Lady of Mt. Carmel (Rev. D. Burke, Pastor), at Belmont Avenue and 187th St., cost $70,000. A. F. A. Schmitt, 604 Courtland Ave., Archt. for both buildings.

N. Y. Telephone Co., 15 Dey Street, has secured site at 208 to 216 Seventy-ninth Street and will erect a central office building according to plans by McKenzie, Voorhees & Gmelin, 1123 Broadway.

Plans filed for following buildings: Two nine-story fireproof apartment houses at 138 to 148 East Thirty-sixth Street for James Hames Co., cost $130,000, George & Edward Blum, Archts., 505 Fifth Avenue; six-story brick tenement at 43 West 139th Street for Anna Roberts, cost $50,000, Gronenberg & Leuchtag, Archts., 303 Fifth Avenue; five-story brick private dwelling at 87 East Seventy-ninth Street for John Sherman Hoyt, cost $150,000, Howells & Stokes, Archts., 100 William Street; seven-story fireproof college at 326 East Forty-second Street for New York College of Dentistry, cost $50,000, Shape & Bready, Archts., 220 West Forty-second Street; five-story fireproof school at 327 West Thirteenth Street for St. Bernard R. C. Church, cost $130,000, James S. Maher, Archt., 431 West Fourteenth Street; six-story brick store, office and display room at Fifth Avenue and Forty-second Street for William Decatur Parsons, cost $50,000; Harry Leslie Walker, Archt., 103 Park Avenue; five-story brick tenement at Loring Place and Fordham Road, cost $55,000, Owner and Architect. John P. Boyland, 2526 Webster Avenue; five-story brick tenement at Walton Avenue and 177th Street for George Nus, cost $50,000, John P. Boyland, Archt., 2526 Webster Avenue; five-story brick tenement at 181st Street and Vyse Avenue for Ronele Constr. Co., cost $60,000, Moore & Landsiedel, Archts., Third Avenue and 148th Street.

Camden, N. J.—Contract will soon be let for erecting three-story concrete, brick and steel, 80 x 130 ft. garage and service building for New Jersey Auto & Supply Co. Joshua C. Jefferis, Archt., 1001 Chestnut Street, Philadelphia, Pa.

Philadelphia, Pa.—Reported Ketchum & McQuade, 1029 Brown Street, will erect a moving picture theater at Fifty-sixth and Pine Streets, to cost $37,000.

Hopkinsville, Ky.—Methodists accepted plans for a $50,000 edifice.

Cleveland, Ohio.—Pennsylvania R.R. Co. (Alex. C. Shand, Ch. Engr., Philadelphia, Pa) considering construction of a union station.

Cleveland, Ohio.—Tentative plans filed for remodeling Ainsfield Building, E. Ninth Street and Prospect Avenue, for John Ainsfield; cost about $25,000. L. W. Thomas, Archt., Pythian Building.

Plans filed for an auditorium and association building to be erected at 2097 E. Twenty-first Street and Prospect Avenue for Bricklayers' Benevolent Assoc.; cost $35,000. W. S. Loguee, Archt., Marshall Building.

Marion, Ohio.—First Reformed Church contemplates erecting a brick and limestone church costing $25,000.

Ravenna, Ohio.—Plans completed by Richards, McCarty & Bulford, Archts., Columbus, for one story and basement brick church for First Methodist Congregation; cost $45,000.

Toledo, Ohio.—Contract soon to be let by Edward Thal, Archt., Ohio Building, for erecting store and loft building for Holberg & Parks; cost $50,000.

Indianapolis, Ind.—Plans being prepared for fireproof apartment house to be erected at College Avenue and Tenth Street by Lewis C. Willis, 2055 Delaware Street. Cost $50,000.

Hastings, Neb.—Plans completed by C. W. Way Co., Hastings, for four-story fireproof moving picture and office building to be erected at Second Street and Burlington Avenue for William Brach; cost $100,000.

Dallas, Tex.—Erection of a five-story hotel, steel and concrete construction is contemplated at Jefferson and Jackson Streets, to cost about $65,000. Davidson, David & Co., Real Estate, 1512 Busch Building, may be able to give further information.

San Francisco, Cal.—Plans approved by Directors Women's Athletic Club as prepared by Bliss & Faville, Balboa Building, for 4-story club building to be erected at Sutter and Mason Streets. Probable cost $100,000.

Portland, Ore.—Reported contract soon to be let by L. M. Lepper, Secy. East Side Holding Co. for erecting the two-story fireproof building for East Side Business Men's Club and the New Citizens Bank; probable cost $70,000.

BIDS DESIRED.

Cleveland, Ohio.—Until Sept. 21, according to press reports, for erecting a one and two-story, 140 x 216 x 265 ft. fireproof administration building for White Sewing Machine Co., E. Seventy-ninth Street and St. Clair Avenue. Probable cost $90,000. George H. Smith, Archt., Colonial Arcade.

PRICES AND LETTINGS.

★*Indicates awarded contract.*

★**Huntington, L. I., N. Y.**—John T. Woodruff & Son, Long Island City, reported to be contractors for $50,000 building to be erected for Bank of Huntington.

★**New York, N. Y.**—Contract awarded H. H. Oddie, Inc., for erecting six-story fireproof mercantile building at Fifth Avenue and Sixtieth Street. Louis E. Jallade, Archt.

★Underpinning & Foundation Co., 230 Broadway, has contract for standard Hercules steel pile construction in building at 33 and 35 W. Forty-sixth Street, of which Ritz Realty Co., 14 E. Forty-sixth Street, is general contractor and L. F. J. Weiher, 271 W. 125th Street, is the architect.

★**Niagara Falls, N. Y.**—Contract awarded Turner Constr. Co., Prudential Building, Buffalo, N. Y., for erecting here for the Norton Co. of Worcester, Mass., a reinforced concrete storage house, 32 ft. wide x 44 ft. high, located on a trestle, with a head house, 40 x 10 ft., 8 ft. high.

★**Irwin, Pa.**—Contract for erecting First Presbyterian Church awarded J. E. Myers, Penn Avenue, at $34,000.

★**Louisville, Ky.**—Contract for erecting five-story reinforced concrete brick and terra cotta building for Bankers' Realty Co. awarded Selden Breck Constr. Co., St. Louis, Mo. Brinton B. Davis, Archt., Louisville.

★**Columbus, Ohio.**—Contract for erecting club house for Scioto Country Club awarded Bert F. Smith, 1449 Fair Avenue, at about $45,000.

★**Dayton, Ohio.**—Contract for erecting nine-story, reinforced concrete, brick and terra cotta hotel at Fifth and Wilkinson Streets awarded T. A. Graham, Springfield, Probable cost $300,000. Thies & Thies, Dayton, Archts.

★**Youngstown, Ohio.**—Contract awarded Heller Bros. Co., Furnace Street, for erecting business building, 3 or 5 stories high, on West Federal Street for Ernest Salow; cost $75,000. C. F. Owsley, Archt., Youngstown.

St. Paul, Minn.—W. J. Hoy Co., Metropolitan Building, submitted lowest bid for erecting Filben Court apartment building at 668 Central Park Place for Mrs. Delia Fillben, St. Paul; cost about $250,000. Mark Fitzpatrick, Archt., 17 W. Nineteenth Street.

★**Sioux Falls, S. D.**—Contract awarded Ben Olson & Co., Omaha, at $26,440, for erecting basement of R. C. Cathedral.

★**Seattle, Wash.**—Contract awarded by Imperial Hotel Co. to Puget Sound Constr. Co., L. C. Smith Building, for erecting seven-story steel and concrete, 63 x 105 ft., brick and terra cotta hotel, at Eighth Avenue and Union Street; cost $135,000.

★**Pocatello, Idaho.**—Contract awarded by Loyal Order of Moose for erecting four-story steel, concrete, brick and terra cotta temple to Le Doux & Le Doux, 189 Simpson Street, Portland, Ore. Cost $75,000. Houghtaling & Dougan, Henry Building, Portland, Ore., Archts.

NEW INDUSTRIAL PLANTS

PROPOSED WORK

Lockport, N. Y.—Simons Mfg. Co., Fitchburg, Mass., will erect addition to Lockport plant; cost $100,000.

Niagara Falls, N. Y.—Reported contract soon to be let by Wright & Kremers, 311 Falls Street, for erecting one and two-story pulp mill, 68 x 82 ft., as an addition to plant of Defiance Paper Co., Main Street and New York Central R.R.

Philadelphia, Pa.—Contract will soon be let for erecting 6-story, 40 x 70 ft., brick, stone and reinforced concrete factory at Fourth and Cherry Streets for Felton, Sibley Co., Inc. Spencer Roberts, Archt., Weightman Building.

South Bethlehem, Pa.—Reported L. P. Lipshutz Cigar Co., Philadelphia, will erect a four-story cigar factory here. Electricity will be used for motive power.

Baltimore, Md.—Maryland Steel Co. intends making improvements at Sparrows Point, to include a machine shop, one story, 180 x 425 ft., structural steel and reinforced concrete, height 80 ft. An electric crane is included in the mechanical outfit.

Newport News, Va.—Reported grain elevator of the Chesapeake & Ohio R.R. (F. I. Cabell, Ch. Engr., Richmond) has been destroyed by fire.

Norfolk, Va.—See "Railroads."

Granite Falls, N. C.—D. H. Caldwell of Granite Falls reported interested in company which intends erecting cotton mill.

Toledo, Ohio — Reported improvements contemplated by Interstate Stock Yards Co. to double capacity of plant.

Chicago, Ill.—Reported Wheeling Corrugated Co., Wheeling, W. Va., will erect a plant on Arlington Street and Campbell Avenue costing $200,000. Plans prepared by Paul Gerhart, Schiller Building, and include a main building, four stories, reinforced concrete, flat type, capacity 4000 lb. per sq. ft. on first floor and 300 lb. on the upper floors; other buildings to be of brick and steel.

South Chicago (P. O. Chicago), Ill.—John S. Metcalf Co., Engrs., 619 The Temple, Chicago, engaged by the Chicago & Northwestern Ry. Co. to design and act as consulting engineers for new grain elevator plant to be constructed in South Chicago. Plant is to be operated by Armour Grain Co., to comprise a working house of a 1,000,000 bu. capacity with facilities for receiving grain at the rate of 360 cars in ten hours, and shipping to cars at the same rate. Arrangements will be made to dry 90,000 bu. of grain and bleach 240,000 bu. of oats in ten hours, besides large clipping and cleaning capacities; also include a marine tower for receiving from vessels at rate of 20,000 bu. per hour, and a river house equipped to ship to boats at the rate of 120,000 bu. of grain per hour, with a shipping gallery to carry grain out along the wharf for trimming the vessels after they have received bulk of their load at the river house. Between the working house and the river house there will be a storage house which will bring the ultimate storage capacity of the plant to approximately 10,000,000 bu. All of the machinery will be electrically driven, power to be from an independent plant of 4700-hp. water-tube boilers and turbo generators will be used. Facilities will be provided for collecting the dust caused by handling and cleaning grain and for sacking this dust or loading in bulk. An independent office building for operators, a welfare building for employees, a shop building, and 1200 ft. of wharf are also included in plant. Plans will be submitted to contractors at an early date.

Waterloo, Iowa.—Illinois Central R.R. (A. S. Baldwin, Ch. Engr., Chicago, Ill.) intends making improvements to the shops here; cost $180,000.
of 1,250,000 bushels.

Omaha, Neb.—Armour & Co. contemplate erecting at their South Omaha plant an office building, sheep killing house, coolers and car shops. Probable cost $250,000.

St. Louis, Mo.—Russell E. Gardner of the Banner Buggy Co., Main and Rutger Streets, reported interested in company which intends erecting a plant here for manufacture of automobiles.

Burnaby, B. C.—Plans approved by Council for plant which Shell Oil Co. will erect on Burrard Inlet, to consist of wharf crib work, warehouses and several steel tanks, capacity from 5000 to 35,000 gal.; cost $110,000.

BIDS DESIRED.

Freemansburg, Pa.—By Peuckert & Wunder, Archts. and Engrs., 310 Chestnut Street, Philadelphia, for erecting one and two-story manufacturing plant for William Shimer Sons & Co. Buildings to be brick, steel and concrete, fireproof, 242 x 75, 100 x 75 and 160 x 75 ft.

PRICES AND LETTINGS.

★*Indicates awarded contract.*

★**Worcester, Mass.**—Contract awarded E. D. Ward, Worcester, for erecting addition to foundry of Crompton & Knowles Loom Wks., on Gardner Street; to be 2 stories, brick, and cost $50,000.

★**Amsterdam, N. Y.**—Contract awarded Turner Constr. Co., Prudential Building, Buffalo, for erecting for Shuttleworth Bros. Co. two buildings for manufacture of carpets, one six stories, 243 x 62 ft., of flat slab type construction, the other six stories, 170 x 54 ft.—a dye house, beam and girder type. Buildings reinforced concrete construction throughout, with brick

contain walls, double glazed windows and wood floors. F. P. Sheldon & Son, Archts. and Engrs., Providence, R. I.

★**Buffalo, N. Y.**—Contract awarded John W. Cowper Co., Fidelity Building, for erecting mill and elevator on Buffalo River and Pennsylvania R.R. for Archer Daniels Linseed Co. of Minneapolis, Minn., cost $100,000.

★**Philadelphia, Pa.**—Reported H. C. Rea Co., 1507 Wood Street, has awarded contract to erect six-story fireproof factory at Eleventh and Race Streets for Manufacturers Realty Co., cost $[illegible]. Balinger & Pepel, Archts., 1211 Arch Street.

★**Philadelphia, Pa.**—Contract awarded William Steele & Sons Co., 1600 Arch Street, for erecting 4-story reinforced concrete manufacturing at Parkes Street and Kruse Avenue for Bennett-Apsden Co., cost $[illegible].

★**Sharon, Pa.**—Contract for erecting two steel buildings for Valley Mould & Iron Co. of Sharpsville awarded Penn Bridge Co., Beaver Falls. One building to be [illegible] ft., the other [illegible] ft. Contract for six electric traveling cranes to be installed in the buildings awarded Morgan Eng. Co., Alliance, Ohio.

★**Baltimore, Md.**—Contract for erecting brick and steel pumping plant addition, [illegible] ft. for Poole Eng. Co., awarded Corwin Bldg. Co., 106 W. Madison Street, Baltimore. Emory & Newmeyer, Archts., Professional Building, Baltimore.

★**Milwaukee, Wis.**—Contract awarded Barnett-Record Co., Minneapolis, Minn., for erecting circular concrete elevator for Chicago & Northwestern R.R. on Kinnickinnic Ave.; cost $[illegible]. Folz Eng. Co., Engrs., St. Paul, Minn.

★**Minneapolis, Minn.**—Contract reported awarded Barnett & Record Co., Minneapolis, for erecting a grain elevator for the Pillsbury Flour Mills Co., and will consist of 24 concrete bins, 26 ft. diameter x 100 ft. high.

MISCELLANEOUS

PROPOSED WORK

Asbestos Supply—Showhegen, Me.—It is reported that Somerset County may in future become an important source of asbestos supply as on the Haynes estate on Stony Brook and Spencer stream tracts owned by Mrs. Elizabeth S. Haynes of Augusta asbestos has been found by Mineralogist Charles H. Warren of Massachusetts Institute of Technology, Boston, Mass., to extend four or five miles. An investment of about $[illegible] will be required to make the supply available. Railroad will have to be built 25 or 30 miles to reach these mines.

Play Ground, Etc., Bonds, Boston, Mass.—See "Sewerage and Sewage Disposal."

Coal Pier—Baltimore, Md.—All bids recently received by Pennsylvania R.R. Co. for the construction of a new coal pier at Canton, Baltimore, have been rejected. As plans were not satisfactory a new set of plans are being prepared and new bids will be received. Alexander C. Shand, Ch. Engr., Philadelphia, Pa.

Tunnel—Baltimore, Md.—Commission on City Plan Charles Penniman, Chmn., reported considering plan for a municipal belt line tunnel for steam railroads entering Baltimore.

Gas Plant—Lake Charles, La.—Andrew Cook, City Clk., writes Jay C. Fisher & John G. Beste of Rochelle, Ill., have been granted a 20-year gas franchise which will have to be ratified at an election on Oct. 8. Building to be of steel, brick and concrete with 10 miles of mains. To be in operation in one year, after approval of franchise by electors.

Wharf—Beaumont, Tex.—See "Sewerage and Sewage Disposal."

BIDS DESIRED.

Shed for Pier—Brooklyn, N. Y.—Until Sept. 17 by R. A. C. Smith, Comr. of Docks, Pier A, foot Battery Place, Manhattan, for furnishing material and erecting a freight shed with appurtenances on pier head, foot of Thirtieth Street, Bore, Brooklyn. Contr. No. 1470. Security $88,[illegible].

Underground Steam Mains in Hospital—Central Islip, N. Y.—Until Sept. 24 by State Hosp. Comr., Albany (E. S. Elwell, Secy.), for renewal of underground steam mains and heating work at Central Islip Hospital, Central Islip, advertised in Engineering Record. Lewis F. Pilcher, State Archt., Albany.

Electric Hoist—Washington, D. C.—Until Sept. 15 at office of Superintendent, State, War and Navy Bldg., for removing present heating engine used for operating coal hoist and substituting an electrically operated hoist.

Steel Cross Ties, Etc.—Chicago, Ill.—Until Sept. 11 by W. K. Moorehouse, Comr. Pub. Wks., for furnishing and delivering at various points along line of Western Avenue subway about 11,000 steel cross ties, also structural steel sidewalk railing at Montrose Avenue bridge.

Cement—Portland, Ore.—Until Oct. 7 by U. S. Engineer's Office, Second Dist., Portland, Ore., for cement, advertised in Engineering Record.

Pipe, Etc.—Panama.—Until Sept. 24 by Maj. F. C. Boggs, Corps Engrs., U. S. A., Genl. Purchasing Officer, Panama Canal, Washington, D. C., for Cir. 986—Wrought iron or steel pipe, c. i. pipe, steel boiler tubes, steel tubing, etc.

Steel Shapes, Etc. — Panama. — Until Sept. 22 by Maj. F. C. Boggs, Corps Engrs., U. S. A., Genl. Purchasing Officer, Panama Canal, Washington, D. C., for Cir. 965—Steel shapes and plates, billet steel, soft steel bars, cold-rolled steel, manganese steel, electric cable, etc.

PRICES AND LETTINGS.

★*Indicates awarded contract.*

Painting Dams—Albany, N. Y.—Lowest bid opened Aug. 31 by W. W. Wotherspoon, Supt. Pub. Wks., Albany, for painting superstructures of movable dams over Mohawk River at Rotterdam, Cranesville, Amsterdam, Tribes Hill, Yost, Canajoharie and Fort Plain, submitted by Vassilaros Contr. Co., 154 Nassau Street, New York. Cost about $8,000.

Elevators — Baltimore, Md. — Following bids opened by Supervising Architect, Treas. Dept., Washington, D. C., Aug. 31 for installation of an elevator plant in U. S. Immigrant Station, Baltimore, Md. Otis Elevator Co., Washington, D. C., $12,-721; Standard Plunger Elevator Co., Worcester, Mass., $10,950; Robert Wetherill & Co., Chester, Pa., $18,580.

★**Sand and Gravel—North Yakima, Wash.**—Contract awarded by Dept. of Interior, Washington, D. C., to Dunn & Hogan of North Yakima, to furnish and deliver sand and gravel along canals of Outlook Irrigation Dist., Sunnyside Unit, Yakima Irrigation Project, at $5,601.

Elevators — Pearl Harbor, Hawaii. — Only bid received and opened Aug. 28 by Chief Bureau of Yards and Docks, Navy Dept., Washington, D. C., for furnishing three hydro-pneumatic freight elevators at the naval station, Pearl Harbor, submitted by Otis Elevator Co., Washington, D. C., at $8,484.

Proposals

For Proposals Advertised, see Pages 46, 47, 48, 49 and 50

WATERWORKS.

Bids Close.		See Eng. Record.
Sep. 14.	Pipe, Washington, D. C..	Aug. 21
Sep. 14.	Gate Valves, Brooklyn, N. Y.	Aug. 28
Sep. 14.	Filter Plant, Macon, Mo.	Sep. 4
Sep. 14.	Well, Glenview, Ill.	Sep. 11
Sep. 15.	Pipes, Valves, Etc., Medina, Ohio. Adv. Aug. 28, Sept. 4.	Aug. 28
Sep. 15.	Water Works, Manchester, N. Y. Adv. Aug. 28, Sept. 4.	Aug. 28
Sep. 15.	Water Works, Salix, Iowa.	Sep. 4
Sep. 15.	Water Works, Spearville, Kan.	Sep. 4
Sep. 15.	Pipe and Fittings, Baltimore, Md. Adv. Sep. 4.	Sep. 4
Sep. 15.	Water Works, Miller, Ind.	Sep. 4
Sep. 15.	Pipe, Chicago, Ill.	Sep. 11
Sep. 15.	Material, Leslie, Ark.	Sep. 11
Sep. 16.	Pipe Trenching, Covington, Ky. Adv. Sept. 4, 11.	Sep. 4
Sep. 16.	Boxes and Extensions, Chicago, Ill.	Sep. 11
Sep. 20.	Water Works, Myton, Utah. Adv. Aug. 28, Sept. 4.	Aug. 28
Sep. 23.	Water Works, Whitehall, Mont. Adv. Aug. 28 to Sept. 11.	Aug. 28
Sep. 23.	Wells, Jamestown, N. Y. Adv. Sep. 11.	Sep. 11
Sep. 27.	Well, Hastings, Neb. Adv. Aug. 28.	Aug. 28
Sep. 27.	Tank, Amboy, Ill.	Sep. 11
Sep. 28.	Cont. 161, New York, N. Y.	Sep. 11
Sep. 30.	Pumping Equipment, Philadelphia, Pa.	Sep. 11
Sep. 30.	Hydrants, Washington, D. C.	Sep. 11
Oct. 1.	System at Univ., Wilberforce, Ohio	Sep. 11
Oct. 5.	Reservoir, Tamaqua, Pa. Adv. Sep. 11.	Sep. 11
Nov. 9.	Water Wks., Bellevile, Ohio	Sep. 11
	Well, Thomasville, Ala.. Adv. Aug. 28.	Aug. 28

SEWERAGE AND SEWAGE DISPOSAL.

Sep. 14.	Ocala, Fla.	Aug. 14
Sep. 14.	Clinton, Iowa	Aug. 21
Sep. 14.	St. Louis, Mo.	Sep. 4
Sep. 14.	Reed City, Mich. Adv. Sep. 11.	Sep. 11
Sep. 14.	Toronto, Ont.	Sep. 11
Sep. 15.	Chicago, Ill.	Sep. 11
Sep. 15.	Betterton, Md. Adv. Sep. 11.	Sep. 11
Sep. 15.	Cleveland, Ohio	Sep. 11
Sep. 15.	Medina, Ohio Adv. Sep. 11.	Sep. 11
Sep. 15.	Walden, N. Y. Adv. Sept. 11.	Sep. 11
Sep. 16.	Santa Barbara, Cal.	Aug. 21
Sep. 16.	Bozeman, Mont.	Sept. 11
Sep. 17.	Kenosha, Wis. Adv. Sept. 4, 11.	Sep. 4
Sep. 17.	Milwaukee, Wis. Adv. Sept. 4, 11.	Sep. 4
Sep. 17.	Brockport, N. Y. Adv. Sept. 4, 11.	Sep. 4
Sep. 17.	Richfield, Utah	Sep. 11
Sep. 17.	Boston, Mass.	Sep. 11
Sep. 17.	Chicago, Ill.	Sep. 11
Sep. 18.	Sioux City, Iowa	Sep. 4
Sep. 20.	Brainerd, Minn.	Aug. 28
Sep. 20.	Port Clinton, Ohio	Aug. 28
Sep. 20.	Centerville, S. D.	Sep. 4
Sep. 20.	Linden, N. J.	Sep. 11
Sep. 20.	Ames, Iowa	Sep. 11
Sep. 21.	Forest Grove, Ore.	Sep. 4
Sep. 23.	Ann Arbor, Mich.	Sep. 11
Sep. 23.	Whitehall, Mont. Adv. Aug. 28 to Sept. 11.	Aug. 28
Sep. 23.	Appleton, Wis.	Sep. 11
Sep. 24.	Seaside Park, N. J. Adv. Sep. 11.	Sep. 11
Sep. 27.	Lyle, Minn.	Sep. 11
Oct. 14.	Mansfield, Ohio	Aug. 28

BRIDGES.

Sep. 14.	Mankato, Kan.	Sep. 4
Sep. 14.	Keyser, W. Va.	Sep. 4
Sep. 14.	Youngstown, Ohio	Sep. 11
Sep. 15.	Buffalo, N. Y. Adv. Sep. 4.	Sep. 4
Sep. 15.	Illinois	Sep. 11
Sep. 15.	Pottsville, Pa.	Sep. 11
Sep. 17.	Steubenville, Ohio	Aug. 28
Sep. 17.	Cincinnati, Ohio	Aug. 28
Sep. 17.	Bangor, Pa.	Sep. 4
Sep. 17.	Columbus, Ohio	Sep. 4
Sep. 17.	Illinois	Sep. 11
Sep. 18.	Ellsworth, Kan.	Aug. 28
Sep. 18.	Tekamah, Neb.	Sep. 11
Sep. 20.	St. Clairsville, Ohio	Sep. 11
Sep. 22.	Cleveland, Ohio	Sep. 11
Sep. 24.	Massillon, Ohio	Sep. 11
Sep. 25.	Hankow, China. Adv. Aug. 14.	Aug. 14
Sep. 28.	Greensburg, Pa.	Sep. 4
Oct. 6.	Lawrence, Kan. Adv. Aug. 14 to Sept. 11.	Aug. 14

PAVING AND ROADS.

Sep. 13.	Montclair, N. J. Adv. Aug. 28, Sept. 4.	Aug. 28
Sep. 14.	Columbus, Wis.	Sep. 4
Sep. 14.	Norwalk, Conn. Adv. Sept. 4, 11.	Sep. 4
Sep. 14.	Pittsburgh, Pa.	Sep. 11
Sep. 14.	Cherryvale, Kan.	Sep. 11
Sep. 15.	Pennsylvania	Sep. 4
Sep. 15.	Indiana.	Sep. 4
Sep. 15.	New York, N. Y.	Sep. 11
Sep. 15.	Brooklyn, N. Y.	Sep. 11
Sep. 15.	Chicago, Ill.	Sep. 11
Sep. 15.	Louisville, Ky.	Sep. 11
Sep. 15.	Glens Falls, N. Y. Adv. Sep. 11.	Sep. 11
Sep. 15.	Baltimore, Md.	Sep. 11
Sep. 16.	Newark, N. J.	Sep. 4
Sep. 16.	Illinois	Sep. 11
Sep. 16.	Boston, Mass.	Sep. 11
Sep. 16.	Buffalo, N. Y.	Sep. 11
Sep. 17.	Xenia, Ohio	Sep. 11
Sep. 17.	Marion, Ohio	Sep. 11
Sep. 17.	Montvale, N. J.	Sep. 11
Sep. 18.	Ellsworth, Kan.	Aug. 28
Sep. 20.	Newark, N. J.	Aug. 28
Sep. 20.	Conneaut, Ohio	Sep. 4
Sep. 20.	Bluff City, Tenn.	Sep. 4
Sep. 20.	St. Charles, Ill. Adv. Sep. 11.	Sep. 11
Sep. 20.	Santa Barbara, Cal.	Sep. 11
Sep. 21.	Baltimore, Md.	Aug. 28
Sep. 21.	Asphalt Plant, New Orleans, La.	Sep. 4
Sep. 21.	Taylor, Tex. Adv. Sept. 4, 11.	Sep. 4
Sep. 21.	New Orleans, La.	Sep. 11
Sep. 23.	Pittsburgh, Pa.	Sep. 4
Sep. 28.	Kansas City, Mo.	Sep. 11

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS.

Sep. 14.	State Canal Wk., Albany, N. Y. Adv. Aug. 14 to Sept. 11.	Aug. 14
Sep. 14.	Ditch, Breckenridge, Minn.	Aug. 28
Sep. 15.	Dredging, Baltimore, Md. Adv. Aug. 14, 21, Sept. 4, 11.	Aug. 14
Sep. 15.	Irrigation Work, Malta, Mont.	Aug. 28
Sep. 15.	Levee Repairs, Shawneetown, Ill. Adv. Sep. 11.	Sep. 11
Sep. 16.	Steel Piling for Dam, Louisville, Ky. Adv. Aug. 21 to Sept. 11.	Aug. 21
Sep. 16.	Irrigation Work, Newell, S. D. Adv. Aug. 28.	Aug. 28
Sep. 16.	Ditches, Windom, Minn.	Sep. 11
Sep. 17.	Dralnage, Palmetto, Fla.	July 24
Sep. 18.	Pier, Pearl City, T. H.	July 10
Sep. 20.	Lock Gates, Montgomery, Ala. Adv. Aug. 21, 28, Sept. 11.	Aug. 21
Sep. 20.	Revetment Work, Hartsburg, Mo. Adv. Aug. 28 to Sept. 11.	Aug. 28
Sep. 20.	Retaining Wall, Washington, D. C. Adv. Aug. 28 to Sept. 11.	Aug. 28
Sep. 20.	Irrigation Work, Malta, Mont. Adv. Aug. 28.	Aug. 28
Sep. 21.	Ditch, Slayton, Minn.	Sep. 11
Sep. 22.	Piers, Honolulu, Hawaii.. Adv. Aug. 7 to Sept. 4.	Aug. 7
Sep. 22.	Wharf Addition, Fort Constitution, N. H.	Sep. 11
Sep. 23.	Dredging, Norfolk, Va. Adv. Aug. 28 to Sept. 11.	Aug. 28
Sep. 24.	Operating Machinery at Dam, Cincinnati, Ohio.. Adv. Aug. 28, Sept. 11.	Aug. 28
Sep. 24.	Drainage, Muscatine, Ia.	Sep. 4
Sep. 25.	Ditch, Worthington, Minn.	Sep. 11
Sep. 28.	Terminal Contr. 47 and 49, Albany, N. Y. Adv. Aug. 28 to Sept. 11.	Sep. 4
Oct. 1.	Dikes, Etc., Cathlamet, Wash.	Aug. 28
Oct. 1.	Bulkhead Shed, San Juan, P. R. Adv. Sept. 4, 11.	Sep. 4
Nov. 8.	Dredge, Jacksonville, Fla. Adv. Sep. 11.	Sep. 11

PUBLIC BUILDINGS AND SCHOOLS.

Sep. 14.	Boston, Mass. Adv. Aug. 28, Sept. 4.	Aug. 28
Sep. 14.	Milledgeville, Ohio	Aug. 28
Sep. 14.	Dayton, Ohio	Aug. 28
Sep. 14.	Batavia, N. Y.	Aug. 28
Sep. 14.	Patton, Cal.	Aug. 28
Sep. 14.	Glenwood, Iowa	Sep. 4
Sep. 14.	Iowa City, Iowa	Sep. 4
Sep. 14.	Wildwood, N. J.	Sep. 11
Sep. 14.	Logan, Ohio	Sep. 11
Sep. 15.	Hyde Park, Ohio.	Aug. 21
Sep. 15.	Arverne, N. Y. Adv. Aug. 21, 28.	Aug. 21
Sep. 15.	Boston, Mass.	Aug. 28
Sep. 15.	Boston, Mass.	Sep. 4
Sep. 15.	Claysville, Pa.	Sep. 11
Sep. 15.	Fort Frances, Ont.	Sep. 11
Sep. 15.	Halfa, Iowa	Sep. 11
Sep. 15.	Milwaukee, Wis.	Sep. 11
Sep. 16.	Dayton, Ind.	Sep. 4
Sep. 16.	Steubenville, Ohio	Sep. 4
Sep. 16.	Toms River, N. J. Adv. Sept. 4, 11.	Sep. 4
Sep. 17.	Ogden, Iowa	Aug. 28
Sep. 17.	Wisner, Neb.	Sep. 11
Sep. 17.	Wood River, Ore.	Sep. 11
Sep. 18.	West Pownal, Me.	Sep. 11
Sep. 20.	Cincinnati, Ohio Adv. Aug. 28.	Aug. 28
Sep. 20.	Steubenville, Ohio	Aug. 28
Sep. 20.	Bardwell, Ky.	Sep. 4
Sep. 20.	Atlanta, Ga.	Sep. 4
Sep. 20.	New York, N. Y.	Sep. 11
Sep. 21.	Marblehead, Ohio Adv. Sept. 4, 11.	Sep. 4
Sep. 21.	Medical Lake, Wash.	Sep. 11
Sep. 21.	Sedro Woolley, Wash.	Sep. 11
Sep. 24.	Wards Island, N. Y. Adv. Sep. 11.	Sep. 11
Sep. 25.	Vallejo, Cal.	Aug. 28
Sep. 25.	Norfolk, Va.	Aug. 28
Sep. 25.	Bremerton, Wash.	Aug. 28
Sep. 25.	Lima, Ohio	Sep. 4
Sep. 25.	Lincoln, Neb.	Sep. 11
Sep. 27.	Tulsa, Okla.	Aug. 14
Sep. 27.	Cleveland, Ohio	Sep. 11
Sep. 28.	Harrisburg, Pa. Adv. Aug. 21, 28.	Aug. 21
Sep. 29.	Smyrna, Del.	Aug. 28
Sep. 30.	Washington, D. C. Adv. July 24, 31.	July 24
Sep. 30.	Tulsa, Okla.	Aug. 28
Sep. 30.	Elizabeth, N. J. Adv. Sept. 4, 11.	Sep. 4
Sep. 30.	Tompkinsville, N. Y.	Sep. 11
Oct. 1.	Kalamazoo, Mich.	Aug. 28
Oct. 1.	Toledo, Ohio	Sep. 11
Oct. 7.	Wilmington, N. C.	Sep. 11
Oct. 8.	Boston, Mass.	Sep. 4
Oct. 18.	Naugatuck, Conn.	Sep. 11
Oct. 14.	Wilkesboro, N. C.	Sep. 11
Oct. 16.	Washington, D. C.	Aug. 28
Oct. 19.	Norton, Va.	Sep. 11

PRIVATE BUILDINGS.

Sep. 15.	Seattle, Wash.	Aug. 14
Sep. 21.	Cleveland, Ohio	Sep. 11

MISCELLANEOUS.

Sep. 14.	Elevator, Camden, N. J.	Aug. 21
Sep. 14.	Steel Cross Ties, Etc., Chicago, Ill.	Sep. 11
Sep. 15.	Hardware for Pub. Bldg., Newark, N. Y. Adv. Sep. 4.	Sep. 4
Sep. 16.	Grade Separation, Cleveland, Ohio	Sep. 4
Sep. 16.	Cable, Steel, Etc., Panama	Sep. 4
Sep. 17.	Shed for Pier, Brooklyn, N. Y.	Sep. 11
Sep. 18.	Ry. at Naval Station, Pearl Harbor, Hawaii	July 10
Sep. 18.	Electric Hoists, Washington, D. C.	Sep. 11
Sep. 20.	Retaining Wall, Washington, D. C.	Sep. 4
Sep. 20.	Cable Ducts, Etc., Toronto, Ont.	Sep. 4
Sep. 22.	Cement, Sand and Gravel, New Orleans, La. Adv. Sept. 4, 11.	Sep. 4
Sep. 22.	Steel Shapes, Etc., Panama	Sep. 11
Sep. 23.	Garbage Incinerator, Greystone Park, N. J.	Sep. 11
Sep. 24.	Pipe, Etc., Panama.	Sep. 11
Sep. 24.	Underground Steam Mains in Hospital, Central Islip, N. Y. Adv. Sep. 11.	Sep. 11
Oct. 7.	Cement, Portland, Ore. Adv. Sep. 11.	Sep. 11
Oct. 8.	Mechanical Equipment in Appraisers' Stores, Boston, Mass. Adv. Sept. 4, 11.	Sep. 4
Oct. 8.	Elevator, Boston, Mass.	Sep. 4
Oct. 16.	Pumps, Etc., for Oil Plants, Washington, D. C.	Aug. 28
Nov. 17.	Power Plants, Etc., Washington, D. C.	Aug. 28

Members of New England Waterworks Association End Convention September 9 with Inspection of Kensico Dam



HENRY B. MACHEN, CHAIRMAN OF COMMITTEE ON ENTERTAINMENT



PRESIDENT LEONARD METCALF AND WILSON FITCH SMITH OF WATER BOARD



ALFRED D. FLINN, CHAIRMAN OF COMMITTEE ON ARRANGEMENTS



C. M. CLARK, MERRITT H. SMITH, MRS. H. B. MACHEN AND W. W. BRUSH



MEMBERS REACH DAM CREST AFTER A HOT ASCENT OF THE STEEP GRADE



LOUIS L. TRIBUS (WEARING STRAW HAT) AT BASE OF DAM



PAST-PRESIDENT R. C. P. COGGESHALL (CENTER) AND W. R. CONARD (LEFT)



FRANK L. FULLER (AT LEFT) AND PARTY LEAVING DAM



GEORGE A. KING REACHES RAILWAY STATION AFTER INSPECTING DAM

CONTRACTING NEWS

Of Special Interest to Engineers, Contractors, Builders and Manufacturers of Engineering and Building Supplies

IT seems that the foreign exchange of England and France is about to be put back on a normal basis at last by a loan to those countries of one billion dollars. This loan will never actually leave this country, but will be turned over in payment for foodstuffs and ordinary manufactures shipped to those nations. They have, it is understood, gold and to spare to pay for the relatively small quantity of actual munitions of war with which we are equipped to supply them. Furthermore, there are other large agricultural countries with a combined export capacity at least equal to the food requirements of England and France, and in which the rate of exchange has not yet been forced down. The consummation of this loan is thus of vital importance to the American farmer and manufacturer, as without it our surplus crops and other products cannot find adequate export outlet. Therefore, the loan may be expected to go through.

The effect that this loan will have on the money available for public improvements will not be noticeable, according to well-informed men in financial circles, as it is not even believed that any considerable curtailment of stock speculation will result. We have much more than the amount of the proposed loan available for investment, in bank reserves and other forms, that is now idle. The money will be paid back to the American farmer and manufacturer, and will be at all times available for use in this country, while France and England will pay us interest on it and repay the principal in a short term of years.

Although pig-iron production in August, and probably also finished steel production, broke all previous records, unfilled orders of the U. S. Steel Corporation decreased during the month less than half of one per cent. The demand has not slackened in the least. Many steel products are now hard to get, and the railroads are being forced into the market already in order to secure 1916 deliveries on rails.

Buildings

Contracts for constructing the White Plains (N. Y.) court house have been awarded at a total of $524,000. The lowest bids received at Philadelphia for erecting an armory total $147,000. A contract for building an automobile warehouse in Washington, D. C., has been awarded at $221,000. A $120,000 contract has been awarded for constructing a passenger station for the Pennsylvania Railroad at Johnstown, Pa. The lowest bid opened Sept. 7 for constructing the Charlotte (N. C.) post office was $192,692. A contract for erecting a $125,000 office building has been awarded at Nashville, Tenn. Bids are desired for constructing a $175,000 hospital building at New Haven, Conn., and for building a $200,000 college dormitory at Wellesley, Mass. Bids are also desired for building a $200,000 school at Carbondale, Pa. A $160,000 building contract will be let Sept. 27 at Seattle.

A bakery to cost $175,000 is to be built at Portland, Me. Plans have been filed for an $800,000 office building and for a $1,000,000 loft building in New York City. The erection of a $500,000 cold-storage warehouse is contemplated at Pittsburgh. Plans are being prepared for a $300,000 office building at Cleveland. The construction of two public institutions being considered by the State of Wisconsin will cost $375,000. A $100,000 addition to an industrial plant at Billings, Mont., is proposed. A contract for a $150,000 addition to a concrete warehouse will soon be let by the port commissioners of Seattle. It is reported that a $150,000 fruit-packing plant will be built at Portland, Ore.

Bridges and Roads

A low bid of $468,000 has been submitted for constructing the Stratford Avenue bridge at Bridgeport, Conn. A highway bridge contract, which will probably amount to $75,000, has been awarded at St. Paul, Neb. Bids are desired by the Maine State Highway Department for constructing a concrete arch bridge with a 174-ft. span. Bids are also desired for constructing five concrete bridges at Binghamton, N. Y. The State of Pennsylvania desires bids Sept. 30 for constructing about nineteen small highway bridges. Bids will be received Sept. 30 for constructing a bridge over the Schuylkill River at Norristown, Pa. Plans have been completed for a $75,000 bridge at Columbus, Ohio. Plans have also been completed for a $60,000 bridge at Lyons Falls, N. Y. Plans are being prepared for a $250,000 railroad viaduct at Lynchburg, Va.

New York City has awarded contracts for paving work totaling $95,000. Two paving contracts awarded at Newark, N. J., total $133,000. Bids have been opened on a number of additional paving contracts at Philadelphia. St. Louis awarded Sept. 10 paving contracts amounting to $283,000. A $234,000 paving contract has been awarded at Seattle. Bids are desired for five sections of road work, for which $250,000 is available, at Dayton, Tenn. Two large road bond issues have been sold, one for $470,000 at Newark, N. J., and one for $784,000 at West Palm Beach, Fla. The City Council of Ames, Iowa, has voted to construct 100,000 sq. yd. of paving.

Waterworks and Sewers

The lowest bid for constructing a pumping plant at East Orange, N. J., was $109,000. A $101,000 contract for building a waterworks dam has been awarded at Quebec. Bids are desired this month at Charleston and at East Liverpool, Ohio, for constructing complete waterworks systems. The installation of a high-pressure fire-main system is being considered at Atlantic City, N. J. Fort Scott, Kan., expects to spend $50,000 for waterworks improvements.

A sewage pumping station to cost $172,000 has been contracted for at Albany, N. Y. Bids are desired Oct. 7 for building a large storm-water drainage system at Atlantic City, N. J. Bids are desired at Lisbon, Iowa, for constructing a sewer system and disposal plant. Verona, N. J., will issue $180,000 bonds and construct a sewer system and disposal plant. A $185,000 sewer system and disposal plant is proposed at Sharon, Pa. Plans are being prepared for a sewer system at Santa Anna, Tex.

Miscellaneous

The lowest bid received for constructing a conduit at Boston was $105,000. A $180,000 dredging contract has been awarded at Jacksonville, Fla. Bids have been opened on a $260,000 drainage contract at Rosseau, Minn. A $110,000 irrigation contract has been awarded at Eureka, Mont. The city of Philadelphia desires bids Oct. 19 for constructing approximately five miles of elevated railroad. The work is divided into four contracts. The survey for a $280,000 drainage project has been completed at Paducah, Ky. Irrigation work to cost $800,000 will be let soon at Echo, Ore. It is reported from San Francisco that contracts are to be let for constructing a $1,800,000 railroad to the site of the Hetch Hetchy dam. It is reported that work is to begin at once on terminal improvements at Vancouver, B. C., which include a retaining wall estimated to cost approximately $115,000.

WATERWORKS

PROPOSED WORK

Atlantic City, N. J.—An ordinance has been introduced providing for high-pressure fire mains, bids not yet called for. David H. V. Bell, City Clk.

Cranford, N. J.—A. R. Denman, Town Clerk, writes no water works improvements contemplated.

New Brunswick, N. J.—It is proposed to install a [illegible]-gal. centrifugal pump, a 6,000,000-gal. filter plant and a 40 x 30-ft. standpipe; cost $175,000. Asher Atkinson, City Engr.

Reading, Pa.—See "Hydraulic Construction and River Improvements."

Shreveport, La.—City Commission has made offer to company to buy plant for $[illegible], and, if offer is not accepted, proposition to build municipal plant will be submitted to a vote, with bonds amounting to $1,[illegible],000 now available for that purpose.

Pass Christian, Miss.—Election soon to be held to vote $[illegible] to $50,000 bonds for constructing water works, electric light plant and sewers; plans prepared by Xavier A. Kramer of Magnolia. W. A. Terrell, City Clk.

Glendale, Ohio.—Election to be held on issuing $[illegible] bonds for water works.

Bloomington, Ind.—Dr. C. E. Harris, of Bloomington, has applied for a water works franchise, and a public hearing will be held Sept. 27 by Indiana Public Service Comm. on proposition. John C. Harris, Mayor.

Carlton, Minn.—City considering installation of water works to cost about $16,000, to include pumping station, 1½ miles of force mains. Steel pipe will be used.

Minneapolis, Minn.—It is reported that an issue of bonds will be asked for to be used for purchase of 1934 ft. 24 in., 2615 ft. 30 in., and 4532 ft. 36 in. c-i hub and spigot pipe to be used for feeder mains to increase present supply on west side of Mississippi River for which plans have been prepared. F. W. Cappelen, City Engr.

Emporia, Kan.—City is considering filtration plant.

Fort Scott, Kan.—City intends improving water works, to include a rapid sand filtration plant; citizens recently voted $50,000 bonds for the improvements.

Bayard, Neb.—Finley & Seizer, Scottsbluff, are engineers for proposed water works, to cost $12,500. Bids for bonds will be received about Dec. 1 and for construction about January, 1916. Address City Clerk.

Galveston, Tex.—City Comrs. authorized A. T. Dickey, City Engr., to prepare plans and specifications, and let contract at once, for reconstructing the 30-in. submerged water main.

Tulsa, Okla.—City Engineer has been directed to prepare a map of ground of proposed site for dam in Osage Hills. Water will probably supply city with water supply. Question will probably be submitted to citizens at election in February.

Everett, Wash.—Burns & McDonnell, Kansas City, Mo., are engineers for water improvements voted Aug. 24 as follows: $600,000 bonds for constructing a flow line from Sultan River to supply to new privately owned water distribution system of the city; also $1,000,000 bonds for acquiring by purchase or condemnation water system of Everett Ry., Light & Water Co. Louis Lesh, City Clk.

Raymond, Wash.—City has taken over water works system from Raymond Water Co. for $93,881, including 32 acres of land. Plans for extending system several miles up South Fork River have been under way for some time, and proceedings have been instituted to condemn right-of-way. When extension is finally completed city will have a complete gravity water supply system.

Baker, Ore.—Reported citizens will soon vote on another bond issue for $110,000 for extension of city water system.

Hood River, Ore.—East Work Irrigation Dist. voted to issue $50,000 bonds to be used to complete improvements to irrigation system, to water 1300 acres of East Side orchards.

Aberdeen, Idaho.—Council reported to have filed with Public Service Comn. certificate of convenience and necessity to permit the installation of a municipal water works system. H. C. Wiebe, Village Clk.

Idaho Falls, Idaho.—City Engineer Wilson estimates the cost of raising dam to increase flow of water at municipal plant, at $12,789.

BIDS DESIRED.

Brooklyn, N. Y.—Until Oct. 5, by Bureau Supplies and Accounts, Navy Dept., Washington, D. C., for Sch. 8801—57,200 ft. galvanized steel conduit.

Central Islip, N. Y.—Until Sept. 24 by State Hospital Comn. (E. S. Elwood, Secy.), Albany, for sanitary work, artesian wells, North and South Colony power plants, at Central Islip State Hospital, advertised in Engineering Record. Lewis F. Pilcher, State Archt., Albany.

Coatesville, Pa.—Until Oct. 7 by Borough Council for constructing high service system, advertised in Engineering Record. Alex. Potter, Engr., 50 Church Street, New York. P. R. Baker, Boro. Secy.

Washington, D. C.—Until Oct. 12, by Bureau Supplies and Accounts, Navy Dept., Washington, D. C., for Sch. 8804—2 single-acting air pumps, miscellaneous feed wire, pumps, valves etc. for navy yards, Norfolk and Charleston.

Cleveland, Ohio. — Until Sept. 22 by Comrs. Purchases and Supplies for two steam, turbine-driven, centrifugal feed pumps and a reciprocating pump for the Division Avenue Pumping Station.

East Liverpool, Ohio.—Until Sept. 25 by E. J. Smith, Dir. Public Service, for constructing a 6,000,000-gal. mechanical filter plant, river intake, pumping station, pumps, boiler chimney, and appurtenances, advertised in Engineering Record. Chester & Fleming, Engrs., Union Bank Bldg., Pittsburgh.

South Charleston Ohio—Until Sept. 30 by W. L. Wentz, Village Clk., for constructing system of water works, advertised in Engineering Record.

Amboy, Ill.—Until Sept. 27 by F. A. Flack, City Clk., for constructing steel water tank, using present steel tower, advertised in Engineering Record.

Luverne, Iowa.—Until Oct. 6 by R. E. Cook, Town Clk., for constructing water works, advertised in Engineering Record. Lawrence W. Cox, Engr., Des Moines.

Marshalltown, Iowa.—By M. S. McFarland, Supt. Water Wks. Dept., for pump for pumping station, capacity 4,000,000 gal. per 24 hrs.; cost about $12,000.

Traer, Iowa.—Until Sept. 20 by T. F. Stoakes, Town Clk., for a 200,000-gal. concrete storage reservoir and water main extensions. Engineer, Charles P. Chase of Clinton.

Urbana, Iowa.—Until Sept. 20 by J. Dean Burrell, Town Clk., for a 100-ft. steel tower and 60,000-gal. tank, approximately 2200 8-in. and 6-in. mains, with hydrants and valves; also pumping station with five-hp. electrical motor. Ralph B. Slippy, Engr., Waterloo.

Gayville, S. D.—Until Sept. 21 by E. A. Aaseth, Town Clk., for constructing water works to consist of 4280 ft. 6 and 4-in. c.-i. pipe, 12 fire hydrants, 5 4-in. and one 6-in. gate valves and boxes, 50,000-gal. steel tank on 110-ft. tower, brick and tile engine house, engine-driven deep well pump and fittings. Stanley H. Edmunds, Engr., Yankton, S. D.

Toronto, Ont.—Until Oct. 12 by T. L. Church (Mayor), Chmn. Bd. Control, for 35-in. stop valves, valve operating mechanism and special castings for main pumping station, advertised in Engineering Record.

PRICES AND LETTINGS.

★*Indicates awarded contract.*

East Orange, N. J.—Lowest bid opened Sept. 10 by Council for superstructure of Doremus Avenue Pumping Plant submitted by W. G. Sharwell Co., Newark, at $109,638.

Brewster, Ohio.—Ross-Cook Eng. Co., 193 Crosby Street, Akron, submitted lowest bid Sept. 9 for constructing water works, at about $19,000. W. J. Sherman Co., Nasby Building, Toledo, Engrs.

★**Cleveland, Ohio.**—Bd. of Control has approved contracts as follows: With the Nassau Smelting Co., for pig lead for division of water, at $23,300, and with T. H. Brooks & Co., for structural steel for Division Avenue pumping station, at $40,936.

★**Jefferson, Wis.**—Contract for flood gates for municipal dam (bids opened Aug. 30) awarded Sept. 7 to Northwestern Bridge & Iron Co., Milwaukee, at $4,000. George J. Angel, Supt. Water Wks.

★**Shenandoah, Iowa.**—Contract awarded to Des Moines Bridge & Iron Co., Des Moines, for constructing a 400,000-gal. steel water tank at $12,300 (bids opened Sept. 2).

Galveston, Tex.—Following are reported to be bids opened Sept. 9 by City Comrs. for an air compressor for the water works at Alta Loma: Sullivan Machinery Co., $16,150; Randall Lovegrove & Co., $16,760, and A. M. Lockett & Co., $15,045.

★**Edgewater, Col.**—Contract for constructing water works (bids opened Aug. 31) awarded Gregg & Fisher, at $39,870. C. W. Gist, Town Clk.

★**Arcadia, Cal.**—Contract for digging and backfilling approximately 20 miles of trench for water works (bids opened Sept. 2) awarded R. F. Ware, Los Angeles, at 4.5 to 5 cts. per ft. George E. Grimes, City Clk.

★**Quebec Que.**—Contract awarded by Quebec Streams Comn. (O. Lefebvre, Ch. Engr.), Sept. 7, for constructing a storage dam at outlet of Lake St. Francis to George Madden at $101,028.

SEWERAGE AND SEWAGE DISPOSAL

PROPOSED WORK

Newark, N. J.—Board Pub. Wks. decided to build a combination sanitary and storm sewer in Sanford Avenue and adjacent streets in Vailsburgh section, at a cost of $30,000.

Sharon, Pa.—Council reported to favor constructing sanitary sewer system and disposal plant, costing $185,000.

Parkersburg, W. Va.—Sewer and paving bonds for $200,000 have been sold.

Athens, Ga.—At recent meeting of City Bd. Health a committee was appointed including Dr. Proctor, President of Bd., and Capt. J. W. Barnett, City Engr., to make investigations and report on plans for septic tank to be placed near Southern Mfg. Co. place to take sewage from that section of city to be pumped into city sewer mains. Board also discussed plans for maintaining and protecting purity of city water supply.

Peru, Ind.—Sewer 27 to 36 in. to be constructed in Tippecanoe Street at a cost of $35,430. Engineer, J. C. Horan, Peru; P. J. Bell, City Clk.

Alton, Ill.—Reported Mayor Beall has instructed engineers to prepare plans for sewer to inclose Piasa Creek. Plans are also being prepared for inclosing Shields branch.

Wausa, Neb.—Citizens voted $12,000 bonds for constructing a sewer system and disposal plant.

Santa Ana, Tex.—Bradshaw & Enbank, Brownwood, engaged to make survey for proposed sewer system.

New Toronto, Ont.—Council on Sept. 7 adopted agreement to construct a sewage system jointly by Mimico and New Toronto.

Marlow, Okla.—W. L. Menham, of the Benham Engineering Co., Oklahoma City, engaged to prepare plans for the proposed sewer system. Cost $15,000.

Portland, Ore.—Plans filed by City Engineer Dater for sewers in East Thirty-third Street and Francis Avenue, on East Side. Contracts for installation will be let soon. A. L. Barbour, City Recorder.

BIDS DESIRED.

Atlantic City, N. J.—Until Oct. 7 by Bd. City Comrs., for constructing an extension to the storm water drainage system, advertised in Engineering Record. J. B. Thompson, Dir. Street & Pub. Improv. John W. Hackney, City Engr.

Glen Gardner, N. J.—Until Oct. 4 by Bd. Mgrs. N. J. Sanitorium for Tuberculosis Diseases (E. J. Burke, Secy.), for additions to sewage disposal plant, advertised in Engineering Record.

Verona, N. J.—Reported desired until Sept. 25 by Robert Chesney, City Clk., for constructing sewerage system and sewage disposal plant.

Philadelphia, Pa.—Until Sept. 29 by M. L. Cooke, Dir. Dept. Pub. Wks., for constructing sewers, Schedules A, B and C, advertised in Engineering Record.

Culpeper, Va.—Until Oct. 1 at office of A. W. Pullman for constructing sewerage pipe line from sewer field to East and Williams Streets and in East, Evans and Main Streets.

North Chattanooga, Tenn.—Until Oct. 5 by Town Comrs. for constructing sewerage system, advertised in Engineering Record. Engineers, Cushman Fairleigh Eng. Co., 724 James Building, Chattanooga.

Glendale, Ohio.—Until Sept. 27 by Ernest Von Bargen, City Purchasing Agent, Cincinnati, for furnishing material and installing a sewage disposal plant for Boys' Opportunity Farm at Glendale.

Lisbon, Iowa.—Until Sept. 22 by H. C. Kurtz, City Clk., for a sewer system and disposal plant, approximately 27,435 ft., 6 to 12-in. pipe, 58 manholes, 22 flush tanks. T. R. Warriner, Engr., Cedar Rapids.

Chatfield, Minn.—Until Sept. 21, by Common Council, for furnishing material and constructing approximately 2300 ft. Dist. sewer, including manholes, septic tank, settling tank and chlorine plant, and 1500 ft. lateral sewers, etc. John Chermak, City Recorder.

St. Paul, Minn.—Reported desired until Sept. 20 by Hohenstein Purchasing Agent, for constructing Fredericka-Fairmont sewer system.

Edgewater, Col.—About Oct. 10 by C. W. Gist, Town Clk., for constructing sewer system to cost $32,000.

PRICES AND LETTINGS.

★*Indicates awarded contract.*

★**Boston, Mass.**—Contract awarded Sept. 7 to William Barrett & Co., at $36,415, for constructing sewers in Albany Street from Dover Street to Massachusetts Avenue, South End (bids opened Aug. 24).

★**Albany, N. Y.**—Contract for constructing sewage pumping station at Westerlo Island in conjunction with the new sewage disposal plants reported awarded by Bd. Contract & Supply to Foundation Co., Woolworth Building, New York, at $172,772.

★**Rochester, N. Y.**—Contract awarded by Bd. Contract & Supply Sept. 1 for constructing storm water sewer in Main Street East to F. V. Botsch, Triangle Bldg., at $20,867.

★**Jersey City, N. J.**—Contract for constructing sewers in Jackson Ave. from Woodlawn to Warner Avenues, awarded Charles T. Kavanaugh, 34 W. Fifty-fifth Street, Bayonne, at 89 per cent of the standard.

★**Sellersville, Pa.**—Contract for constructing sewer system awarded Dwyer & Co., 1524 Chestnut Street, Philadelphia, at $20,622. (For unit prices, see Engineering Record of Sept. 11.)

★**Chardon, Ohio.**—Contract for constructing a sewage treatment plant has been awarded to Kent Constr. Co., Kent, at $12,346 (bids opened Aug. 19). Engineer, R. Winthrop Pratt, 708 Hippodrome Building, Cleveland.

Dallas, Tex.—Reported Roach-Manigan Paving Co. submitted lowest bid Sept. 2 for constructing West Oak Cliff sewer outlet at $17,548. J. M. Preston, second lowest, at $17,735.

★**Pullman, Wash.**—Contract awarded to James C. Broad, 604 Jamieson Building, Spokane, for constructing sewer in Improv. Dist. 34; cost about $12,000. L. V. Edwards, City Engr.

★**San Francisco, Cal.**—Contract awarded by Bd. Pub. Wks. for completing North Point main sewer by constructing Islais Creek section, from Mount Vernon Avenue to Oneida Stdeet, to F. Rolandi, 550 Montgomery Street, at $29,554.

BRIDGES

PROPOSED WORK

Manchester, N. H.—Plans being prepared for constructing bridge at S. Elm Street, city to pay $40,000, Boston & Maine R.R. Co. $24,000 and Manchester St. Ry. Co. $12,000 of cost.

Camden, N. J.—Camden, Gloucester and Burlington Counties voted $12,000 toward cost of a survey for William Penn Memorial Bridge to be constructed over Delaware River to connect Camden and Philadelphia, Pa.

Lynchburg, Va.—Chesapeake & Ohio R.R. Co., Southern Ry. Co. and Norfolk & Western R.R. Co. are having plans prepared for viaduct to be constructed over railway yard and James River at Union Station. City provides approaches and contributes $50,000 of cost, estimated at total $250,000.

Spencer, W. Va.—Roane County Court voted to construct 3 bridges as follows. Over Flat Fork at Harmony, W. Va.; over Reedy at Burdette's Ford in Curtis Dist., and over Henry Fork over mouth of Clover.

Beaufort, S. C.—Beaufort-St. Helena Bridge Comn. (J. B. Walker, Chmn.) has appointed William M. Torrance of Savannah, Ga., engineer for bridge to be built from Beaufort to Ladies Island, across harbor at Beaufort. A bond issue of $80,000 has been voted, and it is expected that the actual site for bridge will soon be chosen. Plans will soon be made and bids asked for some time this autumn.

De Land, Fla.—Volusia & Seminole County Bridge Co. contemplates constructing bridge over St. Johns River near Lake Monroe.

Elizabeth, La. — See "Paving and Roads."

Elizabethtown, Ky. — Hardin County Fiscal Court approved plans and specifications to build a bridge over Rolling Fork at Woolridges Ferry, between Hardin and Buillitt Counties; cost about $15,000.

Columbus, Ohio. — Preliminary plans completed for constructing foot and wagon bridge for city from Fourth Street viaduct to east end of Union Station; cost about $75,000.

Eddyville, Iowa.—Contract is about to be let by County Bd. Supervisors at Ottumwa for repair work to Des Moines River bridge, to consist of replacing one tubular steel pier with concrete pier, one concrete abutment, one 100-ft. steel pony truss, with 18-ft. roadway and wood floor; cost about $6,000.

Riverside, Wash.—All bids opened by County Comrs. at Conconully Sept. 8 for constructing steel span bridge over Okanogan River rejected. According to reports, new bids will be received about Oct. 10.

Portland, Ore.—Contract is about to be let by Oregon-Washington R.R. & Navigation Co. for constructing 210-ft. steel span bridge over Palouse River near Hopper, Wash.

BIDS DESIRED.

Maine.—Until Sept. 20 by State Highway Comn., Augusta, (Paul D. Sargent, Ch. Engr.), for constructing reinforced concrete arch bridge, 174-ft. span, over Carahassett River at Kingfield. Engineers, Saunders Eng. Co., 102 Exchange Street, Portland.

Connecticut.—Until Sept. 22 by Charles J. Bennett, State Highway Comr., Hartford, for constructing bridges in towns as follows:

Thomaston—22-ft. span reinforced concrete girder bridge and 17-ft. reinforced concrete slab bridge. Plans at Selectmen's Office, Thomaston.

Bloomfield—22-ft. span reinforced concrete span, concrete girder bridge and approaches. Plans at office of R. W. Stevens, Connecticut Mutual Building, Hartford.

Binghamton, N. Y.—Until Sept. 22 by Bd. Contract and Supply for constructing five concrete highway bridges and moving a present plate girder highway bridge to new location, advertised in Engineering Record. D. W. Foster, City Clk.

Pennsylvania. — Until Sept. 30 by Robert J. Cunningham, State Highway Comr., Harrisburg, for reconstructing 20 bridges as follows: Centre and Clearfield Co., steel, 70-ft. span; Beaver Co., Raccoon Township, concrete, 32-ft. span; Sullivan Co., Davidson Township, steel, 50-ft. span; Monroe Co., six concrete bridges, one in Hamilton Township, 16-ft. span; one in Polk Township, 14-ft. span; one in Stroud Township, 8 and 5-ft. span; two in Pocono Township; one 4 and 8-ft. span, and one 25-ft. span; Paradise Township, 26-ft. span; Pike Co., Dingman and Milford Township., concrete, one of two spans, 16 and 8 ft.; Wyoming Co., two concrete bridges, one in Eaton Township, 20 and 25-ft. span; and one in Falls Township, 24-ft. span; Cameron Co., Shippen Township, 2 steel bridges, both 50-ft. spans; Susquehanna Co., 4 concrete bridges, one in Brooklyn Township, 20 and 5-ft. span, one in Great Bend Township, 10 and 10-ft. span, one in Gibson Township, 20-ft. span, and one in Clifford Township, 30-ft. span; Butler Co., Penn Township, steel, 50-ft. span; Elk Co., Ridgway Township, reinforced concrete, one of 3 spans, 12, 12 and 24-ft.

Phoenixville, Pa.—Until Sept. 30 by Co. Comrs. Norristown, for constructing concrete arched bridge over Schuylkill River between Phoenixville and Mont Clare, advertised in Engineering Record. John N. Jacobs, Co. Compt.

Maryland.—Until Sept. 28 by State Roads Comn., Baltimore, for bridges and paving as follows:

Cont. No. CI 13—16-ft. reinforced concrete girder bridge over Meadow Creek, west of Westminster.

Cont. No. F 23—repointing walls and coping jug bridge over Monocacy River, along State Road east of Fredericks.

Cont. No. WO 11—concrete roadway about 1½ miles long in Worcester Co., near Stockton.

Beaufort, S. C.—Until Oct. 12 by W. H. Hull, Secy. Bd. Co. Comrs., for constructing a 120-ft. span, steel or concrete, highway bridge between St. Helena and Ladies Island, and repairing two piers of Whale Branch Bridge, advertised in Engineering Record. Engrs., Shand Eng. Co., Columbia, S. C.

Keosauqua, Iowa.—Until Sept. 29 by Co. Bd. Superv. for constructing 80-ft. steel pony truss bridge, 16-ft. roadway, concrete floor and abutments; also 40-ft. steel pony truss, 16-ft. roadway, concrete floor to be erected on old abutments.

Manhattan, Kan. — Until Oct. 6 by County Clerk, for constructing 10 reinforced concrete bridges and for repairs or replacement of several steel bridges. Total cost, $15,000. W. S. Gearhart, State Engr., Manhattan.

PRICES AND LETTINGS.

★*Indicates awarded contract.*

Bridgeport, Conn.—Press reports state Empire Constr. Co., 51 E. Forty-second Street, New York City, submitted lowest bid for constructing the Stratford Avenue bridge (bids opened Sept. 4) at $441,345 for Strauss bascule or $466,080 for Scherzer type, to which $27,485 is to be added for approaches.

Hartford, Conn.—Lowest bid opened by Bd. Contract and Supply Aug. 31 for constructing concrete and stone 3-span arch bridge over Park Rivera at Capitol Avenue submitted by J. E. Goodrich, Glastonbury, at $36,824.

South Amboy, N. J.—Lowest bid opened by Bd. Freeholders at Freehold Sept. 8 for constructing Strauss bascule lift bridge over Matawan Creek, between Keyport and South Amboy, submitted by F. R. Long-W. G. Broadhurst Co., Hackensack, at $34,320.

★**Media, Pa.**—Contract awarded Sept. 9 by Co. Comrs. for constructing concrete bridge over Mackinspatus Creek to Williams Constr. Co., Chester. This company bid for Plan 1 $6,600 or Plan 2 $5,830.

★**Grand Rapids, Ohio.**—Contract awarded by Co. Comrs., Toledo, Sept. 3 to Modern Constr. Co., Fremont, for furnishing material and constructing wood floor and painting bridge across Maumee River at Grand Rapids, at $3,475.

★**Illinois.**—Contract awarded by State Highway Department, Springfield, to Illinois Steel Bridge Co., Jacksonville, for constructing Sitton Bridge in County Line Township, Macoupin County, at $6,430.

★**Austin, Minn.**—Contracts awarded as follows for constructing bridges (bids opened Sept. 10 by Co. Comrs.): Six bridges to Hennepin Bridge Co., Minneapolis, at $10,487; one each to H. T. Garbish, Austin, at $1,725; J. P. Chase & Sons, Stewartville, at $2,333, and to N. M. Stark & Co., Des Moines, at $1,280. O. J. Simmons, Co. Aud.

★**Brainerd, Minn.**—Contract awarded Minneapolis Bridge Co., Minneapolis, for constructing a bridge, three 30-ft. spans, reinforced concrete abutments, across Pine River, at $2,760 (bids opened Sept. 7). C. W. Mahlum, Co. Aud.

★**Ellinwood, Kan.**—Contract for constructing concrete bridge over Arkansas River awarded by County Comrs. (bids opened Sept. 7) to Missouri Constr. & Ballast Co., Eldon, Mo., at $20,642.

★**St. Paul, Neb.**—Following is the bid in detail of Central States Bridge Co., Indianapolis, Ind., for constructing State Aid Bridge (bids opened Sept. 3 by Co. Comrs.): bridge to be across Loup River, about two miles south of St. Paul, to consist of five 145-ft. spans, with 16-ft. roadway, resting on concrete piers and wood piling with concrete floor:

Steel truss bridge, 5 145-ft. spans, complete	$27,936.00
Earthwork in fills, per cu. yd., 2500 yd	0.28
Extra plain concrete, per cu. yd.	15.00
Extra reinforcing steel, per lb.	0.03
Extra Wakefield piling per lin. ft.	0.50
Extra round piling, per lin. ft.	0.60
Extra steel sheet piling, per sq. ft.	1.40
Extra 8-in. Beth. H columns, per lin. ft.	1.25
Extra fabricated steel, per lb.	0.039

★**Harrison, Neb.** — Contract awarded Western Bridge & Constr. Co., Omaha, for constructing a 100-ft standard 15-ton steel bridge (bids opened Sept. 7). Cyrus O. Wertz, Co. Clk.

★**Lincoln, Neb.**—Contract for constructing all bridges in Lincoln County for coming year awarded by Bd. Supervs. to Standard Bridge Co., Omaha.

★**Canton, S. D.**—Contract awarded by Co. Comrs. to Des Moines Bridge & Iron Wks., Des Moines, for constructing superstructure for structural steel span, 125 ft., concrete floor, 18-ft. roadway (bids opened Sept. 7).

★**Terrell, Tex.**—Contract for bridge and culvert work awarded by Permanent Road Comrs. of Terrell to W. W. Fuller, at $25,814.

Aberdeen, Wash.—Following are lowest bids opened by City Council Sept. 8 for constructing 260-ft. steel span and one 150-ft. steel span for West bridge: J. R. Wood, 621 Valley Street, Seattle, $20,729, and Coast Bridge Co., Portland, Ore., $21,218.

★**Portland, Ore.** — Contract for constructing 210-ft. steel span bridge over Umatilla River for Oregon-Washington R.R. & Navigation Co. awarded to Nettleton, Bruce & Eachbach, American Bank Building, Seattle, Wash.

PAVING AND ROADS

PROPOSED WORK

Albany, N. Y.—State Supt. Pub. Wks., Albany, has approved plans and specifications for Contract 2P: Paving terminal now located at Albany, requiring laying 11,000 sq. yd. stone block pavt., together with necessary excav., and laying concrete curb and drain. Engineer's estimate $42,569.

Dobbs Ferry, N. Y.—Citizens Sept. 8 voted $150,000 bonds for paving. Oswald Schuler, Clerk.

Rensselaer, N. Y.—About $30,000 is to be spent by city for street pavements.

Newark, N. J.—Finance Com. Bd. Chosen Freeholders sold about $470,000 bonds for improving county roads.

West Hoboken, N. J.—Contract about to be let by Town Council for repaving and reflagging Paterson Avenue.

Portsmouth, Va.—Norfolk County Road Bond Comn. received from State Highway Comn. estimates of cost of improving 4 toll roads in county with concrete and gravel, cost $384,000, with gravel and macadam $198,600.

Charleston, W. Va.—Contract about to be let by City Council for paving Maple Road, Swarthmore Street and Alley Road.

Parkersburg, W. Va.—See "Sewerage and Sewage Disposal."

Jacksonville, Fla.—Duval County, Florida, Council of Dixie Highway Assoc. is formed to secure route for Dixie Highway into Jacksonville from Macon, Ga. John H. Williams, Chmn.

Pinellas Park, Fla.—T. J. DeHaas, Town Clk., writes that about 28,622 sq. yd. of brick paving on Park Boulevard, Twenty-second and Thirty-third Streets, is contemplated, including 15,482 lin. ft. curb and 32,350 cu. yd. grading. C. M. DeChant, Engr., Pinellas Park.

Sanford, Fla.—Citizens of Seminole County voted $450,000 bonds for constructing brick roads.

West Palm Beach, Fla.—About $784,000 road bonds have been sold by Bd. County Comrs.

Many, La.—Citizens Aug. 17 voted $35,000 bonds to construct roads from plans of L. F. French of Many and Zwolle. J. M. Abington, Secy. Police Jury, Many.

Natchitoches, La.—Citizens voted to spend $30,000 for constructing 12-mile gravel road through Ward 9.

Oberlin, La. — Ward Five, Allen Parish, has voted $150,000 bonds and will build gravel roads north, south, east and west through ward. Bond issue to be sold Sept. 15. There will be a number of small steel or concrete bridges, and a 1,200 steel bridge 1000 ft. long across Calcasieu River. Engineer to be appointed about Oct. 1. S. M. Lee, Member Police Jury.

Pass Christian, Miss.—See "Water Works."

Decatur, Tenn.—About $100,000 bonds for road improvement will be sold by Meigs County Comrs.

Loudon, Tenn.—County Court voted $12,000 bonds for completing Dixie Highway to Loudon County Line.

Cleveland Heights, Ohio.—See "Miscellaneous."

Napoleon, Ohio.—About $45,000 Union County road improvement bonds have been sold by County Comrs.

New Lexington, Ohio.—Bonds will be sold by Clyde M. Penisher, Co. Aud., Sept. 27, for improving Inter-County Highway.

Piqua, Ohio.—Street pavement and sewer bonds amounting to $36,000 were sold by city.

Warren, Ohio.—Bonds for $19,800 reported sold Oct. 2 by George T. Hecklinger, City Aud., for improving Homewood Avenue and E. Franklin Street.

Fort Wayne, Ind.—Bd. Pub. Wks. voted to construct sidewalks on Winch, Murray, Second, Fourth Streets and Victoria and Organ Avenues.

Lansing, Mich.—City proposes paving Capitol Avenue, Townsend and Hosmer Streets with asphalt concrete, work to be done by city under supervision of E. G. Eddy, City Engr.

Pontiac, Mich.—Cement road 5 miles long connecting Pontiac and Detroit is contemplated by county.

Ames, Iowa.—Council has passed resolution for about 100,000 sq. yd. paving, and instructed City Engineer to prepare plans and specifications for same. Bids will probably be called for some time during the coming winter on following types of pavements: Bitulithic, asphaltic concrete, sheet asphalt, brick, and creosoted wood block. J. Q. Wickham, City Engr.

Kearney, Neb.—Citizens Sept. 7 voted bonds for paving, to be used as needed. E. H. Morey, East Twenty-seventh Street, Kearney, Engr.; T. N. Hartzell, City Clerk.

Missoula, Mont.—City Council voted to grade, curb and construct cement walks on West Pine Street; cost about $10,000.

Pine Bluff, Ark.—Construction of road from north approach of free bridge, 7 miles from town, to Lonoke County Line, distance of 21 miles, is contemplated. C. M. Philpot said to be interested.

Beaumont, Tex.—Bonds for $85,000 will be sold Oct. 5 by J. G. Sutton, City Secy., for street improvements.

Denton, Tex.—About $10,000 bonds have been sold by city for street improvements.

Taylor, Tex.—About $100,000 is to be spent by city for street improvements.

Bellingham, Wash.—City Council voted to construct concrete sidewalks on Humboldt and Whatcom Sts., pave Alabama, Iron, Madison, Elizabeth, Dalkin and Flora Sts.

North Yakima, Wash. — Bd. County Comrs. voted to construct one-mile water-bound macadam road on extension of Tieton Drive.

Seattle, Wash.—Plans and specifications submitted by A. H. Dimock, City Engr., to Bd. Pub. Wks. for grading and paving Beacon Avenue; cost about $176,000.

Stevenson, Wash. — All bids opened Sept. 2 by Charles H. Nello, Co. Aud., for constructing Section 2 of the Stevenson Carson Road have been rejected. Lowest bid $14,000.

Walla Walla, Wash.—City Council voted to spend about $25,000 for street improvements.

Berkeley, Cal.—San Francisco-Oakland Terminal R.R. Co. contemplates spending $40,000 for street improvements.

Burley, Idaho.—Bonds for $50,000 for constructing 54 miles of the Idaho-Pacific State Highway in Burley Highway Dist. will be sold Sept. 27 by Albert Ploeger, Pres. Burley Highway Dist., Burley. Contract for constructing this road will be let in about six weeks; $25,000 is to be given by State, making about $75,000 available for work. E. M. Booth, State Highway Engr., Boise.

Lewiston, Idaho.—City Council approved plans and specifications for paving, sidewalks in Special Improvement Dist No. 1. Contract about to be let; cost $30,000.

Montpelier, Idaho.—City Council voted to construct concrete sidewalks, cost about $13,821.

Twin Falls, Idaho.—City Council voted to construct cement sidewalks in Local Improvement Dist. No. 21.

Vancouver, B. C.—See "Railroads."

BIDS DESIRED.

Connecticut.—Until Sept. 22 by Charles J. Bennett, State Highway Comr., Hartford, for constructing sections of highway in towns as follows (length given approximate only):

Colebrook—7600 lin. ft. 5-in. native stone macadam on Colebrook-Robertsville Road. Plans at house of John A. Deming, Colebrook.

Orange—12,805 lin. ft. 3-in. tar penetration, 3-in. asphalt penetration or topeka on Congress Avenue, Main Street and Savin Avenue. Specification at Selectmen's Office, West Haven.

City of New Haven and Town of North Haven—10,418 lin. ft. amiesite, warrenite or topeka on Hartford Turnpike. Specifications at office of O. W. Head, Division Engr., Chamber of Commerce Building, New Haven.

Newington—5400 lin. ft. amiesite, 3-in. tar penetration or 3-in. asphalt penetration on Hartford-Newington Road. Specifications at Town Clerk's Office, Newington.

Brookfield—10,850 lin. ft. graded road on Danbury Road. Plans and specifications at Town Clerk's Office, Brookfield.

Litchfield—2 sections of 4-in. trap rock macadam construction. Plans at Selectmen's Office, Litchfield.

Stamford—30,080 lin. ft. of gravel or native stone macadam on the High Ridge Road. Plans and specifications at Selectmen's Office, Stamford.

Jersey City, N. J.—Until Oct. 7 by Co. Bd. Chosen Freeholders for paving Passaic Avenue and Paterson Plank Road with granite blocks.

Newark, N. J.—Until Sept. 30, for paving portions on N. Seventh Street from Park to Fourth Avenues with bitulithic on 6-in. concrete.

West Paterson, N. J.—Until Sept. 27, by Street Com. of Council of West Paterson, for macadamizing portion of Garbaldi and Grover Avenues. Edw. A. Mulroony, Boro. Clk.

Philadelphia, Pa.—Local press reports state bids desired until Sept. 21 by Bureau of Highways for improving boulevard between Sixteenth and Seventeenth Streets for parkway east of Logan Square.

Baltimore, Md.—Until Sept. 22 by Bd. of Awards, care City Register, for Contr. 144—Improving Ellicott Driveway. Alternate bids for paving approximately as follows: Sheet asphalt, 18,800 sq. yds.; bituminous macadam, 18,800 sq. yds.; reinforced concrete, 24,000 sq. yds.

Maryland.—See "Bridges."

Dayton, Tenn. — Until Sept. 23 by County Highway Comn. (J. H. Hoskins, Ch. Engr.), Dayton, for relocating, grading and improving and macadamizing in Whea County and furnishing f.o.b. cars at different stations in Rhea County, cement, concrete culvert pipe, vitr. culvert pipe, corrugating iron culverts and c.-i. culvert pipe, advertised in Engineering Record.

Jacksboro, Tenn.—Until Oct. 2 by Bd. Highway Comrs. (H. G. Murray, Chmn.), Jacksboro, for grading and macadamizing pike roads Nos. 2, 7 and 8.

Louisville, Ky.—Until Sept. 22, by Bd. Pub. Wks. (Roger G. McGrath, Secy.), for paving a number of alleys with viti. block.

Whitesburg, Ky.—Press reports state bids desired Sept. 22 by Letcher Fiscal Court for constructing road from Whitesburg to Colly, a distance of about 2 miles.

Bexley, Ohio.—Until Sept. 27 by Chester A. Miller, Village Clk., for improving Pleasant Ridge Avenue, from Mound to Main Streets, by grading, curbing and paving with brick, asphalt or treated macadam. Jennings, Lawrence & Lindsay, Engrs., Hartman Building, Columbus.

Leetonia, Ohio.—Reported desired by T. H. Carroll, Township Clk., for improving roads:

Sept. 20, 2.05 miles grading, curbing and paving with brick.

Sept. 21, 11,777 yd. brick or cement paving, curbing, and 15,600 yd. excav.

Sept. 22, 4246 yd. paving, brick or cement curbing and bridging, 6557 yd. excav.

Indiana.—Until Oct. 8 by Co. Comrs., Franklin, for constructing 2½ miles of gravel road between Johnson and Marion Counties. H. L. Knox, Co. Aud.

Indiana.—By Co. Comrs. for constructing roads as follows:

Oct. 4, Franklin, for constructing two gravel roads, one 2¼ miles long and the other ⅝ mile long; also for constructing turnpike in Pleasant Township.

Oct. 8, Muncie, for graveling or macadamizing highways in Delaware Co. Francis M. Williams, Co. Aud.

Winamac, Ind.—Until Oct. 5 (readvertised) for constructing Reinholdt gravel road in Tippecanoe Township, a distance of three miles; cost $9,721. All bids opened Sept. 7 rejected. C. E. Paul, Co. Surveyor.

Chicago, Ill.—Until Sept. 21 by Bd. Local Improv. (Edw. J. Glackin, Secy.) for constructing cement sidewalks on W. Eighty-seventh, W. Forty-first, W. Forty-fourth and numerous other streets.

Until Sept. 22 by Chicago Union Station Co. (Thomas Bond, Ch. Engr.) for improving Canal and Monroe Streets, by raising said streets to ordinance grade and relaying granite block, constructing vaulted concrete sidewalks.

Riverside, Ill.—Until Sept. 20 by Bd. Local Improv. (W. S. Burling, Pres.) for approximately 13,000 sq. yd. two-course reinforced concrete pavement. Village will furnish cement, sand and gravel. C. N. Roberts, Engr., 105 N. Clark Street, Chicago.

Lake Geneva, Wis.—Reported desired until Sept. 20 by City Clerk for paving numerous alleys and intersections with 4-in. vitr. brick on sand cushion.

Walker, Minn.—Reported desired until Sept. 25 by C. D. Bacon, Co. Aud., for State Rural Highway No. 82, in all about 7600 ft. turnpiking, 24,095 cu. yd. surfacing, 25,175 cu. yd. ditching, culverts, etc. George A. Ralph, Engr., 16 Fulton Block, St. Paul.

St. Louis, Mo.—Until Oct. 5, by Bd. Pub. Wks. (W. T. Findly, Secy.) for improving portions of Marcus, Tower Grove and Spring Avenues and Soulard Street with viti. brick pavement and granite curb.

North Yakima, Wash.—Until Sept. 20, by Bd. Co. Comrs., for graveling road near Zillah.

Until Sept. 22, constructing 1⅛ miles gravel road on Summit View Road, and 5½ miles in Wenas Valley. O. A. Brashears, Co. Engr.

Tillamook, Ore.—Until Sept. 23 by John Aschim, City Recorder, for paving with straight reinforced concrete on Second Avenue, about 4359 sq. yd.; cost $7,798. F. E. Hobson, Engr., Tillamook.

East San Diego, Cal.—Until 7. 30 p. m. Sept. 20 by City Clerk for improving nine blocks on Hugh Avenue and cross streets, about 36,000 cu. yd. excav., 40,700 cu. yd. embankment, 13,000 lin. ft. concrete curb, 68,000 sq. ft. concrete sidewalks, 13,000 sq. ft. cobble stone gutter, etc.; cost $45,000. H. A. Kuehmsted, City Engr.

Los Angeles, Cal.—Reported desired until Sept. 20 by H. J. Le Lande, County Clk., for improving Artesia and Amheim Roads, in all about 12,835 sq. yd. concrete pavement, with bituminous wearing surface, etc.

Ontario, Cal.—Until Sept. 27 by Bd. City Trus. for improving East and West roadways of Euclid Avenue, requiring approximately 345,000 sq. ft. concrete pavement, 152,000 sq. ft. macadam pavement and 56,000 sq. ft. concrete gutters.

Santa Ana, Cal.—Until Sept. 21 by County Bd. Superv. for reconstructing, repairing and rebuilding Sect. 2, Irvine Boule. W. B. Williams, Co. Clk.

Ventura, Cal.—Reported desired Sept. 21 by Bd. Superv. for paving extensions of Bardsdale bridge, in all about 13,340 sq. ft. bituminous macadam pavement of 3 in. thickness. J. P. McCloskey, Co. Clk.

Boise, Idaho.—Until Sept. 18, by State Highway Comn., Boise (E. M. Booth, Engr.), for constructing 26½ miles Idaho-Pacific Highway in Bannock County. Estimated cost $26,600 for grading work, $1,900 for concrete culverts. Also constructing 2 miles of Idaho-Pacific Highway in Canyon County; cost $4,000.

PRICES AND LETTINGS.

★*Indicates awarded contract.*

★**Boston, Mass.**—Contract awarded by Metropolitan Park Comn., Boston, to Rowe Contr. Co., Malden, for grading, surfacing and other work on Charles River Reservation, from Charles Bank Road to Brooks Street, Newton, and Boston, at following bid (bids opened Sept. 7): 8500 cu. yd. earth grading, 40 cts.; 2000 lin. ft. 10-in. vitr. pipe drain, 40 cts.; 30 lin. ft. 24-in., $2.25; 38 catchbasins and manholes, $30; 300 lin. ft. straight edgestone, $1.25; 60 lin. ft. curved edgestone, $1.50; 7000 cu. yd. loam to be furnished by contractor, $1.15; 16,500 sq. yd. roadway surfacing, 35 cts.; 4100 sq. yd. walk surfacing, 30 cts.; total $21,040. Next three lowest bids: John J. Marlin, Watertown, $21,533; J. H. Sullivan Co., Brighton, $21,715, and J. C. Coleman & Sons Co., Boston, $22,635. John R. Rablin, Engr.

★**Massachusetts.** — Following are bids opened Sept. 14 by Massachusetts Highway Comn., Boston, for paving:

★Barre to Petersham—(three bids) R. H. Newell Co., Uxbridge, $13,847 (awarded contract); Charles E. Horne, Millbury, $14,604; R. F. Hudson, Melrose, $14,458.

★Leominster—(two bids) R. H. Newell Co., Uxbridge, $6,857 (awarded contract), and J. Keating & Son, Fitchburg, $6,241.

★Braintree—(three bids) E. J. Rourke, Abington, $12,390 (awarded contract); Powers Bros., Brockton, $12,514; Alco Contr. Co., 178 North Street, Boston, $12,632.

Deerfield—(three bids) Archie G. Perry, Brattleboro, Vt., $16,566; Lane Constr. Corp., Meriden, Conn., $18,238; R. H. Newell Co., Uxbridge, $17,872. (Not awarded.)

★**Farmingdale, L. I., N. Y.**—Contracts awarded by Bd. Trus. Long Island Agricultural School as follows: 25,000 ft. concrete walks at 11 cts., 1000 lin. ft. curb at 50 cts., 2000 sq. ft. crossings at 20 cts., to Delta Contr. Co.

★**New York, N. Y.**—Contracts awarded Aug. 31 by Marcus M. Marks, Pres. Manhattan Boro., for paving as follows:

Sheet asphalt: To Sicilian Asphalt Paving Co., 41 Park Row (four contracts), 104th Street, Central Park West to Manhattan Avenue, $3,057; Fiftieth Street, Madison Avenue to 328 ft. east, $2,516; Forty-ninth Street, Sixth to Seventh Avenues, and Eighth to Ninth Avenues, $11,818, and Broadway, Forty-seventh Street to Columbus Circle, and Forty-eighth Street, from Broadway to Eighth Avenue, $62,692; to Barber Asphalt Co., 233 Broadway, 212th Street, from Harlem River to Tenth Avenue, $8,172.

Granite block: To W. J. Fitzgerald, 547 W. Forty-fifth Street, Madison Street, from Roosevelt to New Chambers Streets, and Exterior Street, from Seventy-sixth to Seventy-seventh Streets, at $3,185 and $4,384 respectively.

Rochester, N. Y.—Lowest bid opened by Bd. Contract and Supply for paving Ellicott Street with asphalt submitted by Rochester Vulcanite Pavement Co., Rochester, at $1.60 per sq. yd.

★**Elizabeth, N. J.**—Contracts awarded as follows for paving: Union Paving Co., Philadelphia, Pa., Anna Street with asphalt, and Murray Street with asphalt, at $8,361 and $15,610 respectively; John E. Donovan, for granite block on Broad

Street, $29,755; Standard Bitulithic Co., Newark (four contracts), resurfacing Court Street with asphaltic concrete, $3,464; Second Street, $5,407; South Street, $1,270; Washington Street, $2,862. Uvalde Asphalt Paving Co., Jersey City, resurfacing with asphaltic concrete Irvington Avenue and Prince Street, $6,862, and West Grand Street at $12,825.

★**Jersey City, N. J.**—Contract for paving with bituminous concrete, about 39,500 sq. yd., on Arlington and Garfield Avenues, awarded by City Comn. to William J. Coughlin, Jersey City, at about $37,000.

★**Jersey City, N. J.**—Contract for repaving Storms Avenue from Bergen to Summit Avenues awarded Van Keuren Co., Jersey City, at 89.9 per cent of the standard.

★**Newark, N. J.**—Contracts for paving awarded by Bd. Chosen Freeholders as follows (bids opened Sept. 7): Central Avenue, East Orange, with bitulithic, to Northern Constr. Co., Boston, Mass., at $56,975, and for Washington Avenue, Nutley, with bitulithic, to Standard Bitulithic Co., Newark, at $76,489.

★**Philadelphia, Pa.**—Contracts awarded by Dept. Wharves, Docks and Ferries (John Meigs, Dir.) as follows (bids opened Aug. 30: Resurfacing upper deck of Race Street pier, to Carter Paving Co., 641 N. Eighteenth Street, at $6,000, and Ehret Roofing & Manufacturing Co., Drexel Building, for resurfacing upper deck of Chestnut Street pier, at $6,439.

Philadelphia, Pa.—Following are low bids opened Aug. 28 by Dept. of Pub. Wks. (William H. Connell, Ch. Bureau of Highways):

Asphalt pavement, 6-in. concrete base, low bidders: Eastern Paving Co., Penn Square Building; Union Paving Co, Thirtieth and Locust Streets; average price of $1.572 per sq. yd.; total of low bids $32,518.

Bituminous pavement including 6-in. concrete base and paint coat, low bidder, Union Paving Co., Thirtieth and Locust Streets; average price of $1.60 per sq. yd.; total $11,863.

Asphalt pavement, 6-in. concrete base, low bidders: Union Paving Co., Thirtieth and Locust Streets; Barber Asphalt Paving Co., Land Title Building; Eastern Paving Co., Penn Square Building; average price $1.466 per sq. yd.; total $46,131.

Vitrified block pavement, 6-in. concrete base, low bidder: Philadelphia Paving Co., 1345 Arch Street; average price $2.34 per sq. yd.; total $7,186.

Granite block pavement, 6-in. concrete base, low bidders: E. Mark Contr. Co., Twenty-first and Somerset Streets; McNichol Paving & Constr. Co., 1923 Cherry Street; James Kane, 4840 N. Mascher Street; Philadelphia Paving Co., 1345 Arch Street; average price $3.037 per sq. yd.; total $45,433.

Wood block pavement, mortar cushion and 6-in. concrete base, low bidders: Richard Lamb, 136 Liberty Street, New York; McNichol Paving & Constr. Co., 1923 Cherry Street; average price $2.809 per sq. yd.; total $13,152.

Waterbound macadam 3-in. on a 5-in. broken stone base, low bidders: J. F. Shanley & Co., Commercial Trust Building; Dwyer & Co., 1524 Chestnut Street; P. J. Snyder & Co., 903 Bailey Building; Pugh & Hubbard, 731 Witherspoon Building; Curtis Bros., Torresdale Avenue and Magee Street; average price 98.3 cts. per sq. yd.; total $37,078.

Bituminous pavement, 5-in. concrete base, low bidder: Union Paving Co., Thirtieth and Locust Streets; average price $1.611 per sq. yd.; total $11,757.

Bituminous macadam resurfacing (penetration), low bidder: P. J. Snyder & Co., 903 Bailey Building; average price 69 cts. per sq. yd.; total $5,590.

Passyunk Avenue Improvement, low bidder: E. H. Vare, 712 Lincoln Building, asphalt pavement, 6-in. concrete base; average price $1.435 per sq. yd. and granite block pavement, 6-in. concrete base, average price $3.245 per sq. yd.; total $42,837.

★**Baltimore, Md.**—Contract awarded by Bd. Awards for paving Rosedale Avenue from Edmondson to Arunah Avenues and Arunah Avenue westward to P. Flanigan & Sons, Baltimore, at $1.32 per sq. yd. for sheet asphalt, 6 in. concrete base.

★**Charleston, W. Va.**—Contracts for paving awarded by City Council as follows (price given per sq. yd.): W. Second Street, with asphaltic concrete, to R. M. Hudson & Co., at $1.65; Crescent Road and Bridge Street, with brick, to Glover & Kimberlin, Charleston, at $1.80; Monongalia, Kanawha and Sixth Streets and Columbia Boulevard, with asphaltic concrete, and Caroline, Maryland Streets and Pennsylvania Avenue, with asphalt, to Federal Asphalt Co., Hamilton, Ohio, at from $1.62 to $1.69; Roane Street, with asphaltic concrete, to Carey, Reed & Co., Lexington, Ky., at $1.74.

★**Memphis, Tenn.**—Following are 4 lowest bids opened Aug. 31 by C. C. Pashby, City Clk., for paving S. Main Street, about 9200 sq. yd.: Koehler Bros.-Fowler Constr. Co., Memphis, $22,204 (awarded contract): E. J. Wetterstrom, Kansas City, Mo., $22,563; M. E. Larkin, Memphis, $22,748, and Turner & Thomas, Memphis, $22,765. D. C. Miller, Ch. Clk. Eng. Dept.

★**Brownsville, Ky.**—Contract for constructing 3¼ miles turnpike from Brownsville to Rhoda awarded by Edmonson County Fiscal Court at Brownsville to A. A. Smith, Mount Pleasant, Tenn., at $14,000.

Galion, Ohio.—Following are totals of bids opened Aug. 26 by A. F. Unkrich, Dir. Pub. Service for improving Church Street (a) brick; (b) asphalt: Brooks Constr. Co., Fort Wayne, Ind. (a) $40,095; Fred Gauget & Son, Mansfield (a) $40,800; C. E. Williams, Grand Rapids, Mich. (b) $39,247; Ohio Engr. Co., Lorain (b) $41,192.

★Contract awarded to Brooks Constr. Co. for brick paving, at following bid:

7435 cu. yd. excav.	$0.31
612 ft. circular curb, 5x20 stone	0.85
10,086 ft. straight curb, 5x20 stone	0.49
864 ft. stone edging	0.40
17,717 sq. yd. concrete foundation, 5 in.	0.70
17,717 sq. yd. sand cushion	0.08
17,717 sq. yd. cement filler	0.10
30 inlets, ea.	12.00
5 manholes, ea.	22.00
10,086 ft. subdrain, 3 in.	0.03
500 ft. sewer, storm, 10 in.	0.35
900 ft. sewer, storm, 12 in.	0.45
1990 ft. sewer, storm, 15 in.	0.50
888 ft. sewer, storm, 18 in.	0.65
17,717 sq. yd. brick paving	0.76

★**Lorain, Ohio.**—Contract for paving East Twenty-eighth Street about 15,700 sq. yd. (bids opened Sept. 8) awarded Ohio Eng. Co., Lorain, at $37,191. Other bidders: Pace Bros., Lakewood, $37,276, and Gibson & Scott, Cleveland, $39,528. C. M. Osborn, City Engr.

★**Xenia, Ohio.**—Contract for paving Third Street with sheet asphalt awarded by City Bd. Control to Andrews Asphalt Paving Co., Hamilton, at $22,455.

★**Indianapolis, Ind.**—Contract for paving Eighteenth Street with bituminous concrete awarded by Bd. Public Wks. to Kokomo Asphalt Paving Co., Kokomo, at $14,826.

★**Mount Vernon, Ind.**—Contract awarded Sept. 7 for constructing 2 gravel roads in Black Township, about 15,564 ft., to Lawrence J. Utley, Mount Vernon, at $9,614. Joseph R. Haines, Co. Aud.

★**Belleville, Ill.**—Contract for paving Busch Avenue Paving Dist. awarded by Bd. Local Improvements to Reeb Bros., Belleville, at $18,230.

★Contract for paving Olive Street Dist. for city awarded to Hoeffken Bros., Belleville, at $17,399.

★**Rock Island, Ill.**—Contract for paving with brick on Twenty-fourth Street and Sixteenth Avenue awarded Tri City Constr. Co., Davenport, Iowa, $2.04 and $2.09 per sq. yd.; total $18,977.

★**Boscobel, Wis.**—Contract for 6500 sq. yd. concrete pavt. (bids opened Sept. 2) awarded Edward L. Bartlett, Watertown, at $1.41 per sq. yd. W. E. Howe, Mayor.

★**Fremont, Neb.**—Contract for paving Fourth Street with granite concrete awarded by City Council to A. D. Sears, Fremont, at $1.34 per sq. yd.

★**St. Louis, Mo.**—Contracts awarded Sept. 10 by Bd. Pub. Service for paving as follows:

Asphalt pavement: Florissant Avenue, from Carrie to Bernays Avenues, 40,910 sq. yd., G. A. Heman, Salt Lake City, Utah, cost $82,067; Ashland Avenue, from Cora to Marcus Avenues, 2205 sq. yd., Granite Bituminous Paving Co., Pierce Building, $5,844.

Wood block: Skinker Road, from south line of Forest Park to south line of Forsyth Boulevard, 28,295 sq. yd., Webb-Kunze Constr. Co., 5927 Foyler Avenue, $84,712; Market Street, Broadway to Twelfth Street, 5180 sq. yd., Eyermann Constr. Co., 1216 S. Grand Avenue, $17,-225.

Brick: Marcus Avenue, Margaretta Avenue to Kingshighway Northeast, 11,-660 sq. yd., and from Kingshighway to Florissant Avenue, 8720 sq. yd., both to G. A. Heman, Salt Lake City, Utah, at $29,707 and $21,027 respectively; Liburn Avenue, from Euclid Avenue to Kingshighway, 3025 sq. yd., Perkinson Bros. Constr. Co., 3237 Carter Avenue, $7650; Charlton Street, from Broadway to Nebraska Avenue, 3310 sq. yd., Ruecking Constr. Co., 4036 Marine Avenue, $7,614; Duncan Avenue, from Vandeventer Avenue to Sarah Street, running north to Decatur Avenue, 5500 sq. yd., and Arlington Avenue, from St. Louis Avenue to Natural Bridge Avenue, 6480 sq. yd., both to Hanick Quarry & Constr. Co., Euclid and Ashland Avenues, $13,480 and $15,493 respectively.

★**Cheney, Wash.**—Contract for approximately nine miles of concrete walks and crosswalks on First to Sixth Streets and waterbound macadam on First Street awarded Mitchell Bros. & Payne of Spokane, at $37,000 (bids opened Aug. 17). Next lowest bidder: Miracle Concrete Corp., Great Falls, at $39,069. W. L. Morgan, City Engr.

★**Pullman, Wash.**—Contract for constructing 118,500 sq. ft. concrete walks awarded by City Council to Mitchell Bros. & Payne, Spokane, at $15,265.

★**Seattle, Wash.**—Contract for grading, paving and bridging Admiral Way awarded by city to Independent Asphalt Paving Co., Northern Bank Bldg., at $234,000.

Seattle, Wash.—Lowest bid opened by Bd. Pub. Wks., for paving 20th Avenue, N. E., N. Fiorito & Bros., 1630 25th Avenue, at $21,481.

★**Tacoma, Wash.**—Contract for paving 3.7 miles Sumner-Buckley Highway, Permanent Highway No. 7 awarded by Bd. County Comrs., to Washington Paving Co., Savage-Scofield Bldg., Tacoma, at $32,243.

★**San Francisco, Cal.**—Contract awarded Owen McHugh, Russ Bldg., for paving Arguello Boulevard and north half of Fulton Street, between Twenty-eighth and Thirty-seventh Avenues, at $15,616.

★**Saint Marias, Idaho.**—Contract awarded Two Miracles Concrete Corp., Great Falls, Mont., for improving certain streets and avenues in Improv. Dist. No. 3 and 4 (bids opened Sept. 3) at $23,411. Next three lowest bids: Speaker & McKee, $25,043; Mitchell Bros. & Payne, Spokane, Wash., $25,044, and C. A. Barnette, Spokane, Wash., $25,141. Charles R. Schulte, City Clk.

STREET CLEANING AND GARBAGE DISPOSAL

PROPOSED WORK

Nutley, N. J.—Bd. Health considering garbage disposal plant.

Galveston, Tex.—Only bid received and opened by City Comrs. Sept. 9 for garbage disposal reported submitted by Texas Nu-Fuel Co. It bid 25 cts. per ton for caring for garbage by converting it into patented fuel.

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS

PROPOSED WORK

State Canal Work—Albany, N. Y.—See "Paving and Roads."

State Canal Work, Albany, N. Y.—See "Bridges."

Storm Water Drainage System—Atlantic City, N. J.—Contract soon to be let by City Commission for constructing extension to storm water drainage system in Inlet and Chelsea Sections of city; cost about $100,000.

Creek Improvement—Erie, Pa.—Farley Gannett, Harrisburg, making surveys, plans and estimates for improving Mill Creek. B. E. Briggs, City Engr.

Drainage—Savannah, Ga.—Co. Comrs. taking steps to construct drainage system, to include about fifteen miles of main canals and thirty miles of laterals.

Drainage—Yazoo City, Miss.—Bonds for $78,000 reported sold by Atchafalaya Drainage Dist., to complete drainage work.

Drainage—Paducah, Ky.—Engineers F. F. Shafer, Federal Drainage Expert, and W. C. Kelly, Dist. Engr., Union City, Tenn., have filed with the County Judge official reports on drainage survey of Mayfield Creek Section, which includes a main ditch about 23.25 miles long, requiring about 2,430,000 cu. yd. excav. and ten laterals, a total length of 14 miles; about 25,225 acres will be affected. Cost reported at $281,832, and if bridges are constructed in connection with work, the cost will be $38,000 additional.

Drainage—Kenton, Ohio.—Morgan Eng. Co., Memphis, Tenn., engaged as engineers on Upper Scioto Drainage and Conservancy Dist. in Hardin County. Work will consist of preparation of plans for protection of about 25,000 acres of truck land, and for a portion of city of Kenton. This territory was recently damaged by floods. It is planned to begin field surveys at once, in order that contracts for construction may be let during coming winter.

Levee Bonds—Portsmouth, Ohio.—Bonds for $70,000 will be sold Oct. 5 by George L. Gableman, City Auditor, for levees and embankments.

Ditch—Manhattan, Kan.—Blue River Drainage District No. 10, Riley County, circulating petitions. Open ditch work.

Drainage—Osawatomie, Kan.—Petitions being prepared for organization of a 15,-000-acre drainage district on Marais des Cygees River, Miami County.

Ditch—Scandia, Kan.—Petitions being circulated for drainage district, 3000 acres. Levee and open ditch work.

Drainage—Strong City, Kan.—Surveys have been made for drainage district in Chase County. Open ditch work contemplated.

Irrigation—Lyman, Wyo.—Reported Joseph W. Field of Lyman is interested in an irrigation project here.

Flood Protection—Kansas City, Mo.—Surveys to be made for permanent flood protection work on Turkey Creek.

Wharves, Docks, School and Paving Bonds—Orange, Tex.—Attorney-General at Austin has approved $325,000 bonds for municipal wharves and docks, schools and street improvements. Plans completed and contracts soon to be let for constructing the wharves and docks. J. B. Bisland, City Attorney.

Irrigation Work—Echo, Ore.—Reported contract will soon be let by Directors of Teel Irrigation Dist., Echo (O. D. Teel, Chmn.), for reclaiming 20,000 acres; cost $800,000.

Canal Work—Brigham, Utah.—It is reported that the Hammond Canal is to be improved, the acreage increased from 6500 to 7500 acres. W. V. Call, Local Mgr.

Retaining Wall, Etc.—Vancouver, B. C.—See "Railroads."

BIDS DESIRED.

Wharf Improvement—Fort De Sota, Fla.—Until Oct. 1 at Quartermaster's office, Fort Dade (Lieut. Jacob Frank, Acting Q. M., U. S. A.), for repairing Quartermaster's wharf at Fort De Soto.

Levee Work—Alexandria, La.—By Red River, Atchafalayam and Bayou Levee Dist. Comrs. (Howard B. Gist, Secy., Alexandria) for constructing White Place to Wilson Point levee, riverside enlargement, approximately 140,000 cu. yd.; cost about $17,000.

Levee—Convent, La.—Until Sept. 21 by Bd. Comrs. Pontchartrain Levee Dist., Convent, for Kennerville Levee, new levee and riverside enlargement; approximately 125,000 cu. yd.; cost $21,975.

Ditch—Galloway, Ohio.—Bids will be opened Oct. 1 by Co. Comrs., Columbus, for main ditch: Section 1, Section 2, laterals 2 and 5; Section 3, laterals 1, 3, 4 and 6, 21,375 cu. yd. excav., drain tile, Y-branches, etc., for Krebs ditch, in Pleasant Township; total cost $14,669.

Ditch — Atlantic, Iowa.—Reported desired until Sept. 20 by Co. Comrs. for constructing drainage ditch in Indian Creek Drainage Dist. No. 1, approximately 3 miles long, to consist of 129,000 cu. yd. excav. J. H. Wayne, Engr., Council Bluffs.

Ditch—Morris, Minn.—Until Sept. 21 by C. R. Wollthan, Co. Aud., for constructing Ditch No. 17, Stevens County. Estimated cost, $6,802.

Irrigation Work—St. Ignatius, Mont.—Until Oct. 12 by U. S. Reclamation Service, St. Ignatius, for constructing about ten miles of laterals and appurtenant structures, involving about 43,000 cu. yd. excav., 140 cu. yd. concrete, 430 sq. yd. paving, placing about 9800 lb. of reinforcing steel and placing wooden structures of about 32 M ft. lumber advertised in Engineering Record. Work is situated on east bank of Flathead River from one to seven miles northeast of Dixon.

Drainage—Pocahontas, Ark.—Reported desired until Oct. 1 by Trustees Big Run Water Drainage Dist. at office of Dr. T. Z. Johnson, Holmes, for constructing ditches; about 83,371 cu. yd. earth to be removed.

Ditch—Swifton, Ark.—Until Oct. 6 by Cook Slough Drainage Dist. for constructing approximately 164,000 cu. yd. main ditch, 81,000 cu. yd. lateral excavation for proposed Drainage Dist. near Swifton. The work may be handled by small dredge boats or by drag line and teams. W. A. Bowman, Engr., Remmel, Ark. Ford & MacCrea, Consulting Engrs., Gazette Building, Little Rock.

PRICES AND LETTINGS.

★*Indicates awarded contract.*

State Canal Work—Albany, N. Y.—Two bids were received Sept. 9 by State Supt. Pub. Wks. for improving Sawyer Creek at North Tonawanda: H. S. Kerbaugh, Inc., Buffalo, $9,800, and Eastover Constr. Co., Inc., Utica, $10,200.

No bids received same date as above for improving Three Mile Harbor, Suffolk County.

★**Breakwater, Buffalo, N. Y.**—Contract for furnishing and placing riprap and repairing concrete superstructure on Buffalo breakwater awarded to Coast & Lakes Contr. Cor., 41 Broad Street, New York, at $14,055 (bids opened Sept. 1).

★**Jetties—Atlantic City, N. J.**—Contract constructing jetties at Iowa and Boston Avenues (bids opened Sept. 2) awarded to J. W. Ingersoll at $22,034. Next two bidders: Atlantic Constr. & Supply Co., $23,929, and Edward L. Bader, $33,786. Bidders of Atlantic City. John W. Hackney, City Engr.

Dredging—Wilmington, Del.—Lowest bid opened Sept. 7 by U. S. Engineer, Wilmington, for dredging, submitted by River & Harbor Improv. Co., Philadelphia, Pa., as follows: Murderkill River, 13.7 cts. per cu. yd.; Mispillion River, 15.8 cts. per cu. yd.; total cost, $6,048.

Drainage—Palmetto, Fla.—Following are lowest bids opened Sept. 7 by Co. Comrs. for about 1,340,096 cu. yd. sand, muck and clay excav. on Gamble Creek (price given per cu. yd.): Edgar Chapman, Plant City, 8.39 cts.; Hillsboro Dredging Co., Tampa, 10.7 cts.; Roland Woodward, Jacksonville, 12.4 cts.; A. V. Wills & Son, St. Louis, Mo., 12.5 cts., and Thompson & Moseley, Greensboro, S. C., 12.75 cts. Engineer, Charles S. Hill, Palmetto.

State Canal Work—Albany, N. Y.—Following are four lowest bids opened Sept. 14 by State Supt. Pub. Wks., Albany, for improvement of Seneca and Cayuga Canals, Contract L. (a) Engineer's estimate $71,069. (b) Cleveland Sons Co., Brockport, $68,867. (c) Oswego Constr. Co., Fulton, $65,943. (d) F. M. Whudington Sons, Inc., Rochester, $67,942.

	(a)	(b)	(c)	(d)	(e)
21,000 cu. yd. excav.	$0.75	$0.60	$0.40	$0.50	$0.65
500 cu. yd. facing	1.50	1.30	1.80	1.50	1.50
16.2 M ft. sawed timber	65.00	60.00	75.00	50.00	60.00
3,000 cu. yd. 2d-class concrete	7.00	6.80	6.00	6.50	6.50
500 cu. yd. 1st-class rein. concrete	12.00	12.00	14.40	12.00	12.00
500 cu. yd. 4th-class riprap	2.50	2.50	3.00	2.50	2.50
344,000 lb. structural steel	0.04	0.045	0.048	0.045	0.03
18,000 lb. metal reinforcement	0.03	0.03	0.036	0.03	0.03
50 sq. yd. cobblestone gutter	1.25	1.25	0.50	1.25	1.25
265 sq. yd. brick pave	2.25	2.25	2.70	2.25	2.25
1,240 lin. ft. wooden fence	0.25	0.25	0.30	0.25	0.25
137 lin. ft. lattice railing	1.75	1.75	2.10	1.75	1.75
12 oil signal lamps, each	15.00	15.00	18.00	15.00	15.00
Remove existing superstructure at Gorham Street (lump sum)	....	100.00	120.00	100.00	100.00
Maintain navigation at Gorham Street (lump sum)	....	50.00	25.00	100.00	100.00
Maintain navigation at Kingdom Road (lump sum)	....	50.00	25.00	100.00	100.00
Timber towpath at Gorham Street (lump sum)	....	200.00	25.00	250.00	150.00
Timber towpath at Kingdom Road (lump sum)	....	250.00	25.00	400.00	200.00
Coffer-dams, pumping, bail and drain. (lump sum)	....	10,000.00	12,000.00	10,000.00	8,250.00

State Canal Work—Albany, N. Y.—Following are bids opened Sept. 14 by State Supt. Pub. Wks., Albany, for Barge Canal Terminals, Contract No. 40: (a) Engineer's estimate $27,963; (b) J. E. Bishop, Syracuse, $25,516; (c) Champlain Eng. & Constr. Co., Saratoga Springs, $27,140; (d) Eastover Constr. Co., Inc., Utica, $26,658; (e) Holler & Shepard, Rochester, $26,439.

	(a)	(b)	(c)	(d)	(e)
27,000 cu. yd. excav.	$0.40	$0.35	$0.48	$0.38	$0.38
6,000 cu. yd. forming embankmt.	0.12	0.10	0.14	0.12	0.11
900 cu. yd. gravel surfacing	1.50	1.35	1.80	1.50	1.40
5,000 ft. creosoted timber	65.00	65.00	75.00	65.00	65.00
400 lin. ft. foundation piles	0.35	0.29	0.42	0.35	0.32
2,750 lin. ft. 12-in. reinforced concrete piles	2.40	2.35	1.50	2.35	2.30
50 cu. yd. 2d-class concrete	8.00	7.43	9.60	8.00	7.00
200 cu. yd. 1st-class reinforced concrete	14.00	11.96	10.00	13.50	12.75
100 cu. yd. 2d-class reinforced concrete	9.00	8.94	9.00	9.00	8.00
150 lin. ft. 36-in. reinforced concrete pipe	5.00	4.11	6.00	5.00	4.75
18,000 lb. structural steel	0.04	0.04	0.04	0.04	0.04
14,200 lb. metal reinforcement	0.025	0.03	0.035	0.035	0.03
2,000 lb. iron castings, plain	0.04	0.04	0.04	0.04	0.04
448 lin. ft. wooden fence	0.25	0.22	0.25	0.25	0.25
65 fender fastenings, ea.	1.20	1.21	1.20	1.20	1.20

★**Dredging—Jacksonville, Fla.**—Following are official totals of 4 lowest bids opened July 24 by U. S. Engineer, Jacksonville, for dredging and rock removal in St. Johns River, Fla.—(a) 175,928 cu. yd., per cu. yd., (b) 25,800 cu. yd., per cu. yd. filled, (c) grand total: Standard American Dredge Co., Oakland, Cal., (a) 97.8, (b) 12 cts., (c) $179,055 (awarded contract); Coastwise Dredging Co., Norfolk, Va., (a) 31.08, (b) 20 cts., (c) $202,062; Bowers Southern Dredging Co., Galveston, Tex., (a) $1.18, (b) 20 cts., (c) $217,475; Timothy J. Daly, Brooklyn, N. Y., (a) $1.28, (b) 20 cts., (c) $238,048. Maj. W. B. Ladue, Corps Engrs., U. S. A.

★**Drainage—Defiance, Ohio.**—Contract awarded to Gilmore Bros., Toledo, for drainage work in Defiance County, about 520,000 cu. yd., at about $50,000

★**Ditch — Morris, Minn.** — Contract awarded to Rodgers & Curtin Co., 512 Kasota Building., Minneapolis, at $23,140 for constructing open work for Ditch No. 16, requiring about 274,000 cu. yd excav. (bids opened Sept. 7). E. R. Wollthan, Co. Aud

Ditch — Rosseau, Minn.—Lowest bid opened Sept. 3 for constructing Judicial Ditch No. 41, 2,452,166 cu. yd., submitted by Northwestern Drainage Co., Thief River Falls, at 10.5 cts. per cu. yd. George A. Ralph, Engr. in Charge, 16 Fulton Block, St. Paul.

★**Irrigation—Eureka, Mont.**—Contract awarded for constructing gravity irrigation system in Glen Lake Irrigation Dist. (L. J. B. Chapman, Secy., Eureka) to Nelson Rich, Polson, Mont., at $110,000. Work includes 20 miles of main canal, and 15 laterals, including four miles of various size pipe lines. Other bids: Lord & Blakeslee, Hamilton, $121,500; C. H. Kelly, Kalispell, $122,000 (bids opened Sept. 3).

Irrigation Work—Malta, Mont.—Following are bids reported opened Sept. 8 by U. S. Reclamation Service, Washington, for steel bridge and structural steel movable crest for Vandalia dam of Milk River project—(a) 3 166-ft. steel bridge spans, (b) 3 sets movable crest gates, (c) 3 piers and 2 pier plates, (d) erection of structural steel work, (e) 3 sets hoisting and operating equipment, (f) erection of above: Vierling Iron Works, Denver, Col., (c) $6,166; Minneapolis Steel Machinery Co., Minneapolis, Minn., (a) $8,457, (b) $2,218, (c) $110, Security Bridge Co., Minneapolis, Minn., (a) 2,317, (b) 2.5 cts., (c) $125, (d) $2,150, (e) $6,588, (f) $8,340; Zeh & Wilson Co., St. Paul, Minn., (a) $7,000, (b) $2,200, (c) [illegible], (d) $4,675, (e) total $13,649, (f) $4,125; Hardie-Tynes Mfg. Co., Birmingham, Ala., (c) $21,829, alternate, using ball bearings, $22,611 and $19,762; Lakeside Bridge & Steel Co., North Milwaukee, Wis., (a) $6,237, (b) 2.65 cts., (c) $161, (d) $1,230, (e) $6,500, (f) $1,100; Fulton Iron Works, Los Angeles, Cal., (a) 5 cts. per lb., (b) 5 cts. per lb., (c) $471, (e) $2,941.

★**Levee Repair—Fort Smith, Ark.**—Contract for repairing breaks in Arkansas River levee awarded by the Levee Board to W. H. Rushing, at $73,500.

ELECTRIC RAILWAYS

PROPOSED WORK

Elmira, N. Y.—Contracts about to be let by Elmira Water, Light & R. R. Co. for three 500 kw., 6600-230 volt transformers, two complete sub-stations and lead covered cable.

Waynesboro, Pa. — Chambersburg, Greencastle & Waynesboro St. Ry. Co. contemplates constructing an extension from Blue Ridge Summit to Thurmont or Emmitsburg, 8 or 10 miles.

Chester, Va.—Chester and City Point Ry. Co. incorporated to construct an electric railway from Chester to City Point and Hopewell. Capital $100,000. H. D. Eichelberger, Chester, Pres.; A. C. Buchanan, Chester, Secy.

Decatur, Ind.—Ft. Wayne, Decatur & Southern R. R. Co. incorporated to construct an electric railway from Ft. Wayne to Decatur, Monroe, Berne, Ceylon, Geneva, Bryant, Portland, Winchester, Lynn, Fountain City, Richmond and intervening towns. Among incorporators: Chas. Oetting, Martin Gerke and others.

Menominee, Mich.—Menominee & Marinette Light & Traction Co. contemplates purchasing feeder panel for power house and material for 6 miles transmission line.

Pontiac, Mich.—Detroit, Pontiac & Owosso Ry. Co. secured franchise to construct electric railway over streets of Pontiac; also for an interurban line to connect Pontiac and Corunna, about 61 miles. Headquarters, Detroit. Oliver M. Lau said to be interested.

Ashland, Wis.—Plans being made by Ashland Light Power & St. Ry. Co. to construct a 1500-kw. turbine plant in Ashland.

Clear Lake, Ia.—Mason City & Clear Lake R. R. Co. (F. J. Hanlon, Gen. Mgr., Mason City), contemplates reconstructing 2 miles track in Clear Lake.

Keokuk, Ia.—Surveys completed by Keokuk-Jefferson City Electric Ry. Co. for Keokuk to Jefferson City. H. W. Knight, Chicago, Ill., said to be interested.

Iola, Kan.—Plans being considered by Iola Electric R. R. Co. for extension of line from Iola to Humboldt.

Nevada, Mo.—Plans are being revived for constructing Nevada, Lebanon & Eastern R. R. from Lebanon to Nevada. S. W. Thompson and Andrew Thompson, Kansas City, said to be interested.

Oklahoma City, Okla.—Work is about to be resumed on constructing interurban railway from Oklahoma City to Denison via Sulphur. Power plants will aggregate 75,000 hp., 3 large water plants will be constructed; cost about $1,000,000.

Willapa, Wash.—Federal Light & Traction Co. contemplates constructing railway from Willapa Harbor to Grays Harbor; probable cost $1,000,000. E. H. Sanderson, Pres., 60 Broadway, New York, N. Y.

Jacksonville, Ore. — Southern Oregon Traction Co. plans to extend line from Jacksonville up Jackson's Creek. R. S. Bullis, Gen. Mgr., Medford.

San Francisco, Cal.—Mammoth Copper Co. is to construct a 2-mile electric railway.

BIDS DESIRED.

Philadelphia, Pa.—Until Oct. 19 by A. M. Taylor, Dir. Dept. City Transit, 754 Bourse Building, for steel superstructures and appurtenant work for two-track elevated railway, Contracts Nos. 511, 512, 513 and 514, advertised in Engineering Record.

PRICES AND LETTINGS.

★*Indicates awarded contract.*

★**New York, N. Y.**—Contract awarded by Public Service Comn. for First Dist., 154 Nassau Street, to E. C. Moore, 154 Nassau Street, for constructing a duct line in Forty-fourth Street for use in connection with Queensboro subway, at $34,006. Line begins at Forty-fourth Street and Lexington Avenue and extends easterly under Forty-fourth Street to First Avenue, southerly under First Avenue to Forty-second Street and easterly under Forty-second Street to connection with shaft of Queensboro subway, between First Avenue and the East River.

Following are bids opened Sept. 10 by Public Service Comn., 154 Nassau Street, for supply of trap rock or hard limestone ballast to be used on tracks of new subway system:

Portion A—About 243,000 cu. yd. either trap rock or hard limestone: Upper Hudson Stone Co., 26 Cortlandt Street, $228,010; Haverstraw Crushed Stone Co., $250,240.

Portion B—About 32,500 cu. yd. 3-in. ballast, either trap rock, hard limestone or field stone: Haverstraw Crushed Stone Co., 17 Battery Place, $26,325, and Upper Hudson Stone Co., $27,625.

★**Boise, Idaho.**—Contract awarded Sept. 7 by Boise R.R. Co. to S. E. Burnham, Boise, for constructing thirteen miles of street railway in Boise; cost $25,000.

RAILROADS

PROPOSED WORK

Philadelphia, Pa. — Public Service Comn., Harrisburg, approved contract between the Philadelphia & Reading R. R. and City Connecting R. R. for abolition of several grade crossings in Chestnut Hill Dist.

Mobile, Ala.—See "Hydraulic and Harbor Improvements."

Indianapolis, Ind.—Bonds for $160,000 for track elevation will be sold Oct. 1 by W. T. Patton, Co. Aud.

San Francisco, Cal.—Reported contract soon to be let for constructing sixty-seven miles of railroad from Rosasco to the dam site of the Hetch Hetchy reservoir; cost, $1,800,000. Address M. M. O'Shaughnessy, City Engr.

Seligman, Ariz.—Atchison, Topeka & Santa Fe R. R. (C. F. W. Felt, Ch. Engr., Chicago, Ill.), reported intends building a branch line from Seligman into Bagdad County, tapping Hillside mining district.

PUBLIC BUILDINGS AND SCHOOLS

PROPOSED WORK

East Aurora, N. Y.—Plans prepared by Harris & Merrit, Erie Co., Bank Building, Buffalo, selected by Bd. Educ. for the school, to cost $110,000. An election is to be held this fall on the erection of the building.

Utica, N. Y.—Council passed resolution to issue for $165,000 bonds for erecting Kernan School, West Utica.

Braddock, Pa.—Braddock Hospital will erect 3-story brick and stone addition; cost about $80,000.

Philadelphia, Pa.—Revised plans being prepared by Magaziner & Potter, 603 Chestnut Street, for a two-story building, 40 x 170 ft., and two wings, 27 x 117 ft., each for the West Philadelphia Homeopathic Hospital, 1234 N. Fifty-fourth Street.

Baltimore, Md.—Reported plans completed for the chemical laboratory to be erected at Hopkins Univ.

Batavia, Ohio.—Citizens voted $30,000 bonds to erect addition to high school, plans to be prepared by Schofield & Robertson, Cincinnati.

Mobile, Ala.—See "Hydraulic Construction and River Improvements."

Columbus, Ohio.—Plans being prepared by J. N. Bradford, Univ. Archt., for shop for Ohio State University to cost about $120,000.

Later reports state plans being revised for Homeopathic Hospital for above University. Contract not awarded.

Walton, Ind.—Bonds for $40,000 will be sold Sept. 20 by Trus. Tipton Township (D. A. G. Coblentz, Trus.), to be used for erecting school house.

Detroit, Mich.—A four-story reinforced concrete and limestone fireproof engineering building is to be erected at the Univ. of Detroit.

De Pere, Wis.—Tentative plans prepared for 70 x 200-ft. brick and steel, fireproof addition to St. Norbert's College, Grant Street; cost about $60,000.

Monroe, Wis.—Plans being prepared for Lincoln School; cost $65,000.

Wisconsin.—State Bd. Control, Madison, considering erecting home for feebleminded at Union Grove, cost $200,000, and reformatory for women at Taycheedah, cost $175,000.

Harlan, Iowa.—Citizens voted to erect a $90,000 high and $30,000 grade school.

Rock Rapids, Iowa.—Reported contract will soon be let by Bd. Superv. for erecting court house, according to plans by Joseph Schwartz, Sioux Falls, S. D. Cost about $125,000. E. J. Riegel, Co. Aud.

Denton, Tex.—Bonds for $75,000 for school improvement have been sold. Address City Clerk.

San José, Cal.—A 12-room addition is to be erected to the high school.

BIDS DESIRED.

Wellesly, Mass.—Until Sept. 21, by Trus. Wellesly College, for erecting 4½-story, 202 x 120-ft. brick dormitory for said college. Probable cost, $200,000. Coolidge & Carlson, Archts., 89 State Street, Boston.

New Haven, Conn.—Until Sept. 25, by General Hospital Society of Connecticut for erecting two hospital buildings on Cedar Street. Total cost, $175,000.

Oswego, N. Y.—Until Oct. 4 by Treas. Dept., U. S. Coast Guard, Washington, D. C. (Capt. D. P. Foley, Acting Captain Comdt.), for constructing a boathouse and accessories at Oswego Coast Guard Station, Oswego, advertised in Engineering Record.

Hoboken, N. J.—Until Sept. 29 by City Comrs. for erecting ambulance station.

Jersey City, N. J.—Until Oct. 7 by Co. Bd. Chosen Freeholders, Jersey City, for completing county jail.

Newark N. J.—Until Sept. 30 by Water and Sewer Comrs. (M. R. Sherrerd, Ch. Engr.) for constructing meter repair station, Fourteenth Avenue and S. Eighth Street, for Water Dept.; probable cost $21,000.

Pleasantville, N. J.—Reported desired until Sept. 28 by S. Hudson Vaughn, Archt., Guarantee Trust Building, Atlantic City, for erecting 3-story, 105 x 130-ft., brick and concrete high school; probable cost $40,000.

Carbondale, Pa.—Until Oct. 4 by Thomas L. Scott, Secy. Bd. Educ., for erecting brick and stone high school to cost, including equipment, about $200,000. Edw. Davis, Archt., Scranton.

Pittsburgh, Pa.—Until Sept. 24 at office of City Controller for erecting, including plumbing, heating, electric wiring, etc., two gate house superstructures at the Northside Reservoir on Cabbage Hill, near Millvale. John P. Brennan, City Archt., Northside Municipal Building. Robert Swan, Dir. Dept. Pub. Wks.

Johnson City, Tenn.—Until Sept. 25 preliminary plans for new city hall, two-story, brick, to cost $32,500, and one-story brick market house, cost $15,000. S. E. Miller, Chmn. Com.

Findlay, Ohio.—Reported desired until Oct. 7 for erecting infirmary building; probable cost $100,000. Address J. C. Copeland, Co. Clk.

Marion, Ohio.—Until Oct. 2 by Jeanette L. Hutchinson, Clk. Bd. Educ., for erecting high school. Marriott, Allen & Hall, Archts., 20 E. Broad Street, Columbus.

Until Oct. 4 by Bd. Educ. Grand Pairie Township, Rural School Dist., at office of County Supt. of Schools, Marion, for brick and stone high school. Bids received as a whole or separately for erection, heating, ventilating, plumbing, etc. Bids for labor and material must be stated separately. Howard & Merriam, Archts., 8 E. Broad Street, Columbus.

Woodsfield, Ohio.—Until Sept. 21 by Bd. Educ. (F. W. Pollock, Clk.) for fireproof high school. Bids desired as a whole or separately for erection; ventilating and heating; plumbing, etc. Bids for labor and material must be stated separately. Howard & Merriam, Archts., Builders' Exchange, Columbus.

Indianapolis, Ind.—Reported desired until Sept. 25, by W. T. Patten, Co. Aud., for erecting 4-story, 50 x 100-ft. storage house at W. Twenty-first Street. H. L. Bass & Co., Archts., 801 Hume Mansur Building.

Chicago, Ill.—Until Sept. 21 by Pub. Wks. (W. R. Moorhouse, Comr.) for furnishing, delivering and erecting all structural steel and iron work at garage, at Marshall Boulevard Municipal Plant, W. Thirty-first Street.

Until Sept. 22 by Dept. of Health (John Dill Robertson, Comr.) for furnishing, delivering and erecting structural steel, etc., for new mill building and storage bins at Municipal Reduction Plant.

Until Sept. 22 by Dept. Pub. Wks. (W. R. Moorhouse, Comr.) for furnishing material and erecting 2-story and basement fire engine house at South Kingston Avenue.

Elmhurst, Ill.—Until Sept 28 by Brydges & Somers, Archts., 1200 Steinway Hall, Chicago, for erecting school for School Dist. No. 46.

Rockford, Ill.—Reported desired until Sept. 20 by Bd. Educ. for erecting 2-story, 115 x 130-ft., brick, hollow tile and concrete grade school; probable cost $80,000. Frank A. Carpenter, Archt., Rockford.

Upper Alton, Ill.—Until Oct. 4 by State Bd. Administration, Springfield, for erecting bakery, laundry, kitchen, store and dining-room buildings at Alton State Hospital, near Upper Alton. James B. Dibelka, State Archt., 130 N. Fifth Avenue, Chicago.

Glenwood, Minn.—Until Oct. 5 by W. F. Daugherty, Pres. Bd. Educ., Independent School Dist. No. 8, for erecting high school, including heating, ventilating, etc. Alban & Lockhart, Archts., 347-351 Endicott Bldg., St. Paul.

Lake Park, Minn.—Until Sept. 22 by State Bd. Control, St. Paul, for furnishing material and erecting, including heating, plumbing, electric work, etc., tuberculosis sanatorium at Lake Park. Sund & Dunham, Essex Building, Minneapolis, and A. J. Fridlund, Moorehead, Assoc. Archts. Rose & Harris, 470 Auditorium Bldg., Minneapolis, Engrs.

Moberly, Mo.—Until Oct. 15 by Jas. A. Wetmore, Superv. Archt., Washington, D. C., for extension, remodeling, etc., of U. S. Post Office at Moberly, advertised in Engineering Record.

Denton, Tex.—Until Oct. 16 by Bd. Regents College of Industrial Arts for erecting fireproof addition and alterations to main building of said college. Endress & Watkins, Archts., Houston.

Vancouver, Wash.—Reported desired until Sept. 21 by State Bd. Control, Olympia, for erecting a 4-story, 76 x 136 ft., fireproof School for Blind; probable cost $75,000.

Los Angeles, Cal.—Until Sept. 23 by Bd. Educ. (Wm. A. Sheldon, Secy.) for furnishing material and erecting a school on the Twenty-fourth Street school site.

PRICES AND LETTINGS.

★*Indicates awarded contract.*

Cambridge, Mass.—Following are three lowest bids opened Sept. 8 by city for erecting municipal hospital: Walsh Bros., Cambridge, $78,000; J. J. Powers, Cambridge, $82,679, and C. S. Cunningham & Sons, Boston, $83,600. T. P. Graham, Archt.

Little Falls, N. Y.—Following are lowest bids opened Aug. 31 by Bd. Aldermen for erecting city hall: Masonry and carpenter work, Berrigan Contr. Co., Little Falls, $77,750 and $16,650 respectively; plumbing, Burns Bros., Syracuse, $6,953; heating, Wells & Norton Co., New York, $5,060. Neil Smith, Archt., 101 Park Avenue, New York.

★**White Plains, N. Y.**—Contracts for erecting county court house reported awarded as follows: General contract, John T. Brady & Co., 103 Park Avenue, New York, $494,740; plumbing, P. F. Kennedy Co., Yonkers, $11,830; heating and ventilating, Terran, Mahony & Monro, 601 First Avenue, New York, $18,000. Architect, Benj. Morris, 101 Park Avenue, New York.

★**East Pittsburgh, Pa.**—Contract awarded George M. Hall Co., 135 Seventh Street, Pittsburgh, for erecting 3-story Municipal Building; cost about $50,000.

Philadelphia, Pa.—Following are reported lowest bids opened Sept. 6 by Armory Bd., Harrisburg, for erecting armory: General construction, Fidelity Constr. Co., Philadelphia, $135,950; heating, William McCoach, Jr., Philadelphia, $5,600, and plumbing, same company, $5,683.

Contract awarded Fidelity Constr. Co., 1215 Filbert St., for erecting above building at $139,951.

★**Washington, Pa.**—Contract awarded as follows by State Armory Comrs., Harrisburg, for erecting armory here (bids opened Sept. 6): General contract, William F. Blair & Son, Waynesburg, $24,973; heating, James E. Neff, Washington, $1,567; plumbing, Moss & Blakely Plumbing Co., Pittsburgh, $1,498.

★**Bluefield, W. Va.**—Contract for erecting grade school in South Bluefield (bids opened Sept. 7), awarded by Bd. Educ. to J. F. Barbour & Sons, Roanoke, Va., at $29,300. Next three lowest bidders: Carlin, Clark & Walker Co., Pocahontas, Va., $29,864; Graham Contr. Co., Graham, Va., $32,676, and A. L. Marshall, $33,128. Pedigo & Garry, Archts., Kelley & Moyer Bldg.

★**Madison, W. Va.**—Contract awarded P. Q. Shrake & Son Co., Morgantown, at about $77,556, for erecting Court House. H. Rus Warne, Archt., Charlestown.

Charlotte, N. C.—Following are four lowest bids opened Sept. 7 by Supervising Architect, Washington, D. C., for constructing U. S. Post Office—(a) limestone, (b) sandstone: M. Yeager & Son, Danville, Ill., (b) $210,775; Torbert Constr. Co., Hampton, Va., (a) $194,318, (b) $210,721; James Devault, Canton, Ohio, (a) $199,400, (b) $213,000; J. A. Jones, Charlotte, N. C., (b) $207,000; H. W. Fissell Co., Marbridge Building New York, (a) $196,900; John G. Unkefer & Co., Minerva, Ohio, (a) $192,692.

★**Orangeburg, S. C.**—Contract awarded John S. Mitchell, Orangeburg, for erecting 2-story and basement, red brick and limestone high school; probable cost $21,000. F. H. & J. G. Cunningham, Archts., Greenwich.

Columbus, Ohio.—Four lowest bids opened Sept. 7 for constructing foundation for new East High School: D. W. McGrath, $23,445; William Watson, $27,690; L. C. Herschler, $27,846, and Standard Paving Co., $29,409. Edward B. MacFadden, Clk. Bd. Educ.

★**Eau Claire, Wis.**—Contract awarded Hoeppner-Bartlett Co., Eau Claire, at $52,950, for erecting City Hall on S. Farwell Street. George Awsumb, Archt., 141 E. Jackson Street, Chicago, Ill.

★**Tipton, Iowa.**—F. C. Moffit, County Aud., writes that contract for erecting county house (bids opened Sept. 2), awarded Guarantee Constr. Co., Cedar Rapids, at $44,714. Charles A. Dieman & Co., Archts., Cedar Rapids.

★**Nashwauk, Minn.**—Contract awarded Hugh Fawcett, Duluth, at about $21,999, for erecting City Hall. W. A. Hunt, Archt., Lonsdale Building, Duluth.

Fulton, Mo.—Following are four lowest bids opened Sept. 7 by Supervising Architect, Washington, D. C., for constructing, of red common brick, U. S. Post Office: Frank L. Johnson & Co., Duluth, Minn., $46,596; E. A. Steininger Constr. Co., 407 N. Eighth Street, St. Louis, Mo., $47,619; Balkin Constr. Co., 53 W. Jackson Boulevard, Chicago, Ill., $46,337, and Potter's Lumber Co., East Liverpool, Ohio, $46,490.

★**Corsicana, Tex.**—Contract awarded J. C. Joplin & Bro., Houston, at $81,000 for erecting 2-story dining hall and dormitory, one-story gymnasium and one-story gymnasium and one-story hospital at State Orphan Home. J. H. Wooley, Corsicana, contract for plumbing, at $2,200, and John Martin, Austin, heating and lighting, at $3,000.

★**Los Angeles, Cal.**—Contract for erecting the Fifth Street School at San Pedro awarded Cressmer Constr. Co., Riverside, at $86,400.

★**Douglas, Ariz.**—Contract awarded to T. B. Stewart, Phoenix, to erect two grade schools and an addition to high school (bids opened Sept. 3) at $70,500. Next three lowest bidders: Mayfield & Shaw, El Paso, $75,869; Lutgerding & Egan, Phoenix, $78,675, and Blixt & Co., Douglas, $79,792. Lescher & Kibbey, Archts., Phoenix.

PRIVATE BUILDINGS

PROPOSED WORK

Albany, N. Y.—Fuller & Robinson Co., 95 State Street, will prepare plans for an 8 or 10-story fireproof building to be erected at 74 State Street for Kinney & Woodward Co.

Brooklyn, N. Y.—Plans filed for erection of following buildings: 4-story brick tenement at Bedford and Linden Avenues for Israel E. Kobre, cost $80,000, S. Millman & Son, 1780 Pitkin Avenue, Archts.; 6-story brick tenement at Eastern Parkway and Underhill Avenue for Taggart Building Co., cost $90,000, C. L. Seifert, 110 W. Fortieth Street, New York City, Archt.

New York, N. Y.—Plans have been filed for erection of following buildings; 5-story brick tenement at 517 W. 156th Street for Manhattan Heights Improvement Co., cost $75,000, Sass & Springsteen, 32 Union Square, Archts.; 2-story brick Sunday-school at 564 W. 150th Street for Mount Nebon Congregation, cost $65,000, Berlinger & Moscowitz, Archts., 527 Fifth Avenue; 3-story brick stores and offices at Nassau and Frankfort Streets for Sun Printing & Publishing Co., cost $65,000, F. P. Platt, 1123 Broadway, Archt.; 16-story fireproof bank and office building at Fifth Avenue and Forty-third Street for Five Eleven Fifth Ave. Corp., cost $800,000, York & Sawyer, Archts., 50 E. Forty-first Street; 16-story store and loft building at 136 Madison Avenue for George Backer Constr. Co., cost $1,000,000, Sommerfeld & Steckler, Archts., 31 Union Square; two 5-story brick tenements at Sheridan Avenue and 166th Street for Adger Bldg. Co., cost $100,000, Moore & Landsiedel, Archts., Third Avenue and 148th Street; 5-story brick tenement at 181st Street and Vyse Avenue for Rondle Constr. Co., cost $60,000, Kreymborg Architectural Co., Archts., 1029 E. 163d Street; 5-story brick tenement at 174th Street and Carter Avenue for Moritz Kandel, cost $100,000, Charles B. Myers, 1 Union Square W., Archt.; 5-story brick tenement at Nelson and Macombs Road for Ezra Constr. Co., cost $60,000, Charles B. Meyers, 1 Union Square W., Archt.

Pittsburgh, Pa.—First United Presbyterian Church, Northside, contemplates in spring erecting settlement building at Union Avenue and Moody Street, to cost about $500,000. W. W. Kerr, 801 Union Avenue, Chmn. Bldg. Com.

Plans prepared by O. M. Topp, Jenkins Building, for three-story fireproof parochial school to be erected at North Atlantic Avenue and Kincaid Street for St. Lawrence R. C. Church; cost about $30,000.

South Bethlehem, Pa.—W. Leh, South Bethlehem, is architect for one-story marble bank building; cost, $150,000.

Warminster, Pa.—Plans completed for 2-story clubhouse, 215 x 400 ft., to be erected for Philadelphia Motor Speedway Assoc.

Wilkinsburg, Pa.—Contract will soon be let for erecting on Wallace Avenue an edifice for First Christian Congregation; cost, $40,000.

Baltimore, Md.—Plans prepared and contract soon to be let for three-story brick and marble Y. W. C. A. building to be erected at Eastern Avenue and Clinton Street; cost $50,000.

Charleston, W. Va.—Reported that the Dry Ridge Sanatorium Co. & Hotel Co. will soon let contract for erecting hotel and sanitarium.

Cleveland, Ohio.—Tentative plans reported being prepared by J. Milton Dyer, Cuyahoga Building, for fireproof hotel to be erected at 1833 E. Twelfth Street by John W. Schuster; cost about $150,000.

Toledo, Ohio.—Courts of Foresters reported considering erecting temple costing $50,000. Court Port Lawrence, Moose Temple, may be able to give further information.

Columbus, Ind.—St. John's Lodge of Masons has engaged Graham & Hill, Indianapolis, to prepare plans for the Temple costing $40,000.

New Albany, Ind.—The Masonic Bldg. Assoc. plans erecting a six-story steel and concrete fireproof temple on Spring and Pearl Streets.

Milwaukee, Wis.—Plans filed for 6-story, 60 x 120 ft., reinforced concrete mercantile building, to be erected at Milwaukee and Chicago Streets; cost $100,000. James A. Hannan, 210 Queen Ann Place, Milwaukee, may be able to give further information.

Plans filed for an 8-story, 177 x 110 ft., reinforced concrete apartment house for Blackstone Apartment Co., to be erected at Van Buren Street and Juneau Avenue; cost $250,000.

Plans completed for the brick and stone school and church buildings for Holy Angeles Church, to be erected at Eleventh Street and Atkinson Avenue.

Waterloo, Iowa.—Illinois Central R.R. Co. (A. S. Baldwin, Ch. Engr., Chicago, Ill.) intends enlarging roundhouse and attendant facilities to handle larger motive power equipment.

St. Paul, Minn.—Plans being prepared by Beuchner & Orth, Schubert Building, St. Paul, for 8-story hotel and store building to be erected at Seventh and Wabasha Streets for Herman L. Benz, wholesale liquor dealer.

Great Falls, Mont.—Plans reported being prepared for a parochial school to be erected on Fourth Avenue and Seventh Street N. by St. Ann R. C. Church; cost $60,000. Rev. D. J. Dineen, Pastor.

Galveston, Tex.—G. K. Jorgensen, 1813 Twenty-fifth Street, owner of the Colombo Café, reported planning a three-story bath house on the site of the café; probable cost $100,000.

Seattle, Wash.—Plans reported being prepared by F. F. Travis, Raleigh Hotel, for five-story reinforced concrete brick and terra cotta hospital to be erected for local physicians at a cost of $800,000. Later on a nurses' home, natatorium, power house, heating plant, etc., will be erected. All buildings to be of reinforced concrete.

Contract, it is reported, will soon be let for erecting 2-story and basement, 48 x 112-ft. brick veneer settlement home at Eighteenth Avenue, South and Main Streets, for Council of Jewish Women; probable cost $50,000. D. Marcus Pretica, Pantages Theater Building, Archt.

Portland, Ore.—Contract will probably be let early in October for erecting Benson Trades School at E. 13th and E Irving Streets. Cost $100,000. F. A. Naramore, School Archt.

BIDS DESIRED.

Pittsburgh, Pa.—Reported desired until Sept. 20 by O. M. Topp, Archt., Jenkins Building, for erecting parochial school, 143 x 58 ft., for St. Lawrence R. C. Church.

Lynchburgh, Va.—Reported desired until Sept. 20 by Rev. E. M. Tearny, Pastor Holy Cross Congregation, for erecting 2-story and basement, 62 x 65 ft., parochial school; probable cost $40,000. Murphy & Olmstead, Archts., 1413 H Street N. W., Washington, D. C.

St. Louis, Mo.—Reported desired until Sept. 21 by Albert Kahn and Ernest Wilby, Assoc. Archts., 58 Lafayette Avenue, Detroit, Mich., for erecting 5-story, 144 x 148 ft., service building for Ford Motor Co. in St. Louis.

Seattle, Wash.—Until Sept. 27 for erecting a brick and cement fireproof Masonic Temple to cost, including equipment, about $160,000, George W. Lawton, Archt., 1322 Alaska Building.

PRICES AND LETTINGS.

★*Indicates awarded contract.*

★**Lynn, Mass.**—Contract awarded Turner Constr. Co., 11 Broadway, New York, for erecting 3-story and basement, 104 x 133 ft., reinforced concrete and brick market building at Ellis and Silsbee Streets for J. B. Blood Co. Dana Sanborn, Archt., 38 Exchange Place.

★**Elmira, N. Y.**—Contract awarded by Barker, Rose & Clinton Co. to F. H. Johnson Constr. Co., Elmira, for erecting 5-story, 50 x 70 ft., brick, concrete and tile addition to their warehouse, at State and E. Clinton Streets.

★**Hazleton, Pa.**—Contract awarded A. L. Graeff, Tamaqua, by A. J. Feeley for erecting theater at Hazleton; cost about $75,000.

★**Johnstown, Pa.**—Contract reported awarded W. H. Fissell & Co., 1328 B'way, New York, at about $120,000 for superstructure of passenger station of Penn. R. R.

★**Pittsburgh, Pa.**—Contract awarded Fetzer-Winger Co., 147 Bessemer Building, at about $80,000, for erecting 6-story fireproof warehouse and garage at 206 Second St. for E. W. Proeger.

★**Baltimore, Md.**—Contract awarded West Constr. Co., Knickerbocker Building, for erecting residence for Walter B. Brooks, Jr., at Green Springs Road and Park Heights Avenue, Green Spring Valley; cost about $100,000. Horace Trumbauer, Archt., Land Title Building, Philadelphia.

★**Guilford, Md.**—Contract for erecting two-and-one-half-story stone residence for Jesse Boynton awarded Gladfelter & Chambers, Parkdale and Maryland Avenues, Baltimore; cost $30,000.

★**Nashville, Tenn.**—Contract awarded by Nashville Property Co. to Southern Ferro Concrete Co., Atlanta, at $125,000, for erecting 3-story and basement, 130 x 135-ft. office building at Polk Avenue and Church Street. E. E. Dougherty, Atlanta, and Thomas W. Gardener, Nashville, Assoc. Archts.

★**Columbus, Ohio.**—Contract reported awarded August Roehr, Bucyrus, for erecting the Indianola Methodist Church on Summit Street; cost $40,000. J. Upton Gribbon, Archt., Columbus Saving & Trust Building.

★**Milwaukee, Wis.**—Contract for erecting first unit of the Plankinton House at Second Street and Grand Avenue reported awarded Parker Constr. Co., New York, at about $1,500,000. Holabird & Roach, Chicago, Ill., Archts.

Dubuque, Iowa.—All bids opened Sept. 4 by Y. M. C. A. (E. T. Baer, General Secy.) for erecting building have been rejected.

★**Minneapolis, Minn.**—Contract awarded to C. G. Lindor, 817 Essex Street S. E., for erecting two-story office building for Russell Grader Mfg. Co. (E. E. Ellinton, Pres.) (bids opened Sept. 2).

★**Argenta, Ark.**—Contract awarded by Justin Matthews to L. Collamore, Little Rock, at about $75,000 for erecting 21 story pressed brick and reinforced concrete building.

★**Little Rock, Ark.**—Contract awarded L. Collamore, Little Rock, for erecting 2-story, fireproof, Matthews Building, at Second and Main Streets; cost $75,000.

★**Houston, Tex.**—Contract reported awarded Cook & Co., 410 Prince Theater, for erecting 3-story, fireproof apartment house at Walker and San Jacinto Streets for Mrs. W. W. Wilson; cost about $28,000.

NEW INDUSTRIAL PLANTS

PROPOSED WORK

Portland, Me.—F. A. Hutton Co., Auburn, intends erecting fireproof cracker bakery on First Avenue; cost, $175,000.

Lowell, Mass.—Bay State Cotton Co. intends erecting 2-story, 286 x 65-ft. brick addition; cost, $100,000.

Kingston, N. Y.—Plans being prepared by Kingston Factory Corporation for two-story and basement factory, brick, 50 x 150 ft.

Pittsburgh, Pa.—Union Storage Co. contemplates erecting on Smallman Street an 8-story, 154 x 264-ft. fireproof cold storage warehouse; probable cost, $500,000.

Cumberland, Md.—Plans completed by American-McKenna Process Co., 508 Cream-Abbott Building, Milwaukee, for erecting plant for rerolling steel rails to occupy about 75,000 sq. ft.; cost $100,000.

Fort McHenry, Md.—Reported Baltimore Dry Dock & Shipbuilding Co., Baltimore, contemplates enlarging plant, at a cost of $175,000.

Marianna, Fla.—Citizens voted in favor of establishing a municipal ice plant.

Mobile, Ala.—See "Hydraulic Construction and River Improvements."

Salem, Ohio.—Porter Rubber Co. will erect plant here costing $150,000. J. C. Porter Empire Building, Pittsburgh, Interested.

St. Charles, Ill.—Moline Malleable Iron Co.'s plant, recently destroyed by fire, will be rebuilt. Plans being prepared for brick, steel and fireproof buildings to cost $100,000.

Waterloo, Iowa.—Kelly Mfg. Co.'s plant (D. B. Kimball, Mgr.), Miles and McKinley Streets, recently destroyed by fire, will be rebuilt early this fall. A 2-story, 80 x 150-ft. brick building will be erected on old site.

Billings, Mont.—Case Threshing Co. (O. J. Thomas, Local Mgr.), reported will erect 2-story addition to their plant; probable cost, $100,000.

Baker, Ore.—Rolfe Milling Co. reported will erect a five-story, 60 x 30 ft., ferro concrete grain elevator, capacity 50,000 bushels.

Victorville, Cal.—Reported Southwestern Portland Cement Co. of El Paso, Tex., will erect a plant here for the manufacture of cement.

BIDS DESIRED.

Wilmington, Del.—By Peuckert & Wunder, Archts. and Engrs., 310 Chestnut Street, Philadelphia, Pa., for fireproof, brick, steel and concrete, one and two-story baking plant and stable, 100 x 280 ft. and 32 x 102 ft. respectively, and one-story power plant, 26 x 137 ft., to be erected at Pennsylvania Avenue and Lincoln Street for William Freihofer Baking Powder Co.

PRICES AND LETTINGS.

★*Indicates awarded contract.*

★**Wamesit, Mass.**—Contract awarded Casper Ranger Constr. Co., 20 Bond Street, Holyoke, for erecting chemical plant for Avery Chemical Co., Boston. Engineers Jos. H. Wallace & Co., Temple Court Bldg., and Fredk. J. Falding, 5 Beekman Street, New York.

★**Bridgeport, Conn.**—Contract awarded by Locomobile Co. of America to McArthur Concrete Pile & Foundation Co., 11 Pine Street, New York, for foundation for their new chimney. H. de B. Parsons, Engr., 55 William Street, New York.

★**Newark, N. J.**—Contract awarded by Maas & Waldstein to Fredk. Kilgus, Inc., Newark, for erecting several buildings at their manufacturing plant, Avenue R and Passaic River. Cost $50,000.

★**Verona, Pa.**—Reported contract awarded George Hogg Co., Keystone Building, for erecting plant at Grant Street and Katz Avenue for International Oxygen Co. of New York City.

★**Springfield, Ohio.**—Contract awarded William Poole for erecting 44 x 265 ft. brick and reinforced concrete addition to Nolte Brass Co.'s plant, W. Jefferson Street. R. C. Gotwald, Archt., Gotwald Bldg.

★**Toledo, Ohio.**—Contract awarded MacArthur Concrete Pile & Foundation Co., 11 Pine Street, New York, for covering pile foundations of office and three other buildings at Willys-Overland Co. automobile plant, Toledo. About 4750 concrete piles. Miller, Raines, Bellman & Nordoff, Archts., Ohio Bldg.

MISCELLANEOUS

PROPOSED WORK

Coal Pier — Baltimore, Md.—Reported plans approved by Daniel Willard, Pres. Baltimore & Ohio R.R., for constructing proposed coal pier at Curtis Bay, reported to cost about $1,500,000.

Underpass—Atlanta, Ga.—Plans have been prepared by Engineer Kauffmann of the City County Dept. for Forsters Avenue underpass under the Southern Ry. and have been submitted to Street Com. Cost estimated at $60,000.

Park Bonds—Cleveland Heights, Ohio.—Park and sewer improvement bonds amounting to $211,917 have been sold.

Park Bonds— Massillon, Ohio.—Bonds for $[illegible] will be sold Sept. 20 by R. J. Kramer, City Auditor, for park improvements.

Sprinkler System—Minneapolis, Minn.—Public Safety Com. of the Parents and Teachers Assoc., have recommended to School Board, that Sprinkler systems be installed in all boiler rooms and school buildings; estimated cost, $750,000.

Dock—St. Louis, Mo.—Bd. of Aldermen said to favor constructing a rail and water terminal dock at foot of N. Market Street; cost, approximately $250,000.

BIDS DESIRED.

Park Work—Boston, Mass.—Until Sept 24 by Park and Recreation Dept. (John H. Dillon, Chmn.), for grading, draining, walks and concrete work for Ronan Park.

Pier Shed—New York, N. Y.—Until Sept. 21 by Richard D. Harrison, Acting Comr. of Docks, for Contr. No. 1471—Furnishing material and building a pier shed with appurtenances at W. Twenty-third Street. Security $15,000.

Fire Escapes—Reading, Pa.—Until Sept. 24, by D. K. Hoch, Co. Controller, for erecting fire escapes at the Berks County almshouse.

Swimming Pool — Jacksonville, Fla.—Until Sept. 27 by Com. Pub. Wks. (S. C. Harrison, Jr., Chmn.), City Engrs. Building, for furnishing material and constructing reinforced concrete swimming pool, approximately 100 x 40 ft., from 4 to 10 ft. deep, at Seventh Street and Boulevard, in Springfield Park.

Piles for Foundation—Chicago, Ill.—Reported desired by Chicago & Northwestern R. R. Co. (W. H. Finley, Ch. Engr., Chicago, for 15,000 pieces of piling for use in foundation of new grain elevators to be erected at 118th Street and Calumet River, capacity 2,500,000 bu.

Traveling Crane — Chicago, Ill.—Until Sept. 21 by Dept. Pub. Wks. (W. R. Moorhouse, Comr.) for furnishing material and erecting, complete, a 20-ton electric traveling crane with 5-ton auxiliary hoist at Mayfair Pumping Station.

Grading—St. Louis, Mo.—Until Sept. 23 by Pitzman Co., Surveyors and Engineers, 615 Chestnut Street, for about 600,000 cu. yd. excav. to be made for the University Park Realty Co.

PRICES AND LETTINGS.

★*Indicates awarded contract.*

★**Conduit—Boston, Mass.**—Following are four lowest bids opened Aug. 26 by Bd. Pub. Wks. for Stony Brook conduit, West Roxbury, Sect. 9: West Roxbury Trap Rock Co., $105,491 (awarded contract); William J. Barry, $111,543; James J. Coughlan Co., $111,676, and George M. Byrne, $112,965.

Lumber for State Canal—Albany, N. Y.—Following are bids opened Sept. 9 by State Supt. Pub. Wks., Albany, for furnishing timber and plank (white oak, white pine, hemlock and spruce) for use on the State Canals, about 2000 M ft.—(a) Eastern Division, (b) Middle Division, (c) Western Division: G. Elias & Bro., Inc., Buffalo, (a) $13,273, (b) $15,617; Buffalo Hardwood Lumber Co., Buffalo, (a) $13,449, (b) $17,321, (c) $25,213; Lupfer & Remick, Buffalo, (a) $14,397, (b) $19,254, (c) $29,599; W. J. Dowdle, Oswego, (c) $24,992.

★**Grading College Site—Cincinnati, Ohio.**—Contract for grading site of Medical School (bids opened Sept. 1 by Saml. Hannaford & Sons, Archts., Hulbert Block) awarded Tanner & Byrnes, Cincinnati, at 26.95 cts. per cu. yd., about 80,000 cu. yd. to be excav. Next three lowest bidders: Krichener Constr. Co. and Henkel & Sullivan, Cincinnati, 29 cts.; R. E. Cash, Cincinnati, 29.5 cts.; Meier & Murdock, Cincinnati, 32.5 cts.

★**Cement — Provo, Utah.** — Contract awarded by U. S. Reclamation Service to Ogden Portland Cement Co., Ogden, for 21,000 bbls. Portland cement for use on Strawberry Valley Project, and projects of Idaho Division, at $1.10 net per bbl. f.o.b. cars at company's plant, Baker, Utah.

Proposals

For Proposals Advertised, see Pages 48, 49, 50 and 51.

WATERWORKS.

Bids Close.		See Eng. Record.
Sep. 20.	Water Works, Myton, Utah. Adv. Aug. 28, Sept. 4.	Aug. 28
Sep. 21.	Water Wks., Gayville, S. D.	Sep. 18
Sep. 22.	Pumps, Cleveland, Ohio.	Sep. 18
Sep. 23.	Water Works, Whitehall, Mont. Adv. Aug. 28 to Sept. 11.	Aug. 28
Sep. 23.	Wells, Jamestown, N. Y. Adv. Sep. 11, 18.	Sep. 11
Sep. 24.	Well, Etc., in Hospital, Central Islip, N. Y. Adv. Sep. 11, 18.	Sep. 11
Sep. 25.	Filter Plant, Etc., East Liverpool, Ohio. Adv. Sep. 18.	Sep. 18
Sep. 27.	Well, Hastings, Neb. Adv. Aug. 28.	Aug. 28
Sep. 27.	Tank, Amboy, Ill. Adv. Sept. 18.	Sep. 11
Sep. 28.	Cont. 161, New York, N. Y.	Sep. 11
Sep. 30.	Pumping Equipment, Philadelphia, Pa.	Sep. 11
Sep. 30.	Hydrants, Washington, D. C.	Sep. 11
Sep. 30.	System, South Charleston, Ohio. Adv. Sep. 18.	Sep. 18
Oct. 1.	System at Univ., Wilberforce, Ohio	Sep. 11
Oct. 5.	Reservoir, Tamaqua, Pa. Adv. Sep. 11, 18.	Sep. 11
Oct. 6.	System, Luverne, Iowa. Adv. Sep. 18.	Sep. 18
Oct. 7.	Service System, Coatesville, Pa. Adv. Sep. 18.	Sep. 18
Nov. 9.	Water Wks., Belleville, Ohio	Sep. 11
Oct. 12.	Valves, etc., Toronto, Ont. Adv. Sep. 18.	Sep. 18
———	Well, Thomasville, Ala. Adv. Aug. 28.	Aug. 28

SEWERAGE AND SEWAGE DISPOSAL.

Sep. 21.	Forest Grove, Ore.	Sep. 4
Sep. 21.	Chatfield, Minn.	Sep. 18
Sep. 22.	Ann Arbor, Mich.	Sep. 11
Sep. 22.	Lisbon, Iowa	Sep. 18
Sep. 23.	Whitehall, Mont. Adv. Aug. 28, Sept. 4.	Aug. 28
Sep. 23.	Appleton, Wis.	Sep. 11
Sep. 24.	Seaside Park, N. J. Adv. Sep. 11.	Sep. 11
Sep. 25.	Verona, N. J.	Sep. 18
Sep. 27.	Lyle, Minn.	Sep. 11
Sep. 27.	Glendale, Ohio	Sep. 18
Sep. 29.	Philadelphia, Pa. Adv. Sep. 18.	Sep. 18
Oct. 1.	Culpeper, Va.	Sep. 18
Oct. 4.	Glen Gardner, N. J. Adv. Sep. 18.	Sep. 18
Oct. 7.	Atlantic City, N. J. Adv. Sep. 18.	Sep. 18
Oct. 8.	North Chattanooga, Tenn. Adv. Sep. 18.	Sep. 18
Oct. 14.	Mansfield, Ohio	Aug. 28

BRIDGES.

Sep. 22.	Cleveland, Ohio	Sep. 11
Sep. 22.	Binghamton, N. Y. Adv. Sep. 18.	Sep. 18
Sep. 22.	Connecticut	Sep. 18
Sep. 24.	Massillon, Ohio	Sep. 11
Sep. 25.	Hankow, China. Adv. Aug. 14.	Aug. 14
Sep. 28.	Greensburg, Pa.	Sep. 4
Sep. 28.	Maryland	Sep. 18
Sep. 29.	Keosauqua, Iowa	Sep. 18
Sep. 30.	Pennsylvania	Sep. 18
Sep. 30.	Phoenixville, Pa. Adv. Sep. 18.	Sep. 18
Oct. 6.	Lawrence, Kan. Adv. Aug. 14 to Sep. 18.	Aug. 14
Oct. 6.	Manhattan, Kan.	Sep. 18
Oct. 12.	Beaufort, S. C. Adv. Sep. 18.	Sep. 18

PAVING AND ROADS.

Sep. 20.	St. Charles, Ill. Adv. Sept. 11.	Sep. 11
Sep. 21.	Baltimore, Md.	Aug. 28
Sep. 21.	Asphalt Plant, New Orleans, La.	Sep. 4
Sep. 21.	Taylor, Tex. Adv. Sept. 4, 11.	Sep. 4
Sep. 21.	New Orleans, La.	Sep. 11
Sep. 21.	Leetonia, Ohio	Sep. 18
Sep. 21.	Ventura, Cal.	Sep. 18
Sep. 21.	Chicago, Ill.	Sep. 18
Sep. 21.	Philadelphia, Pa.	Sep. 18
Sep. 21.	Santa Ana, Cal.	Sep. 18
Sep. 22.	Chicago, Ill.	Sep. 18
Sep. 22.	Baltimore, Md.	Sep. 18
Sep. 22.	Whitesburg, Ky.	Sep. 18
Sep. 22.	Leetonia, Ohio	Sep. 18
Sep. 22.	Louisville, Ky.	Sep. 18
Sep. 22.	North Yakima, Wash.	Sep. 18
Sep. 22.	Connecticut	Sep. 18
Sep. 23.	Pittsburgh, Pa.	Sep. 4
Sep. 23.	Tillamooke, Ore.	Sep. 18
Sep. 25.	Walker, Minn.	Sep. 18
Sep. 27.	Bexley, Ohio	Sep. 18
Sep. 27.	West Paterson, N. J.	Sep. 18
Sep. 27.	Ontario, Cal.	Sep. 18
Sep. 28.	Kansas City, Mo.	Sep. 11
Sep. 28.	Maryland	Sep. 18
Sep. 30.	Newark, N. J.	Sep. 18
Oct. 2.	Jacksboro, Tenn.	Sep. 18
Oct. 4.	Indiana	Sep. 18
Oct. 5.	St. Louis, Mo.	Sep. 18
Oct. 5.	Winamac, Ind.	Sep. 18
Oct. 7.	Jersey City, N. J.	Sep. 18
Oct. 8.	Indiana	Sep. 18

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS.

Sep. 20.	Lock Gates, Montgomery, Ala. Adv. Aug. 21, 28, and Sep. 11, 18.	Aug. 21
Sep. 20.	Revetment Work, Hartsburg, Mo. Adv Aug. 28 to Sept. 18.	Aug. 21
Sep. 20.	Retaining Wall, Washington, D. C. Adv. Aug. 28 to Sept. 18.	Aug. 28
Sep. 20.	Irrigation Work, Malta, Mont. Adv. Aug. 28.	Aug. 28
Sep. 21.	Ditch, Slayton, Minn.	Sep. 11
Sep. 21.	Levee Work, Convent, La.	Sep. 18
Sep. 21.	Ditch, Morris, Minn.	Sep. 18
Sep. 22.	Piers, Honolulu, Hawaii. Adv. Aug. 7 to Sept. 4.	Aug. 7
Sep. 22.	Wharf Addition, Fort Constitution, N. H.	Sep. 11
Sep. 23.	Dredging, Norfolk, Va. Adv. Aug. 28 to Sept. 11.	Aug. 28
Sep. 24.	Operating Machinery at Dam, Cincinnati, Ohio. Adv. Aug. 28, Sep. 11 and 18.	Aug. 28
Sep. 24.	Drainage, Muscatine, Ia.	Sep. 4
Sep. 25.	Ditch, Worthington, Minn.	Sep. 11
Sep. 28.	Terminal Contr. 47 and 49, Albany, N. Y. Adv. Aug. 28 to Sept. 18.	Sep. 4
Oct. 1.	Dikes, Etc., Cathlamet, Wash.	Aug. 28
Oct. 1.	Bulkhead Shed, San Juan, P. R. Adv. Sep. 4 to 18.	Sep. 4
Oct. 1.	Ditch, Galloway, Ohio.	Sep. 18
Oct. 1.	Drainage, Pocahontas, Ark.	Sep. 18
Oct. 1.	Repairs to Wharf, Fort De Sota, Fla.	Sep. 18
Oct. 6.	Ditch, Swifton, Ark.	Sep. 18
Nov. 8.	Dredge, Jacksonville, Fla. Adv. Sep. 11, 18.	Sep. 11
Oct. 12.	Irrigation Work, St. Ignatius, Mont. Adv. Sep. 18.	Sep. 18

PUBLIC BUILDINGS AND SCHOOLS.

Sep. 20.	Cincinnati, Ohio Adv. Aug. 28.	Aug. 28
Sep. 21.	Marblehead, Ohio Adv. Sept. 4, 11.	Sep. 4
Sep. 21.	Medical Lake, Wash.	Sep. 11
Sep. 21.	Sedro Woolley, Wash.	Sep. 11
Sep. 21.	Woodsfield, Ohio	Sep. 18
Sep. 21.	Chicago, Ill.	Sep. 18
Sep. 21.	Vancouver, Wash.	Sep. 18
Sep. 21.	Wellesly, Mass.	Sep. 18
Sep. 22.	Lake Park, Minn.	Sep. 18
Sep. 22.	Chicago, Ill.	Sep. 18
Sep. 22.	Newark, N. J.	Sep. 18
Sep. 23.	Los Angeles, Cal.	Sep. 18
Sep. 24.	Wards Island, N. Y. Adv. Sep. 11, 18.	Sep. 11
Sep. 24.	Pittsburgh, Pa.	Sep. 18
Sep. 25.	Vallejo, Cal.	Aug. 28
Sep. 25.	Norfolk, Va.	Aug. 28
Sep. 25.	Bremerton, Wash.	Aug. 28
Sep. 25.	Lima, Ohio	Sep. 4
Sep. 25.	Lincoln, Neb.	Sep. 11
Sep. 25.	New Haven, Conn.	Sep. 18
Sep. 25.	Indianapolis, Ind.	Sep. 18
Sep. 25.	Plans, Johnson City, Tenn.	Sep. 18
Sep. 27.	Tulsa, Okla.	Aug. 14
Sep. 27.	Cleveland, Ohio	Sep. 11
Sep. 28.	Harrisburg, Pa. Adv. Aug. 21, 28.	Aug. 21
Sep. 28.	Pleasantville, N. J.	Sep. 18
Sep. 28.	Elmhurst, Ill.	Sep. 18
Sep. 29.	Smyrna, Del.	Aug. 28
Sep. 29.	Hoboken, N. J.	Sep. 18
Sep. 30.	Washington, D. C. Adv. July 24, 31.	July 24
Sep. 30.	Tulsa, Okla.	Aug. 28
Sep. 30.	Elizabeth, N. J. Adv. Sept. 4, 11.	Sep. 4
Sep. 30.	Tompkinsville, N. Y.	Sep. 11
Oct. 1.	Kalamazoe, Mich.	Aug. 28
Oct. 1.	Toledo, Ohio	Sep. 11
Oct. 2.	Marion, Ohio	Sep. 18
Oct. 4.	Marion, Ohio	Sep. 18
Oct. 4.	Carbondale, Pa.	Sep. 18
Oct. 4.	Upper Alton, Ill.	Sep. 18
Oct. 4.	Oswego, N. Y. Adv. Sep. 18.	Sep. 18
Oct. 5.	Glenwood, Minn.	Sep. 18
Oct. 7.	Wilmington, N. C.	Sep. 11
Oct. 7.	Jersey City, N. J.	Sep. 18
Oct. 7.	Findlay, Ohio	Sep. 18
Oct. 8.	Boston, Mass.	Sep. 4
Oct. 13.	Naugatuck, Conn.	Sep. 11
Oct. 14.	Wilkesboro, N. C.	Sep. 11
Oct. 15.	Moberly, Mo. Adv. Sep. 18.	Sep. 18
Oct. 16.	Denton, Tex.	Sep. 18
Oct. 16.	Washington, D. C.	Aug. 28
Oct. 19.	Norton, Va.	Sep. 11

PRIVATE BUILDINGS.

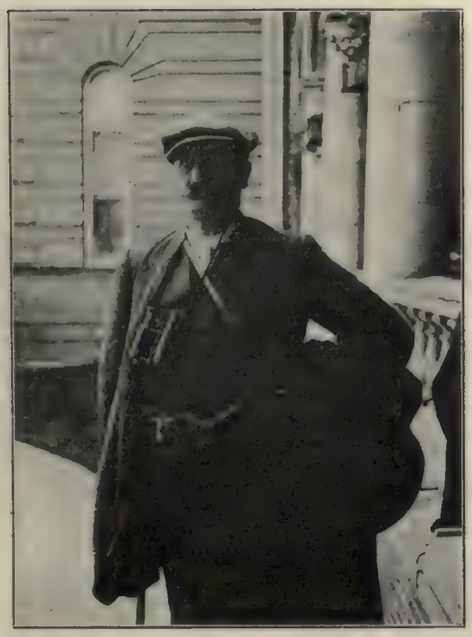
Sep. 21.	Cleveland, Ohio	Sep. 11
Sep. 21.	St. Louis, Mo.	Sep. 18

MISCELLANEOUS.

Sep. 21.	Traveling Crane, Chicago, Ill.	Sep. 18
Sep. 21.	Pier Shed, New York, N. Y.	Sep. 18
Sep. 22.	Cement, Sand and Gravel, New Orleans, La. Adv. Sep. 4 to 18.	Sep. 4
Sep. 22.	Steel Shapes, Etc., Panama	Sep. 11
Sep. 23.	Garbage Incinerator, Greystone Park, N. J.	Sep. 11
Sep. 23.	Grading, St. Louis, Mo.	Sep. 18
Sep. 24.	Pipe, Etc., Panama.	Sep. 11
Sep. 24.	Underground Steam Mains in Hospital, Central Islip, N. Y. Adv. Sep. 11, 18.	
Sep. 24.	Fire Escapes, Reading, Pa.	Sep. 18
Sep. 24.	Park Work, Boston, Mass.	Sep. 18
Sep. 27.	Swimming Pool, Jacksonville, Fla.	Sep. 18
Oct. 7.	Cement, Portland, Ore. Adv. Sep. 11, 18.	Sep. 11
Oct. 8.	Mechanical Equipment in Appraisers' Stores, Boston, Mass. Adv. Sept. 4, 11.	Sep. 4
Oct. 8.	Elevator, Boston, Mass.	Sep. 4
Oct. 16.	Pumps, Etc., for Oil Plants, Washington, D. C.	Aug. 28
Nov. 17.	Power Plants, Etc., Washington, D. C.	Aug. 28
Oct. 19.	El. Ry., Philadelphia, Pa. Adv. Sep. 18.	Sep. 18

By Special Train to the International Engineering Congress

Prominent American and Foreign Engineers En Route from New York to San Francisco, as Snapped by Engineering Record's Camera



JEAN DE PULLIGNY, ON TWO MONTH'S LEAVE FROM FRENCH ARMY



H. J. E. WENCKEBACH, OF THE HAGUE, AND ROBERT J. SNELLEN, OF AMSTERDAM, BOTH REPRESENTING HOLLAND ENGINEERING SOCIETY





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A. PARKER SMITH, NEW YORK, AND JOSE R. VILLALON, CUBA



DELEGATION IN CAR MAKING ASCENT OF PIKE'S PEAK ON COG RAILWAY



PROF. A. E. ROHN, OF ZURICH, REPRESENTING SWISS GOVERNMENT



JOHN A. BRASHEAR (ON PLATFORM) PRESIDENT AM. SOC. MECH. ENG.

CONTRACTING NEWS

Of Special Interest to Engineers, Contractors, Builders and Manufacturers of Engineering and Building Supplies

OUR EXPORTS last week reached the record total of more than $85,000,000. This shows that the drop to $33,000,000 for the week ended Sept. 7 was not due to any fundamental conditions, and was probably traceable to holidays and to the anxiety over negotiations for financing our export trade. These negotiations still continue, as is natural in the case of a transaction of such size and, for this country, without precedent.

It has been pointed out by those informed on economic questions that this country faces a grave danger at the end of the world war. Prices are now high because of dire necessities of buyers, and the temptation is strong to throw economical production methods to the winds and establish standards that will raise the cost of production to a point that leaves a present profit. Standards so raised can be reduced with difficulty, if at all. There is serious danger in our products having to meet cheap competition on a large scale when the war is over, and European production will undoubtedly be cheaper than ever as it is certain that all of the countries engaged in the war will make every effort to regain this export business they have lost, both in this country and in neutral countries where our business is even yet struggling for a foothold. A striking illustration of this possibility is the dyestuff field, into which capital has feared to venture because it is almost certain that after the war Germany will sell dyes in this country cheaper than our standards will permit us to produce them.

In this situation lies danger to the contractor. If our surplus products cannot find a market after the war, to say nothing of their being under sold by other countries in our own markets, the blow to industry will curtail development and construction for years. Consequently the situation is fully appreciated, both by business and by influential labor leaders, and it is hoped that if the occasion comes the country will be in a position to meet it.

Buildings

The lowest bid received for erecting a high school at Englewood, N. J., was $230,000. Contracts amounting to $350,000 have been awarded on the new city and county building at Pittsburgh. A contract for a $250,000 hotel building has been awarded at Louisville. Several contracts have been awarded on enlargements to public institutions at Farview, Pa., which will cost $300,000. An addition to the railroad shops at Waterloo, Iowa, has been contracted for at $181,000. The lowest bid open for constructing the public library at San Francisco was $424,000. Bids are asked on an armory at Grand Rapids, Mich., on a $125,000 courthouse at Rock Rapids, Iowa, on a high-school building at Dallas and on a $160,000 Masonic temple at Seattle.

Kansas City has sold $612,000 school bonds, a $500,000 school bond issue has been sold at Jacksonville, Fla., and another $500,000 issue will be sold Sept. 30 at El Paso, Tex. Plans have been prepared for a $350,000 hospital in New York City. It is reported from Clayton, N. Y., that an architect has been retained for a $400,000 fireproof hotel to be built for the Thousand Islands Development Company. A supervising architect has been selected for the $500,000 university to be built at Chattanooga, Tenn. Plans have been filed with the Georgia State Railway Commission for the new $1,000,000 union passenger terminal in Macon. It is reported that a $500,000 hospital will be built at Dayton, Ohio. Plans are being prepared for a $250,000 factory in Chicago. A contract is to be let for a $175,000 State normal school building at Emporia, Kan.

Bridges and Roads

A contract for reconstructing the Chicago Street viaduct at Buffalo has been awarded at $184,000. A $60,000 bridge contract has been awarded at Logansport, Ind., and a contract for constructing a $66,000 bridge near Canadian, Tex., has also been awarded. A contract is to be let this fall for constructing another bridge at Seattle to cost $445,000. The construction of a $150,000 bridge is contemplated at Grimes, Cal. Two bridges to cost $125,000 are being considered at Indianapolis. Three concrete bridges to be built at Woonsocket, R. I., will cost $85,000. A steel bridge to be built at Portland, Ore., will cost $60,000.

Paving work to cost $194,000 has been contracted for at Hackensack, N. J. Paving contracts amounting to $179,000 have been awarded at Pittsburgh. A Philadelphia paving contract costing $240,600 has been awarded. Tallahassee, Fla., has awarded a $67,000 paving contract. A paving contract amounting to $62,000 has been awarded at Cleveland, and a road contract has been recommended for award at $94,000. A $92,000 paving contract has beeen awarded at Los Angeles.

Bids are desired for 90,000 sq. yd. of paving at Beaumont, Tex. Austin, Tex., will soon let paving work to cost $425,000. Three paving contracts amounting to $219,000 will be let soon at Seattle. De Land, Fla., will sell Oct. 11 road bonds amounting to $400,000.

Waterworks and Sewers

Bids are desired for constructing a filter plant at Lumberton, N. C. Minot, N. D., desires bids Oct. 4 for laying water mains and sewers. Contracts for constructing waterworks and sewers are to be let next month at South Boston, Va. Athens, Ohio, will let a contract for waterworks improvements, including a 2,750,000-gal. concrete reservoir. A sewer system to cost $66,000 has been contracted for at Ocala, Fla. The contract for constructing the tunnel sewer at Milwaukee has been awarded at $160,000. Three sewer contracts totaling $125,000 have been awarded at Clinton, Iowa. Bids are desired Oct. 1 at Mimico, Ont., for sewer work to cost $143,000. Bids are desired at Long Island City, N. Y., for sewer work on which $74,000 security is required. Bids are desired Oct. 6 for constructing about 8 miles of sewers at Visalia, Cal.

Miscellaneous

A contract for the Thirtieth Street pier shed in Brooklyn has been awarded at $213,000. The steel for third-tracking the Myrtle Avenue elevated railway in Brooklyn has also been contracted for. A $400,000 railroad contract has been awarded at Charleston, S. C., and two contracts for double-tracking near Easley, S. C., have been awarded by the Southern Railway. The lowest bid submitted for irrigation work to the U. S. Reclamation Service at Denver Sept. 8 was $203,000. Bids are desired Oct. 1 for constructing a $100,000 dam near Salt Lake City.

Plans for a $1,500,000 coal pier have been approved by the directors of the Baltimore & Ohio Railroad. Preliminary plans for flood-protection work to cost $300,000 have been completed at Olean, N. Y. It is reported from Roanoke, Va., that the Norfolk & Western Railway is considering erecting a $1,000,000 grain elevator. Flood-protection bonds amounting to $250,000 will be sold at Augusta, Ga., Oct. 6. The construction of a $250,000 municipal dock has been recommended at St. Louis. The construction of a $125,000 dam and power house is under consideration at Des Moines, Iowa. At Toronto the hydroelectric commission has approved plans of a power company for developing an additional 100,000 hp. from the Niagara River.

WATERWORKS

PROPOSED WORK.

Hartford, Conn.—Additional water supply bonds amounting to $2,000 sold.

North Hempstead, L. I., N. Y.—Carle Place Water Dist. bonds amounting to $[illegible] sold by North Hempstead Town Bd.

Coatesville, Pa.—Reported Alex Potter, 50 Church Street, New York engaged to prepare plans for the Buck Run project.

Leyston, Pa.—Municipal water works contem[illegible]

Dover, Del.—Plant of Harrington Light & Water Dept. [illegible] damaged by fire.

Newport, Del.—Water supply and sewer system [illegible] contemplated.

South Boston, Va.—[illegible] & Clapp [illegible] Engineers, Richmond, Va., are preparing [illegible] for proposed sewer [illegible] and purification [illegible] to cost $[illegible]. Contract will probably be let in October. E. T. Archer & Co., Kansas City, Mo.

Bascetor, Ga.—Citizens voted $[illegible] bonds for constructing system [illegible] and water works.

Cocoa, Fla.—S. F. Dunton, City Clk., writes [illegible] will be asked for constructing water works.

Lockport, La.—Council adopted resolution relating to construction of water works.

Oakdale, La.—S. A. Pittman, City Clk., writes water works are to be constructed; cost $20,000.

Shreveport, La.—City intends installing municipal water works.

Philadelphia, Miss.—A $30,000 bond issue for water works and sewers being offered for sale. J. N. Irving, City Clerk. Massena L. Culley, Engr., Jackson.

Paducah, Ky.—Issuing of $250,000 bonds to construct water works is under consideration.

Paducah, Ky.—City Comrs. said to be considering municipal water works.

Findlay, Ohio.—Council will extend water mains to West Park; cost $5,000.

Lennoxville, Ohio.—Citizens voted $40,000 bonds for constructing water works. W. W. Baker, Secy.-Treas.

Shoals, Ind.—Shoals Utility Co. of Shoals, incorporated to furnish water and electric current. F. M. Baker, S. E. Shirey and G. A. Harron, Directors.

Clinton, Ill.—City Council has passed ordinance providing $[illegible] bond issue for purchase of high pressure fire pump or pumps having a capacity of 1,000,000 gal. per 24 hr.

Attica, Kan.—Citizens voted $30,000 bonds for electric light and water works system. E. T. Archer & Co., Engrs., Kansas City, Mo.

Amarillo, Tex.—Municipal ownership of water and light plants is reported under consideration.

Grove, Okla.—Council considering improving municipal water works and electric light plant; probable cost $10,000.

Jones, Okla.—Citizens voted $10,000 municipal electric light and water works bonds. Engineers, Benham Eng. Co., Colcord Building, Oklahoma City.

Marshall, Okla.—City Clerk writes city is drilling test wells. If water is found, bids will be asked to construct water works. If water is not found, matter will be abandoned.

Florence, Ore.—City intends constructing water works; cost $10,000.

Kellogg, Idaho.—City Council reported passed an ordinance granting to Kellogg Water Power Co. a franchise to construct, operate and maintain a system of water mains and distributing lines in this city. Source of supply is Big Creek.

BIDS DESIRED.

Washington, D. C.—Until Oct. 11, by Comrs. D. C., for furnishing material and erecting a steam turbine driven centrifugal pumping unit of 5,000,000 gal. capacity in 24 hours for use of the water department

Clarksburg, W. Va.—Until Oct. 21 by Water Wks. and Sewerage Bd. (Scotland G. Highland, Secy.) for two gas engines and two pumps at existing pumping station, advertised in Engineering Record. George W. Fuller, Consulting Engr., 170 Broadway, New York City.

Lumberton, N. C.—Reported desired until Oct. 12, by Mayor and Bd. Comrs., for two concrete tub filters, brick house, concrete coagulating basin, centrifugal pumps, filter equipment, etc., for improving water works, Gilbert C. White, Engr., Charlotte.

Clearwater, Fla.—Until Sept. 29, by City Council, for furnishing to the Water Dept. an oil engine air compressor, one belt-driven air compressor and oil engine. A. J. Brandon, Supt. Water Works Dept.

Middletown, Ohio.—Until Oct. 6, by City Comrs. (John Kunz, Clk.) for driving a number of wells for Water Works Dept.

South Charleston, Ohio.—The city has withdrawn temporarily call for bids to be opened Sept. 30 for constructing water works. W. L. Wentze, Village Clk.

Monticello, Ind.—Until Oct. 12 by City Council for furnishing material and installing two compound duplex pumps with all necessary valves and piping and raising steel standpipe and brick tower at Water Works. F. L. Miner, City Clk.

Harlan, Iowa.—Reported desired until Sept. 27 by William Hayes, City Clk., for water works extension to consist of 4000 ft. 4 and 6-in. water mains, hydrants fittings, etc.

Sidney, Iowa.—Until Oct. 5 by C. B. Hatten, Town Clk., for furnishing material and improving water works to consist of a 200 gal. per min. triplex power pump, 35 hp. internal combustion engine, c-i. pipe and specials, and hydrants and valves, all f.o.b. cars Sidney. Burns & McDonnell, Scarritt Building, Kansas City, Mo.

Jasper, Minn.—Until Sept. 28 by Village Council, for constructing reinforced concrete steel reservoir, capacity of about 45,000 gal. G. S. Smiley, Village Recorder.

Minneapolis, Minn.—By City Engineer for 2858 lin. ft. 48 x 5-16-in., 2993 lin. ft. 42 x 5-16-in. riveted steel pipe, or alternate bid on 46 x 5-16 and 40 x 5-16-in. lock bar steel pipe; also 1473 lin. ft. 48 in. x 3⅛ to ½-in. riveted steel pipe.

Minot, N. D.—Until Oct. 4 by Bd. City Comrs. for water mains, sewers and street grading, advertised in Engineering Record. E. J. Thomas, City Engr.

Benton, Ark.—Until Sept. 28, by Comrs. Water Works, and Sewerage Improv. Dist. No. 1, for two 100-hp. high pressure return tubular boiler with steel casing, across flue and stack, a 200 hp. open type heater, a feed pump, two 500 G.P.M. underwriters steam pumps, two 300-gal. horizontal motor driven centrifugal pumps, a 300-gal. horizontal motor driven centrifugal pump, etc. J. B. McCrary Co., Engrs., Little Rock.

Mimico, Ont.—Until Oct. 1 by J. A. Telfer, Clk., Mimico, for Cont. 1, sewers and water mains, Cont. 2, sewage disposal works, Cont. 3, supply of sanitary viti. pipe, Cont. 4, sewage pumping station, in towns Mimico and New Toronto. T. Lowes, Engineer, 186 King Street, W. Toronto.

PRICES AND LETTINGS.

★Indicates awarded contract.

★Boston, Mass.—Contract awarded Henry Spinach Contr. Co., American House, for laying 11,400 ft. water pipe at $7,381.

★Somerset, Pa.—Contract for constructing 500,000 gal. reservoir awarded W. J. Ferner of Somerset, at $4,500.

★Baltimore, Md.—Contract awarded U. S. C. I. Pipe & Fdry. Co., Burlington, N. J., for water pipe and fittings for the Water Dept., at $4,895.

★Brewster, Ohio.—Contract for constructing water works (bids opened Sept. 9) awarded Ross-Cook Eng. Co., 193 Crosby Street, Akron, at about $19,000. The W. J. Sherman Co., The Nasby, Toledo, Engrs.

Farmersville, Ohio.—A. S. Gilbert, Village Clerk, writes: On account of irregularity no bids were opened Sept. 1 for constructing water works.

East Dundee, Ill.—Lowest bid opened Sept. 13 by city for constructing a reinforced concrete reservoir, 350,000 gal. capacity, submitted by Koeppen, Schartow & Ehylert, Dundee, at $7,564.

★Chinook, Mont.—Contract reported awarded Pittsburgh Filter Manufacturing Co. for installing filtration plant, at $16,415.

SEWERAGE AND SEWAGE DISPOSAL

PROPOSED WORK.

Manchester, N. H.—City intends constructing a trunk line sewer in South Manchester.

Batavia, N. Y.—Chester & Fleming, Engrs., Pittsburgh, Pa., engaged to assist Mayor in plans for restoration of sewage disposal plant damaged by explosion.

East Orange, N. J.—Reported Council is in favor of joining Orange and Montclair, or one of the cities, in building an Imhoff disposal plant.

Garfield, N. J.—Bd. Chosen Freeholders, Hackensack, appropriated $12,000 for constructing storm drain in Garfield Borough.

Overbrook, N. J.—County Engineer Fredk. A. Reimer, Newark, estimates cost of repairing, enlarging and cleaning present sewerage system at Overbrook Hospital at $30,000. He also recommends to Bd. Freeholders, Newark, new process of treating sewage with lime and electricity and estimates the cost of installing the system at $32,000.

Verona, N. J.—Borough Council passed resolution for bond issue of $80,000 for general sewer work and disposal plant; also $100,000 for constructing lateral sewers.

West Orange, N. J.—Town Engineer Rufus Mead estimates cost of constructing 3-ft. storm sewer from Fairmount Avenue to the brook at Joyce Street, or Valley Road, at $12,000.

Ingram, Pa.—Bonds for $14,000 will be sold Oct. 1 by D. H. Hainri, Boro. Clk., 24 Short Street, for street and sewer improvements.

Washington, Pa.—State Comr. of Health, Harrisburg, has approved permit for borough to establish system of sewage treatment.

Hagerstown, Md.—City Engr. J. B. Ferguson and members of City Sewerage Comm. have been instructed to confer with sanitary engineers of State Bd. of Health relative to plans for proposed sewerage system, with a view to ascertaining the cost.

Newport, Del.—See "Water Works."

Jacksonville, Fla.—Citizens voted $500,000 sewer and paving bonds.

Philadelphia, Miss. — See "Water Works."

Coshocton, Ohio—Mayor recommends to Council installation of a new surface drainage sewerage system.

Piqua, Ohio.—See "Paving and Roads."

La Crosse, Wis.—Within the next year this city intends constructing additions to sewer system to cost $200,000. George Bradish, City Engr., is preparing preliminary plans.

Sioux City, Iowa.—City Council will soon let contract for constructing North Morning Side sewer system; cost $12,000.

Amarillo, Tex.—See "Paving and Roads."

Austin, Tex.—N. C. Wilbarn, city engineer, writes improvements to sewers contemplated include extension and work will be done by city.

Austin, Tex.—City Commissioners passed ordinances providing for the sale of $725,000 bonds for school buildings, street, bridge and sewerage improvements. P. W. Powell, Comr. of Streets.

Edgewater, Col.—H. O. Duern, 1940 B'way, Denver, is Engineer for proposed sewer system, to include 2600 ft. 8-in. and 10,000 ft. 10 and 12-in. pipe, septic tank and filtration plant; cost $32,000. C. W. Gist, Town Clk.

Marlow, Okla.—Citizens Sept. 16 defeated issuing $15,000 bonds for sewerage system. Geo. L. Orr, Deputy Clk.

Seattle, Wash.—City Engineer, A. H. Dimock, estimates cost of installing sewers in Sixth Avenue Northwest and other streets at $95,052. Plans being prepared.

City Council authorized sewers in E. Sixty-ninth Street in James Division of Green Lake Addition.

Marysville, Cal.—Bonds for $18,000 reported sold by City Council for extending drainage system.

BIDS DESIRED.

Boston, Mass.—Until Sept. 29 by Edw. F. Murphy, Comr. Pub. Wks. for constructing sewers and drains in Augustus Avenue and Vista Street, West Roxbury; also for constructing pipe sewers and drains in Wardsworth Street, East Boston.

Long Island City, N. Y.—Until Sept. 30, by Maurice E. Connolly, Pres. Queens Boro., for constructing sewers in Borden, Kimball, Guion, Smart Avenues and numerous other streets; also for constructing receiving basins in several streets. Total security $74,830.

Newark, N. J.—Until Sept. 30 (readvertisement) by Bd. Street and Water Comrs. (Morris R. Sherrerd, Ch. Engr.), for constructing Meadow Brook outlet sewer.

Nutley, N. J.—Until Sept. 27 (readvertisement) by Bd. Town Comrs. for constructing storm water sewers on Park and Myrtle Avenues and Center Street, in all about 2917 ft. 12 to 24 in. vitr. pipe sewer, 3387 lin. ft. 36, 42 and 48 in. lock joint cement pipe, 4941 lin. ft. 12 and 10 in. pipe. together with basins, manholes, etc. Frank T. Shepard, Town Engr.

South Bound Brook, N. J.—Until Oct. 11 by Borough Council for furnishing material and constructing about 3.8 miles vitr. pipe sewers 8 to 12 in., with Y branches, including sewage disposal plant, etc., advertised in Engineering Record. Clyde Potts, Engr., 30 Church St., New York. Peter Merlett, Boro. Clk.

Etna, Pa.—Until Sept. 27 by J. C. Armstrong, Boro. Clk., for constructing sanitary sewer in Butler and Center Streets and Clark Alley.

Toledo, Ohio.—Until Sept. 28 by Co. Comrs. for furnishing material and constructing Local Sanitary Sewer No. 20, Main Sewer Dist. No. 6, to consist of 1.8 miles vitr. pipe sewer, 8, 10 and 12-in., together with manholes, flush tanks, etc.

Princeton, Ind.—Until Sept. 27 by City Clerk for constructing system of sanitary sewers to cost $10,000.

Anna, Ill.—Reported desired until Sept. 27, by Bd. Administration (Frank D. Whipp, Fiscal Superv.), Springfield, for constructing sewage tank at Anna State Hospital. W. S. Shields Co., Hartford Bldg., Chicago, Engrs.

Chicago, Ill.—Until Sept. 27, by Bd. Local Improv. (Edw. J. Glackin, Secy.) for constructing tile pipe sewers on South Carpenter, South La Salle, South Bishop and other streets.

Fond du Lac, Wis.—Reported desired until Sept. 24 by J. F. Hohensee, City Clk., for constructing storm sewers in Dist. No. 4, sanitary sewers in Waupum and Elm Streets, and storm sewer in Champion Avenue.

Algona, Iowa.—Until Oct. 5 by S. W. Crowell, City Clk., for constructing sanitary sewers in Grove, Dodge, Diagonal and other streets about 13,950 ft. 8 to 18-in. pipe.

St. Paul, Minn.—Reported desired until Sept. 27 by Aug. Hohenstein, Purchasing Agent, for constructing Hazel Park sanitary sewer system.

Minot, N. D.—See "Water Works."

Beaumont, Tex.—Until Oct. 19 by J. G. Sutton, City Secy., for sanitary sewers, 39,690 ft. 6 to 18 in., advertised in Engineering Record. C. L. Scherer, City Engr.

Roslyn, Wash.—Reported desired until Oct. 11 (readvertisement) by George T. Wake, City Clk., for sewer improvements in Local Improv. Dists. Nos. 1, 2, 3 and 4.

Visalia, Cal.—Reported desired until Oct. 6, by City Trus. for furnishing material and constructing about 28,285 ft. 6, 8 and 10 in. viti, pipe and 14,000 ft. 30 in. concrete or brick sewer, 60 manholes, 12 flushtanks, etc. L. E. McCabe, City Engr.

Mimico, Ont.—See "Water Works."

Toronto, Ont.—Until Sept. 28, by Works Dept. for constructing sewers in Chambers, Howick, Turnberry Avenues and other streets.

PRICES AND LETTINGS.

★Indicates awarded contract.

★Rochester, N. H.—Contract awarded C. W. Tass Co., Fitchburg, for constructing 8,100 ft. sewer at $9,163 (bids opened Aug. 31). F. E. Hussey, City Clk.

★Rochester, N. Y.—Contract awarded by Bd. Contract and Supply to Michael Ripton, Rochester, for constructing Graves Street sewer tunnel to connect with Main and Front Street tunnel at $11,899.

★Schenectady, N. Y.—Contract awarded Thomas F. McGagor, Schenectady, for constructing 2400 ft. 20 to 30 in. pipe and 2400 ft. 42 in. concrete sewer; probable cost $30,000.

★Richmond, Va.—Contract for constructing sewer in West Lehigh Street between Blvd. and McTavish Street, Scott Addition, awarded by Administration Bd. to Leroy E. Newton, at $11,601.

★Ocala, Fla.—Contract awarded Bryan & Co., Jacksonville, at $66,741 for constructing sewerage system consisting of 121,203 ft. 6 to 18-in. sewer pipe, 231 manholes, 51 automatic flush tanks, sewage disposal plant, etc.

★Hammond, La.—Contract awarded J. R. Sutherlin & Co., Kansas City, Kan., for constructing sewerage system at about $40,000.

Medina, Ohio.—Lowest bid opened Sept. 15 by village for 8811 ft. pipe laying, manholes, etc., was submitted by Glenn W. Hadley, Canton, at $5,612. George L. McNeal, Village Clk.

★Reed City, Mich.—Contract for constructing system of sanitary and storm sewers, about 19,000 ft. of pipe, awarded Isaac H. Wells, Kalamazoo, at $16,884 (bids opened Sept. 14). M. W. Brown, Chmn. Sewer Com.

★Milwaukee, Wis.—Contract awarded A. J. Hewitt, Milwaukee, for constructing 7 ft. tunnel sewer under Lake Street from Green Bay Avenue to Milwaukee River (bids opened Sept. 17) at $160,000.

★Toronto, Ont.—Contract for constructing storm overflow sewer on St. Clair Avenue and Russell Hill Road awarded Commissioner of Works, at $47,500, work to be done by day labor, and sewer in Dundas Street from Indian Grove to Clendenan Avenue, to Moyes Constr. Co., at $18,000.

BRIDGES

PROPOSED WORK.

Nashua, N. H.—Plans and specifications being prepared for reinforced concrete arch bridge over Pennichuck Brook between Nashua and Merrimack. Work is to be started as soon as possible. Geo. P. Winn, City Engr., Nashua.

Lyons Falls, N. Y.—Plans and specifications completed by State Engineer, Albany, for continuing construction of bridge over Blank and Moose Rivers at Lyons Falls, consisting of new superstructure, building and lining approaches and all incidental work; cost $59,385.

Schenectady, N. Y.—Plans for constructing a state bridge over the Mohawk at Schenectady approved by Frank Williams, State Engineer, Albany.

Johnstown, Pa.—G. A. Flink, Harrisburg, has been retained by City Council to prepare plans for constructing Horner Street Bridge, cost about $45,000.

Elkton, Md.—Cecil County Comrs. voted to construct 2 bridges in 8th Dist. near Oakwood.

Beckley, W. Va.—See "Paving and Roads."

Greenville, S. C.—Southern Ry. Co. (W. H. Wells, Ch. Engr. Constr., Washington, D. C.) plans building steel viaduct with concrete pedestals across Saluda River on double track between Greenville and Central. The building of these pedestals is included in contract for double track between Greenville and Easley. Steel for same to be furnished by some bridge company, who will also place same.

Rome, Ga.—Citizens of Floyd County voted $225,000 bonds for constructing concrete bridges over 3 rivers in Rome.

Chattanooga, Tenn.—Nothing definite has been done by Southern Ry. Co. (W. H. Wells, Acting Ch. Engr. Construction, Washington, D. C., about constructing bridge contemplated to carry Riverside Drive across the railroad tracks.

★Clinton, Iowa.—Following are unit figures of four lowest bids opened Sept. 14 for constructing sewer in Dist. No. 2 (J. G. Thorne, City Engr.): (a) Thomas Carey & Sons, Clinton, $34,832 (awarded contract); (b) Independent Constr. Co., Davenport, $36,712; (c) Dearborn Constr. Co., Waterloo, $37,247; (d) James Kennedy, Fargo, N. D., $37,775:

	*(a)	(b)	(c)	(d)
Bulkhead	$300.00	$360.00	$500.00	$375.00
675 ft. 33-in. vitr. sewer pipe	6.00	6.30	5.00	6.25
300 ft. 33-in. D. S. track, vitr. sewer pipe	6.00	7.50	6.00	7.25
592 ft. 30-in. vitr. sewer pipe	4.10	4.20	4.80	4.60
674 ft. 28-in. vitr. sewer pipe	3.60	3.75	4.60	3.90
345 ft. 27-in. vitr. sewer pipe	3.10	3.20	4.40	3.40
195 ft. 22-in. vitr. sewer pipe	3.10	3.20	2.19	2.25
480 ft. 20-in. vitr. sewer pipe	2.10	2.25	2.00	2.15
1,030 ft. 15-in. vitr. sewer pipe	1.35	1.40	1.35	1.40
1,295 ft. 12-in. vitr. sewer pipe	0.85	0.90	0.90	1.05
6,740 ft. 10-in. vitr. sewer pipe	0.80	0.85	0.80	0.86
150 ft. 8-in. vitr. sewer pipe	0.50	0.55	0.60	0.50
40 manholes	35.00	38.00	35.00	37.00
68 catchbasins	35.00	35.00	35.00	32.00
1,020 catchbasin connections	0.50	0.55	0.50	0.53
81 cu. yd. rock (track)	5.00	5.00	5.00	7.00
2,498 cu. yd. rock	3.40	3.50	4.00	3.75

★Clinton, Iowa.—Following are four lowest bids opened Sept. 14 for constructing sewers in Sewer Dist. No. 3, Divisions A and B (J. G. Thorne, City Engr.):

Division A: (a) Thomas Carey & Sons, Clinton, segmental pipe, $60,017 (awarded contract); (b) James Kennedy, Fargo, N. D., $63,734; (c) Independent Constr. Co., Davenport, $63,798; (d) Illinois Improv. & Ballast Co., Chicago, Ill., $64,954:

	*(a)	(b)	(c)	(d)
Bulkhead	$550.00	$700.00	$500.00	$610.00
1,710 ft. 54-in. segimental block	8.15	8.40	8.25	8.50
920 ft. 45-in. segimental block	7.15	7.60	7.30	7.50
1,240 ft. 39-in. segimental block	7.15	7.50	7.15	7.50
1,063 ft. 36-in. segimental block	6.15	6.40	6.25	6.50
700 ft. 33-in. segimental block	5.15	5.00	5.20	5.50
323 ft. 30-in. segimental block	4.15	4.70	4.50	4.50
235 cu. yd. rock (track)	5.00	7.00	5.00	6.00
4,361 cu. yd. rock	3.50	3.75	3.50	4.00
15 manholes, No. 1	50.00	80.00	75.00	60.00
3 manholes, No. 2	75.00	80.00	100.00	90.00
28 catchbasins	35.00	32.00	35.00	40.00
420 catchbasin connections	0.50	0.53	0.40	0.60

Division B: (a) Thomas Carey & Sons, Clinton. $30,009 (awarded contract); (b) James Kennedy, Fargo, N. D., $31,134; (c) Independent Constr. Co., Davenport, $31,253; (d) Dearborn Constr. Co., Waterloo, $32,391:

	*(a)	(b)	(c)	(d)
320 ft. 24-in. vitr. pipe	$2.50	$2.65	$2.50	$2.50
370 ft. 22-in. vitr. pipe	1.75	1.90	2.00	2.15
570 ft. 20-in. vitr. pipe	2.00	2.00	2.10	2.00
1,435 ft. 18-in. vitr. pipe	1.30	1.30	1.45	1.60
3,364 ft. 15-in. vitr. pipe	1.25	1.25	1.30	1.35
3,848 ft. 12-in. vitr. pipe	0.90	0.85	0.92	0.90
5,279 ft. 10-in. vitr. pipe	0.67	0.78	0.75	0.75
1,670 ft. 8-in. vitr. pipe	0.60	0.59	0.58	0.60
2,091 cu. yd. rock	3.50	3.75	3.50	4.00
46 manholes, No. 1	35.00	37.00	38.00	35.00
104 catchbasins	35.00	32.00	35.00	35.00
1,560 catchbasin connections	0.50	0.53	0.55	0.50

Marion, Ohio.—About $42,000 bridge bonds sold by County Comrs.

Bedford, Ind.—County Council has appropriated $[illegible] for concrete bridge to be constructed over Salt Creek between Bedford and Oolithic.

Brownstown, Ind.—County Court appropriated $12,625 toward constructing bridges.

Greensburg, Ind.—About $12,500 is to be spent by County Council for repairs to bridges.

Indianapolis, Ind.—County Council considering constructing 2 bridges over Fall Creek, one at Meridian Street, another at Shriver Avenue, cost $75,000 and $50,000 respectively.

Sullivan, Ind.—Comrs. of Greene and Sullivan Counties intend constructing a concrete bridge on county line in Jefferson Township.

Grand Rapids, Mich.—Construction of bridge across Plaster Creek at Grandville Avenue is contemplated by county and state. Frank F. Rogers, State Highway Comr., Lansing.

Hibbing, Minn.—A temporary injunction has been obtained by Oliver Mining Co., restraining city from constructing a reinforced conduit through park addition. Estimated cost $25,000.

Fairbury, Neb.—Construction of a steel bridge 160 ft. long and 20 ft. wide over Blue River at Fairbury is being considered by county and state; cost about $40,000.

Austin, Tex.—See "Sewerage and Sewage Disposal."

Austin, Tex.—M. C. Welbarn, City Engineer, writes nothing definite regarding bridge and paving improvement. Plans and specifications not yet completed.

Cleburne, Tex.—City Council voted to construct concrete bridge 120 ft. long at Poindexter Avenue.

Denison, Tex.—Citizens voted $50,000 bonds for constructing 1,800 ft. steel and concrete viaduct over M. K. & T. Ry. shops, connecting business section with the south side of city.

Seattle, Wash.—Contracts will be let during the next few months by Bd. Pub. Wks. for constructing steel bascule bridge over Lake Washington Canal at Tenth Avenue; cost about $445,000.

Eugene, Ore.—See "Paving and Roads."

Portland, Ore.—Steel span bridge is to be constructed over Willamette River between Lane and Linn Counties, cost about $[illegible]. State Highway Comm. at Salem will prepare plans for structure.

Holbrook, Ariz.—Supervisors intend calling bond election soon to vote $68,000 for steel bridges on county roads.

Idaho.—State Highway Dept., Boise, in co-operation with Hagerman Highway Dist. and the Bliss Highway Dist., is contemplating constructing a bridge, approximately 250 ft. long, across Malad River, between Hagerman and Bliss, in Gooding County. Probably cantilever or steel arch type, and cost $30,000. Hagerman Highway Dist. has voted bonds for their portion of the cost. E. M. Booth, State Highway Engr., Boise.

BIDS DESIRED.

Maine.—Until Sept. 29 by State Highway Comrs., Augusta, for constructing two concrete abutments at Higgins Brook in Harmony, two concrete abutments at Martinsbridge River in Harmonville, one concrete abutment at Fish River in Wallagrass Plt.; one 210 ft. steel span at Harmonville, a 60 ft. span at Harmony and 75 ft. steel span at Frankfort.

Maine.—Until Oct. 4 (extension of date from Sept. 27) by State Highway Comm., Augusta, for constructing a 75-ft. steel bridge in Frankfort.

Providence, R. I.—Until Sept. 27 by Bd. Contract and Supply (Wm. P. Pelkey, Clk.) for constructing steel work for highway bridge over Moshassuck River, at location of present Randall Street bridge.

Conklin, N. Y.—Reported desired until Oct. 4 by County Supt. of Highways, Binghamton, for constructing 125 ft. span bridge over Little Snake Creek, Conklin, also reinforced concrete retaining wall.

New Brunswick, N. J.—Reported desired until Sept. 27 by Bd. Freeholders (A. J. Goldsmith, Dir.) for constructing reinforced concrete slab bridge.

Glenfield, Pa.—Until Oct. 25 by W. N. Kratzer, Durham, for reconstructing steel and concrete bridge over Kellbuck Creek on Bryden Street.

De Land, Fla.—See "Paving and Roads."

Columbia, Miss.—Reported desired until Oct. 4 by L. C. Williams, Chancery Clk., for constructing three steel bridges with concrete floors. Lackey & Logan Bridge Co., Cayce, Memphis, Tenn.

Batavia, Ohio.—Reported desired until Oct. 4 by Co. Comrs. for [illegible] steel superstructures and [illegible] over east fork of Little Miami River at South Milford Bridge Sources Co. Aud.

Xenia, Ohio.—Reported desired until Oct. 1. by Co. Comrs., for constructing floor system and laying creosote or other block floor on two bridges; also for constructing steel bridge.

Greensburg, Ind.—Until Oct. 4 by Co. Comrs., Greensburg, for constructing superstructure of Bear Creek bridge, south of Waynesburg, to be a steel truss bridge with concrete top, 53 ft. clear in length, 16 ft. driveway. Lenton W. Sands, Co. Aud.

Salem, Ind.—Until Oct. 5 by I. H. Rutherford, Co. Aud., for constructing five concrete bridges.

Waukon, Iowa.—Until Oct. 12 by Co. Bd. Superv. for constructing following superstructures: Bridge No. 26 A, Section 36, 80-ft. pony truss, Point Creek Township; Bridge No. 8 A, Section 8, two 100-ft. trusses, Hanover Township; Bridge No. 31 A, Section 31, 140-ft. through truss, Iowa Township; all to have concrete floors and 16-ft. roadways. H. O. Orr, County Engr.; W. F. Shafer, Co. Aud.

Bakersfield, Cal.—Until Oct. 7 by Bd. Supervisors, I. L. Miller, Clk., for constructing pile bridges, reinforced concrete head walls on Div. 5, Sect. 4, Bakersfield-McKittrick Rd., approximately 8 miles long.

PRICES AND LETTINGS.

★Indicates awarded contract.

Kingfield, Me.—Following are four bids opened Sept. 20 by State Highway Comm., Augusta, for constructing 171 ft. reinforced concrete bridge in Kingfield: C. H. Barron, Lewiston, $17,263; Edmond Cyr & Co., Waterville, $17,321; H. P. Cummings Co., Portland, $18,487; Beaver Contr. Co., Boston, Mass., $24,377.

Woonsocket, R. I.—Three concrete bridges, one over Blackstone River, Fairmont Street; one over Blackstone River at the Hamlet, and one over Mill trench at the Hamlet, plans prepared by Frank H. Mills, City Engr., will cost a total of $85,000. William O. Pays, City Clk.

★Hartford, Conn.—Following are four lowest bids opened by Bd. Contract and Supply for constructing bridge at Capitol Avenue over Park River: W. T. Ryan Constr. Co., Hartford, $39,420 (awarded contract); Charles H. Slocum, $40,200; Hynes Constr. Co., $40,200; J. G. Goodrich, $41,154.

★Buffalo, N. Y.—Contract for constructing Chicago Street viaduct (bids opened Sept. 8) awarded Strobel Steel Constr. Co., Chicago, Ill., at $184,700; time 6 months. F. D. Jackson, Asst. Engr.

Hackensack, N. J.—Contract for constructing bridge on Hopper Avenue, between Westwood and Park Ridge, awarded by Bd. Freeholders to Charles Figini, Lodi, at $6,600.

★Dalton, Ga.—Contract awarded by Co. Comrs. (H. J. Wood, Chmn.) for constructing two-span, 80x25 ft. steel and concrete bridge, 12-ft. roadway (bids opened Sept. 11) to Champion Bridge Co., Wilmington, Ohio, at $2,568.

★Guyton, Ga.—Contract for constructing steel bridge with concrete abutments and concrete piers over Ogeechee River awarded by Comrs. Effingham and Bullock Counties to Easterling & Easterling, Daisy, at $5,790.

Cleveland, Ohio.—See "Paving and Roads."

★Logansport, Ind.—Contract for constructing steel bridge with 5 Pratt truss spans, 113 ft. long, on stone piers with abutments reinforced with concrete, over Wabash River, awarded by Vandalia R. R. Co. to Wisconsin Bridge & Iron Co., North Milwaukee, Wis., at about $60,000.

★Avoca, Iowa.—Contract for constructing bridge over Nishnabotna River near Avoca awarded by Bd. County Supervs. at Council Bluffs to Iowa Bridge Co., Des Moines, at $6,965.

Council Bluffs, Iowa.—All bids opened Sept. 10 by Co. Comrs. for constructing 120-ft. through truss bridge in Belknap Township rejected. Lowest bidder: Iowa Bridge Co., Des Moines, at $6,965.

Lowest bid opened same time for constructing 100-ft. pony truss bridge in Knoxe Township was submitted by Iowa Bridge Co., Des Moines, at $6,965.

★West Union, Iowa.—Contract for constructing steel truss bridge in Oran Township, also concrete deck girder bridge in Jefferson Township and concrete box culverts in Oran Township awarded Waterloo Constr. Co. of Waterloo, at $12,-980.

★Alma, Kan.—Contracts for constructing concrete bridges awarded by County Comrs. (bids opened Sept. 7) as follows: Pringle, White and Trea Bridges, to J. A. Johnson, Junction City, Kan., at $5,750, and Todd and Diffley Bridges, to S. C. Clark, Paxico.

★Dillon, Mont.—Contract for constructing a 175-ft. steel bridge across Big Hole River and a 42-ft. steel bridge over the Slough awarded O. E. Peppard, Missoula, at $8,980 (bids opened Sept. 10). Jay S. Baker, Co. Clk.

★Canadian, Tex.—Contract for constructing bridge 2550 ft. long over Canadian River awarded by Comrs. Court to Canton Bridge Co., Canton, Ohio, at $66,-[illegible].

★Albany, N. Y.—Following are four lowest bids opened Sept. 14 by State Supt. Pub. Works, Albany, for Contract L—Improvement of Seneca and Cayuga Canals, Section No. 1, constructing substructures, superstructures and approaches to highway bridges as follows: Gorman Street bridge, Waterloo; Kingdom Road bridge, between Waterloo and Seneca Falls. This is a correction on unit figures under "Hydraulic Construction and River Improvements" in our issue of Sept. 18: (a) Engineer's estimate, $71,469; (b) Scott Bros., Rome, $59,928 (awarded contract); (c) Chesley, Earl & Heimbach, Inc., Buffalo, $62,047; (d) Stanley Constr. Co., Buffalo, $63,062; (e) R. T. Ford Co., Rochester, $63,229:

	(a)	*(b)	(c)	(d)	(e)
21,000 cu. yd. excav.	$0.75	$0.42	$0.65	$0.60	$0.60
500 cu. yd. lining	1.50	1.35	1.50	1.25	1.25
16.5 M ft. sawed lumber	65.00	58.00	60.00	50.00	50.00
3,500 cu. yd. 2d class concrete	7.00	6.00	6.50	8.00	7.00
106 cu. yd. 1st class rein. concrete	12.00	11.00	12.00	11.00	10.00
590 cu. yd. 4th class riprap	2.50	1.30	2.50	2.00	2.00
244,000 lb. structural steel	0.04	0.0378	0.03	0.0375	0.04
16,500 lb. metal reinforcement	0.03	0.0315	0.03	0.03	0.025
95 sq. yd. cobblestone gutter	1.25	1.20	1.25	1.00	1.25
265 sq. yd. brick pavt.	2.25	2.35	2.25	2.00	2.00
1,240 lin. ft. wooden fence	0.25	0.27	0.25	0.25	0.20
137 lin. ft. lattice railing	1.75	1.70	1.75	1.50	1.75
12 oil signal lamps, ea.	15.00	100.00	15.00	100.00	100.00
Remove existing superstructure at Gorham Street (lump sum)	100.00	15.00	100.00	15.00	15.00
Maintaining navigation at Gorham Street bridge (lump sum)	100.00	1.00	100.00	100.00	100.00
Maintaining navigation at Kingdom Road bridge (lump sum)	100.00	1.00	100.00	100.00	100.00
Timber towpath at Gorham Street bridge (lump sum)	250.00	1.00	150.00	250.00	250.00
Timber towpath at Kingdom Road bridge (lump sum)	400.00	1.00	200.00	400.00	400.00
Cofferdams, pumping, bail and drain (lump sum)	10,000.00	11,432.00	8,250.00	3,000.00	6,000.00

★Catoosa, Okla.—Contract for constructing bridge over Verdigris River awarded by County Comrs. at Claremore to R. W. Canfield at $17,900.

Hailey, Idaho.—All bids opened Sept. 13 by George A. McLeod, Co. Clk., for constructing 60-ft. span steel truss bridge over Malad River near Blaine rejected. New bids to be asked.

PAVING AND ROADS

PROPOSED WORK.

Dobbs Ferry, N. Y.—Bonds for $150,000 will be sold Sept. 28 by Oswald Schuler, Village Clk., for grading, curbing, repairing and paving with asphalt block or vitri, brick portions of Bway., Main Street and Livingston Avenue.

Rochester, N. Y.—Bd. Public Wks. contemplates paving Driving Park Bridge with wood block.

Stone Harbor, N. J.—About $33,000 bonds have been sold for constructing board walk at Stone Harbor.

Ingram, Pa.—See "Sewerage and Sewage Disposal."

Sumter, S. C.—Citizens voted to issue $250,000 bonds for street improvements.

Macon, Ga.—City Council voted to pave Oak and Cherry Streets, Coleman and Duncan Avenues.

De Land, Fla.—Bonds for $400,000 will be sold Oct. 11 by Co. Comrs. (Sam'l D. Jordan, Clk.) for roads and bridges.

Columbus, Miss.—About $100,000 is to be spent for constructing roads in Lowndes County.

Dunlap, Tenn.—Bonds for $50,000 will be sold by Bd. Road Comrs., Oct. 2, for roads.

Park City (P. O. Knoxville), Tenn.—City Council passed on second reading ordinance providing for issuing of $90,000 bonds for paving Magnolia Avenue.

Rogersville, Tenn.—Bonds for $250,000 will be sold Oct. 2 by County Comrs. (H. B. Stamp, Chmn.) for road improvements.

Lexington, Ky.—An election will be held Sept. 30 to vote $300,000 road improvement bonds.

Westerville, Ohio.—Bonds for $23,000 will be sold Oct. 18 by R. D. Bennett, Village Clk., for improving Vine, West, Home and Winter Streets.

Woodsfield, Ohio.—About $20,000 Monroe County road improvement bonds sold.

Xenia, Ohio.—See "Bridges."

Bedford, Ind.—County Comrs. at Mitchell considering constructing concrete road from Bedford to Oolitic, cost about $55,-000, also a concrete bridge over Salt Creek, cost $15,000.

Indiana.—Bonds for highway improvements will be sold as follows:
Sept. 28, at Noblesville, about $25,000 bonds, by L. M. Cardwell, Co. Treas.
Oct. 1, at Franklin, $21,600 bonds, by Harry Bridges, Co. Treas.
Oct. 2, at Monticello, $22,500 bonds, by O. C. Middlestadt, Co. Treas.
Oct. 4, at Mount Vernon, $10,000 bonds, by Andrew A Schenk, Co. Treas.

Indianapolis, Ind.—Bd. Public Wks. voted to pave Capitol, University, Garfield, and Ohmer Avenues and Tuxedo Street.

Fremont, Mich.—Citizens of Sheridan Township voted $55,000 bonds for constructing stone and gravel road.

Eveleth, Minn.—C. H. Williams, City Clk., writes that about 2½ blocks of creo block pavt. will be laid on Adams Street and 11,000 ft. concrete on seven streets; also will construct 5000 lin. ft. cement walk on seven streets. Cost of walk with curb about $20,000. C. M. Dorway, Engr., Eveleth.

Minneapolis, Minn.—City Council voted to spend $81,591 for street improvements. Bd. Park Comrs. reported considering completing the boulevard along the north side of Pogue's Run between Spades and Brookside Parks and building a boulevard along south bank of the stream.

Amarillo, Tex.—Citizens voted $40,000 paving and $10,000 sewer bonds.

Austin, Tex.—See "Bridges."

Austin, Tex.—See "Sewerage and Sewage Disposal."

Denison, Tex.—City will soon let contract for 14,680 sq. yd. reinforced or asphaltic concrete street paving. A. B. Clenny, City Engr.

Ozona, Tex.—About $20,000 paving bonds sold by Comrs. Court Crockett County.

Bellingham, Wash.—City Council voted to pave William, Humboldt Streets, and concrete walks on Iron Street.

Cashmere, Wash.—Surveys have been completed by F. A. Warren, County Engr., for constructing Blewett Pass Highway; cost, $24,000.

Everett, Wash.—City Council voted to pave Harrison Ave., cost about $14,000.

Seattle, Wash.—Contract about to be let by Bd. Pub. Wks. for paving Fourteenth Avenue with asphalt, cost about $20,034; Beacon Avenue, cost $176,000, and Twelfth Avenue (n. e.), $23,000.
Contract about to be let by Bd. Public Wks. for paving Forty-seventh Avenue, N. E.
City Council voted to pave Montlake Boulevard with asphalt. Alki Avenue, Donald Street, Sunset Avenue, Hamlin and Shelby Streets.
City Council has authorized paving East Marginal Way with brick about 3 miles, 30 ft. wide.

Astoria, Ore.—City Council voted to hard surface Bond St. with Worswick asphaltic concrete and construct concrete walks.

Eugene, Ore.—Plans being prepared by State Engineer at Salem for paving with creosoted wood block the steel bridge.

Oregon City, Ore.—City Council voted to pave Third, Fourth, Sixth, Eighth and Ninth Sts., estimated cost $15,244.

Portland, Ore.—About half mile of Sandy Road is to be paved.

Santa Clara, Cal.—H. B. Fisher, City Engr., estimates cost of paving 7 streets in Santa Clara at $85,000.

Idaho.—Contract will soon be let by State Highway Dept., Boise, to construct Idaho-Pacific Highway through Bear Lake County, from Bannock County line to the Utah State line, a distance of 48 miles.
U. S. Forest Service, Idaho State Highway Dept. and Fremont County are co-operating in making survey of the Yellowstone Park State Highway, from Warm River to Yellowstone, through Targhee National Forest, a distance of 40 miles; cost $30,000.

BIDS DESIRED.

Brooklyn, N. Y.—Until Sept. 29 by L. H. Pounds, Borough Pres., for regulating and repaving portions of Broadway and Surf Ave., in all about 27,355 sq. yd. asphalt, 32,300 sq. yd. Grade 1 granite pavement, etc. Total security $55,000. Also for furnishing and delivering 800 tons limestone and 1000 cu. yd. binder stone.

Long Island City, N. Y.—Until Sept. 30 by Maurice E. Connolly, Pres. Queens Boro., for regulating and repaving with improved granite block on 6-in. concrete foundation portions of Boulevard, laying sidewalks, etc., on portions of Fairview and Parsons Avenues, in all about 16,200 sq. yd. improved granite block pavt., 14,400 sq. ft. cement sidewalk. Total security, $31,600.

Freehold, N. J.—Until Oct. 6, by Bd. Chosen Freeholders (C. E. Close, Clk.), Freehold, for furnishing material and constructing Tennent Gordon's Corner Rd. Geo. D. Cooper, Co. Engr., 60 Broad Street, Red Bank.

Hackensack, N. J.—Until Oct. 1 by Co. Bd. Chosen Freeholders, at office of Clerk of Bd., for grading and macadamizing Prespect St., Crescent Avenue and Mowerson Rd.

Newark, N. J.—Until Oct. 7, by Bd. Street & Water Comrs. (Morris R. Sherrerd, Ch. Engr.), for paving portions of Chelsea Avenue and Cypress Street, in all about 6200 sq. yd. asphalt pavt. on 6-in. concrete foundation, etc.

West Hoboken, N. J.—Until Oct. 6, by Town Council, for repaving portions of Palisade and Paterson Avenues, and for walks and stairway on the old Hillside Road. A. L. Wachlin, Town Clk.

Mount Union, Pa.—Until Oct. 4 by George W. Morgan, Boro. Secy., for paving East Shirley, Division, Jefferson, Market and West Shirley Streets, approximately 13,000 sq. yd., advertised in Engineering Record. D. W. Dillman, Boro. Engr., 47 Altoona Trust Building, Altoona.

Parkersburg, W. Va.—Local press reports state bids desired until Sept. 29, by City Clerk, for paving portions of 19th Street with brick. Appropriation available, $5,197.

Louisville, Ky.—Until Sept. 27 by Bd. Pub. Wks. (Roger G. McGrath, Secy.) for constructing portions of Guthrie, Twenty-ninth and Thirty-fourth Streets. Samples of vitr. block must be submitted.

Cumberland Gap, Tenn.—Reported desired until Oct. 8 by Co. Road Comrs. (J. H. S. Morison, Chmn., Cumberland Gap) for grading and macadamizing 103 miles of road.

Princeton, Ky.—Press reports state bids desired until Sept. 27 by Caldwell Fiscal Court for constructing 2 miles of macadam road, in all 12,300 yds. excav., 2738 cu. yds. crushed stone, and 195 cu. yds. concrete.

Akron, Ohio.—Until Sept. 30 by Bd. Control, for brick paving on portions of Hazel Street and Grand Avenue.

Granville, Ohio.—Until Oct. 28, by Village Council, for furnishing material and paving with either paving block or sheet asphalt on Broadway from east to west corporation line. Roe E. Morrow, Village Clk.

Ohio.—Until Oct. 8, by Clinton Cowen, State Highway Comr., Columbus, for grading roadway and paving with waterbound macadam Cleveland-Wooster Road, I. C. H. No. 25, in Parma Township, Cuyahoga County, 1.24 miles long. Estimated cost, $8,409.

Indiana.—By County Comrs. as follows:
Oct. 1, at Plymouth, for constructing five gravel roads in German and Center Townships, George F. McCoy, Co. Aud.
Until Oct. 4:
At Goshen, for constructing concrete road in Harrison Township, John W. Brown, Co. Aud.
At Lebanon, gravel road in Perry and Washington Townships, D. M. Clark, Co. Aud.
At Shoals, macadam road in Perry Township, L. D. Haga, Co. Aud.
Until Oct. 5:
At Angola, two gravel roads, F. C. Dewey, Co. Aud.
At Bedford, concrete road in Shawswick Township, E. W. Edwards, Co. Aud.
Until Oct. 6:
At Shelbyville, three gravel roads in Shelby Township, F. W. Fagel, Co. Aud.
Oct. 9:
At Noblesville, concrete road in Noblesville Township, W. O. Horton, Co. Aud.

Logansport, Ind.—Until Oct. 19 by William Pickett, City Clk., for paving W. B'way. and Wheatland Avenue, about 43,540 sq. yd. with brick, asphalt, bituminous concrete or reinforced concrete. W. H. Thompson, Engineer, Logansport.

Chicago, Ill.—Until Sept. 27, by Bd. Local Improv. (Edw. J. Glackin, Secy.), for paving with Portland cement, concrete and vitri. brick and constructing combined curbs and gutters on a number of alleys.

Racine, Wis.—Reported desired until Oct. 9 by Bd. Pub. Wks. (P. H. Connolly, Chmn.), for paving approximately 4491 sq yd. vitl. brick, asphalt concrete, or sheet asphalt on portions of Hamilton Avenue: also for 2268 sq. yd. brick paving on portions of Mead Street.

Creston, Iowa.—Until Sept. 27, Carl Davenport, City Clerk., for constructing Portland cement concrete sidewalks on numerous streets. In all about 12,496 sq. ft.

Creston, Iowa.—Until Oct. 1, by L. J. Storey, City Clk., for furnishing material and paving on "B" Avenue bridge, with either sheet asphalt, viti. paving block or vertical fibre block.

Independence, Kan.—Until Oct. 7 by G. H. Krienhagen, City Clk. for about 18,000 sq. yd. brick pavement, and 12,000 lin. ft. curb and gutter. G. E. Weaver, Engineer, Independence.

Minot, N. D.—Reported desired until Oct. 4 by A. D. Hagenstein, City Aud., for 3¼ miles street grading, including combined curb and gutter and graveling. Probable cost, $39,980. E. J. Thomas, City Engineer.

Mitchell, S. D.—Until Oct. 4 by Thos. Eastcott, City Aud., for paving portions of East Fourth Avenue, in all about 9669 sq. yd. paving, 5400 lin. ft. curb and gutter, etc. Bids will be received on two-coated Portland cement, brick, creosoted wood block, single-coated Portland cement, and asphaltic concrete.

Powell, Wyo.—See "Hydraulic and River Improvements."

Beaumont, Tex.—Until Oct. 19 by J. G. Sutton, City Secy., for approximately 90,000 sq. yds. paving, advertised in Engineering Record. C. L. Scherer, City Engr.

Las Vegas, N. M.—Reported desired until Sept. 30 by Co. Comrs. at office of Lorenzo Delgado, Clk., for grading and paving bridge over Gallinas River, foot Bridge Street. George E. Morrison, Co. Engineer.

Bakersfield, Cal.—Until Oct. 7 by Bd. Superv. (I. L. Miller, Clk.) for grading and constructing concrete pavement on Div. 5, Sept. I, Bakersfield-McKittrick Road, about 6 miles long.

Idaho.—Until Oct. 1 by State Highway Comn., Boise, for constructing 24 miles Idaho-Pacific Highway between Montpeller and Utah State Line. Estimated cost, $50,000. E. M. Booth, State Highway Engineer.

PRICES AND LETTINGS.

★Indicates awarded contract.

★**Boston, Mass.**—Contract for paving Rosewood Street (bids opened Aug. 30) awarded John Kelly Co., 5 Ulmer Street, Roxbury, at $13,052.

★**Norwalk, Conn.** — Contract awarded Empire Constr. Co., New York, at $13,439, for pavement on Washington Street Bridge (bids opened Sept. 14).

★**Albany, N. Y.**—Contract awarded Kenney & Dumary, Albany, for improving Homestead Avenue at $20,027, and laying concrete walks on Delaware Avenue to William B. Daley at $9,963.

★**Glens Falls, N. Y.**—Contract for paving with concrete 5300 sq. yd. (bids opened Sept. 15) awarded by R. J. Lineham, Glens Falls, at $1.10 per sq. yd. C. I. Davis, Clk., Office City Engr.

★**Hackensack, N. J.**—Contracts for paving awarded by Bd. Chosen Freeholders as follows: Saddle River Avenue and Prospect St. in Saddle River Township, Borough Glen Rock and Ridgewood, at $15,055; Palisade Avenue in Englewood and Englewood Cliffs at $112,799 and Lemoine and Sylvan Avenues in Boroughs of Ft. Lee and Englewood Cliffs at $66,356. All to E. C. Humphrey, Hackensack.

★**Bethlehem, Pa.**—Contract for paving about 3 miles with amiesite awarded by Borough Council to R. S. Rathbun, Allentown.

★**Marcus Hook, Pa.**—Contract for 7000 sq. yd. paving awarded by city to Eastern Paving Co., Philadelphia, at $11,016.

★**Pennsylvania.**—Contracts for paving (bids opened Sept. 15) awarded by State Highway Dept., Harrisburg, as follows:
Reconstructing State Highway Route 33 from Huntington to Mill Creek, Huntington County, a distance of 22,999 ft., to William C. Evans, Ambler (amiesite), at $86,080. Low bidders on other materials: R. B. Taylor, Belleforte, (concrete) $92,933; Booth & Flinn, Ltd., Pittsburgh, warrenite) $94,465; R. H. Cunningham & Sons, Turtle Creek, (concrete) $89,011.
★Road in Chester County, State Highway, Route 131, through East Marlboro and Kennett Townships, 11,987 ft., to William C. Evans, Ambler, (amiesite) $34,124. Next three lowest bidders: The Juniata Co., Philadelphia (concrete), $34,933; Gillespie & Sons, Oakview (concrete), $35,098; Frank McInerny, Easton (amiesite), $43,554.

★**Philadelphia, Pa.**—Contract for widening and paving Passyunk Avenue with asphalt and concrete base and granite block pavements between tracks awarded by Director Dept. Public Wks. to E. H. Vare, 712 Lincoln Bldg., at $42,836.
★Contracts for paving awarded by city as follows (bids opened Aug. 31), for list of bids received see Engineering Record, Sept. 18:
Asphalt pavements, to Eastern Paving Co., Penn Sq. Bldg., and Union Paving Co., Thirtieth and Locust Sts., $32,518.
Repaving with asphalt, to Eastern Paving Co., Union Paving Co. and Barber Asphalt Paving Co., Land Title Bldg., at $46,131.
Wood block pavements, to Richard Lamb, 136 Liberty St., New York City, and McNichol Paving & Constr. Co., 1923 Cherry St., $13,151.
Bituminous pavements, to Union Paving Co., $11,863.
Repaving with granite block, to F. Mark Contr. Co., Twenty-first and Somerset Sts.; McNicol Paving &. Constr. Co., Philadelphia Paving Co., 1345 Arch St., and Jas. Kane, 4840 N. Mascher St., $45,433.
Surfacing water bound macadam roads, to J. F. Shanley & Co., Commercial Trust Bldg.; Dwyer & Co., 1524 Chestnut St.; P. J. Snyder & Co., Bailey Bldg.; Pugh & Hubbard, Witherspoon Bldg., and Curtis Bros., Torresdale Avenue and Magee St., at $37,078.
Surfacing with bituminous macadam, to Union Paving Co., at $11,757.

★**Tallahassee, Fla.**—Contract for paving about ¾ miles on Adams and Monroe Streets and Park Avenue with brick awarded by City Council to Southern Paving & Constr. Co., Chattanooga, Tenn., at $67,434.

★**Lake Charles, La.**—Contracts for constructing roads awarded by Police Jury Sept. 7 as follows: Graveling 6 miles highway southwest of Vinton to Texas Grading Co., Houston, Texas, at $16,882, and for gravel road south of Sulphur to W. M. McCorquodale, Lake Charles at $14,200.

★**Memphis, Tenn.**—Contract for paving with concrete on Claybook Street, 5650 sq. yd., awarded George O. White & Co., $9,011.

★**Hopkinsville, Ky.**—Contract for constructing 6 miles of pike starting at Caldwell County line awarded by Christian County Fiscal Court to D. C. McQuarry at $24,611.

★**Cincinnati, Ohio.**—Contract awarded Henkel & Sullivan, Cincinnati, for paving portions of Gest Street (bids opened Sept. 7 by Director of Public Service), at $8,102.

★**Cleveland, Ohio.**—Contract for reinforced concrete floor on Clark Avenue Viaduct awarded by Bd. Control to Edw. A. Welland, Rockefeller Bldg., at $79,000.
★Contract for repaving Lorain Avenue with dressed block Medina stone awarded by Bd. Control to Roehl Bros., Thompson Building, at $62,892.
Bid of Pace Bros., Cleveland, for constructing 5½-mile road from Bedford to Twinsburg is recommended for award by County Comrs. at about $94,000.

★**Newark, Ohio.** — Contract awarded Schilling Constr. Co., Youngstown, for furnishing and surface treating Tarvia, B. and screenings about 10½ miles at Granville and Groton Pike, known as Sect. 2 and 3, at $9,143 (bids opened Sept. 8). J. T. Swartz, Co. Highway Supt.

Ohio.—Following are lowest bids opened by Clinton Cowen, State Highway Comn., at Columbus, Sept. 10, for constructing roads:
Allen County, Lima-Delphos Road, Marion Township, macadam, 2.1 miles; J. A. Westrick, Holgate, $25,900.
Champaign County, Urbana-Sidney Road, Concord Township, macadam, 1 mile; Korah E. Kunkle, Dayton, $7,943.
Delaware County, Columbus-Sandusky Road, Delaware and Liberty Townships, bituminous macadam, 1 mile, to Edwards Bros., Sunbury, $12,500, and water bound macadam, $13,050.
Geauga County, Burton-Bloomfield Road, concrete, 3 miles; Yount & Jackson Co., Dayton, $20,000.
Montgomery County, Dayton-Troy Road, Madiver Township, brick, 1.3 miles; Yount & Jackson Co., Dayton, $24,900.
Dayton-Indianapolis Road, Madison and Jefferson Townships, brick and constructing bridges and culverts, 2 miles; Yount & Jackson, Dayton, $34,940.
VanWert County, VanWert-Delphos Road, Ridge Township, macadam, 1 mile; McArthur & Fox, Belle Center, $9,100.
Wyandot County, Bucyrus-Upper Sandusky Road, Crane Township, brick, 1 mile; Modern Constr. Co. Fremont, $16,700.
Upper Sandusky-Bellevue Road, Crane Township, brick, 1 mile; Modern Constr. Co., Fremont, $15,700.
Jefferson County, Steubenville-Cambridge Road, Cross Creek, Island Creek and Steubenville Townships, macadam resurfacing, 4 miles; J. P. Warnick, Cadiz, $32,775.

★**Toledo, Ohio**—Contract for paving awarded by Bd. Control as follows: Stickney Avenue with sheet asphalt at $79,923 and Huron Street with asphalt concrete at $38,712 to H. P. Streicher & Co., Toledo; Streicher Street with brick to Gessner & Cothrell at $27,557; Princeton Drive with concrete to Peters Bros. & Co., Toledo, at $10.297.

★**Wooster, Ohio.**—Contract awarded Griest & Markley, Wooster, for paving, etc., on North Buckeye Street, at $6,176. P. C. Given, Clk. Bd. Pub. Service.

★**Crawfordsville, Ind.**—Following are bids opened Sept. 7 by Co. Comrs. for steam road roller: Austin-Western Road Machinery Co., $2,950; Kelly Springfield. Co., Springfield, Ohio, $2,750; Hubert Mfg. Co., Indianapolis, $2,495 (awarded contract). Bennett B. Engle, Co. Aud.

★**Franklin, Ind.**—Contract for constructing gravel roads in Union and Pleasant Townships awarded by Bd. County Comrs. to Edward Barrett, Bargersville, at $11,500.

★**Indianapolis, Ind.**—Contract for paving Kenwood Avenue with asphalt awarded by Bd. Public Wks. to Marion County Constr. Co., 1600 South West Street.

★**Rennsselaer, Ind.**—Contract for constructing stone road in Gilian Township awarded Thomas M. Collehan, Rensselaer, at $13,499.

★**Shelbyville, Ind.** — Contracts awarded Kernodle, Dale & Fulwider, Lebanon, for constructing Schoentrup Road, Shelby Township, and Redenbaugh Road, Liberty Township, at $11,958, and to D. H. Fatout, Indianapolis, Pullman Road, Liberty Township, at $5,510.

★**Sullivan, Ind.**—Contract for constructing 12,591 ft. gravel road in Hamilton Township awarded by Co. Comrs. to R. R. Singer, Sandbern, at $10,279.

★**Vincennes, Ind.**—Contracts awarded by Co. Comrs. as follows: Three-mile gravel road in Busseron Township, between Oaktown and Vincennes, Johns C. Stalcup Road, to Snapp & Beard, at $13,199; three miles of gravel road in Widner Township, from Freelandville to Carlisle, A. M. Berry Road, to W. L. Brecksmith, at $12,983; three-mile road in Harrison Township, William Bebe Road, to Manning & O'Donnell, at $12,373.

Warsaw, Ind.—Following are four lowest bids opened recently by Co. Comrs. for constructing Metzger Road in Jackson Township: Martin McHale, Logansport, $24,983; Grossnickle Constr. Co., North Manchester, $24,900; Wolfcale Co., Markle, $25,050, and Thomas E. Sparks, Kirklin, $25,581.

★**Columbus, Wis.**—Contract for paving Madison and Otsego Road and Broadway with bituminous macadam awarded Butler Constr. Co. of Waukesha, at $6,826. W. A. Peirce, City Engr.

★**Des Moines, Iowa.**—Contract for grading streets of extended Capitol grounds awarded F. F. Balzer, Des Moines, at 22.75 cts. per cu. yd. earth; 50 cts. loose rock and 90 cts. rock. A. H. Davison, Secy. Council.

St. Paul, Minn.—Lowest bid opened Sept. 13 by City Council for 22,775 sq. yds. pavement on University Avenue submitted by Fielding & Shepley, St. Paul, at $55,300.

Bozeman, Mont.—Lowest bid opened for repaving with asphaltic concrete 2 miles of streets submitted by Independent Asphalt Paving Co., Seattle, Wash., at $1.16 per sq. yd.

★**Roundup, Mont.**—Contract for constructing concrete sidewalks in Dists. 9 and 10 awarded by City Council to John Tripp, at $13,821.

★**St. Louis, Mo.**—Contract for paving Market Street with wood block awarded by Bd. Public Service to Eyermann Constr. Co., 1216 S. Grand Avenue, at $17,224.

★**San Antonio, Tex.** — City Comrs. awarded contracts for pavements costing in all about $74,973 to Roach-Manigan Paving Co., Gunter Building; Rushmore & Gowdy, 1115 E. Commerce Street, and to Texas Granitoid Co., Frost Building.

★**La Conner, Wash.**—Contract for paving several streets with concrete awarded by City Council to N. W. Ball, Sedro-Wooley, at $13,987.

★**Los Angeles, Cal.**—Contracts for paving awarded by city as follows: 89,930 sq. ft. asphalt concrete pavements on Mariposa Avenue, to H. C. Withers, Builders' Exchange, at $11,743, and for 233,620 sq. ft. asphalt pavement on Third Street to Tryon & Brain, 501 Merchants' Trust Bldg., at $27,000.
★Contract for macadamizing at West Gate near Beverly awarded by county to Brashear-Burns Co., Van Nuys Bldg., at $12,949.
★Contract for 83,880 sq. ft. Warrenite pavement on Twenty-sixth Street awarded by city to Fairchild-Gilmore-Wilton Co., Pacific Electric Building, at $21,872.
★Contract for paving Pacific Avenue with bitulithic awarded by city to Fairchild-Gilmore-Wilton Co., Pacific Electric Building, at $92,096.

★**Manhattan Beach, Cal.**—Contracts for paving awarded by city as follows: Concrete sidewalks and concrete paving with bituminous top on Eighteenth and Nineteenth Streets and concrete sidewalks, concrete paving with oil and screenings surface on Twentieth Street to Crown Contr. Co., Manhattan Beach, at $21,061.

★**Oakland, Cal.**—Contract awarded Sept. 7 for grading and paving with bitulithic on 4-in. base on county roads, to California Bitulithic Co., care of Hutchinson Co., Thirteenth and Franklin Streets, at $14,236. George E. Gross, Co. Clk.

★**Porterville, Cal.**—Contract for paving Morton, St. Belleview, El Grainto and Grand Avenues awarded by city to Federal Constr. Co., San Francisco, at about $50,000.

★**Santa Ana, Cal.**—Contract for paving about 5.3 miles, Section 3, Riverside Road, with concrete awarded by county to Oscar Ford, Riverside, at $14,769.

★**Provo, Utah.**—Contract for improving streets with unreinforced pavements awarded by city to Ryberg Bros., Salt Lake City, at $20,618.

★**Sandpoint, Idaho.**—Contract for paving with cement in Dist. No. 4 awarded by City Council to Spokane Bitu-Mass Paving Co., Spokane, Wash., at $1.32 per sq. yd.

STREET CLEANING AND GARBAGE DISPOSAL

PROPOSED WORK.

Rochester, N. Y.—New York Bureau Municipal Research recommends to city municipal ownership of garbage disposal plant.

Newark, N. J.—Contract soon to be let by Bd. Wks. for collection and disposal of garbage.

Ishpeming, Mich.—City considering installing an incinerating plant, cost $6,000.

BIDS DESIRED.

Houston, Tex.—Until Oct. 8 by E. E. Sands, City Engr., for installing garbage incinerators, destructors or for plants that will otherwise dispose of garbage, advertised in Engineering Record.

PRICES AND LETTINGS.

★Indicates awarded contract.

★Americus, Ga.—Contract awarded Nye Colloran Chemistry Co., Macon, for constructing incinerating plant, cost $3,500.

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS

PROPOSED WORK.

State Canal Work—Albany, N. Y.—Plans and specifications have been prepared by State Engineer for improvement as follows: Canisteo River, at and near Hornell and Canisteo, calling for constructing a concrete wall at Hornell, excavating material in front of wall, deepening and widening channel of Canisteo River from point 1200 ft. east of Carson River Bridge to Depot Street, Canisteo, and channel of Colonel Bill's Creek at its mouth. Other improvements also may be made; estimated cost, $40,480; improvement of Mohawk River and West Canada Creek, including excav. and placing rip rap along easterly banks of West Canada Creek from German Street, Herkimer, and extending northward as directed by engineer, cost, $8,240.

Pier—Coney Island.—R. A. C. Smith, Dock Comr., New York City, has submitted plans for a new pier to replace old pier at Dreamland Park, Coney Island.

Flood Abatement—Olean, N. Y.—O'Connor & Chapman, Consulting Engrs., 19 State Street, Albany, have about completed preliminary plans for improvement of Allegany River and Olean Creek, which calls for straightening, widening, dredging, diking and other improvements on Allegany River, Olean Creek and their tributaries, relieve high water conditions existing at this point. Plans are to be submitted to State Supt. of Pub. Wks. for approval. Cost will be about $300,000, half to be paid by State and half by Olean. Contract will probably be let this fall. F. W. Fitzgerald, Comm., Olean Flood Abatement Comm.

Pier—Camden, N. J.—Harbor Comm. adopted resolution declaring its intention to build public pier at Twenty-fifth Street, North Cramer Hill.

Waterway—Trenton, N. J.—New Jersey State Commerce & Navigation Bd. has decided to construct proposed Barnegat Bay-Manasquan River inland waterway, which will form northernmost link of intercoastal canal from Cape May to New York; $23,000 is available to start this work.

Flood Protection Bonds—Augusta, Ga.—Bonds for $750,000 will be sold by Finance Com. (Wm. Martin, Clk. of Council), Oct. 6, for flood protection.

Causeway — Miami, Fla.—Isham Randolph & Co., 1527 Continental Bank Building, Chicago, Ill., have prepared a preliminary report on proposed causeway across Biscayne Bay.

Docks—Warehouses, Etc.—Mobile, Ala.—Terminal Transfer & Storage Co. of Mobile, in which J. H. Quill is interested, is reported taking steps to construct docks, warehouses, cold storage and ice plants, railroad tracks, and modern loading devices in Mobile.

Levee Work—Water Valley, Miss.—Bd. Supervisors, Coffeeville, authorized construction of levee and 3 steel bridges in Panola County line through Yocona Bottoms from Water Valley to Batesville.

Ditch Bonds—Boonville, Ind.—Bonds for Four Points Drainage Dist. amounting to $14,000 sold to county treasurer.

Levee Bonds—East St. Louis, Ill.—Bonds for East side Levee and Sanitary Dist. amounting to $300,000 have been sold.

Dam, Etc.—Des Moines, Iowa.—Des Moines Electric Co., it is reported, contemplates constructing new water house and dam costing $1,000,000.

Ditch Blue Earth, Minn.—Engineers of County Drainage Dist. No. 10 have filed report. Ditch is to be 2 miles long, and cost $40,000.

Drainage—Ozawkie, Kan.—Engineers for Drainage District No. 1, Jefferson County, contemplating additional work in ... Drainage Dist. No. 1 ... purchase ... Drainage Engr., Manhattan.

Drainage—Topeka, Kan.—Kaw River Drainage District ... Topeka and ... Engrs., Topeka. C. Caldwell ... engineer ... surveys will ... Topeka Drainage District.

County, for reclaiming 7000 acres on Soldier and Indian Creeks. Thos. Forbes, Secy., North Topeka.

Flood Protection—Kansas City, Mo.—Ordinance being considered by Council for emergency work to be done on Missouri side of Missouri River above intake of Quindaro pumping station, which is on Kansas side of river. Contracts to be let at once. Cost, about $20,000 to $30,000.

Dock—St. Louis, Mo.—The Waterways Com. appointed by the Mayor has adopted report recommending a municipal dock, costing $250,000, to be constructed at foot of N. Market Street.

Drainage Bonds—Cuero, Tex.—Bonds for County Drainage Dist. No. 1 amounting to $30,000 sold.

Causeway—Galveston, Tex.—Plans have been submitted for the rebuilding of the causeway. Address City Clerk.

Irrigation—Portland, Ore.—A. Laurgaare, Portland, is consulting engineer for proposed irrigation system for Suttle Lake Irrigation district. Probable cost $600,000. An election will be held Oct. 2 on issuing bonds.

Irrigation Work—Salem, Ore.—State Engineer Lewis has authorized Suttles Lake Irrigation Dist., Jefferson County, to issue $600,000 bonds for irrigating 12,000 acres. A dam 58 ft. high will be constructed to store 21,500 acre ft. water in Blue and Suttles Lakes, also a canal 18 miles long. George S. Young, Project Engr.

Irrigation—Modesto, Cal.—Bd. Directors Modesto Irrigation Dist. authorized improvements costing $50,000.

Harbor Improvement—Redondo Beach, Cal.—Bd. Trus. considering building an inner harbor at the beach.

Hydro-Electric Plant—Orangeville, Ont.—Citizens reported voted $33,000 bonds to buy the Pine River Light & Power Co. and $27,000 to build a new hydro-electric local plant.

Hydroelectric Plant— Toronto, Ont.—Hydroelectric Comn. approved plans for power development of hydroelectric system of Ontario. The plans call for initial development of 100,000 hp. by utilizing the maximum head of power on Niagara River now undeveloped.

BIDS DESIRED.

Dredging — New London, Conn.—Until Oct. 2 by Bureau Yards and Docks, Navy Dept., Washington, D. C. (H. R. Stanford, Ch.), Spec. 2194—For dredging at the Naval Station, New London.

Harbor Improvement—Albany, N. Y.—Until Oct. 6 by State Supt. Pub. Wks., Albany, for improving Three Mile Harbor, eastern end of Long Island, requiring the excavation of 34,000 cu. yds. from bottom of harbor. Engineer's preliminary estimate, $8,500.

Pier Extensions—New York, N. Y.—Until Sept. 28, by R. A. C. Smith, Comr. Docks, for Cont. 1479—Extending pier 22, near foot Jay Street, North River, and depositing riprap thereat. Security $9,700.

Bulkhead—Keansburg, N. J.—Until Oct. 4 by J. T. Yates, Lighthouse Inspector, Tompkinsville, N. Y., for furnishing material for building a riprap bulkhead wall and making repairs to the jetty at Point Comfort Light Station, Keansburg.

Dock—Wilmington, Del.—By Du Pont Powder Co., Wilmington, for constructing a dock and ferry slip wharf to be 450 ft. long, at Deep Waterway Point.

Levee Work—New Orleans, La.—Until Sept. 28, at U. S. Engrs. office, Queen and Crescent Bldg., New Orleans, for constructing about 1,093,400 cu. yd. earth work in the Lower Tensas and Atchafalaya levee district.

Dry Dock Gate—Louisville, Ky.—Until Oct. 22 by U. S. Engineer, Louisville, for furnishing and erecting one mitering dry dock gate for two leaves, advertised in Engineering Record.

Channel Work—Chicago, Ill.—Until Oct. 21 by John McGillen, Clk. Sanitary Dist., Chicago, for Contract Sect. 13 and 14 of the Calumet Sag Channel, advertised in Engineering Record.

Irrigation Work—Powell, Wyo.—Until Oct. 28, by U. S. Reclamation Service, Powell, for constructing canals and structures on the Shoshone Project, in all about 56,000 cu. yd. excavation, 1400 cu. yd. reinforced concrete, 15,000 sq. yd. grouted pavement, etc. The work is located near stations of Garland, Mantua, Frannie and Deaver, Wyo., on the C., B. & Q. R.R.

Irrigation Work—Montrose, Colo.—Until Oct. 21 by U. S. Reclamation Service, Montrose, for constructing about 11 miles of Ironstone Canal, Uncompahgre Valley project, vicinity of Olathe, about 200,000 cu. yds. excav., advertised in Engineering Record.

Dam—Salt Lake City, Utah.—Reported desired until Oct. 1 by S. Q. Cannon, City Engr., for constructing dam, 105 x 300 ft., in Parleys Canyon; probable cost $100,000.

PRICES AND LETTINGS.

★Indicates awarded contract.

★State Canal Work—Albany, N. Y.—See "Bridges."

★State Canal Work, Contract L—Albany, N. Y.—Contract awarded by State Superintendent of Public Works to Scott Bros., Rome, at $59,928, for Contract L—constructing substructures, superstructures and approaches of two highway bridges, one at Gorham Street, Waterloo, and another on Kingdom Road, between Waterloo and Seneca Falls. Both structures being over the Cayuga-Seneca Branch of the Barge Canal.

★Lock Gates — Pittsburgh, Pa.—Contracts awarded as follows by U. S. Engineer, Pittsburgh, for furnishing steel lock gates, valves and lock operating machinery at Lock No. 6, Monongahela River (bids opened Aug. 20): Thomas Carlin Sons Co., Pittsburgh, Section A, $7,600; Union Foundry & Machine Co., Pittsburgh, Section B, $13,557.

★Concrete Wall and Filtration Plant—Reading, Pa.—Contract awarded Reading Constr. Co. for constructing an additional section of reinforced concrete wall along Schuylkill River for the Carpenter Steel Co.; also erection of filtration plant for water used in the works; cost, about $35,000. Harold C. Stevens, Consulting Engr., 150 Nassau Street, New York.

★Dredging—Jacksonville, Fla.—Contract awarded Seaboard Dredging Co., for dredging and filling in bulkheading at new terminals of Commodores Point Terminal Co., at Commodores Point; cost $100,000.

★Levee Work—New Orleans, La.—Contracts reported awarded by State Bd. Engrs. as follows for levee work: To Lower Coast Constr. Co., Pointe a la Hache, for constructing Mill Bayou to Simmsport Levee, Parish of Avoyeles Bayou Des Glaises, right bank new levee and riverside enlargement, approximately 350,000 cu. yd., at 9.34 cts.; to Roach, Stansell & Lowrance Bros. Co., Memphis, Tenn., Salem Levee, Parish East Carroll, Mississippi River, riverside enlargement, 350,000 cu. yd., at 29.9 cts.; to Burt, Bond & McMurray, Boston Road Crossing levee, riverside enlargement, 31,000 cu. yd., at 37 cts.; to R. F. Clark, Cross Levee, 300,000 cu. yd., at 25 cts. per cu. yd.

★Channel Improvement—Crystal Falls, Mich.—Contract awarded by Bristol Mining Co., of Crystal Falls, to Hicks & Barber, of Vulcan, Mich., to change channel of Briar Hill Creek. It will be handled with a drag line outfit and necessitates the removal of 60,000 yd. of material.

Dock—Detroit, Mich.—Following are four lowest bids for constructing municipal dock at foot of West Grand Boulevard: A. J. Dupuis Co., $22,659; Candler Dock & Constr. Co., $26,503; John Ginzel, $28,261; Great Lakes Dock & Dredge Co., $30,511.

★Dredging—Chicago, Ill.—Contract for dredging at beach in Jackson Park awarded Byrne Bros. Dredging Co., 208 S. La Salle Street, at about $60,000.

★Breakwater — Chicago, Ill.—Contract for building breakwater at foot Sixty-third Street extended, in Jackson Park, awarded by South Park Bd. to Great Lakes Dredging & Dock Co., Chicago, at $60,000.

Irrigation Work—Newell, S. D.—Curtis Bros., Columbus, Neb., submitted lowest bid Aug. 27 to U. S. Reclamation Service for excavation of North Canal extension and laterals, Belle Fourche Project: They bid on Excavation, Class 1, 64,600 cu. yd., 12.5 cts.; Class 2, 1100 cu. yd., 30 cts.; Class 3, 200 cu. yd., 50 cts; overhaul, 13,300 cu. yd., 2 cts.; grand total, $8,771. Other bidders on complete work: Owen Constr. Co., Sturgis, S. D., $12,443; Chambers & Doody, Newell, $11,687.

★Channel Improvement—Houston, Tex.—Contract awarded Atlantic Gulf & Pacific Co., Houston, to widen Houston Ship Channel in front of plant of Texas Portland Cement Co. About 40,000 cu. yd. to be removed.

★Creek Improvement—San Jose, Cal.—Contract awarded by City Council Sept. 10 for constructing by-pass to carry off flood waters of Canoas Creek to M. E. Kilcourse, at $10,230.

★Buildings—Preston, Ont.—Contracts awarded by Hydro-Electric Comn. to Metal Shingle & Siding Co., Ltd., Preston, for furnishing material and erecting six transformer station store houses, one in Guelph, Preston, Berlin, St. Mary's, Woodstock and Crooksville. Buildings will be 36x60 ft., metal construction throughout.

ELECTRIC RAILWAYS

PROPOSED WORK.

Kenmore, N. Y.—The International Ry. Co. has received from City Council a franchise to double-track main line in Kenmore.

Beckley, W. Va.—Surveys being made for an electric railway to be constructed between Fayette Station and Beckley, 35 miles. H. G. Scott, Gen. Mgr., Virginia Power Co., Charleston, W. Va., said to be interested.

Charleston, S. C.—Charleston-Southern Ry. Co. chartered to construct steam or electric railway from Charleston to Hutchinson Island, distance of 86 miles. Capital $43,000. Headquarters Darlington. Bright Williamson, Pres., Darlington.

St. Louis, Mo.—St. Louis Subway & Elevated Cor. organized to construct 4.76 miles elevated railway and 3.29 miles subway in St. Louis. The road will connect with interurban railways at city limits. Jas. D. Houseman and T. E. Niesen, Bank Commerce Bldg., said to be interested.

Temple, Tex.—Construction work about to begin on electric railway between Temple and Marlin, about 30 miles. S. D. Hanna, Temple, Ch. Engr.

Miami, Okla.—Surveys are being made by Oklahoma & Interstate Ry. Co. (John R. Rose, Pres., Oklahoma City) for railway to connect Columbus, Galena, Baxter Springs, Miami and Centralia.

BIDS DESIRED.

San José, Cal.—Until Oct. 4 by Bd. Superv. for franchise to construct and operate an electric railway over certain roads in the county as applied for by San José Railroads. Henry A. Pfister, Co. Clk.

PRICES AND LETTINGS.

★Indicates awarded contract.

★Brooklyn, N. Y.—Contract awarded by N. Y. Municipal Corporation to Phoenix Bridge Co., 49 William Street, for furnishing structural steel for the third tracking of Myrtle Avenue Ry. Corporation at $40.50 per net ton.

★New York, N. Y.—Contract awarded by Public Service Comn. for First Dist. as follows for ballast for new rapid transit railroads (bids opened Sept. 10): ★Portion A, 243,000 cu. yd. trap rock or hard limestone, Upper Hudson Stone Co., 26 Cortlandt Street, $228,010. ★Portion B, 32,500 cu. yd. 3 in., either trap rock, to Haverstraw Crushed Stone Co., 17 Battery Palce, at $26,325.

★Kansas City, Mo.—The receivers of Metropolitan Street Ry. Co. have awarded contracts for constructing about 10 miles of railway extensions to Columbia Constr. Co., Milwaukee, Wis.

★Oklahoma City, Okla.—Contract for constructing 176-mile railway for Southwestern Light, Power & Ry. Co., connecting Oklahoma, New Castle, Duncan, Lawton, Lindsay, Davis, Ishmengo, Durant and Dennison,, awarded to Arbuckle Constr. & Improvement Co. Power station at Davis and repair shops at Arbuckle. W. T. Croslen, Pres.; W. P. Woolsep, Gen. Mgr., both at Oklahoma City.

Irrigation Work—Denver, Col.—Following are unit prices of four lowest bids opened Sept. 8 by U. S. Reclamation Service, Denver, for earth work on Fort Laramie Canal, Sta. 3 to Sta. 525+50, North Platte Project, Neb.-Wyo.—(a) Engineer's estimate, $255,456, grand total; (b) Winston Bros. Co., Minneapolis, Minn., $203,858; (c) Foley Bros., Welch & Stewart, St. Paul, Minn., $224,305; (d) J. H. Flick Constr. Co., Chicago, Ill., $224,987; (e) Kilpatrick Bros. & Collins Contr. Co., Beatrice, Neb.

	(a)	(b)	(c)	(d)	(e)
Schedule 1:					
349,000 cu. yd., Class 1	$0.18	$0.144	$0.15	$0.157	$0.185
18,200 cu. yd., Class 2	0.60	0.428	0.40	0.39	0.60
7,200 cu. yd., Class 3	1.00	0.428	0.80	0.71	0.80
62,000 sta. yd. overhaul	0.02	0.02	0.02	0.02	0.02
Schedule 2:					
360,000 cu. yd., Class 1	0.19	0.156	0.16	0.157	0.1425
7,200 cu. yd., Class 2	0.60	0.156	0.40	0.39	0.45
8,700 cu. yd., Class 3	1.00	0.156	0.80	0.71	0.55
17,000 sta. yd. overhaul	0.02	0.02	0.02	0.02	0.02
Schedule 3:					
297,000 cu. yd., Class 1	0.18	0.148	0.15	0.157	0.14
2,200 cu. yd., Class 2	0.60	0.148	0.40	0.39	0.45
2,700 cu. yd., Class 3	1.00	0.148	0.89	0.71	0.55
30,000 sta. yd. overhaul	0.02	0.02	0.02	0.02	0.02
Schedule 4:					
257,000 cu. yd., Class 1	0.17	0.144	0.16	0.157	0.155
100 cu. yd., Class 2	0.60	0.144	0.40	0.39	0.80
400 cu. yd., Class 3	1.00	0.144	0.80	0.71	0.80
5,200 sta. yd. overhaul	0.02	0.02	0.02	0.02	0.02

RAILROADS

PROPOSED WORK.

Petersburg, Va.—Norfolk & Western R.R. Co. (J. E. Crawford, Ch. Engr., Roanoke) will construct double tracks from Petersburg to Cedar Point.

Winding Gulf, W. Va.—E. M. Merrill, Raleigh County Bank Bldg., Beckley, W. Va., engaged by Virginia Ry. Co., for all engineering work on Winding Gulf coal properties.

Charleston, S. C.—See "Electric Railways."

Cleveland, Ohio.—$38,918 grade crossing bonds will be sold Oct. 27 by C. A. Neff, Clerk Village of Bratenahl, 219 E. 105th Street, Cleveland.

Indianapolis, Ind.—Bonds for $160,000 for track elevation will be sold Oct. 1 by W. T. Patton, Co. Aud.

Virginia, Minn.—Reported building of the Great Northern Ry. (A. H. Hogeland, Ch. Engr., St. Paul, Minn.) from Virginia to Tower, a distance of about thirty miles, is contemplated.

Ozark, Ark.—Ozark R. R. Co. incorporated to construct a road from a point in Greene County, Mo., to Rothville, Baxter County, Ark. R. S. Wickersham of Springfield, Mo., Secy.

Idaho. — Governor Moses Alexander, Boise, reported interested in proposed North & South R. R. between New Meadows, present terminus of Pacific & Idaho Northern R. R., and Lewiston, on Oregon-Washington R. R. & Navigation Co.'s division of Union Pacific system, a distance of 180 miles.

Vancouver, B. C.—Reported work is to commence at once on the Canadian Northern Ry. False Creek terminal facilities here to include construction of retaining wall, adjoining Main St. bridge, to cost $115,000, a fireproof depot, train shed, riprap fill, warehouses, freight sheds and storage yards, etc.

PRICES AND LETTINGS.

★*Indicates awarded contract.*

★**Charleston, S. C.**—Contract awarded Gadsden Contr. Co., Savannah, Ga., by W. R. Bonsal, for constructing ten miles of the railway between Savannah and Charleston. Probable cost $400,000.

★**Easley, S. C.**—Contract awarded by Southern Ry. Co., Sept. 15, to M. M. Elkan, Macon, Ga., for building second track from Easley to Central, and to H. J. Dunavant & Co., Knoxville, second track from Greenville to Easley. W. H. Wells, Ch. Engr. Constr.

PUBLIC BUILDINGS AND SCHOOLS

PROPOSED WORK.

Eastport, Me.—Site is being selected for Shead Memorial High School to be erected at cost of about $35,000.

Manchester, N. H.—Erection of town hall under consideration by Town Bd. Probable cost $125,000.

North Adams, Mass.—Contract will soon be let by Bd. Educ. for erecting high school. Gardner & Gardner, Archts., Springfield.

Mansfield Depot, Conn.—Bldg. Com. Bd. Trus., Connecticut School for Feeble Minded (Judge L. P. Waldo Marvin, Member, Hartford) considering plans for buildings to be erected for said institution at Mansfield Depot.

Brooklyn, N. Y.—Plans filed for erection of following buildings: One-story brick laundry at Winthrop Street and Albany Avenue for city of New York, cost $75,000, Sylvester A. Taggart, Municipal Building, New York; 7-story brick hospital at Hicks and Johnson Streets for St. Christopher's Hospital, cost $250,000, Donn Barber, Archt., 101 Park Avenue, New York.

Utica, N. Y.—Bonds for $165,000 will be sold Sept. 29 by Arthur M. Burke for erecting school.

Bayonne, N. J.—Reported Board of Educ. has decided to ask Bd. of School Estimates for $130,000 to purchase additional land adjoining school No. 4 to erect a new school.

Wildwood, N. J.—Reported new bids desired for erecting two-story and basement, 138 x 176 ft., brick and stone school. Lowest bid recently opened submitted by Eugene Tourison of Philadelphia, Pa., at $74,818. Clyde S. Adams, Archt., 1233 Arch Street, Philadelphia, Pa.

Philadelphia, Pa.—State Armory Bd., Harrisburg, rescinded contract awarded Sept. 7 for erecting cavalry squadron armory. New bids will be received.

Turtle Creek, Pa.—$45,000 school bonds will be sold Sept. 27 by School Dist. (E. R. Smith, Secy.).

Baltimore, Md.—School Bd. considering erecting school in Patterson Park. Cost about $100,000.

Wheeling, W. Va.—Plans being prepared by F. F. Faris, Wheeling, for 3-story brick, fireproof, central grade school to be erected on Warwood Avenue for Richland Dist. Bd. Educ.; cost, $40,000.

Spartanburg, S. C.—Plans completed for Steedy Hospital to be erected on E. Main Street. Cost about $60,000.

Jacksonville, Fla.—Erection of a municipal hospital is being considered. Marvin Smith is said to be interested .

Jacksonville, Fla. — School bonds amounting to $500,000 sold Sept. 11 by School Bd.

Hammond, La.—See "Garbage Disposal and Street Cleaning."

New Orleans, La.—Tentative plans prepared for six-story terra cotta and pressed brick office building to be erected at Carondelet and Lafayette Streets for Sewerage and Water Board.

Conover, Ohio.—Plans completed by A. W. Stover, Springfield, for 75 x 65 ft. pressed brick high school.

Dayton, Ohio.—Peter Kuntz, lumber dealer, Dayton, intends erecting tuberculosis hospital in connection with local hospital. Cost approximately $500,000.

East Liverpool, Ohio.—Citizens voted $40,000 bonds for erecting market house.

Lisbon, Ohio. — Election of Normal School in Columbiana County is contemplated; cost $1,000,000.

West Unity, Ohio.—$25,000 bonds will be sold Oct. 2 by Bd. Educ. (Henry Reifel, Clk.) for erecting school.

Hartford City, Ind.—Bonds for $26,000 for county infirmary buildings will be sold Oct. 26 by J. L. McGrath, Co. Aud.

Mitchell, Ind. — Council authorized School Board to issue bonds for erecting high school.

Portland, Ind.—County Council voted $260,000 for erecting courthouse.

Romney, Ind.—Bonds for $25,000 for school improvements will be sold Oct. 6 by James Shoemaker, Treas., Randolph Township.

Manistique, Mich.—Plans being prepared by Robinson & Campau, Grand Rapids, for school.

Arcola, Ill.—Contract will be let in about 30 days for erecting 3-story, fireproof, brick and concrete high school, 170 x 100 ft., to cost, including equipment, $70,000. Joseph Royer, Archt., Urbana; John J. Armstrong, City Clerk.

Springfield, Ill.—Board of Superv. in favor of erecting $100,000 jail.

Improvements costing $50,000 are to be made in the Capitol building. J. B. Dibelka, Archt., 130 N. Fifth Avenue, Chicago.

De Pere, Wis.—W. E. Reynolds, Green Bay, is architect for fireproof building to be erected for St. Norbert's College, to be 4-story, 64 x 82 ft., cost $60,000. Contract will be let possibly this fall. B. H. Penning, Pres. St. Norbert's College.

New Hampton, Iowa.—Fire Dept. has raised $30,000 to erect a building.

Appleton, Minn. — Independent School District voted $65,000 bonds to erect high school.

Chatfield, Minn.—Tyrie & Chapman, 320 Auditorium, Minneapolis, are architects for the high school.

Minneapolis, Minn.—Plans being prepared for building for Northrop College to be erected in Kenwood Parkway.

Sauk Center, Minn.—Citizens voted $50,000 bonds toward erecting Junior High Grade School, to replace structure recently destroyed by fire. Cost $65,000. C. H. Parsons, Archt.

St. Cloud, Minn.—Plans being prepared by Tyrie & Chapman, Auditorium, Minneapolis, for the high school. Probable cost $75,000. C. H. Maxson, Supt. Schools.

Emporia, Kan.—Contract will soon be let for erecting administration building at State Normal School; it will contain 70 class rooms in addition to administration offices. Cost $175,000. Charles Chandler, State Archt., Topeka.

Kansas City, Mo. — About $612,000 school bonds sold.

St. Joseph, Mo.—See "Railroads."

Austin, Tex.—See "Sewerage and Sewage Disposal."

Austin, Tex.—Contract soon to be let for erecting several schools. A. N. McCallum, Supt. Schools.

El Paso, Tex.—$500,000 school bonds will be sold Sept. 30 by J. F. Dawson, City Clk.

Lubbock, Tex.—Reported citizens voted $100,000 bonds to erect court house.

Seattle, Wash.—See "Industrial Plants."

Woodburn, Ore.—Citizens Sept. 7 voted $40,000 bonds for erecting school. Address, Clerk School Dist. No. 103, Marion County, Woodburn.

Mountain Home, Idaho.—Wayland & Fennell, Boise, will prepare sketch plans for courthouse. Cost $35,000. Address F. M. Hibbs, Co. Aud.

BIDS DESIRED.

Chelsea, Mass.—Reported desired until Sept. 30, by Mayor, for erecting 3-story 165x85 ft. brick and concrete school. Probable cost $112,000. Kilham & Hopkins, Archts., 9 Park Street, Boston.

Providence, R. I.—Press reports state bids desired until Oct. 4 by Bd. Contract and Supply for erecting police station, to include adjoining stable and garage, at Wayland Avenue and Sessions Street. Knight C. Richmond, Archt., 10 Weybosset Street

Albany, N. Y.—Until Oct. 5 by Trus. Pub. Bldgs., Executive Chamber, Capitol, Albany, for construction work and electric elevator in executive offices, Capitol. Lewis F. Pilcher, State Archt., Capitol, Albany.

Newark, N. J.—Until Sept. 27 by Com. on Pub. Bldgs., (Thos. J. Lee, Jr., Chmn.), for erecting laboratory building for Newark City Hospital. Separate bids will be received for mason, carpenter, structural steel and iron work, plumbing, heating, etc. H. J. & J. V. King, Archts., 9-15 Clinton St., Newark. Geo. W. Knight Co., Firemen's Bldg., Engrs.

Skillman, N. J.—Until Oct. 4, by Bd. Managers, N. J. State Village for Epileptics (David F. Weeks, M.D., Supt.),. for furnishing material and erecting assembly building, custodial building, two cottages for patients, employees' home, etc.

Monongahela, Pa.—Until Oct. 27, by Jas. A. Wetmore, Superv. Archts., Washington, D. C., for constructing complete (including mechanical equipment, lighting fixtures and approaches), U. S. post office at Monongahela.

Pittsburgh, Pa.—Until Oct. 6 by Dept. Pub. Wks. (Robert Swan, Dir.) and Hyatt M. Cribbs, Co. Controller, for cement work and cinder fill, fireproofing, brick work, architectural terra cotta No. 2, sheet metal work, roofing and waterproofing, entering into the construction of new city and county building. Edward B. Lee, and Palmer Hornbostel & James, Archts., 345 Fourth Avenue, Pittsburgh.

Scranton, Pa.—Until Oct. 4 by School Dist. (Thomas L. Scott, Secy.), for erecting high school on Lincoln Avenue; bids for plumbing, heating, electric wiring, etc., will be received separately. Edward H. Davis, Archt., Connell Building, Scranton.

Lexington, Va.—Until Oct. 11 by Bldg. and Grounds Com. Bd. of Visitors, Virginia Military Institute at Lexington (M. B. Corse, Secy.), for erecting 3-story brick building.

Toccoa, Ga.—Until Sept. 29 by Mayor for following: concrete power house; steel flume, 340 lin. ft. 42 in. No. 8 plate; transmission line. H. J. Cox, City Clk. S. D. Brown, Engineer.

Pensacola, Fla.—Until Oct. 16 at Bureau Yards and Docks, Navy Dept., Washington, D. C. (H. R. Stanford, Ch.), for Spec. No. 2195—Constructing 3 hangars at the U. S. Navy Aeronautic Station, Pensacola.

Oxford, Ohio.—Until Oct. 19, by W. L. Tobey, Chmn. Bldg. Com. Bd. Trus. Miami University, at his office, Third and Market streets, Hamilton, for furnishing material and erecting central pavilion, Ohio State Normal College, Miami University, Oxford. Frank L. Packard, Archt., New Hayden Bldg., Columbus.

Woodsfield, Ohio.—Until Sept. 30 by Bd. Educ. (F. W. Pollock, Clk.) for furnishinb material and erecting a fireproof high school. Howard & Merriam, Archts., 8 E. Broad St., Columbus.

Newcastle, Ind.—Until Oct. 27, by Jas. A. Wetmore, Superv. Archt., Washington, D. C., for constructing complete, including mechanical equipment and approaches, U. S. post office at New Castle.

Seymour, Ind.—Until Oct. 30 by James A. Wetmore, Acting Superv., Archt., Washington, D. C., for erecting complete (including mechanical equipment and approaches), U. S. post office at Seymour.

Grand Rapids, Mich.—Until Sept. 29, by State Military Bd. (John S. Bersey, Adj. Genl.), Lansing, for erecting armory for Grand Rapids Battalion. Separate bids will be received for heating, plumbing, and electric work. Williamson & Crow, Archts., Grand Rapids.

Dixon, Ill.—Until Oct. 18 by Administration Bd. (Frank D. Whipp, Fiscal Superv.), Springfield, for erecting power, laundry, cold storage and bakery buildings, at State Colony for Epileptics, at Dixon. Separate bids will be received for heating, plumbing, wiring, etc. Hon. James B. Dibelka, State Archt., 140 N. Fifth Street.

Watertown, Wis. — Reported desired until Oct. 11 by Bd. Educ. for erecting a high school, also heating, plumbing, etc. Parkinson & Dockendorf, Archts., La Crosse.

Eldora, Iowa.—Until Sept. 30 by Bd. State Control, Des Moines (F. S. Treat, Secy.), for erecting brick and concrete gymnasium 80 x 120 ft. for State Industrial School for Boys, Eldora. H. F. Liebbe, State Archt., Des Moines.

Jefferson, Iowa.—Reported desired until Oct. 6 by B. S. McCully, Co. Aud., for erecting 3-story 78 x 117 fireproof brick courthouse. Proudfoot, Bird & Rawson, Archts., Des Moines.

Lanyon, Iowa.—Reported desired until Oct. 1 by G. T. Peterson, Secy., School Bd., for erecting including plumbing, heating, etc., a 2-story and basement fireproof brick consolidated building. E. O. Damon, Jr., Archt., Fort Dodge.

Rock Rapids, Iowa.—Until Oct. 18 by Bd. Superv. (T. E. Moen, Chmn.), care of E. J. Riegel, Co. Aud., for furnishing material and erecting 3-story and basement fireproof, stone or brick court at Rock Rapids. Cost, $125,000. Bids desired as a whole or separately for erection; heating, plumbing, and electric wiring. Joseph Schwarz, Archt., Sioux Falls, S. D.

Morris, Minn.—Until Sept. 28 by State Bd. Control, St. Paul, for erecting, including plumbing, heating, etc., Engineering building at West Central School of Agriculture, Morris. C. H. Johnston, Archt., 715 Capital Bank Building, St. Paul.

Norton, Kan.—Reported desired until Sept. 30 by State Bd. Control, Topeka (J. W. Howe, Secy.), for erecting patients cottage and hospital at State Sanatorium for tubercular patients, Norton. Charles H. Chandler, State Archt., Topeka.

Sidney, Neb.—Reported desired until Sept. 30 by City Clk., for erecting 2-story and basement city hall. Bert M. Reynolds, Archt., North Platte.

Baker, Mont.—Until Oct. 4 by Co. Comrs. (T. A. Fitzsimons, Clk.) for erecting jail, court house and heating plant. Link & Hare, Archts., Billings, Mont.

Kirksville, Mo.—Until Oct. 28 by James A. Wetmore, Acting Superv. Archt., Washington, D. C., for extension, remodeling, etc., of U. S. Patent Office at Kirksville, advertised in Engineering Record.

Gatesville, Tex.—Until Oct. 4, by David R. Hall, Pres. State Juvenile Training School, for erecting a reinforced concrete hospital; also for fireproof dormitory building for said school. Roy E. Lane, Archt., Waco.

Huntsville, Texas.—Until Sept. 27 by State Normal Bd. of Regents, Austin, for erecting fireproof science building at Huntsville for Sam Houston State Normal. Endress & Watkins, Archts., Austin.

Johnson City, Tex.—Reported desired until Sept. 30 by William Martiny, Co. Judge, for erecting 2-story stone and concrete courthouse. Harry T. Phelps, Archt., Gunter Building, San Antonio.

Sedro-Woolley, Wash.—Reported desired until Oct. 4 (extension of date from Sept. 21) by State Bd. Control, Olympia (E. S. Emigh, Secy.), for erecting for Northern States Hospital Norium, near Sedro-Woolley, Class "A," fireproof, auditorium and two ward buildings. Cost, $30,000 and $128,000 respectively; also separately for plumbing and drainage; ventilating and heating; electric wiring and fixtures. Heath & Gove, Archts., National Realty Building, Tacoma.

Oakland, Cal.—Until Oct. 5 by Bd. Library Dir. (Charles S. Greene, Secy.), for furnishing material and erecting one-story and basement concrete building to be known as Melrose branch, Oakland Free Library, at Foothill Boule. W. H. Weeks, Archt., 75 Post Street, San Francisco.

Flagstaff, Ariz.—By Northern Arizona Normal School Board on material for girls' dormitory to cost $48,000, and for $9,000 extension boys' dormitory. Building to be of native sandstone construction.

PRICES AND LETTINGS.

★*Indicates awarded contract.*

★**Ossiper, N. H.**—Contract awarded Wallace Building Co. of Laconia, for erecting Court House.

Englewood, N. J.—Lowest bids received for erecting high school were submitted as follows: General construction, Kelly Constr. Co., at $240,000; ventilating and heating, F. G. Sanford & Co., $15,000; plumbing, P. F. Kenny, $10,000. Bidders all of Yonkers, N. Y. Ernest Sibley and J. J. Ferry, Archts., Englewood.

Contract for erecting above high school awarded Kelly Constr. Co., Yonkers, N. Y., at $142,296.

★**Du Bois, Pa.**—Contract for erecting Maple Ave. Hospital awarded Orner Co., Du Bois, at $41,200.

★**Farview, Pa.** — Contract awarded Sept. 13 by Bldg. Com., Asylum for Criminal Insane, Philadelphia, for Ward H. kitchen and butcher shop, engine room and dining room as follows: General contract, P. J. Hurley Co., Bayside, L. I., N. Y., at about $185,000; ventilating, heating and plumbing to S. Faith & Co., 2427 Pennsylvania Avenue, Philadelphia, and wiring to J. F. Buchanan & Co., 1719 Chestnut Street, Philadelphia. Total cost, $306,000. C. J. M. Shirk, Archt., 321 Chestnut Street, Philadelphia.

★**Gettysburg, Pa.**—Contract awarded A. R. Warner, E. Main Street, Waynesboro, at $50,000, for erecting 2-story and basement, 50 x 156 ft. brick and stone church.

Philadelphia, Pa.—Abel Bottom's Sons & Co., 4 S. Fifteenth Street submitted lowest bid at $[illegible] for erecting addition to McIntyre School; bids opened Sept. 10. Total cost of building, $81,045.

★**Pittsburgh, Pa.**—Contracts awarded for granite and terra cotta material for entire construction of new city-county building, as follows: Woodberry Granite Co., bids A, B and C at $[illegible]; Atlantic Terra Cotta Co., Fuller Bldg., terra cotta work, $[illegible]; New England Granite Co., 489 5th Avenue, New York, granite work included in "Bid D, Granite Work," $[illegible]; Edw. B. Lee, Archt., 307 4th Avenue.

★**Beckley, W. Va.**—Contract awarded D. J. Phelps, Roanoke, at $37,141, for erecting county jail.

★**Columbia, S. C.**—General contract awarded George W. Waring, Columbia, for erecting 1-story brick, fireproof high school at $[illegible], bowing to American Heating and Ventilating Co., Richmond, and plumbing to W. B. Guimarin & Co., Columbia. Crowder & Johnson, Archts., Palmetto Building, Columbia.

★**Port Royal, S. C.**—Contract awarded by Bureau Yards and Docks, Navy Dept., Washington, D. C., for constructing bulkheads and an incinerator at the naval disciplinary barracks, Port Royal, to Newport News Eng. & Contr. Co., Newport News, Va., at $34,678.

★**Palatka, Fla.**—Contract for erecting U. S. Post Office awarded Westchester Engineering Co., White Plains, N. Y., at about $[illegible].

★**Richwood, Ohio.**—Following are four lowest bids opened Sept. 12 by Board of Education for erecting 2-story, 8-room school: Fraizer Constr. & Supply Co., Columbus, $[illegible] (awarded contract); Stevens & Taylor, $[illegible]; C. D. Herbick & Bros., Columbus, $[illegible]; Asa F. Moreland, Marysville, $[illegible]; Paul T. Cahill, Archt., 1360 Euclid Avenue, Cleveland.

★**Sheboygan, Wis.**—Contract awarded Bero Constr. Co., Fond du Lac, at $[illegible] for erecting Municipal Building.

★**Iowa City, Iowa.**—Following are four lowest bids opened Sept. 14 by Board of Trustees, Des Moines, for erecting dentistry building for State University of Iowa: Chas. Findlay, Iowa City, $124,200 (awarded contract); Splude, Albee & Smith, $[illegible]; A. H. Neumann & Co., $139,767; **Theodore Stark & Co., $139,942.** Proudfoot, Bird & Rawson, Archts., Hubbell Bldg., Des Moines.

★**Rochester, Minn.**—Contract awarded G. Schwartz & Co., Rochester, for erecting a 4-room and an 8-room brick and concrete school, Hoffman & Mosse, Archts., Rochester.

★**Rochester, Minn.**—Contracts awarded as follows for erecting an armory: General contract to G. Schwartz & Co., at $25,900; plumbing and heating, Maass & Mc[illegible], $[illegible], both of Rochester.

Leavenworth, Kan.—Following are four bids opened Sept. 10 by Superintendent of Prisons Department of Justice, Washington, D. C., for reinforcing materials, structural steel, etc., for cell blocks in west wing and wing Leavenworth Penitentiary: Missouri Iron Co., St. Louis, $[illegible]; Crown Iron Wks. Co., Minneapolis, $[illegible]; St. Paul Founder Co., St. Paul, $55,480; Van Dorn Iron Wks. Co., Cleveland, $56,778.

★**Wisner, Neb.**—Following are four lowest bids opened Sept. 17 by Board of Educ. for erecting high school: Anton Hansing, Wisner, $31,715 (awarded contract); George F. Johnson, Central City, Neb., $[illegible]; W. J. Creedon, Omaha, $[illegible]; E. P. Quest & Son, Omaha, $[illegible]; heating and plumbing awarded Judson Heating & Plumbing Co., Omaha, $[illegible]; Jens Latzsaw & Sons, Archts., Omaha; I. A. Morse, Secy. Bd.

★**Dallas, Texas.**—Contracts awarded for erecting County Farm Buildings as follows: General construction, Ennison & Mc[illegible], Fordyce, $29,995; plumbing, C. Wallace Plumbing Co., 3024 Main street, $1,445; wiring and fixtures, Commercial Electric Co., 307 S. Ervay street, $[illegible]; Wiemer & Cole, Archts., Kempner Building.

★**San Angelo, Texas.** — Contract for erecting school on N. Oakes Street awarded Willeke Bros., San Angelo, at $54,176. Rose & Gaston, Archts., Waco.

Grand Mound, Wash.—Following are lowest bids opened by State Bd. Control, Olympia, for erecting State School for Girls: (a) concrete, (b) brick, (c) concrete with special reinforcements. Moeller & [illegible], Tacoma, (a) $47,[illegible]; (b) $[illegible]; (c) $[illegible]; Schram & Thompson, Tacoma, (a) $53,982; (b) $[illegible]; Bebb & Gould, Seattle, (a) $55,-[illegible]; (b) $[illegible]; (c) $[illegible].

★[illegible] for erecting brick building awarded at [illegible], Pocatello, for brick construction at Boise, $49,471.

San Francisco, Cal.—Two lowest bids opened for general construction (cost including heating work), Public Library in Civic Center were submitted by Lindgren Co., Merritt Building, at $424,000, and Clinton Plastering Co., Mutual Bank Building at $[illegible].

Metcalf, Ariz.—All [illegible] for erecting [illegible] Board of Education.

★**Preston, Ont.**—See "[illegible] and River Improvements."

PRIVATE BUILDINGS

PROPOSED WORK.

Amherst, Mass.—Contract soon to be let for erecting brick car barn and substation for Amherst & Sunderland Street Railway.

Boston, Mass.—John Hardy will erect an 11-story, brick, 127 x 78-ft. business block on High Street. Parker, Thomas & Rice, Archts., 110 State Street, Boston.

Chicopee, Mass.—Plans being prepared for parochial school, 17-room auditorium, three-story brick, for Stanislaus Polish Church. Rev. Lawrence Cyman, Pastor.

Worcester, Mass.—Plans being prepared by C. W. Daniels, Engr., Norton Grinding Co., for concrete bond building for this company; cost, $50,000.

Brooklyn, N. Y.—Plans filed for erection of following buildings four 4-story brick tenements at Butler and Sterling Places, for Bryan Realty Co., cost total $180,000, Shampan & Shampan, Archts., 772 Broadway; 1-story brick sales station. Bedford Avenue and Sterling Place, for Ford Motor Co., cost $50,000. Francesco & Jacobus, Archts., 200 Fifth Avenue, New York.

Buffalo, N. Y.—Reported Bank of Buffalo, Main and Seneca Streets, has secured site at Main and North Streets on which to erect new building.

New York, N. Y.—Plans filed for erection of following buildings: 2-story brick store and office building at 1604 Broadway for Julius Fleischman; cost, $50,000; Joseph C. Schaeffler, Archt., 28 W. Thirty-second Street; two 5-story brick tenements at Hoe Avenue and Jennings Street for Galveston Building Co., cost, $80,000, Sass & Springsteen, Archts., 32 Union Square; 6-story brick tenement at Jennings Street and Bryant Avenue for Lyttle Constr. Co., cost $50,000, Harry T. Howell, Archt., Third Avenue and 149th Street; alterations to 5-story loft at 5 E. Fifty-ninth Street, for Mary B. Brandagee, cost $125,000. Louis E. Jallade, Archt., 37 Liberty Street.

New York, N. Y.—Plans completed by Jardine, Hill & Murdock, 3 W. 29th Street, for 25-story office building to be erected at Madison Avenue and Forty-second Street for August Heckscher.

Allentown, Pa.—Plans and specifications prepared for erection of building for Loyal Order of Moose at 30 N. Tenth Street; cost about $25,000.

Bethlehem, Pa.—Masons contemplate erecting Temple on E. Broad Street. Cost, $60,000. Paul Kempsmith, Pres. Masonic Temple Assoc.

Lehighton, Pa.—Improvements costing about $50,000 contemplated by Zion's Reformed Church.

Norfolk, Va.—Plans being prepared by Ferguson, Carlow & Wrenn for a theater to be erected on Park Avenue; cost $35,000.

Clarksburg, W. Va.—Plans prepared for erection of an edifice at W. Main and Chestnut Streets for Congregation of St. Paul's Methodist Church; cost about $35,000. William H. Fogiesong, Pastor.

Huntington, W. Va.—Contract will soon be let by Verus T. Ritter, Archt., First Natl. Bank Bldg., for 7-story, reinforced concrete and terra cotta store and office building to be erected on Fourth Avenue for Miller-Ritter Estate. Probable cost, $5[illegible].

Plans being completed by L. J. Dean, Foster Bldg., for 4-story and basement, brick apartment house to be erected on Sixth Street for Mrs. T. W. Dinkins, 509 W. 110th Street, New York.

Macon, Ga.—C. K. Lawrence, Ch. Engr., Central of Georgia Ry., filed plan with State Railroad Comn., Atlanta, for the $1,000,000 Union Passenger Station to be erected in Macon.

Columbus, Ohio.—Preliminary plans submitted by Rev. E. S. Mathney, for a reinforced concrete and brick, 3-story semi-office building, to be erected for Ohio Central M.E. Church, known as Wesley Chapel, Broad and 4th Streets. Probable cost $300,000.

Cleveland, Ohio.—Reported plans being prepared for 6-story office building to be erected at Euclid Avenue and E. Ninth Street to cost at least $200,000. Frank H. Ginn, Attorney, Williamson Bldg., Cleveland, may be able to give further information.

Neenah, Wis.—Plans completed by Edw. Bergstrom, 520 N. Vermont Avenue, Los Angeles, for 4-story and basement, brick or concrete and terra cotta hotel, to be erected at Wisconsin Avenue and Walnut Street for Merchants' & Manufacturers' Assoc.

Highland Park (P. O. Des Moines), Iowa. — Highland Park Presbyterian Church will erect edifice on site of present building, Fourth Street and Euclid Avenue.

Duluth, Minn.—Duluth Council, No. 447, Knights of Columbus, contemplate erecting a lodge building at Second Street and Third Avenue. Cost about $75,000.

Fargo, N. D.—The Rumely Products Co. reported taking steps to erect on N. Pacific Avenue and Second Street a concrete three-story building costing $100,000.

Beaumont, Tex.—Likens P. Ogden, owner of the two-story building at Pearl and Crockett Streets, intends erecting five additional stories to said building. Steel columns will be used and the cost will be about $85,000. Cook & Co., Archts., Beaumont.

Galveston, Tex.—Detailed plans and specifications being prepared for 4-story, reinforced concrete combined bathhouse and amusement center, to be erected at Tremont Street and Avenue Q, for Galveston Natatorium Co.

Seattle, Wash.—Reported contract will soon be let by Northern Bond & Mortgage Co., Central Bldg., for erecting 5-story, 60x120 ft. reinforced concrete and brick addition to Raleigh Hotel, Fourth Avenue and Pike Street. Cost $75,000.

I. B. Johnson, 3838 Evanston Avenue, will erect 3-story 120x120 ft. brick and concrete apartment house at Summit Avenue and University Street, for Kreelscheimer & Frye, 202 First Avenue South. Probable cost $75,000.

Contract about to be let by F. F. Travis, Archt., Raleigh Hotel, for 3-story, stone, 92 x 100 ft., apartment house at Twelfth Avenue and Spruce Street for John D. Morrissey; cost about $50,000.

Marshfield, Ore.—Houtaling & Dougan, Portland, will prepare plans for 3-story, 50 x 100 ft. brick and terra cotta lodge building to be erected for the Elks; cost about $60,000.

BIDS DESIRED.

Charleroi, Pa.—Until Sept. 27 by Harry Zellers, Secy. Bldg. Com. Charleroi Aerie No. 390, Fraternal Order of Eagles, for erecting brick club building for said order. J. A. Lohman, Archt., Monessen.

Richmond, Va.—Reported desired until Oct. 1, by Carneal & Johnston, Archts., National Bank Bldg., for erecting 6-story 80x80 ft. brick and concrete warehouse for Baldwin & Brown. Probable cost $30,000.

Oberlin, Ohio.—Reported desired until Sept. 30 by W. H. Nicklas, Archt., Euclid Building, Cleveland, for erecting 2-story and basement 60 x 100 ft. edifice for First Baptist Church, Oberlin. (Rev. H. I. Tillotson, Pastor, 148 N. Main Street.)

Dubuque, Iowa.—Until Sept. 30 by Secretary Y. M. C. Assoc. for erecting three-story fireproof building; cost $35,000. Cyrus D. McLane, Archt., Rock Island, Ill.

Seattle, Wash.—Reported desired until Sept. 27 by George W. Lawton, Archt., Alaska Building, for erecting 3-story masonic temple at Harvard Avenue. Probable cost, $150,000.

PRICES AND LETTINGS.

★*Indicates awarded contract.*

★**Washington, D. C.**—Contracts awarded Irwin & Leighton, Dime Savings Bank Bldg., Detroit, Mich., for erecting at John Marshall Place and Pennsylvania Avenue, 6-story, 139 x 166 x 125 ft. Bedford stone salesroom and service building for Ford Motor Co., Detroit, Mich. Total probable cost, $221,200.

★**Hopkinsville, Ky.**—Contract for erecting Bowling Green stone edifice on S. Main Street for Southern Methodist Congregation, awarded to Forbes Mfg. Co., Hopkinsville, at $48,975. John Gaisford, Memphis, Tenn., Archt.

★**Louisville, Ky.**—Contract awarded Bailey & Koerner, Louisville, for erecting reinforced concrete, brick and terra cotta 10-story addition to and raising present Tyler Hotel 2 stories. Total cost, about $250,000. D. X. Murphy & Bro., Archts., Louisville.

★**Piqua, Ohio.**—Contract awarded A. M. Fry, Piqua, for erecting one-story office and laboratory building for George Rundle on North Main Street; cost $25,000.

★**Grand Rapids, Mich.** — Contracts awarded Hause-Owens-Ames Co., for constructing the foundation, and to Golden-Boter Co., for excavating of site for the 13-story building to be erected for the Grand Rapids Savings Bank.

★**Galesburg, Ill.**—Contract awarded Henry W. Horst, Rock Island, at about $25,000 for erecting 3-story fireproof hotel at Main and Kellogg Sts., for Churchill Hardware Co. C. D. McLane, Archt., Rock Island.

★**Peoria, Ill.**—Contract awarded Kuhn & Menley, Champaign, at about $55,000, for 3-story, 72x120 ft. brick and stone edifice for Central Christian Church.

★**Seattle, Wash.**—Contract for erecting 4-story fireproof 46 x 108 ft. concrete building at Second Avenue and Virginia Street for Puget Sound News Co., awarded to A. W. Quist, Hoge Building, at about $55,000. Bebb & Gould, Denny Building, Archts.

★**Spokane, Wash.** — Contract awarded W. J. Hog & Co., Spokane, for erecting five-story reinforced concrete warehouse at Wall Street and Railroad Avenue for Powell Sanders Wholesale Grocery Co.; cost $100,000.

NEW INDUSTRIAL PLANTS

PROPOSED WORK.

Hartford, Conn.—Chamber of Commerce voted to erect factory building. Thomas J. Kelleyn, of Special Bldg. Com., may be able to give further information.

Hartford, Conn.—The S. K. F. Ball Bearing Co. will erect plant near tracks of N. Y., N. H. & H. R.R. for manufacture of ball bearings. Cost $2,000,000. B. M. W. Hanson, Hartford, interested.

Brooklyn, N. Y.—Plans completed by M. Joseph Harrison, 63 Park Row, New York, for 4-story and basement, semi-fireproof, factory building to be erected at Atlantic Avenue and Cleveland Street, for P. & L. Contracting Co. Estimated cost, $75,000.

Camden, N. J.—Armstrong Cork Co. contemplate erecting brick and concrete, 94 x 228 ft. building. Henry Boettcher, Archt., Lancaster, Pa.

Ardmore, Pa.—Autocar Co. contemplate erecting 5-story, reinforced concrete and brick factory building. Probable cost, $75,000. Stearns & Castor, Archts., Stephen Girard Bldg., Philadelphia.

Manheim, Pa.—Plans completed for a 200-100 ft. factory, to be erected for U. S. Asbestos Co., Manheim. New machinery will be installed.

Philadelphia, Pa.—Contract soon to be let for erecting addition to plant of Hess-Bright Mfg. Co. Watson & Huckle, Archts., 1211 Walnut Street

Contract will soon be let for erecting addition of about 130,000 sq. ft. floor space to plant of American Ice Co., Sixth and Arch Streets, at Belfield Avenue and Reading Ry., Germantown.

Baltimore, Md.—Baltimore Tube Co., Wicomico and Ostend Streets, intend erecting one-story, brick, 141 x 77 ft. tube mill at Wicomico and Raymond Streets.

Roanoke, Va.—Norfolk & Western R. R. Co. reported considering erecting grain elevator, capacity 2,000,000 bushels. Cost $1,000,000.

Concord, N. C.—Plans being prepared for cotton mill to be erected by Norcutt Cotton Mills (W. G. Broadfoot, Secy.).

New Orleans, La.—Board of Port Commission authorized Ford, Bacon & Davis, their engineers, to secure bids on a grain dryer, capacity 2000 bushels per hour, standard type, for the million dollar grain elevator.

Canton, Ohio.—United Steel Co., it is reported, will erect two additions to its Canton plant; cost, $50,000.

Warren, Ohio.—Plans completed by Trumbull Steel Co., Youngstown (Jonathan Warner, Pres.), for additions to its plant at Warren as follows: 80 ft. addition to sheet bar mill; erecting new bar mill; 380 ft. addition to main building; new building 420 ft. long for annealing department, and another 400 ft. long for galvanizing department.

Chicago, Ill.—Plans being prepared by Alfred S. Alschuler, 28 E. Jackson Boulevard, for factory for Hump Hair Pin Co., to be erected at Prairie Avenue and Twentieth Street. Cost, $250,000.

Minneapolis, Minn.—Borne Aeroplane Co. incorporated by Walter R. Hauser, 4140 Thiry-third Avenue C., and Arthur R. Borne, 433 Andrews Building, to erect factory for manufacture of aeroplanes, hydroplanes, etc.

Galveston, Tex.—Armour & Co., it is reported, will rebuild plant recently destroyed by fire at Tremont St. and Avenue A. It will be 2 stories, reinforced concrete, waterproof and fireproof, equipped with electric elevators and improved refrigerating system; cost, $60,000.

Denver, Colo.—Reported Midwest Refining Co., Denver (Henry M. Blackmer, Vice-Pres.), intends erecting a refinery, daily capacity 5000 bbl.

Seattle, Wash.—Contract will soon be let by Port of Seattle Comrs. (J. R. West, Engr.) for refrigeration equipment for 7-story, 150 x 200-ft. ice and cold storage building at East Waterway Terminals; cost, about $105,000; also for 4-story, 90 x 268-ft. reinforced concrete addition to Whatcom Avenue warehouse, foot of Lander Street; cost, about $150,000.

Ford Motor Co., Detroit, contemplates erecting an extension to Seattle Assembling Plant; cost about $100,000.

Portland, Ore.—Oregon Packing Co., Portland, reported will erect plant for packing fruit and vegetables in Kenton Dist.; probable cost, $150,000.

Pomona, Cal.—Indian Hill Citrus Assoc. intends erecting a pre-cooling plant; probable cost, $50,000.

BIDS DESIRED.

Newton Center, Mass.—Reported desired until Sept. 30 by Norton & West, Archts., 16 State Street, Boston, for erecting Ice House for Crystal Lake Ice Co., Newton Center.

Newbern, N. C.—Reported desired until Oct. 5 by Bd. Alderman, for erecting and operating a sanitary abattoir. F. T. Patterson, City Clerk.

PRICES AND LETTINGS.
★Indicates awarded contract.

★**Baltimore, Md.**—Reported contract awarded George A. Fuller Co., Washington, D. C., for erecting vinegar plant near Curtis Bay. Cost about $600,000.

★**Sparrows Point, Md.**—Contract awarded Raymond Concrete Piling Co., 140 Cedar Street, New York, for substructure and piling of 180x425 ft. machine shop of Marine Dept., Maryland Steel Co. Building to cost approximately $500,000.

★**Waterloo, Iowa.**—Contract awarded T. S. Leake & Co., 608 S. Dearborn Street, Chicago, Ill., at about $181,000 for improvements and extension to Illinois Central shops.

★**Tacoma, Wash.** — Contract awarded Cornell Bros., Savage Scofield Building, for erecting four steel buildings at plant of Tacoma Smelting & Refining Co.; cost about $250,000.

MISCELLANEOUS

PROPOSED WORK.

Transmission Lines — Athens, Ohio.—Athens Electric Co. said to be contemplating extending its transmission lines throughout the city. Page C. Morris, Gen. Mgr.

Subway—New Carlisle, Ind.—County Comrs. at South Bend and Lincoln Highway Assoc. reported considering building subway beneath three railroads east of New Carlisle.

Transmission Line—Wall Lake, Iowa.—Reported bonds amounting to $7,500 have been voted to be used for improvements, including building of transmission line. Address City Clerk.

Causeway—Galveston, Tex.—The officials of the railroads entering Galveston, have decided to extend 1000 ft. the reinforced concrete archway of the causeway that opens Galveston Bay; cost approximately $1,500,000. F. Merrill, Ch. Engr., Gulf, Colorado & Santa Fe Ry., Galveston, may be able to give information.

Subway—Denver, Colo.—Plans prepared by Van Sant-Houghton Co., San Francisco, Cal., for a cattle subway to be constructed by Union Pacific R. R. Co. under tracks at Denver Union stockyards; cost, $10,000.

Transmission Lines—Chinook, Wash.—Co. Comrs. granted franchise to E. S. Lakeman of Chinook to construct transmission lines over Columbia North Bank Road and Prest Road.

Filling Trestles—Seattle, Wash.—Reported the Chicago, Milwaukee & St. Paul Ry. Co. (C. F. Loweth, Ch. Engr., Chicago, Ill.) will fill timber trestles on its main line between Seattle and Tacoma; estimated cost $300,000.

Transmission Lines — Toronto, Ont.—The Hydroelectric Power Comn. of Ontario will construct transmission lines as follows: From Chatham to Petrolea and thence to Oil City, a distance of 24 miles; from Granton to Kirkton and thence to Exeter, about 25 miles, and from Lucan to Ailsa Craig, 10 miles.

BIDS DESIRED.

Elevator—Albany, N. Y.—See "Public Buildings."

Hoists—Washington, D. C.—Until Oct. 23 by Chief of Engineers, U. S. A., Washington, D. C., for 12-in. projectile hoists, advertised in Engineering Record.

Seawall-Bay St. Louis, Miss.—Reported desired until Sept. 29, by Seawall Comrs., Dist. No. 1 (Chas. G. Moreau, Pres.), for constructing seawall on beach front from Bay St. Louis, Waveland dividing line to northeast line of Waveland Terrace. About 7500 ft. long.

Tunnel Piping and Elevator—Chicago, Ill.—Until Sept. 28 by Dept. Pub. Wks. (W. R. Moorhouse, Comr.), for furnishing material and installing a complete piping system in the tunnels and buildings of Marshall Boule. Municipal Plant; also separate bids, Sept. 30, for furnishing material, constructing and erecting complete in the carpenter and paint shops buildings at Marshall Boule. Municipal Plant one direct connected freight elevator.

Copper Wire, Etc.—Panama.—Until Oct. 6 by Maj. F. C. Boggs, General Purchasing Officer, Panama Canal, Washington, D. C., for cir. 970—Copper wire, copper, steel and brass tubing, valves, etc.

Panama.—Until Oct. 6, by Maj. F. C. Boggs, General Purchasing Officer, Panama Canal, Washington, D. C., for cir. 970—Copper wire, copper, steel and brass tubing, valves, etc.

Locomotive Jib Crane—Panama.—Until Nov. 3, by Maj. F. C. Boggs, Corps Engrs., U. S. A., General Purchasing Officer, The Panama Canal, Washington, D. C., for one locomotive jib crane, 50 gross ton capacity, for Dry Dock No. 1, Balboa Terminals, Circular 973, advertised in Engineering Record.

PRICES AND LETTINGS.
★Indicates awarded contract.

★**Transmission Line—Milford, N. H.**—Contract reported awarded Fred T. Ley & Co., Springfield, Mass., for constructing transmission line between Milford and Townsend, Mass., for Milford Electric Light & Power Co.

★**Pier—Brooklyn, N. Y.**—Following are four lowest bids opened Sept. 17 by R. A. C. Smith, Comr. of Docks, Pier A, Battery Place, New York, for constructing freight shed at foot of Thirtieth Street, Boro. Brooklyn: Snare & Triest Co., Woolworth Building, New York, $213,370; Conners Bros. Co., 64 W. 88th Street, $213,850; Post & McCord, Inc., 101 Park Avenue, $216,760; Simon Russer, Inc., 261 Broadway, $219,750. Contract awarded Snare & Triest, Woolworth Building.

Steel Cranes, Etc.—New York, N. Y.—Contract awarded Terry & Tench Co., Inc., New York City, as follows: Two shipyard cranes for Harlan-Hollingsworth Corp.; also steel works on nine-story building at 33 W. Forty-sixth Street for Ritz Realty Co.; also reinforcing floor system of Willis Avenue bridge across Harlem River for purpose of operating Third Avenue railway trolley cars across that bridge.

Pier Shed—New York, N. Y.—Following are four lowest bids opened Sept. 21 by R. A. C. Smith, Comr. Docks, Pier A, Battery Place, for constructing pier shed at West Twenty-third Street, North River, borough of Manhattan: Thomas J. Waters Co., 271 West 125th Street, $36,600; G. E. Tiet Co., $37,218; Simon Russek, Inc., 261 Broadway, $37,440; Post & McCord, 101 Park Avenue, $37,978.

Gradings — Trenton, N. J. — Contract awarded Robert W. Smith Corporation, 50 Church St., N. Y., for 20,000 cu. yd. filling and grading on land in rear of state capitol.

★**Waterproofing Pier—Baltimore, Md.**—Contract awarded by Bd. Awards to Minwax Co., 18 East Forty-first Street, New York, for waterproofing roof of recreation pier at $10,160.

★**Track Elevation Work—Fort Wayne, Ind.**—Contract for constructing city's portion of work to be done under track elevation Resolution No. 12., awarded Moellering Constr. Co., Ft. Wayne, at about $28,000. H. W. Becker, Clerk, Dept. of Pub. Wks.

Dock—Detroit, Mich.—Following are reported bids opened Sept. 14 by Parks & Blvd. Dept. for municipal dock to be built at foot of West Grand Blvd.: A. J. Duplus Co., $22,659; John Ginzel, $28,261; Candler Dock & Constr. Co., $26,503, and Great Lakes Dock & Dredg. Co., $30,511.

★**Transmission Line—Elizabeth, Ill.**—Contract awarded to T. G. Hamilton Co., Laporte, Ind., for constructing three miles transmission line, substation distribution system, at $5,660. A. J. Nichols, Secy., Elizabeth Light & Power Co.

Ditch—Bermidji, Minn.—All bids opened Sept. 13 for constructing Judicial Ditch No. 30 have been rejected by county commissioners. New bids to be asked. Probable cost $244,142. J. L. George, Co. Aud.

★**Street Car Tracks—Kansas City, Mo.**—Contract for street car track on Fourteenth, Forty-eighth, Twenty-first and other streets for Metropolitan Street Railway Co. awarded Columbia Constr. Co.

★**Doors on Shed—San Francisco, Cal.**—Contract for constructing rolling doors on shed of Pier No. 22 awarded Kinnear Mfg. Co., San Francisco, at $6,330. Leo. V. Merle, Jr., Secy. Bd. State Harbor Comrs.

Proposals

For Proposals Advertised, see Pages 45, 46 and 47.

WATERWORKS.

Bids Close.		See Eng. Record.
Sep. 27.	Well, Hastings, Neb. Adv. Aug. 28.	Aug. 28
Sep. 27.	Tank, Amboy, Ill. Adv. Sept. 18.	Sep. 11
Sep. 28.	Cont. 161, New York, N. Y.	Sep. 11
Sep. 28.	Boilers, Pumps, Etc., Benton, Ark.	Sep. 25
Sep. 28.	Reservoir, Jasper, Minn.	Sep. 25
Sep. 29.	Air Compressors, Engines, Etc., Clearwater, Fla.	Sep. 25
Sep. 30.	Pumping Equipment, Philadelphia, Pa.	Sep. 11
Sep. 30.	Hydrants, Washington, D. C.	Sep. 11
Sep. 30.	System, South Charleston, Ohio. Adv. Sep. 18.	Sep. 18
Oct. 1.	System at Univ., Wilberforce, Ohio	Sep. 11
Oct. 1.	Water Works, Mimico, Ont.	Sep. 25
Oct. 4.	Mains, Minot, N. D. Adv. Sep. 25.	Sep. 25
Oct. 5.	Reservoir, Tamaqua, Pa. Adv. Sep. 11 to 25.	Sep. 11
Oct. 5.	Pumps, Engines, Etc., Sidney, Iowa	Sep. 25
Oct. 6.	System, Luverne, Iowa. Adv. Sep. 18.	Sep. 18
Oct. 6.	Wells, Middletown, Ohio.	Sep. 25
Oct. 7.	Service System, Coatesville, Pa. Adv. Sep. 18, 25.	Sep. 18
Oct. 11.	Pump Unit, Washington, D. C.	Sep. 25
Oct. 12.	Valves, etc., Toronto, Ont. Adv. Sep. 18.	Sep. 18
Oct. 12.	Centrifugal Pumps, Etc., Lumberton, N. C.	Sep. 25
Oct. 12.	Water Works Improv., Monticello, Ind.	Sep. 25
Oct. 21.	Gas Engines, Clarksburg, W. Va. Adv. Sep. 25.	Sep. 25
Nov. 9.	Water Wks., Belleville, Ohio	Sep. 11
———	Well, Thomasville, Ala. Adv. Aug. 28.	Aug. 28

SEWERAGE AND SEWAGE DISPOSAL.

Sep. 28.	Toronto, Ont.	Sep. 25
Sep. 28.	Toledo, Ohio	Sep. 25
Sep. 29.	Philadelphia, Pa. Adv. Sep. 18.	Sep. 18
Sep. 29.	Boston, Mass.	Sep. 25
Sep. 30.	Newark, N. J.	Sep. 25
Sep. 30.	Long Island City, N. Y.	Sep. 25
Oct. 1.	Culpeper, Va.	Sep. 18
Oct. 4.	Minot, N. D. Adv. Sep. 25.	Sep. 25
Oct. 4.	Glen Gardner, N. J. Adv. Sep. 18.	Sep. 18
Oct. 5.	Algona, Iowa	Sep. 25
Oct. 6.	Visalia, Cal.	Sep. 25
Oct. 7.	Atlantic City, N. J. Adv. Sep. 18.	Sep. 18
Oct. 7.	Lincoln, Neb.	Sep. 25
Oct. 8.	North Chattanooga, Tenn. Adv. Sep. 18	Sep. 18
Oct. 11.	South Bound Brook, N. J. Adv. Sep. 25.	Sep. 25
Oct. 11.	Roslyn, Wash.	Sep. 25
Oct. 14.	Mansfield, Ohio	Aug. 28
Oct. 19.	Beaumont, Tex. Adv. Sep. 18, 25.	Sep. 18

BRIDGES.

Sep. 28.	Greensburg, Pa.	Sep. 4
Sep. 28.	Maryland	Sep. 18
Sep. 29.	Keosauqua, Iowa	Sep. 18
Sep. 29.	Maine	Sep. 25
Sep. 29.	Philadelphia, Pa. Adv. Sept. 18.	Sep. 18
Sep. 30.	Pennsylvania	Sep. 18
Sep. 30.	Phoenixville, Pa. Adv. Sep. 18, 25.	Sep. 18
Oct. 1.	Xenia, Ohio	Sep. 25
Oct. 4.	Batavia, Ohio	Sep. 25
Oct. 4.	Greensburg, Ind.	Sep. 25
Oct. 4.	Conklin, N. Y.	Sep. 25
Oct. 4.	Columbia, Miss.	Sep. 25
Oct. 5.	Salem, Ind.	Sep. 25
Oct. 5.	Maine	Sep. 25
Oct. 6.	Lawrence, Kan. Adv. Aug. 14 to Sep. 25.	Aug. 14
Oct. 6.	Manhattan, Kan.	Sep. 18
Oct. 7.	Bakersfield, Cal.	Sep. 25
Oct. 12.	Beaufort, S. C. Adv. Sep. 18.	Sep. 18
Oct. 12.	Waukon, Iowa	Sep. 25
Oct. 27.	Glenfield, Pa.	Sep. 25

PAVING AND ROADS.

Sep. 28.	Kansas City, Mo.	Sep. 11
Sep. 28.	Maryland	Sep. 18
Sep. 29.	Brooklyn, N. Y.	Sep. 25
Sep. 30.	Newark, N. J.	Sep. 18
Sep. 30.	Akron, Ohio	Sep. 25
Sep. 30.	Las Vegas, N. M.	Sep. 25
Sep. 30.	Long Island City, N. Y.	Sep. 25
Oct. 1.	Indiana	Sep. 25
Oct. 1.	Hackensack, N. J.	Sep. 25
Oct. 1.	Idaho	Sep. 25
Oct. 1.	Creston, Iowa	Sep. 25
Oct. 2.	Jacksboro, Tenn.	Sep. 18
Oct. 4.	Indiana	Sep. 18
Oct. 4.	Indiana	Sep. 25
Oct. 4.	Minot, N. D. Adv. Sep. 25.	Sep. 25
Oct. 4.	Mount Union, Pa. Adv. Sep. 25.	Sep. 25
Oct. 4.	Mitchell, S. D.	Sep. 25
Oct. 5.	St. Louis, Mo.	Sep. 18
Oct. 5.	Winamac, Ind.	Sep. 18
Oct. 5.	Indiana	Sep. 25
Oct. 6.	Shelbyville, Ind.	Sep. 25
Oct. 6.	West Hoboken, N. J.	Sep. 25
Oct. 6.	Freehold, N. J.	Sep. 25
Oct. 7.	Jersey City, N. J.	Sep. 18
Oct. 7.	Bakersfield, Cal.	Sep. 25
Oct. 7.	Independence, Kan.	Sep. 25
Oct. 7.	Newark, N. J.	Sep. 25
Oct. 8.	Indiana	Sep. 18
Oct. 8.	Cumberland Gap, Tenn.	Sep. 25
Oct. 8.	Columbus, Ohio	Sep. 25
Oct. 9.	Indiana	Sep. 25
Oct. 9.	Racine, Wis.	Sep. 25
Oct. 19.	Logansport, Ind.	Sep. 25
Oct. 19.	Beaumont, Tex. Adv. Sep. 18. 25.	Sep. 18
Oct. 28.	Granville, Ohio	Sep. 25

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS.

Sep. 28.	Terminal Contr. 47 and 49, Albany, N. Y. Adv. Aug. 28 to Sep. 25.	Sep. 4
Sep. 28.	Levee Work, New Orleans, La.	Sep. 25
Oct. 1.	Dikes, Etc., Cathlamet, Wash.	Aug. 28
Oct. 1.	Bulkhead Shed, San Juan, P. R. Adv. Sep. 4 to 25.	Sep. 4
Oct. 1.	Ditch, Galloway, Ohio.	Sep. 18
Oct. 1.	Drainage, Pocahontas, Ark.	Sep. 18
Oct. 1.	Repairs to Wharf, Fort De Sota, Fla.	Sep. 18
Oct. 1.	Dam, Salt Lake City, Utah	Sep. 25
Oct. 2.	Dredging, New London, Conn.	Sep. 25
Oct. 4.	Bulkhead, Keansburg, N. J.	Sep. 25
Oct. 6.	Ditch, Swifton, Ark.	Sep. 18
Oct. 6.	Harbor Improv., Albany, N. Y.	Sep. 25
Oct. 12.	Irrigation Work, St. Ignatius, Mont. Adv. Sep. 18.	Sep. 18
Oct. 20.	Irrigation Work, Montrose, Col. Adv. Sep. 25.	Sep. 25
Oct. 20.	Irrigation Work, Powell, Wyo.	Sep. 25
Oct. 21.	Channel Work, Chicago, Ill. Adv. Sept. 25.	Sep. 25
Oct. 22.	Dry Dock Gate, Louisville, Ky. Adv. Sept. 25.	Sep. 25
Nov. 8.	Dredge, Jacksonville, Fla. Adv. Sep. 11 to 25.	Sep. 11

PUBLIC BUILDINGS AND SCHOOLS.

Sep. 28.	Harrisburg, Pa. Adv. Aug. 21, 28.	Aug. 21
Sep. 28.	Pleasantville, N. J.	Sep. 18
Sep. 28.	Elmhurst, Ill.	Sep. 18
Sep. 28.	Morris, Minn.	Sep. 25
Sep. 29.	Smyrna, Del.	Aug. 28
Sep. 29.	Hoboken, N. J.	Sep. 18
Sep. 29.	Grand Rapids, Mich.	Sep. 25
Sep. 29.	Toccoa, Ga.	Sep. 25
Sep. 30.	Washington, D. C. Adv. July 24, 31.	July 24
Sep. 30.	Tulsa, Okla.	Aug. 28
Sep. 30.	Elizabeth, N. J. Adv. Sept. 4, 11.	Sep. 4
Sep. 30.	Tompkinsville, N. Y.	Sep. 11
Sep. 30.	El Paso, Tex.	Sep. 25
Sep. 30.	Johnson City, Tex.	Sep. 25
Sep. 30.	Chelsea, Mass.	Sep. 25
Sep. 30.	Norton, Kan.	Sep. 25
Sep. 30.	Sidney, Neb.	Sep. 25
Sep. 30.	Eldora, Iowa	Sep. 25
Sep. 30.	Woodsfield, Ohio.	Sep. 25
Oct. 1.	Kalamazoo, Mich.	Aug. 28
Oct. 1.	Toledo, Ohio	Sep. 11
Oct. 1.	Lanyon, Iowa	Sep. 25
Oct. 2.	Marion, Ohio	Sep. 18
Oct. 4.	Marion, Ohio	Sep. 18
Oct. 4.	Carbondale, Pa.	Sep. 18
Oct. 4.	Upper Alton, Ill.	Sep. 18
Oct. 4.	Oswego, N. Y. Adv. Sep. 18, 25.	Sep. 18
Oct. 4.	Providence, R. I.	Sep. 25
Oct. 4.	Skillman, N. J.	Sep. 25
Oct. 4.	Scranton, Pa.	Sep. 25
Oct. 4.	Baker, Mont.	Sep. 25
Oct. 4.	Sedro-Woolley, Wash.	Sep. 25
Oct. 4.	Gatesville, Tex.	Sep. 25
Oct. 5.	Glenwood, Minn.	Sep. 18
Oct. 5.	Albany, N. Y.	Sep. 25
Oct. 5.	Oakland, Cal.	Sep. 25
Oct. 6.	Jefferson, Iowa	Sep. 25
Oct. 7.	Wilmington, N. C.	Sep. 11
Oct. 7.	Jersey City, N. J.	Sep. 18
Oct. 7.	Findlay, Ohio	Sep. 18
Oct. 8.	Boston, Mass.	Sep. 4
Oct. 11.	Watertown, Wis.	Sep. 25
Oct. 11.	Lexington, Va.	Sep. 25
Oct. 13.	Naugatuck, Conn.	Sep. 11
Oct. 14.	Wilkesboro, N. C.	Sep. 11
Oct. 15.	Moberly, Mo. Adv. Sep. 18, 25.	Sep. 18
Oct. 16.	Denton, Tex.	Sep. 18
Oct. 16.	Washington, D. C.	Aug. 28
Oct. 16.	Pensacola, Fla.	Sep. 25
Oct. 18.	Rock Rapids, Iowa.	Sep. 25
Oct. 18.	Dixon, Ill.	Sep. 25
Oct. 19.	Norton, Va.	Sep. 11
Oct. 19.	Oxford, Ohio	Sep. 25
Oct. 27.	Newcastle, Ind.	Sep. 25
Oct. 27.	Monongahela, Pa.	Sep. 25
Oct. 28.	Kirksville, Mo. Adv. Sep. 25.	Sep. 25
Oct. 30.	Seymour, Ind.	Sep. 25

PRIVATE BUILDINGS.

Sep. 27.	Charleroi, Pa.	Sep. 25
Sep. 30	Dubuque, Iowa	Sep. 25
Sep. 30.	Oberlin, Ohio	Sep. 25
Oct. 1	Richmond, Va.	Sep. 25

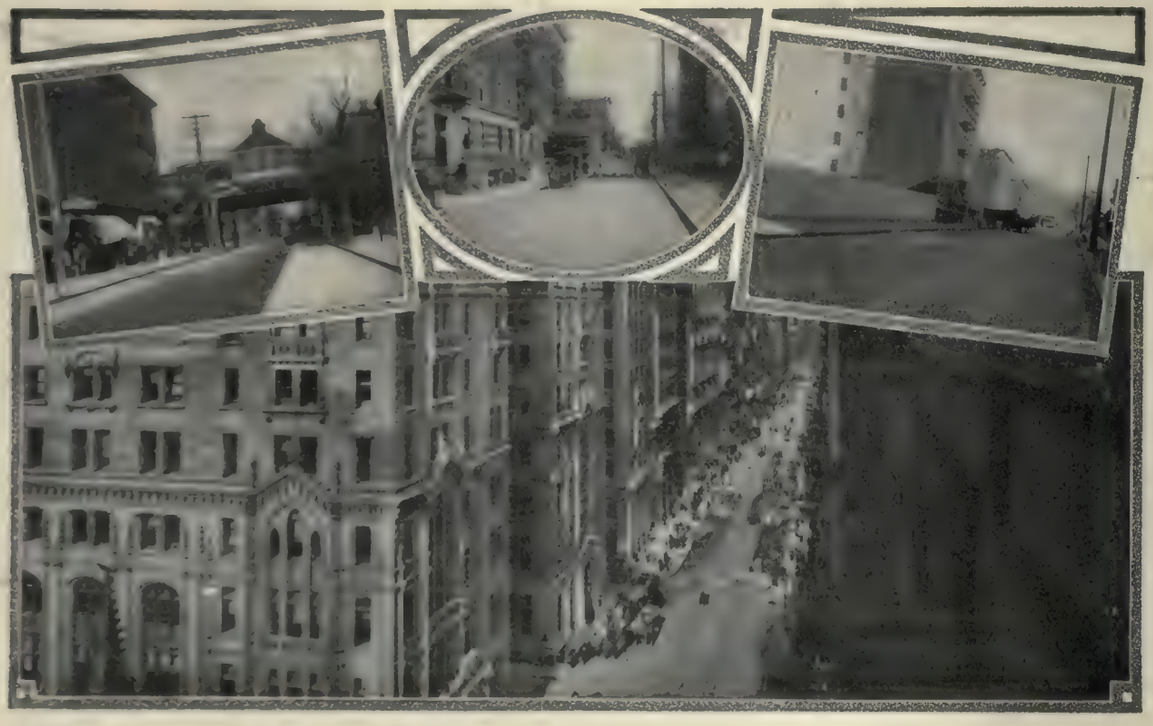
NEW INDUSTRIAL PLANTS.

Sep. 30.	New Center, Mass.	Sep. 25
Oct. 5.	Newbern, N. C.	Sep. 25

MISCELLANEOUS.

Sep. 28.	Tunnel Piping, Chicago, Ill.	Sep. 25
Sep. 29.	Seawall, Bay St. Louis, Miss.	Sep. 25
Sep. 30.	Electric Elevator, Chicago, Ill.	Sep. 25
Oct. 4.	El. Ry. Franchise, San José, Cal.	Sep. 25
Oct. 6.	Copper, Steel, Etc., Panama	Sep. 25
Oct. 7.	Cement, Portland, Ore. Adv. Sep. 11 to 25.	Sep. 11
Oct. 8.	Mechanical Equipment in Appraisers' Stores, Boston, Mass. Adv. Sept. 4, 11.	Sep. 4
Oct. 8.	Elevator, Boston, Mass.	Sep. 4
Oct. 8.	Garbage Incinerator, Houston, Tex. Adv. Sep. 25.	Sep. 25
Oct. 16.	Pumps, Etc., for Oil Plants, Washington, D. C.	Aug. 28
Oct. 19.	El. Ry., Philadelphia, Pa. Adv. Sep. 18, 25.	Sep. 18
Oct. 23.	Hoists, Washington, D. C. Adv. Sept. 25.	Sep. 25
Nov. 3.	Jib Crane, Panama. Adv. Sep. 25.	Sep. 25
Nov. 17.	Power Plants, Etc., Washington, D. C.	Aug. 28

Wood Block Pavement



Lower Photo Copyrighted, 1913, by Underhill, N. Y.

Varied tests in New York

New York City affords every possible kind of paving condition. The Borough of Richmond (Staten Island), for instance, is largely rural. It has three miles of Wood Block pavement. The Commissioner of Public Works, Mr. W. L. Tribus, said: "Aside from its noiselessness of traffic, Creosoted Wood Block Paving is to be commended on account of its low traction resistance, long life, small cost of maintenance and cleanliness."

Queens Borough, also largely rural, has about five miles of Wood-paved streets, which the engineer says have been uniformly satisfactory.

In the Boroughs of Brooklyn and the Bronx, with general city traffic, there are large and steadily increasing areas of Wood pavement, the controlling reason for its selection being its low ultimate cost.

In Manhattan, with intense metropolitan traffic, Wood Pavement is employed all through the office building district in order to bring some degree of peace to that busy section. The pavement is exceedingly popular there with both property owners and business men. The streets which receive heavy traffic, particularly those near the ferries and docks, are also Wood-paved, the chief reason being the superior durability of wood. It will outlast even granite blocks.

Under all conditions, from the quiet, elm-shaded streets of Flushing in Queens Borough, to Broadway and the Battery, Wood Block pavements have made good in New York City.

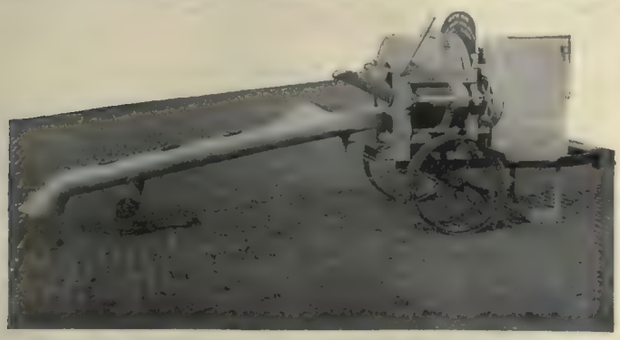
Write for free booklets.

U. S. WOOD PRESERVING COMPANY

165 Broadway, New York City

One Man Can Move This Grouting Machine from Place to Place

A grouting machine for paving work, that weighs only 1000 lb. and can be operated by one man, has been put on the market by the Marsh-Capron Manufacturing Company, 478 Old Colony Bldg., Chicago. It is equipped with a 2-hp. gasoline engine, inclosed in a steel house. The drum is of steel plate and heavy enough, the manufacturer states, to stand long wear. It will discharge easily and quickly. Chains form no part of this mixer, which is driven by means of cut gears, direct from the engine shaft. The frame is constructed of steel channels, riveted together and strongly braced. A rolled steel channel forms the track upon which the drum revolves. The distributing spout, which is 6 ft. long, is pivoted and will deliver grout to cover a radius of that length. The width of tires on the truck wheels is 12 in. The drum holds 2 cu. ft. of unmixed material. Convenient handles are provided, and the machine is easily moved from place to place by one man. The Marsh-Capron grouter is about 6 ft. long, exclusive of spout, 5 ft. wide, and 4 ft. 7½ in. high. Its weight is distributed at five points, so balanced as to prevent the possibility of moving or displacing the paving bricks.



MACHINE WILL DELIVER GROUT TO 6-FT. RADIUS

Coal Handling Equipment Has Capacity of 100 Tons Per Hour

A coal handling crane of the gantry or bridge type, of an unusually long span, that has a capacity of 100 tons per hour in unloading coal from car to storage pile, or from pile to conveyor, has recently been installed at the plant of the Scranton Electric Company at Scranton, Pa., by the Whiting Foundry Equipment Company, of Harvey, Ill. The span from center to center of gantry leg is 118 ft. The total height of crane is 53 ft. and the depth of girder is slightly over 12 ft. There is a 50-ft. cantilever at one end. The installation is equipped with a Whiting Foundry Equipment Company's bucket-handling, three-motor trolley. One motor is on the closing line, one on the holding line and one travels the trolley.

Asbestos Concrete Sheets Successfully Used for Roofing and Siding

Cement, reinforced by asbestos fibers, a dense homogeneous structure being secured by an extensive beating together of the materials, with an excess of water, and subsequently building the material up in thin layers on a paper machine and subjecting the sheets to a great pressure, has been successfully used for roofing and siding on various buildings recently constructed. The product, as manufactured by Keasbey & Mattison, of Ambler, Pa., is in corrugated sheets of a uniform width of 27½ in. and in lengths of from 4 to 10 ft. They vary in thickness from 3/16 to 5/16 in. and weigh from 2.8 to 3 lb. per square foot. The corrugations are 2½ in. wide and 1 in. deep, from the top to bottom.

When used for roofing the material is lapped two corrugations sidewise and 6 in. endwise. The best device for attaching the roofing to steel and iron frame work has been found to be aluminum tie wires. The holes are drilled through the sheet, one just above and one just below the purlin, no larger than is necessary to allow space for drawing the wire through. The outer end of each wire is provided with a head similar to that of a wire nail and holds a soft lead washer. The inner ends of the two wires are twisted together around the purlin. In applying the material to wooden purlins iron wire nails and lead washers are used.

The fastening for siding consists of a galvanized iron clip, bent so that the inner end rests over the purlin or other horizontal iron support. The clip is fastened to the corrugated material by two ¼ in. stove bolts, the heads of which are outside and rest against soft iron washers.

Business Notes

Milliken Brothers, Inc., manufacturer and erector of all classes of structural steel, New York, has moved its executive and general offices from the Whitehall Building, New York City, to its plant at Milliken, N. Y. The sales office for the metropolitan district has been moved from the Whitehall Building to the Trinity Building.

The Barr Clay Company, of Streator, Ill., has become a licensee of the Dunn Wire-Cut-Lug Brick Company of Conneaut, Ohio.

The H. W. Johns-Manville Company, manufacturer of asbestos materials, has moved its Chicago office to Michigan Avenue and Eighteenth Street.

The Asbestos Protected Metal Company, of Pittsburgh, has moved its Detroit office from the Chamber of Commerce Building to the Dunne Bank Building.

W. H. P. Fisher has been appointed sales manager of the L. M. Booth Company, manufacturer of Booth water softeners, of New York City.

The Goulds Manufacturing Company, manufacturer of pumps and hydraulic machinery, of Seneca Falls, N. Y., opened a Philadelphia office at 111 Third Street Oct. 1. For this purpose the business of H. E. Trotman, who up to the present has been distributor of the company's pumps in the Philadelphia territory, has been bought and his storeroom and warehouse have been leased. E. S. Jenison, formerly with the Canadian Fairbanks-Morse Company, Montreal, has been appointed manager of the new office, and F. G. Kramer, formerly in the employ of Mr. Trotman, will be assistant manager. Mr. Trotman will continue with the company.

The Chicago Builders' Specialties Company, Chicago, has moved its offices in that city from the Old Colony Building to the Lumber Exchange Building.

The Marsh-Capron Manufacturing Company, Chicago, has moved its offices in that city from the Old Colony Building to the Lumber Exchange Building.

The Mays & Talley Company, Chicago, has taken over the business of the Great Lakes Equipment Company, and will continue to handle contractors' equipment in the Middle Western territory with offices at 14 East Jackson Boulevard.

The Pneumatic Placing Company, manufacturer of pneumatic conveying equipment, of New York City, has moved its offices from 45 Broadway to 2 Rector Street.

The York Bridge Company plant, recently purchased at a receiver's sale by W. H. Miller of Pittsburgh for $31,000, will soon resume operations. It is understood that the purchase was made in the interests of H. R. Hortenstine and C. H. Vaughan, formerly officials of the Penn Bridge Company, at Beaver Falls. The new owners will incorporate as the York Bridge and Construction Company, and it is reported that the new management will begin active operations before the end of the month.

Gordon H. Williams, president of the G. H. Williams Company, manufacturer of clam-shell buckets and steel derricks, of Erie, Pa., was killed in an automobile collision in front of the company's plant at Erie, Sept. 25. He was born in 1851 and first worked at carriage-making. About twenty-nine years ago he became associated with John McMyler in what has since grown into the McMyler Interstate Engineering Company, of Bedford, Ohio. He was with that concern for eighteen years, in charge of its field erection work for a good part of the time. After this he was employed for about a year by the Macbeth Iron Company of Cleveland. He went into business for himself in 1905 with practically no capital and has since built up one of the largest derrick and clam-shell bucket manufacturing concerns in the country.



THREE MOTORS HANDLE MATERIAL ON THIS UNUSUALLY LONG-SPAN CRANE

Trade Publications

Erie Pump & Engine Works, Erie, Pa. Bulletins 29, 30 and 31, 6 x 9 in., 8, 32 and 16 pages respectively, illustrated. Covers Class L. low-head centrifugal pumps, belted and direct connected and sand-gravel-dredging pumps, fittings and high duty centrifugal pumps respectively.

Trussed Concrete Steel Company, Youngstown, Ohio. Circular, 8 x 11 in., 11 pages. Briefly indicates the general uses of Hy-rib, rib-lath, diamond lath, pressed-steel studs, etc. Gives illustrations from the more complete handbooks published by the company.

McKiernan-Terry Drill Company, New York City. Leaflet, 6 x 9 in., 4 pages, illustrated. Describes a spike-driver attachment to type B-1 hammer drills, which may be used for dock, crib or any other heavy timber work.

CONTRACTING NEWS

Of Special Interest to Engineers, Contractors, Builders and Manufacturers of Engineering and Building Supplies

A LOAN to England and France of $500,000,000, underwritten by bankers of this country, has been arranged to restore the foreign exchange market and make it possible for those countries to continue to buy here without paying a heavy premium. This loan, which was arranged on terms highly flattering to the strength of this country's position, will be used to finance the exporting of our surplus foodstuffs and ordinary manufactured products. War supplies will be paid for in cash, as before.

Recent estimates of the increase in building permits for last August over the same period a year ago vary from 11 to 13.7 per cent for the country. The increase is in the larger cities. The value of Chicago building permits for the first three weeks of September nearly doubled that for the same period in 1914, the large number of moderate sized buildings being very noticeable.

Large orders for steel railway cars are said to be pending that will further stiffen the structural steel market in the East. Pittsburgh prices now range from $1.40 to $1.45 per 100 lb. for plates, shapes, bars and structural material. Reports to *The Iron Age* show that fabricator's prices, although still weak, are rising, and that the structural steel situation in the far West is showing improvement.

The cement market is improving, and the Eastern market is fairly strong. Prices recently quoted have been based on a mill price to dealers of $0.90 per barrel for the Lehigh district, $1.00 per barrel for the Hudson River, Ohio and Kansas districts and $1.10 for the Southern district. These prices do not include freight or containers, and prices on sales direct to consumers range from 5 to 10 cents per barrel higher.

Recent retail lumber sales at the Chicago yard have been at $22 to $26 per thousand feet for yellow pine scantlings, $26 for Norway pine and $22 to $25 for hemlock. Timbers up to 8 x 8 in. sold at $25 to $26 for yellow pine, $26 for Norway pine and $35 to $37 for Douglas fir. All prices are for lengths of 20 ft. or less.

Buildings

A contract for the armory at Philadelphia noted recently has been awarded at $134,000. It is reported that the construction of a $450,000 hotel has been contracted for at Evansville, Ind. The contract for erecting a physics laboratory for the University of Wisconsin, at Madison, has been let at $180,000. An automobile plant to cost $250,000 has been contracted for at Omaha. A contract for constructing buildings for a State institution has been awarded by the State of Washington at $227,000. Bids are reported desired Oct. 12 by the Central of Georgia Railway for constructing the $1,500,000 passenger terminal at Macon. It is reported that bids are desired on the same date for constructing a $100,000 armory at Akron, Ohio.

Plans have been filed in New York City for a $275,000 loft building. Plans have been invited for a $500,000 armory at Baltimore, and plans have been completed for an armory to be erected on Lake Shore Drive in Chicago. It is reported that a $500,000 distilling plant will be built at Chester, Pa. Plans are to be prepared for a $700,000 high school in Pittsburgh. Plans have been filed for a $350,000 apartment house in Cincinnati. It is reported that a contract will soon be let for building a $250,000 State normal school at Oshkosh, Wis. A contract will soon be let for building a $500,000 home for the Minnesota Historical Society in St. Paul. A hotel proposed at Dallas, Tex., will cost $500,000.

Bridges and Roads

Bids are desired Oct. 11 by the State highway commissioner of Connecticut for three steel bridges. Bids are desired Oct. 9 for constructing a concrete arch bridge over the Hudson River at Fort Edward, N. Y. Plans have been approved for a bascule bridge over the Saugatuck River at Westport, Conn. The construction of a $150,000 bridge is being considered at Indianapolis. It is reported that a contract will soon be let for the Chouteau Avenue viaduct at St. Louis, to cost $200,000. Citizens of Miami, Fla., have voted in favor of building three bridges across the Miami River. Plans have been completed for a bridge and fill at Portland, Ore., to cost $66,000.

The State of Connecticut has opened bids on highway contracts amounting to $118,000. Bids opened recently for paving work at Philadelphia total $225,000. Paving contracts amounting to $170,000 have been awarded at Newark, N. J. Bids will be opened Oct. 13 at Columbus, Miss., for constructing 51 miles of roads. Bids are desired for considerable paving work at Canton, Ohio. The State of Ohio will open bids Oct. 8 for road work estimated to cost $226,000. Twenty-five additional city blocks are to be paved in the Borough of Manhattan, New York City. Plans have been completed for 25 miles of macadam road to be built near Eureka Springs, Ark.

Waterworks and Sewers

A contract has been awarded at $173,000 for constructing a sewage pumping station at Albany, N. Y. The lowest bid for equipping this station, including motor-generator sets, was $90,000. It is reported that the lowest bid received for constructing a sewer at St. Paul was $95,000. A $150,000 sewer contract has been awarded at Kenosha, Wis. Bids are desired for constructing sewerage systems at Brooklyn, Iowa, and at Compton, Cal. A chief engineer has been selected in connection with the new $12,000,000 water supply proposed for Providence, R. I. A contract will soon be let for laying the $1,500,000 pipe line proposed from Brookdale to Jersey City, N. J. A waterwork system to cost $95,000 is to be built at Wilson, N. C. Plans have been completed for rebuilding a sewer in Portland, Ore., at a cost of $50,000.

Miscellaneous

It is reported that the Southern Railway has awarded contracts for double-tracking 33 miles of line in Virginia. A contract amounting to $121,000 for constructing an irrigation ditch has been awarded at Denver. The lowest bid received at Eureka, Mont., for doing the construction work on an irrigation project was $110,000. The U. S. Government has opened bids for a $122,000 railway, a $151,000 wharf and a $112,000 torpedo-boat station, including four piers; all to be constructed at Pearl Harbor, Hawaii. Bids were received Oct. 1 for constructing a large irrigation canal at Twin Falls, Idaho. Bids are desired Oct. 26 at Albany, N. Y., for constructing a $66,000 barge canal terminal at Syracuse. It is reported from New London, Conn., that the New York, New Haven & Hartford Railroad contemplates a relocation involving extensive improvements. The Erie Railroad is reported to be planning improvements near Valparaiso, Ind., which include double tracking and the elimination of several grade crossings. A $500,000 irrigation reservoir is being planned at Baker, Ore. A contract will soon be let for a $150,000 wharf at Orange, Tex.

WATERWORKS

PROPOSED WORK.

Providence, R. I.—Frank E. Winsor of Providence is chief engineer of new water supply. This work will consist in constructing a storage reservoir and dam covering approximately six square miles, with a watershed of 72 square miles and furnishing 60,000,000 gal. of water daily; an earth dam some 210 ft. in height and about 6 miles of aqueduct in tunnel, filter beds and various other work. Estimated cost of dam, reservoir and tunnel, $12,000,000.

Jersey City, N. J.—Contract soon to be let by City Comsn. to lay a twin pipe line from Brookdale to Jersey City, cost estimated at $1,500,000.

Wildwood, N. J.—Citizens voted in favor of purchasing plant of Wildwood Water Works Co. Improvements will be made by city, including extending extra fire mains.

Pennsylvania.—Following permits issued by State Bd. Health, Harrisburg, Capital C. Dimm, Comr., relative to water works:

Summit Water Supply Company, Beaversdale, Cambria County. Intake dam and supply mains.

Langhorne Sewer Water Company, Langhorne.—Modifications in water filtration plant.

Summit Water Supply Company, Lilly.—Intake dam and extensions to supply lines.

Marsh Creek Water Company, Marsh Creek.—New source of supply from drilled well and reservoir.

Stroudsburg Water Supply Company, Stroudsburg.—Temporary disinfection apparatus.

Youngsville, municipal water works—Distributing system and drilled wells.

Reynoldsville Water Company, Reynoldsville.—Drilled wells.

Summit Hill Water Company, Summit Hill.—Steel standpipe and extensions to distributing system.

Pine Grove, municipal water works—Storage reservoir and gravity supply main.

Hatfield, municipal water works—Distributing system and drilled wells.

Jamestown Water Company, Jamestown.—Drilled wells.

Punxsutawney, Pa.—E. W. Hess, Boro. Engr. of Clearfield, engaged by Punxsutawney to prepare estimates, etc., for submission to Public Service Comn., to secure permission to install municipal water works.

Wilson, N. C.—Water works costing $95,000, street paving $240,000 and gas plant $75,000 are to be constructed in this city. Municipal bonds amounting to $170,000 have been sold. Anderson & Christie, Inc., Charlotte, N. C., Engrs.

Atlanta, Ga.—Reported city will lay 9000 ft. 8-in. main from city limits to the park at Lakewood, cost $74,000, the county supplying labor to dig the ditch. Address City Clerk.

Louisville, Ky.—Louisville Water Co. has rejected all bids opened for laying 6-in. pumping main from Ohio River to Crescent Hill reservoir and will do the work themselves. Lowest bid $27,504.

Athens, Ohio.—Contract soon to be let by Fred Scott, Dir. Pub. Service, for constructing water works, including 2,750,000-gal. concrete reservoir, 25,000-gal. standpipe, air compressor, pipe, etc. Phillip Burges, Engr., Columbus; C. H. Harris, City Clk.

Findlay, Ohio.—Plans prepared by W. C. Musser, Supt. Water Wks., for water mains in West Park to cost about $5,000. Joseph Page, City Clk.

Salem, Ohio.—The W. J. Sherman Co., Toledo, engaged to investigate water resources and submit plans for conservation of a reserve supply for fire protection.

South Charleston, Ohio.—Water works bonds amounting to $30,000 have been sold.

Tiffin, Ohio.—The Tiffin Water Wks. Co. will in 1916 construct a concrete dam 6 ft. high by 277 ft. long. No contract will be let. C. H. Wetter, Supt.

McBain, Mich.—Citizens voted $9,400 bonds for water works.

Platteville, Col.—Citizens voted $20,000 bonds to construct water works.

Brewster, Wash.—Brewster Irrigation District voted $1,250,000 bonds to build about 50 miles of canal, including 25 to 30 miles of flume to deliver water from Methow River by gravity to 15,000 acres of bench land near Brewster. A. Laurgaart, Portland, Ore., consulting engineer.

Colville, Wash.—Council reported to be considering construction of new water system.

Seattle, Wash.—A. H. Dimock, City Engr., submitted plans and specifications to Bd. Pub. Wks. for constructing watermains in Dexter Avenue; cost, $32,000.

Amity, Ore.—Ralph Marvin, City Engr., instructed to prepare plans for water works; cost, $15,000.

Milwaukie, Ore.—Contract, it is reported, will soon be let for extensions to the water system at a cost of $25,000, to include 2 to 8-in. pipe. J. W. Morris, City Engr.

San Francisco, Cal.—High pressure service system to be extended, about $17,000 available. Address City Engineer.

Carey, Idaho.—Plans being prepared by Elmer H. Caldwell, Engr., Salt Lake City, Utah, for reservoir and irrigation system for Little Wood River. Joseph S. Cooper, Cashier Carey State Bank, interested.

St. Hyacinthe, Que.—Citizens voted to construct gravity filters. A. Messier, City Clk.

BIDS DESIRED.

New York, N. Y.—Until Oct. 7 by William Williams, Comr. Water Supply, Gas and Electricity, Manhattan, for furnishing, delivering and laying water mains and appurtenances in Westchester Avenue, from Third Avenue to Southern Boulevard, borough of the Bronx; security $15,000.

New York, N. Y.—Until Oct. 19 by Bd. Water Supply, Municipal Building, New York, N. Y. (Charles Strauss, Pres.), for Contract 166—Erecting two steel frame buildings, galvanized steel covered, for drainage chambers at Shafts 11 and 21, City Tunnel, at Catskill Aqueduct, New York City, advertised in Engineering Record.

Trenton, N. J.—Until Oct. 8 by City Comn. for construction on land of Municipal Colony, Hamilton Township, a pump well with building, and furnishing and placing therein vertical electric motor-driven centrifugal pump, etc. Frank Thompson, City Clk.

Louisville, Ky.—Until Oct. 8 by Bd. Pub. Wks. (Roger G. McGrath, Secy.) for constructing fire hydrants on numerous streets.

Poplar Grove, Ill.—Reported desired until Oct. 12 by Bd. Village Trus. (R. S. Renne, Clk.) for erecting brick and stone pumping station. Hugh M. Price, Engr., 1205 Hartford Building, Chicago.

Kanawha, Iowa.—Until Oct. 15 by F. L. Bush, Mayor, for a 30,000-gal. steel tank on an 80-ft. tower and 7000 ft. 4 to 8-in. main. Charles P. Chase, Engr., Clinton.

Marshalltown, Iowa.—Until Oct. 15 by City Clerk for pumps to be installed in the water works.

Traer, Iowa.—Until Oct. 4 by T. F. Stoakes, Town Clk., for either a rotary, centrifugal or triplex pump, capacity 300 g.p.m. Charles P. Chase, Engr., Clinton.

Galveston, Tex.—Until Oct. 14 by Bd. City Comrs. (John D. Kelley, Secy.), for installing a submerged 30-in. c.-i. water main, approximately 3600 lin. ft., across a part of Galveston Bay, near the Causeway. City will furnish all pipe, etc. Probable cost $41,220. A. T. Dickey, City Engr.

Bids desired until Oct. 7, same place as above, for furnishing f.o.b. Galveston, c.-i. pipe and fittings as follows: 200 pieces 12 ft. length Class D pipe 30 in. diam.; 100 pieces pipe 12 ft. length 30 in. diam; 50 pieces to have flexible bell and standard spigot and 50 with standard bell and flexible spigot, 4 pieces 1-16 bends 30 in. diam, Class D.

Until Nov. 4 (readvertisement) by Bd. City Comrs. for mechanical equipment for an air pumping engine at Alta Loma, advertised in Engineering Record. A. N. Burgess, Supt. Water Works & Sewerage.

The Pas, Man.—Until Oct. 5 by H. H. Elliott, Town Clk. M. D., for trenching and laying c.-i. steel water mains, supply and deliver c.-i. steel water pipe or specials, fire hydrants, valves, and vitr. sewer pipe. Murphy & Underwood, Consulting Engrs., Saskatoon.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**South Bethlehem, Pa.**—Contract for installing system in University Heights, near South Bethlehem, awarded Standard Supply Co., Philadelphia, at about $10,000.

★**Medina, Ohio.**—Contract for 12,336 ft. 4-in. pipe, 37-in. valves, 15 hydrants, etc., awarded Lynn & Cahoon, Akron, at $7,884 (bids opened Sept. 15). B. E. Eckard, City Clk.

★**Oberlin, Ohio.**—Contract for constructing reservoir (bids opened Sept. 10) awarded Power Constr. Co., Cleveland, at $6,833.

★**St. Charles, Ill.**—Following are bids opened by Bd. Local Improv. Sept. 20 for water main extension, including 255.92 tons 6-in. and 4-in. pipe, 490 tons special castings, 32 fire hydrants, nine 4-in. hub end double gate valves, and valve boxes, 12 6-in. hub end double gate valve and valve boxes, 17,605 lin. ft. trenching and laying and calking pipe (John W. Wilson, Engr. of Bd.): H. D. Hallet, Aurora, $12,113 (awarded contract); Delhannty & Co., Decatur, $13,302; Albrecht Bros., Kewanee, $12,308; Engineer's estimate, $12,849.

★**Monticello, Wis.**—Contract for constructing water works awarded J. N. Roberts, Madison.

★**Traer, Iowa.**—Contract for constructing 200,000-gal. concrete storage reservoir awarded Josef Seda, Traer, at $4,560. T. F. Stoakes, Town Clk.

★**Broken Bow, Neb.**—Contract awarded Alamo Engine & Supply Co., Omaha, for constructing wells and extensions to waterway system and electric light plant (bids opened Sept. 6). R. C. Thompkin, City Clerk. Probable cost, $16,000.

★**Gayville, S. D.**—Contract for constructing water works, not including well, awarded Sept. 21 to Ellerman & McLain, Yankton, at $8,977. Stanley Edmunds, Engr., Yankton; Elmer A. Aaseth, Town Clk.

★**Fromberg, Mont.**—Following are four lowest bids opened Sept. 20 by Charles J. Jones, Town Clk., for constructing water works: Security Bridge Co., Billings, $15,980 (awarded contract); Lindstrom & Owen, Billings, $15,995; W. D. Lovell, $17,200, and McLaughlin & O'Neil, Livingston, $17,400.

Whitehall, Mont.—Following are four lowest bids opened Sept. 23 by F. E. McCall, Town Clk., for constructing water works and sewers: Independent Constr. Co., Bozeman, $26,013; James R. Silver, Jr., Butte, $27,698; McLaughlin & O'Neil, Livingston, $27,654; Monarch Constr. Co., Bozeman, $27,912.

★**San Francisco, Cal.**—Contract awarded by Bd. Wks. to Ingersoll Rand Co., 139 Townsend Street, and Rix Compressed Air & Drill Co., 5 First Street, for air compressing plant and drills for use at Hetch Hetchy.

Following are bids opened for clearing portion of Hetch Hetchy reservoir site: Karl Ehrhart, Twentieth Avenue and Kirkham Street, $24,984; A. J. Reeder, $43,987, and McArthur Bros., $45,218.

★**Myrton, Utah.**—Contract for constructing water works (bids opened Sept. 20) awarded John Lyman, Salt Lake City, at $10,350.

SEWERAGE AND SEWAGE DISPOSAL

PROPOSED WORK.

Boston, Mass.—Reported plans prepared for a $400,000 automatic pumping station proposed for the South End of city to remove excess water in sewers.

Buffalo, N. Y.—City Council has authorized construction of tile sewers in Stevens Street and Shenandoah Road.

Newark, N. J.—Reported contract recently awarded by Passaic Valley Sewerage Comn. for constructing superstructure of proposed pumping station on Newark Meadows, refused through an error.

Toms River, N. J.—Question of constructing a sewerage system reported under consideration.

Pennsylvania.—Following permits issued by State Bd. Health, Harrisburg (Samuel G. Dixon, Comr.), relative to sewerage:

East Washington—Lateral sewer extensions.

Commissioners of Ridley Township, Delaware County—Sewage disposal site.

Southwest Greensburg—Lateral sewer extensions.

Commissioners of Bradford County Home—Modifications in sewage disposal plans.

Westfield—Sewer system and sewage treatment plant.

Philadelphia—Intercepting sewers and sewage treatment works.

Scranton—Decree relative to sewerage construction.

Bogalusa, La.—Citizens reported considering improvements costing $200,000, including new sewer system.

Mansfield, Ohio.—Bonds for $110,000 will be sold Oct. 19 by Hoyt Johns, City Aud., for improving sewage disposal plant.

Peoria, Ill.—Bd. Trus. Village of Averyville adopted ordinance to install sanitary sewers at a cost of $39,000. Ray Crozier, Engr. Peoria Water Wks. Co., prepared plans.

West Chicago, Ill.—City Council reported to be considering constructing a sewer system.

Appleton, Wis.—All bids opened Sept. 23 by City Clerk for constructing sewers. 2300 ft., have been rejected. Lowest bid $34,800.

Ft. Worth, Tex.—See "Water Works."

Port Arthur, Tex.—See "Hydraulic Construction and River Improvements."

Cushing, Okla.—Citizens voted $30,000 bonds for constructing intercepting sewer. Benham Eng. Co., Colcord Building, Oklahoma City, Engrs.

Bellingham, Wash.—Sewer improvements on Ellis Street requiring 3540 ft. 10 to 24-in. pipe and costing $8,300, contemplated.

Seattle, Wash.—Plans submitted by A. H. Dimock, City Engr., to Bd. Pub. Wks., for constructing outfall sewer in Seaview Avenue; cost, $453,567.

Portland, Ore.—Commissioner Pub. Wks. filed plans for sewers in Ninth, Seventy-eighth, E. Salmon and E. Eighty-third Streets.

Mesa, Ariz.—Contract soon to be let for constructing sewer system. Address Town Clerk.

Mountain Home, Idaho.—Contract soon to be let for constructing main trunk sewer and disposal works to cost $10,000.

BIDS DESIRED.

New Haven, Conn.—Until Oct. 4 by F. L. Ford, City Engr., for constructing sewers and appurtenances in West Division Street and Sherman Avenue.

New Brighton, S. I., N. Y.—Until Oct. 5, by Calvin D. Van Name, Pres. Richmond Boro., for constructing temporary sewer and storm sewer on Castleton Avenue. Security $3,900.

New York, N. Y.—Until Oct. 6 by Marcus M. Marks, Pres. Manhattan Borough, for constructing numerous receiving basins, etc., in several streets; security $16,000.

Covington, Ky.—Following are four lowest bids opened Sept. 16 by J. Mason Howk, Comr. Public Property, for excavation necessary for receiving Licking River pipe trenching (George Hornung, Consulting Engr., Woolsack Building, Newport): One line—(a) 7266 cu. yd. earth; (b) 1470 cu. yd. rock; (c) total. Two lines—(d) 1390 cu. yd. earth; (e) 2410 cu. yd. rock; (f) total:

	(a)	(b)	(c)	(d)	(e)	(f)
L. Eid Concrete & Steel Co., Cincinnati, Ohio	4.35	13.50	$23,090	4.20	9.80	$29,446
Thomas P. Strack, Cincinnati, Ohio	2.00	17.50	27,217	2.00	15.00	38,930
Claude Harris, Cincinnati, Ohio	2.00	18.00	27,952	2.00	15.25	39,532
Cleary, White Constr. Co.	10.25	10.25	30,360	7.20	7.20	27,360

Fairview, N. J.—Until Oct. 6 by Mayor and Council for laying laterals, sanitary and storm sewers in Walker, Lincoln and Prospect Streets. McClure & McClure, Engrs., Grantwood.

Paterson, N. J.—Reported desired until Oct. 5 for constructing sewers in 13 streets. H. J. Harder, City Engr.

Albemarle, N. C.—Until Oct. 15 by Mayor and Bd. Aldermen for about four miles of 6 to 20-in. c.-i. and vitr. sewers, with appurtenances, advertised in Engineering Record. J. D. Spinks, Engr. in Charge; Anderson & Christie, Inc., Consulting Engrs., Charlotte, N. C.

Miami, Fla.—Until Oct. 7 by City Council for furnishing and erecting two vertical centrifugal pumps and electric motor for sewage pumping station in Riverside. B. H. Klyce, City Engr., 52 Real Estate Building, Miami.

Cheviot, Ohio.—Until Oct. 13 by Albert J. Reusing, Village Clk., for furnishing material and constructing 3 and 3½-ft. trunk sewer in the ravine east of Glenmore Avenue; also trunk drain in North Glenmore Avenue; together with necessary manholes, basin outlets, etc.

Findlay, Ohio.—Until Oct. 5 by Director Pub. Service for furnishing material and constructing combination storm water and sanitary sewers on south sides of West Lincoln and Hardin Streets.

Knox, Ind.—Until Oct. 5 by County Comrs. for constructing several sewers and three iron bridges. C. W. Weninger, Co. Aud.

Ashland, Wis.—Reported desired until Oct. 14 by W. C. Morris, City Clk., for constructing sewers in several alleys and Whittlesey Avenue. Conrad J. Wadak, City Engr.

Brooklyn, Iowa.—Until Oct. 5 by Frank Talbott, Town Clk., for constructing sewerage system and sewage disposal plant to consist of 27,891 lin. ft. 15, 10, 8 and 6-in. vitr. clay or concrete pipe sewer, concrete bulkhead, Imhoff tank complete with filter and sludge beds, 65 manholes, 12 flush tanks, etc.

Dennison, Iowa.—Reported desired until Oct. 12 by E. F. Tucker, City Clk., for constructing sanitary sewers on various streets.

Cokato, Minn.—Reported desired until Oct. 5 by M. E. Berg, Village Recorder, for constructing sewer system.

Compton, Cal.—Until Oct. 12 by City for constructing sanitary sewer system. Olmsted & Gillelen, Engrs., 1112 Hollingworth Building, Los Angeles.

Mountain Home, Idaho.—Until Oct. 7 by City Council for constructing sanitary sewers in Local Sewerage Dists. Nos. 1 and 2, in all about 14,820 ft. 8 to 15-in. vitr. clay or cement pipe, concrete tank, concrete manholes, flush tanks, etc. R. J. Newell, Engr. Sewer Dist.

The Pas, Man.—See "Water Works."

The Pas, Man.—See "Water Works."

PRICES AND LETTINGS.

★*Indicates award of contract.*

Albany, N. Y.—Following are totals of the bids opened Sept. 7 by Bd. Contract and Supply for equipment of sewage pumping stations—(a) including motor generator sets, (b) not including motor generator sets: Lupfer & Remick, Buffalo, (a) $94.500, (b) $87.000, De Laval pumps; (a) $92,000, (b) $84,500, Alberger pumps; Turbine Equipment Co., Trenton, N. J., (a) $118.275, (b) $109,300; R. D. Wood & Co., Philadelphia, Pa., (a) $90,000, (b) $80.900; Thompson Banner Co., New York, (a) $117,555, (b) $105.250, Alberger pumps, and (a) $115,980, (b) $104,675, De Laval pumps.

★**Albany, N. Y.**—Following are unit figures of Foundation Co., Woolworth Building, New York, the successful bidder for the sewage pumping stations (bids opened Sept. 7 by Bd. Contract and Supply):

6,000 cu. yd. excav. above elev. 3	$0.60
9,000 cu. yd. excav. below elev. 3	3.50
16,000 cu. yd. general embankment and filling	0.50
1,900 cu. yd. loam	0.50
1¾ acres seeding	30.00
250 sq. yd. sodding	0.30
100 cu. yd. gravel in roadways and walks	2.00
500 sq. yd. concrete pavement	1.00
230 cu. yd. concrete, Class A	15.00
1,600 cu. yd. concrete, Class B	14.00
970 cu. yd. concrete, Class C	12.50
1,100 cu. yd. concrete, Class D	10.00
300 cu. yd. concrete, Class E	12.00
270 cu. yd. concrete, Class F	9.00
20 lin. ft. 2-duct vitr. conduit	0.25
250 lin. ft. 4-duct vitr. conduit	0.40
90 lin. ft. 6-duct vitr. conduit	0.55
80 lin. ft. 9-duct vitr. conduit	0.80
40 tons c.-i. pipe	35.00
28 tons bell and spigot special castings	65.00
2 tons flange special castings	90.00
1 4-in. gate valve	15.00
5 6-in. gate valves, ea.	16.00
1 6-in. gate valve (single seat)	30.00
2 8-in. gate valves (single seat) ea.	30.00
8 valve boxes, ea.	6.00
3 fire hydrants, ea.	50.00
2 6-in. sluice gates, ea.	25.00
1 54-in. sluice gate (elec. oper.)	800.00
5 6-in. flop valves, ea.	20.00
Diversion gate (lump sum)	175.00
250 lin. ft. railroad track, steel ties, straight	0.60
35 lin. ft. railroad track, steel ties, curved	0.75
1,200 lin. ft. railroad track, wooden ties, straight	0.65
200 lin. ft. railroad track, wooden ties, curved	0.90
2 switches, steel ties, ea.	35.00
10 switches, wooden ties, ea.	30.00
Storage battery locomotive (lump sum)	2,850.00
Crane runway (lump sum)	100.00
Power rails for crane (lump sum)	190.00
Locomotive crane (lump sum)	5,000.00
Screenings bucket (lump sum)	100.00
60-in. venturi meter (lump sum)	3,500.00
Reconstruction sewage force main (lump sum)	600.00
Indicating apparatus (lump sum)	700.00
20,000 lb. iron castings	0.055
37,000 lb. miscellaneous steel work	0.07
260,000 lb. steel reinforcement bars	0.025
5,000 lb. wrought steel floor plates	0.10
200 sq. yd. surfacing floors, granolithic finish	1.00
280 sq. yd. surfacing floors, concrete hardened	1.00
500 lin. ft. pipe railing, plain knobs	2.50
40 lin. ft. pipe railing, brass knobs	3.00
2 stop plank gates for grit chamber, ea.	50.00
Superstructure, Westerio Station (lump sum)	18,439.00
Superstructure, Gate House (lump sum)	1,481.00
Superstructure, Tool House (lump sum)	2,157.00
Patroons pumping station (lump sum)	13,100.00
Work appurtenant to Patroons Station (lump sum)	1,400.00
200 working days for completion, per day	20.00
Total	$172,772.25

★**Norwood, Ohio.**—Contract for constructing sanitary sewer in Lexington Avenue, awarded John Dempsey, Norwood, at $7,500.

★**Indianapolis, Ind.**—Contract for constructing an interceptor to connect Warman Avenue main sewer with Harding Street interceptor, awarded Columbia Constr. Co., Indianapolis, at $22,827.

★**Indianapolis, Ind.**—Contract awarded Columbian Constr. Co., to construct an interceptor to connect new Harman Avenue main sewer with Harding Street interceptor at $22,827.

★**Kenosha, Wis.**—Contract for constructing sewers (bids opened Sept. 17 by Street Assessment Com. awarded Joseph Kennedy, Fargo, at $149,828. B. C. Brennan, City Engr.

★**Ames, Iowa.**—Contracts awarded as follows for constructing sewers (bids opened Sept. 20).

★Sanitary sewer and subdrain, Dearborn Constr. Co., Waterloo, $24,789 (awarded contract); Cole Bros., Ames, $25,962; Moore, Seig Co., Waterloo, $26,134; Public Service Constr. Co., Omaha, $28,124.

★Sanitary sewer—Ward Four: Dearborn Constr. Co., $13,961 (awarded contract); Cole Bros., $14,501; Moore, Seig Co., $14,563; George M. King, Des Moines, $14,647.

★Storm sewers: Dearborn Constr. Co., $28,937; Cole Bros., $32,570; Moore Seig Co., $31,855; Public Service Constr. Co., $35,302. A. B. Maxwell, City Clk.

St. Paul, Minn.—Siems-Cary Co., 514 Germania Life Bldg., submitted lowest bid for constructing Fredericka-Fairmont sewer system, $95,000, $100,000 and $102,000, according to material.

Centerville, S. D.—Following are four lowest bids opened Sept. 20 by Soren Christinsen, City Aud., for constructing sewer system: Schruth & Jackson, Fargo, $24,066; H. T. Gerisher, Grand Forks, N. D., $24,935; Ellerman & McClain, Yankton, $26,075; Turner Bros., St. Paul, Minn., $27,500.

Whitehall, Mont.—See "Water Works."

Seattle, Wash.—Lowest bid opened by Bd. Pub. Wks. for constructing overflow sewers in First Avenue and other streets was submitted by McDonald & Jones, Globe Building, at $15,549.

BRIDGES

PROPOSED WORK.

Westport, Conn.—State Highway Comn., Hartford, adopted plans of Strauss Bascule Bridge Co., Chicago, for lift bridge over Saugatuck River at Westport. Contract soon to be let.

Jamesville, N. Y.—Concrete culvert on Delaware Lackawanna & Western R. R. Co., one mile south of Jamesville, is reported to be destroyed by floods. George J. Ray, Ch. Engr., Hoboken N. J.

Milburn, N. J.—See "Railroads."

New Brunswick, N. J.—About $69,000 bridge bonds sold by Middlesex Bd. Freeholders.

Natrona, Pa.—Plans have been approved by U. S. War Dept. for construction of a bridge over Allegheny River connecting Natrona and Braeburn.

Sunbury, Pa.—Philadelphia & Reading R. R. Co. (Samuel T. Wagner, Ch. Engr. Reading Terminal, Philadelphia), contemplates constructing 13 span steel girder bridge over Susquehanna River at Sunbury.

Miami, Fla.—Citizens voted Sept. 21 in favor of issuing bonds for constructing three bridges across Miami River and for street paving, dredging channel across bay and building hospital. Isham Randolph, Engr., Chicago, Ill., engineer for channel work. Harrington, Howard & Ash, Kansas City, Mo., Engrs. for bridges. E. H. Kivett, City Engr.

Palatka, Fla.—See "Paving and Roads."

Estherwood, La.—The Police Jury is considering erecting a steel draw bridge over Mermentau River; cost about $4,000.

Crown Point, Ind.—Bonds for $116,000 reported to be sold Oct. 28 to Edw. Steele Co. Aud., for bridges in Dyer and Hobart.

Indianapolis, Ind.—Reported city and county are considering letting a bridge across Fall Creek at Meridian Street to cost $150,000.

Lawrenceburg, Ind.—Comrs. Dearborn and Ohio Counties selected site at Curtis's Ford as site for erection of bridge over Laughery Creek; estimated cost $11,000.

Concordia, Kan.—County proposes constructing eight reinforced concrete bridges and repairs to several steel bridges. Probable cost, $15,000.

Carthage, Mo.—Bonds for $30,000 reported to be sold Oct. 9 for viaduct. Address Hugh McIlvaine, Mayor.

Joplin, Mo.—$11,000 N. Main Street viaduct bonds will be sold Oct. 9. C. A. Robinson, Comr. of Revenue.

St. Louis, Mo.—**Contract about to be let** by city for constructing Chouteau Avenue Viaduct. United Rys. Co. to pay $14,000; Frisco R. R. Co. $35,000, and Missouri Pacific Ry. $175,000 of cost.

Lewisville, Ark.—Plans completed by Hugh E. Carter, State Highway Engineer at Little Rock, for constructing steel bridge 240 ft. long over Bodcaw Creek.

Rockport, Tex.—Citizens of the County voted $300,000 bonds to construct a causeway from Rockport to Lamar, across Aransas Bay, about 18,000 ft. long. Address County Clerk, Corpus Christi.

Kalama, Wash.—See "Paving and Roads."

Hooper, Ore.—S. Murray, Acting Ch. Engr. Oregon-Washington R. R. & Navigation Co., Wells Fargo Building, Portland, writes that the bridge to be constructed across Palouse River near Hooper is to be a plate girder bridge having three 70-ft. spans on concrete piers.

Portland, Ore.—See "Paving and Roads."

Grimes, Cal.—Construction of bridge over Sacramento River at Grimes is contemplated by Bd. Supervs. of Sutter and Colusa Counties; cost about $150,000. Yuba City, county seat Sutter County.

Santa Barbara, Cal.—$350,000 state highway bridge bonds will be sold Oct. 11 by Co. Bd. Supervisors (C. A. Hunt, Clk.).

Florence, Ariz.—Reported plans and specifications desired by Supervisors for two bridges over Gila River, one at Williams and the other at Kenyon; cost $30,000 each. E. S. Stafford, Co. Engr.

BIDS DESIRED.

Connecticut.—Until Oct. 11 by C. J. Bennett, State Highway Comr., Hartford, for constructing bridge in East Hartford over Connecticut and Granby, advertised in Engineering Record.

Fort Edward, N. Y.—Until Oct. 9 by Alfred Case, Jr., Town Supv., for constructing concrete arch bridge over Hudson River. Engineers, Concrete Steel Eng. Co., Park Row Building, New York.

Perkasie, Pa.—Reported desired until Oct. 14 by Co. Comrs., Doylestown, for constructing a reinforced concrete bridge over Pleasant Spring Creek.

Sharon, Pa.—Reported desired until Oct. 5 by Co. Comrs. for constructing either concrete or steel bridge across Shenango River at Sharon.

Arcadia, Fla.—Until Oct. 11 by A. L. Durrance, Co. Clk., for furnishing material and constructing concrete or steel or combination bridges in Special Road and Bridge Dist. No. 1. Gordon Sumner, Engr., Wauchula.

Belzoni, Miss.—Reported desired until Oct. 8 by T. A. Dunbar, Mayor and Bd. Aldermen, for constructing steel and concrete bridge across Fish Bayou.

Meridian, Miss.—Reported desired by Co. Supervs. until Oct. 4 to construct 75-ft. span steel bridge across Okatibbee Creek. Reported desired until Oct. 9 by R. L. Barnes, City Clk., for constructing concrete bridges. J. C. Watts, City Engr.

Columbus, Ohio.—Until Oct. 25, by Bd. Co. Comrs. (John Scott, Clk.) for furnishing material and constructing substructure of Brown bridge over Big Run, Franklin Township, Neiswander concrete culvert and approaches on the Mifflin and Jefferson Township lines; moving Guthrie Canal bridge from Hamilton Township to Brown Road over Big Run in Franklin Township and constructing new floor system; raising and widening approaches to Chenoweth Mill bridge, Pleasant Township; constructing roadway on Havens Corner bridge over Black Lick Creek, Jefferson Township.

Ohio.—See "Paving and Roads."

Steubenville, Ohio. — Reported desired until Oct. 15 by Co. Comrs. for constructing steel superstructure of bridge in Smithfield Township and reinforced concrete bridge on State Road in Springfield.

Brownston, Ind.—Until Oct. 4 by County Auditor for constructing four steel bridges, each 80-ft. span; cost $7,200.

Knox, Ind.—See "Sewerage and Sewage Disposal."

Lebanon, Ind.—Until Oct. 18 by County Comrs. for constructing two reinforced concrete bridges and repair of another. D. M. Clark, Co. Aud.

Munster, Ind.—Until Oct. 7 by Co. Comrs. (George O. Schaaf, Chmn.) for constructing a through pony truss span bridge over Hart Ditch, Brown Street. Edw. Simon, Co. Aud.

Petersburg, Ind.—Until Oct. 5 by County Comrs. for constructing seven steel bridges. John D. Gray, Co. Aud.

Illinois. — By State Highway Comn., Springfield, for constructing bridges as follows:

Until Oct. 4, at Cordes Station, 2 reinforced concrete and steel bridges, known as Burnet and Zachies, spans 35 and 20 ft., roadways 16 ft., height over all 15 and 9½ ft. Engineer's estimate, Burnet bridge $1,510 and Zachies bridge $695. J. A. Davenport, Supt. Highways, Nashville.

Town Hall, Eagle Township, constructing reinforced concrete bridge, known as Moon bridge, 24-ft. span, roadway 22 ft., height over all 13½ ft. Engineer's estimate $1,220. George L. Farnsworth, Co. Supt., Ottawa.

Illinois. — By State Highway Comn., Springfield, for constructing bridges as follows:

Oct. 9, at Kampsville, for constructing Main Street Bridge, reinforced concrete, 40-ft. span, 20-ft. roadway, height over all 16 ft., in Road Dist. No. 2; Engineer's estimate $1,760. John A. Earley, Co. Supt. of Highways, Batchtown.

Oct. 12, at Mount Sterling, constructing Clark Bridge, reinforced concrete, 36-ft. span, 18-ft. roadway, 12 ft. high; Engineer's estimate $1,160. W. O. Grover, Co. Supt., Mount Sterling.

Oct. 15, at Quincy, Wolf Ridge Bridge, constructing reinforced concrete, 10-ft. span, 16-ft. roadway, 13½ ft. high; Engineer's estimate $845. L. L. Boyer, Co. Supt., Quincy.

Oct. 29, at Rockford, State Street Bridge, constructing steel structure, with concrete floors on old stone abutments and partly reinforced concrete abutments, 140-ft. span, 24-ft. and one 8-ft. walks, 20 ft. high; Engineer's estimate $10,735. A. R. Carter, Co. Supt., Rockford.

Concordia, Kan.—Until Oct. 25 by George C. Guilbert, Co. Clk., for constructing 11 reinforced concrete bridges.

Washington, Kan. — Reported desired until Oct. 12 by Co. Comrs. (E. V. McKelvy, Clk.) for constructing a 200-ft. bridge in Hanover Township, 40-ft., 36-ft. and 50-ft. superstructures in Brantford Township.

Wichita, Kan.—Reported desired until Oct. 11 by H. M. Barrett, Co. Clk., for constructing four concrete and steel bridges, two 20-ft., one 40-ft. and one 24-ft., width of roadway 27 ft. Edgar V. Moone, Co. Engr.

Los Angeles, Cal.—Until Oct. 18 by County Bd. Superv. Los Angeles (H. J. Lelande, Clk.), for furnishing material and constructing four bridges as follows: One over Santa Clara River, one over South Fork of Santa Clara River, one over Castiac Creek, and one over San Francequito Creek.

San José, Cal.—Until Oct. 4 by Bd. Superv. (Henry A. Pfister, Clk.) for constructing reinforced concrete bridge on Payne Avenue.

Visalia, Cal.—Reported desired until Oct. 13 by City Clk. for constructing a concrete bridge, 60 ft. wide, and 16-ft. roadway across Mill Street.

Ste. Martine, Que.—Reported desired until Oct. 4 by Nap Mallette, Secy.-Treas., for constructing 85-ft. span steel bridge on concrete abutments at outlet of Beau River.

Vancouver, B. C.—See "Hydraulic Construction and River Improvements."

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Scarboro, Me.**—Contract for constructing concrete State bridge across Nonesuch River at Scarboro awarded Hasbam Paving Co., Worcester, Mass., at cost. Plus percentage, estimated cost $2,500.

Aberdeen, Wash.—Following are the unit prices of four lowest bids opened Sept. 8 for constructing a steel bridge, one 260-ft. span and one 118-ft. (L. D. Kelsey, City Engr.): (a) Weymouth Constr. Co., $20,810; (b) J. R. Wood, $21,829; (c) Coast Bridge Co., $22,208; (d) E. E. Davis & Co., $22,440.

	(a)	(b)	(c)	(d)
Erection of steel	$4,556.00	$6,250.00	$4,618.00	$6,020.00
Repairs to piers	5,323.00	7,100.00	6,640.00	5,316.00
200 cu. yd. riprap	3.00	3.00	3.20	3.00
Machinery repairs	500.00	1,800.00	2,600.00	1,160.00
Operator's house	600.00	950.00	530.00	770.00
Repairs to draw span	4,500.00	2,500.00	2,725.00	2,282.00
New floor on draw	3,700.00	.....	2,950.00	3,840.00
65 M. ft. new floor for draw rest 1br	20.00	19.00	17.50	18.00
1500 lin. ft. piles for draw rest	0.50	0.25	0.40	0.70

On the 375,000 lb. steel work f.o.b. Aberdeen, North West Bridge Co. bid .0375 cts. and Toledo Bridge & Crane Co. bid .03375 per lb. Total, $14,062.50 and $12,656.25 respectively.

★**Binghamton, N. Y.**—Contracts for constructing five concrete highway bridges and moving present girder bridge (bids opened Sept. 22) awarded as follows: To Owego Concrete Co., Owego, Conklin Avenue Bridge, at $5,500; to Foster Constr. Co., Newark, N. J., Eldredge Street Bridge and Water Street Bridge, at $2,978 and $8,658 respectively; Van Name & Case, Horsehead, Morris Street, Holland Street and moving bridge, at $1,939, $1,110 and $1,486 respectively. D. W. Foster, City Clk.

Buffalo, N. Y.—Eastern Concrete Steel Co., Buffalo, submitted lowest bid at $46,272 for constructing Bailey Avenue Bridge over Pennsylvania Railroad.

★**South Amboy, N. J.**—Contract for constructing Strauss bascule lift bridge over Matawan Creek between Keyport and South Amboy awarded by Bd. Freeholders to F. R. Long-W. C. Broadhurst Co., Hackensack, at $36,220.

★**Pineville, Ky.**—Contract for constructing steel bridge 300 ft. long over Cumberland River awarded by Fiscal Court to Vincennes Bridge Co., Vincennes, Ind., at $9,021.

★**Fredericksburg, Ohio.**—Contract for constructing steel bridge at Fredericksburg (bids opened Sept. 14) awarded by Co. Comrs., Youngstown, to Massillon Bridge & Structural Co., Massillon, at $11,333. Next three lowest bidders: Penn Bridge Co., Beaver Falls, $13,200; Wymer Harris Constr. Co., Youngstown, $13,487; Capitol Constr. Co., Columbus, $13,569. H. C. Fox, Secy. Dept. Pub. Service.

★**Red Oak, Iowa.**—Contract for constructing steel bridge over river near Grant awarded by County Bd. to Red Oak Bridge & Iron Wks., Red Oak, at $6,400.

★**Mankato, Kan.** — Contract awarded Western Bridge Co., Harrison, Vittle, Mo., for constructing Lovewell Bridge, at $5,594; also repairs amounting to $3,000.

★**Roundup, Mont.**—Contracts awarded Security Bridge Co., Billings, as follows for constructing bridges across Musselshell River: The Gage bridge, 122.5 ft. span at $6,988, and the Delphi and Ryegate bridges, each 140 ft. span, at a total of $8,990. Ray E. Bushnell, Co. Surveyor.

PAVING AND ROADS

PROPOSED WORK.

Boston, Mass.—Paving E. First Street with granite block is contemplated by city.

New Britain, Conn.—Bd. Public Wks. voted to pave Elm Street, cost about $27,000.

Buffalo, N. Y.—Contract about to be let by Comr. Pub. Wks. for paving Exeter Avenue and Galveston Place and repaving Jersey Street.

New York, N. Y.—Following paving to be laid in borough of Manhattan (Marcus M. Marks, Boro. Pres.):

Granite block, Eighteenth Street, from Fourth Avenue to Broadway, widen and repaving Duane Street, from Rose to William Streets.

Sheet asphalt, Fifty-first Street, from First to Third Avenues; Fifty-second Street, from Fifth to Sixth Avenues; 151st Street, from Amsterdam Avenue to Broadway; Lexington Avenue, from Twenty-first to Twenty-third Streets; Twenty-second Street, from Lexington to Fourth Avenues; Columbus Avenue, from Sixty-fifth to Sixty-ninth Streets; Sixth Avenue, from Twenty-third to Thirty-second Streets; Twenty-fifth Street, from Broadway to Sixth Avenue; Thirty-second Street, from Fifth Avenue to Broadway; Thirty-second Street, from Sixth to Seventh Avenues.

Sidewalks, Cathedral Parkway (110th Street), from Seventh to Eighth Avenues.

Jersey City, N. J.—Later reports state that new bids will be received by City Commission for repaving Garfield and Arlington Avenues.

Madison, N. J.—All bids opened Sept. 17 by Borough Council for 3000 sq. yd. pavement on Waverly Place and Prospect Street rejected, being excessive. According to reports new bids will be received.

Gastonia, N. C.—About $50,000 paving bonds sold by Bd. County Comrs.

Kinston, N. C.—Bd. Aldermen voted to pave 35 blocks with sheet asphalt.

Wilson, N. C.—See "Water Works."

Palatka, Fla.—Citizens voted $208,000 bond issue for constructing roads and bridges.

Columbus, Miss.—$90,000 highway bonds reported to be sold Oct. 4 by Bd. Superv.

Park City (P. O. Knoxville), Tenn.—John A. Anderson, Recorder, writes Magnolia Avenue is to be paved with asphalt, about 50,000 sq. yd., on concrete found., and 20,000 lin. ft. curbing.

Calcutta, Ohio.—All bids opened for improving three roads leading out of Calcutta rejected by St. Clair Township Trustees, being in excess of estimated costs. According to reports, new bids will be received.

Canton, Ohio.—City Council considering paving Fourth Street S. E. and Sterling Avenue S. E.; cost about $116,000.

Cleveland, Ohio.—City Council voted to pave E. Fifty-ninth Place, Dearborn, Baxter, Trent, Oakfield, Rexford, and Unity Avenues, W. Sixty-second Street, E. Seventy-fifth, E. 124th, and other streets.

Newburg Heights, Cuyahoga County, Ohio.—Bonds for $28,714 will be sold Oct. 4 by J. A. Fitzgerald, Village Clk., Newburg Heights, for grading, draining, curbing and paving with vitr. brick or block, Beta, Bridgeview, Gamma and Sigma Avenues.

Indianapolis, Ind.—Reported County intends spending about $200,000 on roads next year. Address County Clerk.

St. Paul, Minn.—The City Council voted to pave with asphalt concrete Prescott Street and State Street and Oakdale Avenue with brick; cost about $22,260.

Kansas.—Earl Akers, State Treasurer, Topeka, is in favor of issuing $25,000,000 bonds for constructing permanent State roads.

North Platte, Neb.—Citizens voted $16,000 bonds for paving street intersections.

North Platte, Neb.—Citizens voted $16,000 paving bonds. C. J. McNamara, Engr., North Platte.

Kansas City, Mo.—City Council voted to pave Forty-fifth, Indiana, Askew and Twenty-fourth Streets.

Eureka Springs, Ark.—Plans completed by Hugh R. Carter, State Highway Engineer, at Little Rock, for construction of 25 miles macadam road between Eureka Springs and Seligman.

Orange, Tex.—See "Hydraulic Construction and River Improvements."

Deming, N. M.—Citizens of county Sept. 14 voted $100,000 bonds for highway improvements. C. R. Hughes, Co. Clk.

Everett, Wash.—City Council voted to construct cement sidewalks and concrete curbs on Harrison Avenue; cost, about $18,000.

Kalama, Wash.—Cowlitz County Comrs. considering spending $120,000 for constructing bridges and roads.

Puyallup, Wash.—City Council voted to grade and gravel Meridian Street; cost, about $20,000.

Seattle, Wash.—A. H. Dimock, City Engineer, submitted plans and specifications for paving Western Avenue to Bd. Pub. Wks.; cost, $30,875.

Paving of Meridian Avenue is contemplated by city.

Clatskanie, Ore.—Paving of Bridge and Nehabem Streets is contemplated. Material not decided upon. George B. Conyers, City Recorder.

Portland, Ore.—Dept. Pub. Wks. completed plans and specifications for extending Union Avenue to Columbia Slough Road. A bridge 219 ft. long and 58 ft. wide with fill about 700 ft. long will be required; cost about $66,000.

San Francisco, Cal.—Portions of Athens, Andover and Worth Streets are to be paved with asphalt. F. J. Churchill, Secy. Bd. Pub. Wks.

Idaho. — Edward S. Smith, Ashton, Idaho, is Chief Engineer of proposed Yellowstone Park Highway, connecting the park with present State Highway System and to be constructed jointly by U. S. Forest Service, Fremont County, and State of Idaho. Surveys will be completed about Nov. 1, and construction started next spring. Probably 60 miles long.

BIDS DESIRED.

Brooklyn, N. Y.—Until Oct. 6, by L. H. Pounds, Boro. Pres., for regulating, grading, curbing and laying cement sidewalks of Bay Thirty-fourth, Sixty-first Street,

Twenty-third Avenue, and Lincoln Place, paving with sheet asphalt, portions of Dumont and Williams Avenues, in all about 38,620 sq. ft. cement sidewalk, 9990 lin. ft. steel bound cement curb, 2900 sq. yd. asphalt, etc. Total security, $10,100.

Long Island City, N. Y.—Until Oct. 5, by Maurice E. Connolly, Pres. Queens Boro., for improving portions of Jerome and New York Avenues, in all about 18,400 sq. ft. cement sidewalks, 5000 lin. ft. bluestone curb, 4500 cu. yd. embankment, together with sewer pipe, manholes, etc. Also for 200,000 gal. light road oil or refined tar oil in tank cars as directed in Boro. of Queens. Total security, $5,000.

New Brighton, S. I., N. Y.—See "Sewerage and Sewage Disposal."

New Brighton, S. I., N. Y.—Until Oct. 5, by Calvin D. Van Name, Pres. Boro. Richmond, for regulating, grading, laying sidewalks, etc., and paving portions of Barrett Boulevard, Frelinger Road, and Havenwood Road, in all about 19,500 sq. ft. cement sidewalk, 13,674 sq. yd. bituminous macadam pavt., 7570 lin. ft. cement curb with steel guard, 2015 sq. yd. vitl. brick gutters, etc. Total security, $10,900.

Hoboken, N. J.—Until Oct. 13 by City Comrs. for improving First, Third and Harrison Streets, in all about 4250 sq. yd. paving.

Montclair, N. J.—Oct. 11 by Harry Trippott, Town Clerk, for paving with asphaltic concrete, sheet asphalt, warrenite, amiesite or asphalt block on Upper Mountain Avenue, approximately 10,000 lin. ft., advertised in Engineering Record.

Paterson, N. J.—Reported desired until Oct. 5 for macadamizing 27 streets and grading and curbing 3 streets. H. J. Harder, City Engr.

Altoona, Pa.—Reported desired until Oct. 4 for 16,000 yd. paving and 8000 ft. curbing. D. W. Dillman, Engr., Altoona Tribune Building.

Hagerstown, Md.—Until Oct. 5 by Co. Comrs., Hagerstown (Harry M. Hartle, Clk.), for constructing sections of State Aid Highway from Indian Springs to Big Pool, 1.89 miles, and between Williamsport and Clearspring, about 1.10 miles.

Washington, D. C.—Until Oct. 19 by Secretary Commissioners D. C. for paving with sheet asphalt, asphalt block and bitulithic, advertised in Engineering Record.

Pensacola, Fla.—Reported desired until about Oct. 16 by City Comrs., for three blocks of pavement around Pensacola Hospital. Probable cost, $10,000. L. Earle Thornton, City Engr.

Columbus, Miss.—Until Oct. 13 at Columbus as follows, for macadam roads, graded, drained and surfaced with rock:
By Highway Comn. of Supervisors, Dist. No. 4, for 35 miles.
By Highway Comn., Artesia Road Dist., 11½ miles.
By Highway Comn., Bent Oak Road Dist., 5 miles. Gus. E. Hauser, Jr., Consulting Engr., Columbus, Miss.

Raymond, Miss.—Reported desired until Oct. 4 by Bd. Superv., Jackson (W. W. Downing, Chancery Clk.), for constructing about 1½ miles of road and putting covering on about 2 miles of Rankin Pike.

Canton, Ohio.—Until Oct. 6 by Co. Bd. Comrs. for furnishing material and improving Cadro-Bartville Road, Plain and Lake Townships, on brick pavement, 50,306 sq. yd.; 50,306 sq. yd. wire cut or repressed block; 58,569 sq. yd. concrete pavement; 27,165 cu. yd. bituminous macadam.

Columbus, Ohio.—Until Oct. 8 by Bd. Co. Comrs. (John Scott, Clk.), Columbus, for grading, draining and macadamizing McCoy, Cambridge and Millers Roads, Perry Township; grading, curbing and paving Ryan Avenue, Franklin Township, and Mason Road, Marion Township.

East Liverpool, Ohio.—Until Oct. 5 by Bd. Trus. Liverpool Township, City Building, Market and Third Streets, for improving portions of Jethro Hollow Road and Parkway, in all about 12,819 sq. yd. brick block pavt., 11,331 sq. yd. cement pavt., 33,565 cu. yd. excav. and 145 cu. yd. concrete retaining wall. John N. George, Engr., First Natl. Bank Building.

Ohio.—Bids desired until Oct. 8 by State Highway Dept., Columbus, for constructing State highways in counties as follows: Carroll Co., Section F, Canton-Steubenville Road, Union and Lee Townships, waterbound macadam, 14 ft. wide, 1.93 miles long; cost $24,387. Coshocton Co., Section C, Newcomerstown-Coshocton Road, Tuscarawas Township, brick and bituminous macadam, 16 and 20 ft. wide, 1.88 miles long; cost $41,041. Portage Co., Section R, Cleveland-Kent Road, Franklin Township, concrete, 12 ft. wide, 2.63 miles; cost $28,190. Mahoning Co., Section R, Akron-Canfield Road, Berlin Township, waterbound macadam, 14 ft. wide, 0.30 miles; cost $2,397. Perry Co., Section P, New Lexington-Athens Road, Monroe Township, sandstone, 16 ft. wide, 3.61 miles; cost $53,228. Perry Co., Section O, Newark-New Lexington Road, Reading Township, brick, 14 ft. 8 in. wide, 1.19 miles; cost $28,525. Jefferson Co., Section I, Ohio River Road, Wells Township, brick and concrete, 16 ft. wide, 1.32 miles; cost $46,804 and $40,459 respectively. Also constructing arch bridge and culvert, Vinton Co., Section G, on McArthur-Logan Road, Swan Township; cost $1,457.

Indiana.—By County Comrs. for constructing roads as follows:
Until Oct. 14:
New Albany, 10,590 ft. road in New Albany Township. Julian T. Miller, Co. Aud.
Until Oct. 20:
Franklin, gravel road on Johnson-Marion County Line, ⅝ miles long. H. L. Knox, Co. Aud.
Until Nov 5:
Columbia City, 3 highways in Smith Township. Thomas A. McLaughlin, Co. Aud.

Winamac, Ind.—Until Oct. 5, by Co. Comrs. for constructing Reinholdt gravel road in Tippecanoe Township, 5 miles long. Cost, $9,231. Also for constructing 12 bridges from 10 to 70 ft. long.

Des Plaines, Ill.—Until Oct. 13 by Village Trus. for constructing 4500 yd. one-course reinforced concrete pavt. Engineers Central Bureau of Consulting Engineers, 1403 Harris Trust Bldg., Chicago.

Green Bay, Wis.—Reported desired until Oct. 4 by Com. on Streets (F. Biemeret, Chmn.) for grading and placing graveling or crush stone on portions of W. Mason Street and paving with concrete several alleys.

Des Moines, Iowa.—Until Oct. 6 by Horace Susong, City Clk., for paving with either No. 1 vitr. brick or vertical fiber brick on a 5-in. Portland cement concrete foundation, portions of Oak Park Avenue and portions of east and west alleys, between Locust Street and Grand Avenue, and east and west alleys between Walnut and Locust Streets, with vitr. brick, vertical fiber brick or sheet asphalt or Warren bitulithic on 8-in. Portland cement concrete foundation, in all about 7228 sq. yd.

Hardin, Mont.—Reported desired until Oct. 4 by Co. Comrs. (R. P. Ross, Clk.) for 4½ miles of road between Big Horn River bridge and Dry Creek.

Missoula, Mont.—Until Oct. 6 by L. E. Harris, City Clk., for constructing pavement of vitr. brick, creosoted wood block, standard bitulithic, or asphaltic concrete, all on 5-in. concrete base, together with all accessories, in Special Improv. Dist. No. 41, West Pine Street. E. S. Hathaway, City Engr.

Kansas City, Mo.—Until Oct. 5 by Bd. Pub. Wks. (Thomas F. Callahan, Secy.), for paving with Portland cement concrete portions of Euclid Avenue, Forty-second, Fifty-third and several other streets.

Pawnee, Okla.—Until Oct. 4 by H. A. Rexroad, City Clk., for paving approximately 20,000 sq. yd. vitr. brick blocks with cement grout filler and sand cushion laid on concrete base. The Benham Eng. Co., Colcord Building, Oklahoma City, Engrs.

Issaquah, Wash.—Reported desired until Oct. 12 by Bd. Co. Comrs., Seattle (Bryon Phelps, Clk.) for constructing Bond Road No. 18.

Tonasket, Wash.—Reported desired until Oct. 7 by Co. Comrs. at Conconcully for grading, draining and surfacing Permanent Highway No. 4A near Tonasket.

Washington. — Reported desired until Oct. 11 by State Highway Comrs., Olympia, for constructing roads as follows:
Dayton—Grading and surfacing 7 miles Inland Empire Highway between Waitsburg and Dayton.
Colfax—Surfacing with gravel 17 miles Inland Empire Highway between Colfax and Rosalia.

Arcadia, Cal.—Until Oct. 7 by Bd. Trus. for constructing 16 miles oiled macadam road and approximately 10,000 ft. concrete curb and gutter.

Los Angeles, Cal.—Until Oct. 11 by H. J. Lelande, Clk. Bd. Superv., for paving on portions of Friend, Sweetzer and Pacific Avenues and Flores Street in Road Dist. No. 3; also Alameda Street in Road Dist. No. 4.

Manhattan Beach, Cal.—Until Oct. 6, by Llewellyn P. Price, City Clk., for improving Sixth, Seventh and adjoining alleys, consisting of 15,731 sq. ft. concrete sidewalks, 15,519 sq. ft. oil and screening pavt., etc.

Santa Ana, Cal.—Until Oct. 6, by Bd. Superv. for reconstructing, repaving and rebuilding with a 4-in. concrete asphalt pavt. 4450 ft. Garden Grove Road.

Santa Barbara, Cal.—Until Nov. 1 (readvertisement) by Bd. County Supervisors (C. A. Hunt, Clk.) for paving Booths Point Road; probable cost $17,689.

Phoenix, Ariz.—Until Oct. 5 for paving six blocks on Madison Street with bitulithic. V. A. Thompson, City Engr.

Idaho.—Until Oct. 15 by State Highway Comn., Boise (George R. Barker, Secy.), for constructing seven miles Idaho-Pacific State Highway between Weiser and Canyon County Line; cost $8,500. E. M. Booth, State Highway Engr.

PRICES AND LETTINGS.

★Indicates awarded contract.

★Malden, Mass. — Contract awarded Holland Constr. Co., Lawrence, for 3000 lin. ft. concrete road on N. Main Street, at $1.49 per sq. yd.

Norwell, Mass.—Following are three lowest bids opened Sept. 28 by Selectmer for building 14,300 ft. highway: Wm. F. Loud & Son, Wollaston, Mass., $10,806 (awarded contract); Pallotto & Davis Co., Lowell, Mass., $11,145; D. J. Sheehan & Co., Lynn, Mass., $11,360.

★Massachusetts.—Following are four lowest bids opened Sept. 21 by Massachusetts Highway Comn. for constructing a road in Granby and South Hadley towns; Lane Constr. Corp., Meriden, Conn., $16,295 (awarded contract); William M. Flynt Granite Co., Monson, $18,348; Middlesex Constr. Co., Boston, $18,430.

★Connecticut, — Following are bids opened Sept. 22 by State Highway Commissioner, Hartford, for State road work:
★New Haven and North Haven, 10,418 lin. ft. bituminous concrete on New Haven turnpike: Union Paving Co., Schenectady, $22,981 (awarded contract). Next three lowest bidders: Lane Constr. Corp., Meriden, $23,172; C. W. Blakeslee & Sons, New Haven, $28,788; Connecticut & Rhode Island Co., Meriden, $30,345 (amiesite).
★Brookfield, 10,850 lin. ft. graded construction on Danbury Road: Louis Longhi & Bro., Torrington, $11,191 (awarded contract). Next three lowest bidders: Framingham Contr. Co., South Framington, $11,385; John de Michiel & Bro., Torrington, $11,722; R. G. Miller Contr. Co., Hartford, $11,844.
★Orange — 13,806 lin. ft. bituminous macadam on Main St. and Congress and Savin Avenues: Robert S. Daley Contr. Co., New Haven, $28,448 (awarded contract). Leonardo Suzie, Meriden, $31,833; C. W. Blakeslee & Sons, New Haven, $33,701; B. D. Pierce, Jr., Co., Bridgeport, $34,579.
★Colebrook—A section of 5-in. native stone macadam on Robertsville Road awarded to Frank A. Wilcox, Norwich, at $7,852.
Stamford—$0,080 lin. ft.—(a) native stone macadam; (b) gravel, on High Ridge Road (not awarded): John Arborie, New Haven, (a) $31,829, (b) $28,288; Louis Longhi & Bro., Torrington, (b) $29 811; Connecticut Good Roads & Constr. Co., New Britain, (b) $30,782; R. G. Miller Contr. Co., Hartford, (a) $31.258, (b) $31,593; Ahern Constr. Co., Willimantic, (a) $32,092.
Newington—5,400 lin. ft. Lowest bidders: Connecticut & Rhode Island Co., Meriden, $10,715, amiesite; Thomas Kearney, Meriden, $7,028, tar penetration, and $8,036 asphalt penetration.
Litchfield—4414 lin. ft. 4-in. trap rock macadam. John de Michiel & Bro., Torrington, $7,011, lowest bidder.

★New York, N. Y.—Contracts awarded by President Boro. Manhattan as follows for sheet asphalt pavt.: to Sicilian Asphalt Paving Co., 41 Park Row, Forty-fourth Street from Madison Avenue to 324 ft. east; Sixty-sixth Street from Park to Fifth Avenue, and Eighty-eighth Street from West End Avenue to Broadway, at a total of $10,848.55; Aztec Asphalt Co., 90 West Street, Sixty-second Street from second to Fifth Avenue, $18,121; Asphalt Constr. Co., 208 Broadway, Haven Avenue from 170th to 172d Street, $4.673; Cleveland Trinidad Paving Co., Flushing, Second Avenue from Third to Fourth Street (granite) at $2,383.

Rochester, N. Y.—Julius Friedrich submitted lowest bid for paving with asphalt on Elmwood Avenue, at $8,680.

★Utica, N. Y.—Contract for paving westerly section of Parkway from Genesee Street to Sunset Avenue with bitulithic awarded by Bd. Contract & Supply to Harry W. Roberts Co., Utica.

★Belleville, N. J.—Contract for paving Overlook Avenue with asphalt block awarded by Town Commission to Glenfield Constr. Co. at $15,042.

★Newark, N. J.—Following are four lowest bids opened Sept. 16 by Bd. Street and Water Comrs. for grading, curbing, flagging and paving Front Street and Saybrook Place, 4200 sq. yd. granite oblong pavt., Alex. J. Milmoe, $23,621 (awarded contract): Newark Paving Co., $23.632; Ralph Sangiovanni, $24.250; Jackson Contr. Co., $24,371; all of Newark.
★Contracts awarded by Bd. Freeholders as follows: repaving with Warrenite on Broad Street from Bloomfield Center to Bay Avenue, Bloomfield, and Valley Road, Montclair from Bloomfield Avenue to Passaic County Line, both to Standard Bitulithic Paving Co., at $37.517 and $86,450 respectively; repaving Wyoming Avenue, South and West Oranges, with asphalt block, to Bamberger-Chapman Co., at $46,167.

Trenton, N. J.—Following are lowest bids opened by City Comn. for paving: E. Canal Street, with Mount Airy granite block, C. A. Reid & Co., $3.16 per sq. yd., and Eastburn and N. Clinton Avenues, with Bermudez. Newton Paving Co., Trenton, at $1.52 per sq. yd.

Philadelphia, Pa.—Lowest bid opened by Bureau Highways Sept. 21 for constructing parkway between Sixteenth and Seventeenth Streets submitted by Keystone Constr. Co., Meadville.

Philadelphia, Pa.—Following are low bids opened recently by Dept. Pub. Works (William H. Connell, Ch. Bureau of Highways):
Grading 231,671 cu. yd. Low bidders: J. D. Dorney, 1204 E. Montgomery Avenue; O'Neill Co., 7811 Germantown Avenue; T. P. Lee, 5629 Cherry Street; Alex McIlhenny, 1230 S. Twenty-eighth Street; J. R. Leewright, 426 W. Seville Street; P. J. Snyder & Co., Bailey Building; J. J. McHugh, 1430 S. Penn Square; S. A. McClay, Allegheny Avenue and Tulip Street; E. H. Vare, Lincoln Building; J. A. Miller, 5512 Vine Street; M. & J. B. McHugh, 892 Markoe Street; Est. D. McMahon, Germantown Avenue and Chelten Avenue; Frank Curran, 3023 Richmond Street. Average price per cu. yd. 0.244 cts.; total $67,586.
Asphalt pavement, 6-in. concrete base. Low bidders: Barber Asphalt Pav. Co., Land Title Building; Eastern Paving Co., Penn Square Building; Union Paving Co., Thirtieth and Locust Streets; Phila. Paving Co., 1345 Arch Street. Average price $1.625 per sq. yd.; total $140,576.
Repaving with vitrified block on 6-in. concrete base. Low bidders: Cunningham Paving & Constr. Co., 1345 Arch Street, and J. J. McHugh, 1430 S. Penn Square. Average bid $2.12 per sq. yd.; granite block $2.943 per sq. yd.; total of low bids $25,436.
Repaving with wood block, including mortar cushion and 6-in. concrete base. Low bidders: Phila. Paving Co., 1345 Arch Street; Richard Lamb, 136 Liberty Street, New York; McNichol Paving & Contr. Co., 1923 Cherry Street. Average bid $2.83 per sq. yd.; total of low bidders $22,025.

★Pittsburgh, Pa.—Contracts for paving awarded by County Comrs. as follows: With brick, 2.7 miles Elkhorn and Monongahela Road, in Forward Township, and ½ miles Lincoln Highway, in Versailles Township, to J. W. Butler, Pittsburgh, at $99,959 and $9,100 respectively; 2.37 miles Round Hill Road, with macadam, to John F. Howley, 237 Fourth Avenue, $35,956, and 1.75 miles Scotia Hollow Road, with macadam, in Jefferson Township, to Ridge Bros. Co., Pittsburgh, at $34,137.

★Wilmington, Del.—Following are 2 lowest bids opened by Levy Court Sept. 14 for constructing about 3 miles stone road on Kennett Pike; John F. O'Neill, Mt. Arba, and I. J. Hollingsworth, Elsmere, at $31,582.

★Clearwater, Fla.—Contract for paving with brick on Franklin Street, including concrete curb and gutter (bids opened Sept. 17) awarded Sept. 22 to Pinellas Constr. Co., Augusta, Ga., at $6,007. R. L. Davis, Tampa, bid $6,207. J. N. Drew, City Engr.

★Louisville, Ky.—Contracts for paving awarded by Bd. Pub. Wks. as follows: Brook Street, with asphalt, to Louisville Asphalt Co., Louisville, at $10,900, and for Dupuy Street, with brick, to Henry Bickel Co., Louisville, at $10,500.

Cleveland, Ohio.—County Comrs. recommended for award of contract to Pace Bros., Cleveland, for paving 5½ miles of road between Bedford and Twinsburg; cost about $94,000.

★Columbus, Ohio.—Contract for paving with asphalt Rhoades Avenue awarded by Bd. Public Service to A. G. Pugh, Columbus, at $15,000.

★Jeffersonville, Ind.—Contracts for constructing Lentz Road and Coots Road in Utica and Silver Creek Townships respectively awarded by Bd. County Comrs. to Martin F. O'Neil at $7,992 and $15,900 respectively.

★Atlanta, Ill.—Contract for paving five blocks with brick on concrete base awarded J. E. Bretz, Springfield.

Chicago, Ill.—Following are lowest bids opened by Bd. Local Improvements for paving (price given per sq. yd.): Campbell Avenue, 8200 sq. yd., F. P. McCormick, 68 W. Washington Street, $1.71; Harding Avenue, 2000 sq. yd., R. F. Conway Co., 6208 Sheridan Road, $1.78; Forty-fourth Street, 4800 sq. yd., R. F. Conway, $1.74; Leamington Avenue, 1920 sq. yd., American Asphalt Paving Co., 133 W. Washington Street, $1.69; Stewart Avenue, 16,500 sq. yd. American Asphalt Paving Co., $1.64; Ward Street, 2520 sq. yd., R. F. Conway Co., $1.70; Yale Avenue, System 66,800 sq. yd., Frank Proudfoot, 127 N. Dearborn St., $1.48.

Illinois.—Following are lowest bids opened Sept. 16 by State Highway Commission, Springfield, for State aid work on roads:
Kane County—Earth road, Sect. F, 3390.04 ft. long; lowest bidder, Cameron Joyse Company, Keokuk, Iowa, $6,195. Concrete road, Sect. G, 7400 ft. long; four lowest bidders, Grohne Constr. Co., Joliet, Ill., $11,988; Reed & Reed, Michigan City, Ind., $12,995; Connelly & Dunning, Chicago, $13,189; Logan & Gertz Contr. Co., Elgin, $13,300.
Piatt County, brick road, Sect. B, 16,200 ft. long; four lowest bidders: C. A. Micheal, Malloon, $28,250; A. Pfizenmayer, Jr., Terra Haute, $29,350; Granite City Lime & Cement Co., Granite City, $30,399; W. S. Lodge, Monticello, $31,013.

★Milwaukee, Wis.—Contracts for paving aggregating about $61,513 in all awarded by city as follows: Twenty-fourth Avenue, Cedar, Fifty-first Street, Center Street with asphalt to Badger Construction Co., Railway Exchange Building; Davis Street and Greenfield Avenue with asphalt to F. P. Coughlin.

★Clear Lake, Iowa.—Contract for about 50,000 sq. yd. asphalt pavement at Clear Lake awarded to Bryant Asphalt Co., Waterloo, at $1.71 per sq. yd.

★**Guthrie Center, Iowa.**—Moore Selg Co., Waterloo, secured contract to pave about thirty blocks on State, Fifth and other streets. They bid $1.89 for fiber brick and $2.075 for brick block. Reinking Constr Co., Des Moines, bid $1.89 for bitulithic and Lama Constr Co., Council Bluffs, $2.05 for brick block. Seth B. Weeks, City Clk.

★**St. Louis, Mo.**—Contract for paving Magnolia Avenue awarded by Bd. Pub. Wks. to Webb-Kunze Constr Co., 3927 Tyler Avenue, at $13,207.

★**Seattle, Wash.**—Contract for paving Twentieth Avenue N. E awarded by Bd. Pub. Wks. to N. Fiorito & Bros., 616 Twenty-sixth Avenue, N., at $21,481.

Lowest bids opened by Bd. Pub. Wks. for paving submitted by Cascade Constr. Co., Central Building, as follows: Mill Street, $13,584, and Massachusetts Street (2 bids) $33,984 and $31,804.

★**Riverside, Cal.**—Contract for constructing 4.11 miles concrete pavements on Route 2, portion of Route 1 (Riverside Road to Scully Property), awarded by Bd. Supervs to Isbell Constr Co., 3969 Oregon Street, San Diego, at $22,740.

★Contract for constructing 9.29 miles (route 11 (Perris to Elsinore Road) awarded by county to C. L. Hyde Construction Co., Spreckles Building, San Diego, at $38,740.

San Francisco, Cal.—Lowest bid opened recently Sept. 15 by Bd. Wks. for second section of Twin Peaks Boule. was from F. R. Ritchie & Co., Chronicle Building, at $54,745.

Salt Lake City, Utah.—Lowest bid opened by City Comn. for paving Thirteenth Street E. submitted by J. W. Mellen, Auditorium Building, at $15,951.

★**Idaho.**—Contract awarded by State Highway Comn., Boise, to Reese & Munson, Blackfoot, as follows: to construct 2¼ miles of State highway between Lava Hot Springs and Lund, at following bid: 82,000 cu. yd. earth excav., 18 cts.; 3000 cu. yd. wet earth excav., 25 cts.; 4925 cu. yd. loose rock excav., 50 cts.; 325 cu. yd. solid rock excav., $1.50; 4530 cu. yd. overhaul per 100 ft., 1.5 cts.; .5 mile machine grading, $150; 30 acres sage brush to clear, $6; 1263 ft. 12-in. iron culvert pipe to lay, 20 cts.; 566 ft. 18-in., 30 cts.; 174 ft. 24-in., 35 cts.; 24 ft. 30-in. 37½ cts.; 113 cu. yd. concrete in culvert end walls, $14; total, $21,161. Other bidder: Idaho Constr Co., Boise, $23,389. Reese & Munson also secured contract for constructing 3½ miles State Highway between Alexander and Grace, at $5,266.

★**Toronto, Ont.**—Contract awarded to Construction & Paving Co. for paving with asphalt on Bloor Street, from Dundas Street to Indian Road, at $13,416, and from Pacific to Hill Park Avenue, at $7,450; and to J. H. McKnight Constr. Co., for brick pavt. on Bloor Street, from Indian Road to Pacific Avenue, at $19,004.

STREET CLEANING AND GARBAGE DISPOSAL

PROPOSED WORK.

Buffalo, N. Y.—Revised plans being prepared by Howard Beck, City Architect, for the 3-story addition to garbage disposal plant at Hamburg Street and Lake Shore R. R.; cost, $150,000.

Atlantic City, N. J.—Director Bacharach of Dept. Parks and Pub. Property has prepared specification for contract for disposal of garbage for a period of five years from Sept. 1, 1916. Present contract expires Aug. 31, 1916.

Elgin, Ill.—City Council reported to be considering building an incinerator and disposal plant; probable cost $12,000.

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS

PROPOSED WORK.

Drainage — Waterbury, Conn.—Charles H. Preston, Jr., 138 Grand street, Waterbury, has submitted to manufacturers of Naugatuck Valley a report on feasibility of conserving water on a large basis in Upper Naugatuck Drainage Basin for equalizing Naugatuck River flow. State Board of Engineers has accepted the recommendation that a series of dams be constructed of cyclopean masonry, 1200 ft. long, 60 ft. high, and impounding about 10,000 cu. yd., impounding 1,500 million gal. of water. The project if constructed will cost several million dollars.

Piers—Baltimore, Md.—Mayor Preston and The Harbor Bd. are co-operating with the Way Dept. for developing waterfront between Ft. McHenry and Ferry Bar, including construction of eight piers each 1200 ft. long. Work to be started as soon as funds are available.

Hydroelectric Plant—Burnsville, N. C.—A hydroelectric plant costing $16,000 is to be constructed here. No contracts will be let. C. W. Harper, Burnsville, Engr.

Hydroelectric Plant — Lenoir, N. C.—Reported Citizens Light & Power Co. of Lenoir intends constructing a hydroelectric plant below dam of Granite Falls Mfg. Co.

Canal—Monroe, La.—Police Jury passed ordinance providing for a combination road and drainage district to dig a canal and build road southeast from Monroe through the Lafourche swamp. Plans prepared by H. E. Atkinson, State Highway Engr. Cost, $65,000.

Ditch—Fremont, Ohio.—County engineer has been directed to submit estimates for Pickerel Creek ditch improvement. Cost, about $16,000.

River Improvement Bonds—St. Louis, Mo.—Mayor is in favor of issuing $14,500,000 bonds for following purposes: to improve River des Peres, $6,000,000; reconstruction and improvement of sewers, $4,000,000; $1,000,000 each for bridges, viaducts and city's share of grade crossings separation and for municipal docks; garbage plant and municipal ash hauling, $750,000; improving water front, $250,000; industrial school, $250,000; tuberculosis hospital, $200,000; asphalt plant, $200,000; municipal stables, $100,000; and zoo buildings $300,000.

Drainage Bonds—Ennis, Tex.—Citizens of Drainage and Levee Dist. No. 2 voted $125,000 bonds to reclaim 12,000 acres of land on Trinity River from State Rock to the cut-off.

Wharves, Docks, Etc.—Orange, Tex.—Contract soon to be let for constructing wharves and docks in southern part of city to cost $150,000. Attorney General approved $325,000 bond issue for municipal wharves and docks, schools and streets.

Seawall—Port Arthur, Tex.—The Citizens Com. engaged J. F. Coleman, New Orleans, to prepare preliminary plans for storm protection, including drainage plans for removing water falling inside seawall.

Irrigation — Newberry, Wash.—R. W. Carter, John W. Sumner, of Newberry, interested in organizing an irrigation district to irrigate 500,000 acres of land.

Irrigation—North Yakima, Wash.—Reported U. S. Reclamation Service is preparing plans for storage of 95,000 acre feet more of water at lake reservoirs, at Sunnyside and Tietin Irrigation Dist. The reservoirs to be enlarged and other improvements made. R. K. Tiffany, Project Mgr.

Irrigation—Baker, Ore.—Baker Irrigation Ditch Co., controlled by Balfour, Guthrie & Co., Portland, Ore., plans construction of a reservoir four miles long in Sumpter Valley Canyon, 15 miles south of Baker. Cost, $500,000.

Irrigation District—Porterville, Cal.—Bd. Superv. approved plans for proposed Strathmore-Lindsay Irrigation Dist.

Irrigation—Ripon, Cal.—Board of Directors of the irrigation district voted in favor of reservoir and drainage system.

Esplanade—San Francisco, Cal.—Bd. Pub. Wks. approved plans and specifications for first section of esplanade on ocean beach, this section to be about 650 ft. long. Contract let early part of October.

Irrigation—Carey, Idaho.—Plans being prepared by Elmer H. Caldwell, Engr., Salt Lake City, Utah, for reservoir and irrigation system for Little Wood River. Joseph S. Cooper, Cashier Carey State Bank, interested.

Canal Improvement — Rigby, Idaho.—Great Feeder Canal Co., Rigby, plans constructing new head gates and other improvements at new impounding dam. Cost $15,000.

Power Development — Niagara Falls, Ont. — Reported Ontario Hydroelectric Comn. has completed plans for the proposed power development at the Falls, and will soon submit them to the Government. It is planned to develop power from the Welland Canal spillways and the Niagara River. The chief development will be on Smeaton Farm, at Queenstown, where the Government plans to construct a generating station and transformer plant. Water will be brought to the generating plant through a power canal from Chippawa Creek at a point near Montrose. The power canal will require the construction of a tunnel at Lundy's Lane and Green Corners, nearly 300 ft. long. A dam is also contemplated at Chippawa Creek, above Montrose.

BIDS DESIRED.

State Canal Work—Albany, N. Y.—Until Oct. 6, by W. W. Wotherspoon, Supt. Pub. Wks. Capitol, Albany, for improving Canisteo River, near city of Hornell and village of Canisteo, and repairing wall of canal feeder on Main St., Oneida.

Albany, N. Y.—Until Oct. 26 by State Supt. Pub. Wks., Albany, for Terminal Contracts as follows:

No. 20, constructing barge canal terminals in city of Syracuse, to include terminal basins and connecting channel to Onondaga Lake, piers, dockwalls, spillway and highway bridge, and about 1,620,000 cu. yd. excav. Engineer's preliminary estimate about $66,575.

No. 50, terminal town of Holley, grading terminal site and approaches to include 1000 cu. yd. excav., 900 cu. yd. embankment, etc. Engineer's preliminary estimate, $1,197.

Riprap—Philadelphia, Pa.—Until Oct. 14 by U. S. Engineer's Office, Philadelphia, for furnishing and placing riprap in Delaware River at Mifflin Bar Dike, advertised in Engineering Record.

Reclamation Work—Washington, D. C.—Until Oct. 20 at U. S. Reclamation Service, Washington, D. C. (A. P. Davis, Ch. Engr.), for furnishing operating mechanism for two cylinder gates of 12 ft. diameter for Sherburne Reservoir, Milk River Project, Mont., and duplicate set for Keechelus Reservoir, Yakima Project, Wash.

Dredging—Norfolk, Va.—Until Oct. 9, by Bureau Yards and Docks, Navy Dept., Washington, D. C. (H. R. Stanford, Ch.), for Spec. No. 2189, dredging at the navy yard, Norfolk.

Levee Work—New Orleans, La.—By State Bd. Engrs., New Orleans, for following levee work:

Willow Chute, Bossier Parish, Red River, left bank; new levee, approximately 55,000 cu. yd.

Gold Point Spur Levee, Bossier Parish, Red River, left bank; new levee, approximately 15,000 cu. yd.

Riverside Levee, Bossier Parish, Red River, left bank; new levee, approximately 125 cu. yd.

Colquit Point Levee, Bossier Parish, Red River, left bank, new levee; approximately 36,000 cu. yd.

Pat Cash Levee, Bossier Parish, Red River, left bank; new levee, approximately 60,000 cu. yd.

Rocky Bayou Levee, Rapides Parish, Red River, left bank; new levee, approximately 44,000 cu. yd.

Levee Work — Shreveport, La.—Until Oct. 6 by Bd. Comrs., Caddo Levee Dist., Shreveport, for constructing following levees:

Improving drainage in Kelly Bayou, Section 2, Caddo Parish, about nine miles; approximate excav. 275,000 cu. yd. of earth; clearing in addition.

Upper Missionary Levee, Caddo Parish, Red River, right bank; new levee; approximately 34,000 cu. yd.

Thompson Levee, Caddo Parish, Red River, right bank; new levee; approximately 110,000 cu. yd.

West Egypt Levee, Caddo Parish, Red River, right bank; new levee; approximately 55,000 cu. yd.

Cedar Bluff Levee, Caddo Parish, Red River, right bank; new levee; approximately 40,000 cu. yd.

Long Point Levee, Caddo Parish, Red River, right bank; new levee; approximately 35,000 cu. yd.

Loggie Lea Levee, Caddo Parish, Red River, right bank; new levee; approximately 100,000 cu. yd.

Campo Bello Levee, Caddo Parish, Red River, right bank; new levee; approximately 55,000 cu. yd.

Spillway—Cincinnati, Ohio.—Until Oct. 15 at U. S. Engr's. Office., Cincinnati, for reconstructing, in concrete, top of spillway at Dam No. 4, Muskingum River, at Beverly and Waterford, on the B. O. R.R. (Ohio and Little Kanawha Division); the river is navigable between the site and Marietta and Zanesville. Maj. Robert R. Ralston, Corps Engrs., U. S. A.

Ditch—Winamac, Ind.—Until Oct. 16 same place as above for main ditch 16,000 ft. long. 16,533 cu. yd. excav. branch 5100 ft. long.

Channel—Bedford, Iowa.—Reported desired until Oct. 15 for constructing channel E, Nodawa River. W. L. Holbrook, Engr. Address J. N. Hughes, Auditor.

Levee—South Bend, Ark.—Reported desired until Oct. 4 by Linwood & Auvurn Levee Bd. (Gus Waterman, Chmn., Varner, Ark.) for constructing 65,000 yd. new levee at South Bend. C. C. Price, Engr., Dumas.

Drainage—Victoria, Tex.—Reported desired until Oct. 14 by Herman Fischer, Co. Clk., for constructing drainage system consisting of about 1,100,000 cu. yd. excav. and necessary clearing, etc. Citizens voted $160,000 bonds. J. G. Johnston, Drainage Engr., Victoria.

Reclamation Work — Grand Junction, Col.—Until Nov. 8 by U. S. Reclamation Service, Washington, D. C. (A. P. Davis, Ch. Engr.), for furnishing chain shafts and chains for the rolling crest of Grand River diversion dam. Grand Valley Project, Col.

Reclamation Work—Carlsbad, N. M.—Until Oct. 12 by U. S. Reclamation Service, Carlsbad, for constructing Dark Canyon pipe line extension of Carlsbad Project. The work is located about two miles south of Carlsbad and involves the excavation of approximately 750 cu. yd. material, raising former outlet work, involving removal of approximately 100 cu. yd. reinforced concrete and placing 200 cu. yd. reinforced concrete in structures.

Drainage—North Yakima, Wash.—Reported desired until Oct. 4 by County Comrs. for constructing drainage system in Drainage Improv. Dist. No. 27, consisting of furnishing and laying 4.44 miles closed drains, excav., etc. I. O. Greenway, Co. Engr.

Guide Wall—Seattle, Wash.—Reported desired until Oct. 11 by Lieut.-Col. J. B. Cavanaugh, Corps Engrs., U. S. A., Burke Bldgs., Seattle, for constructing a guide wall 600 ft. long, 16 ft. wide, to be constructed at western entrance of Lake Washington Canal locks, of creosoted pile and timber construction. Cost $10,000.

Pile Jetty—San Luis Obispo, Cal.—Reported desired until Oct. 11 by Bd. Superv. for constructing pile jetty for reclamation along north side of Santa Maria River, approximately 3600 ft. long.

Sea Wall.—Vancouver, B. C.—Until Oct. 5 by City Engineer for constructing sea wall on Main Street bridge.

PRICES AND LETTINGS.

★Indicates award of contract.

★**State Canal Work—Albany, N. Y.**—Contracts awarded as follows by State Superintendent Public Works:

★Contract for improving Sawyers Creek, North Tonawanda (bids opened Sept. 9), to H. S. Kerbaugh, Inc., 6 Church Street, New York, at $9,440.

★Terminal Contract 40—to J. E. Bishop, 228 McDerman Avenue, Syracuse, at $25,516.

State Canal Work—Albany, N. Y.—Lowest bid opened Sept. 28 for constructing terminal in Village of Spencerport—grading terminal site east of Union Street lift bridge—submitted by F. J. Munn Contr. Co., Inc., Buffalo, at $1,406.

State Canal Work—Terminal Contract 47—Albany, N. Y.—Following are four lowest bids opened Sept. 28 by State Supt. Pub. Wks. for Terminal Contract 47—Raising height of wall, grading and paving terminal sites on north and south sides of barge canal east of Main-Delaware Avenue bridge at Tonawanda: Public Service Contr. Co., Niagara Falls, $39,466; F. J. Munn, Contr. Co., Buffalo, $40,120; Holler & Shepard, Rochester, $41,555; I. M. Ludington Sons, Inc., Rochester, $38,630.

★**Jetty Work—Atlantic City, N. J.**—Contract awarded Atlantic Constr. & Supply Co., Atlantic City, at $13,427, for constructing extension of Tennessee Avenue jetty.

★**Drainage Station—Burlington, N. J.**—Contract for pumps and pipes for municipal drainage station awarded R. D. Wood Co., Philadelphia, Pa., at $5,379.

★**Drain—Newark, N. J.**—Contract for constructing drain in Valley Road awarded by Bd. Freeholders to Cestare Constr. Co. at $15,000.

★**Dredging—Baltimore, Md.**—Following are bids opened Sept. 15 by U. S. Engineers, Baltimore, Md., for dredging river and harbor on east shore of Chesapeake Bay, approximately 158,250 cu. yd. (price given per cu. yd.): Maryland Dredging & Contr. Co., Baltimore, 26.5 cts. (recommended for award); Darsey & Miller Co., Washington, D. C., 27.75 cts.; River & Harbor Improvement Co., Philadelphia, 27 cts.; Norfolk Dredging Co., Norfolk, Va., 29 cts.

★**Dredging—Wilmington, Del.**—Contract for dredging Murderkill and Mispillion Rivers, Delaware (bids opened Sept. 7), awarded River & Harbor Improv. Co., Philadelphia, at $5,048.

★**Jetties — Wilmington, Del.**—Contract for furnishing and placing stone for repairs to jetties Cold Spring Inlet, N. J., awarded Coast & Lakes Constr. Co., New York, at $29,520.

Wharf—Charleston, D .C.—Following are four bids received recently by Lighthouse Inspector, Sixth Dist., Charleston, for construction of depot wharf: Simmons, Mayrant Co., $38,873; Gadsden Contr. Co., $44,440; Charleston Eng. & Contr. Co., Charleston, $46,418; Alsop & Pierce, $49,480.

Steel Piling for Dam—Louisville, Ky.—Following are bids opened Sept. 16 by U. S. Engineer's Office, Louisville, for steel sheet piling for Dam No. 43, Ohio River: Quantity sufficient for 1364 lin. ft. of sheeting in place; piles 40 ft. long; total quantity 54,560 sq. ft. in place: (a) estimated weight of piling per sq. ft. in place, lb.; (b) total estimated weight required, lb.; (c) price per lb.; (d) total: Jones & Laughlin Steel Co., Pittsburgh, Pa., (a) 45.25, (b) 2,305,160, (c) 1.64 cts., (d) $37,805; Carnegie Steel Co., Pittsburgh, (a) 39.1, (b) 2,135,296, (c) 1.599 cts., (d) $34,111; Lackawanna Steel Co., Lackawanna, N. Y., (a) 40, (b) 2,182,400, (c) 1.64 cts., (d) $35,791.

★**Ditch — Blue Earth, Minn.**—Contract for constructing Ditch No. 33 awarded Carl C. Knudsen, Blue Earth, at $5,478.

★**Ditch—Windom, Minn.**—Contract for constructing P. & L. tile and open ditch work awarded by county commissioners as follows (bids opened Sept. 16): Ditch No. 40 to Thompson & Jacobson, Windom, $5,441; Ditch No. 15 to Henry Swift, Webster City, $13,279. S. A. Brown, Co. Aud.

★**Irrigation Work—Belle Fourche, S. D.**—Contract for earthwork on North Canal extension and laterals, Belle Fourche irrigation project, S. D., awarded Curtis Bros., Columbus, Neb., at $8,771. About 58,000 cu. yd. excavation and 13,000 cu. yd. overhaul.

Irrigation Work—Malta, Mont.—Following are totals of bids opened Sept. 20 by U. S. Reclamation Service, Malta, for Milk River Project, Bowdoin Canal, First Unit, earthwork and structures — (a) Schedule 1, (b) Schedule 2, (c) Schedule 3, (d) Schedule 4: Jurgens, Booth & Co., Glasgow, (a) $13,999, (b) $5,555, (c) $11,489, (d) $6,267; Mendenhall & Bird, Springville, Utah, (a) $17,722, (b) $6.029, (c) $14,045, (d) $9,434; James O'Connor, Saco, Mont., (a) $13,293, (b) $5,325, (c) $11,745; George P. Wright, 602 Provident Building, Tacoma, Wash., (a) $16,047, (b) $4,790; Charles Wilhite & Co., Malta, (a) $15,670, (b) $9,220, (c) $12,550; Security Bridge Co., Minneapolis, Minn., (d) $7,527.

Irrigation—Malta, Mont.—Following are bids opened Sept. 20 by U. S. Reclamation Service, Malta, for Milk River Project, Nelson Reservoir, South Canal, structures, Schedule 1: (a) Jurgens, Booth & Co., Glasgow, $34,081; (b) Security Bridge Co., Minneapolis, Minn., $39,409.

	(a)	(b)
25,000 cu. yd. excav., Class 1.	$0.40	$0.50
750 cu. yd. excav., Class 2.	0.60	1.00
10 cu. yd. excav., Class 3.	1.15	1.50
2,500 sta. yd. overhaul	0.02	0.02
1,500 cu. yd. puddling	0.60	0.60
1,700 cu. yd. concrete	8.80	10.00
115,000 lb. placing reinforcing steel	0.015	0.0132
6,000 lb. erecting structural steel	0.02	0.02
3,000 sq. yd. dry paving	1.55	1.60
150 lin. ft. laying vitrified pipe	0.40	0.66
450 lin. ft. erecting metal flumes	0.30	0.66
85 M ft. erecting lumber.	12.00	16.00

★Revetment Work—Hartsburg, Mo.—Following are bids opened by U. S. Engineer Office, Kansas City, Sept. 20, for constructing about 13,000 ft. of standard revetment on Missouri River, about two miles from Hartsburg, Mo.: (a) per lin. ft.; (b) total: Kansas City Bridge Co., Orear-Leslie Bldg., Kansas City, (a) $8.18; (b) $106,340 (awarded contract); Marshall Rust, Pilot Grove, (a) $8.74,; (b) $107,120; Munn-Reise Constr. Co., Kansas City, Kan., (a) $8.49; (b) $110,370; DeWitt & Shobe, Glasgow, (a) $8.73; (b) $113,490; J. W. McMurry Contr. Co., 709 Sharp Bldg., Kansas City, (a) $9.75; (b) $126,750.

Piers—Pearl Harbor, T. H.—Following are four lowest bids opened Sept. 18 by Bureau of Yards and Docks, Washington, D. C., for constructing torpedo boat Piers 1, 2, 3 and 4, of reinforced concrete, at Naval Station: John Monk, Sharon Building, San Francisco, Cal., $111,870; Hawaiian Dredg. Co., Honolulu, $112,935; Lord Young Eng. Co., Honolulu, $114,600.

Wharf—Pearl Harbor, T. H.—Following are four lowest bids opened Sept. 18 by Bureau Yards and Docks, Washington, D. C., for constructing a reinforced concrete wharf at U. S. Naval Station: Spaulding Constr. Co., San Francisco, $151,500; Hawaiian Dredg. Co., Honolulu, $155,900; Lord Young Eng. Co., Honolulu, $164,800; Healy Tibbetts Constr. Co., San Francisco, $167,300.

ELECTRIC RAILWAYS

PROPOSED WORK.

Hillsboro, Ill. — Hillsboro, Synthiana, Bainbridge & Chillicothe Traction Co. plans to construct a 42-mile electric railway between Hillsboro and Chillicothe.

Pratt, Kan.—Anthony & Northern Ry. Co. plans to build extensions north from Pratt. Headquarters Hutchinson.

Ceres, Cal.—Tidewater & Southern R.R. Co. (J. H. Wallace, Ch. Engr., Stockton) received franchise to construct railway through Ceres.

San Francisco, Cal.—Bd. Supervs. voted to construct an extension of Municipal Ry. across Golden Gate Park. T. A. Cashin, Supt., San Francisco.

BIDS DESIRED.

Brooklyn, N. Y.—See "Public Buildings."

New York, N. Y.—Until Oct. 15 by Public Service Comn. for First Dist., 154 Nassau Street, New York, for portion "C" of the ballast contract for new rapid transit railway, about 80,000 cu. yd. of trap rock or hard limestone.

Mauch Chunk, Pa.—Bids being received by Carbon Transit Co. for power equipment, consisting of boiler with culm burning furnace and 300-kw., 600-volt, direct-current, turbo- or engine-driven generator installed, complete, with condenser, piping, etc.

RAILROADS

PROPOSED WORK.

Etterick, Wis.—Citizens voted $75,000 to construct railroad to Blair, 10 miles away.

St. Joseph, Mo.—State Public Service Comn., Jefferson City, and the railroads are reported considering erecting a union station and eliminating grade crossings in St. Joseph.

Coalmont, Col.—The Union Pacific R. R. according to reports, will extend Colorado, Wyoming & Eastern R. R. from present terminus at Coalmont to Steamboat Springs. Location survey completed to Steamboat Springs.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Virginia.** — Contracts awarded by Southern Ry. Company, Washington, D. C. (W. H. Wells, Ch. Engr. of Constr.), for double tracking as follows:

Sycamore to Gretna, 4 miles, to Hall-Crawford Constr. Co., Macon, Ga.

Whittles to Dry Fork, 9.7 miles, to Robert Russell, Danville, Va.

Arrowhead to Elma, 20 miles, to W. W. Boxley & Co., Roanoke, Va.

PUBLIC BUILDINGS AND SCHOOLS

PROPOSED WORK.

Worcester, Mass.—Plans being prepared by George C. Halcott, Superintendent Public Buildings, for two-story brick ward building for Belmont Hospital; cost $50,000.

Worcester, Mass.—Plans being prepared by Fuller & Delano Co., Worcester, for two-story fireproof building to be erected for Belmont Hospital. George C. Holcott, Supt. Pub. Bldg.

East Hartford, Conn.—Contract soon to be let for erecting brick fireproof high school, costing about $80,000, with equipment. Wilson Potter, Archt., 1 Union Square, New York.

New York, N. Y.—Reported Ernest Flagg, 109 Broadway, prepared plans for an eight-story brick, terra cotta and limestone hospital, which it is proposed erecting at Broad and Water Streets. Probable cost $350,000.

Rosebank, S. I., N. Y.—Plans filed for erection of 3-story brick orphan asylum at Fingerboard Road and Sherman Avenue, Fort Wadsworth, for Bethlehem Orphan Home, cost $95,000. Kopp & Strong, 7 Wall Street, New York City, Archts.

Bayonne, N. J.—Board of Education passed resolutions to ask Board of School Estimates for $146,000 for new school in Ward 5; also $130,000 for school to replace School No. 1 on West Fifth Street.

Camden, N. J.—Arthur Truscott of Merchantville engaged as supervising architect to pass on plans for proposed $400,000 Manual Training and High School building to be erected at Park Boulevard and Baird Avenue.

Newark, N. J.—Ernest F. Guilbert, Archt. Bd. Educ., has been directed to prepare plans for nine school buildings.

Chester, Pa.—Reported Bd. Educ. is considering erecting a girls' high school or commercial high school.

Pittsburgh, Pa.—Reported plans for Homewood Brinston High School to be revised to include complete building costing $700,000. First plans provided only for one-third of the building at a cost of $265,000.

Savannah, Ga.—Citizens voted $400,000 bonds for public schools.

De Land, Fla.—$92,000 school bonds will be sold Oct. 18 by Bd. Pub. Instructions (C. R. M. Sheppard, Secy.).

Raleigh, N. C.—Citizens voted $100,000 public school building bonds.

Jacksonville, Fla.—Erection of a municipal hospital, probably four stories and cost $50,000, under consideration. M. B. Herlong, Chmn. City-Owned Hospital Assoc., may be able to give further information.

Chattanooga, Tenn.—W. T. Downing, Atlanta, Ga., selected supervising architest for University of Chattanooga plant. Buildings to be erected include administration building, library and museum, science building, liberal arts building and Gothic chapel. Other buildings to follow later. Total cost about $500,000.

Batavia, Ohio.—$30,000 school bonds will be sold Oct. 15 by T. P. Breeding, Clk. Bd. Educ., Batavia Village School Dist.

Cleveland, Ohio.—City Architect F. H. Betz has prepared plans for cement and brick municipal dance hall and concert building, contemplated in Gordon Park. Probable cost $90,000.

Massillon, Ohio.—State Bd. Administration, Columbus, intends erecting at Massillon Hospital a brick fireproof cottage for patients to cost about $70,000. H. C. Eyman, Supt.

Midvale, Ohio.—Goshen Township Bd. Educ. has sold $35,000 bonds, proceeds to be used to erect a central high school at Midvale.

Rootstown, Ohio.—School bonds amounting to $30,000 have been sold.

Logansport, Ind.—The sum of $25,000 has been bequeathed to this city with which to erect a hospital. Frank V. Guthrie, Mayor.

Chicago, Ill.—Plans completed by Holabird & Roche, Monroe Building, for armory for First Cavalry, to be erected on Chicago Avenue near Lake Shore Drive, to be concrete and steel, 200 x 300 ft., five story. Col. Milton G. Foreman, Comdg.

Chicago, Ill.—Plans completed by James B. Dibelka, State Archt., 140 N. Fifth Street, and Holabird & Roche, Monroe Building, for concrete and steel armory for First Cavalry, I. N. G., to be erected at Lake Shore Drive and Chicago Avenue.

Joliet, Ill.—Plans completed by C. W. Webster, Cutting Building, for three-story stone addition to Silver Cross Hospital; cost about $35,000.

Board of Education considering erecting new school on East Side.

Madison, Wis.—Committee on Plans for reinforced concrete athletic stadium, Univ. of Wisconsin, taking steps to construct stadium, toward which Legislature appropriated $20,000.

New Hampton, Iowa.—M. B. Cleveland, Waterloo, is architect for brick building which Fire Department (J. E. Gannen, Ch., Chmn. Bldg. Com.) will erect at a cost of $30,000.

Nevada, Iowa.—Citizens, Sept. 19, voted $80,500 bonds for new school.

Kansas. — Plans being completed by Charles Candler, State Archt., Topeka, for buildings as follows:

Emporia, administration building, State Normal School. Cost $175,000.

Fort Hays, Sheridan Hall, Kansas Normal School, yellow limestone and reinforced concrete. Cost $100,000.

Parsons, State Hospital, new building. Cost $50,000.

Winfield, State Hospital, erect new building, complete building under construction and make minor improvements. Cost $32,504.

Larned, State Hospital, new cottage. Cost $40,000.

Carthage, Mo. — Citizens of county voted $100,000 bonds to erect tuberculosis sanitarium.

Beaumont, Tex.—Citizens voted $25,000 jail-building annex bonds.

Orange, Tex.—See "Hydraulic Construction and River Improvements."

Temple, Tex.—Attorney-General has approved $30,000 central fire station bonds. Address City Clerk.

Seattle, Wash.—Plans completed by Bebb & Gould, Denny Building, for erection of school for University of Washington; cost about $150,000.

Seaside, Ore. — Ernest K. Kroner, Worcester Building, Portland, engaged to prepare plans for erecting Union High School for School Dist. of Klatsop Plains, Seaside and Hamlet; cost about $50,000.

Sacramento, Cal.—Competitive plans being received until Nov. 1 for Carnegie library; cost about $100,000.

Santa Barbara, Cal.—Library Trus. intend erecting a brick and concrete semi-fireproof library at a cost of about $80,000 with equipment. Francis W. Wilson, Archt., Santa Barbara.

Montreal, Que.—McGill University has received a gift of $150,000 to erect a students' residence at the University.

Hamilton, Ont.—Technical Com. of Bd. Educ. reported to be considering erecting a technical school in East Hamilton.

BIDS DESIRED.

Boston, Mass.—Until Oct. 16, by Bureau Yards and Docks, Navy Dept. Washington, D. C. (H. R. Stanford, Ch.), for Spec. No. 2192—Constructing reinforced concrete floor in pattern shop Building No. 42, U. S. Navy Yard, Boston.

West Springfield, Mass.—Until Oct. 5 by Library Bldg. Com. (H. E. Schmuck, Chmn.) for furnishing material and erecting, including heating, plumbing and electric work, for library, Elm and Park Streets. Edw. L. Tilton, Archt., 32 Broadway, New York.

Brooklyn, N. Y.—Until Oct. 26 by Public Service Comn. for First Dist., 154 Nassau Street, New York, for the finish of eleven stations on the road between Tenth Avenue and Coney Island. The stations are Fort Hamilton Parkway, Fiftieth, Fifty-fifth, Sixty-second, Seventy-first and Seventy-ninth Streets and Eighteenth, Twentieth and Twenty-fifth Avenues, Bay Parkway and Bay Fiftieth Street.

Little Falls, N. Y.—Until Oct. 12 (re-advertisement) by M. A. Leahy, City Clk., for erecting municipal building.

Metuchen, N. J.—Until Oct. 7 by Bd. of Educ. Metuchen High School for furnishing material and erecting a grade school on New Brunswick Avenue. Separate bids will be received for construction; heating and ventilating; plumbing and electrical work. John Noble, Pierson & Son, Archts., 130 Smith Street, Perth Amboy.

Pleasantville, N. J.—Until Oct. 5 by Bd. Educ. for erecting high school.

East Pittsburgh, Pa.—Until Nov. 6 by James A. Wetmore, Acting Superv. Archt., Washington, D. C., for erecting, complete (including mechanical equipment and approaches), U. S. Post Office at East Pittsburgh.

Philadelphia, Pa.—Until Oct. 8, by Dept. Pub. Wks. (M. L. Cooke, Dir.) for erecting caretaker's house in Black Oak Park, 46th Ward, and field house on municipal athletic field, Twenty-seventh and Clearfield Streets, 38th Ward.

Washington, D. C.—Until Oct. 25 by Comrs. D. C. for erecting building for Truck Co. No. 1 on New Jersey Avenue and E Street, N. W.

Norfolk, Va.—Until Oct. 23, at Bureau Yards and Docks, Navy Dept., Washington (H. R. Stanford, Ch.), for Spec. No. 2190—Erecting 2-story brick building at St. Helena Navy Yard, Norfolk.

Akron, Ohio.—Reported desired until Oct. 12 by B. L. Bargar, Secy. State Armory Bd., Columbus, for erecting 2-story and basement, 115 x 164 ft., auditorium and armory; probable cost $100,000. Harpster & Bliss, Archts., Nantucket Building, Akron.

Columbus, Ohio.—Until Oct. 8 by Dir. Pub. Service (Paul B. Kemper, Clk.) for furnishing material and erecting a recreation building at Schiller Park. Bassett & Tresselt, Archts., 401 Central Natl. Bank Building, Columbus.

East Cleveland, Ohio.—Until Oct. 16 by Charles Ammerman, Clk. Bd. Educ., for furnishing material and erecting addition to Rozell School on Philip Avenue. Bids will be received as a whole or separately on excav., mason work, cut stone; fireproofing concrete and cement work; steel and iron work; carpentry; heating, ventilating, wiring, etc. Bids for labor and material must be stated separately. W. H. Nicklas, Archt., 608 Euclid Building, Cleveland.

Northfield, Ohio.—Until Oct. 27 by Bd. Educ. (G. L. Williams, Clk.) for erecting school; probable cost $28,000.

Sidney, Ohio.—Until Nov. 8 by Supervising Architect, Washington, D. C., for erecting U. S. Post Office, advertised in Engineering Record.

Van Wert, Ohio.—Until Nov. 10 by James A. Wetmore, Acting Superv. Archt., Washington, D. C., for construction, complete (including mechanical equipment and approaches), of U. S. Post Office at Van Wert.

Detroit, Mich.—Until Oct. 12, by Bd. Educ. (Chas. A. Gadd, Secy.) for furnishing material and erecting a twenty-room school on Honora Avenue and Pitt Street. Malcomson & Higginbothan, Archts., 404 Moffatt Bldg. Ammerman & McColl, 1310 Penobscot Bldg., Engrs.

Chicago, Ill.—Until Oct. 5, by W. R. Moorhouse, Comr. Pub. Wks., for furnishing material and erecting municipal bath house 1023 N. Lincoln St.

Until Oct. 6 at office Business Mgr. Bd. Educ. for work at the Lewis-Champlin School, Englewood and Princeton Avenues, to include masonry, cutstone, terra-cotta composition roofing, structural iron, carpentry, asphalt floors, steam heating, ventilation, plumbing, electric work, etc.

Monmouth, Ill.—Until Oct. 20 by W. W. Brent, City Clerk, for erecting fireproof city hall; probable cost $50,000. Separate bids will be received on plumbing, heating and wiring. Temple & Burrows, Archts., Davenport, Iowa.

Rock Island, Ill.—Reported desired until Oct. 8 by Bd. Educ. for erecting 3-story, 82 x 132 ft., brick and concrete school. Probable cost $70,000. Olaf C. Cervin, Archt., Rock Island.

Merrill, Wis.—Until Nov. 1 by James A. Wetmore, Acting Superv. Archt., Washington, D. C., for constructing, complete (including mechanical equipment and approaches), U. S. Post Office, Merrill.

Luthers, Iowa.—Reported desired until Oct. 8 by Bd. Educ. Consolidated School Dist. (C. H. Patterson, Secy.) for erecting combination grade and high school. Proudfoot, Bird & Rawson, Archts., 810 Hubbell Building, Des Moines.

Anselmo, Neb.—Until Oct. 11 by School Bd. Dist. No. 129 for furnishing material and erecting a high school. R. A. Bradley & Co., Archts., Hastings.

Bridgeport, Neb.—Reported desired until Oct. 7 by Bd. Educ. School Dist. No. 63 (J. E. Frennier, Secy.) for erecting high school. O. J. Hehnke, Archt., Scottsbluff.

Clearwater, Neb.—Until Oct. 12 by School Bd. Dist. No. 12 for furnishing material and erecting a high school. R. A. Bradley & Co., Archts., Hastings.

O'Fallon, Neb.—Reported desired until Oct. 16 by L. Laubner, Secy. Bd. Educ., for erecting 2-story and basement school. B. M. Reynolds, Archt., North Platte.

Brookings, S. D.—Until Oct. 19 by Regents of Educ. (I. D. Aldrich, Secy.), care of State College, Brookings, for erecting a 4-story brick fireproof girls' dormitory and pavilion for State College at Brookings. Bids will be received separately on heating, plumbing and wiring.

Ft. Bliss, Tex.—Until Oct. 27 by Depot Quartermaster, El Paso, for constructing one granary and one hay shed at Ft. Bliss, advertised in Engineering Record.

New Braunfels, Tex.—Until Nov 5 by James A. Wetmore, Supervising Archt., Washington, D. C., for constructing combination (including mechanical equipment), (except lighting fixtures and appliances) for U. S. Post Office at New Braunfels.

Carlsbad, N. M.—Until Oct 5 by Carlsbad Armory Bd. of Control (Robert C. Dow, Secy.) for erecting an armory. C. F. Ward, Archt., Roswell.

Seattle, Wash.—Until Oct. 27 by Bd. Regents University of Washington, for erecting university building, probable cost $[illegible]. Babb & Gould, Archts., Denny Building.

Los Angeles, Cal.—Until Oct 18 by County Bd. Supervs., H. J. Lelande, Clk., for erecting a highway maintenance building opposite EastLake Park.

PRICES AND LETTINGS.

★Indicates award of contract.

★North Attleboro, Mass.—Contract awarded James A. Munroe North Attleboro, for erecting U. S. Post Office, at $50,500.

Gouverneur, N. Y.—Following are four lowest bids opened recently by U. S. Supervising Architect, Washington, D. C., for erecting U. S. Post Office: (a) limestone, (b) sandstone: Westchester Engineering Co., White Plains (b) $57,000; Potter's Lumber Co., East Liverpool, Ohio, (a) $53,279; W. A. Fissell & Co., New York City (a) $54,000, (b) $56,300; James Levantt (a) $52,000 (awarded contract), (b) $52,750; W. H. Deacon, New York City (a) $52,855, (b) $53,900.

★Newark, N. J.—Contract awarded R. W. Patrick, 139 Montclair Avenue, to erect a 3-story school at 31 Mulberry Street.

★Philadelphia, Pa.—Reported contract for erecting squadron armory awarded by State Armory Bd., Harrisburg, to Fidelity Constr. Co., Philadelphia, at about $134,245.

Tampa, Fla.—Following are four lowest bids opened Sept. 20 by Supervy. Architect, Washington, D. C., for construction of attendants' quarters, etc., at Quarantine Station, Tampa Bay: E. Hart, Norfolk, Va., $62,110; A. Bassford, Tampa, $53,740; Algernon Blair, Montgomery, Ala., $54,-000; Mutual Co., St. Petersburg, Fla., $54,485.

Cincinnati, Ohio.—Following are bids opened Sept 26 by Bd. Educ., for erecting Walnut Hills School: Harig & Co., 31 E. Fourth Street, $[illegible]; Roche, Braner & Co., Johnson Building, $481,680; Ohio Building Co., 1624 Main Street, $458,860; Thompson, Starritt Co., $468,000.

★Columbus, Ohio.—Contract for constructing foundation of East High School awarded, according to reports, to D. W. Morrison, New First National Bank Building, at $23,445. Edward B. MacFadden, Clk. Bd. Educ.

★Dayton, Ohio—Contract for erecting addition to high school awarded as follows: Total about $50,267. Ernst Kromer, Davies Building, excavating, reinforced concrete and cement work, rock face and cut stone work, also lathing and plastering, total $14,240; Structural Concrete Co., U. B. Building, brick work, carpenter work, and marble and tile work, total $14,[illegible]; Hoerning & Holtman, 1153 W. Third Street, sheet metal work, $2,955; A. Bentley & Sons Co., First and Webb Street, structural iron and steel work, $1,[illegible]; J. W. Bacon, plumbing, $7,679; ventilating and heating, $6,573. Edward J. Mountstephen, Archts., 903 U. B. Building.

★Marblehead, Ohio.—Contract for erecting boathouse, crew's quarters, etc., at Marblehead Coast Guard Station, awarded Lake Shore Contr. Co., Cleveland, at $[illegible].

★Steubenville, Ohio. — Contract for erecting three story 48 x 166 ft. addition to Wells High School, bids opened Sept. 16 by Bd. Educ., awarded James C. Coyne, Steubenville. Petersen & Clarke, Archts., Steubenville.

★Dayton, Ind.—Contract for erecting school awarded J. Wesley Reed, Hammond, at $2[illegible].

★Madison, Wis.—Contract for erecting physics building at Univ. of Wisconsin awarded by Bd. Regents to Wisconsin Constr. Co., Chippewa Falls, at $180,778. Arthur Andrew Peabody, Supervy. Archt., Univ. Wisconsin, Madison.

★Monroe, Wis.—Contract for erecting Lincoln School, brick, two-story, awarded Wagner & Berners, Monroe, cost $[illegible]; Claude & Starck, Archts., Madison. M. E. Baltzin, Secy., Union School Dist. No. 1.

★Minneapolis, Minn. — Contract for erecting Materials Research awarded J. & W. A. Elliott Lumber Exchange. A. R. Van Dyke, Archt., [illegible] Building.

★Syracuse, Kan.—Contract for erecting school awarded Hanney Mackey Constr. Co., at $[illegible]; [illegible] and wiring to J. C. Eby, at $[illegible]; E. Hyde & Co., Archts., First National Bank Building, Hutchinson.

★Beatrice, Neb.—State Bd. Control awarded contracts as follows for gymnasium auditorium and class room at State Institute for Feeble Minded: General construction, Gould & Son, Omaha, $[illegible]; plumbing, George A. Mentz, Lincoln, $3,516.

★Wood River, Neb.—Contract for erecting two-story brick school (bids opened Sept. 17) awarded by R. R. Root, Director School Dist. No. 8, to A. G. Ludwig, Arlington, at $33,695. Next three lowest bidders A. Almquist, Central City, $34,800; G. F. Johnson, Central City, $35,-880, and Henry Ohlsen & Son, David City, $34,952. Belinghof & Davis, Archts., Lincoln.

★Fulton, Mo.—Contract for erecting U. S. Post office awarded Balkin Constr. Co., Monadnock Blk., Chicago, Ill., at $46,337.

★Dallas, Tex.—General contract for erecting two-story building at County Farm (bids opened Sept. 6) awarded Ennison & McCord, Dallas, at $26,880. Charles E. Gross, Co. Aud.

★Perry, Okla.—Contract for erecting four-story stone court house (bids opened Sept 13) awarded by County Commissioners to Manhattan Constr. Co., Muskogee, at $82,950. J. W. Hawk, archt., Oklahoma City.

Bremerton, Wash.—Following are bids opened Sept. 11 by U. S. Supervising Architect, Washington, D. C., for constructing steel frame shell house and two brick magazines at naval magazine, Puget Sound, Washington: Booker, Kiehl & Whittle, Seattle, $33,874; Arvid Evergreen, Seattle, $36,440; Eckman & Mowat, Seattle, $34,913; Martin & Dugan, Seattle, $34,913.

Patton, Cal. — Following are four lowest bids, opened Sept. 14, by W. S. McClure, state engineer, Sacramento, for erecting cottages N and O, Southern California State Hospital, Patton: W. E. Kier Constr. Co., $34,999; Robert Jordan, $38,-190; The Kling Co., $38,472; The John Harnish Co., $38,700.

PRIVATE BUILDINGS

PROPOSED WORK.

Portland, Me.—National Biscuit Co. intends erecting on Kennebec and Cedar Streets an office and warehouse building.

Clayton, N. Y.—Frank A. Wright, 110 E. Twenty-third Street, New York, reported architect for fireproof hotel to be erected for Thousand Island Development Co.; cost $400,000.

Geneva, N. Y.—Ark Lodge No. 33 of the Masons reported taking steps to erect on Main and Seneca Streets a temple costing $50,000.

New York, N. Y.—Plans filed for erection of following buildings: 9-story fireproof apartment building at 51 W. Fifty-fifth Street for Thomas C. Dunham Estate and Farmers Loan & Trust Co., cost $130,000, Rouse & Goldstone, 38 W. Thirty-second Street, Archts.; 12-story loft building at 318 W. Thirty-ninth Street, for 324 W. Thirty-ninth Street Corp., cost $275,000, Crow, Lewis & Wickenhoefer, 200 Fifth Avenue, Archts.; 12-story store and loft at 53 W. Twenty-third Street for Nameloc Co.; cost $300,000, William H. Birkmire, Archt., 1133 Broadway; 5-story brick tenement at Creston Avenue and 188th Street for Picken Bldg. Co., cost $65,000, Andrew J. Thomas, Archt., 25-26 Webster Avenue; two 5-story brick tenements at Westchester Avenue and Freeman Street for Durbar Realty Co., cost $100,000, Gronenberg & Leuchtag, Archts., 303 Fifth Avenue; two 5-story brick tenements at Home Street and Longfellow Avenue, for Durbar Realty Co., cost $100,000, Gronenberg & Leuchtag, Archts., 303 Fifth Avenue; 6-story brick tenement at 181st Street and Vyse Avenue, for Philip Weinstein & Son, cost $50,000, Goldner & Goldberg, Archts., 391 E. 149th Street.

Bayonne, N. J.—Corporation Realty Co., of Bayonne, contemplates erecting on old city hall site an office building.

Bayonne, N. J.—Texas Co., Bayonne, intends erecting at Avenue A and First Street, a one-story storage building and three-story, hollow tile compounding building; cost, $75,000.

Logan, Pa.—Plans being prepared by Neff & Thames, Heed Building, Philadelphia, for a one-story stone church for Methodist Church.

Middletown, Pa.—Ernest R. Graham of Graham, Burnham & Co., Chicago, Ill., is preparing plans for building for Keystone State Fair & Exposition Co., near Middletown; also for 2½-mile speedway for automobiles.

Philadelphia, Pa.—Rev. Eugene McDonnell, Pastor St. Aloysius Church and Rector of Conzaga College, reported considering erecting a girls' high school costing $60,000.

Washington, D. C.—Congregation of Mount Pleasant M. E. Church South contemplate erecting an edifice at Sixteenth and Lamont Streets N. W., cost about $50,000. Contract is about to be let for the chapel for said church to cost $20,000. F. J. Prettyman, Pastor.

Rock Hill, S. C.—Reported Lodge No. 111, A. F. Masons, considering erection of Masonic Temple; cost about $35,000.

Birmingham, Ala.—Richard W. Massey, 1401 Beach Street; Frank Nelson, Terrace Court, and others reported interested in five-story reinforced concrete building to be erected on Third Avenue and Twentieth Street. Harry Wheelock, Archt., Steiner Building.

Cincinnati, Ohio.—Plans filed for five and a half story concrete apartment house to be erected on Plum and Elder Streets by W. Cooper Proctor, Albion Avenue, Glendall; cost $350,000.

Cleveland, Ohio.—Contract will soon be let by Garfield Savings Bank for erecting a two-story brick and stone bank, store and loft building; cost $50,000. Walker & Weeks, Archts., 1900 Euclid Avenue.

Plans prepared by Hubbell & Benes, Power & Light Building, for Masonic Temple at Euclid Avenue for Shrine Temple Co.; cost about $500,000.

Toledo, Ohio.—Plans being prepared by Ottenheimer, Stern & Reichert, 105 W. Monroe Street, Chicago, Ill., for a synagogue to be erected at Scottwood and Acklin Avenues. Rev. David Alexander, Rabbi.

Logansport, Ind.—Luke H. Balfe, Lafayette, reported interested in building a five-story hotel on site of the Broadway Theater; cost $150,000.

Detroit, Mich.—Plans being prepared by Louis Kamper, Fine Arts Building, for a 10-story stone office and mercantile building which J. E. Book, Jr., will erect on Washington Boulevard. Mr. Book also intends erecting adjoining this building a 6-story and a 4-story building.

Muskegon, Mich. — Loyal Order of Moose reported taking steps to erect a brick lodge building costing $50,000.

Chicago, Ill.—William M. Hoyt, Twenty-second Street Bridge, purchased a site at Thirty-second and Grove Streets for erection of 4-story, 100 x 300 ft., concrete building; probable cost $200,000.

Milwaukee, Wis.—Plans prepared by Fitzhugh Scott, 424 Jefferson Street, for a dwelling to be erected for A. J. Lindemann at Wahl and Bradford Avenues at a cost of $30,000.

Ottumwa, Iowa.—Plans reported being prepared by Proudfoot, Bird & Rawson, Des Moines, for six or seven-story hotel, which Ottumwa Hotel Co. intends erecting at a cost of $300,000.

St. Paul, Minn.—Reported I. H. Ruben, 1824 S. Fremont Avenue, Minneapolis, interested in theater to be erected at Seventh and Wabasha Streets. Cost $350,000. Buechner & Orth, Archts., Shubert Building, St. Paul.

Riverton, Wyo.—Episcopal Church Organization of Wyoming purchased a site for erection of a seminary for boys and girls; cost about $100,000. Bishop N. S. Thomas of Cheyenne said to be interested.

Chain of Rocks (P. O. St. Louis), Mo.—Clubhouse is to be erected on Riverview Drive near Chain of Rocks for St. Louis Yacht Club. C. C. Butler, Ex-Commodore. T. P. Barnett Co., Archts., Central Natl. Bank Building, St. Louis.

Dallas, Tex.—Edgar Zielian, Adolphus Hotel, reported taking steps to erect apartment hotel, costing $500,000.

Portland, Ore.—Reported contract will soon be let by R. F. Wassell Co., 204 E. Fifteenth Street, for erecting a four-story and basement brick apartment house at Twentieth and Morrison Streets, to cost $125,000.

San Francisco, Cal.—J. R. Miller, Lick Building, is reported architect for the Claus Spreckles Building, to be erected at Market and Third Streets at a cost of $200,000.

Salt Lake City, Utah.—J. E. Jennings of Salt Lake City is reported interested in Jennings-Hanna Investment Co., which has been incorporated to erect three-story reinforced concrete warehouse on Second South and Third West Streets.

BIDS DESIRED.

Macon, Ga.—Reported bids desired until Oct. 12 by Central of Georgia Ry. Co. (C. K. Lawrence, Ch. Engr., Macon) for erecting three buildings, one and three stories, brick, concrete, stone, steel and marble, 84 x 243 ft., 57 x 134 ft. and 57 x 112 ft.; three platforms, each 19 x 1300 ft.; subway, etc.; probable cost $1,500,000. Alfred Feilheimer, Archt., 7 E. Forty-second Street, New York.

Bellaire, Ohio.—Reported desired until Oct. 14 by George H. Dieringer, Wheeling, W. Va., for remodeling Roma Theater. Antonio Megna, Proprietor. Probable cost $25,000.

Dubuque, Iowa.—Until Oct. 2 (extension of date from Sept. 30) by Secretary Y. M. C. Assoc. for erecting three-story fireproof building; cost $35,000. Cyrus D. McLane, Archt., Rock Island, Ill.

PRICES AND LETTINGS.

★Indicates award of contract.

★New Bedford, Mass.—Contract awarded Turner Construction Co., 11 Broadway, New York, to erect 9-story reinforced concrete warehouse, 100 x 160 ft., for the Merchants' Terminal Warehouse Company. Lockwood, Greene & Co., 60 Federal Street, Boston, Archts. and Engrs.

★Providence, R. I.—Contract reported awarded Norcross Bros. Co., Providence, for erecting 120 x 140 ft. stone edifice at Wayland and Lloyd Avenues for Central Baptist Church.

★New Britain, Conn.—Contract awarded to B. H. Hibbard Co., Hartford, for erecting for Hartford Auto Parts Co. a two-story, 60 x 210 ft., building. Unkleback & Perry, Archts., New Britain.

★Jamestown, N. Y.—Contract for erecting warehouse for D. H. Grandin & Co., Inc., awarded to Charles Haas at about $25,000. Gaggin & Gaggin, University Building, Syracuse, Archts.

★Newark, N. J.—Contract awarded Hedden Constr. Co., 763 Broad Street, for erecting two-story fireproof brick store and office building at Broad Street for Prudential Insurance Co. Cost, about $60,000.

★Pittsburgh, Pa.—Contract awarded Cranford Constr. Co., Keystone Building, for Simplex concrete piling for freight station and warehouse Baltimore & Ohio R. R., Isabella Street, North Side.

★Shenandoah, Pa.—Contract awarded Andrew J. Breslin of Summit Hill for erecting Elk's Hall. Probable cost, $30,000.

★Dunkirk, Ohio.—Contract for erecting Methodist Church awarded J. W. Warrington of Broadway at $24,000.

★Nashotah, Wis.—Contract awarded Gunder Anderson of Oconomowoc for erecting tile and concrete station for Milwaukee R. R.

NEW INDUSTRIAL PLANTS

PROPOSED WORK.

Brooklyn, N. Y.—Plans filed for erection of following buildings: 6-story brick creamery at Fulton Street and New York Avenue, for Sheffield Farms Slawson Decker Co., cost $300,000, Frank A. Rooke, 489 Fifth Avenue, New York City, Archt.; 4-story brick factory at Atlantic Avenue and Cleveland Street, for P. & L. Contr. Co., cost $50,000, M. J. Harrison, World Building, New York City, Archt.

Hornell, N. Y.—Plans completed by E. J. Thompson for 2-story foundry addition, 40 x 140 ft., and 2 coke ovens, 30 x 22 ft., brick and hollow tile construction, to the plant of Davies Foundry Co.

Lockport, N. Y.—The Fibre Corp. is having plans prepared for rebuilding plant on Mill Street, recently destroyed; estimated cost $50,000.

Solvay, N. Y.—Plans completed by Faber & Baxter, Syracuse, for a one-story brick, 100 x 450 ft., manufacturing plant for Candel Incubator Co., Syracuse.

Troy, N. Y.—Plans completed by Alfred E. Baxter, Ellicott Square Building, Buffalo, for erecting on River Street for Bontell Milling Co. concrete 5-story, 50 x 125 ft., flour mill, and 5-story, 42 x 64 ft., grain warehouse.

Chester, Pa.—Stewart Distilling Co., 214 S. Second Street, Philadelphia, it is reported, will erect a $500,000 distilling plant here.

Chester, Pa.—Plans prepared for plant for Stewart Distilling Co., main office, 254 S. Third Street, Philadelphia.; to cost $500,000.

Ellwood City, Pa.—United States Steel Corporation reported intends making improvements in the plant of the Shelby Steel Tube Mills.

Reading, Pa.—Carpenter Steel Works, River Road and Exeter Street, intends erecting two-story, steel and cement building; cost about $30,000.

Schuylkill Haven, Pa.—Reported Schuylkill Haven Foundry & Machine Co. has decided to rebuild plant recently destroyed by fire.

Norfolk, Va.—Norfolk & Western Ry. (Joseph E. Crawford, Ch. Engr., Roanoke) reported considering constructing grain elevator at Lamert's Point, Norfolk Harbor; capacity 2,000,000 bu.; cost $2,000,000.

Charleston, S. C.—Riverside Iron Wks. (G. H. W. Bruggemann, Pres.), it is reported, intends erecting a plant at Rosemont, one mile from this city; cost, $25,000

Greenville, S. C.—T. R. Hapgood purchased a site at Hampton Avenue and Southern R.R. for erection of an ice plant to have a daily capacity of 40,000 tons.

Shelbyville, Tenn. — Reported Sylvan Cotton Mills intends installing new machinery, including 3000 spindles.

Cleveland, Ohio.—Cyclone Woven Wire Fence Co., E. Fifty-fifth Street, considering erection of five-story concrete power building on E. Fifty-fifth Street; cost approximately $150,000.

Marion, Ohio.—Reported Interstate Iron & Steel Co. of Chicago, Ill., intends erecting a plant here to replace the Cambridge works destroyed by fire.

Minneapolis, Minn.—Northwestern Elevator Co. (Charles A. Magnuson, Pres.), intends erecting a 1,000,000 bu. fireproof grain elevator, provision to be made for a 500 bu. increase.

Butte, Mont. — Plans completed by Floyd Hamill & Co., Hennessey Building, for two-story concrete and brick creamery; cost $35,000.

Foreman, Ark.—Consumers' Portland Cement Co. reported intending erecting cement plant here.

Gresham, Ore.—M. H. Squires, Gresham, contemplates erecting a fireworks factory in Gresham; cost about $40,000.

Oshawa, Ont.—Citizens voted to assist new steel plant, which David Maxwell of Toronto and others will erect in East Whitby Township.

BIDS DESIRED.

Rochester, N. Y.—Bids being received by Eastman Kodak Co. for erecting 2-story concrete, 45 x 140 ft., and 5-story concrete, 80 x 165 ft., buildings at their plant at Kodak Park.

Peking, China.—Until Oct. 16 at Bureau Yards and Docks, Navy Dept., Washington, D. C. (H. R. Stanford, Ch.), Spec. No. 2191—Furnishing f.o.b. cars San Francisco, and installing in Peking, China, an ice-making and cold storage plant at the U. S. Marine Barracks, Peking.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Portland, Me.** — Contract awarded Chas. B. Howatt & Son, Portland, to rebuild plant of Twitchell-Champlin Co., recently damaged by fire.

★**Buffalo, N. Y.**—Contract for erecting 7-story brick and steel addition to Gerhard Lang Brewing Co. plant at Best and Jefferson Sts. awarded to Western Building Co., Buffalo, at about $35,000.

★Monarch Engineering Co., Chamber Commerce Building, secured contract for erecting concrete grain elevator at Buffalo River and Buffalo Creek Terminal R.R. for Archer Daniels Co.; cost $60,000.

★Contract for steel work for addition to foundry building of Atlas Steel Casting Co., at Elmwood Avenue and Erie R.R., awarded to Progressive Structural Steel Co., Builders Exchange Building.

★Contract for erecting 4-story brick and steel addition, 80 x 300 ft., to plant of Curtiss Aeroplane Co., at Churchill St. and New York Central R.R., awarded to John W. Cowper Co., 620 Fidelity Building.

★**Montour Falls, N. Y.**—Contract for erecting one-story brick and steel addition, 125 x 200 ft., addition to plant of Shepherd Crane & Hoist Co. awarded to Compton Realty Co., and to Montour Steel Wks. for the structural steel.

★**Rochester, N. Y.**—Contract for erecting steel, tile and concrete automobile factory for Crowther Motor Car Co. at Ridgeway Avenue and Buffalo, Rochester & Pittsburgh R. R awarded Martens Co., Rochester.

★**Seneca Falls, N. Y.**—Contract for erecting steel plant for Seneca Falls Mfg. Co. awarded to T. H. McHale Constr. Co., Syracuse. Main plant to be 2 stories, concrete, steel and brick. Foundry to be 62 x 142 ft.

★**Solvay, N. Y.**—Contract for erecting 2 buildings, each one-story, 250 x 354 ft., at Malleable Iron Wks. of Frazer & Jones Co., awarded to Dawson Bros., Union Building, Syracuse, at $100,000.

★**Cleveland, Ohio.** — Contract reported awarded S. W. Emerson Co., Chamber of Commerce Building, to erect brick and concrete fireproof factory at 2206 Parkwood Drive for Steel Products Co.; cost $30,000.

★**Omaha, Neb.**—Reported contract for erecting assembly plant at Sixteenth and Izard Streets for Ford Motor Co. awarded Hodgin Constr. Co., Germania Life Building, St. Paul, at about $250,000.

MISCELLANEOUS

PROPOSED WORK.

Coal Pier—Baltimore, Md.—Bd. Directors of Baltimore & Ohio R. R. (F. L. Stuart, Ch. Engr., Baltimore) voted to construct a coal pier, 700 ft. long x 115 ft. wide, at Curtis Bay Terminal; capacity 10,000,000 tons per year; approximate cost, $1,500,000.

Park Bonds—Massillon, Ohio.—Park bonds amounting to $25,000 sold.

Subway—Seattle, Wash.—General Chittenden of Seattle recommends constructing Norman Street tunnel and Lenora Street subway. Post Engineer West estimates cost of Norman Street tunnel at $412,519, with an additional $145,000 if paved. Proposed improvement will be 1165 ft. long.

BIDS DESIRED.

Retaining Wall—Pittsburgh, Pa.—Until Oct. 12, by Hyatt M. Cribbs, Co. Controller, for furnishing material and constructing 3300 cu. yds. of concrete retaining wall along Scotia Hollow Road.

Installation Car Tracks — Cincinnati, Ohio.—Until Oct. 7 by Dir. Pub. Wks. (Parke S. Johnson, Secy.) for installation of car tracks on Hopple Street viaduct.

Pneumatic Hoists, Crane Runways, etc., Panama.—Until Oct. 18 by Maj. F. C. Boggs, Corps Engrs., U. S. A., General Purchasing Officer, the Panama Canal, Washington, D. C., for frames and covers for flooding and sluice valves, circular steel stairways, crane runways, etc., according to Circular 974, and until Oct. 20 for pneumatic hoists, hydraulic jacks, etc., according to Circular 976.

Capstans—Panama.—Until Oct. 11 by Maj. F. C. Boggs, Corps Engrs., U. S. A., Genl. Purchasing Officer, Panama Canal, Washington, D. C., for Cir. 975—Motor-driven capstans.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Dry-Dock — Boston, Mass.**—Reported Executive Council voted to award contract for constructing 1100 ft. dry dock to Holbrook, Cabot & Rollins, New York. Cost reported at about $3,000,000.

Retaining Wall—Washington, D. C.—Boyle-Robertson Constr. Co., Washington, bid $23,596 for constructing a retaining wall along west side Meridian Hill Park (bids opened Sept. 20).

★**Transmission Line—Decatur, Ind.**—Contract for constructing transmission line from Decatur to Monroe awarded Protection Electric Supply Co., Ft. Wayne, C. E. Bahmer, City Clk.

Proposals

For Proposals Advertised, see Pages 48 and 49.

WATERWORKS.

Bids Close.		See Eng. Record.
Oct. 4.	Mains, Minot, N. D. Adv. Sep. 25.	Sep. 25
Oct. 5.	Reservoir, Tamaqua, Pa. Adv. Sep. 11 to 25.	Sep. 11
Oct. 5.	Pumps, Engines, Etc., Sidney, Iowa	Sep. 25
Oct. 5.	Hydrants, The Pas, Man.	Oct. 2
Oct. 6.	System, Luverne, Iowa. Adv. Sep. 18.	Sep. 18
Oct. 6.	Wells, Middletown, Ohio.	Sep. 25
Oct. 7.	Service System, Coatesville, Pa. Adv. Sep. 18, 25.	Sep. 18
Oct. 7.	Mains, New York, N. Y.	Oct. 2
Oct. 7.	Pipe, Galveston, Tex.	Oct. 2
Oct. 8.	Pumps, etc., Trenton, N. J.	Oct. 2
Oct. 8.	Fire Hydrants, Louisville, Ky.	Oct. 2
Oct. 11.	Pump Unit, Washington, D. C.	Sep. 25
Oct. 12.	Valves, etc., Toronto, Ont.	Sep. 18
Oct. 12.	Centrifugal Pumps, Etc., Lumberton, N. C.	Sep. 25
Oct. 12.	Water Works Improv., Monticello, Ind.	Sep. 25
Oct. 12.	Pump Station, Poplar Grove, Ill.	Oct. 2
Oct. 14.	Main, Galveston, Tex.	Oct. 2
Oct. 15.	Pump, Marshalltown, Ia.	Oct. 2
Oct. 15.	Tank and Tower, Kanawha, Iowa.	Oct. 2
Oct. 19.	Contr. 166, New York, N. Y. Adv. Oct. 2.	Oct. 2
Oct. 21.	Gas Engines, Clarksburg, W. Va. Adv. Sep. 25, Oct. 2.	Sep. 25
Nov. 4.	Pumping Engine, Galveston, Tex. Adv. Oct. 2.	Oct. 2
Nov. 9.	Water Wks., Belleville, Ohio	Sep. 11

SEWERAGE AND SEWAGE DISPOSAL.

Oct. 4.	Minot, N. D. Adv. Sep. 25.	Sep. 25
Oct. 4.	Glen Gardner, N. J. Adv. Sep. 18.	Sep. 18
Oct. 5.	Algona, Iowa	Sep. 25
Oct. 5.	North Chattanooga, Tenn. Adv. Sep. 18	Sep. 18
Oct. 5.	Paterson, N. J.	Oct. 2
Oct. 5.	New Brighton, S. I., N. Y.	Oct. 2
Oct. 5.	Knox, Ind.	Oct. 2
Oct. 5.	Findlay, Ohio.	Oct. 2
Oct. 5.	Cokato, Minn.	Oct. 2
Oct. 5.	Brooklyn, Iowa	Oct. 2
Oct. 6.	Visalia, Cal.	Sep. 25
Oct. 6.	Fairview, N. J.	Oct. 2
Oct. 6.	New York, N. Y.	Oct. 2
Oct. 7.	Atlantic City, N. J. Adv. Sep. 18.	Sep. 18
Oct. 7.	Lincoln, Neb.	Sep. 25
Oct. 7.	Miami, Fla.	Oct. 2
Oct. 11.	South Bound Brook, N. J. Adv. Sep. 25.	Sep. 25
Oct. 11.	Roslyn, Wash.	Sep. 25
Oct. 12.	Compton, Cal.	Oct. 2
Oct. 12.	Dennison, Iowa.	Oct. 2
Oct. 13.	Cheviot, Ohio	Oct. 2
Oct. 14.	Mansfield, Ohio	Aug. 28
Oct. 14.	Ashland, Wis.	Oct. 2
Oct. 15.	Albemarle, N. C. Adv. Oct. 2.	Oct. 2
Oct. 19.	Beaumont, Tex. Adv. Sep. 18 to Oct. 2.	Sep. 18

BRIDGES.

Oct. 5.	Salem, Ind.	Sep. 25
Oct. 5.	Maine	Sep. 25
Oct. 5.	Sharon, Pa.	Oct. 2
Oct. 5.	Knox, Ind.	Oct. 2
Oct. 5.	Vancouver, B. C.	Oct. 2
Oct. 6.	Lawrence, Kan. Adv. Aug. 14 to Oct. 2.	Aug. 14
Oct. 6.	Manhattan, Kan.	Sep. 18
Oct. 7.	Bakersfield, Cal.	Sep. 25
Oct. 7.	Munster, Ind.	Oct. 2
Oct. 8.	Ohio.	Oct. 2
Oct. 9.	Illinois	Oct. 2
Oct. 11.	Wichita, Kan.	Oct. 2
Oct. 11.	Connecticut. Adv. Oct. 2.	Oct. 2
Oct. 11.	Arcadia, Fla.	Oct. 2
Oct. 12.	Beaufort, S. C. Adv. Sep. 18.	Sep. 18
Oct. 12.	Waukon, Iowa	Sep. 25
Oct. 12.	Washington, Kan.	Oct. 2
Oct. 12.	Illinois	Oct. 2
Oct. 13.	Visalia, Cal.	Oct. 2
Oct. 15.	Steubenville, Ohio.	Oct. 2
Oct. 15.	Bedford, Iowa	Oct. 2
Oct. 15.	Illinois	Oct. 2
Oct. 18.	Los Angeles, Cal.	Oct. 2
Oct. 25.	Concordia, Kan.	Oct. 2
Oct. 25.	Columbus, Ohio	Oct. 2
Oct. 27.	Glenfield, Pa.	Sep. 25
Oct. 29.	Illinois	Oct. 2

PAVING AND ROADS.

Oct. 4.	Minot, N. D. Adv. Sep. 25.	Sep. 25
Oct. 4.	Mount Union, Pa. Adv. Sep. 25.	Sep. 25
Oct. 5.	St. Louis, Mo.	Sep. 18
Oct. 5.	Winamac, Ind.	Sep. 18
Oct. 5.	Indiana	Sep. 25
Oct. 5.	New Brighton, S. I., N. Y.	Oct. 2
Oct. 5.	Long Island City, N. Y.	Oct. 2
Oct. 5.	Paterson, N. J.	Oct. 2
Oct. 5.	East Liverpool, Ohio.	Oct. 2
Oct. 5.	Phoenix, Ariz.	Oct. 2
Oct. 5.	Hagerstown, Md.	Oct. 2
Oct. 5.	Kansas City, Mo.	Oct. 2
Oct. 6.	Shelbyville, Ind.	Sep. 25
Oct. 6.	West Hoboken, N. J.	Sep. 25
Oct. 6.	Freehold, N. J.	Sep. 25
Oct. 6.	Canton, Ohio.	Oct. 2
Oct. 6.	Des Moines, Iowa.	Oct. 2
Oct. 6.	Brooklyn, N. Y.	Oct. 2
Oct. 6.	Missoula, Mont.	Oct. 2
Oct. 6.	Manhattan Beach, Cal.	Oct. 2
Oct. 6.	Santa Ana, Cal.	Oct. 2
Oct. 7.	Jersey City, N. J.	Sep. 18
Oct. 7.	Bakersfield, Cal.	Sep. 25
Oct. 7.	Independence, Kan.	Sep. 25
Oct. 7.	Newark, N. J.	Sep. 25
Oct. 7.	Mountain Home, Idaho.	Oct. 2
Oct. 7.	Tonasket, Wash.	Oct. 2
Oct. 7.	Arcadia, Cal.	Oct. 2
Oct. 8.	Indiana	Sep. 18
Oct. 8.	Cumberland Gap, Tenn.	Sep. 25
Oct. 8.	Columbus, Ohio	Sep. 25
Oct. 8.	Columbus, Ohio.	Oct. 2
Oct. 8.	Ohio.	Oct. 2
Oct. 9.	Indiana	Sep. 25
Oct. 9.	Racine, Wis.	Sep. 25
Oct. 11.	Washington.	Oct. 2
Oct. 11.	Los Angeles, Cal.	Oct. 2
Oct. 11.	Montclair, N. J. Adv. Oct. 2.	Oct. 2
Oct. 12.	Issaquah, Wash.	Oct. 2
Oct. 13.	Hoboken, N. J.	Oct. 2
Oct. 13.	Columbus, Miss.	Oct. 2
Oct. 13.	Des Plaines, Ill.	Oct. 2
Oct. 14.	Indiana.	Oct. 2
Oct. 15.	Idaho.	Oct. 2
Oct. 16.	Pensacola, Fla.	Oct. 2
Oct. 19.	Logansport, Ind.	Sep. 25
Oct. 19.	Beaumont, Tex. Adv. Sep. 18 to Oct. 2.	Sep. 18
Oct. 19.	Washington, D. C. Adv. Oct. 2.	Oct. 2
Oct. 20.	Indiana.	Oct. 2
Oct. 28.	Granville, Ohio	Sep. 25
Nov. 1.	Santa Barbara, Cal.	Oct. 2
Nov. 5.	Indiana.	Oct. 2

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS.

Oct. 5.	Sea Wall, Vancouver, B. C.	Oct. 2
Oct. 6.	Ditch, Swifton, Ark.	Sep. 18
Oct. 6.	Harbor Improv., Albany, N. Y.	Sep. 25
Oct. 6.	State Canal Work, Albany, N. Y.	Oct. 2
Oct. 6.	Levee Work, Shreveport, La.	Oct. 2
Oct. 9.	Dredging, Norfolk, Va.	Oct. 2
Oct. 11.	Guide Wall, Seattle, Wash.	Oct. 2
Oct. 11.	Pile Jetty, San Luis Obispo, Cal.	Oct. 2
Oct. 12.	Irrigation Work, St. Ignatius, Mont. Adv. Sep. 18.	Sep. 18
Oct. 12.	Reclamation Work, Carlsbad, N. M.	Oct. 2
Oct. 14.	Drainage, Victoria, Tex.	Oct. 2
Oct. 14.	Riprap, Philadelphia, Pa. Adv. Oct. 2.	Oct. 2
Oct. 15.	Spillway, Cincinnati, Ohio	Oct. 2
Oct. 16.	Ditch, Winamac, Ind.	Oct. 2
Oct. 20.	Irrigation Work, Montrose, Col. Adv. Sep. 25.	Sep. 25
Oct. 20.	Irrigation Work, Powell, Wyo.	Sep. 25
Oct. 20.	Reclamation Work, Washington, D. C.	Oct. 2
Oct. 21.	Channel Work, Chicago, Ill. Adv. Sept. 25.	Sep. 25
Oct. 22.	Dry Dock Gate, Louisville, Ky. Adv. Sep. 25, Oct. 2.	Sep. 25
Oct. 26.	State Canal Work, Albany, N. Y.	Oct. 2
Nov. 8.	Dredge, Jacksonville, Fla. Adv. Sep. 11 to 25.	Sep. 11
Nov. 8.	Reclamation Work, Grand Junction, Col.	Oct. 2

PUBLIC BUILDINGS AND SCHOOLS.

Oct. 4.	Oswego, N. Y. Adv. Sep. 18, 25.	Sep. 18
Oct. 5.	Glenwood, Minn.	Sep. 18
Oct. 5.	Albany, N. Y.	Sep. 25
Oct. 5.	Oakland, Cal.	Sep. 25
Oct. 5.	Pleasantville, N. J.	Oct. 2
Oct. 5.	West Sprinfield, Mass.	Oct. 2
Oct. 5.	Carlsbad, N. M.	Oct. 5
Oct. 5.	Chicago, Ill.	Oct. 2
Oct. 6.	Jefferson, Iowa	Sep. 25
Oct. 6.	Pittsburgh, Pa.	Oct. 2
Oct. 6.	Chicago, Ill.	Oct. 2
Oct. 7.	Wilmington, N. C.	Sep. 11
Oct. 7.	Jersey City, N. J.	Sep. 18
Oct. 7.	Findlay, Ohio	Sep. 18
Oct. 7.	Metuchen, N. J.	Oct. 2
Oct. 7.	Bridgeport, Neb.	Oct. 2
Oct. 8.	Boston, Mass.	Sep. 4
Oct. 8.	Rock Island, Ill.	Oct. 2
Oct. 8.	Columbus, Ohio.	Oct. 2
Oct. 8.	Luthers, Iowa.	Oct. 2
Oct. 8.	Philadelphia, Pa.	Oct. 2
Oct. 11.	Watertown, Wis.	Sep. 25
Oct. 11.	Lexington, Va.	Sep. 25
Oct. 11.	Anselmo, Neb.	Oct. 2
Oct. 12.	Akron, Ohio.	Oct. 2
Oct. 12.	Detroit, Mich.	Oct. 2
Oct. 12.	Clearwater, Neb.	Oct. 2
Oct. 12.	Little Falls, N. Y.	Oct. 2
Oct. 13.	Naugatuck, Conn.	Sep. 11
Oct. 14.	Wilkesboro, N. C.	Sep. 11
Oct. 15.	Moberly, Mo. Adv. Sep. 18, 25.	Sep. 18
Oct. 15.	Cleveland, Ohio.	Oct. 2
Oct. 16.	Denton, Tex.	Sep. 18
Oct. 16.	Washington, D. C.	Aug. 28
Oct. 16.	Pensacola, Fla.	Sep. 25
Oct. 16.	O'Fallon, Neb.	Oct. 2
Oct. 16.	Boston, Mass.	Oct. 2
Oct. 16.	East Cleveland, Ohio.	Oct. 5
Oct. 18.	Rock Rapids, Iowa.	Sep. 25
Oct. 18.	Dixon, Ill.	Sep. 25
Oct. 18.	Los Angeles, Cal.	Oct. 2
Oct. 19.	Norton, Va.	Sep. 11
Oct. 19.	Oxford, Ohio	Sep. 25
Oct. 19.	Brookings, S. D.	Oct. 5
Oct. 20.	Monmouth, Ill.	Oct. 2
Oct. 23.	Norfolk, Va.	Oct. 2
Oct. 25.	Washington, D. C.	Oct. 5
Oct. 26.	Brooklyn, N. Y.	Oct. 2
Oct. 27.	Newcastle, Ind.	Sep. 25
Oct. 27.	Monongahela, Pa.	Sep. 25
Oct. 27.	Ft. Bliss, Tex. Adv. Oct. 2.	Oct. 2
Oct. 27.	Seattle, Wash.	Oct. 2
Oct. 27.	Northfield, Ohio	Oct. 2
Oct. 28.	Kirksville, Mo. Adv. Sep. 25, Oct. 2.	Sep. 25
Oct. 30.	Seymour, Ind.	Sep. 25
Nov. 1.	Merrill, Wis.	Oct. 2
Nov. 5.	New Braunfels, Tex.	Oct. 2
Nov. 6.	East Pittsburgh, Pa.	Oct. 2
Nov. 8.	Sidney, Ohio Adv. Oct. 2.	Oct. 2
Nov. 10.	Van Wert, Ohio.	Oct. 2

PRIVATE BUILDINGS.

Oct. 12.	Macon, Ga.	Oct. 2
Oct. 14.	Bellaire, Ohio.	Oct. 2

NEW INDUSTRIAL PLANTS.

Oct. 5.	Newbern, N. C.	Sep. 25
Oct. 16.	Peking, China.	Oct. 2

MISCELLANEOUS.

Oct. 6.	Copper, Steel, Etc., Panama	Sep. 25
Oct. 7.	Cement, Portland, Ore. Adv. Sep. 11 to Oct. 2.	Sep. 11
Oct. 7.	Installation of Car Tracks, Cincinnati, Ohio.	Oct. 2
Oct. 7.	Fire Hose, Gulfport, Miss. Adv. Oct. 2.	Oct. 2
Oct. 8.	Mechanical Equipment in Appraisers' Stores, Boston, Mass. Adv. Sept. 4, 11.	Sep. 4
Oct. 8.	Elevator, Boston, Mass.	Sep. 4
Oct. 8.	Garbage Incinerator, Houston, Tex. Adv. Sep. 25.	Sep. 25
Oct. 8.	Improving armory site, Albany, N. Y. Adv. Oct. 2.	Oct. 2
Oct. 11.	Capstans, Panama	Oct. 2
Oct. 12.	Retaining Wall, Pittsburgh, Pa.	Oct. 2
Oct. 12.	Street Lighting, Fort H. G. Wright, N. Y. Adv. Oct. 2.	Oct. 2
Oct. 12.	Steel Furniture, Capitol, Albany, N. Y. Adv. Oct. 2.	Oct. 2
Oct. 15.	El. Ry., New York, N. Y.	Oct. 2
Oct. 16.	Pumps, Etc., for Oil Plants, Washington, D. C.	Aug. 28
Oct. 18.	Crane and Runways, Steel Stairs, etc., Panama.	Oct. 2
Oct. 19.	El. Ry., Philadelphia, Pa. Adv. Sep. 18, 25.	Sep. 18
Oct. 19.	Steel Dome For Sale, Madison, Wis. Adv. Oct. 2.	Oct. 2
Oct. 20.	Pneumatic Hoists, etc., Panama	Oct. 2
Oct. 20.	Alternators, etc., Slater, Mo. Adv. Oct. 2.	Oct. 2
Oct. 23.	Hoists, Washington, D. C. Adv. Sep. 25, Oct. 2.	Sep. 25
Nov. 3.	Jib Crane, Panama. Adv. Sep. 25.	Sep. 25
Nov. 17.	Power Plants, Etc., Washington, D. C.	Aug. 28

SEARCHLIGHT SECTION

Bids open October 19, 1915.

FOR SALE—CAST IRON DOME

MADISON, WIS.

The Capitol Commission had removed from the old Capitol building its cast iron dome and, pursuant to legislative act, had the same taken down so that it could be re-erected, that is, each part was numbered and drawings were made showing the location of each part in any future re-erection.

It now has this material for sale either for junk or otherwise and invites proposals for its purchase.

The material which it is purposed to sell is now stored on the University campus directly west of Main Hall and it is estimated that there is of it between 800 and 1,000 tons, all of which will be sold to the successful bidder with the exception of a few pieces not to exceed in weight two tons which the Commission desires to retain.

The condition of this sale will be that the purchaser shall purchase the material in the position which it now is and shall pay for it by the ton, it to be weighed **under the supervision and to the satisfaction** of the State that he shall pay for it in cash before it is removed from the premises.

Such payment may be made in installments as may be mutually agreed be**tween the purchaser and the Commission.**

Sealed **proposals will be received for the purchase of this material until noon of Tuesday, October 19.**

Proposals must be made on blanks which may be secured by application to the undersigned and must be accompanied **by a certified check of $1,000.00 made payable** to Lew F. Porter, Secretary of the Capitol Commission, and which will be forfeited to the State in case the tender of **the maker is accepted and he fails to complete** the purchase as per proposal and herein provided.

Plans of the original structure may be seen and information may be secured at the Capitol Commission office.

LEW F. PORTER,
Secretary, Capitol Commission
of Wisconsin.

Madison, Wis., September 22, 1915.

Bids open October 15, 1915.

SEWAGE SYSTEM

ALBEMARLE, N. C.

Sealed proposals will be received for **labor and material in connection with the above work, consisting of about four (4) miles of vitrified and cast iron sewers from six (6) inches to twenty (20) inches in** diameter, complete with appurtenances, by the Mayor and Board of Aldermen, at the City Hall, Albemarle, N. C., until (12) **o'clock, noon, of October 15, 1915, when** they will be publicly opened and read.

Plans and specifications are on file at **the office of the Town Clerk and of the** Consulting Engineer. They may be procured at the office of the Engineer in charge, Albemarle, and to whom requests **for additional information should be addressed.**

A set of prints consisting of map and profile together with specifications, may be procured by prospective bidders by depositing them the Engineer in Charge, and making a deposit of $5.00, which deposit will be refunded upon the return of the plans and specifications in good condition.

Each proposal must be accompanied by a certified check on the bank of five (5) per cent of the amount bid as evidence of good faith upon the part of the bidder.

The Town reserves the right to reject any and all bids or to accept any which may seem to it to be to the best interest of the Town of Albemarle.

M. J. HARRIS, Mayor.
J. D. SEEKS,
Engineer in Charge.

ANDERSON & CHRISTIE, INC.
Consulting Engineers,
Charlotte, N. C.

Official Proposal Announcements

Price, $2.40 an inch.—Copy can be received until Thursday 10 a. m. for issue mailed the next morning

Bids open October 11, 1915.

PROPOSAL FOR STATE BRIDGE WORK

HARTFORD, CONN.

SEALED PROPOSALS will be received by the State Highway Commissioner, Room 27, Capitol, Hartford, Conn., until 2 p. m., Monday, October 11, for the following bridge work:

TOWN OF NEW HARTFORD: Superstructure of a highway bridge consisting of two 100 Foot Through Truss Steel Spans over the Farmington River. TOWNS OF SOUTHINGTON AND CHESHIRE: Superstructure of a highway bridge consisting of a 70.5 Foot Low Riveted Truss Span over the Quinnipiac River. TOWN OF GRANBY: Superstructure of a highway bridge consisting of a 50 Foot Low Riveted Truss Span over the Salmon River.

Complete data, plans, specifications, etc., can be seen at the office of the State Highway Commissioner, State Capitol, Hartford, Connecticut. Contractors can obtain complete sets for $2 per set upon application to the State Highway Commissioner, the sets thus secured to remain the property of the contractor without refund.

All bids must be accompanied by a surety company bond or a certified check of not less than one-third (⅓) of the cost of the work. Contractors will be required to furnish satisfactory evidence of their experience in doing similar work and their ability to finance the work, and any bidder to whom the contract has been awarded, refusing to sign the contract at the prices offered and furnish a surety company bond, or a certified check in one-third (⅓) of the amount of the work, shall forfeit from his bond or check a sum equal to difference in price between his bid and the next lowest bidder.

The State Highway Commissioner reserves the right to reject any or all proposals.

Dated at Hartford, Conn., September 24, 1915.

C. J. BENNETT,
State Highway Commissioner.

Bids open October 12, 1915.

NOTICE TO CONTRACTORS.

STEEL FURNITURE

ALBANY, N. Y.

Sealed proposals for steel furniture for the State Tax Commission, Capitol, Albany, N. Y., will be received by the Trustees of Public Buildings, Executive Chamber, Capitol, Albany, N. Y., until 2 o'clock p. m., on Tuesday, October 12, 1915, when they will be publicly opened and read. Proposals shall be enclosed in an envelope furnished by the State Architect, sealed and addressed and shall be accompanied by a certified check for $350.00. The contractor to whom the award is made will be required to furnish surety company bond in the sum of fifty per cent (50%) of the amount of the contract within thirty (30) days after official notice of award of contract and in accordance with the terms of specification 2187. The right is reserved to reject any or all bids. Drawings and specifications may be consulted at the New York office of the Department of Architecture, Room 1224, Woolworth Building and at the Department of Architecture, Capitol, Albany, N. Y. Drawings and specifications and blank forms of proposal may be obtained at the Department of Architecture, Capitol, Albany, N. Y., upon reasonable notice to and in the discretion of the State Architect, Lewis F. Pilcher, Capitol, Albany, N. Y.

Albany, N. Y., September 28, 1915.

Bids open November 4, 1915.

AIR PUMPING ENGINE

GALVESTON, TEX.

Sealed proposals will be received by the Board of Commissioners of the City of Galveston at the office of the City Secretary until 5 o'clock p. m. Thursday, Nov. 4, 1915, and opened at the first regular or special commissioners' meeting thereafter, for furnishing, delivering and erecting the complete mechanical equipment of an air pumping engine at Alta Loma, Texas, consisting of the following:

One (1) 2450 cu. ft. air compressor.

One (1) surface condensor and reinforced concrete foundation and all necessary steam pipe connections, pipes, valves and unions.

Air pipe and connection from compressor to wells.

In accordance with specifications on file in the office of the City Secretary of the City of Galveston and in the office of the waterworks department.

Each proposal must be submitted in duplicate and accompanied by a certified check payable to the order of the City Secretary of the City of Galveston in the sum of 5 per cent of the amount of bid or the same will not be considered. A bond in the sum of 50 per cent of the contract price will be required for the faithful performance of the contract, with sureties satisfactory to the Board of Commissioners.

The right is reserved to reject any and all bids, or to accept the proposal that may in the judgment of the Board of Commissioners to be considered for the best interest of the city.

M. E. SHAY,
Waterworks and Sewerage Commissioner.
A. M. BURGESS,
Superintendent of Water Works and Sewerage.
JOHN D. KELLEY,
City Secretary.

Galveston, Tex., Sept. 16, 1915.

Bids open October 19, 1915.

CONTRACT 166

Sealed bids will be received by the Board of Water Supply, at its offices, twenty-second floor, Municipal Building, Park Row, Centre and Chambers Streets, New York City, until 11 A. M. on Tuesday, October 19, 1915, for Contract 166, for the erection of two steel frame buildings, galvanized-steel-covered, for the drainage chambers, at Shafts 11 and 21, of the city tunnel of Catskill aqueduct, New York City. Both buildings are of, approximately, the same size, the larger one being about 48 feet by 40 feet by 83 feet. The substructures or foundations of these buildings are being built under other contracts.

At the above place and time the bids will be publicly opened and read. Pamphlets containing information for bidders and contract drawings can be obtained at the above address, at the office of the Secretary, by depositing the sum of ten dollars ($10) in cash or its equivalent for each pamphlet. For further particulars, apply to the office of the Principal Assistant Engineer at the above address.

CHARLES STRAUSS, President,
CHARLES N. CHADWICK,
JOHN F. GALVIN,
Commissioners of the Board of Water Supply.

GEORGE FEATHERSTONE, Secretary.

PROPOSALS FOR PROJECTILE Hoists—Office of Chief of Engineers, U. S. Army, Washington, D. C.—Sealed proposals will be received here until 3 00 p. m., October 23, 1915, and then opened, for 12-inch projectile hoists. Further information on application.

Bids open October 21, 1915.

NOTICE TO BIDDERS.

GAS ENGINES AND PUMPS

CITY OF CLARKSBURG, W. VA.

Sealed proposals for furnishing all labor and materials and installing complete with appurtenances two gas engines and two pumps at the existing pumping station of the City of Clarksburg, W. Va., will be received by the Water Works and Sewerage Board of said city at the office of the Secretary, Scotland G. Highland, until 12 o'clock, noon, Thursday, October 21, 1915, in accordance with the plans and specifications on file at the office of the Board and at the office of George W. Fuller, Consulting Engineer, 170 Broadway, New York City, from whom copies may be obtained.

Proposals shall be made on the blank forms to be obtained from the Secretary or the Consulting Engineer, and shall be sealed and filed with the Secretary of the Water Works and Sewerage Board on or before the hour above stated.

All proposals will be considered informal and rejected which contain bids not asked for, or which do not contain prices in both words and figures for all items of any group upon which bids are asked, or which otherwise are not in conformity with this Notice.

Each proposal shall contain the full name of every person, firm, or corporation interested in the same and the address of the person, firm or corporation and secretary of the corporation bidding, and shall be accompanied by a certified check upon a National Bank drawn to the Treasurer of the City of Clarksburg, W. Va., in the sum of Three Hundred ($300) Dollars for each of Contracts A and B.

The bidders to whom the contracts may be awarded shall attend at the office of the Board in Clarksburg, W. Va., with the sureties offered by them within five days (Sundays excepted) after the date of the notification by the City of the acceptance of their proposal, and there sign the contract in triplicate for the work. In case of the failure so to do, they will be considered as having abandoned the same, and the certified checks, accompanying the proposal shall be forfeited to the city.

The checks of all unsuccessful bidders will be returned upon demand, and also the checks of the successful bidders upon the execution of the contract and the furnishing of the required bond.

A bond in the sum of twenty-five (25%) Per Cent of the amount of the contract with sureties satisfactory to the Water Works and Sewerage Board will be required for the faithful performance of the work.

Drawings and specifications showing the arrangement and construction of the machinery offered and all important dimensions of the parts and material used in construction of same shall be submitted with the proposals.

Bids will be received separately for Contracts A and B. The Board reserves the right to reject any and all bids.

(Signed) TRUMAN J. LYNCH,
President.
(Signed) SCOTLAND G. HIGHLAND,
Secretary.
GEORGE W. FULLER,
Consulting Engineer.

TREASURY DEPARTMENT, Supervising Architect's Office, Washington, D. C., September 16, 1915.—Sealed proposals will be opened in this office at 3 p. m., October 28, 1915, for the extension, remodeling, etc., of the United States post office at Kirksville, Mo. The extension is of 2500 square feet ground area, nonfireproof construction, stone and brick facing, and slate roof. Drawings and specifications may be obtained from the custodian at Kirksville, Mo., or at this office, in the discretion of the Supervising Architect. JAS. A. WETMORE, Acting Supervising Architect.

FORT H. G. WRIGHT, N. Y. SEALED proposals for constructing and installing new underground street lighting system, including eleven lamps, Fort Terry, N. Y., will be received until 9 a. m., Oct. 12, 1915. Information on application to Constructing Quartermaster.

CONTRACTING NEWS

Of Special Interest to Engineers, Contractors, Builders and Manufacturers of Engineering and Building Supplies

EXPORTS last week reached a new high total of more than $67,700,000. The increase was largely due to much heavier exports of cotton from Savannah, New Orleans and Galveston, the latter taking second place to New York with exports of more than $7,500,000 for the week. Cotton exports last week were much heavier than the average for last year, and about four times the average for last summer, indicating that this crop is moving on a fair basis, and that conditions in the South should be helped thereby. Steady improvement of general conditions and increasing confidence all over the country are noted in reports from the Federal reserve districts. Labor is not so plentiful, and an actual shortage has been reported from eastern Pennsylvania. Railroad buying, largely for next year, has been the heaviest in more than a year, and still continues. Reports of several trunk lines show a continued increase in net earnings. Structural steel contracts closed last month are estimated at about 137,000 tons, which is less by 9000 tons than the August orders; but a large amount of business is already in sight for October.

Buildings

Two $500,000 building contracts have been awarded at Philadelphia. A contract for erecting factory buildings to cost $500,000 has been awarded at Gloucester, N. J. The lowest bid received for erecting a U. S. post office at Harrisburg, Pa., was $127,000. The lowest bid received by the Navy Department for erecting barracks at Norfolk, Va., was $199,000, and the lowest bid received by the same department for constructing barracks at the Mare Island Navy Yard, near Vallejo, Cal., was $137,500. The lowest bid received for erecting a U. S. post office at Tulsa, Okla., was $185,000. The contract for building the Masonic temple at Seattle has been awarded at $130,000.

Bids are desired for erecting a $100,000 university building at Norman, Okla. It is reported from El Paso, Tex., that bids are desired for constructing a $400,000 court house. It is reported that bids will be received this month for two buildings in Seattle, to cost $150,000 each. Plans have been filed in New York City for a $300,000 apartment house, and for two apartment houses to cost $150,000 each. It is reported that the Philadelphia Board of Education will soon let a contract for constructing a $500,000 high school. Plans are being prepared for a $125,000 business building in Fort Wayne, Ind. A contract will soon be let for erecting a $100,000 addition to a Minneapolis high school. Plans are being prepared for a $175,000 school building in Detroit.

Bridges and Roads

Bids were opened in Philadelphia Sept. 29 for four bridges to cost $110,000, and two contracts have been awarded. A contract for building a $90,000 viaduct has been awarded at Macon, Ga. A $70,000 contract for steelwork in connection with the Fifteenth Avenue bridge in Seattle has been awarded. The construction of a bridge to cost $132,000 has been contracted for at Trenton, Ont. It is reported that bids are desired Oct. 30 for a $135,000 viaduct at Dallas, Tex. The bridge over the Quinnipiac River being planned at New Haven will cost $360,000. An engineer has been selected for the $250,000 bridge to be built across the James River at Lynchburg, Va. Plans have been prepared for a $50,000 highway bridge at Prairie du Sac, Wis.

Bids have been opened on a $120,000 paving contract in Brooklyn. Bids were opened recently for road work at Dayton, Tenn., for which $250,000 is available. A $70,000 road contract has been awarded at Gastonburg, Ala. A $250,000 paving contract has been awarded at Taylor, Tex. The lowest bid received in Seattle for building Green Lake Way was $103,000, and the lowest bid received for grading East Marginal Way was $80,000. It is reported that bids are desired at Newport, Tenn., for road work to cost $150,000. Bids are desired at Terrell, Tex., for road work which will cost $200,000. A number of large road bond issues have been voted in the South, including $300,000 at Morgantown, W. Va., $350,000 at Winchester, Tenn., $200,000 at Tallahassee, Fla., and $175,000 for building a road from Savannah, Ga., to Tybee.

Waterworks and Sewers

The lowest bid received Sept. 30 for constructing sewers in Long Island City, N. Y., was $57,000. Bids have been opened in Philadelphia for waterworks equipment to cost $133,500. Contracts for sewer work to cost $143,000 have been awarded at Philadelphia. A contract for building a $43,500 sewage-disposal plant has been awarded at Berlin, Ont. Bids are to be received at Hertford, N. C., for constructing waterworks and sewer systems, including about 3 miles each of water mains and sewers. A $92,000 filter plant is to be built at South Boston, Va. St. Paul, Minn., will spend $400,000 for waterworks improvements. The construction of a new reservoir and water-purification plant at North Yakima, Wash., has been directed by the State public service commission. A report has been made on an additional water supply for York, Ont., to cost $750,000.

Miscellaneous

The lowest bid received Oct. 1 for constructing the Thirty-fifth Street pier shed, in Brooklyn, was $280,000. A large contract for wharves, tracks and terminal equipment has been awarded at Mobile, Ala. A contract for constructing a $300,000 dam has been awarded at Fowler, Colo. Bids are being received for enlarging the main canal in the irrigation works at Modesto, Cal. Bids will be received early next month for constructing a $100,000 dam at Salt Lake City. The chief engineer of the Public Service Commission of Pennsylvania has reported the cost of eliminating grade crossings on the Lincoln Highway in Pennsylvania at more than $8,300,000. Ennis, Tex., has voted $121,000 for levee work. Drainage improvements being planned at Jefferson, Iowa, will cost more than $500,000. A contract will soon be let for constructing a $250,000 pier in San Francisco. It has been decided to begin construction on the $16,000,000 flood-control project at Los Angeles, the initial expenditure of $6,000,000 to be submitted to popular vote Oct. 26.

WATERWORKS

PROPOSED WORK.

Essex Junction, Vt.—W. B. Nichols, Superintendent of Water Works, writes that it is expected in early spring to install a plant for pumping water; also make extensions to mains; considerable concrete work included. F. O. Sinclair, Burlington, Engineer.

Cambridge, Mass.—Construction of filtration plant under consideration. James J. Scully, Pres. Water Bd.

Lenox, Mass.—The Lenox Water Co. (G. F. Bouren, Comr.), intends constructing another reservoir as soon as permission is received from Gas and Electric Light Co.

Huntington, L. I., N. Y.—Installation of municipal water works reported under consideration. Walter E. Sexton has submitted a plan for incorporation of a district comprising about seventeen square miles with about 95 miles of highways. It is proposed to lay about 41 miles of mains and install a plant with every up-to-date improvement.

Savona, N. Y.—Robert O. Hayt of Corning reported to have submitted a report on constructing a reservoir and dam across Lamoka Valley, three miles from Savona.

Connersville, Pa.—Council passed ordinance providing for collection and disposal of garbage, and authorized a bond issue of $150,000 for the purpose of erecting a municipal water plant or taking over present plant of Connersville Water Co. An election will be held in November to vote on the question.

South Boston, Va.—The improvements to the water works will include a filter plant costing $92,000. Anderson & Christie, Engrs., Charlotte, N. C.

Williamsburg, Va.—Citizens, Sept. 28, voted $30,000 bond to construct waterworks.

Wilson, N. C.—Bids opened by Town Comrs. for $95,000 water bonds rejected, being excessive.

Coolidge, Ga.—Water works improvements, including 30 to 50 g.p.m. pump, 40,000-gal. tank on 80-ft. tower, cast and galvanized pipe, hydrants, valves, etc. Cost, including electric light plant, about $50,000. W. Hopson Goodloe, Engr., Macon.

Cincinnati, Ohio.—Bonds sold amounting to $210,000 for contsructing stand pipe and installing equipment in Kennedy Heights.

Farmersville, Ohio.—Contract for constructing water works will be let about March 1 and for bonds about January 1. The National Co., Engrs., South Bend, Ind.; A. F. Gilbert, Clerk.

Ironton, Ohio.—No bids received for the $100,000 water works bonds.

Galesburg, Ill.—City Council has passed an ordinance calling for an election Oct. 26 on issuing $70,000 bonds for improvements to water works and $20,000 bonds for additional equipment at electric lighting plant. Improvements at water plant include deep well, installation of new pump and new reservoir.

Hayward, Wis.—Plans being prepared for improvements to the water works to include two pumps 400 gal. per minute, and standpipe 50,000 gal.; estimated cost, $11,000. A. M. Johnson, Deputy City Clk.

Pulaski, Wis.—Citizens voted in favor of waterworks and sewerage system. Plans and specifications being prepared by Steller Eng. Co., Loan and Trust Building, Milwaukee.

St. Paul, Minn.—City Council authorized the City Attorney to prepare an ordinance authorizing a $400,000 bond issue for improvements to waterworks.

Emporia, Kan.—It is proposed to construct municipal water works, consisting of reservoir, repaired, filtration plant installed, new dam, improvements to distribution system, etc., at a cost of $120,000. Black & Veatch, Engrs., Kansas City. Fred H. Smith, City Clk.

Manhattan, Kan.—State Public Utilities Comn., Topeka, has issued an order permitting city of Manhattan to issue $69,500 bonds for extensions of mains and betterments to the municipal pumping plant.

City Comrs. passed an ordinance providing for above $69,000 bond issue.

Dallas, S. D.—Citizens voted $12,000 water works improvement bond.

Malvern, Ark.—See "Prices and Lettings."

Elgin, Tex.—J. W. Thomas, City Secy., writes that nothing will be done about constructing water works until the bonds are sold.

Ft. Worth, Tex.—Reported plans being prepared by Homan & Laird for completing West Fork reservoir water supply system and construction of sewage disposal plant. E. T. Tyra, Mayor.

Rusk, Tex.—Attorney General has approved $5,000 water works bonds.

Jones, Okla.—Contract will be let about Dec. 1 for constructing municipal waterworks; probable cost $10,000. Benham Engineering Co., Oklahoma City, Engrs.; A. Keyes, City Clk.

Platteville, Col.—S. Salomon, Town Clerk, writes plans are being prepared by L. L. Stimson of Greeling for the proposed water works. Bids for construction will be asked about Oct. 15.

Aberdeen, Wash.—Citizens voted Sept. 25 to construct water works; cost, $400,000. R. H. Thompson, Engineer, Alaska Building, Seattle.

North Yakima, Wash.—State Public Service Comn., Olympia, directed construction of a new reservoir and installation of additional equipment to purify water supply.

Olympia, Wash.—City Council passed an ordinance authorizing issue of $100,000 to take over and improve the local water

Seattle, Wash.—A bill has been introduced in Council providing for the extension of the Bristol Water system in Rainier Valley and contiguous territory; the proposed extension to include construction of a 300,000-gal. stand pipe near Lincoln Avenue and Leo Street, with a 16-in. trunk water main leading from the stand pipe to an intersection with the proposed main at Bangor Street and Benton Avenue. Also a 30-in. trunk main at Thirtieth Street. Cost estimated at $75,000. L. B. Young, Superintendent of Water.

Seattle, Wash.—Board of Public Works approve plans of city engineer for water mains in Dexter Avenue; cost, $32,000.

Martinez, Cal.—City is reported considering municipal ownership of waterworks. It is proposed to purchase plant of present water company, and install a new system of piping for the entire city, including new territory.

Bonners Ferry, Idaho.—Bonners Water & Light Co. reported taking steps to construct a water system for the Northside to consist of concrete water tank, capacity 120,000 gal., a pumping station, and mains; cost about $12,000.

Pocatello, Idaho.—Reported Bennock Eng. Co., Pocatello, engaged to prepare plans for municipal water works; cost $40,000.

Lennoxville, Que.—Citizens of Lennoxville, Que., not Ohio as previously stated, voted to issue $40,000 water works improvements bonds. No plans have been prepared, and it will be some time before contracts are awarded. W. W. Baker, Secy.-Treas.

Markham, Ont.—Citizens voted to authorize Council to proceed with the proposed extension of the water works system; cost, about $20,000. Bids were opened Aug. 23.

York, Ont.—Hugh Gall, engineer, has submitted a report to York Township Council recommending a scheme to provide a water supply for the southern portion of York township; cost estimated at

BIDS DESIRED.

New York, N. Y.—Until Oct. 26, by Bd. Water Supply, Municipal Building, New York, for Contract 128, constructing two concrete stone and brick buildings at Uptake and Lowerlake Chambers of Hill View Reservoir in city of Yonkers, advertised in Engineering Record.

Jersey City, N. J.—Until Oct. 11, by Hudson County Park Comm., 1 Exchange Place, Jersey City (Walter G. Muirhead, Secy.), for furnishing 12,000 lin. ft. wrought iron pipe for North Hudson Park, North Bergen, and 3,000 cu. yd. ¾ to 2½ in. broken trap rock, 500 bbl. Alpha or Atlas Portland cement, wrought iron pipe, manhole cover, posts, etc., for Bayonne Park, Bayonne.

Hertford, N. C.—Until Oct. 12 by Town Clerk at the office of Mayor, for furnishing material and constructing water works and sewerage system to consist of a steel and steel tank on 75 ft. tower, 24,000 ft. 10, 8 and 6-in. c. i. pipe, Class A, B and C, 11,500 ft. ¾-in. galvanized iron pipe and fittings, two 750 G. P. M. steam fire pumps, one 400 centrifugal pump, hydrants, valves, etc., 14,500 ft. 10 and 8-in. T. C. sewer pipe and special branches, manholes, flush tanks, etc. J. B. McCrary Co., Engrs., Third National Bank Bldg., Atlanta, Ga.

Cincinnati, Ohio.—Until Oct. 13 by Philip Fosdick, Dir. Pub. Service (Parke S. Johnson, Secy.) for furnishing and delivering cast-iron pipes, special and miscellaneous castings for water distribution system.

Until Oct. 20 by Director of Public Service for the Kennedy Heights Stand Pipe, which will provide 3 tanks, 40 x 100 ft., steel, supported by reinforced concrete. J. A. Heller, City Hall, Designing Engineer.

Miller, Ind.—Reported desired until Oct. 20 (extension of date from Sept. 15) by Town Clerk for constructing water works. W. J. Fulton, Engr., Gary.

Van Buren, Ind.—Until Oct. 21 by Town Clerk for c.-i. pipe, pumping equipment and installation of same. Charles Brossmann, Engr., 1006 Merchants Bank Bldg., Indianapolis.

Three Rivers, Mich.—Reported desired until Oct. 21 by E. A. Seidell, City Clk., for constructing water works to consist of motor driven centrifugal pump, elevated steel tank of 150,000 gal. capacity, water wheels, etc.

Perry, Iowa.—Bids are wanted by Adrian Cross, City Clk., for a high duty pump, with capacity of not less than 1200 gal., for the water works.

Aurora, Minn.—Until Oct. 20 by Alfred E. Hill, Village Clk., for constructing a 100,000 gal. concrete reservoir, a brick building 20 x 30 ft. pump station, and two 600 gal. electric pumps cost $7,000. W. J. Hejda, Engr., Virginia, Minn.

Attica, Kan.—Reported desired until Oct. 14 by J. C. McCaddon, City Clk., for constructing water works to consist of 16,200 ft. 4, 6 and 8-in. c. i. water pipe, etc. Probable cost, $28,000. E. P. Archer, Engr., Kansas City, Mo.

Pleasantville, Neb.—Reported desired until Oct. 12 by A. E. Pearson, City Clk., for constructing water works.

Hillyard, Wash.—Reported desired until Oct 12 by City Clerk, for repairs to water pumping station as follows: Furnishing steel standpipe, 30 ft. diam., 70 ft. high (new or second-hand), and constructing concrete foundation, 25 ft. high and erecting thereon said steel standpipe, furnishing and installing pump, 350 gal. per min., etc. Sawyer Bros., Engrs., Lindell Blk., Spokane.

The Narrows, Man.—Reported desired until Oct. 12 by H. H. Elliott, Town Clk., for improving water works. Murphy & Underwood, Bottomley Blk., Saskatoon, Sask., Engrs.

PRICES AND LETTINGS.

★Indicates award of contract.

★Jamestown, N. Y.—Following are four lowest bids opened Sept. 22, by Board of Water & Light Comrs., for furnishing about 10 11-in. driven wells: Artesian Well & Supply Co., Providence, R. I., $10,175 (awarded contract); Ridpath & Potter Co., Philadelphia, Pa., $11,000; Harper Machinery Co., New York, N. Y., $11,115; P. H. & J. Conlan, Newark, N. J., $12,510.

★Manchester, N. Y.—Contracts awarded as follows for new water system: Trenching, pipe laying and foundation for pump, pump house, etc., George H. Bliven and Ray O. Beal, Rochester, at $21,919; stand pipe, Tibbett & Wood, Phillipsburg, N. J., $14,000; valves, hydrants, valve boxes, etc., Eddy Mfg. Co., Eastford, Conn., $9,615; Robert P. Dunlop, Rochester, Village Engr.

★New York, N. Y.—Contract awarded by Board of Water Supply, New York City, on bids opened Sept. 28 for furnishing 16 locomotive electric operated equipment for construction service on Catskill Aqueduct, Kensico, High View and Silver Lake reservoirs to Lord Electric Co., 195 W. Fortieth Street, at $39,982.

Philadelphia, Pa.—Bids opened by Water Bureau Sept. 29, for following improvements:

At Shawmont pumping station, installation of three 16 and 600 gal. turbo-centrifugal pumps, M. L. Bayard, Pennsylvania Bldg., $9,000. Southwark Foundry & Machine Co., 429 Washington Avenue, $9,000. Bruce-Doyle Co., Commercial Trust Bldg., $13,500.

At Queen Lane Filtration plant, installation of mechanical stoker equipment, Combustion Engineering Cor., 11 Broadway, New York City, $14,850; and Wilmont Engineering Co., Hazleton, Pa., $16,317; installation of cold storage appliances (2 lowest bidders were) Day & Zimmerman, 611 Chestnut Street, $28,772, and Edward Fay & Son, $29,030.

★Atkinson, Ill.—Contracts for constructing municipal water works to cost about $25,000 awarded as follows: Pump, Keystone Driller Co., Beaver Falls, capacity 200 P. M., $1,640; Stand pipe, Chicago Iron Wks., Chicago, $4,120; station, S. O. Thompson, Chicago, $750; well, Cambridge Drilling Co., Cambridge, Ill. (Bids opened Sept. 14.) James H. Thompson, Engr., 607 Marquette Bldg., Chicago; Jesse Steiner, Village Clk.

★Amboy, Ill.—Contract for erecting steel water tower and tank (bids open Sept. 27), awarded Chicago Bridge & Iron Wks., Chicago, at $3,930. F. S. Vaughan, Mayor.

Luverne, Iowa.—Circular Constr. Co., Minneapolis, submitted lowest bid for constructing circular reinforced concrete reservoir at $4,426.

★Virginia, Minn.—Contract for furnishing steam turbine, 1500 kw. (bids open Sept. 6), awarded General Electric Co., Chicago, at $29,200. Other bidders: Westinghouse Electric & Mfg. Co., Minneapolis, $32,750; United Engineering Co., Chicago, Ill., $35,990. C. T. Harding, Engr. for Water & Light Department.

★Hastings, Neb.—Contract for furnishing a well and pump (bids opened Sept. 27) awarded by Commissioner Water and Light Departments to Hydraulic Eng. and Machinery Co., at $4,790.

★Leslie, Ark.—Contracts for water works awarded as follows: Pipe, American C. I. Pipe Co., Birmingham, Ala.; hydrants and valves, Columbia Iron Wks., Chattanooga, Tenn.; pumps, Hoshall Machine Co., Memphis, Tenn.; and reinforcing steel work, Corrugated Metal Co., Buffalo, N. Y. Bonds amounting to $28,000 have been sold for this work.

★Malvern, Ark.—Reported conditional contract awarded Lane & Bowler, Stuttgart, for drilling several 100 ft. test wells to find pure water supply. If test is successful bonds will be sold and a water system installed. Address Mayor.

★Halfway, Ore.—Crane Co., Portland, reported to have secured contract for furnishing material for gravity water system; city to install the system. A. Marles, Recorder.

Ottawa, Ont.—Following are lowest bidders on municipal improvement: Overland pipe, trench work, Thomas McLaughlin, $63,514; concrete bridge, Thomas McLaughlin, $42,527; special work (c.-i.), tees, elbows, etc., Victoria Foundry Co., Ottawa, $12,455; valves, General Supply Co., $14,518; pumps, Escher Wyss Co., Zurich, Switzerland, $10,900; motors, Canadian Westinghouse Co., $14,600; switchboard and apparatus, Canadian Westinghouse Co., $11,912; transformers, Canadian Westinghouse Co., $11,253; lock bar pipe, Laurin & Leitch, Montreal, $194,400.

★New Westminster, B. C.—Contract awarded by Water Committee of City Council to Vulcan Iron Wks., of New Westminster, at $7,000, for furnishing 4800 ft. of riveted steel pipe for the diversion of the 14-in. water main.

SEWERAGE AND SEWAGE DISPOSAL

PROPOSED WORK.

Boston, Mass.—Public Works Dept. has authorized installation of a sewer on Telford Street, Brighton, at an estimated cost of $12,000.

New Bedford, Mass.—City Council has passed order authorizing loan of $65,000 for addition to intercepting sewers and $20,000 for permanent road work on Dartmouth and Kempton Streets.

Hamden, Conn.—It is proposed to construct about 30 miles of 8 to 24-in. sanitary sewers, pumping plant and disposal plant. Cost for sewer, $200,000, disposal plant, $50,000. No date yet set for receiving bids on bonds or work. Clyde Potts, Engr., 30 Church Street, New York.

Patchogue, L. I., N. Y.—Construction of sewage disposal plant being considered; cost about $175,000. Address Village Trus

Syracuse, N. Y.—City Engineer W. T. Wooley estimates cost of constructing 15 miles of sanitary and storm sewers and 8 miles of trenches in Seventeenth Ward and Fairview tract at $185,000.

Bayhead, N. J.—Plans and specifications being prepared by Remington & Vosburg, Camden, for sewerage system and disposal plant, approximate cost $40,000.

Bogota, N. J.—Citizens voted $30,000 bonds for extending sewer system.

Camden, N. J.—Plans and specifications being prepared by Remington & Vosburg, Camden, for a 4-ft. segment sewer, one mile in length, to be built jointly by Baldwin's Run and city of Camden; cost $12,000.

South Boston, Va.—The sewer improvements will cost $7,500. Anderson & Christie, Engrs., Charlotte, N. C.

Atlanta, Ga.—City ordinance calling for a bond election on Sept. 30 has been repealed by Council. The proposed issue included $1,000,000 for sewers, $750,000 for water works, $1,000,000 for schools and $150,000 for the fire department. An attempt will be made to vote the bond issue next spring.

Dayton, O.—Bonds for $40,000 will be sold Oct. 11, by Hugh E. Wall, City Accountant, for constructing sanitary sewers in Dist. No. 6.

Xenia, Ohio.—City Council passed ordinance providing bond issue of $60,000 for purchasing site and constructing sewage disposal works.

East St. Louis, Ill.—City Council has authorized the city to borrow $40,000; of this sum $37,000 will be used to repair sewers damaged by recent floods.

Pulaski, Wis.—See "Water Works."

Oskaloosa, Iowa.—H. C. Hawkins, City Engr., writes that no definite steps have been taken to construct the sewage disposal plant.

Loup City, Neb.—Engineer engaged to prepare an estimate of cost of constructing sewerage in downtown district; probable cost $10,000. Address City Clerk.

Austin, Tex.—The Mayor is signing the $725,000 sewer, street and school improvement bonds.

Hugo, Colo.—Plans of Royal D. Salisbury, Denver, for sewer system adopted by Council. Bonds amounting to $12,000 to be sold Oct. 25.

Deming, N. M.—Constructing sewers at a cost of $20,000 and disposal plant at $10,000 is contemplated, but nothing definite will be done about the matter until after the election in April. A. A. Gemke, City Clerk.

Seattle, Wash.—Streets and Sewers Committee authorized construction of sewers in North and West Thirty-eighth Street; estimated cost, $10,436.

Portland, Ore.—Reported plans about completed for the reconstruction of the lower end of the Tanner Creek trunk sewer, at a cost of $50,000. It is proposed to repair the present system and construct another to supplement it.

Los Angeles, Cal.—Reported Council is considering submitting to a vote of the citizens in October question of issuing $2,694,000 bonds for constructing the Hyperion & Point Firmin sewage disposal station; approximately $1,000,000 will be asked; for fire station site and building, $714,000; for bridge at Ivanhoe station, $15,000; police and fire alarm system, about $400,000.

Esquimalt, B. C.—Reported city intends extending sewerage system to include residential section of city. About two and half miles of pipe required.

BIDS DESIRED.

New York, N. Y.—See "Paving and Roads."

Seaside Park, N. J.—Until Oct. 18 (readvertisement) by Boro. Council for constructing sanitary sewers and a disposal plant. Remington & Vosburg, Consulting Engrs., 501 Market Street, Camden; Frank Brockway, Boro. Clk.

Trenton, N. J.—Until Oct. 13, by City Commission, for constructing sewer in Hobart Avenue, Steamboat Street. Frank Thompson, City Clk.

Verona, N. J.—Until Oct. 20 by Borough Council for constructing 17 miles of pipe sewers, 8 to 20 in., advertised in Engineering Record. Clyde Potts, Engr., 30 Church Street, New York, N. Y.; T. E. Brooks, Boro. Clk.

Parkesburg, Pa.—Sewer contractor wanted to complete pipe sewer contract, about 6000 ft., average 8 ft. deep, advertised in Engineering Record. Address Box 243, Parkesburg.

Pittsburgh, Pa.—Until Oct. 11 at office of City Controller, for constructing sewers in Phillips and Mansfield Avenues, Somers, Sarah and numerous other streets; also regrading, recurbing and repaving with asphalt portions of Forbes Street.

Baltimore, Md.—Until Oct. 13, by Bd. Awards (Harry W. Rodgers, Secy.), at Office of City Register, for Cont. 163, constructing sand bed and concrete channel at Sewage Disposal plant, to consist of 3350 cu. yd. excav., 3100 lin. ft. 4-in. unglazed tile, 2800 cu. yd. sand, etc.

Washington, D. C.—Until Oct. 12, by Commissioners D. C. for constructing Sect. 5 Anacostia Main Interceptor in Dist. Columbia, about 15,000 ft. 4 ft. 6 in. x 5 ft. sewer advertised in Engineering Record.

Until Oct. 19 by Comrs. D. C. for constructing approximately 11,000 lin. ft. 24 in. pipe sewers, advertised in Engineering Record.

Hertford, N. C.—See "Water Works."

Alliance, Ohio. — See "Paving and Roads."

Cincinnati, Ohio.—Until Oct. 15 by Dir Pub. Service (Parke S. Johnson, Secy.), for constructing sewers on Pennsylvania and Boudinot Aves and Culvert Street.

Marion, Ill.—Until 7.30 p. m., Oct. 11, by George C. Campbell, City Clk., for constructing sanitary sewers. Frank Payne, City Engr.

Oakland, Iowa.—Reported desired until Oct. 12, by E. F. Wentz, City Clk., for 10,000 ft. 8 in., 1000 ft. 10. sewers, manholes, etc. J. H. Mayne, Engr., Merriam Block, Council Bluffs.

Pella, Iowa.—Until Oct. 20, by A. C. Kuyper, City Clk., for constructing approximately 14,500 ft. sanitary sewers, 13 flush tanks, and 19 manholes, advertised in Engineering Record.

Houston, Tex.—Reported desired until Oct. 11 by M. Campbell, Mayor, for constructing storm sewers in San Jacinto, Hathaway and Garrott Streets. E. E. Sands, City Engr.

Ogden, Utah.—Until Oct. 13, by Florence O. Stanford, City Recorder, for constructing pipe sewers in Twenty-seventh, Twenty-eighth and Twenty-ninth Streets in Sewer Improv. Dist. No. 128.

Toronto, Ont.—Until Oct. 12 by Works Dept. for constructing sewers in St. Clair, Mulbock Aves., Keele St., and West Toronto Sewer Div. No. 2.

PRICES AND LETTINGS.

★Indicates award of contract.

★Boston, Mass.—Contract for constructing sewers in Telford Street (bids opened Sept. 17) awarded Anthony Barnffaldr, 9 Market Place, at $9,072.

★Brockport, N. Y.—Contract for constructing sewage disposal works (bids opened Sept. 17) awarded Sept. 27 to Suburban Eng. Co., 15 W. Thirty-eighth Street, New York.

Long Island City, N. Y.—Following are totals of bids opened Sept. 30 by Maurice E. Connolly, Pres. Queens Boro., for constructing sewers in portions of Kimball, Lawn and other avenues; Green Contr. Co., Long Island City, $22,847. Angelo Paino, $24,632; Joseph L. Sigretto Co., $24,787; James H. Johnson, $27,110.

Lowest bid, opened same date as above, for sewers in Herald Avenue from Forest Park to Grant Avenue and other streets, submitted by James H. Johnson, at $15,756.

Newark, N. J.—Lowest bid opened Sept. 30 by Board Street and Water Commissioners, for constructing Meadow Brook Outlet Sewer, was submitted by Matteo Rinaldo, at $7,242.

★Philadelphia, Pa.—Contracts awarded as follows by Department of Public Works, Bureau of Surveys, on bids opened Sept. 29 for constructing sewers: Main sewers—Cobbs Creek Intersecting Sewer Extension, 460 ft. of 3 ft. 6-in. brick sewer in tunnel, 271 ft. of 3 ft. 6-in. brick sewer in open cut, to Adolph Jafolla, 139 S. Fiftieth Street, at $16,555; Gunners Run relief sewer extension, 127 ft. of 10-in. brick sewer in tunnel, to Joseph Lonbardi, Philadelphia, at $11,623; Lardner Street extension, 1245 ft. of 9 ft. x 14 ft. 6-in. reinforced concrete on piles, to Richard Walsh & Son, Sixty-sixth Avenue, at $61,551; North Mount Pleasant Avenue, 2759 ft. of 15-in. vitri. pipe to estate of David McMahon, Main and Chelten Streets, at $12,198; Snyder Avenue extension, 318 ft. of 6 ft. x 9 ft. reinforced concrete on piles and platforms, to C. A. Conan, at $16,117; Wingohocking extension across Front Street, 250 ft. 19-in. reinforced concrete, to Frank Mark Constr. Co., 2820 N. Twenty-first Street, for $25,570; Branch sewers—Forty-one contracts for small brick sewers in various sections of the city costing about $150,000 not yet awarded; construction depends on future appropriation.

★Toledo, Ohio.—Contract awarded by Co. Comrs. to J. N. Bick, The Nasby, for constructing sewer in Parkside addition at $14,341.

★Princeton, Ind.—Contract for constructing sewer system (bids opened Sept. 27) awarded by Earl M. Miller, City Clk., to John L. Newman, Evansville, at $6,126.

★Ann Arbor, Mich.—Contracts for constructing sewers (bids opened Sept. 22), awarded by City Council as follows: Glen Avenue storm sewer and sewers in Dist. 68 awarded William Eddy & Son, Saginaw, at $8,955 and $3,249 respectively; sewers in Dists. 69, 70, 71 and 72 to Thomas Joyce, Kokomo, Ind., at a total of about $10,819. Manley Osgood, City Engr.

★Anna, Ill.—Contract for constructing sewage-disposal plant at Southern Illinois Hospital for Insane, awarded by State Bd. Administration, Springfield, to Sell & Koller, Pana, at $9,722.

★Fond du Lac, Wis.—Contract for constructing storm sewers in Dist. No. 4 (bids opened Sept. 24), awarded George A. McCabe, Fond du Lac, Wis., and for sanitary sewers to Robert Bernett, Fond-du Lac. J. S. Hohensee, City Clk.

Long Island City, L. I., N. Y.—Following are details of four lowest bids opened Sept. 30 by Maurice E. Connolly, Pres. Queens Boro., for constructing sewers in portions of Hunters Point, Borden and Laurel Hill Avenues and other streets: (a) Joseph L. Sigretto & Co., Fort Schuyler Road, $57,703; (b) Anabel Constr. Co., $61,065; (c) Murphy Bros., Madison Avenue and Forty-second Street, $65,476; (d) U. S. Drainage & Irrigation Co., 17 Battery Place, $67,939. All bidders of New York.

	(a)	(b)	(c)	(d)
1,099 lin. ft. 6-ft. reinforced concrete sewer	$11.00	$10.00	$14.00	$12.85
1,864 lin. ft. 5-ft. 6-in. reinforced concrete sewer	10.00	7.80	10.62	10.65
905 lin. ft. 5-ft. reinforced concrete sewer	8.00	8.00	8.90	8.90
667 lin. ft. 4-ft. 3-in. reinforced concrete sewer	6.00	7.00	6.35	8.55
256 lin. ft. 3-ft. plain concrete sewer	5.25	7.00	5.50	7.00
1,669 lin. ft. 2-ft. 6-in. plain concrete sewer	5.25	4.60	5.75	6.26
6 lin. ft. 24-in. vitrified pipe sewer	3.00	5.00	2.00	4.50
3 lin. ft. 20-in. vitrified pipe sewer	3.00	5.00	1.75	4.00
37 lin. ft. 15-in. vitrified pipe sewer	2.50	4.00	1.30	3.50
247 lin. ft. 12-in. vitrified pipe sewer	1.12	3.30	1.00	2.00
38 manholes, complete	49.00	40.00	0.65	40.00
3 cleaning shafts, complete	75.00	94.00	1.50	75.00
7 single receiving basins, complete	99.00	75.00	115.00	110.00
4 double receiving basins, complete	140.00	110.00	175.00	200.00
1 junction chamber, complete, at Packard Street and Anable Avenue	200.00	300.00	215.00	250.00
1 junction chamber, complete, at Packard Street and Nelson Avenue	200.00	300.00	200.00	150.00
350 lin. ft. 12-in. culvert pipe	1.00	0.94	0.70	2.00
80 lin. ft. 10-in. culvert pipe	0.70	0.94	0.60	2.00
327 6-in. spurs on concrete sewers, 24-in. long	0.25	0.94	0.45	0.60
16 6-in. spurs on 12-in. vitrified pipe sewers	0.70	0.94	0.50	3.00
248 lin. ft. 6-in. pipe for house connection drains	0.45	2.00	0.60	0.80
8,500 cu. yd. of displaced material for sewer embankment	0.01	0.38	0.01	0.10
150 M ft. timber for sheeting and bracing	0.01	25.00	0.01	1.00
20 M ft. timber for foundation	0.01	30.00	0.01	40.00
100 cu. yd. Class A concrete, not shown on plan	5.00	6.00	5.20	7.00
2,000 lb. reinforced steel, not shown on plan	0.02½	0.04	0.03	0.04
1,000 lin. ft. of fencing	0.25	0.50	0.25	0.50

Kenosha, Wis.—Following are bids opened Sept. 17 by Bd. Pub. Wks. for constructing sewers: (a) James Kennedy, Fargo, N. D., Interceptor along Pike River, $54,609; Middle, Edward, and other streets, $49,080; Howland, Charles, and other streets, $46,138 (awarded all three contracts). James Ferry & Sons, $79,366, $79,567, and $101,854 respectively; Johnson & Frandsenm bid on Middle, Edward, and other streets at $65,109, and on Howland, Charles, and other streets, at $60,652; Christopher Johnson bid only on Middle and other streets at $69,636, and Thurber & Browning on interceptor along Pike River at $74,626.

The detail bid of James Kennedy, the successful bidder, is as follows:

Interceptor along Pike River: 4300 lin. ft. 60-in. pipe: reinforced concrete brick lining, $8.46; concrete pipe, $9.50; 2300 lin. ft. 48-in. pipe; brick lining, $4.87; concrete pipe, $5.85; 1300 lin. ft. 42-in. pipe; reinforced concrete brick lining, $4.44; concrete, $4.90; 70 lin. ft. 36-in.; concrete, $3.00; 74 lin. ft. 18-in. tile and c-i. pipe, $2.00; 24 concrete manholes, $30.00; 4 concrete bulkheads, $45.00.

Middle Edward, and other streets: 2990 lin. ft. 60-in.; segmental block, $9.00; concrete pipe, $9.60; concrete, $7.37; brick, $9.37; 2180 lin. ft. 48-in. pipe; segmental, $7.00; concrete pipe, $7.40; concrete, $5.91; brick, $7.25; 33 lin. ft. 42-in.; segmental block, $6.00; concrete pipe, $6.00; concrete, $4.69; brick, $6.00; 40 lin. ft. 24-in. vitr. tile, $1.94; 2040 lin. ft. 22-in., $2.72; 2380 lin. ft. 18-in., $1.86; 1880 lin. ft. 15-in., $1.44; 40 manholes, $30.00; 1 bulkhead, $45.00.

Howland, Charles, and other streets: 3710 lin. ft. 48-in. pipe: segmental, $7.96; concrete pipe, $8.10; concrete, $7.29; brick, $8.20; 1580 lin. ft. 42-in. pipe: segmental block, $6.85; concrete pipe, $6.85; concrete, $6.12; brick, $7.20; 730 lin ft. 22-in. vitr. tile, $2.67; 640 lin. ft. 20-in., $2.46; 575 lin. ft. 18-in., $2.26; 1375 lin. ft. 15-in., $2.01; 600 lin. ft. 12-in. vitr., $1.56; 30 manholes, $30.00.

★**Grand Rapids, Mich.**—Contract for constructing sewage disposal plant in East Grand Rapids awarded A. H. Prange, Grand Rapids, at about $10,000.

★**Eveleth, Minn.**—Contract for constructing storm sewers 24 in. awarded Lawrence McCann Co., at about $10,000. C. M. Darway, Engr. C. H. Williams, City Clk.

St. Paul, Minn.—Lowest bid opened Sept. 27 for constructing sanitary sewer system for Hazel Park was submitted by O'Neil & Preston, St. Paul, at $24,645. August Hohenstein, Purchasing Agt.

★**Lyle, Minn.**—Contract for constructing 12,246 lin. ft. 8 to 15-in. sewers (bids opened Sept. 27) awarded William Danforth, St. Paul, at $14,500. G. A. Martin, City Clk.

★**Berlin, Ont.**—Contract for constructing sewage disposal plant awarded G. B. Moogk of Weston, at $43,500. H. Johnston, City Engineer.

BRIDGES

PROPOSED WORK.

New Haven, Conn.—Plan being completed by City Engr. for bridge to be constructed over Quinnipiac River at Belle Dock to be either concrete with steel, or steel with masonry piers. Cost about $350,000.

New London, Conn.—See "Railroads."

Buffalo, N. Y.—See "Railroads."

Harrisburg, Pa.—State Water Supply Comn. approved applications for constructing following bridges:

Green County, bridge over Bates Fork at Ten Mile Creek, near Sycamore.

Concrete arch bridge over Stoney Creek at Haynes Street for city of Johnstown.

Bridges over Dotter Run and Milk Creek in Rockland Township, Venango County, for Pennsylvania R. R. Co.

Bridge over Catfish Run in Madison Township, Clarion County, for Pennsylvania R. R. Co.

Bridge over Hoovers Run, Wayne Township, for Green County.

Bridge over Streets Run, for Boro West Homestead.

Bridge over Saw Mill Run, near Elwyn Station, for Allegheny County.

Bridges over Ferrier Run and over Crisswells Run in Brush Valley Township, Indiana County, for Pennsylvania R. R. Co.

Bridge over Yellow Britches Run in Delaware Township for Mercero County.

Phoenixville, Pa.—All bids opened Sept. 30 by Co. Comrs., Norristown, for constructing concrete arched bridge across Schuylkill River between Phoenixville and Mont Clare rejected. John N. Jacobs, County Compt.

Lynchburg, Va.—Ben. H. Davis, 17 Battery Place, New York City, is engineer for bridge to be constructed over James River at Lynchburg by city, Chesapeake & Ohio R. R., Southern Ry. and Norfolk & Western R. R. Cos. Cost about $250,000.

Knoxville, Tenn.—Reported Knoxville, Sevierville & Eastern Ry. Co. will build bridge over Wrinkle's Crossing, 5 miles east of Knoxville.

Johnson Creek, Wis.—Citizens voted to construct concrete bridge over Creek; cost $5,000.

Prairie du Sac, Wis.—Preliminary plans prepared by M. W. Torkelson, Engr. Bridge Div. State Highway Dept., Madison, for a bridge 600 ft. long, which it is proposed constructing across Wisconsin River at a cost of $70,000.

Wisconsin.—M. W. Torkelson, Engr. Bridge Division of Wisconsin Highway Dept., Madison, has been directed to prepare plans for twenty additional bridges to be constructed in Rock, Dane, Walworth, Jefferson and Green Counties. Probable total cost about $30,000.

Minneapolis, Minn.—City Council has been asked to appropriate $6,000 as city's share for ornamental concrete bridge which Great Northern Railroad Co. intends constructing over Brownie Cedar Lake Canal.

Tentative plans for ornamental concrete bridge 50 ft. roadway, to be constructed over Minneapolis & St. Louis and the Chicago, Minneapolis & St. Paul Railroad tracks at West Lake Street are soon to be presented to the Council. Construction begun as soon as plans approved. A. P. Emery, Dist. Engr. of the Chicago, Milwaukee & St. Paul Railroad may be able to give additional information.

Kansas City, Kan.—Kansas City Southern Ry. (C. E. Johnston, Ch. Engr., Kansas City, Mo.) has accepted the franchise recently voted the company by the city, which requires the railroad to remove present bridge over Kaw River at Ohio Avenue and replace same with a two-pier structure costing approximately $250,000; also requires the changing of track at a cost of $25,000 additional.

Fort Benton, Mont.—County Comrs. voted to construct steel bridge, 200 ft. long over Teton River, south of Genou.

Dallas, Tex.—See "Electric Rys."

Rockport, Tex.—Percival & Son of Rockport are Resident Engrs. and Whiteaker & Washington of San Antonio are Designing Engrs. of proposed causeway to be constructed in Aransas County to connect the main land at La Mar with peninsula at Rockport, to consist of about 17,033 ft. of protected hydraulic fill and 13,000 ft. of concrete beam and girder bridge, with a large draw span in midstream.

Antlers, Okla.—Plans and specifications approved for constructing 5 steel bridges in Pushmataha County; cost about $40,000.

Aberdeen, Wash.—Citizens voted $25,000 bonds for purchase and reconstruction of West Toll Bridge over Chehalis River.

Mount Vernon, Wash.—Construction of steel bridge with concrete piers to replace bridge over Baker River between East and West Concrete is contemplated by Skagit County Comrs. at Mt. Vernon. Cost about $60,000.

Riverside, Wash.—Horace E. Smith, County Engr., Conconcully, writes that probably this fall or next spring a bridge will be constructed by the County over Okanogan River at Riverside.

Seattle, Wash.—F. A. Rapp, Structural Engr., City Hall, writes the proposed bridge over Lake Washington Canal, at Tenth Street, is to be a double leaf bascule bridge, 60 ft. wide, superstructure of steel, foundation of concrete, and cost $350,000.

Walla Walla, Wash.—All bids opened Sept. 10 by County Comrs. for constructing a 102-ft. steel truss span with concrete abutments, or a reinforced concrete arch bridge, have been rejected; new date for receiving bids not yet set. G. C. Cockesy, Co. Engr.

Los Angeles, Cal.—Public Utilities Bd. approved plans for constructing viaduct over Pacific Electric Ry. Co. tracks to connect West Boulevard and Sherman Drive; cost about $40,000.

Twin Falls, Idaho.—County Comn. voted to construct steel bridge over Snake River at Hansen and a steel bridge at Shoshone Falls; cost about $60,000.

BIDS DESIRED.

Fort Edward, N. Y.—Until Oct. 23 (extension of date from Oct. 9) by Alfred Case, Jr., Town Supt., for constructing concrete arch bridge over Hudson River. Engineers, Concrete Steel Eng. Co., Park Row Bldg., New York.

Pittsburgh, Pa.—See "Hydraulic Construction and River Improvements."

York, Pa.—Until Oct. 11, by F. S. Bartenschlarger, Co. Controller, for constructing stone arch bridge over Bennet Run, Newberry Township, 66 ft. span, 14 ft. roadway, 14 ft. rise with parapet and wing walls; also reinforced concrete arch bridge over West Branch of Codoru Creek, Manheim Township, 35 ft. span, 14 ft. roadway, 7 ft. rise.

Delphos, Ohio.—Until Oct. 29 at Van Wert by Joint Board Commissioners, Van Wert and Allen Counties, for constructing bridge across Miami River and Erie Canal at Fifth Street, Delphos. Bids to be submitted separately for substructure and superstructure.

Concordia, Kan.—Reported desired until Oct. 20, by County Commissioners (George C. Guilbert, Clk.), for constructing 11 reinforced concrete bridges.

Baker, Mont.—Reported desired until Oct. 15 by F. C. Bunn, Co. Clk., Baker, for constructing bridges as follows: Steel bridge, also combination steel and wood bridge across Sandstone Creek, near Plevna; combination wood and steel bridge across Pennell Creek, north of Baker; steel bridge across Little Missouri River at Albion.

Dallas, Tex.—Reported desired until Oct. 30 by County Commissioners, for constructing Commerce Street viaduct over Trinity River. Probable cost, $135,000.

Spokane, Wash.—Reported desired until Oct. 14, by City Council for constructing steel bridge across middle channel of Spokane River at Howard Street. Probable cost $25,000. Also constructing concrete approach at south end of present Monroe Street bridge over Spokane River. Probable cost, $27,500. Morton MacCartney, City Engineer.

Portland, Ore.—Reported desired until Oct. 11, at office of County Roadmaster, for constructing reinforced concrete viaduct 228 ft. long 20 ft. roadway, 525 ft. railing, at Bertha Station.

Eureka, Cal.—Reported desired until Oct. 13 by County Supervisors for constructing trestle bridge at Field Landing and reinforced concrete culvert near Beatrice.

Boise, Idaho.—Reported desired until Oct. 22 by County Comrs. (G. Carlson, Chmn.), for furnishing material and constructing a 454 ft. steel highway bridge across Snake River, Grand View Valley.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Maine.**—Contract awarded by State Highway Comn., Augusta, for constructing bridge in Haynesville as follows (bids opened Sept. 29): Abutments, Wiseman & McPhail, Smyrna Mills, at $3,695; steel superstructure, 210-ft. span, to Groton Bridge Co., Groton, N. P., at $6,900.

★**Providence, R. I.**—Contract for erecting steel on Tandall Street Bridge awarded Louis F. Shoemaker & Co., 45 Broadway, New York, at following bid: 130,000 lb. steel fastenings, 3.56 cts., 2750 lb. new cast-iron bed plates, 3.56 cts.; 72 lin. ft. railing, $2.00.

★**Bristol, Conn.** — Contract for constructing bridge over the Pequabuck at Broad Street awarded to Pierson Engineering & Constr. Co., Hartford, at $5,000, for foundation 61 cts. per cu. yd. and $500 for removal of old bridge.

★**Binghamton, N. Y.**—Contract for constructing concrete bridge at Eldredge Street (bids opened Sept. 22) awarded Foster Constr. Co., Newark, N. J., at $12,978, not $2,978 as previously stated.

★**Greensburg, Pa.**—Contract for constructing a plate girder bridge over Jacobs Creek, at Overton, between Fayette and West Moreland Counties, awarded Harvey & Watson, Mount Washington, Pittsburgh (bids opened Sept. 28). John S. Sell, Co. Compt.

Kulpsville, Pa.—Contract for rebuilding bridge over Towamencin Creek to be steel girder span awarded to August Needs at $7,784.

★**Pennsylvania.**—Contracts awarded by State Highway Comr., Harrisburg, as follows for constructing bridges (bids opened Sept. 30): Two bridges in Cameron County, Shippen Township, one to Farrier Eng. Co., Pittsburgh, at $4,388, and one to G. W. Ensign, Inc., Harrisburg, at $5,115; Sullivan County, Davidson Township, to Whittaker & Diehl, Harrisburg, at $4,258.

★**Philadelphia, Pa.**—Contract awarded by Department of Public Works, Bureau of Surveys on bids opened Sept. 29 for constructing bridges as follows: At Sherwood Avenue over Indian Run, a 20-ft. concrete arch, 90-ft. long rubble wings and face, grading, etc., to S. J. Boas, 201 N. Broad Street, at $19,229; Torresdale Avenue over Frankford Creek, 70 ft. wide, 80-ft. span, steel superstructure, encased in concrete on concrete abutment, asphalt pavement, to Day & Zimmerman, 611 Chestnut Street, at $30,766; Fifty-fourth Street bridge over P. B. & W. R.R., 60 ft. wide, 150 ft. long, main span 81 ft., steel superstructure, encased in concrete on concrete abutments, asphalt paving, Peoples Bros., Inc., Twenty-fifth and Callowhill Streets, $34,990 (not yet awarded); Orthodox Street bridge over Frankford Creek, 48 ft. wide, 80 ft. long, two spans, steel superstructure, concrete floor, on reinforced concrete foundation, asphalt paving, low bid in excess of estimated cost, $25,355.

Maryland.—Following are lowest bids opened Sept. 28 by State Roads Comn., Baltimore, for bridges and paving:

Contr. No. CI 13—16-ft. reinforced concrete girder bridge over Meadow Creek, west of Westminster—Thomas Bennett & Hunter, Westminster, Md., $1,238.

Contr. No. F 23—Repointing walls and coping jug bridge over Monocacy River, along State Road east of Fredericks—Thomas Mullan, 4001 Greenmount Ave., Baltimore, $2,494.

Contr. No. WO 11—Concrete roadway about 1¼ miles long in Worcester Co., near Stockton—Russo Parker Constr. Co., Hudson, N. Y., $15,793.

★**Macon, Ga.**—Contract for constructing 2000 ft. steel and concrete viaduct from Bay to Third Street reported awarded by Central of Georgia Ry. to Virginia Bridge & Iron Co., Roanoke, Va., at about $90,000.

★**Edwardsville, Ill.**—Contract for erecting steel bridge over Cahokia Creek for Illinois Central R. R. Co. awarded to Decatur Bridge & Iron Co., Decatur, at $8,000.

★**Paxton, Ill.**—Contract for constructing 100 ft. steel bridge near Paxton awarded by Kankakee & Urbana Traction Co. to Central States Bridge Co., Indianapolis, Ind.

★**Yellville, Ark.**—Contract for constructing bridge over Crooked Creek awarded Larimer & Burgett, Memphis, Tenn., at about $5,000. J. H. Thompson, County Auditor, Yellville.

★**Seattle, Wash.**—Contracts for work in connection with erection of Fifteenth Avenue N. W. Bridge over Lake Washington Canal for city awarded as follows: Steel, to Golden West Iron Wks., San Francisco, Cal., at $70,000, and for machinery, to Puget Sound Machinery Depot, Seattle, at $20,000.

★**Hanford, Cal.**—Contract for contsructing bridges and culverts on Highway No. 1, Div. 1, Sec. 1 and Div. 2, Hanford to Lemoore Road, awarded by county to Mercereau Bridge & Constr. Co., Pacific Electric Bldg., Los Angeles, at $32,000.

★**Trenton, Ont.**—Contract for furnishing steel work and substructure of bridge over Trent River awarded by Dominion Government to Ontario Bridge Co., Toronto, at about $132,000.

PAVING AND ROADS

PROPOSED WORK.

New Bedford, Mass.—See "Sewerage and Sewage Disposal Plants."

Taunton, Mass.—City Council considering paving County, South W. Britannia and School Streets, cost about $14,200.

Westerly, R. I.—Reported a town meeting will be held to appropriate $20,000 for reconstructing highway.

Kenmore, N. Y.—Citizens voted to pave, with asphalt on Cornell Avenue. Elmer W. Johnson, Village Clk.

Monawk, N. Y.—Paving of Columbia Street with bitulithic contemplated; paving of Marshall Avenue, Orchard, Michigan, Porter and other streets also under consideration. A. H. Wagin, City Clerk.

New York, N. Y.—Marcus M. Marks, President Boro. Manhattan has announced the following streets to be repaved:

Asphalt—Thirty-ninth Street from Park Avenue to Broadway, and Eighth to Eleventh Avenue; Thirty-seventh Street, East to Second Avenue, Ninety-fifth Street, Madison to Fifth Avenue; **124th Street, First and Third Avenues**, Sixty-fifth Street and Sixty-sixth Street from Amsterdam to West End Avenue, Columbus Avenue, Eighty-fourth to Ninety-fifth Street, Twenty-seventh Street, Lexington to Madison Avenue; Thirty-eighth Street, Madison to Sixth Avenue, Eighth Avenue, 110th Street to 125th Street, and 125th Street, Seventh to Eighth Avenue; Thirty-fifth Street, Madison and Sixth Avenues.

Asphalt block—125th Street, Northern and Haven Avenues.

Granite block—Perry Street, Greenwich to West Avenue.

Pensauken, N. J.—Contract will be let about Oct. 25 for about 22,764 lin. ft. concrete curbing and 57,596 sq. ft. concrete sidewalks; cost $14,[illegible]. Remington & Vosburg, Engrs., Camden.

Allentown, Pa.—Contract about to be let by City Council for paving 10,000 sq. yd. on Tenth and Howard Streets.

Connellsville, Pa.—City Council considering paving section of Wills Road and Angle and other streets, cost about $79,200.

South Boston, Va.—The paving contemplated here is about 15,000 sq. yd. on North Main Street on concrete foundation; cost about $[illegible]. Anderson & Christie, Inc., Engineers, Charlotte.

Morgantown, W. Va.—Citizens of Morgan Dist. voted $300,000 bonds for constructing roads.

Mount Airy, N. C.—Citizens of Marsh Township voted $25,000 bonds for constructing roads.

Winterville, N. C.—$10,000 bonds will be sold Oct. 10 by J. E. Green, Secy and Treas., office of Bd. Town Comrs., for street improvements.

Savannah, Ga. — Citizens Chatham County voted $375,000 bonds for constructing road from Savannah to Tybee.

Tallahassee, Fla. — Citizens of Leon County voted $200,000 bonds for road improvements.

Tampa, Fla.—Bd. Pub. Wks. voted to pave 7,720 sq. yd. with asphalt block.

Mobile, Ala.—Alabama, Mississippi Gulf Coast Highway Assn. is interested in the construction of a road and bridge across the delta to connect Mobile and Bayou La Batre. S. A. Le Blanc, Pres. Rotary Club, is a member.

New Orleans, La.—Orleans Levee Bd. contemplates construction boulevard along Seventeenth Street Canal from Metairie Road to Lakeside.

Rutledge, Tenn.—Citizens of county voted $[illegible] bond issue for road improvements.

Winchester, Tenn.—Citizens Franklin County voted $[illegible] bonds for road improvements.

Lexington, Ky. — Citizens of county voted $[illegible] bonds for constructing roads.

Alliance, Ohio.—Bonds for $32,150 for road improvements and $46,500 for sewage disposal will be sold Oct. 25 by Charles O. Silver, City Auditor.

Cincinnati, Ohio.—County Comrs. approved plans and specifications for improvement of Van Zandt Road, estimated cost $[illegible].

Findlay, Ohio.—$[illegible] road improvement bonds will be sold Oct. 1 by City Auditor.

Reported $18,373 paving bonds will be sold Oct. 26 by Ruth O. Morgan, City Auditor.

Zanesville, Ohio.—City Council voted to pave Forest, Prospect Avenues, Sheridan Street, Dresden Road and other streets, cost about $22,[illegible].

Dixon, Ill.—Bd. Local Improvements contemplates macadamizing E. Everett, E. Water, E. Chamberlain, N. Jefferson and other streets, cost about $25,[illegible].

Des Moines, Ia.—City Council voted to pave North Avenue and Thirty-third Street.

Larned, Kan.—It is proposed to pave State, Fourth, Fifth and other streets, in all about 37,[illegible] sq. yd. and about 15,000 lin. ft. of curbing. L. D. Burgess, City Clerk.

Anaconda, Mont.—City Council voted to pave and construct storm sewer on Park Avenue; cost about $38,000.

Livingston, Mont.—City Council voted to pave Park Street; cost about $10,000.

Colorado.—Beginning in the spring of 1916 the State, under the good roads law, will spend $650,000 annually for an indefinite period in the construction of permanent good roads. It is planned to first perfect the 15,000 miles of road now under State Highway Commission, and then to add an additional 15,000 miles. Of this sum about $250,000 will be spent in territory immediately tributary to Denver. J. E. Maloney, Engr., and T. J. Ehrhart, Secy. Highway Comn., Denver.

Denver, Col.—The City and the State Highway Comn. intends constructing permanent roads to connect Denver and the adjacent mountain parks. The first road will probably extend from Sheridan Boulevard to Golden, a distance of ten miles. The plan is to build an 18-ft. concrete roadway costing about $125,000.

Bellingham, Wash.—City Council voted to construct concrete walks on Chestnut and Grant Streets; cost about $16,000.

Seattle, Wash.—Contract for paving with asphalt and brick block on Beacon Avenue will probably be let in March; probable cost $180,000. I. W. Embury, Designing Engr., City Engineer's Office.

A. H. Dimock, City Engr., estimated cost of improvements as follows: Concrete walks on East Valley Street, $10,007; filling and planking Ninth Avenue, south, $109,712; paving Thirty-fifth Avenue, S. W., $48,491.

Plans and specifications prepared by A. H. Dimock, City Engr., for paving Harrison Street; cost $28,800.

Waitsburg, Wash.—City Council voted to construct cement sidewalks on Third and Main Streets and Coppei Avenue.

City Council voted to gravel and macadamize Fifth and Orchard Streets; cost about $10,000.

Cooston, Ore.—About $24,000 is to be spent by city for street improvements.

The Dalles, Ore.—Wasco County Court considering spending $262,500 for road improvements.

Alameda, Cal.—R. E. Bosshard, City Clk., writes that paving work is only in contemplation. About $100,000 to be raised by tax levy.

Eureka, Cal.—About $125,000 highway improvement bonds to be sold by county.

Phoenix, Ariz.—Contracts soon to be let by City Comn. for paving as follows: 12 blocks on Jefferson Street, 12 blocks on First Street, 14 blocks on Monroe Street, 8 blocks on Central Avenue and portions of other streets. Other paving work is also contemplated in near future.

BIDS DESIRED.

Albany, N. Y.—Until Oct. 15 by W. W. Wotherspoon, Supt. Pub. Wks., Capitol, Albany, for constructing new highway north of West Shore R.R., at Port Gibson, Town of Palmyra.

Albany, N. Y.—See "Hydraulic Construction and River Improvements."

Albany, N. Y.—Until Oct. 26 by State Highway Comn., Albany (Edwin Duffey, Comr.), for constructing state highway improvements, advertised in Engineering Record.

New York N. Y.—Until Oct. 14 by Marcus M. Marks, Pres. Manhattan Boro., for improving portions of E. Eighteenth, W. Fifty-second Street, W. Twenty-fifth Street, Deane and other streets, in all about, 39,900 sq. yd. sheet asphalt, 1720 sq. yd. granite block, 7200 cu. yd. concrete, 4530 lin. ft. granite curb, together with sidewalks, sewer manholes, sluice basins, excav., etc.; also for 6000 bags Portland cement. Total security, $29,500.

Same date as above, by Douglas Mathewson, Pres. Bronx Boro., for paving with bituminous concrete pavt. on cement concrete foundation, portions of Kingsbridge Terrace and Rosedale Avenue, laying sidewalks, crosswalks, etc., on portions of Powell and Walker Avenues, in all about 7480 sq. yd. bituminous concrete, 69,150 sq. ft. sidewalks, 41,500 cu. yd. earth excav., 1100 cu. yd. rock excav., 13,500 lin. ft. new curb, etc.; also for constructing sewers and appurtenances in portions of Olmstead and McGraw Avenues. Total security, $47,400.

New York, N. Y.—Until Oct. 19 by Marcus M. Marks, Pres. Manhattan Borough, for improving portions of E. Twenty-seventh, E. Thirty-fifth, E. Thirty-seventh, Perry, W. 179th Streets, Eighth and Columbus Avenues and other streets, together with curbing, sewering, manholes, basins, excav., etc., in all about 76,320 sq. yd. sheet asphalt, 2210 cu. yd. granite block, 225 sq. yd. asphalt block, 19,960 lin. ft. new bluestone curb, 8240 lin. ft. old curb reset, 9650 cu. yd. concrete, etc. Total security $59,300.

Hammonton, N. J.—Until Oct. 13 for constructing a reinforced concrete road on Bellevue Avenue, ½ miles long, to be built jointly by State, county and town; cost $6,000. Remington & Vosburg, Camden, Engrs.

New Brunswick, N. J.—Reported desired until Oct. 11 by Board Freeholders (A. J. Gebhardt, Dir.) for improving Sections 2 and 3 of South Amboy-Keyport Road from Morgan Station to Monmouth County Line at Whale Creek.

Paterson, N. J.—Until Oct. 12 by Wayne Township Committee for grading and macadamizing portions of Berdan Avenue. Isaac Hopper, Clk., R. F. D. No. 1, Paterson.

Philadelphia, Pa.—Until Oct. 14 by Dept. Pub. Wks. (M. L. Cooke, Dir.), for improving streets as follows: Paving and repaving with asphalt, repaving with vitr. block, granite block, and wood block, surfacing with bituminous and waterbound macadam, resurfacing with asphalt (heater method), improving Bustleton Avenue and grading streets.

Pittsburgh, Pa.—See "Sewerage and Sewage Disposal."

Salisbury, Md.—Reported desired until Oct. 12 by County Commissioners, for constructing 2 miles State Aid highway along Salisbury-Anderson Mill Road.

Moundsville, W. Va.—Reported desired until Oct. 11 by O. B. Bonar, City Clk., for paving with vitr. brick or vitr. block with sand, cement or tarvia filler on Grant and Western Avenues, Fourth and Seventh Streets. Alex. Purdy, City Engr.

Newport, Tenn.—Reported desired until Oct. 16 by Coke County Pike Committee (Geo. W. Gorrell, Chmn.) for grading and macadamizing county roads. Probable cost, $150,900.

Brighton, Mich.—Reported desired until Oct. 11 by Burt Beurmann, Highway Comr., for constructing 6¾ miles trunk line road on Grand River Rd. in Genoa Township.

Kansas City, Mo.—Time for receiving bids for grading Meyer Boulevard has been extended from Sept. 28 to about one month later. Address Secretary Bd. Pub. Wks.

Fort Worth, Tex.—Until Oct. 12 by F. J. Von Zuben, City Engr., for paving with poured asphalt macadam, portions of Landrum and Rosedale Streets, in all about 12,300 sq. yd.

Terrell, Tex.—Reported desired until Oct. 28 by F. W. Raley, Secy. Road Dist., for constructing gravel macadam roads to cost about $200,000. Bartlett & Ranney, Engrs., San Antonio.

Until Oct. 12 by City Commission at office of J. Trueheart, City Secy., for improving portions of Francis Street, in all about 11,983 sq. yd. Bids will be received on creosoted wooden block, brick, both on concrete foundation, Ada, Okla.; or Texas rock asphalt, gravel, asphalt macadam, Hassam compressed concrete, bitulithic, concrete curbs and gutters. Herbert Brewster, City Engr.

Pullman, Wash.—Reported desired until Oct. 19, by Matilda F. Gannon, City Clk., for laying brick pavement, etc., in Local Improv. Dist. No. 26. L. V. Edwards, City Engr.

Pasco, Wash.—Reported desired until Nov. 1 by County Commissioners, for macadamizing trunk highways. Probable cost $35,000. J. W. Hamilton, Co. Engr.

Stevenson, Wash. — Reported desired about Oct. 20 for constructing about 8 or 10 miles of road. Address County Commissioner.

California.—Until Oct. 18, by California Highway Comn. (Wilson R. Ellis, Secy.), Forum Bldg., Sacramento, for constructing state highways as follows:

Placer County, about 9 miles with Portland cement concrete.

Sonoma County, 4.2 miles to be graded.

Mariposa County, about 10 miles to be graded.

Idaho.—Until Oct. 15 by State Highway Commission, Boise, for constructing 54 miles of Idaho-Pacific State Highway across Cassia County; cost $55,000. E. M. Booth, State Highway Engr.

PRICES AND LETTINGS.

★Indicates award of contract.

★Boston, Mass.—Contract for paving with bitulithic on Montebello Road, West Roxbury (bids opened Sept. 16), awarded Marteno DeMatteo, 146 Dudley Avenue, Roslendale, at $8,387. W. J. McGlenchy, Contract Clk.

★Contract for paving Elgin Street and Glendower Road, West Roxbury, with asphalt, awarded by city to Charles J. Jacobs, Boston, at $21,754.

★Connecticut.—Contracts awarded by State Highway Commissioner, Hartford, for constructing following State Roads:

Stamford, about 6 miles native stone on High Ridge Road, to R. G. Miller Contr. Co., Hartford, at $31,000.

Wallingford—North Haven, about 2 miles bituminous concrete on Boston Post Road, to Lane Constr. Corp., Meriden, Conn., at $24,000.

Litchfield, two sections, 4-in. trap rock macadam, to Louis Longhi & Bro., Torrington, Conn., at $6,810.

Newington, a section of bituminous macadam to Thomas Kearney, Meriden, Conn., at $46,878.

★Darien, Conn.—Wilkes-Casey Eng. & Contr. Co., New Rochelle, N. Y., secured contract to construct Rings End Road and Noroton Avenue with reinforced concrete (bids opened Sept. 11) at $26,130. Robert N. Greene, Supt. Dept. Highways and Bridges.

Brooklyn, N. Y.—Following are totals of four lowest bids opened Sept. 29 by Louis F. Pounds, Boro. Pres. for repaving with asphalt on 6-in. concrete foundation on Surf Avenue, from W. Twenty-sixth to W. Thirty-seventh Streets: Barber Asphalt Paving Co., Woolworth Building, $41,353; Topeka Paving Co., Inc., 147 Fourth Avenue, New York, $43,070; Sicilian Asphalt Paving Co., 14 Park Row, New York, $43,520; Borough Asphalt Co., 1301 Metropolitan Avenue, Brooklyn, $46,718.

Long Island City, L. I., N. Y.—Following are four lowest bids opened Sept. 30 by Maurice E. Connolly, Pres. Queens Boro. for regulating and repaving with improved granite blocks on portions of Boulevard from Park to Remsen Avenues, Fifth Ward: Henry J. Mullen Contr. Co., Flushing, $57,460; Astoria Contr. Co., Long Island City, $59,848; Queens Plaza Contr. Co., Long Island City, $61,102; Borough Asphalt Co., Brooklyn, $61,326.

★Kearny, N. J.—Contract for paving 6250 sq. yd. on Brighton Avenue with asphalt awarded by Town Council to Northern Constr. Co., Newark, at $11,215.

Newark, N. J. — Lowest bid opened Sept. 30 by Board of Street and Water Commissioners for paving North Sixth Street with bitulithic on 6-in. concrete foundation was from Glenfield Constr. Co., Newark. at $8,332.

★Westfield, N. J.—Contract for rebuilding Alston Road, about 9910 sq. yd. macadam, awarded by Town Council to J. Walter Butcher, Westfield, at $17,600.

★Annapolis, Md.—Contract for constructing roadway from Curtis Bay to Wagoner's Point awarded by County Comrs. to Smith & Ruggles Co., Baltimore, at $9,665.

Baltimore, Md.—Following bids opened by Bd. Awards for paving Alameda Street with asphalt (bids opened Sept. 22): American Paving Co., Baltimore, $16,922; P. Flanigan & Sons, 120 E. Lexington Street, $17,717; Baltimore Asphalt Block & Tile Co., Baltimore, $17,650; Consolidated Engineering Co., 126 Hughes Street, $21,200.

★Gastonburg, Ala.—Contract for constructing 30-mile road from Gastonburg to Clark County line awarded by Comrs. Wilcox County at Camden, to Central Alabama Constr. Co., at $70,000.

Baton Rouge, La.—See "Hydraulics and River Improvements."

New Orleans, La.—Following are two bids opened recently by Department of Public Finances for constructing an asphalt plant: Warren Bros. Co., $42,900; Jefferson Constr. Co., $53,994.

★Carlisle, Ky. — Contracts for constructing roads awarded by Nicholas Fiscal Court as follows: Carlisle and East Union Road, to Phelps, Post, Guyn & Co., Lexington, at about $20,000, and for Carlisle and Parks Ferry Road, to Games & Jones, Louisville, at about $15,000.

Louisville, Ky.—Following are lowest bids opened by Bd. Pub. Wks. for paving with asphalt (price given per sq. yd.): Louisville Asphalt Co., Louisville, Guthrie Street, $1.82; Twenty-ninth Street, $1.79; Bickel Asphalt Paving Co., Louisville, Thirty-fourth Street, $1.80.

★Madisonville, Ky.—Contract for piking 4 miles Greenville, Hopkinsville, Calhoun and Princeton Roads awarded by Fiscal Court to A. A. Smith at $23,139.

Newport, Ky.—Lowest bid opened by City Commission for paving Tenth Street submitted by Schoolfield & Jones, at $9,478.

★Princeton, Ky.—Contract for constructing two miles of macadam road awarded by Fiscal Court (R. L. Gresham, Clk.), to Dureett Constr. Co., Louisville, at about $6,250.

★Conneaut, Ohio.—Contract for paving 14,400 sq. yd. on State Street with asphalt awarded John McCormick & Son, Erie, Pa., at $29,844.

★Leetonia, Ohio.—Contracts awarded by Township Com. for paving, bids opened on following dates:

Sept. 20, 2.05 miles grading, curbing and paving with brick to Frank George, Pittsburgh, Pa., at $29,968.

Sept. 21, 11,777 yd. brick paving and curbing, and Sept. 22, 4246 yd. brick paving to M. P. Connelly & Son, Youngstown, at $24,965 and $9,754 respectively.

★Chicago, Ill.—Contract awarded by South Park Comrs. (J. F. Neil, Secy.) for furnishing creosoted wood paving blocks for street paving purposes (bids opened Sept. 15) to Republic Creosoting Co. of Indianapolis, Ind., at $1.55 per yard.

St. Charles, Ill.—Following are lowest bids opened by city for paving with brick E. Main and W. Main Streets: Western Improvement Co., Racine, $55,391; Logan & Giertz, Elgin, $56,958, and Arwin E. Price, Elgin, $[illegible].

Brooklyn, N. Y.—Following are detail bids of the four lowest bids opened Sept. 29 by L. H. Pounds, Boro. Pres., for repaving with granite Broadway, from Havemeyer Street to Patchen Avenue: (a) Charles A. Myers Contr. Co., Stagg Street and Morgan Avenue, $114,286; (b) Rosenthal Eng. & Contr. Co., 165 Hooper Street, $119,147; Mathew T. Meagher, 15 Orient Avenue, $121,871; Frank J. Gallagher, 49 Park Place, $122,102.

	(a)	(b)	(c)	(d)
450 lin. ft. old curbstone reset in concrete	$0.60	$1.25	$0.90	$0.60
1,225 lin. ft. new curbstone set in concrete	1.20	1.25	0.90	0.98
2,990 lin. ft. granite heading stones set in concrete	0.98	0.90	0.80	1.00
1,990 sq. yd. asphalt pavt. outside railroad area (no maintenance)	0.85	1.10	0.85	1.00
40 sq. yd. asphalt pavt. within railroad area (no maintenance)	0.85	1.10	0.85	1.00
4,585 cu. yd. concrete outside railroad area	3.85	4.70	3.90	5.19
795 cu. yd. concrete within railroad area	0.01	0.01	3.90	2.20
27,520 sq. yd. Grade 1 granite pavt. with joint filler of coal tar pitch and sand, outside railroad area (no maintenance)	2.63	2.59	2.88	2.69
4,780 sq. yd. Grade 1 granite pavt. with joint filler of coal tar pitch and sand, within railroad area (no maintenance)	3.25	3.37	2.88	2.69
60 sq. yd. adjacent pavt. to be relaid	1.00	2.50	1.00	1.60
73 new iron sewer basin heads	30.00	40.00	29.00	40.00
19 new sewer manhole covers	2.50	4.00	2.50	7.00
2 new covers and heads for sewer manholes	10.00	20.00	11.00	15.00

Dayton, Tenn.—Following are unit prices of the four lowest bidders for paving, etc. (bids opened Sept. 23) by County Highway Comn. (J. H. Hoskins, Ch. Engr.): (a) J. A. Kries & Co.; (b) Freemans-Robbins Co.; (c) Boyd Williams; (d) Oliver Hill Constr. Co. (About $250,000 available for this work):

	(a)	(b)	(c)	(d)
Clearing, 200 acres	$18.00	$10.00	$15.00	Free
Grubbing, 125 acres	30.00	30.00	30.00	Free
Earth, 300,000 cu. yd	.21	.21	.21	.24
Loose rock, 110,000 cu. yd.	.30	.25	.30	.24
Solid rock, 40,000 cu. yd.	.70	.70	.70	.70
Screened gravel, 8500 cu. yd.	.95	1.00	1.00	1.00
Pit-run gravel, 8000 cu. yd.	.95	.85	.90	.90
Screened chert, 8500 cu. yd.	1.50	1.15	1.10	1.05
Pit-run chert, 30,000 cu. yd.	.90	.90	.90	.90
Limestone, 12,000 cu. yd.	1.60	1.60	1.55	1.50
Rip-rap, 600 cu. yd.	1.25	1.00	1.00	1.00
Concrete, 2500 cu. yd.	7.40	7.00	6.75	7.00
Installing Corrugated Culverts:				
12" 500 lin. ft.	.10	.12	.12	.12
15" 800 lin. ft.	.12	.15	.15	.15
18" 500 lin. ft.	.15	.18	.18	.18
24" 400 lin. ft.	.20	.24	.24	.24
Installing Concrete Pipe:				
12" 500 lin. ft.	.20	.15	.12	.12
15" 800 lin. ft.	.25	.20	.15	.15
18" 500 lin. ft.	.35	.25	.18	.18
24" 400 lin. ft.	.45	.35	.24	.24
Installing Vitrified Pipe:				
12" 500 lin. ft.	.20	.15	.12	.12
15" 800 lin. ft.	.20	.20	.15	.15
18" 500 lin. ft.	.30	.25	.18	.18
24" 400 lin. ft.	.40	.35	.24	.24
30" 350 lin. ft.	.50	.40	.30	.30
Force Account:				
Teams	3.50	4.00	3.50	3.85
Foremen	2.50	3.00	3.00	3.00
Laborers	1.55	1.65	1.50	1.50

★**Milwaukee, Wis.**—Contract for paving Center Street with asphalt awarded by Comr. Public Wks. to Badger Constr. Co., Milwaukee, at $32,000.

★**Des Moines, Ia.**—Contract for paving First Street with asphalt awarded by City Council to Bryant Asphalt Paving Co., Des Moines, at $1.89 per sq. yd.

St. Paul, Minn.—Lowest bid opened by city for paving Warsaw Street submitted by Fielding & Shipley, St. Paul, at $17,900.

Walker, Minn.—Following are lowest bids opened by County Comrs. for road improvement requiring 7600 ft. turnpiking, 24,095 cu. yds. surfacing, 25,175 cu. yd. ditching, culverts, etc.; Walker-Cass Lake Highway, 26 miles, Brandenburg Constr. Co., Minneapolis; highway from Walker to Pillager, Moberg Constr. Co., Grand Rapids and Park Rapids Constr. Co.; culverts for highways, Wheeling Corrugating Co., Wheeling, W. Va.

★**Bozeman, Mont.**—Contracts for paving Dist. 101, Tracy Avenue, and Dist. 104, Bozeman Avenue, awarded by city to Warren Constr. Co., Journal Building, Portland, Ore., at $14,050 and $11,687 respectively.

San Antonio, Tex.—Following bids opened by County Comrs. for surfacing about 20 miles Corpus Christi, Pleasanton, Ashley, Twenty-fourth Streets: Findley Method Co., 39 cts. per sq. yd. for tarvia, and Colglazier Constr. Co., 40 cts. per sq. yd. for bituminous surface using trap rock.

★**Taylor, Tex.**—Contracts for paving awarded Uvalde Rock Asphalt Co., San Antonio, and Kaw Paving Co., Topeka, Kan.; total cost about $250,000.

★**Poteau, Okla.**—Contract for paving streets with concrete awarded by city to J. W. Rooks, McAlester, at $15,768.

★**Bellingham, Wash.**—Contract for paving Madison and Walnut Streets with asphalt awarded by Bd. Pub. Wks. to Washington Paving Co., Savage-Scofield Building, Tacoma, at $16,515.

★**North Yakima, Wash.**—Contract for constructing 1⅛ miles of gravel road on Summit View Road (bids opened Sept. 27), awarded A. H. Zane & Co., North Yakima, at $6,739. O. E. Brashears, Co. Engineer.

Seattle, Wash.—Following are three lowest bids opened by Bd. Pub. Wks. for paving East and West Green Lake Way: R. G. Stevenson, 1327 Ewing Street, $103,303; P. J. McHugh, Third, North and Mercer Streets, $103,446, and Washington Paving Co., Savage Scoffield Bldg., Tacoma, $104,524.

Puget Sound Bridge & Dredge Co., Central Bldg., submitted lowest bid for grading, filling, etc., East Marginal Way, $80,957.

★Contracts for paving awarded by Bd. Pub. Wks., as follows: W. Massachusetts Street, Cascade Constr. Co., Central Bldg., $33,984; Mill Street to E. Arnoldo & Co., 507 Jackson Street, $11,260.

★**Portland, Ore.**—Contract for paving Upper Washington Street with bitulithic awarded by city to Oskar Huber, Portland, at $10,635.

★**Tillamook, Ore.**—Contract awarded F. C. Feldschau of Tillamook for paving 4359 sq. yd. on Second Avenue with concrete (bids opened Sept. 23) at $7,089. John Ashim, City Recorder.

★**East San Diego, Cal.**—Contract for paving nine blocks on Hugh Avenue awarded N. D. Goodbody of San Diego at $39,000. Other bidder, G. R. Daley, San Diego, at $44,000. O. J. Early, City Clk.

★**Los Angeles, Cal.**—Contract for paving 64,630 sq. ft. of Rampart Boulevard with asphalt awarded by city to California-Arizona Constr. Co., 1700 E. Washington Street, at $32,297.

★**Stockton, Cal.**—Contracts awarded by City Council as follows for paving: Della and Lafayette Streets to R. C. Tumelty at $14,302, and Scotts Avenue, Van Buren and Monroe Streets to A. B. Munson & Son, at $13,100. Contractors of Stockton. George W. Pulich, City Clk.

★**Visalia, Cal.**—Contract for constructing Three Rivers Road awarded to J. E. Hines, Tulare, at $13,800.

★**Toronto, Ont.**—Contract for brick pavt. on Scarborough Road from Queen Street to 900 ft. north awarded Asphaltic Concrete Co., Toronto, at $8,430.

STREET CLEANING AND GARBAGE DISPOSAL

PROPOSED WORK.

Providence, R. I.—The Aldermanic Committee on Health reported considering garbage disposal plant.

Madison, Wis.—City Council considering constructing two incinerators, one on North Street and one on west side of city, to cost about $17,000.

Batesville, Okla.—Citizens voted $45,000 for park improvements and $6,500 for an incinerator plant.

BIDS DESIRED.

Newark, N. J.—Until Oct. 21 by Bd. Street & Water Comrs. (M. R. Sherrerd, Ch. Engr.), for collection, removal, and disposal of ashes, rubbish, paper and garbage for a period of five years from Jan. 1, 1916, price to be per year, advertised in Engineering Record.

Ishpeming, Mich.—Until about Oct. 15, by R. H. Oles, City Recorder, for constructing an incinerator plant to cost $6,500. P. H. Devine, Supt. Pub. Wks.

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS

PROPOSED WORK.

Flood Protection — Erie, Pa.—Farley Dannett, consulting engineer, Harrisburg, is reported to have submitted nine reports on proposed flood prevention of Mill Creek. The least expensive estimated at $798,000, exclusive of land damage.

Drainage System—Lake Worth, Fla.—Surveys being made under direction of Orrin Randolph, Lake Worth, Engr. of Dist., and plan for reclamation will probably be completed by January 1.

Drainage — Monroe, La.—Jack Creek Drainage bonds amounting to $20,000 sold.

Drainage — Rock Island, Ill.—Contract will be let some time in November, by City Clerk, for constructing storm drainage system.

Waterways — Washington, La. — Construction of deep water connections between this section and Morgan City and New Orleans is under consideration. J. W. Mary, Mayor.

Ditch—Sycamore, Ill.—Plans being made by Kane and De Kalb Counties for widening and deepening channel of Maple Park Cortland Virgil Drainage Dist. No. 1, a distance of 16 miles; cost $20,000. Similar project is under way for dredging nine miles of Afton Milan Ditch, in Dist. No. 1, estimated cost $15,000. Daissler, Fulton & Roberts. Sycamore, Attorneys; Hay & Lowman, Engrs., Sycamore.

Drainage—Jefferson, Iowa.—S. J. Melson is engineer in charge of drainage improvements contemplated in Greene County; Ditch No. 102 is estimated to cost $62,000, and 107 $65,000; $200,000 ditch is to be constructed in Dawson Township, and a larger one in Willow Township.

Docks, Improvements—Muscatine, Iowa.—City Council has indorsed plan as presented by Muscatine Levee Commission by which $15,000 will be expended in the construction of a sea wall and modern dock facilities.

Ditch—Fargo, N. D.—Two ditches are to be constructed through Noble and a portion of Kenyon townships. J. G. Brown, chairman of Drainage Board.

Draining—Marion, Ark.—Commissioner of Drainage District No. 6 has sold $140,000 bonds.

Wharves and Docks—Belmont, Tex.—Reported contract will soon be let for constructing wharves and docks costing $100,000. J. Frank Keith, Chairman, Wharves and Docks Comn.

Levee Work — Ennis, Tex.—Citizens voted $121,000 bonds for constructing levees on Trinity River in Ellis County Levee Dist. No. 2. Bids for bonds will be received in November. O. W. Finley, Engr., Waxahachie; Edmond Raphael, Chmn. Bd. Superv., Ennis.

Levee Work—Fort Worth, Tex.—Levee Bd. is considering raising $50,000 bonds for repairing levees damaged by recent floods.

Irrigation—Santa Fe, N. M.—Reported Dr. George E. Fosberg, Chicago, Ill., contemplates spending $75,000 on project to revive and complete Arroyo-Honde Irrigation Project.

Drainage—Aberdeen, Wash.—The South Bay Drainage Dist. of Aberdeen reported formed and will construct a 3-mile open waterway between Grays Harbor and Willapa Harbor. Small lakes will connect ditch. Estimated cost about $15,000.

Irrigation—Ephrata, Wash.—A. H. Wilburn, Ephrata, reported Chmn. Bd. Directors of Grants Orchard Irrigation Dist. formed for purpose of constructing an irrigation district costing $75,000.

Irrigation — Yakima, Wash.—Reported Union Gap Irrigation Co., Yakima, will issue bonds amounting to $35,000 for continuance of permanent improvements on the canal, including replacing wooden flume with concrete and in places with steel flume, and permanent lateral headings will be undertaken at once.

Irrigation—Phoenix, Ore.—Town Council has granted franchise to Rouge River Canal Co., and it is reported that the company will immediately construct an irrigation system south of Medford.

Dam—Portland, Ore.—A concrete dam 150 ft. long and 30 ft. high is to be constructed at Bull Run River headworks next spring by city; cost about $110,000. Address City Clerk.

Flood Control—Los Angeles, Cal.—Bd. Superv. decided to enter upon the plan of flood control outlined by the engineers and to expend approximately $16,000,000 on the project. The initial expenditure of $6,000,000 will be submitted to a vote of the people Oct. 26. If approved, the money will be spent as follows: Restraining dams in the mountains, $500,000; spreading grounds at mouths of canyons, $600,000; for Arroyo Seco, Pacoima, San Gabriel, Eaton and other dams, $500,000; rights-of-way and other items related thereto, $2,000,000; clearing channels and work relating thereto, $200,000.

Levee—Sacramento, Cal.—Bd. Directors of Sacramento River West Side Levee Dist. plans to construct next year a levee from Knights Landing to Colusa, 50 miles, cost reported at $500,000.

Esplanade — San Francisco, Cal.—The proposed esplanade to be constructed on the Ocean Beach is to include reinforced concrete bulkhead estimated to cost $50,000. M. M. O'Shaughnessy, City Engineer.

Pier—San Francisco, Cal.—Contract soon to be let by State Board of Harbor Comrs., San Francisco, for constructing pier 29, foot of Chestnut Street, to be 200 x 800 ft. and cost about $250,000.

Dam—Clifton, Ariz.—J. B. Girand, City Engr., Phoenix, reported making preliminary surveys for six dams in Grand Canyon, reservoir sites and hydro-electric plants. One dam to be in Diamond Canyon north of Peach Springs, to develop 50,000 hp. The hydro-electric plant to have capacity of 40,000 hp.

Irrigation—Turlock, Ariz.—Voters of Turlock Irrigation District voted an assessment of $186,478 for upkeep and maintenance, also some minor construction work, and another assessment of $14,250 to complete outlet gate and strengthen dams C, H and J of Alfred Reservoir.

Irrigation — Caldwell, Idaho.—Guy C. McGee, Chief Engineer, Caldwell, writes an irrigation district is being formed; estimated cost $180,000.

Drainage—Nyssa, Idaho.—Guy McGeen, of Caldwell, reported appointed chief engineer of the Nyssa-Arcadia Drainage Dist. which includes about 10,000 acres near Nyssa which will be improved at once.

Hydro-Electric Plant—Chesley, Ont.—Citizens voted the hydro-electric by-law favorably.

Harbor Improvements—Vancouver, B. C.—Harbor Comrs. have filed with Civic Building Dept. plans for bulkheading False Creek Dist. to reclaim about 40 acres of mud flats under Granville Bridge; cost, $50,000.

BIDS DESIRED.

State Canal Work, Albany, N. Y.—Until Oct. 19 by State Superintendent of Public Works, for the continuation of the work to be done on bridge over Black and Moose Rivers at Lyons Falls. Engineers estimates $59,385.

State Canal Work—Albany, N. Y.—Until Nov. 9 by W. W. Wotherspoon, State Supt. Pub. Wks., for Terminal Contract 2-P, paving barge canal terminal at Albany, to consist of 11.230 sq. yd. stone block pave., 1800 lin. ft. concrete curbing, 3654 cu. yd. excav., 6300 lin. ft. drain. Engineer's estimate $42,869.

State Canal Work—Albany, N. Y.—Until Oct. 26, by State Superintendent Pub. Wks., Albany, for Terminal Contract No. 20, constructing barge canal terminals in city of Syracuse, to include terminal basins and connecting channels to Onondaga Lake, piers, dockwalls, spillway and highway bridge, and about 1,030.000 cu. yd. excav. Engineer estimate $665,875, not $66,575 as previously stated.

Rip-rap—Tompkinsville, S. I., N. Y.—Until Oct. 26, at office of Lighthouse Inspector, Tompkinsville, for furnishing and placing rip rap at Centerville and Saltersville Lights, Newark Bay, N. J.

Dredging—Newark, N. J.—Until Oct. 21, for dredging portion of Passaic River. Plans on file at office of Edward L. Rankin, engineer, city hall.

Trestles and Bridges—Pittsburgh, Pa.—Until Nov. 5, by U. S. Engineer Office, Pittsburgh, for service bridge and Poiree trestles at dam No. 10, Ohio River, advertised in Engineering Record.

Irrigation Work—Washington, D. C.—Until Nov. 5 by U. S. Reclamation Service, Washington, D. C. for furnishing a set of six cast steel hydraulic operating cylinders and appurtenances for slide gates for Keechelus Dam, Yakima Project, Wash., and a duplicate set for Sherburne Lakes Dam, Milk River Project, Mont., advertised in Engineering Record.

Irrigation Work—Washington, D. C.—Until Nov. 1 by U. S. Reclamation Service, Washington, D. C., for furnishing ten hoists for radial gates New Jackson Lake Dam, advertised in Engineering Record.

Ditches—Arcadia, Fla.—Reported de-[illegible] until Oct. 14 by Arcadia Drainage Dist. for constructing about 12 miles open ditches requiring [illegible] cu. yd. excav. Preliminary cost, $24,000. Craven & Kimmel, Engrs., Arcadia.

Flood Protection Wall — Portsmouth, Ohio.—Until about Nov. 1 by William Jergens, Dir. Pub. Service for construction of the second section of the concrete flood protection wall. George S. Wilhelm, City Engr.

Drainage—Albany, Ill.—Reported de-[illegible] until Oct. 14 by County of Morrison Levee and Drainage Dist. for constructing about 8½ miles drainage ditch.

Crib Protection and Dock Repair—Chicago, Ill.—Until Oct. 28 by W. B. Mearkle, Comr. Dept. Pub. Wks., for furnishing material, constructing and placing a protection crib in South Fork of south branch of Chicago River at Thirty-fifth Street. Also for repairing existing dock at foot of Lumber Street, east side of Sanitary Slip, south branch of Chicago River.

Ditches—Blue Earth, Minn.—Reported awarded until Oct. 22 to Jesse L. Hedrick Co. And., at Blue Earth, for constructing Judicial Ditch Nos. 9 and 10 and repairing and changing Ditch No. 9 in Faribault and Blue Earth Counties. Probable cost, $83,350. H. H. Hansen, Engr., Delavan, Minn.

Ditch—Breckenridge, Minn.—Reported awarded until Oct. 12 by P. E. Truax, Co. Aud., for constructing Ditch No. 4A, Wilkin County. Probable cost, $19,049.

Ditch Work—Mankato, Minn.—Reported awarded until Oct. 25 by C. L. Kennedy, Co. Aud., for 18,240 ft. 26 to 8 in. tile with concrete head wall, etc. Probable cost $34,842.

Ditch Work—Montevideo, Minn.—Reported awarded until Oct. 11 by J. J. Stevens, Co. Aud., for 15,505 ft. of 22 to 6 in. tile concrete bulkhead, 4040 cu. yd. earth excav., etc.

Riprap, etc. — Galveston, Tex. — Until Oct. 26 by Isaac M. Mayer, Co. Aud. for [illegible] more or less rip rap to be deposited in front of seawall from Twenty-fifth to Forty-ninth Streets. Also for constructing and placing lining in the area south of seawall between Nineteenth Street and Broadway, requiring approximately [illegible] cu. yd. Also bids on 350,000 and 500,000 cu. yd. lining, should city desire to increase their bids to such quantities.

Irrigation—Harlingen, Tex.—Reported awarded until Oct. 24 by Directors Cameron County Irrigation Dist. No. 1, for excavating canals, requiring 110,200 cu. yd. excavation.

Irrigation Work—Grand Junction, Col.—Until Nov. 4 by U. S. Reclamation Service, Grand Junction, for about 340,000 yds. canal excav. in vicinity of Loma and Mack, Col., advertised in Engineering Record.

Canal Work — Modesto, Cal. — Until Oct. 30 by Board Directors Modesto Irrigation Dist. (C. E. Abbott, Secy.), for enlarging main canal and tunnel, in sections of main canal, Modesto Irrigation [illegible] between Upper Dominici and Basham Falls, below the intake of the La Grange dam, constructing reinforced concrete structures in lower main canal. Bids will be received separately on each part of the work.

Dams, Salt Lake City, Utah.—Sylvester Q. Cannon, City Engr., writes bids will be opened early in November for concrete dam in Mountain Dell Packer's Canyon. It is to be 205 to 300 ft. and cost probably $150,000.

PRICES AND LETTINGS.

★Indicates award and contract.

Excavating Channel—Waltham, Mass.—[illegible] Bids opened Sept. 27 by Metropolitan Park Comm., Boston, for excavating channel of Charles River from Elm Street to Bacon's Dam, Waltham, 15,000 cu. yd. earth excav.—[illegible] Bacon, 70 Devonshire Street, Boston, at $1 cu. yd.; [illegible] Lawrence Construction Co., at $1.10; [illegible] Lute F. Cunningham Co., at $1.47; [illegible] Bay State Dredging & Contracting Co., at $2.9 cts., [illegible] Lute F. Larkin, Engr.

★Terminal Contract 47—Albany, N. Y.—Contract awarded by State Superintendent Public Works to F. M. Livingston & Sons, Inc., of Rochester, for constructing Terminal Contract 47. Bids opened Sept. [illegible]

★State Canal Work—Contract for constructing channel in village of Spencerport, Monroe County, N. Y., awarded by [illegible] Mfg. Const. Co., Inc., of Buffalo, at $[illegible].

★Breakwater—Buffalo, N. Y.—Contract reported awarded Great Lakes Contr. Co., 10 Broad Street, New York, N. Y., for repairs to timber and concrete construction of outer breakwater by U. S. Engineers. Cost, about $[illegible].

Dredging—Trenton, N. J.—[illegible] Bids opened Sept. 18 by Engr. Commissioner and Navigation Comm. for dredging Sand Island channel, Delaware River, [illegible] Mississippi River Dredging Co., Philadelphia, Pa., 9.98 cents; H. E. Dredging Co., Atlantic City, 17.4 cents; D. X. Shubin, Philadelphia, Pa., 9.98 cents. Total cost about $20,000.

★Dredging — Baltimore, Md.—Contract awarded Maryland Dredging & Constr. Co., Baltimore, for dredging on certain [illegible] and harbors on east shore of Chesapeake Bay (bids opened Sept. 15) at $41,986.

Dredging—Norfolk, Va.—Following are [illegible] of bids opened Sept. 23 by U. S. Engineer, Norfolk, for dredging and rock excavation in James River, Va. (a) 15,000 cu. yd. earth excav., (b) 2800 cu. yd. hard rock, (c) total. Norfolk Dredging Co. (a), 70 cts., (b) $11.50, (c) $42,700; A. V. Wills & Son, (a) $1.05, (b) $9.50, (c) 242,350; Maryland Dredging & Contracting Co., (a) 57 cts., (b) $9.30, (c) $34,590; P. Sanford Ross, Inc., (a) 69 cts., (b) $10.28, (c) $39,-134.

★Wharves and Terminal Improvements—Mobile, Ala.—Contracts reported awarded Stone & Webster, Boston, Mass., for erecting buildings, wharves, tracks and other equipment for the Terminal Transfer & Storage Co.

★Levee Work—Alexandria, La.—Contract for constructing levee from White Place to Wilson Point, Red River, 12 miles below Alexandria, about 175,000 cu. yd. awarded by State Bd. Engrs., New Orleans, to Dameron-White Co., Baton Rouge, at 12 cents per cu. yd.

★Dyke—Baton Rouge, La.—Contract for enlarging dyke over University Lake and building roadway leading to dyke on north side of lake awarded by City Commission Council and Police Jury of East Baton Rouge, to Dameron & White, Baton Rouge, at $10,209.

★Piling for Dam—Louisville, Ky.—Contract for furnishing and delivering sheet piling for Dam. 42, Ohio River, awarded Carnegie Steel Co., Philadelphia, Pa., at $34,111.

Drainage — Muscatine, Iowa.—All bids opened Sept. 24 by Central State Engineering Co., Hershey Building, for constructing three sections of drains, about 47 miles in all, have been rejected. Work to be done by day labor.

★Ditch — Morris, Minn. — Contract awarded Carl Christensen, Litchfield, for constructing Ditch No. 17, at $6,772 (bids opened Sept. 21). C. R. Wantham, Co. Aud.

★Ditch—Worthington, Minn.—Contract for constructing Ditch No. 12 awarded as follows by Co. Comrs. (bids opened Sept. 25): Open work, about 132,348 cu. yd., to James McKilly, Waterloo, at 8.2 cts. per cu. yd.; tile work, P. L. Rivaed, Pocahontas, Iowa, at $12,700. Gus. Swanberg, Co. Aud.

Irrigation — Eureka, Mont.—Following are reported bids opened recently by Bd. Directors, Glen Lake Irrigation Dist. (F. P. Carey, Chmn.) for constructing Glen Lake Project: C. H. Kelley, Kalispell, $122,500; Lord Constr. Co., Hamilton, $122,000; Nelson Rich., Prosser, Wash., $110,000.

★Irrigation — Malta, Mont. — Contracts awarded by U. S. Reclamation Service, Malta, for constructing earthwork on Nelson Reservoir, south canal, Milk River Irrigation Project, Mont., as follows: To Winston Bros. Co., Minneapolis, Minn. Schedules 1 and 2, involving excav. of about 296,100 cu. yd. of material and 25,000 cu. yd. of overhaul, at $41,930 and to Nelson Bros., Glasgow, Mont., for Schedule 3, involving 60,550 cu. yd. excav. and 5000 cu. yd. overhaul at $6,490.

★Irrigation — Malta, Mont.—Contracts awarded by U. S. Reclamation Service for earthwork on Nelson Reservoir, South Canal, Milk River Irrigation Project, Montana, as follows: To Winston Bros. Co., Minneapolis, Minn., Schedules 1 and 2, involving excav. of 296,100 cu. yd. of material and 25,000 cu. yd. overhaul, estimated cost $41,930, and to Snelson Bros., Glasgow, Schedule 3, involving 60,550 cu. yd. excav. and 5000 cu. yd. overhaul, at $7,490.

★Drainage—Pocahontas, Ark.—Contract for constructing drainage system in Little Aumey Water Drainage Dist., to cost about $40,000 (bids opened Sept. 27), awarded A. B. Wills & Sons, Paragould, at $6.79 per cu. yd. Benjamin A. Brown, Clerk Commissioner; J. A. Ryan, Engineer, Corning.

★Victoria, Tex. — Contract for ditch work in Dist. No. 2 awarded to U. D. McCurdy, Lake Placedo; cost about $15,000.

★Irrigation — Denver, Col. — Contract awarded by U. S. Reclamation Service, Washington, D. C., for work as follows on first division of St. Lucaine Canal, North Platte Irrigation Project, Wyo.: Winston Bros. Co., Minneapolis, Minn., Schedules 1 and 2, involving excav. 770,000 cu. yds. material and 79,000 cu. yd. overhaul, at $[illegible] and to Fred N. Crane Co., Omaha, Neb., Schedules 3 and 4, involving 559,700 cu. yd. excav. and 25,300 cu. yd. overhaul at $[illegible].

★Irrigation Work — Denver, Col.—Contracts awarded by U. S. Reclamation Service, Denver, as follows for constructing First Division of Fort Laramie Canal, North Platte Irrigation Project, Nebraska: To Winston Bros. Co., Minneapolis, Minn., Schedules 1 and 2, involving excavation of 770,000 cu. yd. material and 79,000 cu. yd. overhaul, estimated cost $121,347; to Fred N. Crane Co., Omaha, Neb., Schedules 3 and 4, involving 559,700 cu. yd. excav. and 25,300 cu. yd. overhaul, cost $77,960.

★Irrigation — Fowler, Colo.—Contract awarded Oscar Oleson for constructing a dam and other work in the Apishapa Canon at a cost of $300,000.

Bulkheading—Seattle, Wash.—Reported lowest bid opened Sept. 24 by Bd. Pub. Wks. for filling in and bulkheading East Marginal Way, submitted by Puget Sound Bridge & Dredg. Co., Seattle, at about $80,957.

State Canal Work—Terminal Contract No. 47—Albany, N. Y.—Following are four lowest bids opened Sept. 28 by State Supt. Pub. Wks. for constructing Terminal Contract 47—Increasing height of dockwalls, grading and paving terminal sites east of Main-Delaware Bridge, Tonawanda: (a) Engineer's estimate, $44,660; (b) I. M. Ludington Sons, Inc., Rochester, $38,630; (c) Public Service Constr. Co., 44 Falls Street, Niagara Falls, $39,466; (d) F. J. Mumm Contr. Co., Inc., Buffalo, $40,120; (e) Holler & Shepard, Rochester, $41,555.

	(a)	(b)	(c)	(d)	(e)
1,600 cu. yd. excavation	$0.60	$0.50	$0.35	$0.45	$0.50
1,300 cu. yd. embankment	0.20	0.15	0.10	0.10	0.15
2,250 cu. yd. second-class concrete	6.00	4.70	4.80	4.70	5.00
620 cu. yd. sand cushion	1.25	1.25	1.25	1.25	1.10
10,900 sq. yd. stone block pavement	2.25	2.05	2.17	2.20	2.24
8,500 lb. iron castings, plain	0.04	0.04	0.04	0.04	0.04
10,000 lb. structural steel	0.04	0.04	0.02	0.04	0.04
1,760 lin. ft. malleable cast-iron nosing	1.25	1.25	0.80	1.25	1.20
1,400 lin. ft. drilling and grouting	1.00	0.50	1.00	0.50	0.90
Removing buildings (lump sum)	300.00	300.00	200.00	300.00	100.00

RAILROADS

PROPOSED WORK.

New London, Conn. — Reported New York, New Haven & Hartford R. R. Co. (Edw. Gagel, Ch. Engr., New Haven) intends making improvements which will include the relocation of bridge over Thames River at New London, elimination of grade crossings and construction of a bridge 194 ft. long over the tracks of the Vermont Central R.R.

Buffalo, N. Y.—Plans being prepared for elimination of grade crossing at Main Street at Hamburg Canal Drain. It is proposed to cut down the grade about 4 or 5 ft. over the canal and to repave the street. George H. Norton, Deputy Engr. Comr.

Milburn, N. J.—Township Com. has accepted plans of Lackawanna R.R. Co. (G. J. Ray, Ch. Engr., Hoboken) for elimination of two grade crossings in Wyoming section, which will include the building of a steel foot bridge at Myrtle Avenue and concrete bridges at Wyoming Avenue and Cypress Street in Model Park. It is reported that the cost to the railroad will be about $70,000.

Pennsylvania.—S. Herbert Snow, chief engineer of the Public Service Comm. has submitted a report to the commission on the eliminating of grade crossings on the Lincoln Highway in Pennsylvania. He estimates the cost in the city at $5,100,-000, in boroughs at $2,208,000, and in country districts at $1,032,000.

Elko, Va.—Press reports state that the Chesapeake & Ohio R.R. Co. (F. I. Cabell, Ch. Engr., Richmond) contemplates constructing a branch line from Elko south to James River and across to Epes Island.

Miami, Fla.—See "Hydraulic Construction and River Improvements."

Boston, Ga.—State Railroad Commission has granted permission to Georgia Northern Railway (F. R. Pidcock, Vice-Pres. and Gen. Mgr., Moultrie) to issue $450,000 bonds, $150,000 to be used for improvements and new terminals.

Valparaiso, Ind.—Reported Erie R.R. Co. (R. C. Falconer, Supt. Constr., New York, N. Y.) intends making extensive improvements in this county which will include the double tracking and elimination of several grade crossings, mainly between Griffith and Lomax, and includes new highways, steel overhead bridges, etc. The grade between Boone Grove and Palmer will be eliminated.

Minneapolis, Minn.—Reported construction of the second link of the St. Paul & Southern Railroad will be started soon.

Kansas City, Kan.—See "Bridges."

Pierre, S. D.—South Dakota Short Line Ry. reported incorporated to construct a line from Mitchell to Pierre. G. W. Adams, Council Bluffs, Iowa, is one of the incorporators.

Newport, Ark.—Reported Iron Mountain, Missouri Pacific Railroad Company intends improving White River division of the system; cost, $50,000.

Olympia, Wash.—C. D. Hillman, Central Building, Seattle, reported intends building a railway from Olympia to Boston Harbor, a distance of six miles.

Seattle, Wash.—The Port Comn. has instructed J. R. West, Chief Engineer, to prepare plans and specifications for a belt line railway along Whatcom and Railroad Avenues and other streets. An election on the question will probably be held in December.

White Salmon, Wash.—George H. Seeley, 350 Security Bank Bldg., of Minneapolis, Minn., is reported to have engaged engineers to survey for a railroad between White Salmon and Glenwood.

San Francisco, Cal.—Contract will be let in about six weeks for constructing a railroad 67 miles long from Rosasco to Hetch-Hetchy dam site; esimated cost $1,300,000. Bonds now on sale. M. M. O'Shaughnessy, City Engr.

ELECTRIC RAILWAYS

PROPOSED WORK.

Torrington, Conn.—Torrington Traction Co. incorporated to construct an electric railway between Torrington and Thomaston. Capital $300,000. Hosea Mann, Torrington, Pres.; E. M. Canfield, Hartford, Secy.

Andrews, N. C.—Hiawassee Valley Ry. Co. will spend about $125,000 for completing construction work on line from Andrews to Hayesville, 25 miles. S. E. Cover, Andrews, Pres.

Durham, N. C.—Chapel Hill and Bingham townships, Orange County, voted a subsidy to Alamance, Durham and Orange Ry. & Electric Co., to construct electric railway from Ossippee to Durham. Junius Harden, Burlington, Pres.

McComb, Miss.—Plans being considered to construct an interurban railway from McComb to Summit, Fernwood and Magnolia, also a railway in McComb. Guy M. Walker, 60 Broadway, New York, N. Y., said to be interested.

Bristol, Tenn.—Carolina, Greenville & Northern R.R. Co. will construct an electric railway from Bristol to Knoxville via Kingsport, Newport and Sevierville.

Fort Wayne, Ind.—Goshen, Fort Wayne & Northern Indiana Interurban Ry. Co (Clarence F. Tasker, Efficiency Engr.) reported interested in building interurban road between Goshen and Fort Wayne, with branches probably to Ligonier, Churubusco, Warsaw, Winona Lake, North Webster, Wolf Lake, Albion, Kendallville, Topeka, Lagrange, Columbia City, Collins, Huntertown, Lee and Grabill.

Corning, Ark.—North Arkansas Utilities Co. incorporated to construct power plant and railways. Capital $75,000. George A. Booser and C. L. Daniel said to be among incorporators.

Melbourne, Ark. — Surveys will soon be made for electric railway to be constructed from Guion to Melbourne. A. C. Veach, Gravette, is interested.

Dallas, Tex.—City Comn. granted franchise to Northern Texas Traction Co. for railway on Jefferson Street, thus assuring the construction of Dallas-Oak Cliff Viaduct.

Los Angeles, Cal. — Pacific Electric Ry. Co. (Geo. E. Pillsbury, Ch. Engr., Los Angeles), received franchise from City Council to construct electric railway on Figueroa, Hoover Streets, Denver, Menlo, and Vermont Avenues.

Lewiston, Idaho. — Plans being made by Lewiston-Clarkson Transit Co. (H. C. Hartung, Gen. Mgr., Clarkston, Wash.), to extend line from Sixth and Sycamore Streets to Thirteenth Street and Hyland Avenue, Clarkston, Wash.

PRICES AND LETTINGS.

★Indicates award of contract.

★Three Forks, Mont.—Contract for constructing electric railway between Three Forks and Radersburg awarded to Clifton, Applegate & Co., Spokane, Wash. Julius Rosholt, Fairmount, N. D., said to be interested.

★Beaver, Okla.—Contract for completing Beaver, Meade and Englewood Ry. from Forgan to Beaver, awarded to Beaver Constr. Co. L. A. Walten, Engr.

Pearl Harbor, H. T.—Following are bids opened Sept. 18 by Bureau of Yards and Docks, Washington, D. C., for constructing complete marine railway at U. S. Naval Station, Pearl Harbor: Tibbetts-Pacific Constr. Co., San Francisco, Cal., $164,800; Booker Kiehl & Whipple, Seattle, $159,000; Lord Young Eng. Co., Honolulu, H. T., $122,700; Crandall Eng. Co., East Boston, Mass., bid $181,100 according to bidder's own design.

PUBLIC BUILDINGS AND SCHOOLS

PROPOSED WORK.

Providence, R. I.—Isaac O. Winslow, Supt., in report to School Committee, recommends erection of new high school.

Brooklyn, N. Y.—Bd. of Estimate has approved report of Bureau of Contract Supervision on the forms, contracts and estimates of the cost of completion of the laboratory buildings and greenhouses for the Brooklyn Botanic Garden, costing $170,000.

Rochester, N. Y.—Contract will soon be let by State Armory Commission, Albany, for erecting armory for Troop H, First Cavalry, N. G. N. Y., at Eastern Widewaters and Culver Road, to cost about $100,000.

Philadelphia, Pa.—Plans being prepared by Frank A. Rommel, Weightman Building, for erecting a five-story maternity hospital building for German Hospital at Twentieth and Cambridge Streets.

Contract soon to be let by Board of Education for erecting high school at Amber and Cumberland Streets; cost about $500,000. J. Horace Cook, Archt., City Hall.

Wilmington, Del.—Managers of Free Library considering erecting new building to cost about $300,000.

Baltimore, Md.—Fourth Regiment Armory Comn. reported to be receiving competitive plans until Dec. 1 for the armory to be erected at North and Maryland Avenues; cost, $500,000.

Washington, D. C.—Reported plans completed for proposed three-story brick and limestone addition to Casualty Hospital at Seventh Street and Massachusetts Avenue, to cost about $50,000.

Jacksonville, Fla.—Messrs. Mark & Sheftall, Clark Building; R. A. Benjamin, Bisbee Building; Rutledge Holmes, Duval Building; M. C. Greeley, 1905 Oak Street, and H. J. Klutho, St. James Building, engaged to prepare plans for proposed schools which Board of Public Instruction intends erecting with $1,000,000 bonds recently voted. W. B. Ittner, 911 Locust Street, St. Louis, Mo., to be Consulting Architect.

Okeechobee, Fla.—Contract will be let in about 30 days for erecting brick school, two stories, to cost $40,000. W. L. Foote, Trustee.

Nashville, Tenn.—Board of Education considering erecting Elliott School for white children to cost about $71,800 and Pearl School for colored children; cost about $65,200.

Columbus, Ohio.—Dave Riebel, New First Nat. Bank Building, is architect for East High School, to cost complete $520,000. Contract for excavation has been awarded.

Toledo, Ohio.—City intends erecting police station on East Side to cost about $40,000.

Terre Haute, Ind.—Board of School Trustees has engaged following architects to prepare tentative plans: Johnson & Miller of Brazil, for school to be erected at Twenty-fifth Street and Fourth Avenue, cost about $70,000, and Rodney Leonard, Rea Building, Terre Haute, for a school on Kafader site, not to exceed $130,000.

Detroit, Mich.—Plans being prepared by School Board Architect for twenty-room school to be erected at Richmond and Cameron Avenues; cost about $175,000.

Green Bay, Wis.—Reported State Bd. Control, Madison, will let contract next spring for steel work for new cell wing at State Reformatory; cost, $50,000. Ferry & Clas, Archts., Milwaukee.

Oshkosh, Wis.—Reported contract will be let about December by State Bd. Normal Regents, Madison, for erecting main building at Oshkosh State Normal School to cost $250,000. Van Ryn & DeGelleke, Archts., Milwaukee.

Minneapolis, Minn.—Contract soon to be let for erecting West High School addition, costing $200,000, and for a one-story, twelve-room school at Forty-fifth Street and Twenty-second Avenue; cost $60,000. G. F. Womrath, Bus. Supt. School Bd.

Reported erection of an art school building is contemplated at Minneapolis Institute of Fine Arts; probable cost $25,000. Joseph Beck, director.

St. Paul, Minn.—Contract soon to be let for erecting building for Minnesota Historical Society (Solon Buck, Secy.); cost, $500,000.

Austin, Tex.—Atlee B. Ayres, San Antonio, selected as architect for all buildings to be erected by the State during the years 1915 and 1916.

Steps being taken to erect Blind Institute for which Legislature appropriated $300,000 for site and buildings. Address Atlee B. Ayres, State Architect, Capitol, Austin.

Fort Worth, Tex.—Reported Attorney-General approved $35,000 bonds issue recently voted by Diamond Hill School Dist., for erecting new building.

Palestine, Tex.—Attorney General has approved the $100,000 school improvement bonds.

Walla Walla, Wash.—State Bd. Equalization, Olympia, has approved plans of Adjutant-General Maurice Thompson for the proposed armory to be erected in Walla Walla, cost $60,000.

Portland, Ore.—The Benson Polytechnic School is to be two stories, include a shop, 266 x 138 ft., and an administration building, 180 x 60 ft., and cost, including equipment, $250,000. Equipment for power plant, foundry, sheet metal, printing, machine shop, etc., to be purchased. F. A. Naramore, School Archt.; R. H. Thomas, School Clk., Dist. No. 1.

BIDS DESIRED.

Boston, Mass.—Until Oct. 11 (readvertisement) by Trus. Boston, City Hospital (John J. Dowling, M.D., Supt.), for erecting addition and alterations to superintendent's house, nurses' home, whooping cough pavilion, men's dormitory, scarlet fever pavilion, domestic building and diphtheria pavilion, all at West Dept. of City Hospital, Spring Street. Wells & Dana, Archts., 29 Central Street.

Bridgeport, Conn.—Reported desired until Oct. 18 by Leonard Asheim, Archt., Bridgeport, for erecting addition to city Normal School. Probable cost $60,000.

New York, N. Y.—Until Oct. 22 by State Armory Comn. (Franklin W. Ward, Secy.), Capitol, Albany, for roofing and painting, repairs and improvements to State Arsenal, Seventh Avenue and Thirty-fifth Street, New York, advertised in Engineering Record.

New York, N. Y.—See "Water Works."

Salamanca, N. Y.—Until Nov. 12, by Jas. A. Wetmore, Acting Superv. Archt., Washington, D. C., for constructing complete (including mechanical equipment and approaches) U. S. Post Office at Salamanca.

Belvidere, N. J.—Reported desired until Oct. 11 by Bd. Educ. for erecting two-story high school. Probable cost $30,000. Rasmussen & Wayland, Archts., 1133 Bway., New York.

Newark, N. J.—Until Oct. 21 (readvertisement by Street and Water Comrs. (M. R. Sherred, Ch. Engr.) for 2-story meter repair and testing station, at Fourteenth Avenue and S. Eighth Street, for Water Dept. Separate bids for excavating, masonry, structural steel, iron work, etc.; plumbing and gas fitting; steam heating; electric wiring; elevator work. C. F. Zachan, Archt., 45 Clinton Street.

Nutley, N. J.—Until Oct. 13, by Essex County Park Comn., Newark (A. C. Church, Secy.) for furnishing material and erecting a field house at Yanticaw Park; also heating, plumbing and electrical work. F. A. Wright, Archt., 110 E. Twenty-third Street, New York.

Ridgewood, N. J.—Until Oct. 19 by Bd. Education (Hadley Ford, Clk.) for erecting new Upper Ridgewood school. Separate bids will be received for plumbing, heating, ventilating, electric work. Charles Granville Jones, Archt., 280 Broadway, New York.

Trenton, N. J.—Until Oct. 19 by Dept. Charities and Correction (Alfred Gaskill, Dir.), for erecting laboratory building for Department of Conservation and Development.

Until Oct. 19 by State House Comn. (E. I. Edwards, Secy.) for furnishing material and erecting extensions to House of Detention for Convict and Criminal Insane at State Hospital, Trenton, advertised in Engineering Record.

Pittsburgh, Pa.—Until Oct. 26 by Hyatt M. Cribbs, County Controller, and by City Controller, for separate bids on miscellaneous and ornamental iron, rolled steel windows, timbrel arches, plumbing, heating and ventilating, electric work, metal furring and lathing, plaster and imitation caen stone for the city and county building. Edw. B. Lee and Palmer, Hornbostel & Jones, 345 Fourth Avenue, Pittsburgh.

Wormleysburg, Pa.—Until Oct. 11 by Ralph E. Schrack, Secy. Council, Town Hall, for erecting municipal building.

Yatesboro, Pa.—Until Oct. 16, by School Board of Cowanshannoc, Peter Miller, Secy., Armstrong Township, for erecting a 12-room brick-cased school.

Huntington, W. Va.—Until Nov. 16 by James A. Wetmore, Superv. Archt., Washington, D. C., for extensions, remodeling, etc., of U. S. Post Office and Court House at Huntington.

Athens, Ohio.—Until Oct. 30 by Bd. Trus. Ohio University (Isaac M. Foster, Secy.), for furnishing material and erecting Women's Dormitory for Ohio University at Athens. Frank L. Packard, Archt., New Hayden Bldg., Columbus.

Ironton, Ohio.—Reported desired until Oct. 14 by Bd. Educ. South Point and Delta Dist., for erecting brick school. De Voss & Donaldson, Archts., Portsmouth.

Wilberforce, Ohio.—Until Nov. 4, by Bd. Trus., care of W. A. Joiner, Supt. Combined Normal and Industrial Depts. at Wilberforce University, for furnishing material and erecting gymnasium and recitation buildings at said university. Frank L. Packard, Archt., New Hayden Bldg., Columbus.

Peru, Ind.—Until Oct. 12 competitive plans will be received by P. L. Bell, Jr., City Clk., for the new city hall.

Washington, Ind.—Until Oct. 19 by Willis Hoddinott, City Clk., for erecting city hall. J. W. Gaddis, Archt., Vincennes.

Chicago, Ill.—Until Oct. 13, by Dept. Pub. Wks. (W. R. Moorhouse, Comr.), for furnishing material and installing cork composition, ceramic tile flooring and foundations in the Administration and Ward building of the Contagious Disease Hospital.

Des Moines, Iowa.—Until Oct. 26, by the Clerk Des Moines School Dist., for erecting addition to the North High School gymnasium. Proudfoot, Bird & Rawson, Archts. Hubbell Bldg., Des Moines. A. L. Clinite, Secy., Bd. Educ.

Rinard, Iowa.—Until Oct. 29, by Bd. Educ. Consolidated School Dist., G. A. Cafferty, Secy., for erecting school; also separate bids on plumbing and heating. Smith & Keffer, Archts., 610 Youngerman Bldg., Des Moines.

Byers, Kan.—Until Oct. 20, for erecting two-story 92½ x 53 ft. brick school. Address N. H. Welch, Architect, Ponca, Okla.

Neodesha, Kan.—Until Oct. 26, by A. M. Sharp, Secy. Bd. Trus. Wilson County Hospital, for furnishing material and erecting hospital building. Bids for heating, vacuum cleaning and plumbing will be received separately. C. A. Henderson, Architect, Coffeyville.

El Paso, Tex.—Reported desired until Nov. 9 by County Commissioners, for erecting courthouse. Probable cost $400,000. Trost & Trost, Archts., Mills Bldg., El Paso.

Nacogdoches, Tex.—Reported desired until Oct. 12, by Bd. Educ. (F. H. Tucker, Pres.), for high school and addition to Ward school. C. H. Page & Bro., Architect, Austin.

Norman, Okla.—Reported desired until Oct. 27 by State Bd. Pub. Affairs, Oklahoma City, for erecting Science building at State University, Norman. Probable cost, $100,000.

Mountain Home, Idaho.—Until Oct. 14 by County Commissioners (F. M. Hobbs, Clk.), for erecting a stone, concrete and brick court house. Wayland & Fennel, Archts., Boise.

PRICES AND LETTINGS.

★Indicates award of contract.

★Easthampton, Mass.—Contract awarded by Trustees of Williston Seminary to H. Wales Lines Co., Meriden, Conn., for erecting three-story fireproof, brick and granite dormitory; cost about $100,000. R. C. Sturgis, 120 Boylston Street, Boston, Archt.

★Providence, R. I.—Contract awarded by Board of Contracts and Supply as follows for erecting the new Second Ward Police Station: General construction, to Famiglietti Bros., Providence, at $39,975. Next three lowest bidders: W. H. Hamlin, $40,530; William Williams, $41,000; Horton & Hemenway, $41,378. Plumbing, to E. J. Sullivan, at $4,486. Heating and ventilating, to Allen Fire Department Supply Co., $2,380.

Wards Island, N. Y.—Following are lowest bids opened Sept. 24 by State Hospital Comn., Albany, for erecting addition to power house, etc., at Manhattan State Hospital, Wards Island: General construction: Harby, Abrons & Melius, Inc., 30 E. Forty-second Street, New York, $57,335; heating, Walker & Chambers, 222 E. Forty-first Street, New York, $89,720; plumbing, R. T. Ford Co., Rochester, $2,793; electric work, Jandous Electric Equipment Co., 109 W. Thirty-first Street, New York, $2,250; coal and ash handling apparatus, Gifford Wood Co., Hudson, $18,900. Lewis F. Pilcher, State Archt., Albany.

Harrisburg, Pa.—Following are bids opened Sept. 28 by Supervising Architect, Washington, D. C., for constructing an extension, etc., to U. S. Post Office: H. L. Brown Co., Mt. Vernon, N. Y., $127,900; Conners Bros. Co., 64 W. Eighty-eighth Street, New York, $133,000; Newport Contr. & Eng. Co., Newport News, Va., $128,917.

Norfolk, Va.—Following are four lowest bids opened Sept. 25 by Bureau of Yards and Docks, Navy Dept., Washington, D. C., for constructing, complete, three-story and basement, steel frame and brick, Marine Barracks at navy yard, Norfolk: Norcross Bros. Co., Washington, D. C., $199,800; Singer-Pentz Co., Baltimore, Md., $203,700; P. F. Gormley Co., Washington, D. C., $207,222; George E. Wyne, Washington, D. C., $209,500.

★Jacksonville, Fla.—Contract reported awarded by Port Commissioners to Hillyer & Sperring Co., Jacksonville, for erecting 420 x 97 ft. concrete warehouse for cotton compress; cost about $81,000.

★Charlestown, Ind.—Contract reported awarded W. H. Isgrigg & Son, of Greensburg, for erecting high school; cost, $30,000.

★Ypsilanti, Mich.—Contract awarded J. S. Wahlman, Ishpeming, for constructing complete U. S. Post Office, at $49,330.

★Tipton, Iowa.—Contract for erecting county home awarded Guarantee Constr. Co., Cedar Rapids, at $43,474. Next three lowest bidders: Blackhawk Constr. Co., $43,979; Logan Bros., Clinton, $44,200; H. F. Jones, Cedar Rapids, $45,000.

★Minneapolis, Minn.—Contract for erecting Asbury Hospital awarded Pike & Cook Co., 416 S. Sixth Street. Cost, about $125,000.

★Sauk Center, Minn.—Contract awarded National Contr. Co. of Alexandria for erecting two-story brick fireproof high school (bids opened Oct. 1) at about $50,000. C. Howard Parsons, Archt., Minneapolis.

★Herington, Kan.—Contract for erecting High School awarded Sanneman Bros. of Green, Kan., at $34,000.

★Leavenworth, Kan.—Contract awarded Mesker Bros. Iron Co., St. Louis, Mo., for furnishing steel cell fronts and locking devices in Leavenworth U. S. Penitentiary, at $43,575.

★Huntsville, Tex.—Contract for erecting science building at Fort Sam Houston Normal School (bids opened Sept. 27), awarded by State Normal Bd. Regents, Austin, to Gross Constr. Co., Waco., at $68,900. Other bidders: Watson & Co., $71,000; Buchanan & Gilder, Dallas, $75,749; McDaniel Constr. Co., Beaumont, $76,000; J. F. Johnson, Denton, $76,775. Endress & Watkins, Archts., Austin.

Tulsa, Okla.—Following are four lowest bids offered Sept. 27 by U. S. Supervising Architect, Washington, D. C., for erecting U. S. Post Office (a) marble, (b) limestone, (c) sandstone: M. Yeager & Son, Danville, Ill., (a) $225,756, (b) $184,856, (c) $196,265; W. D. Lovell, Minneapolis, Minn., (a) $228,000, (b) $185,000; Dieter & Wenzel Constr. Co., Wichita, Kan., (c) $208,908; W. H. Fissell & Co., New York, (a) $238,800, (b) $196,300, (c) $209,300; John G. Unkefer & Co., Minerva, Ohio, (a) $242,535, (b) $192,110; James Devault, Canton, Ohio, (c) $214,750.

★Bremerton, Wash.—Contract awarded Sept. 11 by Bureau of Yards and Docks, Washington, D. C., for erecting shellhouse at Naval Mazagine, Puget Sound, to Booker, Kiehl & Whipple, Central Bldg., Seattle, at about $35,074.

Seattle, Wash.—Reported desired until Oct. 20, by Port Seattle Commission (C. E. Remsberg, Secy.), for erecting four-story reinforced concrete 90 x 268 ft. addition to Port Commission's warehouse at Whatcom Avenue. Probable cost $150,000. J. R. West, Ch. Engr.

Reported desired until Oct. 29, by Board Regents, University Washington, for erecting Home Economics building. Probable cost $150,000. Bebb & Gould, Archts., Denny Bldg., Seattle.

★Washington.—Following are four lowest bids opened Sept. 21 by State Bd. Control at Olympia for constructing buildings at State Institutions. Julius Zittle, Spokane, Archt.:

★Medical Lake—School for Feeble-Minded, five-story administration building, two-story custodial building, one-story power house, two 2-story cottages, all of reinforced concrete: Boyajohn-Arnold Co., Panama Bldg., Portland, Ore., $227,000 (awarded contract); F. E. Peterson, Spokane, $239,486; Huetter Constr. Co., Spokane, $241,785, and J. J. Lorenz, Spokane, $243,680.

★Vancouver—School for Blind, four-story reinforced concrete administration building: S. C. Erickson, Tacoma, $58,695 (awarded contract); Bancroft & Morgan, Everett, $59,901; Bingham & Shelley Co., Portland, Ore., $59,753, and Harding F. Allan, Seattle, $61,642.

Austin, Ore.—See "New Industrial Plants."

Vallejo, Cal.—Following are four lowest bids opened Sept. 25 by Bureau Yards and Docks, Navy Dept., Washington, D. C., for constructing, complete, Marine Barricks at U. S. navy yard, Mare Island: Pringle, Dun & Co., San Francisco, $137,542; Van Sant-Houghton Co., San Francisco, $142,000; Foster & Vogt Co., and Lange & Bergstrom, both of San Francisco, bid the same at $143,387; Wm. A. Newson, San Francisco, $143,477.

Ventura, Cal.—Until Oct. 18 by W. F. McClure, State Engr., Forum Bldg., Sacramento, for furnishing material and erecting two cottages and detention building for School for Girls near Ventura.

★Brighton, Ont.—Contract awarded for erecting Union High School to Sutherland Construction Co., Toronto.

PRIVATE BUILDINGS

PROPOSED WORK.

Hartford, Conn.—Plans to be prepared by Lawrence W. Morris, 1st Park Avenue, New York, for four-story brick and stone office building to be erected at Trinity and Elm Streets for Phoenix Insurance Co.

Bingham, N. Y.—Contract soon to be let for erecting 2-story and basement brick and steel addition to Carlton Hotel; estimated cost $40,000. E. W. Dickerman, Archt., Perry Building.

Buffalo, N. Y.—Plans being prepared by S. F. Heckert, Bessemer Building, Pittsburgh, Pa., for one-story, 70 x 145 ft., edifice to be erected on Seneca Street for St. John the Evangelist R. C. Church; estimated cost $75,000.

New York, N. Y.—Plans filed for erection of following buildings: 5-story brick tenement at Academy Street and Post Avenue for Academy Constr. Co., cost $40,000; Sass & Springsteen, Archts., 32 Union Square. 7-story apartment at 16 Amsterdam Avenue for Surety Land Co., cost $150,000; George and Edward Blum, Archts., 156 Fifth Avenue. two 5-story brick tenements at 171st Street and Washington Avenue, for Maxwell Building Co., cost $120,000. Samuel Katz, 405 Lexington Avenue, Archt. 5-story brick apartment house at 184th Street and Audubon Avenue for City Constr. Co., cost $54,000. Andrew J. Thomas, Archt., 2256 Webster Avenue. 12-story apartment house at West End Avenue and 106th Street for Schuyler Square Realty Co., cost $200,000. Schwartz & Cross, and B. N. Marcus, 347 Fifth Avenue, Archts., 9-story apartment house at 126 E. Seventy-fourth Street for Bernhard Mayer, cost $150,000. George and Edward Blum, 156 Fifth Avenue, Archts., 7-story and other building at 54 Lexington Avenue for Benjamin W. Mayer, cost $60,000. Herman L. Meaden, 2 W. Thirty-third Street, Archt., two 5-story brick tenements at 141st Street and Daly Avenue, for Arklin Realty Co., cost $130,000. Kreymborg Architectural Co., 1029 E. 163d Street, 5-story brick tenement at 41st Street and Crotona Parkway, for Louis Rosen Realty Co., cost $75,000. Buchner & Goldberg, Archts., 391 E. 149th Street.

Rochester, N. Y.—Plans reported prepared by Klee-Thompson Co., 327 E. Fortieth Street, New York, for the Chamber of Commerce Building, to be erected on St. Paul Street.

New York, N. Y.—Plans being prepared by S. Edson Gage, 28 East Forty-ninth Street, for five-story and basement residence to be erected at 109 East Ninety-First Street for J. Townsend Burden, Jr.; cost approximately $50,000.

Newark, N. J.—Plans prepared by J. B. Ascuello, 9 Clinton Street, for a 4-story brick club house, to be erected at New York Avenue by Polish Falcon's Athletic Assoc. Cost, approximately $30,000.

Braddock, Pa.—Edgewood Presbyterian Church contemplating erecting addition to present edifice; cost about $80,000. Rev. Duncan Cameron, Pastor.

Harrisburg, Pa.—Congregation of Messiah Lutheran Church contemplate erecting an edifice at South and Forster Streets; cost about $75,000.

Philadelphia, Pa.—Plans prepared for four-story brick, concrete and marble building to be erected at 833 Market Street for Bloomer & Co., 833 Market Street; cost $[illegible].

Plans prepared by Dallinger & Berrot, 1211 Arch Street, for five-story brick and stone club house to be erected for the City Club at 213 South Broad Street.

Sum of $[illegible] bequeathed for erection of an Episcopal Church in Philadelphia in memory of the mother of Mrs. Annie Marsden Vaughan Watson.

Plans being prepared by Hoffman Co., Juniper and Market Streets, for six-story brick, steel and concrete building to be erected at Nineteenth and Market Streets for automobile sales purposes.

Plans completed for erecting parish house for St. Michaels Episcopal Church, Germantown; cost about $25,000. Rev. Clifford Prosser, Rector.

Plans being prepared by Stewardson & Page, 316 Walnut Street, for two-story brick and stone clubhouse to be erected at 726 Wood Street for Public Bath Assoc.

Baltimore, Md.—Contract, it is reported, will soon be let for erecting the Sacred Heart R. C. Church, Strick Avenue, near Mount Washington, according to plans by Baldwin & Pennington, Professional Bldg.; cost $[illegible].

Reported contract about to be let for erecting stone edifice at Preston and Lanvale Streets for congregation of St. Katherine's R. C. Church, East Preston Street and Mine Bank Lane; cost about $[illegible]. Rev. William Clements, Pastor. Francis E. Turnier, Archt., 813 Newington Avenue.

Norfolk, Va.—See "Miscellaneous."

Atlanta, Ga.—Plans prepared by A. Ten Eyck Brown, Forsyth Building, for a moving picture theater which Hugh Richardson intends erecting on Forsyth and Luckie Streets; cost about $50,000.

Miami, Fla.—Reported N. Victor Frohling, Miami, is architect for proposed hotel to be erected here; cost $500,000.

Louisville, Ky.—Mr. F. M. Sackett, 1414 Third Street, reported interested in Speed Realty Co., which intends erecting six-story warehouse east of Fourth and Guthrie Streets for Stewart Dry Goods Co.

The Louisville Gas & Electric Co. will erect a freight sub-station at Bardstown Road and Stevens Avenue, to be 35 x 75 ft. and 32 ft. high.

Cleveland, Ohio. — Reported tentative plans prepared by D. H. Burnham Co., Chicago, for proposed union passenger station at E. Third Street have been submitted to City Plan Commission and supervising architects of city group plan. Cost $17,000,000, including cost of raising tracks 8 ft. above their present level and making other changes in track layouts in connection with depot project.

Plans being prepared by Christian, Schwarzenberg & Gaede, 1900 Euclid Avenue, for two and three-story brick and reinforced concrete store and service building to be erected at 2248 Euclid Avenue for Studio Realty Co.; cost $60,000.

Portsmouth, Ohio.—Trustees of Fourth Street Methodist Church considering erection of new edifice to cost $40,000.

Ft. Wayne, Ind.—Plans being prepared by Mahurin & Mahurin, Swinney Blk., for three-story and basement building on Harrison Street for Flick Floral Co.; probable cost, $125,000.

Chicago, Ill.—Reported Grace Episcopal Church, recently destroyed by fire, will be rebuilt. Rev. William Otis Waters, Rector.

Chicago, Ill.—Reported William H. Ranford, 42 N. Dearborn Street, intends erecting on Belmont Avenue a high grade apartment house to cost about $50,000.

Sioux City, Iowa.—Reported Chicago & Northwestern Ry. Co. (W. H. Finley, Ch. Engr., Chicago, Ill.) contemplates erecting freight depot 1350 ft. in length extending from Jackson to Virginia on Third Street, to be one and two stories; cost about $180,000.

Minneapolis, Minn.—Minneapolis Iron Store Co., it is reported, intends erecting at Washington Avenue and Sixth Street, N., a nine-story office and warehouse building.

Reported the Security Bond & Mortgage Co., McKnight Building, is interested in the twelve-story fireproof physicians' office building to be erected at Seventh Street and Hennipen Avenue.

Minot, N. D.—G. E. Voelker, it is reported intends erecting next spring a five-story office building; cost approximately $50,000.

Butte, Mont.—Max Daniels, representing W. H. Swanson, Salt Lake City, will soon let contract for erecting fireproof moving picture theater to cost $200,000.

Great Falls, Mont.—Contract soon to be let for erecting St. Mary Academy at Fourth Avenue., N., and Seventh Street, to be two-story, brick and stone, and cost $50,000. George Shanley, Archt., Great Falls.

St. Louis, Mo.—Reported Independent Evangelical Protestant Church, Tyler and Thirteenth Streets, will build a new edifice at Fair and Margaretta Avenues; cost, $70,000. Rev. J. C. Reess, Pastor.

San Angelo, Tex.—C. H. Powell, banker of San Angelo, and others interested in organizing a company for construction of tourist hotel to cost about $200,000.

Newport, Ark. — Reported Arkansas Bank & Trust Co. will soon let contract for erecting bank and office building; cost $25,000.

Pine Bluff, Ark.—Plans being prepared by Frank Blaisdell for Roman Catholic Church; cost $35,000. P. Enright, Pastor.

Corpus Christi, Tex.—Reported erection of a Y. M. C. A. building costing $65,000 is contemplated.

Spokane, Wash.—Reported plans completed for seminary which St. Michael's Jesuit Scholastic on Peone Prairie intends erecting; cost about $100,000. Rev. A. F. Schinner, Bishop.

Baker, Ore.—A natatorium costing $30,000 is to be constructed here by Natatorium Corporation, Baker (Mose Fuchs, Pres.).

The Dalles, Ore.—Reported Masonic Temple recently destroyed by fire is to be rebuilt.

San Francisco, Cal.—Reported contract soon to be let by Willis Polk & Co., Archts., Merchants Exchange Building, for erecting country villa for W. B. Bourn, 2250 Webster Avenue in Hillsborough; cost about $200,000.

San Mateo, Cal.—Reported E. A. Husing, 419 B Street, intends erecting at B Street and Fourth Avenue a concrete store building.

BIDS DESIRED.

Youngstown, Ohio.—Sub-bids desired by Amsterdam Bldg. Co., Inc., until Oct. 8, at 140 West Forty-second Street, New York, N. Y., and until Oct. 13 by T. H. Maxwell, Statler Hotel, Cleveland, Ohio, for the Tod House Hotel and Theatre to be erected in Youngstown.

PRICES AND LETTINGS.

★Indicates award of contract.

★**Albany, N. Y.** — Contract awarded Feeney & Sheehan Bldg. Co., 164 Montgomery Street, for erecting parochial school at Madison Avenue and Ontario Street, and convent on Morris Street, for Church of St. Vincent de Paul's, Pine Hills.

★**New York, N. Y.**—Contracts awarded to Raymond Concrete Pile Co., 140 Cedar Street, New York, as follows: Concrete piling in foundation of Ore Yard extension for Pennsylvania Steel Co., Steelton, Pa.; reinforced concrete foundation, including concrete piles for foundation of new building for American Dye Wood Extracting Co., Chester, Pa.; concrete piling for foundations of transmission towers at Ambridge, Pa., for Duquesne Light Co., Pittsburgh; foundations, including concrete piling for new eight-story building at Harrison, N. J., for Hyatt Roller Bearing Co., Harrison, N. J.; concrete piling required for piers, abutments, culverts, etc., for the N. Y. Connecting Ry. Co. at Jackson Avenue, Hayes Avenue and Fillmore Avenue, Long Island City. Wilson & English Constr. Co., General Contractors.

★Contract for erecting 12-story and basement, fireproof, steel and concrete printery at 318 West Thirty-ninth Street for Finck heirs awarded to E. Brooks & Co., 3 West Thirty-ninth Street. Crow, Lewis & Wickenhoefer, Archts., 200 Fifth Avenue.

★**Philadelphia, Pa.**—Contract awarded H. G. Carson, 205 South Forty-second Street, for erecting two-story stone and timber residence and garage at Conyngham Pass for George B. Markle. Cost, $69,000.

★Contract for erecting ten-story building at Ninth and Sansom Streets awarded Cramp & Co., Denckla Building; probable cost $500,000. Frederick Webber, Archt., Morris Building.

★Contract for erecting building at 1416 Chestnut Street for Franklin National Bank also awarded Cramp Co.; cost about $500,000. Furness-Evans Co., Provident Building, Philadelphia, and McKim, Mead & White, 101 Park Avenue, New York, Assoc. Archts.

★**Evansville, Ind.** — Caldwell & Drake, Evansville, reported contractors for hotel which Evansville Hotel Building Co. (recently incorporated) intends erecting at a cost of about $450,000.

★**Manhattan, Kan.**—Contract for erecting Presbyterian Church awarded M. E. Brady Constr. Co. at Beloit at $45,000.

★**Sioux Falls, S. D.**—Contract awarded O. H. Olsen, Stillwater, Minn., for erecting six-story steel, reinforced concrete and granite fireproof bank and office building for Security Bldg. Co., at about $100,000. E. Jackson Casse Co., Chicago, Ill., Archts.

★**Glasgow, Mont.** — Contract reported awarded Northwestern Mill & Constr. Co. for erecting three-story, 130 x 90 ft., brick and concrete business building at Second Avenue South and Fifth Street for Rundle Land & Loan Co.; cost $75,000.

★**Seattle, Wash.**—Contract awarded A. W. Quist, Hoge Bldg., for erecting four-story fireproof building on Second Street for Puget Sound News Co.; cost, $50,000. Bebb & Gould, Denny Bldg., Archts.

★Contract awarded Hans Pederson, Alaska Building, for erecting Masonic Temple on Harvard Avenue and Pine Street, at $130,113. George W. Lawton, Archt., Alaska Building.

NEW INDUSTRIAL PLANTS

PROPOSED WORK.

Providence, R. I.—Reported U. S. Gutta Percha Paint Co., Providence, will erect four-story brick addition to their plant.

Amsterdam, N. Y.—Plans being prepared by H. W. Grieme, Amsterdam, for three-story and basement addition to plant of Amsterdam Silk Mill; estimated cost $60,000.

Buffalo, N. Y.—Contract soon to be let by Edwin C. Haas, 558 E. North Street, for a 1-story, 50 x 100-ft. foundry and 2-story, 36 x 85-ft. machine shop, brick and steel, to be erected for the Unique Brass Foundry Co. at Grant Street and N. Y. Central R. R.

Norwich, N. Y.—Plans being prepared for a two-story hollow tile and mill constructed manufacturing building, 75 x 200 ft., for Norwich Wire Basket Co. (T. B. Fennald, Vice-Pres.).

Oakfield, N. Y.—C. A. Ingalsbe, Oakfield, intends erecting a concrete feed mill.

Salamanca, N. Y.—Reported Chesbro Milling Co., whose plant was seriously damaged by fire recently, is considering rebuilding. J. D. Gibbey, Secy.-Treas.

Homestead, Pa.—Reported Homestead Steel Wks., 434 Fifth Avenue, Pittsburgh, approved plans for a 1500-ton metal mixer at open hearth plant No. 3; cost about $300,000.

Philadelphia, Pa.—Reported additional contracts amounting to $300,000 about to be let for proposed $700,000 improvements and additions to plant of William Cramp & Sons Ship & Engine Bldg. Co.

Baltimore, Md.—Reported George A. Boyden Pump Co. (George A. Boyden, Pres.) intends erecting a plant here.

Belmont, N. C.—Reported A. C. Lineberger, Pres. of Imperial Yarn Mills, Belmont, will organize $200,000 company to build cotton yarn mill.

Edenton, N. C.—C. R. Makepeace & Co., of Providence, R. I., engaged to prepare plans for proposed enlargement of Edenton Cotton Mills.

Savannah, Ga.—Mexican Petroleum Co., Security Building, Los Angeles, Cal., contemplates erecting branch plant here.

Fairfield, Ala.—Tennessee Coal, Iron & R.R. Co., Woodward Building, Birmingham, according to reports, intends erecting $350,000 addition to benzol plant here.

Gadsden, Ala.—Reported Gulf State Steel Co., Gadsden, will spend $800,000 on improvements and additions to finishing mills.

Cleveland, Ohio.—Reported Ward Baking Co., 1506 Superior Avenue, intends erecting plant on Perkins Avenue; cost, $250,000.

Reported contract soon to be let by W. J. Carter, Archt., Illuminating Bldg., for erecting four-story factory for Van Dorn & Dutton Co., E. Seventy-ninth Street; cost, about $60,000.

Reported Harry Bialosky, Iron and Steel Dealer, Leader News Building, intends erecting group of buildings on St. Clair Avenue and Babbitt Road N. E., to be used by a company being organized, of which he is to be head; cost approximately $200,000.

Yorkville, Ohio.—Reported Wheeling Steel & Iron Co., Wheeling, W. Va., intends making improvements in their plants which will include new tin plate mill here, including installation of ten hot mills.

Chicago, Ill.—Plans being prepared by S. N. Crowen, 30 N. La Salle St., for a five-story and basement building, mill construction, on East Superior Street, for Price Flavoring Extract Co.; cost, approximately $40,000.

Freeport, Ill.—Reported Illinois Central R.R. Co. (A. S. Baldwin, Ch. Engr., Chicago, Ill.) intends spending about $100,000, on new buildings, shop equipment and improvements at the Freeport shops.

Minneapolis, Minn.—Contract, it is reported, will soon be let by National Candy Co. for erecting four-story reinforced concrete brick-faced candy factory; estimated cost, $100,000.

Castle Rock, Wash.—Reported Castle Rock Briquet Co. (M. R. Cummings, Secy.) will erect a plant near here costing $50,000.

PRICES AND LETTINGS.

★Indicates award of contract.

★**Gloucester, N. J.**—Contract reported awarded William Steele & Sons Co., 1600 Arch Street, Philadelphia, Pa., for erecting two factories and two warehouses of reinforced concrete for Weisbach Co.; cost, $500,000.

★**Jersey City, N. J.**—Contract awarded Turner Constr. Co., 11 Broadway, New York, N. Y., for erecting for the Great Atlantic & Pacific Tea Co., a factory, reinforced concrete construction, brick curtain walls, 175 x 50 ft., six stories, at Bay and Provost Streets. Timmis & Chapman, 315 Fifth Avenue, New York, Archts.

★**Syracuse, N. Y.**—New Process Gear Corp., 500 Plum Street, awarded to R. H. Howes Constr. Co., 105 West Fortieth Street, New York, contract for erecting five-story and basement 118 x 181 ft. machine shop on Plum Street; cost, $75,000.

★**Philadelphia, Pa.**—Contract awarded Turner Concrete Steel Co., Philadelphia, for alterations and additions to mill building at Walnut Lane and Main Street, Manayunk, for Robert Krook; building to be two-story brick, steel and concrete, 52 x198 ft. Peuckert & Wunder, Engrs. and Archts., 310 Chestnut Street.

William J. McCahan Sugar Refining Co., Front and Chestnut Streets, contemplates erecting six-story brick and reinforced concrete building on Front and Tasker Streets.

★Contract awarded by William Cramp & Sons Ship & Engine Bldg. Co., Bourse Building, to Hoffman Eng. & Constr. Co., Pennsylvania Building, for erecting two-story mill; cost about $100,000.

★**Freemansburg, Pa.**—Contract awarded to Forrest F. Speck, Bethlehem, for erecting steel and concrete fireproof plant for William Shimer Son & Co., 500 x 75 ft.; approximate cost, $60,000. Peuckert & Wunder, engineers and architects, 310 Chestnut Street, Philadelphia.

★**Sharon, Pa.**—Contract reported awarded Wallis & Carley Co., Bank Street, for a 280 x 36-ft. addition to plant of Pennsylvania Tank Car Co. at Petroleum.

★**Struthers, Ohio.**—Reported contract awarded Hunter Constr. Co., 407 Dollar Bank Building, Youngstown, for erecting an 80 x 320 ft. steel building at plant of Youngstown Sheet & Tube Co.

★**Kansas City, Mo.**—Contract reported awarded R. F. Wilson & Co., 23 East Lake Street, Chicago, Ill., for erecting four-story and basement, 113 x 265 ft., factory in North Kansas City for American Can Co., 1212 W. Ninth Street.

★**Galveston, Tex.**—Contract reported awarded Texas Carnegie Steel Assoc., American National Insurance Bldg., for furnishing about 100 tons steel for the conveyor at the Texas Star flour mill.

★**Tacoma, Wash.**—Contract awarded by Tacoma Smelting Co. to Cornell Bros., Tacoma, for erecting four buildings (additions to their present plant), and to Far West Clay Co. contract for constructing flues at new works.

★**Astoria, Ore.** — Contract reported awarded by Port of Astoria Comn. to H. E. Doering, 568 Maple Street, Portland, for corrugated sheet piling foundation for grain elevator at $22,658.

MISCELLANEOUS

PROPOSED WORK.

Pier—Norfolk, Va.—Reported Norfolk & Western R.R. Co. (J. E. Crawford, Ch. Engr., Roanoke) will construct two coastwise freight warehouse piers.

Heating Franchise—Louisville, Ky.—The Louisville Gas & Electric Co. has agreed to steam-heating franchise proposed by the mayor, authorizing company to lay and operate steam-heating main for a period of twenty years.

Transmission Line—Battle Ground, Ind.—Public Service Comn. of Indiana has given permission to Battle Ground Light & Water Co. to issue $5,600 to make improvements, including building a transmission line 5.2 miles long.

Park Improvements—Houston, Tex.—Plans prepared by George E. Kessler, St. Louis, for George H. Hermann Park. Probable cost, $100,000. Address Park Bd.

Park Improvements—Bartlesville, Okla.—See "Street Cleaning and Garbage Disposal."

Steel Towers—Los Angeles, Cal.—Contract soon to be let for constructing steel towers for the electric light plant. E. F. Scattergood, Ch. Electrical Engr.

BIDS DESIRED.

Park Work—Jersey City, N. J.—See "Water Works."

Cable, Etc.—Chicago, Ill.—Until Oct. 14 by Sanitary Dist. Chicago (John McGillen, Clk Bd. Trus.), for multiple conductor cable, 250 k.v.a. transformers, and installing mud drums in boilers at H. N. May Plant, Fullerton Avenue and Chicago River.

Fire Escapes—Jacksonville, Ill.—Until Oct. 18, by Bd. of Administration, Frank D. Whipp, Fiscal Superv. Springfield, for erecting five fire escapes at the Jacksonville State Hospital.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Dredging — Boston, Mass.—Following are bids opened Sept. 29 by Directors of the Port for dredging 35,000 cu. yd. of material in Neponset River: J. P. O'Riorden, Charlestown, 18¾ cts.; Eastern Dredging Co., East Boston, 20.25 cts.; J. S. Packard Dredging Co., Providence, R. I., 23⅞ cts.

Iron Fence, Boston, Mass.—Following are bids opened Sept. 29 by Comr. of Public Works for erecting an iron fence at West Department of the City Hospital, Spring Street: McNeil Constr. Co., 201 Devonshire Street, $8,750; W. A. Snow Iron Works, 14 Portland Street, $8,875; J. Caddigan Co., 319 Washington Street, $8,960.

Freight Shed—Brooklyn, N. Y.—Following are four lowest bids opened Oct. 1 by R. A. C. Smith, Comr. Docks, New York, for constructing a freight shed with appurtenances at foot of Thirty-fifth Street, Boro. Brooklyn, Contract 1473: (Bidders of New York City), Post & McCord, 101 Park Avenue, $279,846; Conners Bros. Co., 64 W. Eighty-eighth Street, $281,400; Snare & Triest Co., Woolworth Bldg., $281,440; North Eastern Constr. Co., 225 Fifth Avenue, $288,612.

★**Head House for Coal-Handling Plant—New York, N. Y.**—Contract for head house and appurtenances part of the coal-handling plant for O. H. Perry & Son., Inc., Foot of East Nineteenth Street, awarded Guarantee Constr. Co., 140 Cedar Street, New York. Charles Houghin Higgins, Engineer, 30 Church Street.

★**Pier—New York, N. Y.**—Following contracts awarded by R. A. C. Smith, Comr. Docks, New York, for pier improvements, Borough Manhattan: Pier at West Twenty-third Street, Contract 1471, Thomas J. Waters Co., 271 West 125th Street, New York, $36,600 (bids opened Sept. 21); extending pier at Jay Street, Contract 1479, to Riverside Contr. Co., 39 Cortlandt Street, New York, at $22,266 (bids opened Sept. 28).

Boardwalk—Stone Harbor, N. J.—Lowest bid opened recently for constructing the boardwalk submitted by Franklin Eng. & Contr. Co., Philadelphia, Pa.; $33,000 bonds have been sold for this project.

★**Pier—Baltimore, Md.** — Contract for constructing in Canton, coal pier for Pennsylvania R. R. reported awarded Arthur McMullin, Singer Bldg., New York. Pier to be 66 ft. wide and 935 ft. long, of steel and concrete.

★**Retaining Wall—Washington, D. C.**—Contract for constructing retaining wall on west side of Meridian Park awarded Boyle Robertson Constr. Co., Washington, at $21,522 (bids opened Sept. 20).

★**Grading — St. Louis, Mo.**—Contract awarded Sept. 23 by Pitzman Co., Surveyors, 615 Chestnut Street, to Fruin Colnon Contr. Co., St. Louis, for about 600,000 cu. yd. excav. for the University Park Realty Co., at 16.6 cts. per cu. yd.

★**Drainage—Marion, Ark.**—Commissioners reported to have awarded to Otto Kochititzky at Cape Girardeau, Mo., contract for 1,600,000 cu. yd. of excavation at $7.07 per cubic yard.

Proposals

For Proposals Advertised, see Pages 42 and 43.

WATERWORKS.

Bids Close.		See Eng. Record.
Oct. 12.	Valves, etc., Toronto, Ont. Adv. Sep. 18.	Sep. 18
Oct. 12.	Centrifugal Pumps, Etc., Lumberton, N. C.	Sep. 25
Oct. 12.	Water Works Improv., Monticello, Ind.	Sep. 25
Oct. 12.	Pump Station, Poplar Grove, Ill.	Oct. 2
Oct. 12.	Water Works, Pleasantville, Neb.	Oct. 9
Oct. 12.	Improvements, The Narrows, Man.	Oct 9
Oct. 12.	Water Works, Hertford, N. C.	Oct. 9
Oct. 12.	Repairs to Pumping Station, Hillyard, Wash.	Oct. 9
Oct. 13.	C. I. Pipes, etc., Cincinnati, Ohio	Oct. 9
Oct. 13.	W.-I. Pipe, Etc., Jersey City, N. J.	Oct. 9
Oct. 14.	Main, Galveston, Tex.	Oct. 2
Oct. 14.	Water Works, Attica, Kan.	Oct. 9
Oct. 15.	Pump, Marshalltown, Ia.	Oct. 2
Oct. 15.	Tank and Tower, Kanawha, Iowa	Oct. 2
Oct. 19.	Contr. 166, New York, N. Y. Adv. Oct. 2.	Oct. 2
Oct. 20.	Water Works, Miller, Ind.	Oct. 9
Oct. 20.	Reservoir, etc., Aurora, Minn.	Oct. 9
Oct. 20.	Standpipe, Cincinnati, Ohio	Oct. 9
Oct. 21.	Gas Engines, Clarksburg, W. Va. Adv. Sep. 25, Oct. 2.	Sep. 25
Oct. 21.	Tank, pumps, etc., Three Rivers, Mich.	Oct. 9
Oct. 21.	Pipe, etc., Van Buren, Ind.	Oct. 9
Oct. 26.	Contract 128, New York, N. Y. Adv. Oct. 9.	Oct. 9
Nov. 4.	Pumping Engine, Galveston, Tex. Adv. Oct. 2.	Oct. 2
Nov. 9.	Water Wks., Belleville, Ohio	Sep. 11

SEWERAGE AND SEWAGE DISPOSAL.

Oct. 11.	South Bound Brook, N. J. Adv. Sep. 25.	Sep. 25
Oct. 12.	Compton, Cal.	Oct. 2
Oct. 12.	Dennison, Iowa.	Oct. 2
Oct. 12.	Washington, D. C. Adv. Oct. 9.	Oct. 9
Oct. 12.	Toronto, Ont.	Oct. 9
Oct. 13.	Cheviot, Ohio	Oct. 2
Oct. 13.	Baltimore, Md.	Oct. 9
Oct. 13.	Ogden, Utah.	Oct. 9
Oct. 13.	Trenton, N. J.	Oct. 9
Oct. 14.	Mansfield, Ohio	Aug. 28
Oct. 14.	Ashland, Wis.	Oct. 2
Oct. 15.	Albemarle, N. C. Adv. Oct. 2, 9.	Oct. 2
Oct. 15.	Cincinnati, Ohio.	Oct. 9
Oct. 18.	Seaside Park, N. J.	Oct. 9
Oct. 19.	Beaumont, Tex. Adv. Sep. 18 to Oct. 2.	Sep. 18
Oct. 19.	Washington, D. C. Adv. Oct. 2, 9.	Oct. 2
Oct. 19.	Pullman, Wash.	Oct. 9
Oct. 19.	New York, N. Y.	Oct. 9
Oct. 20.	Indiana.	Oct. 2
Oct. 26.	Albany, N. Y. Adv. Oct. 9.	Oct. 9
Oct. 28.	Granville, Ohio	Sep. 25
Oct. 28.	Terrell, Tex.	Oct. 9
Nov. 1.	Santa Barbara, Cal.	Oct. 2
Nov. 1.	Pasco, Wash.	Oct. 9
Nov. 5.	Indiana.	Oct. 2
Oct. 19.	Washington, D. C. Adv. Oct. 9.	Oct. 9
Oct. 20.	Pella, Iowa, Adv. Oct. 9.	Oct. 9
Oct. 20.	Verona, N. J. Adv. Oct. 9.	Oct. 9
———	Parkersburg, Pa. Adv. Oct. 9.	Oct. 9

BRIDGES.

Oct. 11.	Connecticut, Adv. Oct. 2.	Oct. 2
Oct. 12.	Beaufort, S. C. Adv. Sep. 18.	Sep. 18
Oct. 12.	Waukon, Iowa	Sep. 25
Oct. 12.	Washington, Kan.	Oct. 2
Oct. 12.	Illinois	Oct. 2
Oct. 13.	Visalia, Cal.	Oct. 2
Oct. 13.	Eureka, Cal.	Oct. 9
Oct. 14.	Spokane, Wash.	Oct. 9
Oct. 15.	Steubenville, Ohio.	Oct. 2
Oct. 15.	Bedford, Iowa	Oct. 2
Oct. 15.	Illinois	Oct. 2
Oct. 15.	Baker, Mont.	Oct. 9
Oct. 16.	Huntington, Ind.	Oct. 9
Oct. 18.	Los Angeles, Cal.	Oct. 2
Oct. 20.	Concordia, Kan.	Oct. 9
Oct. 22.	Boise, Idaho.	Oct. 9
Oct. 23.	Ft. Edward, N. Y.	Oct. 9
Oct. 25.	Concordia, Kan.	Oct. 2
Oct. 25.	Columbus, Ohio	Oct. 2
Oct. 27.	Glenfield, Pa.	Sep. 25
Oct. 29.	Illinois	Oct. 2
Oct. 29.	Delphos, Ohio	Oct. 9
Oct. 30.	Dallas, Tex.	Oct. 9

PAVING AND ROADS.

Oct. 11.	Montclair, N. J. Adv. Oct. 2.	Oct. 2
Oct. 12.	Issaquah, Wash.	Oct. 2
Oct. 12.	Salisbury, Md.	Oct. 9
Oct. 12.	Terrell, Tex.	Oct. 9
Oct. 12.	Fort Worth, Tex.	Oct. 9
Oct. 12.	Paterson, N. J.	Oct. 9
Oct. 13.	Hoboken, N. J.	Oct. 2
Oct. 13.	Columbus, Miss.	Oct. 2
Oct. 13.	Des Plaines, Ill.	Oct. 2
Oct. 13.	Hammondton, N. J.	Oct. 9
Oct. 14.	Indiana.	Oct. 2
Oct. 14.	New York, N. Y.	Oct. 9
Oct. 14.	Philadelphia, Pa.	Oct. 9
Oct. 15.	Idaho.	Oct. 2
Oct. 15.	Idaho.	Oct. 9
Oct. 15.	Albany, N. Y.	Oct. 9
Oct. 16.	Pensacola, Fla.	Oct. 2
Oct. 16.	Newport, Tenn.	Oct. 9
Oct. 18.	California.	Oct. 9
Oct. 19.	Logansport, Ind.	Sep. 25
Oct. 19.	Beaumont, Tex. Adv. Sep. 18 to Oct. 2.	Sep. 18
Oct. 19.	Washington, D. C. Adv. Oct. 2, 9.	Oct. 2
Oct. 19.	Pullman, Wash.	Oct. 9
Oct. 19.	New York, N. Y.	Oct. 9
Oct. 20.	Indiana.	Oct. 2
Oct. 26.	Albany, N. Y. Adv. Oct. 9.	Oct. 9
Oct. 28.	Granville, Ohio	Sep. 25
Oct. 28.	Terrell, Tex.	Oct. 9
Nov. 1.	Santa Barbara, Cal.	Oct. 2
Nov. 1.	Pasco, Wash.	Oct. 9
Nov. 5.	Indiana.	Oct. 2

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS.

Oct. 12.	Irrigation Work, St. Ignatius, Mont. Adv. Sep. 18.	Sep. 18
Oct. 12.	Reclamation Work, Carlsbad, N. M.	Oct. 2
Oct. 12.	Ditch, Breckenridge, Minn.	Oct. 9
Oct. 12.	Drainage, Albany, Ill.	Oct. 9
Oct. 14.	Drainage, Victoria, Tex.	Oct. 2
Oct. 14.	Riprap, Philadelphia, Pa. Adv. Oct. 2, 9.	Oct. 2
Oct. 15.	Spillway, Cincinnati, Ohio	Oct. 2
Oct. 16.	Ditch, Winamac, Ind.	Oct. 2
Oct. 16.	Canal Work, Modesto, Cal.	Oct. 9
Oct. 18.	Riprap and Filling, Galveston, Tex.	Oct. 9
Oct. 18.	Dock Repair, etc., Chicago, Ill.	Oct. 9
Oct. 19.	Ditch Work, Mankato, Minn.	Oct. 9
Oct. 19.	State Canal Work, Albany, N. Y.	Oct. 9
Oct. 20.	Irrigation Work, Montrose, Col. Adv. Sep. 25.	Sep. 25
Oct. 20.	Irrigation Work, Powell, Wyo.	Sep. 25
Oct. 20.	Reclamation Work, Washington, D. C.	Oct. 2
Oct. 21.	Channel Work, Chicago, Ill. Adv. Sept. 25.	Sep. 25
Oct. 21.	Irrigation, Harlingen, Tex.	Oct. 9
Oct. 21.	Dredging, Newark, N. J.	Oct. 9
Oct. 22.	Dry Dock Gate, Louisville, Ky. Adv. Sep. 25 to Oct. 9.	Sep. 25
Oct. 22.	Ditches, Blue Earth, Minn.	Oct. 9
Oct. 26.	State Canal Work, Albany, N. Y.	Oct. 2
Nov. 1.	Flood Protection, Portsmouth, Ohio.	Oct. 9
Nov. 1.	Irrigation Work, Washington, D. C. Adv. Oct. 9.	Oct. 9
Nov. 4.	Irrigation Work, Grand Junction, Col. Adv. Oct. 9.	Oct. 9
Nov. 5.	Irrigation Work, Washington, D. C. Adv. Oct. 9.	Oct. 9
Nov. 5.	Trestles, Pittsburgh, Pa. Adv. Oct. 9.	Oct. 9
Nov. 8.	Dredge, Jacksonville, Fla. Adv. Sep. 11 to 25.	Sep. 11
Nov. 8.	Reclamation Work, Grand Junction, Col.	Oct. 2
Nov. 9.	Canal Work, Albany, N. Y.	Oct. 9

PUBLIC BUILDINGS AND SCHOOLS.

Oct. 12.	Akron, Ohio.	Oct. 2
Oct. 12.	Detroit, Mich.	Oct. 2
Oct. 12.	Clearwater, Neb.	Oct. 2
Oct. 12.	Little Falls, N. Y.	Oct. 2
Oct. 12.	Peru, Ind.	Oct. 9
Oct. 12.	Nagodeches, Tex.	Oct. 2
Oct. 13.	Naugatuck, Conn.	Sep. 11
Oct. 13.	Nutley, N. J.	Oct. 9
Oct. 13.	Chicago, Ill.	Oct. 9
Oct. 14.	Wilkesboro, N. C.	Sep. 11
Oct. 14.	Rinard, Iowa.	Oct. 2
Oct. 14.	Ironton, Ohio.	Oct. 9
Oct. 14.	Mountain Home, Idaho.	Oct. 2
Oct. 15.	Moberly, Mo. Adv. Sep. 18, 25.	Sep. 18
Oct. 15.	Cleveland, Ohio.	Oct. 2
Oct. 16.	Denton, Tex.	Sep. 18
Oct. 16.	Washington, D. C.	Aug. 28
Oct. 16.	Pensacola, Fla.	Sep. 25
Oct. 16.	O'Fallon, Neb.	Oct. 2
Oct. 16.	Boston, Mass.	Oct. 2
Oct. 16.	East Cleveland, Ohio.	Oct. 5
Oct. 16.	Yatesboro, Pa.	Oct. 9
Oct. 18.	Rock Rapids, Iowa.	Sep. 25
Oct. 18.	Dixon, Ill.	Sep. 25
Oct. 18.	Los Angeles, Cal.	Oct. 2
Oct. 18.	Bridgeport, Conn.	Oct. 9
Oct. 18.	Ventura, Cal.	Oct. 9
Oct. 19.	Norton, Va.	Sep. 11
Oct. 19.	Oxford, Ohio	Sep. 25
Oct. 19.	Brookings, S. D.	Oct. 5
Oct. 19.	Trenton, N. J. Adv. Oct. 9.	Oct. 9
Oct. 19.	Washington, Ind.	Oct. 9
Oct. 19.	Ridgewood, N. J.	Oct. 9
Oct. 20.	Monmouth, Ill.	Oct. 2
Oct. 20.	Seattle, Wash.	Oct. 9
Oct. 20.	Byers, Kan.	Oct. 9
Oct. 21.	Newark, N. J.	Oct. 9
Oct. 22.	New York, N. Y. Adv. Oct. 9.	Oct. 9
Oct. 23.	Norfolk, Va.	Oct. 2
Oct. 25.	Washington, D. C.	Oct. 5
Oct. 26.	Brooklyn, N. Y.	Oct. 2
Oct. 26.	Des Moines, Ia.	Oct. 9
Oct. 26.	Neodesha, Kan.	Oct. 9
Oct. 26.	New York, N. Y. Adv. Oct. 9.	Oct. 9
Oct. 26.	Pittsburgh, Pa.	Oct. 9
Oct. 27.	Newcastle, Ind.	Sep. 25
Oct. 27.	Monongahela, Pa.	Sep. 25
Oct. 27.	Ft. Bliss, Tex. Adv. Oct. 2, 9.	Oct. 2
Oct. 27.	Seattle, Wash.	Oct. 2
Oct. 27.	Northfield, Ohio	Oct. 2
Oct. 27.	Norman, Okla.	Oct. 9
Oct. 28.	Kirksville, Mo. Adv. Sep. 25, Oct. 2.	Sep. 25
Oct. 29.	Seattle, Wash.	Oct. 9
Oct. 30.	Seymour, Ind.	Sep. 25
Oct. 30.	Athens, Ohio.	Oct. 9
Nov. 1.	Merrill, Wis.	Oct. 2
Nov. 4.	Wilberforce, Ohio	Oct. 9
Nov. 5.	New Braunfels, Tex.	Oct. 2
Nov. 6.	East Pittsburgh, Pa.	Oct. 2
Nov. 8.	Sidney, Ohio Adv. Oct. 2, 9.	Oct. 2
Nov. 9.	El Paso, Tex.	Oct. 9
Nov. 10.	Van Wert, Ohio.	Oct. 2
Nov. 12.	Salamanca, N. Y.	Oct. 9
Nov. 16.	Huntington, W. Va.	Oct. 9

PRIVATE BUILDINGS.

Oct. 12.	Macon, Ga.	Oct. 2
Oct. 13.	Youngstown, Ohio.	Oct. 9
Oct. 14.	Bellaire, Ohio.	Oct. 2

NEW INDUSTRIAL PLANTS.

Oct. 16.	Peking, China.	Oct. 2

MISCELLANEOUS.

Oct. 12.	Retaining Wall, Pittsburgh, Pa.	Oct. 2
Oct. 12.	Street Lighting, Fort H. G. Wright, N. Y. Adv. Oct. 2.	Oct. 2
Oct. 12.	Steel Furniture, Capitol, Albany, N. Y. Adv. Oct. 2, 9.	Oct. 2
Oct. 14.	Cables, etc., Chicago, Ill.	Oct. 9
Oct. 15.	El. Ry., New York, N. Y.	Oct. 2
Oct. 16.	Pumps, Etc., for Oil Plants, Washington, D. C.	Aug. 28
Oct. 18.	Crane and Runways, Steel Stairs, etc., Panama.	Oct. 2
Oct. 18.	Fire Escapes, Jacksonville, Ill.	Oct. 9
Oct. 19.	El. Ry., Philadelphia, Pa. Adv. Sep. 18, 25.	Sep. 18
Oct. 19.	Steel Dome For Sale, Madison, Wis. Adv. Oct. 2, 9.	Oct. 2
Oct. 20.	Pneumatic Hoists., etc., Panama	Oct. 2
Oct. 20.	Alternators, etc., Slater, Mo. Adv. Oct. 2.	Oct. 2
Oct. 21.	Garbage Disposal, Newark, N. J. Adv. Oct. 9.	Oct. 9
Oct. 23.	Hoists, Washington, D. C. Adv. Sep. 25 to Oct. 9.	Sep. 25
Oct. 25.	Material for water distilling plant for sale, Fort Caswell, N. C. Adv. Oct. 9.	Oct. 9
Nov. 3.	Purchase of Steamer, Newport, R. I. Adv. Oct. 9.	Oct. 9
Nov. 8.	Jib Crane, Panama. Adv. Sep. 25.	Sep. 25
Nov. 17.	Power Plants, Etc., Washington, D. C.	Aug. 28

SEARCHLIGHT SECTION

Official Proposal Announcements

Price, $2.40 an inch.—Copy can be received until Thursday 10 a. m. for issue mailed the next morning

Bids open October 21, 1915.

CITY OF NEWARK, N. J.
NOTICE TO CONTRACTORS.

DISPOSAL PLANT

OFFICE OF THE BOARD OF STREET AND WATER COMMISSIONERS
CITY HALL, NEWARK, N. J.

Sealed proposals will be received by the Board of Street and Water Commissioners at its office in the City Hall from 3.15 to 3.30 o'clock p. m., on Thursday, October 21, 1915, and opened at the last named hour, at a public meeting of the Board, to be held at said time and place.

For the collection, removal and disposal of ashes, rubbish material, paper and garbage in the City of Newark, each bid to be a price per year for each of five years from January 1, 1916, in accordance with the specifications therefor, which are to be made a part of this contract.

In comparing proposals the totals bid for the entire period of five years will be used.

Bids must be made on forms of proposals prepared and printed by the Board, and copies of which are attached to the printed specifications and description of the contract work. Said printed forms of blank proposals and specifications will be furnished persons desiring the same at the office of the Chief Engineer of the Board, in the City Hall, Newark, N. J. Bidders must state in words and figures the gross price per annum for which it is proposed to do the work specified in the proposal.

Each proposal to be accompanied by the consent in writing of a surety company, qualified to do business in New Jersey, who shall, at the time of putting in such proposal, obligate itself to the amount of $100,000 that, if the contract be awarded to the person or persons making the proposal, it will, upon its being so awarded, become his or their sureties for the faithful performance of said work; and that if the said person or persons omit or refuse to execute the contract, said surety company will pay to the City of Newark any difference between the sums to which he or they would have been entitled upon completion of the contract and that which the City of Newark may be obliged to pay the person or persons by whom such contract shall be executed.

The Board of Street and Water Commissioners of the City of Newark reserves to itself the right to accept or reject proposals for the above work, as it may deem best for the interest of the City.

By direction of the Board of Street and Water Commissioners,

M. R. SHERRERD,
Chief Engineer.

October 4, 1915.

Bids open October 19, 1915.

BUILDING EXTENSION AT STATE HOSPITAL

TRENTON, N. J.

Sealed proposals will be received at the office of the Governor, Trenton, N. J., until 12 o'clock noon, on Tuesday, October 19, 1915, for furnishing all labor and material necessary for the further extension of the House of Detention for Convict and Criminal Insane at the State Hospital, Trenton, N. J., in accordance with plans and specifications on file in the office of the Commissioner of Charities and Corrections, State House, Trenton, N. J.

Each bidder must accompany his proposal with a certified check for ten per centum of the amount of his proposal, payable to the order of the Governor, which will be returned to the successful bidder immediately following the award of the contract.

Proposals must be enclosed in envelopes sealed and marked "Proposals for the further extension of the House of Detention for Convict and Criminal Insane at the State Hospital, Trenton."

E. I. EDWARDS,
Secretary State House Commission.

Bids open October 12, 1915.

NOTICE TO CONTRACTORS.

STEEL FURNITURE

ALBANY, N. Y.

Sealed proposals for steel furniture for the State Tax Commission, Capitol, Albany, N. Y., will be received by the Trustees of Public Buildings, Executive Chamber, Capitol, Albany, N. Y., until 2 o'clock p. m., on Tuesday, October 12, 1915, when they will be publicly opened and read. Proposals shall be enclosed in an envelope furnished by the State Architect, sealed and addressed and shall be accompanied by a certified check for $350.00. The contractor to whom the award is made will be required to furnish surety company bond in the sum of fifty per cent (50%) of the amount of the contract within thirty (30) days after official notice of award of contract and in accordance with the terms of specification 2187. The right is reserved to reject any or all bids. Drawings and specifications may be consulted at the New York office of the Department of Architecture, Room 1224, Woolworth Building and at the Department of Architecture, Capitol, Albany, N. Y. Drawings and specifications and blank forms of proposal may be obtained at the Department of Architecture, Capitol, Albany, N. Y., upon reasonable notice to and in the discretion of the State Architect, Lewis F. Pilcher, Capitol, Albany, N. Y.

Albany, N. Y., September 28, 1915.

Bids open October 19, 1915.

FOR SALE—CAST IRON DOME

MADISON, WIS.

The Capitol Commission had removed from the old Capitol building its cast iron dome and, pursuant to legislative act, had the same taken down so that it could be re-erected, that is, each part was numbered and drawings were made showing the location of each part in any future re-erection.

It now has this material for sale either for junk or otherwise and invites proposals for its purchase.

The material which it is purposed to sell is now stored on the University campus directly west of Main Hall and it is estimated that there is of it between 800 and 1,000 tons, all of which will be sold to the successful bidder with the exception of a few pieces not to exceed in weight two tons which the Commission desires to retain.

The condition of this sale will be that the purchaser shall purchase the material in the position which it now is and shall pay for it by the ton, it to be weighed under the supervision and to the satisfaction of the State; that he shall pay for it in cash before it is removed from the premises.

Such payment may be made in installments as may be mutually agreed between the purchaser and the Commission.

Sealed proposals will be received for the purchase of this material until noon of Tuesday, October 19.

Proposals must be made on blanks which may be secured by application to the undersigned and must be accompanied by a certified check of $1,000.00 made payable to Lew F. Porter, Secretary of the Capitol Commission, and which will be forfeited to the State in case the tender of the maker is accepted and he fails to complete the purchase as per proposal and herein provided.

Plans of the original structure may be seen and information may be secured at the Capitol Commission office.

LEW F. PORTER,
Secretary, Capitol Commission of Wisconsin.
Madison, Wis., September 22, 1915.

Bids open October 26, 1915.

HIGHWAY WORK

OFFICE OF THE STATE COMMISSION OF HIGHWAYS.

ALBANY, N. Y.

Sealed proposals will be received by the undersigned at their office, No. 55 Lancaster Street, Albany, N. Y., at 1 o'clock p. m., on Tuesday, the 26th day of October, 1915, for the improvement of the following highways in the following counties:

Albany (approx. 3.41); Allegany (approx. 5.25); Cayuga (approx. 6.06); Clinton (approx. 3.79); Columbia (two highways, 4.27; 7.77); Cortland (approx. 4.00); Erie (four highways, 9.14, 4.30, 4.50, 5.19); Genesee (approx. 4.53); Livingston (approx. 7.69); Madison (two highways, 3.05, 0.18); Monroe (two highways, 0.73, 2.91); Oneida (approx. 0.70); Onondaga (approx. 0.18); Orange (four highways, 3.64, 3.17, 3.70, 0.38); Schenectady (approx. 5.62); Seneca (approx. 5.01); Steuben (approx. 5.25); Sullivan (approx. 0.43); Tioga (approx. 4.07); Tompkins (approx. 2.48); Ulster (approx. 10.24).

Maps, plans, specifications and estimates may be seen and proposal forms obtained at the office of the Commission in Albany, N. Y., and also at the offices of the division engineers in whose divisions the roads are to be improved. The addresses of the Division Engineers and the counties in which they are in charge will be furnished on request.

The especial attention of bidders is called to "GENERAL INFORMATION FOR BIDDERS" in the itemized proposal, specifications and contract agreement.

EDWIN DUFFEY,
Commissioner.

IRVING J. MORRIS,
Secretary.

Bids open October 15, 1915.

SEWAGE SYSTEM

ALBEMARLE, N. C.

Sealed proposals will be received for labor and material in connection with the above work, consisting of about four (4) miles of vitrified and cast iron sewers from six (6) inches to twenty (20) inches in diameter, complete with appurtenances, by the Mayor and Board of Aldermen, at the City Hall, Albermarle, N. C., until (12) o'clock, noon, of October 15, 1915, when they will be publicly opened and read.

Plans and specifications are on file at the office of the Town Clerk and of the Consulting Engineers. They may be procured at the office of the Engineer in Charge, Albermarle, and to whom requests for additional information should be addressed.

A set of prints consisting of map and details, together with specifications, may be procured by prospective bidders by addressing direct the Engineer in Charge, and making a deposit of $25.00, which deposit will be refunded upon the return of the plans and specifications in good condition.

Each proposal must be accompanied by a certified check in the sum of five (5) per cent of the amount bid as evidence of good faith upon the part of the bidder.

The Town reserves the right to reject any and all bids or to accept any which may seem to it to be to the best interest of the Town of Albemarle.

M. J. HARRIS, Mayor.
J. D. SPINKS,
Engineer in Charge.

ANDERSON & CHRISTIE, INC.
Consulting Engineers,
Charlotte, N. C.

Bids open October 26, 1915.

BUILDINGS

Sealed bids will be received by the Board of Water Supply, at its offices, twenty-second floor, Municipal Building, Park Row, Centre and Chambers Streets, New York City, until 11 a. m., on Tuesday, October 26, 1915, for CONTRACT 128, for the construction of two concrete stone and brick buildings at the Uptake and Downtake chambers of Hill View reservoir, in the City of Yonkers, Westchester County, New York. The larger one of the buildings is, approximately, 125 ft. by 88 ft. by 35 ft. and the other is somewhat smaller. The substructures or foundations of these buildings have been built and the City will furnish and erect the roof covers for the buildings.

At the above place and time the bids will be publicly opened and read. Pamphlets containing information for bidders and contract drawings can be obtained at the above address, at the office of the Secretary, by depositing the sum of ten dollars ($10) in cash or its equivalent for each pamphlet. For further particulars, apply to the office of the Principal Assistant Engineer at the above address.

CHARLES STRAUSS, President.
CHARLES N. CHADWICK,
JOHN F. GALVIN,
Commissioners of the Board of Water Supply.
GEORGE FEATHERSTONE,
Secretary.

Bids open October 20, 1915.

SEWERS

PELLA, IOWA.

Sealed proposals will be received by the City Clerk of the City of Pella, Iowa, for the construction of approximately 14,500 ft. sanitary sewers, 18 flush tanks and 19 manholes, as per plans and specifications on file in the office of the City Clerk, the work to be commenced on or before the first day of April, 1916, and completed on or before the first day of July, 1916, all bids to be accompanied, in a separate envelope, with a certified check payable to the order of the Treasurer of the City of Pella, Iowa, in the sum of $500.00, all bids to be filed with the City Clerk not later than 5 o'clock p. m. of the 20th day of October, 1915. Bids will be opened by the Council at 7.30 o'clock p. m. of said day, the right is reserved to reject any or all bids.

A. C. KUPYER,
City Clerk.

TREASURY DEPARTMENT, SUPERvising Architect's Office, Washington, D. C., September 28, 1915.—Sealed proposals will be opened in this office at 3 p. m., November 8, 1915, for the construction complete (including mechanical equipment and approaches) of a two-story and basement stone and brick-faced building of 4925 square feet ground area, fireproof construction, composition roof, for the United States post office at Sidney, Ohio. Drawings and specifications may be obtained from the custodian at Sidney, Ohio, or at this office, in the discretion of the Supervising Architect. JAS. A. WETMORE, Acting Supervising Architect.

OFFICE OF COMMISSIONERS, WASHington, D. C., September 28, 1915. Sealed proposals will be received at the office of Secretary, Board of Commissioners, Room 509, District Building, until 2 o'clock p. m., Tuesday, October 19, 1915, for paving streets with sheet asphalt, asphalt blocks and bitulithic pavement. Forms of proposals, specifications and necessary information may be obtained from the Chief Clerk of the Engineer Department, Room 427, District Building. Oliver P. Newman, Louis Brownlow, Charles W. Kutz, Commissioners, D. C.

FORT CASWELL, N. C. SEALED bids are wanted until Oct. 25, 1915, for sale of material for pure water distilling plant consisting of pretreatment tanks, stills, pumps, heat exchange, iron platform and assortment valves and piping. Approximately 350,000 lb. metal. All apparatus with exception two low pressure pretreatment tanks and one high pressure pretreatment tank which has fractured flange are suitable for working pressure of 100 lb. per square inch. Information on application Constructing Quartermaster.

CONTRACTING NEWS

Of Special Interest to Engineers, Contractors, Builders and Manufacturers of Engineering and Building Supplies

THE CROP of wheat, oats and barley will exceed all previous records, according to the forecast of the U. S. Department of Agriculture based on conditions on Oct. 1. For the first time this country will have a 1,000,000,000-bu. wheat crop, which is more than 300,000,000 bu. in excess of the last five-year average. The oats crop, 1,517,000,000 bu., is nearly 400,000,000 bu. in excess of the average for the last five years, and the barley crop, which is much smaller, shows a still greater proportionate increase and far exceeds the record. The corn crop, estimated at more than 3,000,000,000 bu., while not a new record, is well in excess of the last five-year average. So also is the potato crop, which makes by far the poorest showing of any of the large crops.

To move these crops will tax the rolling stock of the railroads of the country, and should swell their gross revenues to a good figure. The Interstate Commerce Commission has urged all shippers to rush the loading, unloading, handling and return of cars, and has revised demurrage rules to that end. The large orders being placed for new cars are a reflection of the fear of a car shortage this fall and winter. Exports last week were only a few thousand dollars below the high record for the week previous, and the indications are that the business of the railroads in handling export shipments, other than the proportion of the crops sent abroad, to the seaboard will continue to grow.

The Canadian crops of wheat, oats, barley and flax are estimated at a value of $330,000,000. Of the two largest, the wheat crop is about 23 per cent of that in this country, and the oats crop about 14 per cent. It is expected that conditions in Western Canada will be materially improved when these crops are marketed.

Buildings

A $100,000 reinforced-concrete building has been contracted for at Philadelphia. A contract has been awarded for building a State institution to cost $150,000 at Skillman, N. J. The construction of a $500,000 theater building has been contracted for at St. Louis. Contracts awarded for building an armory at Grand Rapids, Mich., amount to more than $110,000. A university building contracted for at Lincoln, Neb., will cost $111,000. The lowest bids opened Oct. 4 for constructing the State institution at Sedro Woolley, Wash., total $159,000. Bids have been received for erecting a $90,000 Masonic temple at Terre Haute, Ind. Bids will be opened Oct. 19 for erecting a $100,000 municipal building at Milford, Conn.

Plans have been filed in New York City for a $250,000 asylum, and for two apartment houses to cost $200,000 and $300,000 respectively. It is reported that a $500,000 cotton mill will be built at Albermarle, N. C. Improvements to a steel plant contemplated at Martins Ferry, Ohio, will cost $100,000. A Minneapolis company intends to erect a $100,000 office building. Plans are being prepared for a $600,000 theater in Chicago. A college building to cost $100,000 is contemplated at Waukesha, Wis. Plans have been completed for adding eight stories to a Seattle building at a cost of $100,000.

Bridges and Roads

Bids were opened Oct. 6 for constructing a bridge over the Kansas River at Lawrence, Kan., the lowest of which was almost $200,000. Bids will be opened Oct. 19 for constructing a bridge over the Shenango River at Sharon, Pa. Plans for the $400,000 Harlem Avenue viaduct at Buffalo are in the hands of the State public service commission. The bids opened Sept. 30 for replacing a bridge across the Schuylkill River at Phoenixville, Pa., have been rejected, and an engineer has been retained to design a reinforced-concrete bridge for this location. Indianapolis has appropriated its half of the cost of the $150,000 bridge to be built over Full Creek in that city. Bonds in the sum of $116,000 for bridge improvements will be sold the latter part of the month at Crown Point, Ind.

Two contracts for constructing sections of the Dixie Highway totaling $256,000 have been awarded at Dayton, Tenn., and Bloomington, Ind. Pawnee, Okla., has awarded a $51,000 paving contract. Bids will be opened Oct. 29 for constructing 70 miles of road at Elizabethton, Tenn. The New York State highway department has approved the construction of 4½ miles of county road at Buffalo, to cost $90,000. The mayor of Boston has recommended the expenditure of $1,000,000 for street pavements in 1916. Road bonds in the sum of $100,000 will be sold Nov. 1 at Greenville, N. C. Crown Point, Ind., has sold road bonds totaling $572,000.

Waterworks and Sewers

A contract has been awarded for rebuilding a waterworks dam at Dundas, Ont. A $90,000 waterworks contract has been let at West Vancouver, B. C. Bids are desired at Peapack, N. J., for constructing a reservoir and furnishing 8 miles of pipe. It is reported that bids are desired for constructing a $165,000 waterworks system at East Youngstown, Ohio. A report has been submitted to the board of aldermen of Fall River, Mass., on the new $3,000,000 water project for that city. Surveys are being made for new water-supply and sewerage systems at Grantville, Md. It is reported that an $80,000 filtration plant will be built at New Albany, Ind. It is reported that Tulsa, Okla., will hold an election to vote $600,000 bonds for constructing a reservoir and waterworks improvements. A company has been incorporated to construct a waterworks system at Columbia Falls, Mont.

Bids have been opened on a $126,000 sewer contract at Atlantic City, N. J. The lowest bid received for sewer work at Forest Grove, Ore., was $58,000. Bids were opened Oct. 15 for considerable sewer work in Kansas City. Plans have been prepared for a $61,000 storm-sewer system at South Orange, N. J. The construction of a sewage-disposal plant is contemplated at Chester, Pa. Bonds amounting to $300,000 for constructing a sewer system have been voted at Columbia, S. C. An election is to be held in Dayton, Ohio, to vote $700,000 for sewer construction. The construction of a $2,000,000 collecting sewer is under consideration at Montreal.

Miscellaneous

The contract for building a wharf at the naval station, Pearl Harbor, Hawaii, has been awarded at $155,000. All bids for the industrial railway to be built at the same station were rejected. The construction of a 1000-ft. pier has been contracted for at Greenville, N. J. A contract for building 17 miles of dike at Cathlamet, Wash., has been awarded at $98,000. The lowest bids opened Oct. 9 by the New York Municipal Railway Corporation for the extension and reconstruction of elevated railroad lines in Brooklyn total more than $3,800,000. Track-elevation bonds amounting to $160,000 have been sold at Indianapolis. The elimination of grade crossings is being considered at Youngstown and Akron, Ohio. A flood-prevention project to cost $6,000,000 has been recommended at St. Louis. Bonds have been voted at Culver, Ore., for constructing a $500,000 irrigation system. It is reported that plans have been prepared for a fourth pier to be built at Cristobal, Panama.

WATERWORKS

PROPOSED WORK.

Rochester, N. Y.—Finance Committee reported favorably on request of Controller and the Council to issue $100,000 bonds for water works extension.

Grantsville, Md.—Surveys being made by William Harver of Frostburg preparatory to the installation of a water supply and sewerage system. Robert B. Morse, Chief Engineer, Department of Health, Baltimore.

Orangeburg, S. C.—City Council has authorized James E. Salley, City Electrician, to prepare plans for extensions to municipal electric light plant and water works system; cost approximately $50,000.

Acworth, Ga.—The city authorities have voted to construct a waterworks and electric light plant. Artesian wells will be the source of supply.

Savannah, Ga.—Reported the building of a new water conduit is contemplated. Address W. J. Pierpont, Mayor.

Fairhope, Ala.—The town is arranging to take over the water works system, and will also install an electric light plant; cost $12,000.

Henderson, Tenn.—Bonds amounting to $57,000 for water works, sewers and lights will be sold by the City Clerk on Oct. 19. Frank L. Wilcox, St. Louis, Mo., Engineer.

East Youngstown, Ohio—Chester & Fleming, Pittsburgh, Pa., are preparing detailed plans and specifications for water works to include a complete distributing system, force main, pumping station, filtration plant and standpipe.

Tiffin, Ohio—Reported the filtration system at waterworks has been condemned by State Board of Health. A new plant may be installed.

Brook, Ind.—The Brook Utility Co. has been granted authority by the State Public Service Commission to issue bonds to construct water works.

Brookville, Ind.—Water works bonds amounting to $20,525 have been sold. Address Board of Town Trustees.

Ladoga, Ind.—Bonds amounting to $12,000 for water works will be sold by the Town Trustees Oct. 20.

Michigan City, Ind.—The Mayor has been authorized by the State Public Service Commission to issue $75,000 bonds. These bonds to be used for water works improvements already done, contemplated and in process of construction.

Morocco, Ind.—The Morocco Utility Co. has been granted authority by the Public Service Commission to issue bonds for constructing water works here

New Albany, Ind.—The New Albany Water Co. intends installing a filtration plant, according to plans by J. O. Endris, Supt. of the company; estimated cost $80,000.

Wakarusa, Ind.—The Wakarusa Water Co. of Wakarusa has been granted permission by the State Public Service Commission to issue $20,000 stock for purpose of constructing waterworks in this town.

Aurora, Ill.—Board of Public Works considering building new reservoir.

Clinton, Ill.—Citizens voted $8,000 bonds for repairing and reconstructing reservoir at city water plant.

Frederic, Wis.—G. R. Bascom of the University of Wisconsin, Madison, has been asked to outline a program for improvements in the village, and advises that a competent engineer be engaged to prepare a grade map of the village and then plans and specifications for relocation of water works, sanitary sewers and pavings.

Madison, Wis.—Water Board is in favor of Lake Mandoca for a future water supply.

Columbia Falls, Mont.—J. A. Talbott Water Co. has been incorporated and will construct a water system here. Capital, $75,000. Incorporators: J. A. Talbott, M. T. Linden and others.

Lee Summit, Mo.—Plans being prepared by Henrici, Kent & Lowry, Reserve Bank Building, Kansas City, for water works; cost $45,000.

Tulsa, Okla.—Reported City Council has voted to hold an election, probably Nov. 2, to issue $600,000 bond for constructing reservoir and waterworks improvements.

Seattle, Wash.—The Utilities Committee of City Councils has introduced a bill authorizing the Board of Public Works to seal by silting or otherwise approximately 1000 ft. of the leaky impounding basin at Cedar Falls. The bill includes an appropriation of $25,000.

East Side, Ore.—An election is to be held in December to vote $50,000 bonds for municipal water system.

Kellogg, Idaho—Reported the Kellogg Water Power Co., Kellogg, have purchased water system and will improve and extend same.

McCammon, Idaho.—Reported town board desires estimates on cost of installing waterworks.

Port Coquitlan, B. C.—Council has passed the water works bylaw and installation of a municipal water system will be started early in November. Cost, $35,000. John Smith, city clerk.

BIDS DESIRED.

Hartford, Conn.—Until Nov. 1, by Board of Water Commissioners (Fred D. Berry, Secretary) for Contract 14—clearing and grubbing southerly portion of basin and Contract 15—northerly portion of basin Nepaug reservoir about 400 acres and 430 acres respectively, advertised in the Engineering Record. Caleb Mills Saville, Chief Engineer, Pilgard Building, Hartford.

New York, N. Y.—Until Oct. 22 by William Williams, Comr. Water Supply, Gas and Electricity, for furnishing, delivering, unloading, stacking and storing c.-i. pipe, special and valve box castings, cast-steel castings and valves. Security $3,300.

Peapack, N. J.—Until Oct. 26 by Frank Ludlow, Borough Clk., Peapack, for furnishing f.o.b. Peapack and Gladstone, 8 miles 4 to 8-in. c.-i. pipe, 2-in. galvanized wrought-iron pipe (extra heavy); constructing reservoir and valve house; excavating, etc. F. S. Tainter, Boro. Engr., Peapack.

Indian Head, Md.—Until Oct. 30 by Bureau Yards and Docks, Navy Dept., Washington, D. C.; H. E. Stamford, Ch. J., for 50,000-gal. steel water tank and tower at naval proving ground, Indian Head.

Washington, D. C.—Until Nov. 2, by Bureau Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the Navy Yards miscellaneous material as follows: Brooklyn, N. Y., Sch. 8502—wrought pipe. Boston, Mass., Sch. 8502—, pipe fittings. Boston and Brooklyn Sch. 8506—composition pipe fittings, and composition valves. Applications for proposals should designate Schedule desired by number.

Cleveland, Ohio.—Until Oct 20 by A. R. Cadle, Comr. Purchases and Supplies, for laying two 60-in. water mains for the Division Avenue Pumping Station.

Columbus, Ohio.—Until Oct. 28 by Ohio Bd. of Administration, Oak and North Streets (**A. F. Shepherd, Pres.**), for furnishing and installing water softening equipment for Institution for Feeble-Minded. H. S. Riddle, Consulting Engr., Ohio Bd. Administration, Columbus.

Dayton, Ohio—Until Oct. 28, by James R. Harlow, **Dir. Pub. Service**, for construction, delivery and erection at Keowee Street pumping station one 20,000,000 gal. daily capacity, low service, steam driven, pumping unit.

East Youngstown, Ohio.—Reported desired until Dec. 1 by Carl R. Anderson, Village Clk., for constructing water works. Probable cost $187,000.

Middletown, Ohio—Until Oct. 19, by John Kunz, Clk. City Comn., for laying 18 and 12-in. c.-i. water pipe with necessary fittings, valves, tees, etc., First, Second and Charles Streets and Ishehart Avenue.

Elmhurst, Ill.—Until Oct. 20 by Arthur H. Kochalsky, **City Clk.**, for constructing reinforced concrete tower pumping station, tank, reservoir and well house and appurtenances. H. L. Emerson, Engr., 1118 **Chamber of Commerce Building, Chicago.**

Jacksonville, Ill.—Until Oct. 18 by Board Administration, Springfield (Frank D. Whipp, Fiscal Supervr.), for extending mains and hydrants for fire protection at Illinois School for Blind, Jacksonville.

Caney, Kan.—Until Oct. 19 by Grace V. Ridgeway, **City Clk.**, for furnishing, erecting and testing one triple-expansion duplex direct-acting steam pump with auxiliaries. Black & Veatch, Con. Engrs., Interstate Bldg., Kansas City, Mo.

Panama. See "Miscellaneous."

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Philadelphia, Pa.**—Contract for turbo centrifugal pumps at Southwest Pumping Station, bids opened Sept. 30, awarded to M. L. Bayard, 701 Penna. Building, at $90,000.

★**Cleveland, Ohio.**—Contract for dismantling and removing pumps at the Division Avenue pumping station awarded Allis-Chalmers Co., Minneapolis, Minn., at about $25,000.

★**Liverpool, Ohio**—Contract awarded by Board of Control as follows: For excavating and constructing intake work for river intake, new pumping station and filtration plant, to T. A. Gillespie Co., New York and Pittsburgh, at $264,062; for force main and distributing mains to J. L. Dick of Scottdale, Pa., for $54,472. Chester & Fleming, engineers, Pittsburgh, Pa.

★**Wilberforce, Ohio.**—Trustees of the Wilberforce University have awarded contract for improvements to the water supply at a cost of $8,472 as follows: 50,000-gal. steel tank and tower to Pittsburgh-Des Moines Steel Company, Pittsburgh, Pa., at $4,850; 60-ft. well and connections to H. Boyd; two steam pumps, Wisconsin Pump Manufacturing Co., Columbus; hot water storage heater and softening plant, Sharple Machine Co., Columbus.

★**San Francisco, Cal.**—Contract for clearing floor at Hetch Hetchy Valley awarded A. J. Breeder at $21,875.

★**Dundas Ont.**—Contract for rebuilding dam at the water works awarded to Lockman Engineering Co., McPhee, Kadle & Darling of Hamilton, Engrs. John S. Fry, Town Clerk.

★**West Vancouver, B. C.**—Contract awarded by Municipal Council to Cotton Co., Ltd., of Vancouver for installation of the new Sisters Creek water system at $90,000. Contract includes construction of about 25 miles of mains, setting hydrants and a Deep Pumping Unit, a capacity of 2,000,000 gal. Owen Leather & Associates, Planning & Engineering Office, Vancouver, B. C., at $100,000.

SEWERAGE AND SEWAGE DISPOSAL

PROPOSED WORK.

Stratford, Conn.—Preliminary steps as to the establishment of a sewage system are being discussed by the Board of Finance. Probable cost $300,000.

South Orange, N. J.—Plans prepared by Edmund R. Halsey, Township Engr., for a system of storm sewers on the slope in **Maplewood section of South Orange township**, cost about $61,400.

Chester, Pa.—Reported extension of the **sewerage system and the construction of a sewage disposal plant is contemplated.**

Greensburg, Pa.—Reported **Borough Council considering sites for proposed sewage disposal plant.**

Crisfield, Md.—The State Board of Health, Baltimore, **has ordered the Mayor and the City Council to submit plans and specifications for a complete sewerage system.** Robert B. Morse, Ch. Engr., Dept. Health, Baltimore.

Columbia, S. C.—Citizens Oct. 5 voted $300,000 bonds for constructing sewer system. L. A. Griffith, Mayor.

Eustis, Fla.—Citizens voted $60,000 bonds to construct a sewerage system and hard surfaced streets.

Starke, Fla.—Citizens voted $26,000 sewer and $16,000 paving bonds. In addition $38,000 will be spent for paving. McCreary & Co., Atlanta, Ga., Engrs.

Alliance, Ohio—Forty thousand dollars sewage disposal bonds will be sold Oct. 25, by Charles O. Silver, City Aud.

Dayton, Ohio.—An election soon to be held to vote on following bond issues: $457,000 for a city portion of street sewage improvements; $130,000 for real estate needed for fire houses and also for additional fire apparatus, $252,000 for large storm sewers in downtown districts, $5,000 for water works extensions, $18,000 for street and highway improvements, $50,000 for new work house, $115,000 for bridge over Mad River at Keowee Street.

Toledo, Ohio.—Sewer bonds amounting to $60,000 will be sold Nov. 3 by County Commissioners. About five miles of sewer construction is contemplated.

Springfield, Ohio.—Contracts soon to be let for constructing Rose Street storm water sewer, Lowry Avenue sewer, storm sewer in Liberty Street (cost $10,000) and Mulberry Street sewer. Address Director Public Service.

Youngstown, Ohio.—Plans of City Engineer F. M. Lillie for the proposed Mill Creek district sewer have been approved by Council and authorized submitted to the State Board of Health for approval.

Xenia, Ohio.—Bonds for $60,000 will be sold Nov. 2 by C. F. Logan, City Aud., for constructing sewage disposal plant.

Bloomington, Ill.—Officials of Bloomington and Normar considering the valley sewers disposal plant.

Frederic, Wis.—See "Waterworks."

Burlington, Iowa.—Reported contract soon to be let for constructing a sewer system in Lincolnville. Address City Engr.

Beaumont, Tex.—See "Hydraulic Construction and River Improvements."

Waco, Tex.—An election is to be held Oct. 19 to vote $75,000 bonds for constructing sewage disposal plant.

Muskogee, Okla.—Citizens voted $23,000 bonds to contsruct sanitary sewer to the Arkansas River.

Montreal, Que.—Building of a $2,000,000 collecting sewer to serve northern wards is reported under consideration.

BIDS DESIRED.

New York, N. Y.—See "Electric Railways."

Yorktown Heights, N. Y.—Until Nov. 9, by William B. Osgood Fields, president Board of Managers, New York State Training School for Boys, for sewerage and sewage disposal plant at said school advertised in the Engineering Record. Lewis F. Pilcher, State Architect, Albany.

Elizabeth, N. J.—Reported desired until Oct. 19, by County Board Chosen Freeholders for 502 lin. ft. tile underdrain along Westfield Avenue from Bayway, Elizabeth to Walnut Streets, Roselle Park. Jacob L. Bauer, Co. Engr., 120 Broad Street, Elizabeth.

Mansfield, Ohio.—Reported desired until Oct. 26 by Director Pub. Service for constructing 4150 ft. 12, 10 and 8-in. sewer. W. J. Hazeltine, City Engr.

Upper Alton, Ill.—Until Oct. 25 by Board Administration (Frank D. Whipp, Fiscal Supvr.), Springfield, for sanitary and storm water sewers and tunnel drain connections etc., also for tunnel work at Alton State Hospital, Upper Alton. James R. Edbelen, State Archt., 120 N. Fifth Avenue, Chicago.

Plymouth, Wis.—Reported desired until Oct. 19 by H. A. Luedke, City Clk., for 11,800 ft. 8 to 12 in. sanitary sewers. Jerry Donahue, Engr., Sheboygan.

Algona, Iowa.—Until Oct. 27 (readvertisement) by S. W. Crommell, City Clk., for constructing sanitary sewers.

Elliott, Iowa.—Until Oct. 19 by Town Clerk for constructing sanitary sewer mains and laterals as all about 11,652 ft. 6 to 15-in. pipe, 103 manholes. Bids will be received on vitr. clay and concrete pipe. Theodore S. De Lay, Consulting Engr., Creston, Iowa.

★**Milwaukee, Wis.**—Following are details of the four lowest bids opened Sept. 17 by the Department of Public Works for constructing Lake Street sewer, including the tunnel section, all shafts, manholes, and outfall section: (a) A. J. Hewitt, Milwaukee, $150,789; (b) M. Synovitz, Milwaukee, $168,055; (c) J. Ferry & Sons, Baltimore, $175,904; (d) M. A. Herrin & Sons, Baltimore, $180,995. Edward F. Leidel, Chief Engineer.

		(a)	(b)	(c)	(d)
5234	excavation and construction of concrete sewer and 18-in. pipe	$23.50	$25.00	$26.45	$27.00
865	excavation and construction of concrete sewer and 15-in. pipe	23.50	25.00	25.50	27.00
164.5	construction of outfall sewer, revetment and backfilling	12.50	50.00	25.00	35.00
	Manhole Lake and Hubbard Street excav. and constr.	300.00	400.00	125.00	800.00
	Manhole Lake and Seventh Street excav. and constr.	800.00	400.00	2,000.00	800.00
	Manhole Lake and Fourth Street excav. and constr.	800.00	400.00	2,000.00	800.00
192	standard manholes, 12 ft. deep and less, having 9-in. walls	6.00	10.00	10.00	16.00
253	standard manholes more than 12 ft. deep, having 13-in. walls	8.00	15.00	15.00	18.00
22	manholes, frame and covers	15.00	20.00	15.00	24.50

Chatfield, Minn.—Until Oct. 22, by John Chermak, City Clk., for furnishing material and constructing about 3800 ft. 6 and 8-in. vit. pipe sewers, also for sewage disposal plant consisting of Imhoff tank, disinfecting plant, etc.

San Benito, Tex.—Until about Oct. 30, by J. H. Lyons, Mayor, for constructing a sewage disposal plant to cost about $5,000. Texas Engineering & Sewer Company of Pittsburgh, Tex., Engrs.

Sumner, Wash.—Reported desired until Oct. 20, by J. B. Barron, Town Clk., for constructing lateral sewers on Ryan St. Probable cost, $11,000.

Enterprise, Ore.—Reported desired until Oct. 20 by W. F. Savage, City Recorder, for constructing about 24,000 lin. ft. lateral sewers.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Boston, Mass.—The following are the four lowest bids opened Oct. 6 by the Metropolitan Water and Sewerage Board for constructing Section I of the Deer Island Outfall Sewer: George M. Bryne, 166 Devonshire Street, Boston, $43,370; Bay State Dredging & Contr. Co., Boston, $44,358; J. H. Ferguson, Dorchester, $50,584; W. H. Ellis & Son Co., East Boston, $57,832. The detail bid of George M. Bryne, the lowest bidder, is as follows: 765 ft. 78-in. outfall sewer in trench, $18.00; 400 ft. 60-in. c.-i. pipes in dredged trench, $40.00; 20 yd. brick masonry, $20.00; 1650 yd. concrete masonry in trench, $8.00.

Atlantic City, N. J.—Following are the four lowest bids opened on Oct. 7 by City Comrs. for constructing extensions to the storm water drainage system: James Ferry & Sons, 2411 Madison Avenue, Baltimore, Md., $125,921; M. B. Markland, 1315 Atlantic Avenue, Atlantic City, $147,856; Culp Co., Inc., East Forty-third Street and Twentieth Avenue, Paterson, $150,039; Atlantic Constr. & Supply Co., 925 Mediterranean Avenue, Atlantic City, $159,598. D. H. V. Bell, City Clerk.

★**Glen Gardner, N. J.**—Contract awarded by Bd. of Managers, New Jersey Sanitarium for Tuberculous Diseases, for additions to sewage disposal plant (bids opened Oct. 4) to New York Sewage Disposal Co., New York, N. Y.

Findlay, Ohio.—Lowest bid opened Oct. 5 for constructing storm and sanitary sewers on West Lincoln and Hardin Streets submitted by William Wilson of Findlay. Joe Page, City Clerk.

★**Knox, Ind.**—County Auditor writes, contract for constructing sewers and three iron bridges awarded Rochester Bridge Co., Rochester, Ind. E. E. Horner of Knox, Ind., and O. Lucas of Aldine, Ind. (bids opened Oct. 5).

★**Forest Grove, Ore.**—Following are three [illegible] received recently by City Council for constructing a sewer system. Bids are the same on clay and concrete pipe: E. W. Elliott, Portland, $58,448 (awarded contract); Jacobsen Bade Co., Portland, $63,440; Giebisch & Joplin, Portland, $66,421.

Visalia, Cal.—The following are the four lowest bids opened Oct. 6 for constructing sewers: Michael Murphy, 1321 Milvia Street, Berkeley, $40,500; C. L. Bienfield, San Francisco, $40,865; Miagennovich & Gillespie, Los Angeles, $41,825; James Kennedy, San Francisco, $47,251. L. E. McCabe, city engineer.

BRIDGES

PROPOSED WORK.

Buffalo, N. Y.—Public Service Comn. considering plans for constructing Harlem Avenue viaduct; cost $400,000. The state to contribute $100,000 of cost.

Paterson, N. J.—Contract about to be let by Bd. Freeholders for erecting bridge over Passaic River on Newark-Pompton Turnpike; cost about $40,000. Garwood Ferguson, County Engr.

Bethlehem, Pa.—Reported commissioners of Lehigh and Northampton counties will repair and strengthen wooden bridge across Lehigh River here. Estimated cost $40,000. Robert Rathbun of Allentown, engineer for Lehigh County.

Phoenixville, Pa.—E. H. Davis, Whitehall Building, New York, engaged by the Commissioners of Montgomery and Chester Counties as Consulting Engineer to design and superintend construction of a reinforced concrete bridge over the Schuylkill River between Phoenixville and Mont Clare to replace large covered bridge destroyed by fire early this summer. Bids opened Sept. 30 for this bridge were rejected.

Charleston, S. C.—The Carolina, Atlantic & Western Ry. Co. applied to War Dept. for permission to construct draw bridges over Ashley, Stono, Edisto and Ashepoo Rivers in South Carolina.

Chattanooga, Tenn.—Reported Southern Ry. Co. (W. H. Wells, Acting Ch. Engr., Washington, D. C.) contemplates erecting concrete bridge over railroad tracks at Oak Street on site of present structure.

Indianapolis, Ind.—City Council has appropriated $75,000 for constructing a stone bridge over Fall Creek at North Meridian Street. The County Commissioners are to appropriate a like sum. The complete bridge to cost $150,000.

Mankato, Minn.—H. F. Blomquist, City Engr., writes that no bids were opened Oct. 1 for constructing the concrete bridge across Minnesota River at Main Street. Changes are being made in the plans and no date yet set for the receiving of bids.

Minneapolis, Minn.—The city council has ordered an issue of $85,000 bond for continuing work on construction of the ornamental concrete arch bridge across Mississippi River at Third Avenue, south.

Columbus, Mont.—See "Paving and Roads."

Galveston, Tex.—Bartholow-Willits Eng. Co., 2202 Mechanic Street, are Managing Engineers of the proposed bridge to be constructed across the bay to serve during the construction of the causeway. It has not been definitely decided whether the bridge will be built, but if constructed it is to be wood on pile foundations and cost $40,000.

Afton, Okla.—See "Public Buildings and Schools."

BIDS DESIRED.

Newark, N. J.—Until Oct. 25, by Wm. Cardwell, Chmn. Com. on Roads, Assessments and Speedways, Co. Bd. Chosen Freeholders, Newark, for constructing a concrete steel I-beam bridge on Hobart Gap Rd. over Canoe Brook, Livingston Township. Fred A. Reimer, Co. Engr.

Sharon, Pa.—Until Oct. 19 by County Commissioners, Mercer (H. T. Comstock, Clk), for furnishing material and constructing a highway bridge, including substructure and superstructure, over Shenango River on State Street, and dredging Shenango River above and below site of bridge. Bids to be submitted on alternate designs of steel and concrete bridges. Lewis E. Burnside, Grove City, County Engr.

Frederick, Md.—Until Oct. 19 by State Roads Comn. (W. M. Marcy, Secy.), Baltimore, for Contr. F 23—Repointing walls and coping, Jug Bridge over Monacacy River, along State Road east of Frederick.

Blairsville, Ga.—Until Oct. 23, by V. I. Butt, Ordinary, Union County, for constructing a 192 ft. steel bridge known as Thompson Bridge, across Notla River, main span, 112 ft., west approach 30 ft. span, east approach 25 ft. span, substructure to consist of two reinforced concrete piers, and two reinforced concrete abutments with wing walls, etc.

Covington, Ky.—Until Oct. 28 by J. Mason Hawk, Comr. Pub. Property, for pier work for a bridge to carry duplicate supply main of Licking River advertised in Engineering Record. George Hornung, Consulting Engr., Wool-Sack Bldg., Newport.

Lebanon, Ind.—Until Oct. 18 by the County Commissioners for constructing two reinforced concrete bridges and repairing one bridge. D. M. Clark, County Auditor.

Mankato, Kan.—Until Oct. 26, by County Clerk, Mankato, for constructing Wilder Bridge, a steel truss superstructure, 80 ft. span, 16 ft. roadway, reinforced concrete floor, plain concrete abutments, on Buffalo Creek, 4.5 miles from Randalls Station.

Lincoln, Neb.—Until Oct. 22 by H. E. Wells, Co. Clk., for constructing bridge over Oak Creek Channel. Bids to be submitted on the following: 80-ft. steel span, 74-ft. reinforced concrete arch, double 60-ft. reinforced concrete arch, and double 50-ft. reinforced concrete arch.

Kansas City, Mo.—Until Oct. 21, at office of Allen C. Southern, Co. Controller, for constructing two steel bridges, embankment and rip-rap, a concrete bridge and plain concrete arch culvert.

St. Louis, Mo.—Until Oct. 22, by Board Public Service, for constructing reinforced concrete viaduct on Choteau Ave.

Harrisburg, Tex.—Until Nov. 1, by H. L. Washburn, Co. Aud., Houston, for constructing bridge over Brays Bayou at Harrisburg. H. L. Washburn, Co. Engr.

Walla Walla, Wash.—Until Oct. 25 by County Commissioners for constructing a steel truss bridge with tubular piers, 100-ft. span. G. C. Cookerly, County Engineer.

Madera, Cal.—Until Oct. 18 for constructing a bridge over Fresno River at D Street, to cost $10,500. Leonard & Day, San Francisco, Designing Engineers. W. C. Utter, City Clerk.

San Diego, Cal.—Until Oct. 21, by J. T. Butler, Clk. Co. Bd. Superv., for constructing reinforced concrete bridge over San Elijo Lagoon, on State Highway at Cardiff.

San Jose, Cal.—Until Oct. 25, by Henry A. Pfister, Clk. Co. Bd. Superv., for constructing reinforced concrete bridge on New Avenue.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Providence, R. I.**—Contract for steel work for highway bridge over Moshassuck River at Randall St. awarded by Bd. Contract & Supply (bids opened Sept. 27) to Shoemaker Co., Hartstown, Pa., at $4,870.

★**Batavia, Ohio.**—Contract for constructing bridge over Little Fork of Big Miami River, known as Milford Bridge (bids opened Oct. 4), has been awarded Rochester Bridge Co., Cincinnati. C. Searles, Co. Aud.

★**Crown Point, Ind.**—Edward Simon, county auditor, writes contract awarded for constructing pony truss span bridge over Hart Ditch in town of Munster (bids opened Oct. 7) to Barnes & Shearer of Hobart at $4,696.

Cedar Rapids, Iowa—See "Paving and Roads."

Lawrence, Kan.—Following are the four lowest bids opened Oct. 6 for constructing reinforced-concrete bridge: Missouri Valley Bridge & Iron Co., Leavenworth, Kan., $199,910; Monarch Engineering Co., Fall City, Neb., $209,769; Winston Bros., Minneapolis, Minn., $211,-052; Vang Constr. Co., Chattanooga, Tenn., $214,000; Hedrick & Cochrane, consulting engineers, Interstate Bldg., Kansas City, Mo.

★**Leavenworth, Kan.**—Contracts for constructing twenty-seven county bridger awarded by County Comrs. Sept. 28 to Leavenworth Bridge Co., Leavenworth, E. F. Bowman and J. F. Ward; total cost $26,787.

★**Nashua, N. H.**—Following are four lowest bids opened recently for constructing reinforced concrete bridge over Pennichuck Brook between Nashua and Merrimack: Hynes Constr. Co., $10,360; alternate bid, $8.500 (awarded on alternate bid); H. P. Cummings, $10,974; Bay State Dredging and Constr. Co., $11,500; alternate bid, $11,300; C. W. Keith, $11,-545; George P. Winn, city engineer.

PAVING AND ROADS

PROPOSED WORK.

Boston, Mass.—Mayor Curley recommends expenditure next year of $1,000,000 for street pavements.

Buffalo, N. Y.—State Highway Department has notified Board of Supervisors of its approval of the county's plan for the improvement of the Transit Road from Depew to the Buffalo city line at Broadway. It is proposed to construct about 4½ miles of road, one section waterbound macadam, one section bituminous macadam and one section concrete. Cost to the county about $90,000.

Contract about to be let for paving East Woodlawn and Heusey Avenues with asphalt and Spaulding and Springer Streets with brick.

Montclair, N. J.—Harry Trippett, Town Clk., writes all bids opened Oct. 11 for paving Upper Mountain Avenue have been rejected.

Greensboro, N. C.—Macadam road 2 miles long is to be constructed between Greensboro and High Point by county.

Greenville, N. C.—Road bonds amounting to $100,000 will be sold Nov. 1 by County Commissioners (Brascoe Bell, Clerk); advertised in Engineering Record.

Eustis, Fla.—See "Sewerage and Sewage Disposal."

Starke, Fla.—See "Sewerage and Sewage Disposal."

Euclid, Ohio.—$12,352 bonds will be sold Nov. 8 by H. S. Dunlop, Village Clk., for paving Chardon Road with brick.

Independence, Ohio.—Bonds for $9,500 will be sold Nov. 1 by Arthur J. Goudy, Village Clk., for improving Breckville Road.

Lorain, Ohio.—County Comrs. considering paving Lake Shore Drive from city limits of Lorain to Cuyahoga county line.

Zanesville, O.—County Comrs. considering grading, graveling and macadamizing South River Rd.; cost about $49,000.

Crown Point, Ind.—Gravel road bonds amounting to $572,000 have been sold by county commissioner.

Hartford City, Ind.—Contract soon to be let by County Commissioners for constructing Brown Studabaker and Philebaum Road.

Geneva, Ill.—Property owners of West Third Street have petitioned board of local improvements for brick pavement.

Peoria, Ill.—Bd. Local Improvements considering paving Seventh Avenue, Kansas Street and New York Street.

Frederic, Wis.—See "Waterworks."

Hibbing, Minn.—The injunction restraining the city from constructing a paved highway from Hibbing to Alice, a distance of one mile, and completing a long concrete conduit for sewers, has been dismissed. It is expected work will be under way very soon.

Minneapolis, Minn.—City Council has been asked to make an appropriation for paving the creosoted wood block on Cedar Avenue about eight blocks and on Thirty-eighth Street about twelve blocks.

Columbus, Mont.—About $150,000 to be spent by Comrs. Stillwater County for constructing roads and bridges.

Hardin, Mont.—R. P. Ross, County Clerk, writes all bids opened Oct. 4 for constructing about 4½ miles of road between Big Horn River Bridge and Dry Creek rejected.

Beaumont, Tex.—See "Hydraulic Construction and River Improvement."

Oakville, Wash.—City Council contemplates paving 1½ miles.

Walla Walla, Wash.—Rights-of-way for construction of Touchet-Wallula portion of Inland Empire Highway, distance 15 miles, secured by County Comrs. Contract soon be let by State Highway Dept. at Olympia.

Los Angeles, Cal.—Plans being prepared for paving First Street from Lake Shore to Vermont Avenues. Homer Hamlin, city engineer.

Kingman, Ariz.—Citizens of Mojave County voted $100,000 bonds for constructing roads in county.

BIDS DESIRED.

Massachusetts.—Until Oct. 19, by Massachusetts Highway Commission, Boston, for constructing highways in towns of Grafton and Upton, in all about 22,300 sq. ft.

Brooklyn, N. Y.—Until Oct. 20 by L. H. Pounds, Borough Pres., for regulating and repaving portions of Bridge St., about 1800 sq. yd. Grade 1 granite pavement, 6-in. concrete foundation, etc.; also for grading, curbing and laying sidewalks on portions of Ditmas, Ralph Avenues, and E. Eighty-third Street, about 20,130 sq. ft. cement sidewalk, 4320 lin. ft. steel bound cement curb, etc. Total security $6,700.

Bethlehem, Pa.—Until Oct. 25, by County Commissioners, at Easton, for paving with brick and concrete, roadway and constructing sidewalk of Inter-County Bridge No. 88 over Monocacy Creek, Broad Street, Bethlehem. George P. Young, Co. Controller.

Greensburg, Pa.—Reported desired until Oct. 26 by John S. Sell, Co. Controller, Greensburg, for paving, curbing, etc., Scottsdale, Tyrone Road and Jeanette Grapeville Road.

Pennsylvania.—Until Nov. 4 by State Highway Department, Harrisburg, for reconstructing the following roads:

Indiana County, Marian Center Borough, 4054 ft., with brick block.

Montgomery County, Narberth Borough, 1756 ft. bituminous or cement concrete.

Lawrence County, Hickory Township, 5508 ft. telford macadam. Robert J. Cunningham, State Highway Comr.

Pittsburgh, Pa.—Until Oct. 29, by Hyatt M. Cribbs, County Controller, for improving roads as follows: Clinton and Frankfort Road, near village of Clinton, for distance of 2.4 miles; and Beatty Road, Patton Township, a distance of 2.9 miles.

Hagerstown, Md.—Until Oct. 19 by Co. Comrs. (Harry M. Hartle, Clk.) for constructing section of State Aid Highway in Washington County, along Cearfoss Road, a distance of 1.12 miles.

Camden, Ala.—Reported desired until Nov. 1 by Blair Hughes, Co. Road Superv., for constructing clay and sand or clay and gravel road from limit of first 5 mile, Camden, and Oak Hill and Pineapple Road to Oak Hill, about 10 miles.

Elizabethton, Tenn.—Until Oct. 29 by Bd. County Road Comrs. (L. D. Gasteiger, of Bremer, Secy.) for constructing approximately 70 miles graded road; also completing and repairing other roads, constructing small concrete bridges and culverts.

Euclid, Ohio—Until Nov. 8 by H. S. Dunlop, Village Clk., for furnishing material and paving with brick portion of Chardon Road. F. A. Pease, Village Engr., Marshall Bldg., Cleveland.

Findlay, Ohio—Until Oct. 22, by J. Page, Clk. Dir. Pub. Service, for furnishing material and improving portions of Park Avenue and Cory Street with brick.

Franklin, Ind.—Until Oct. 20 by the County Commissioners for constructing ⅝ mile of gravel road on Johnson-Marion County line. A. L. Knox, County Auditor.

Sault Ste. Marie, Mich.—Until Oct. 18 by H. A. Osborn, County Road Comr., for 7½ miles, 14 ft. wide, stone or gravel, roadway.

Chicago, Ill.—Until Oct. 18 by Bd. Local Improv. (Edw. J. Glackin, Secy.) for improving alleys, South Avenue, Darwin Terrace and other streets. Bids to be submitted on vitr. paving brick, Portland cement concrete, asphalt and other paving.

Rockford, Ill.—Reported desired until Oct. 20, for macadamizing Fourth and Thirteenth Streets. Address Edwin Main, City Engr.

Akron, Iowa.—Reported desired until Oct. 18 by S. W. Burnette, City Clk., for 15,000 sq. yd. concrete paving. C. B. Wooley, Engr., Le Mars.

Independence, Kan.—Until Oct. 21 (readvertisement) by G. H. Krienhagen, City Clerk, for about 18,000 sq. yd. brick pavement and 12,000 lin. ft. curb and gutter. G. E. Weaver, Engineer, Independence.

Dennison, Tex.—Reported desired until Oct. 19 by Robert Gerlach, City Secy., for constructing about 13,000 sq. yd. paving, 5-in. concrete base, 2-in. asphalt wearing surface, curbing, guttering, etc. A. B. Clenny, City Engr.

Pomeroy, Wash.—Reported desired until Nov. 1 by E. D. Smith, Chmn. Bd. Co. Comrs., for improving and extending Permanent Highway No. 1. Radford W. Rigsby, Co. Engr.

Troutsdale, Ore.—Reported desired until Oct. 18 by W. L. Lightner, Chmn. Bd. Co. Comrs., Portland, for constructing under crossings on Sandy Road, near Troutsdale, Multnomah County, in all about 550 cu. yd. concrete, 30 ton structural steel, 12,000 lb. reinforced steel, etc.

Corona, Cal.—Until Oct. 19 by Board City Trustees at office of M. Terpenning, City Clk., for improving with concrete and macadam pavement and culverts North Main and River Streets, about 1 mile.

Los Angeles, Cal.—Until Oct. 25 by H. J. Leland, Clk. Co. Bd. of Supervisors, for constructing oiled macadam pavement with reinforced concrete culverts, etc.; streets in Road Improv. Dist. No. 44. Engineer's estimate $6,414.

Riverside, Cal.—Reported desired until Oct. 21, by Board Supervisors, for grading and oiling approximately 50 miles of India Permanent Road Division.

Yuma, Ariz.—Until Oct. 25 by Board Supervisors (R. I. Winn, Clk.) for separate bids on work as follows: 20,000 bbls. Portland cement, 5500 bbl. asphaltic oil, about 2000 ft. cor.-iron pipe, about 16 miles concrete pavement, with light surfacing, reinforced concrete culverts, etc.; about 17 miles 2-in. oil macadam, 4-in. cement road gravel base, 16 ft. wide, etc.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Buffalo, N. Y.**—Bd. Aldermen voted to award contract for repaving Mortimer Street to Henry P. Burgard Co., 1968 Fillmore Avenue, at $25,225.

★Contract awarded by Commissioner of Public Works to the German Rock, Asphalt & Cement Co., Ltd., D. S. Morgan Bldg., for paving with German rock asphalt Virgil Avenue from Hertel Avenue to Tacoma Place, at $12,120.

★**Kenmore, N. Y.**—Contract for paving Cornell Avenue with asphalt awarded by Village Bd. to H. P. Burgard Co., Buffalo, at $10,500.

Jersey City, N. J.—Lowest bids opened Oct. 7 by Bd. Chosen Freeholders, Jersey City, for improving Passaic Avenue, Kearny, was submitted by Northern Constr. Co., Newark, at 97½ per cent, total $39,-516; engineer's estimate $40,530; and improving Paterson Plank Road, Nolan & Hornung Constr. Co., West Hoboken, at 72 per cent; total $44,003; engineer's estimate $61,115.

Newark, N. J.—Following are four lowest bids opened Oct. 7 by Board of Street and Water Commissioners for paving Chelsea Avenue from South Orange Avenue to the city line: Northern Constr. Co., Newark, $10,512; Newton Paving Co., Trenton, $10,807; W. T. S. Crichfield, Hoboken, $10,809; Continental Public Works Co., Kearny, $10,838.

★**Mount Union, Pa.**—Contract for constructing about 16,000 yd. of paving and 8000 ft. of curbing (bids opened Oct. 4), awarded Curwensville Constr. Co., Curwensville, using mack, paxton and clearfield blocks. D. W. Dillman, Borough Engr., Altoona.

Baltimore, Md.—All bids opened by Bd. Awards Sept. 22 for paving Ellicott Driveway rejected. Grading contract about to be let and paving postponed to next year.

★**Dayton, Tenn.**—Contract for constructing section of Dixie Highway awarded by County Highway Comn. (bids opened Sept. 23) to Freeman & Robins, Knoxville, at $210,000.

★**Mayfield, Ky.**—Contract for graveling 11 miles Mayfield and Paris Tenn. Road, awarded by Graves Fiscal Court to C. E. Cresap & Bro., Humboldt, Tenn., at $25,285.

★**Cleveland Heights, Ohio.**—Cleveland Trinidad Paving Co., Cleveland, secured contract for paving Derbyshire Road and Cedar Road with asphalt macadam.

★**East Liverpool, Ohio.**—Contract for constructing Camp Ground Road (bids opened Oct. 5) awarded Patterson & Grafton, Wellsville, at $22,918. Next three lowest bidders: Rinehart Bros., $22,938; Jones Constr. Co., $25,143; Graham & King, $26,949. The detail bid of Patterson & Grafton, the successful bidder, is as follows: 8000 cu. yd. excav., 50 cts.; 5273 sq. yd. brick paving, $1.73; 6180 sq. yd. concrete paving, $1.15; 6180 sq. yd. reinforced fabric, 12 cts.; 2280 ft. armored joint, 15 cts.; 14,196 ft. broken stone shoulder, 10 cts.; 32 ft. 10-in. c.-i. pipe, $1.50; 40 ft. 24-in. terra cotta pipe, $1.25; 50 ft. 12-in. terra cotta pipe, $1.20; 900 ft. 4-in. drain tile, 10 cts. John N. George, Engr., First Natl. Bank Building.

Bloomington, Ind.—Following are four lowest bids opened Oct. 5 by County Commissioners for constructing Oolitic and Bedford concrete highway, 2½ miles on Dixie Highway: Stewart & Dunn, $46,987; Ewing Shields, $48,117; R. E. M. Constr. Co., $49,560; George W. Elbertson, $49,571.

★**Franklin, Ind.**—H. L. Knox, County Auditor, writes contract awarded Oct. 4 for constructing 2 gravel roads to Byers & Byers of Trafalgar.

★**Indiana**—Contract for constructing 2½ miles of gravel road (bids opened Oct. 8) awarded John W. Murphy, Greenwood. H. L. Knox, county auditor, Franklin.

★**Indianapolis, Ind.**—Contract for resurfacing Capitol Avenue from Indiana Avenue to Tenth Street with asphalt awarded by Bd. Pub. Wks. to Republic Constr. Co., Indianapolis, at $3.35 per lin ft. on each side of street.

★**Decatur, Ill.**—Contract awarded by Board of Local Improvements to S. A. Tuttle at $34,712 for paving Hilton, Jasper, Prairie, Illinois and Cerro Gordo Streets.

★**Winamac, Ind.**—Contract for constructing Reinholdt Gravel Road in Tippecanoe Township (bids opened Oct. 5), awarded John E. Bair of Winamac, at $8,265.

Cedar Rapids, Iowa.—Lowest bid opened by City Council for paving "B" Avenue bridge with creosote block submitted by Ford Paving Co., Cedar Rapids, at $2.74 per sq. yd.

★Contract for paving Third Avenue between First and Fourth Streets and Third Avenue bridge with creosote block awarded to Ford Paving Co., Cedar Rapids, at $2.79 and $2.95 per sq. yd. respectively.

★**Ottumwa, Iowa.**—City Council awarded a contract to Keokuk Quarry & Constr., Keokuk, for paving streets at cost of about $30,000.

★**Minot, N. D.**—Contract awarded Minot Constr. Co., Minot, for 3½ miles street grading, curbs and gutters (bids opened Oct. 4), at $33,742. A. D. Hagenstein, City Auditor.

★**Great Falls, Mont.**—Contract for paving about Whittier Park with bitulithic awarded by Park Bd. to Birch & Sons, Great Falls, at $24,598.

★**Oregon, Mo.**—The contract for paving, guttering and grading portions of Washington, Missouri, Main and Nodaway Streets (bids opened Oct. 1), awarded to A. Jaicks Co., 510 American Bank Building, Kansas City, Mo., at the following bid: 1578 cu. yd. of grading (earth) 25 cts.; 5926 lin. ft. concrete combined curb and gutter, 84 cts.; 16,550 sq. yd. asphaltic concrete pavt., $1.84, total $35,-100. D. B. Kunkel, city clerk.

★**St. Louis, Mo.**—Contract for paving with brick awarded as follows: Skrainka Constr. Co., Security Building, on Marcus Avenue, 2895 sq. yd., at $7,685; Webb Kunze Constr. Co., 5927 Tyler Avenue, on Tower Grove Avenue, 4905 sq. yd., at $13,133; Eyermann Constr. Co., St. Louis, Spring Avenue, 3655 sq. yd., at $10,592, and John McMahon, St. Louis, on Soulard Street, 9295 sq. yd., at $22,406.

Newark, N. J.—Following are the detail bids of the four lowest bids opened Oct. 7 by Board of State Water Comrs. for paving Sussex Avenue from Summit Street to Warren Street: (a) W. T. S. Crichfield, $23,850; Union Paving Co., $25,235; Standard Bitulithic Co., $25,781; Continental Public Works Co., $26,300:

	(a)	(b)	(c)	(d)
21,200 sq. yd. asphalt resurfacing	$0.99	$1.04	$1.07	$1.09
250 sq. yd. asphalt on old concrete	0.90	1.25	1.00	1.25
150 sq. yd. brick on old concrete	0.40	1.25	2.00	1.40
200 lin. ft. 16 x 5-in. curb	0.70	0.75	0.70	0.75
50 lin. ft. old curb	0.35	0.45	0.30	0.35
5 basins with single inlet	60.00	85.00	95.00	85.00
6 basins with old connections	75.00	85.00	80.00	90.00
4 basins with double inlet	80.00	95.00	100.00	90.00
7,500 sq. ft. artificial stone walk	0.18	0.16	0.12½	0.16½

★**East Liverpool, Ohio.**—Following are detail bids of four lowest bidders for constructing Thompson Park Road (bids opened Oct. 5 by Liverpool Township Trus.): (a) Mclaughlin & Allison, $41,268 (awarded contract); (b) Rinehart Bros., $32,398; (c) Hixson & Cunningham, $36,54; (d) Jones Constr. Co., $36,212. John N. George, Engr., First Natl. Bank Building.

	(a)	(b)	(c)	(d)
25,568 cu. yd. excav.	$0.40	$0.40	$0.30	$0.50
7,346 sq. yd brick paving	1.45	1.55	1.70	1.62
4,361 sq. yd concrete paving	1.24	1.30	1.40	1.62
5,151 sq. yd. reinforced fabric	0.04	0.12	...	0.10
1,[illegible] armored joints	0.20	0.15	0.15	0.20
15,854 ft broken stone shoulder	0.12	0.10	0.11	0.15
6,[illegible] ft 10-in. c.-i. pipe	0.75	0.50	...	...
2[illegible] ft. 24-in. c.-i. pipe	1.50	1.25	2.00	1.75
2[illegible] ft. 12-in. terra cotta pipe	0.75	0.75	1.00	0.50
2[illegible] ft. 4-in. drain tile	0.10	0.10	0.20	0.15
9[illegible] ft. 15-in. terra cotta pipe	0.80	1.00	1.25	0.75
[illegible] 1:2:4 concrete	5.00	7.00	7.00	9.00
11[illegible] 1:3:6 cyclopean masonry	4.50	5.00	6.00	6.00

★**San Antonio, Tex.**—Contract for applying tarvia to about 17 miles Bexar County roads awarded to Finley Method Co. at 34 cents per sq. yd.

★**Pawnee, Okla.**—Contract for paving in Dist. No. 1 awarded M. A. Swadek & Co., Oklahoma City, at $4,419 (bids opened Oct. 4 by City Clerk). Other bidders: Elliott & Valree Parsons, Kan., $52,545; Charles H. Shaw Lawton, $60,822, and Carmody Constr. Co., El Reno, at $62,136. Paving to be vertical fiber vitr. brick Secos, 1½-in. sand cushion, 4-in. concrete base, with curbs and storm sewers. Benham Engineering Co., Colcord Building, Oklahoma City, Engineers.

★**Prosser, Wash.**—Contract for constructing Permanent Highway No. 5 awarded to Counter Comrs. to A. H. Zane & Co., North Yakima, at $19,230.

★**Seattle, Wash.**—Contract for paving East and West Green Lake Way awarded to Jel Pole Wire to R. G. Stevenson, 1327 Ewing Street, at $196,395.

Hermosa Beach, Cal. — Lowest bid opened by city for paving Twenty-sixth Street, Manhattan Court, Hawthorne Avenue, Bard's Avenue, with concrete and constructing concrete sidewalks submitted by California-Arizona Constr. Co., 1700 E. Washington Street, Los Angeles, at $18,579.

★**Los Angeles, Cal.**—Contract for improving Twenty-second Street awarded by city to George H. Oswald, O. T. Johnson Building, at $10,838.

★**San Jose, Cal.**—Contract for constructing 4½ miles macadam road from Bascome Avenue to Prospect Road, awarded by Bd. Superv. to J. W. McDonald, at $49,497.

Ontario, Cal.—Lowest bid opened by city for 345,000 sq. ft. concrete, 152,000 sq. ft. macadam pavements submitted by Ford & Stout, 736 Bradbury Bldg., Los Angeles, at $57,068.

★**Phoenix, Ariz.**—Contract awarded California Arizona Construction Company, Phoenix, for 25,000 sq. yd. of bituthic pavement at $2.10 per square yard. V. A. Thompson, superintendent of streets.

STREET CLEANING AND GARBAGE DISPOSAL

PROPOSED WORK.

Mason City, Iowa.—E. J. Jones at Macon, Ga., has been engaged to prepare plans and specifications for a garbage disposal plant, cost $8,000.

Bartlesville, Okla.—See "Miscellaneous."

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Rock Island, Ill.**—We are informed that contract for constructing a Decarie incinerator awarded Stacy Bates Co., Minneapolis Minn., at $20,250.

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS

PROPOSED WORK.

Flood Improvement—Erie, Pa.—Reported the Council is considering a bond issue of $1,000,000 for the prevention of floods in Mill Creek, various sets of plans have been submitted by Farley Garrett, Consulting Engineer, of Harrisburg, the least expensive being about $[illegible],000 exclusive of land damages.

Dams—Norfolk, Va.—The Finance Committee has voted to recommend to the Council that $[illegible] be authorized for the purpose of repairing the two Little Creek dams and the spillway. It was decided to postpone for the present the rebuilding of Lake Taylor dam and spillway estimated to cost about $25,000, and the repair of the other water basin, estimated at $25,000.

Dams—Granite Falls, N. C.—Reported Granite Falls Manufacturing Co. intends constructing a C.-I. dam and enlarging equipment to electric drive, cost $[illegible],000.

Hydroelectric Plant—Lenoir, N. C.—Citizens Light & Power Co. of Lenoir writes that the report that they propose constructing a hydroelectric plant is incorrect.

Piers—Norfolk, Va.—The Norfolk & Western Railroad, it is reported, will soon let contract for building at Lambert Point two coastwise warehouse piers costing $1,800,000.

Dyke Improvement—Wellsville, Ohio.—At the coming election the citizens will probably vote on issuing $60,000 bonds for necessary dike construction for protection of city from high water.

Ditch Improvement—Lawrenceville, Ind.—Contract soon to be let by the England Pond, Drainage Ditch Commissioners for redredging ditch in the district; 10½ miles to be redredged and in some places widened and deepened.

Dock—Ashland, Wis.—The Soo intends constructing an ore dock. C. N. Kalk, Ch. Engr., Minneapolis, Minn.

Ditch Improvements—Crookston, Minn.—State Board of Immigration, St. Paul, voted to spend $15,000 appropriated by the Legislature to improve Sandhill River ditch in Polk County.

Ditch Bonds — Owatonna, Minn.—The State Board of Investment has made a loan to Steel County on county bond for ditch work.

Levee Improvement—Harrisonville, Mo.—It is proposed to form drain levee district between Bates and Cass County Drainage District, comprising 1,000,000 yd. of dirt. Contract will be let in about 60 days.

Levee Improvement — Nevada, Mo.—Commissioners of Vernon County are taking preliminary steps toward constructing levee improvement along Maries Des Cygnes River preparatory to organizing a drainage district.

Wharf Bonds—Beaumont, Tex.—Wharf bonds amounting to $100,000, street improvement $85,000 and sewer $40,000 have been sold.

Drainage—Corpus Christi, Tex.—Attorney-General approved $158,000 Nueces County Drainage Dist. No. 2 bonds.

Levee Improvement—Fort Worth, Tex.—Reported survey being made by Arthur A. Stiles of Austin, State Reclamation Agent, for the northside levee district.

Irrigation—North Yakima, Wash.—The Secretary of the Union Gap Irrigation Co. writes that it is proposed to reconstruct the old works and to make general improvements. Contract soon to be let.

★**Hydro Electric Plant—Cornucopia, Ore.**—Baker Mines Co., it is reported, is planning to install a hydroelectric plant in Pine Creek to supply electricity to operate an air compressor and milling machinery. Approximately 10,000 ft. of pipe line will be built, and two water wheels and other equipment installed. The plant will have an output of from 400 to 500 hp.

Irrigation — Culver, Ore.—The Suttles Lake Irrigation Dist. of Culver recently voted in favor of issuing bonds for the construction of an irrigation and water system to water 12,000 acres. Total cost of the project estimated at $532,390. A gravity system is proposed with a storage reservoir at Suttles and Blue Lakes.

Irrigation—Los Angeles, Cal.—Board of Supervisors is considering issuing $2,600,000 bonds for organization of irrigation district No. 3.

Pier — Panama. — Reported plans prepared for a fourth pier to be constructed at port of Cristobal. Address the Panama Commission, Washington, D. C.

BIDS DESIRED.

Terminal Contract 2-P—Albany, N. Y.—Until Nov. 9 by W. W. Wotherspoon, State Supt. Pub. Wks., for Terminal Contract 2-P, paving barge canal terminal at Albany, to consist of 11,230 sq. yd. stone block pave., 1800 lin. ft. concrete curbing, 3654 cu. yd. excav., 6300 lin. ft. drain, advertised in Engineering Record. Engineer's estimate $42,869.

Dredging—Sharon, Pa.—See "Bridges."

Dredging — Jacksonville, Fla. — Until Nov. 8 by U. S. Engineer Office, Jacksonville, for dredging and rock removal at Miami River and St. Lucie Inlet, Fla., advertised in Engineering Record.

Drainage Ditch—Henderson, Ky.—Reported desired until Oct. 27 by Co. Drainage Comrs. (O. A. Benton, Secy.) for drainage ditch about 34,810 ft. long.

Levee Work—Silver City, Miss.—Reported desired until Oct. 22 by Atchafalaya Drainage and Levee Dist. (R. L. Campbell, Secy.) for constructing 15 miles of canals, requiring 407,000 cu. yd. excav. and 90,000 cu. yd. levee work. M. H. Brewer, Engr., District Office.

Protection Wall—Franklin, O.—Until Oct. 18, by M. E. Ross, Clk. Co. Comrs., Lebanon, for furnishing material and constructing a 50-ft. head wall protection to north end of wall recently built on west side of Great Miami River. Bids to be submitted on piling and plank protection wall with rock and earth fill, or concrete protection wall with earth fill.

Levee Improvements—Shawneetown, Ill.—Until Oct. 20 by Rivers & Lakes Commission, 905 State Building, Chicago (Charles Christman, Secretary) for levee repairs in Shawneetown, advertised in Engineering Record. Approximate quantities 12,000 cu. yds. levee enlargement and repair.

Drainage—Bristol, Wis.—Until Oct. 28 by Town Supervisor for constructing drainage system for Bristol Drainage Dist., consisting of about 150,000 cu. yd. excav. and constructing bridges. William E. O'Brien, Engr., Kenosha.

Channel—Bedford, Iowa.—Reported desired until Oct. 17 by J. F. Hughes, Co. Aud., for constructing new channel for East Nodaway River.

Concrete Wall—Muscatine, Iowa—Until Oct. 20 (readvertisement) by H. W. Metzger, Secy., Muscatine Levee Improv. Comn., German American Savings Bank Bldg., for furnishing material and constructing concrete wall for terminal improvement along harbor line between harbor line and the east line of Chestnut Street, to consist of 700 cu. yd. earth excav., 4500 lin. ft. piling, 14,000 ft. sheet piling, left in place, 1443 cu. yd. concrete, etc. James J. Ryan, Engr. in charge, Muscatine.

Ditches—Albert Lea, Minn.—Reported desired until Oct. 19, by Fred Tavis, Co. Aud., for constructing Ditch No. 29, consisting of 15,407 24 to 6-in. tile, 2100 ft. open channel, underdrains, etc. Probable cost, $8,150. Rollin P. Briggs, Engr., Albert Lea.

Drainage Work—Kansas City, Kan.—Until Oct. 20 by P. W. J. Broll, Secy. Dir. Kaw Valley Drainage Dist. for constructing sewer gate on the river end of Santa Fe Ditch.

Ditches—Fargo, N. D.—Until about December for constructing two drainage ditches about 6 miles long each and to cost approximately $30,000 each. Samuel F. Crabbe of Fargo, Engr.

Levee Improvement—Butler, Mo.—Until Oct. 21 by W. F. Duvall, President of the Duvall-Percival Trust Co., Butler, for constructing approximately 10 miles of levee along Maries-Des Cygnes River, the Miami Ditch and the Lyons Levee. Work consists of the reconstruction of levee, waste banks and new work. All material will be obtained from both sides of the levee for part of the work and one side of the levee for the balance. Light clearing will be necessary for about thirty per cent. of the distance. Work is suitable for a small drag line or walking machine. Approximate estimate 150,000 cu. yd. Engineers, Towl Engineering Co., Omaha, Neb.

Revetment and Dike—Kansas City, Mo.—Until Oct. 20 by J. P. Langan, Purchasing Agent, for constructing shore revetment and pile dike, south of Parkville Bend of Missouri River, between Parkville and Kansas City, to consist of approximately 2700 ft. shore revetment and 250 ft. 2-pile dike.

Wharf Improvement—Beaumont, Tex.—Until Nov. 1 by Bd. Wharf & Dock Commissioners (J. F. Keith, Pres.), for furnishing material and labor for the following work: Quay construction, shed construction and freight handling machinery, advertised in Engineering Record. H. McL. Harding, Consulting Engr.; J. G. Sutton, City Secy.

Drainage System—Edna, Tex.—Reported desired until Oct. 28 by County drainage Comrs., Drainage Dist. No. 8 (A. E. Landin, Chmn.), for constructing canals and levees, straightening and cleaning water courses, to consist of 75 miles ditches, in all about 317,000 cu. yd. R. J. Bryan, Dist. Engr., Ganado, Tex.

Ditches—Westminster, Cal.—Until about December for constructing main drainage canal and laterals costing $25,000; bids on bonds will be received in November. S. H. Finley, designing engineer, Santa Ana. Willis H. Warner, Secy. of Drainage Commissioners.

PRICES AND LETTINGS.

★*Indicates award of contract.*

State Canal Work—Albany, N. Y.—W. W. Wotherspoon, State Superintendent of Public Works writes no bids submitted Oct. 6 for improving 3 mile harbor, eastern end of Long Island, about 34,000 cu. yds. excavation. Engineers estimate $8,500.

★**Pier — Greenville, N. J.** — Contract awarded Henry Steer, Inc., New York, N. Y., for constructing a pier in Greenville for the Pennsylvania R.R. Co. Pier to be 1000 ft. long, 200 ft. wide, have concrete deck on pile foundation, one-story shed.

Levee Work—New Orleans, La.—Lowest bid opened recently by State Board of Engineers, New Orleans, for constructing the Kennerville Levee in the parish of Jefferson, Mississippi Left Bank, about 125,000 cu. yds., was submitted by Dameron-White Co., at 9.43 cts. per cubic yd.

★**Levee Improvements—New Orleans, La.**—Following contracts awarded by State Bd. Engineers for levee improvements: Bossier Parish, Willow Chute, Red River, left bank, new levee, approx. 55,000 cu. yd., Douglas & Burt, Benton, 16 cts.; Gold Point Spur levee, Red River, left bank, new levee, approx. 15,000 cu. yd., J. H. Simson, Benton, 16.09 cts.; Riverside levee, Red River, left bank, new levee, approx. 125 cu. yd., and Colquit Point levee, Red River, left bank, new levee, approx. 36,000 cu. yd., both to Roach & Stansell, Memphis, Tenn., at 17 cts. and 14.50 cts. per cu. yd. respectively; Pat Cash levee, Red River, left bank, new levee, approx. 60,000 cu. yd., W. M. Rushing, Bayou Current, La., 13.97 cts.; Rapides Parish, Rocky Bayou levee, Red River, left bank, new levee, approx. 44,000 cu. yd., Charles J. Martin, Alexandria, 14.73 cts.

★**Levee Improvements—Shreveport, La.**—Following are contracts awarded Oct. 6 by State Bd. Engineers, New Orleans, for constructing levees in Caddo Parish.

Improving drainage in Kelly Bayou, Sect. 2, Caddo Parish, 275,000 cu. yd. of earth clearing in addition, Dutton & Nattin, Shreveport, 12.94 cts.; Upper Missionary levee, Red River, right bank, new levee, approximately 34,000 cu. yd., and Thompson levee, Red River, right bank, new levee, approx. 110,000 cu. yd., both to Noel Bros., Missionary, 12.48 and 13.68 cts. respectively; West Egypt levee, Red River, right bank, new levee, approx. 55,000 cu. yd., and Cedar Bluff levee, Red River, right bank, new levee, approx. 40,000 cu. yd., to F. M. Hearne, Missionary, at 10.98 and 11.50 cts. per cu. yd.; Long Point levee, Red River, right bank, approx. 30,000 cu. yd., and Loggie Lea levee, Red River, right bank, 100,000 cu. yd., to Hall Nattin, Shreveport, at 15.20 and 17.40 cts. per cu. yd.; Campo Bello levee, Red River, right bank, new levee, approx. 55,000 cu. yd., Douglas & Burt, Dixon, at 15.90 cts.

Seawall—Bay St. Louis, Miss.—Charles G. Moreau, president Seawall Comrs. District No. 1, writes no contract was awarded on bids opened Sept. 29 for constructing seawall on beach front from Bay St. Louis, Waveland dividing line, to northeast line of Waveland Terrace, about 7500 ft. long. Height of wall changed and new bids to be asked at once.

Operating Machinery at Dam 29, Ohio River—Cincinnati, Ohio.—J. & J. B. Millholland Co., 714 Fifth Avenue, Pittsburgh, Pa., submitted lowest bid as follows for furnishing operating machinery, etc., at Dam No. 29, Ohio River (bids opened Sept. 24) at U. S. Engineer's Office, in Cincinnati: Lot A, including duplex engine, cast-iron elbow, cast-iron plugs, etc., at $5,664; Lot B, water turbines, lap-welded wrought-iron pipe, tees, crosses, etc., at $7,453; Lot C, cast-iron cylinders, hand operating levers, etc., at $3,410.

The Miller Supply Co., Huntington, W. Va., submitted the lowest bid on Lot D, which includes air compressors, drainage receiver, feed water pumps, cast and malleable iron elbows, flanges, valves, etc., at $9,314.

★**Levee Improvements — South Bend, Ark.**—Contract for constructing 65,000 yd. of new levee (bids opened Oct. 4) awarded by Linwood & Auburn Levee Board at Varner, Ark., to Brown & Farley of Little Rock at 13.95 cts. per cu. yd.

★**Pumping Plants, Etc.—Quincy, Ill.**—Contract awarded by Board of Supervisors, Fabius River Drainage Dist., for constructing pumping station to Purdy & Henderson Co., and for the two 42-in. centrifugal pumps to United Engineering Co., both companies of Chicago, Ill. Total cost about $65,000. Harman Eng. Co., Engrs., Peoria.

★**Dike Improvement—Cathlamet, Wash.**—Following are bids opened recently by commissioners of Diking Dist. No. 1 for constructing 17 miles of dike in the Columbia River, including the construction of dikes, tide gates, inlet culverts, pump house, etc.: Montague O'Reilly Co., Portland, Ore., $98,614 (awarded contract); Grant Constr. Co., Seattle, Wash., $117,260; Fred E. Barnace, Portland, $138,860; Hans-Peterson, Seattle, $157,947. G. A. Kyle, consulting engineer, Spaiding Bldg., Portland, Ore.

Conduit—Lincoln, Neb.—Following are unit prices on bids opened Oct. 7 by City Clerk for constructing reinforced concrete conduit for Antelope Creek, approximately 1074 lin. ft. long: (a) Abel & Roberts, $35,240; (b) Burke-Cochrane Constr. Co., $35,844; (c) H. T. Ward Co., $35,952; (d) H. J. Cathroe Co., $36,226.

	(a)	(b)	(c)	(d)
1074 lin. ft. conduit	$32.60	$33.00	$33.20	$33.50
2 manholes	20.00	50.00	35.00	50.00
6 catchbasins	15.00	25.00	18.00	25.00
175 lin. ft. 15-in. pipe sewer	0.50	0.80	0.60	1.00
25 lin. ft. 12-in. pipe sewer	0.40	0.50	0.50	0.90

★**Drainage — North Yakima, Wash.** — Contract awarded to Dunn & Hogan, North Yakima, for constructing drainage work in Dist. No. 27 at $19,656.

★**Canal Improvement—Seaside, Ore.**—Contract for erecting cement headgates at the head of the Great Feeder Canal, awarded Wilson Bros. of Grant, Ore., at the following figures: Cement gate $8,-610; removing old gate, $175; caring for water while work in progress, $1,168.

★**Pier—Redondo Beach, Cal.**—Later reports state contracts awarded by Board of Trustees to McArthur Bros. Co. of New York for the triangular shaped pier.

★**Wharf — Esquimalt, B. C.**—Contract awarded to Taylor Engineering Company, Credit Foncier Building, Vancouver, for constructing wharf, warehouse, etc., at Esquimalt, for the Imperial Oil Company, to cost about $60,000.

★**Wharf—Pearl Harbor, T. H.**—Contract awarded Hawaiian Dredging Company of Honolulu for constructing a reinforced concrete wharf at the Naval Station, Pearl Harbor, at $155,900.

ELECTRIC RAILWAYS

PROPOSED WORK.

New York, N. Y.—Public Service Comn. for First Dist., 154 Nassau Street, has approved contract and plans for reconstruction of Brighton Beach elevated line in Brooklyn, submitted by the N. Y. Municipal Railway Corp. This contract involves the reconstruction of the line from Church Avenue northward to Malbone Street and the widening of this portion from two to four tracks and the reconstruction of three stations, namely, Church Avenue, Woodruff Avenue and Prospect Park stations; estimated cost of work $750,000 to $1,000,000. Also approved contract and plans submitted by N. Y. Municipal Ry. Corp for the construction of foundations and structures on Sect. No. 2 of the Jamaica elevated extension, comprising 2.2 miles of two-track elevated railroad running from Walnut Street along Jamaica Avenue to Cliffside Avenue. Also approved form of contract for same company for the erection of steel for additional tracks on the Myrtle Avenue line from Willoughby Avenue to Palmetto Street, as well as for certain additional work on the Lutheran Cemetery line.

Kinston, N. C.—Kinston Belt Line Ry. Co. incorporated to construct steam railroad around Kinston and an electric railway in Kinston. Capital $25,000. J. T. Deal, M. L. German among incorporators.

Sumter, S. C.—Plans being considered to construct electric railway from Sumter to Shiloh, distance about 32 miles. E. I. Reardon, Sumter, interested.

Florence, Ala.—Preliminary survey being made by Florence & Huntsville Interurban Ry. Co. for line between Florence and Elk River, 27 miles. T. H. Allen, Florence, Secy.

Des Moines, Iowa—Des Moines City Ry. Co. plans to rebuild 20 miles track and extend line over Seventh Street bridge.

Minneapolis, Minn.—The Electric Short Line Railroad, it is reported, has decided to construct 25 miles of additional track this fall.

Houston, Tex.—Construction work about to begin on constructing Houston, Richmond & Western Traction line between Houston and San Antonio.

Pueblo, Colo.—Plans being made by Arkansas Valley Ry. & Power Co. to construct line from Pueblo to State line.

San Jose, Cal.—Franchise granted to the San Jose Railroad Co. of San Jose for constructing an electric railway.

Coeur d'Alene, Idaho—Spokane & Inland Empire R. R. Co. received franchise from Council to construct single track steam and electric railway on streets of Coeur d'Alene.

Transcona, Man.—H. W. Adcock, Winnipeg, received franchise for constructing railway to Winnipeg city boundary.

Pearl Harbor, T. H.—All bids opened Sept. 18 by Bureau Yards and Docks, Navy Department, Washington, D. C., for constructing Marine Railway at the Naval Station, Pearl Harbor, had been rejected.

BIDS DESIRED.

New York, N. Y.—Until Oct. 19 by Pub. Service Comn., First Dist., 154 Nassau Street, for storm vitr. pipe drain, manholes, etc., for Queensboro Subway Rapid Transit Railroad, under Queens Boulevard.

PRICES AND LETTINGS.

★*Indicates award of contract.*

New York, N. Y.—Lowest bid opened Oct. 9 by New York Municipal Railway Corporation for 60,000 tons structural steel for new lines and terminals and reconstructing of existing terminals and lines was submitted by the American Bridge Co. at the following bid: 18,000 tons for East New York Division, $48 per ton; 24,000 tons, Fulton Street line, $42 per ton; 2100 ton Brighton Beach section, $42 per ton, and 15,000 tons Coney Island Terminal, $45 per ton. Lowest bid for the third tracking Jamaica Avenue requiring 3000 ton, was submitted by Conners Bros. at $48.80 per ton on the steel work alone, and complete work $215,168.

RAILROADS

PROPOSED WORK.

Paterson, N. J.—Erie R.R. Co. (R. C. Falconer, Supt. Constr., New York) is considering plans for grade crossings in Paterson.

Kinston, N. C.—See "Electric Railways."

Akron, Ohio.—The Pennsylvania R.R., Baltimore & Ohio, and Erie R.R. and the County Commissioners are considering the elimination of three grade crossings, namely the Wuchter crossing east of Akron, the Manchester Road crossing in Kenmore and the Tuscarawas Avenue crossing in Barberton.

Youngstown, Ohio.—The city and the Erie R.R. Co. are considering the elimination of grade crossings.

Decatur, Ind.—The Fort Wayne, Decatur & Southern R.R. Co. intends extending the line of the Fort Wayne & Springfield Ry., which they have recently taken over.

Indianapolis, Ind.—The Board of Public Works has directed the Pennsylvania R.R. Co. to elevate tracks from Ray Street to a point 300 ft. south of Harris Avenue. Work to be completed by latter part of next year.

Track elevation bonds amounting to $160,000 have been sold by the County Commissioners.

Mitchell, S. D.—The South Dakota & Western Railroad Co. reported incorporated by W. L. Bruce, W. E. Heaton and others, of Yankton, to build a railroad from Mitchell to Brule by way of Platte, a distance of 80 miles.

Graniteville, Mo.—Belleview & Western R.R. Co. of Graniteville incorporated to build a road from Graniteville to Belleview, a distance of three miles.

Newport, Ark.—Reported citizens have voted the Portland & West Coast Ry. Co. $100,000 to induce the said company to construct the first 15 miles of line from Portland to Newport. J. H. Fitzgerald, Manager of the road.

San Antonio, Tex.—Reported the receivership proceedings instituted against Missouri, Kansas & Texas R.R. Co. will not interfere with the plans of the company for the construction of the proposed million dollar passenger station and terminal in San Antonio.

Depew, Okla.—The Sapulpa & Oil Field Railroad Co. of Tulsa, incorporated and intends building a line 14 miles long from Depew to Drumright.

Portland, Ore.—The Portland & West Coasts R.R. & Navigation Co., Portland, intends building a railroad from Portland to Newport, via Bay City. J. H. Haak, Portland, President.

The Oregon, California & Eastern Railroad Company, reported incorporated for the purpose of constructing a 400 mile standard gage railroad in central Oregon. Robert C. Sterahorn, of Portland, reported interested, also William M. Ladd, of Portland.

PUBLIC BUILDINGS AND SCHOOLS

PROPOSED WORK.

Belmont (P. O. Boston), Mass.—Steps being taken for erecting high school; cost about $150,000.

Worcester, Mass.—Plans for fireproof brick building to be erected at Belmont Hospital are being prepared by Fuller & Delano Co., Worcester, Mass.; cost $50,-000. George C. Halcott, Superintendent Public Buildings.

Providence, R. I.—Board of Control and Supplies (Gilbert R. Parker, Secy.), is considering plans for detension home for children.

Buffalo, N. Y.—The Department of Public Works has been authorized to have plans prepared for improvements at the J. S. Adam Memorial Hospital, Perrysburg, to include addition to help dining room; addition to kitchen; school building, sewage disposal plant, etc. Cost about $50,000.

New York, N. Y.—Plans filed for erect-3-story brick asylum at Grand Boulevard and Kingsbridge Road for Society for Relief Destitute Blind; cost $250,000. M. L. & H. G. Emery, 68 Bible House.

East Rutherford, N. J.—John T. Simpson, Architect and Engineer, 1224 Essex Building, Newark, writes plans for 8-room fireproof school will be ready for bidders about Oct. 13. E. P. Hutten, Secretary Board of Education, 21 Lincoln Place. Estimated cost $34,500.

Lambertville, N. J.—City Council passed ordinance providing $62,000 bond issue for school improvements.

Paulsboro, N. J.—Plans prepared by Clyde S. Adams, 1509 Arch Street, Philadelphia, Pa., for a school which Board of Education will erect.

Flourtown, Pa.—Albert Kelsey, Perry Building, Philadelphia, Pa., selected to prepare plans for proposed Carson College for Orphan Girls.

Philadelphia, Pa.—Plans being prepared by J. Horace Cook, City Hall, for three-story, 92 x 220 ft., school to be erected at Allegheny Avenue and B Street.

Wilkinsburg, Pa.—School Board will rebuild Horner School, recently destroyed by fire.

York, Pa.—Directors of County Poor approved plans of B. F. Willis of York for almshouse.

Reported city intends erecting a library costing about $500,000. Address City Clk.

Savannah, Ga.—Henrik Wallin, 23 Abercorn Street, submitted preliminary plans to Auditorium Com. of Council for four-story building to be erected on Barnard Avenue.

Decatur, Ala.—School Board considering erection of high school or enlarging present building.

Akron, Ohio.—$400,000 school bonds will be sold Nov. 2 by Bd. Educ. (J. F. Barnhart, Clk.).

Dayton, Ohio.—Summerville School Dist. passed bond issue for $35,000 for erecting combination grade and high school.

Lafayette, Ind.—High school bonds amounting to $25,000 have been sold by Trustees of Randolph Township.

Rochester, Mich.—Citizens voted $25,000 bonds for erecting high school.

Geneva, Ill.—All bids opened recently by Board of Education for erecting six-room brick grade school have been rejected. New plans to be prepared and bids again asked. Cost not to exceed $30,000.

Menasha, Wis.—City intends erecting addition to high school; cost $30,000.

Waukesha, Wis.—Trustees Carroll College intend erecting boys' dormitory to cost $100,000.

Duluth, Minn.—Reported local architects will be asked to submit competitive plans for $30,000 Carnegie Library.

Minneapolis, Minn.—The Board of Education, it is reported, intends erecting an addition to the South High School. Estimated cost $175,000.

St. Cloud, Minn.—State Board of Investment, St. Paul, has approved a loan in this city of $100,000. This is to provide a fund for school buildings and is available at once.

North St. Paul, Minn.—A $40,000 school contemplated here. Address Bd. Educ.

St. Paul, Minn.—E. E. Corliss, Custodian of the State Capitol Building, has recommended to the Efficiency and Economy Board that the State erect an office building near the capitol to house many of the State departments.

Austin, Tex.—Plans being prepared by Atlee B. Ayers, state architect, San Antonio, for repairs to the state capitol; cost $125,000.

San Antonio, Tex.—Plans approved by Directors Agricultural and Mechanical College for new buildings to cost $115,000.

Afton, Okla.—Citizens of the county have voted $160,000 bonds, $75,000 for a court house, $85,000 for bridges.

Eugene, Ore.—Preliminary plans completed by Ellis F. Lawrence, Chamber of Commerce Bldg., Portland, for proposed Women's Memorial Building; cost $100,000.

Portland, Ore.—Erection of new building for Jefferson High School being considered by Bd. Educ.; cost about $80,000.

BIDS DESIRED.

Boston, Mass.—Until Oct. 19, by Schoolhouse Comrs. (Jos. P. Lomasney, Chmn.) for erecting addition to high school of Practical Arts, Dearborn Dist., Greenville and Winthrop Sts., Roxbury.

Providence, R. I.—Until Oct. 28 by Board of Control & Supply (Gilbert R. Parker, Secy.), State House, for erecting dormitory at State Home and school, Providence. Clark & Howe, Turk Head Bldg., Archts; Rich. D. Kimball Co., Industrial Trust Bldg., Engrs.

Milford, Conn.—Reported desired until Oct. 19 by Arthur B. Clark, Chmn. Bldg. Com., for erecting one-story, 104 x 107-ft. municipal building. Probable cost, $100,-000. Tracy & Swartwout, Archts., 244 Fifth Avenue, New York.

Albany, N. Y.—Until Nov. 1 by Board Contract and Supply (Isadore Wachsman, Secy.) for erecting fire alarm station on Myrtle Avenue and Lark Streets. Also separately on plumbing, gas work, electric work, heating. Obenaus-Nichols Co., Archts., 119 State Street.

Trenton, N. J.—Until Oct. 20, by Scott Scammell, Secy Bd. Mgrs. New Jersey State Hospital, Trenton, for erecting admission building at said hospital.

Vineland, N. J.—Until Oct. 22, by Commissioners Charities and Corrections, Trenton, for erecting building for imbeciles, dining hall, kitchen, etc., at New Jersey State Institute for Feeble Minded, Vineland.

Lebanon, Pa.—Reported desired until Oct. 22, by Bd. Educ., for erecting 2½-story and basement brick, stone, and concrete fireproof 180 x 180 ft. high school. Probable cost $200,000. A. A. Richter, Archt., Reading.

Pittsburgh, Pa.—Until Oct. 18 by George W. Gerwig, Secy. Bd. Educ. for constructing foundation of the Westinghouse High School. George S. Orth & Bros., Archts., Farmers Bank Bldg.

Indian Head, Md.—Until Nov. 6 by Bureau Yards & Docks, Navy Dept., Washington, D. C. (H. R. Stanford, Ch.), for erecting magazine building at the Naval Proving Grounds, Indian Head.

Washington, D. C.—Until Nov. 8, by Comrs. D. C. for erecting an engine house at Connecticut Avenue and Ordway Street, N. W., known as No. 28, advertised in Engineering Record.

Norfolk, Va.—Until Oct. 30 at Bureau Yards and Docks, Navy Dept., Washington, D. C. (H. R. Stanford, Ch.), for Spec. No. 2198—Shell house at Naval Magazine, Norfolk.

Richmond, Va.—Until Oct. 22, by C. P. Walford, Clk. School Bd. for furnishing material and erecting school on Fulton Hill. Also separate bids for heating and ventilating system. Carneal & Johnston, Archts., National Bank Bldg.

Live Oak, Fla.—Until Nov 2, by J. W. O'Hara, Secy. Co. Bd. Pub. Instructions, for erecting school. Also separate bids for heating and ventilating. Marks & Sheftall, Archts., 210 Clark Bldg., Jacksonville.

Ludlow, Ky.—Reported desired until Oct. 18 by Board Education (H. J. Ordelmundt, Clk.) for erecting school. Separate bids to be submitted on excav., iron and steel work, concrete masonry, plumbing, electric work, etc. Weber, Werner & Adkins, Archts., Mercantile Library Bldg., Cincinnati, Ohio.

Akron, Ohio.—Until Oct. 27 by Bd. Educ., Northfield, Village School Dist. (G. L. Williams, Clk.), for erecting school. Probable cost $28,000.

Dayton, Ohio.—Until Nov. 1, by C. J. Schmidt, Clk. Bd. Educ. for following work in connection with the Steele High School addition; excavation. reinforced concrete and cement work; structural iron and steel; rock face and cut stone work, etc. Edw. J. Mountstephen, Archt., 803 U. B. Building, Dayton.

Elyria, Ohio.—Until Nov. 19 by James A. Wetmore, Acting Superv. Archt., Washington, D. C., for erecting (including mechanical equipment and approaches) post office at Elyria.

Chicago, Ill.—Until Oct. 22 by Board Directors Municipal Tuberculosis Sanitarium (Theodore B. Sachs, Secy.) for erection, including heating, plumbing and electrical work, adult patients' and children's cottages for said sanitarium. Otis & Clarke, Archts., 6 North Michigan Ave.

St. Croix Falls, Minn.—Until Oct. 22 by J. C. Hogland, Village Clk., for erecting auditorium. Hartford & Hausler, Archts., 1611 Pioneer Bldg., St. Paul.

St. Cloud, Minn.—Until Oct. 25 by St Cloud Independent School Dist. No. 28 (Julius Adams, Secy.) for furnishing material and erecting high school. Also separate bids for plumbing, heating, ventilating, etc. Tyrie & Chapman, Archts., 320 Auditorium Bldg., Minneapolis.

St. Paul, Minn.—Until about Nov. 10 by State Board of Control, St. Paul, for erecting the Minnesota Historical Society Building, to be fireproof, granite exterior, and cost $500,000. C. H. Johnston, State Archt., St. Paul.

Wabasha, Minn.—Until Oct. 19 by State Board Control, St. Paul, for erecting tuberculosis sanatorium at Wabasha. Hoffman & Mosse, Archts., Rochester.

Salina, Kan.—Reported desired until Oct. 27 by O. E. Walker, Pres. Board Educ., for erecting 2-story and basement, 62 x 72-ft. school. Probable cost, $60,000. W. T. Schmitt, Archt., Oklahoma City, Okla.

El Paso, Tex.—Reported desired until Oct. 20 by Board Trus. Independent School Dist. for erecting high school. Trost & Trost, Archts., Mills Bldg.

Carlsbad, N. M.—Later official report states bids desired until Oct. 20 by Robert C. Dow, Secy. Carlsbad Armory Bd. Control, for erecting armory. C. F. Ward, Archt., Roswell.

Los Angeles, Cal.—Reported desired until Oct. 27 by Harbor Comn., for erecting 6-story reinforced concrete warehouse for Municipal Dock No. 1. Probable cost $350,000.

Boise, Idaho.—Until Nov. 18 by James A. Wetmore, Superv. Archt., Treas. Dept., Washington, D. C., for extensions, remodeling, etc., U. S. Post Office at Boise.

PRICES AND LETTINGS.

★Indicates award of contract.

★**Bridgeport, Conn.**—Contract for completing new high school at a cost of $45,- has been awarded by Bd. of Educ. to William J. Sharkey, present Superintendent of the building.

Brooklyn, N. Y.—The following are the four lowest bids opened Oct. 11 by Board of Education, New York City, for general construction of addition to School 88, Borough of Brooklyn: H. C. Stowe Construction Company, Academy and Vernon Avenues, $41,660; Mitchell Farrell, Adrian, Inc., $43,187; J. Kresse Co., $43,[illegible]; Architectural Contracting Co., Inc., $48,980. The lowest bid for plumbing in said alteration was from Harry Klein, 1861 Second Avenue, at $5,130.

Jersey City, N. J.—Following are four lowest bids opened Oct. 7 by Bd. Chosen Freeholders, Jersey City, for erecting county jail:

General construction: John T. Brady, New York, $754,340; George Bennett Long, Worcester, Mass., $778,000; George A. Fuller, New York, $814,765, and P. J. Carlin Constr. Co., New York, $817,000.

Heating and Ventilating: W. H. & F. W. Cane, New York, $48,000; Thompson-Starrett Co., New York, $52,500; J. F. Kelly, Newark, $61,615, and Wells-Newton Co., New York, $61,900.

Plumbing: W. H. & F. W. Cane, New York, $8,000; Murphy Plumbing Co., Jersey City, $56,360; P. F. Kenny Co., New York, $60,371, and Wells, Newton & Co., New York, $63,500.

Lowest bid for electric work was submitted by Pette & Powers, New York, at $8,200.

★**Skillman, N. J.**—Contract for erecting brick, stone, concrete and terra cotta buildings for New Jersey State Village for Epileptics awarded Edward Fay & Son, 1421 Carstensel St., Philadelphia, Pa., at $[illegible]; George S. Drew, State Archt., Trenton.

★**Morganza, Pa.**—Contract for erecting new industrial building and additional cottage at Pennsylvania Training School awarded Hardy & Rankin of Canonsburg.

Smyrna, Del.—Lowest bids opened Sept. 20 by Supervising Architect, Washington, D. C., for constructing U. S. Post Office submitted by Kings Lumber Co. of Charlottesville, Va., at $24,521.

Washington D. C.—The following are the bids opened Sept. 13 by Bureau of Lighthouses, Washington, D. C., for constructing the Navassa Island Light Station, West Indies—(a) metal work only, (b) erection including metal work, (c) [illegible] E. Hart, Norfolk, Va., (b) $80,000. Champion Iron Works, Champion, Ohio, (a) $12,078; Snare & Triest Co., New York, (b) $[illegible]; P. J. Carlin Constr. Co., New York, (c) $150,000; Durolithic Co., Buffalo, (b) $[illegible]; Ellicott Machine Corporation, Baltimore, Md., (a) $13,292.

Columbus, Ohio.—All bids opened Oct. 8 for erecting a building at Schiller Park have been rejected as being too high. Lowest bid was $46,[illegible]. P. B. Wemper, secretary, Dir. Pub. Service.

Findlay, Ohio—Lowest bid opened Oct. 7 by County Commissioners for erecting [illegible] buildings submitted by J. G. Belanger of Toledo at $73,[illegible].

★**Marion, Ohio.**—Contract for erecting high school, bids opened Oct. 6 awarded Victor County Marion Vernon Riegel, County Superintendent.

★**Van Wert, Ohio.**—Contract awarded Lafont-Davidson Co. of La Porte, Ind., for erecting hospital three stories, to cost $[illegible].

★**Woodsfield, Ohio.**—Contract for erecting high school awarded Hartig & Spindler, Wheeling, W. Va., at $[illegible], exclusive of heating and ventilating.

★**Grand Rapids, Mich.**—Contract for erecting armory for Grand Rapids Battalion (bids opened Sept. 29) awarded by State Military Board, Lansing, as follows: General construction to Horner & Keller Co., Grand Rapids, at $83,[illegible]; plumbing, C. O. Kyselka, Grand Rapids, $14,240; heating, Pulte Plumbing & Heating Co., Grand Rapids, $7,975; wiring, Electrical Equipment Co., $4,345. John S. Bersey, Adjt. General.

★**Grundy Center, Iowa.**—Contract for erecting school reported awarded Standard Construction Co., Minneapolis, Minn., at about $[illegible].

★**Lanyon, Iowa.**—Contract for constructing two-story brick consolidated building for Board of Education, G. T. Peterson, secretary, Bids opened Oct. 11, awarded Carl Soderstrom of Roswell, Iowa.

★**Glenwood, Minn.**—[illegible] for erecting high school [illegible], opened Oct. 6, awarded Construction Co., Alexandria.

★**Lincoln, Neb.**—Contract awarded by Board of Regents, University of Nebraska, to Selden-Breck Construction Co., Des Moines, Ia., [illegible] for erecting Bessey Hall at $111,[illegible].

★**Johnson City, Tex.**—Contract for erecting [illegible] bonds opened Sept. 20, awarded Lyons Waterworks of Johnson at $25,[illegible].

Tulsa, Okla.—N. Vernon & Sons of Louisville, Ky., reported [illegible] lowest bid to erect U. S. Post Office at $[illegible].

Sedro Woolley, Wash.—Following are lowest bids opened by State Bd. Control, Olympia, Oct. 4, for erecting male ward building, female ward building, auditorium and laundry building at Northern Hospital for Insane: General construction, Warnack Constr. Co., $134,763; plumbing, D. M. King Co., $9,677; heating Duper Bros., $11,435; electric wiring, J. J. Agutter & Co., $4,022 (bidders all of Seattle). Heath & Gove, Archts., Tacoma.

★**San Francisco, Cal.**—Contract for general construction of Public Library in Civic Center awarded Lindgren Co., Monad Bldg., at about $414,000, not including granite work.

PRIVATE BUILDINGS

PROPOSED WORK.

Albany, N. Y.—Propositions made to city by Delaware & Hudson R.R. Co. (James MacMartin, Ch. Engr., Albany) and Albany Journal Co. to erect buildings at foot of State Street to cost $440,000.

Brooklyn, N. Y.—Plans filed for following buildings: Two-story brick and concrete office, shop and garage at 13 Quincy Street for Edison Electric Illuminating Co., cost $40,000; six four-story brick apartment houses at Howard Avenue and Bergen Street for Abraham & Kaplan, total cost $150,000; four-story apartment house at 1276 Pacific Street for Farber Constr. Co., cost $45,000.

Long Island City, L. I., N. Y.—Plans filed for erecting 5-story brick tenement at Academy Street and Jamaica Avenue, for N. Hubbard, Jr., cost $50,000; Geo. Schmidt, 9 Manheim Street, Elmhurst.

New York, N. Y.—Plans filed for erecting following buildings: 12-story apartment house at 331 W. 108th Street, for Anthony A. Paterno Constr. Co., cost $300,000, Gaetan Ajello, 1 W. Thirty-fourth Street, archt.; 12-story apartment house at 124 W. Seventy-second Street, for G. B. Beaumont Co., owner and archt., cost $200,000; four 5-story brick tenements at 190th Street and Audubon Avenue, for A & K Constr. Co., cost $200,000, Saas & Springsteen, archts., 32 Union Square; 5-story brick tenements at Tenth Avenue and 214th Street, for H M Constr. Co., cost $130,000, Andrew J. Thomas, archt., 2526 Webster Avenue; 3-story brick store and dwelling at University Place and Twelfth Street, for John T. Smith, cost $66,000, Robt. J. Reiley, archt., 477 Fifth Avenue; 6-story office building at 58 E. Fifty-seventh Street for Henry B. Anderson, cost $70,000, Louis A. Abramson and Lawrence Barrard, associate archts., 220 Fifth Avenue; four 5-story brick tenements at Morris Avenue and 169th Street, for Hensle Constr. Co., cost $120,000, Moore & Lansiedel, archts., Third Avenue and 148th Street; 5-story brick tenement at Park Avenue and 171st Street, for Selena Realty Co., cost $55,000, Kreymborg Architectural Co., archts., 1029 E. 163d Street; 5-story brick tenement at 189th Street and Cambrelling Avenue, for De Caudio Constr. Co., cost $50,000, Lucian Pisciotta, archt., 391 E. 149th Street; two 5-story brick tenements at 169th Street and Morris Avenue, for Hensle Constr. Co., cost $90,000, Moore & Landsiedel, archts., Third Avenue and 149th Street; two 5-story brick tenements at University Avenue and 190th Street, for Osborne Realty Co., cost $90,000, J. M. Felson, archt., 1133 Broadway.

Poughkeepsie, N. Y.—New York Central R. R. informs us that the station to be erected here will not be taken up for several years.

Syracuse, N. J.—Syracuse Light Co. (J. C. De Long, Pres.), is considering building a substation on West Fayette St.

Philadelphia, Pa.—Eastern Pennsylvania Conference of United Brethren, at Harrisburgh, decided to erect a $75,000 church in North Philadelphia.

Baltimore, Md.—The Public Service Building Co., it is reported, intends erecting a 12-story brick, stone and steel office building according to plans by Parker, Thomas & Rice, Union Trust Bldg.

Danville, Va.—Reported Dan River Cotton Mills Co. intends erecting Y. M. C. A. building for its employees; cost $40,000.

Huntington, W. Va.—Reported plans being prepared by A. F. Dickey of Huntington, for fireproof theater which the Princess Theater Co. will erect on Fourth Avenue; cost about $25,000.

Wheeling, W. Va.—Edgwood Evangelical Lutheran Church will erect edifice on Lenox Place; cost $30,000. Rev. Ralph A. Harshman, Pastor.

Savannah, Ga.—Sacred Heart Roman Catholic Church intends erecting parochial school on Thirty-eighth Street.

Cleveland, Ohio.—Jacob Rabin, Williamson Bldg., will erect a building on Superior Avenue and E. 115th Street; cost approximately $100,000.

Toledo, Ohio.—St. Mark's Lutheran Church contemplates erecting new edifice at Emerson and Woodville Streets; cost about $35,000. Rev. A. L. Burman, Pastor.

Fort Wayne, Ind.—Achduth Veshalom Congregation intends erecting new synagogue.

Eagles considering erection of a building.

Indianapolis, Ind.—Plans prepared by Herbert L. Bass & Co. of Indianapolis for two-story brick and concrete building to be erected at 705 North Meridian Street; cost $25,000.

Muncie, Ind.—Reported Star League will erect two-story brick newspaper plant.

Shelbyville, Ind.—The order of Elks, Lodge No. 457, intends erecting next spring on West Broadway a clubhouse costing $50,000.

Chicago, Ill.—Plans being prepared by Marshall & Fox, 38 S. Dearborn Street, for theater to be erected at S. State and Van Buren Streets; cost $600,000. Jones, Linick & Schaefer, 110 S. State Street, reported interested.

Madison, Wis.—Monona Lodge No. 12, Knights of Pythias, proposes erecting a $35,000 club house.

Milwaukee, Wis.—University Club contemplates erecting five-story clubhouse at Oneida St. and Juneau Pl.; cost about $25,000.

Wausau, Wis.—Congregation of St. Mary's Church intends erecting new school; cost about $40,000.

Clarinda, Iowa.—Congregtion of United Presbyterian Church will erect new edifice; cost $30,000. Rev. W. C. Williamson, Pastor.

Ft. Dodge, Ia.—Congregational Church contemplates erecting new edifice; cost about $55,000.

Minneapolis, Minn.—The Sinton Guild reported planning erection of a $50,000 building. Miss Rose Kane, 206 Fourth Street, Secy.

The Rapid Transit Realty Co. (Horrace Lowry, 11 Street & Hennipen Avenue, President) intends erecting twelve-story office building to cost about $100,000, probably on 2nd Avenue, South.

St. Louis, Mo.—Erection of parish school in connection with the Roman Catholic Cathedral is contemplated; cost about $75,000. Rev. Francis Gilfillan, Pastor.

Plans approved by St. Vincent's German Orphan Society for new home to be erected on Florissant Road; cost about $200,000.

F. H. Britton, 3671 Lindell Blvd., will erect an apartment building on Lindell Blvd. to cost $100,000.

San Antonio, Tex.—See "Railroads."

Seattle, Wash.—Plans completed by Howells & Stokes, Henry Building, for eight additional stories to Cobb-Healy Building on Third Avenue; cost $100,000.

Contract reported about to be let by I. B. Johnson, 209 First Avenue, South, for three-story, 117 x 120 ft. brick and concrete apartment house to be erected at Summit Avenue and University Street, for Kreilscheimer Bros.; cost $90,000.

Portland, Ore.—Plans being prepared by W. W. Lucius, Lewis Building, for reconstructing building on Third and Morrison Streets, recently destroyed by fire; cost approximately $50,000.

Reported contract soon to be let by R. T. Dabney, 133 E. 29th St., for erecting tourist hotel near Crown Point; cost approximately $200,000. Edgar M. Lazarus, Archt., 18th and Flanders Streets.

Sacramento, Cal.—Sacramento Valley Warehouse Co. will erect a warehouse.

BIDS DESIRED.

Elgin, Ill.—Until Oct. 25 by Board Administration (Frank D. Whipp, Fiscal Superv.), Springfield, for erecting power house at Elgin State Hospital. Jas. B. Dibelka, State Archt., 130 N. 5th Avenue, Chicago.

Carlos, Minn.—Reported desired until Oct. 19 by Rev. E. J. Steinbach, pastor, Belle River, for erecting brick edifice for St. Nicholas Church at Carlos.

Omaha, Neb.—Reported desired until Oct. 27 by Graham, Burnham & Co., Archts., 80 E. Jackson Blvd., Chicago, Ill., for erecting 14-story basement and sub-basement, 66 x 132-ft. bank store and office building for Union Securities Co., Omaha. Probable cost, $800,000.

St. Joseph, Mo.—Reported desired until Oct. 28 for erecting 60 x 120 ft. office building at Seventh and Francis Streets for W. F. Kirkpatrick, 721 Felix Street. Probable cost $50,000. Address Walter Boschen, Archt., Tootle-Lemon Bank Building.

PRICES AND LETTINGS.

★Indicates award of contract.

★**South Deerfield, Mass.**—Contract awarded Allen Bros. of Amherst for erecting 60 x 30 ft. brick and marble library on Main Street as a memorial to Chauncy B. Tilton. W. Leslie Walker, Archt., 30 West Fifty-ninth Street, New York.

★**Providence, R. I.**—Contract awarded Robert T. Collins, Cumberland, for erecting St. Joseph Parish Church, Prospect Hill.

★**Westerly, R. I.**—Contract awarded to Charles B. McGuire Co., Providence, for erecting Industrial Trust Company Building.

★**Brooklyn, N. Y.**—Contract awarded Turner Construction Co., 11 Broadway, New York, for erecting a two-story reinforced concrete building for W. Beckers Aniline & Chemical Co. at East Eighty-Third Street and Ditmars Avenue. Benjamin Driesler, Architect, 153 Remsen Street.

★**Buffalo, N. Y.**—Contract awarded by Lehigh Valley R. R. Co. to Eastern Concrete Steel Co., D. S. Morgan Bldg., for 195 x 837 ft. reinforced concrete and glass train shed to be erected at Main and Scott Streets; cost $150,000.

★**Jamestown, N. Y.**—Contract awarded by Jamestown Traction Co. to Kellogg Structural Steel Co., Buffalo, for erecting brick and steel carhouse.

★**Philadelphia, Pa.**—Contract awarded Cramp & Co., Denckla Building, for erecting seven-story and basement, brick, stone and reinforced concrete loft building on Arch Street for Charles E. Schmidt, 327 Arch Street; cost $100,000. Sauer & Hahn, Archts., 1112 Chestnut Street.

★**Pittsburgh, Pa.**—Contract for erecting parochial school for St. Lawrence R. C. Church awarded McGinness Bros., 202 Millvale Street; cost about $30,000. O. M. Topp, Archt., Jenkins Bldg.

★**Tipton, Iowa.**—Contract reported awarded Western Constr. Co. of Iowa City for erecting building for Odd Fellows; cost $30,000.

★**Billings, Mont.**—Reported contract for erecting addition to Northern Hotel awarded E. H. Gagnon & Co., 201 N. 22d Street; cost about $60,00. Link & Haire, Archts., Billings.

★**Great Falls, Mont.**—Contract for erecting school for Roman Catholic diocese awarded Ness-Theisen Contr. Co., Great Falls; cost, $70,000.

★**St. Louis, Mo.**—Contract for erecting reinforced concrete and structural steel theater for Orpheum Theater Circuit, at Ninth and St. Charles Streets, awarded Murch Bros. Constr. Co., St. Louis; cost about $500,000.

★**Olympia, Wash.**—Contract for erecting depot for Oregon-Washington R. R. & Navigation Co., awarded E. D. Rounds Constr. Co., Seattle, at about $25,000.

★**Windsor, Ont.**—Contract awarded P. H. Secord & Sons, Ltd., of Brantford, for erecting bank building at Ouellette Avenue and Chatham Street for Merchants Bank of Canada; cost $100,000. Hogle & Davis, Archts., Montreal, Que.

NEW INDUSTRIAL PLANTS

PROPOSED WORK.

Hartford, Conn.—Gordon Bros. intend erecting three-story and basement cold storage building, brick construction, 50 x 140 ft. F. C. Walz, Architect, 118 Asylum Street.

Norwich, Conn.—Shetucket Co. intends erecting two-story brick weave shop, 84 x 356 ft. to cost $75,000.

Brooklyn, N. Y.—Plans filed for a five-story factory at 71 Flatbush Avenue for F. A. Koch & Co., 524 Broadway, New York, to cost $80,000.

Kearny, N. J.—Plans filed for four factory buildings for American Splint Corp., 141 Broadway, New York; total cost $100,000.

Westville, N. J.—Manwaring & Cummins, 1326 Chestnut Street, Philadelphia, are reported engineers in charge of the sand handling plant, consisting of elevators, screens, storage bins, etc., to be erected by the West Jersey Sand & Gravel Co.

Baltimore, Md.—Henry Hess, 1510 Allegheny Street, Philadelphia, Pa., reported interested in organizing a company here for establishing a plant for manufacturing steel, probably in Canton. John R. Bland, Pres. U. S. Fidelity & Guaranty Co., Calvert and German Streets, Baltimore, is also reported interested.

Nemours, W. Va.—Reported E. I. du Pont de Nemours Powder Co., Wilmington, Del., reported will erect powder factory here. Also magazines for explosives at Charleston, Martinsburg, Huntington, Piedmont and Bluefield.

Albemarle, N. C.—Reported Efird Manufacturing Co., Albemarle, intends erecting additional cotton mill; cost about $500,000.

Greensboro, N. C.—Reported Revolution Cotton Mills Co. will erect additional warehouse near city, to be four or five stories; cost about $30,000.

Martins Ferry, Ohio.—American Sheet & Tinplate Co., Wheeling, W. Va., contemplates improvements to Laughlin plant here, to cost $100,000.

Gary, Ind.—Reported the Carnegie Steel Co. intends erecting a tin plate mill here.

Kokomo, Ind.—Haynes Automobile Co. contemplates erecting factory building costing $250,000.

Marion, Ind.—Reported United Steel Corp. intends extensive improvements to their plant, including enlarging the Schoen Steel Car Works at McKee Rocks and the Shelby Tube Plant at Ellwood City largely extended; it is stated the cost of these two plants will be approximately $2,000,000.

Sheron Bros. Drain Tile Co. intends erecting a three-story factory.

Muncie, Ind.—Plans completed for additions to plant of Interstate Automobile Co.

Jackson, Mich. — Reported Briscoe Motor Co. will erect factory on Wildwood Avenue; cost $100,000.

Minneapolis, Minn.—The Price Cereal Products Co., 702 Lincoln Bldg., intends erecting a cereal plant at Jackson Street and Thirteenth Avenue, North East, to cost $100,000.

Webb City, Mo.—C. T. Orr of Webb City, reported interested in company which intends erecting zinc smelter near this city.

Sacramento, Cal.—Sacramento Valley Pipe Line Co. has applied to State Railroad Comm. for permission to issue stock to erect a plant.

BIDS DESIRED.

Yardley, Pa.—Contract soon to be let by Peuckert & Wunder, Archts. and Engrs., 310 Chestnut Street, Philadelphia, Pa., for erecting a 1-story manufacturing plant at Yardley, Pa., for Klauder-Weldon Dyeing Machine Co., Amsterdam, N. Y. Building to be 111 x 78 ft. of stone and structural steel, fireproof.

Algiers (P. O. New Orleans), La.—Until Oct. 20, by M. L. & T. R. R. & S. S. Co., Metropolitan Bank Bldg., New Orleans, for erecting structural steel for erection shop in Algiers.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Garfield, N. J.** — Contract awarded John W. Ferguson Co. of Paterson for erecting a four-story, 64 x 198 ft., brick and bluestone, mill construction building for the Forstmann & Huffman Co.

★**Garwood, N. J.**—Contract awarded John W. Ferguson Co., Paterson, for erecting a one-story concrete, brick and terra cotta factory for the Anchor Post Iron Works.

★**Jersey City, N. J.**—Contract awarded urner Construction Company, 11 Broadway, New York, for erecting for the Standard Oil Company of New Jersey, at the Eagle Works, a three-story kiln building, reinforced concrete, skeleton, and hollow tile curtain walls.

★**Shimerville, Pa.**—Contract for rebuilding Shimer Toy Foundry, recently destroyed by fire, reported awarded F. F. Speck of Bethlehem; cost about $60,000.

★**Albemarle, N. C.**—Contract for erecting two-story mill for Wiscasett Mills Co., reported awarded Holbrooks & Bradshaw, Salisbury; probable cost $70,000.

★**Charlotte, N. C.**—Contract for erecting U. S. Post Office and Court House awarded John G. Unkefer & Co., Minerva, Ohio, at $192,692.

MISCELLANEOUS

PROPOSED WORK.

Transmission Line—Pepperell, Mass.—The Shirley Electric Co., Shirley, will erect a high tension transmission line from present terminus cordage works to Pepperell.

Transmission Line—Chatham, N. Y.—Chatham Electric Light, Heat & Power Co. will extend the transmission lines to Morehouse.

Transmission Line—Fredonia, N. Y.—Public Service Comn. has granted Niagara & Erie Power Co., Fredonia, permission to extend transmission lines to Town of Brant and Village of Farnham.

Transmission Line—Bay City, Mich.—Bay City Power Co. has secured right-of-way for the construction of an electric transmission line from city to mines of Robert Gage Coal Co.

Transmission Line—Butterfield, Minn.—Citizens voted $8,000 bonds to install an electric lighting system. It is proposed to construct a transmission line to connect with the transmission system of Consumers Power Co. at St. James.

BIDS DESIRED.

Park Work—New York, N. Y.—Until Oct. 21 by Park Board (Cabot Ward, Pres.), Borough Manhattan, for improving Isham Park. Security $7,500.

Electric Hoists—Philadelphia, Pa.—Until Nov. 2, by Bureau of Supplies and Accounts, Washington, D. C., for Sch. 8882—6 electric hoists, at the Navy Yard, Philadelphia.

Ventilating Skylights—Washington, D. C.—Until Oct. 21 by Dept. of Interior (B. Sweeny, Asst. Secy.) for furnishing and installing ventilating skylights on the Patent Office Building.

Cranes—Charleston, S. C.—Until Nov. 20 by Bureau Yards and Docks, Navy Dept., Washington, D. C. (H. R. Stanford, Ch.), for furnishing two shipbuilding cranes at Navy Yard, Charleston. Specification No. 2199.

Fence—Devils Lake, N. D.—Until Nov. 5 by Dept. Agriculture (C. F. Marvin, Acting Secv.), Washington, D. C., for furnishing material and constructing enclosure on the Sully's Hill National Park, N. D.

Electric Light & Power Plant, Poplar Bluff, Mo.—Until Nov. 3, by H. H. Wilcox, City Clerk, constructing a municipal electric light and power plant; $75,000 bonds sold. Fuller-Coult Co., Engineers, St. Louis, Mo.

Mail Chutes—Denver, Col.—Until Nov. 8 by James A. Wetmore, Superv. Archt., Washington, D. C., for installing two mail chutes in U. S. Post Office, Denver.

Freight Elevator—New Westminster, B. C.—Reported desired until Oct. 29 by R. C. Desrochers, Secy. Dept. Pub. Wks., Ottawa, for an electric freight elevator. William Henderson, Resident Archt., Victoria.

Crane, Etc.—Panama.—Until Oct. 27 by Maj. F. C. Boggs, Corps Engrs., U. S. A., General Purchasing Officer, for Cir. 978—Traveling crane, copper tubing, flexible copper or brass conduit, galvanized pipe, pipe fittings, valves, vitr. pipe, etc.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Cement—New Orleans, La.**—Contract for furnishing cement, sand and gravel (bids opened Sept. 22) awarded by U. S. Engineers to Lester F. Alexander of New Orleans at $19,220.

★**Electric Light Plant — Bloomington, Wis.**—Contract awarded by Bloomington Electric Light & Power Co. to Globe Electric Co. of Milwaukee for an Electric Light Plant to cost $11,500.

Cement—Portland, Ore.—Following are four lowest bids opened Oct. 7 by U. S. Engineers' Office, Portland, for 10,000 bbl. Portland cement for use in connection with the reconstruction of the lock at Oregon City, Ore.: (a) price per bbl. exclusive of sacks; (b) location f. o.b. cars: Geo. N. Short, (a) $1.25, (b) Trident, Mont.; Standard Portland Cement Co., (a) $1.40, (b) Napa Junction, Cal.; Henry Cowell Lime & Cement Co., (a) $1.45, (b) Cowell, Cal.; Pacific Portland Cement Co., (a) $1.45, (b) Tolenas, Cal.

Proposals

For Proposals Advertised, see Pages 42 and 43.

WATERWORKS.

Bids Close.		See Eng. Record.
Oct. 19.	Contr. 166, New York, N. Y. Adv. Oct. 2.	Oct. 2
Oct. 19.	Pump, Caney, Kan.	Oct. 16
Oct. 19.	C.-i. Pipe, Etc., Middletown, Ohio	Oct. 16
Oct. 20.	Water Works, Miller, Ind.	Oct. 9
Oct. 20.	Reservoir, etc., Aurora, Minn.	Oct. 9
Oct. 20.	Standpipe, Cincinnati, Ohio	Oct. 9
Oct. 20.	Mains, Cleveland, Ohio	Oct. 16
Oct. 20.	Tank, Tower, Etc., Elmhurst, Ill.	Oct. 16
Oct. 21.	Gas Engines, Clarksburg, W. Va. Adv. Sep. 25, Oct. 2.	Sep. 25
Oct. 21.	Tank, pumps, etc., Three Rivers, Mich.	Oct. 9
Oct. 21.	Pipe, etc., Van Buren, Ind.	Oct. 9
Oct. 22.	Pipes, Etc., New York, N. Y.	Oct. 16
Oct. 26.	Contract 128, New York, N. Y. Adv. Oct. 9.	Oct. 9
Oct. 26.	Pipe, Reservoir, Etc., Peapack, N. J.	Oct. 16
Oct. 28.	Softening Equipment, Columbus Ohio	Oct. 16
Oct. 28.	Pumping Unit, Dayton, Ohio	Oct. 16
Oct. 30.	Tank and Tower, Indian Head, Md.	Oct. 16
Nov. 2.	Pipe Fittings, Etc., Washington, D. C.	Oct. 16
Nov. 4.	Pumping Engine, Galveston, Tex. Adv. Oct. 2.	Oct. 2
Nov. 9.	Water Wks., Belleville, Ohio	Sep. 11
Dec. 1.	Water Works, East Youngstown, Ohio	Oct. 16

SEWERAGE AND SEWAGE DISPOSAL.

Oct. 19.	Beaumont, Tex. Adv. Sep. 18 to Oct. 2.	Sep. 18
Oct. 19.	Washington, D. C. Adv. Oct. 9.	Oct. 9
Oct. 19.	Elliott, Iowa	Oct. 16
Oct. 19.	Elizabeth, N. J	Oct. 16
Oct. 19.	Plymouth, Wis.	Oct. 16
Oct. 20.	Pella, Iowa, Adv. Oct. 9, 16.	Oct. 9
Oct. 20.	Verona, N. J. Adv. Oct. 9.	Oct. 9
Oct. 20.	Sumner, Wash.	Oct. 16
Oct. 20.	Enterprise, Ore.	Oct. 16
Oct. 22.	Chatfield, Minn.	Oct. 16
Oct. 25.	Upper Alton, Ill.	Oct. 16
Oct. 26.	Mansfield, Ohio	Oct. 16
Oct. 27.	Algona, Iowa	Oct. 16
Nov. 9.	Yorktown Heights, N. Y. Adv. Oct. 16.	Oct. 16
———	Parkersburg, Pa. Adv. Oct. 9.	Oct. 9

BRIDGES.

Oct. 19.	Frederick, Md.	Oct. 16
Oct. 19.	Sharon, Pa.	Oct. 16
Oct. 20.	Concordia, Kan.	Oct. 9
Oct. 21.	San Diego, Cal.	Oct. 16
Oct. 21.	Kansas City, Mo.	Oct. 16
Oct. 22.	Boise, Idaho.	Oct. 9
Oct. 22.	Lincoln, Neb.	Oct. 16
Oct. 22.	St. Louis, Mo.	Oct. 16
Oct. 23.	Ft. Edward, N. Y.	Oct. 9
Oct. 23.	Blairsville, Ga.	Oct. 16
Oct. 25.	Concordia, Kan.	Oct. 2
Oct. 25.	Columbus, Ohio	Oct. 2
Oct. 25.	Newark, N. J.	Oct. 16
Oct. 25.	San José, Cal.	Oct. 16
Oct. 26.	Mankato, Kan.	Oct. 16
Oct. 27.	Glenfield, Pa.	Sep. 25
Oct. 28.	Covington, Ky. Adv. Oct. 16.	Oct. 16
Oct. 29.	Illinois	Oct. 2
Oct. 29.	Delphos, Ohio	Oct. 9
Oct. 30.	Dallas, Tex.	Oct. 9
Nov. 1.	Harrisburg, Tex.	Oct. 16

PAVING AND ROADS.

Oct. 19.	Logansport, Ind.	Sep. 25
Oct. 19.	Beaumont, Tex, Adv. Sep. 18 to Oct. 2.	Sep. 18
Oct. 19.	Washington, D. C. Adv. Oct. 2, 9.	Oct. 2
Oct. 19.	Pullman, Wash.	Oct. 9
Oct. 19.	New York, N. Y.	Oct. 9
Oct. 19.	Boston, Mass.	Oct. 16
Oct. 19.	Hagerstown, Md.	Oct. 16
Oct. 19.	Corona, Cal.	Oct. 16
Oct. 20.	Indiana.	Oct. 2
Oct. 20.	Brooklyn, N. Y.	Oct. 16
Oct. 20.	Rockford, Ill.	Oct. 16
Oct. 20.	Franklin, Ind.	Oct. 16
Oct. 21.	Independence, Kan.	Oct. 16
Oct. 21.	Riverside, Cal.	Oct. 16
Oct. 22.	Findlay, Ohio	Oct. 16
Oct. 25.	Bethlehem, Pa.	Oct. 16
Oct. 25.	Los Angeles, Cal.	Oct. 16
Oct. 25.	Yuma, Ariz.	Oct. 16
Oct. 26.	Albany, N. Y. Adv. Oct. 9, 16.	Oct. 9
Oct. 28.	Granville, Ohio	Sep. 25
Oct. 28.	Terrell, Tex.	Oct. 9
Oct. 29.	Elizabethton, Tenn.	Oct. 16
Oct. 29.	Pittsburgh, Pa.	Oct. 16
Nov. 1.	Santa Barbara, Cal.	Oct. 2
Nov. 1.	Pasco, Wash.	Oct. 9
Nov. 1.	Pomeroy, Wash.	Oct. 16
Nov. 1.	Camden, Ala.	Oct. 16
Nov. 5.	Indiana.	Oct. 2
Nov. 8.	Euclid, Ohio	Oct. 16

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS.

Oct. 19.	Ditch Work, Mankato, Minn.	Oct. 9
Oct. 19.	State Canal Work, Albany, N. Y.	Oct. 9
Oct. 19.	Ditches, Albert Lea, Minn.	Oct. 16
Oct. 20.	Irrigation Work, Montrose, Col. Adv. Sep. 25.	Sep. 25
Oct. 20.	Irrigation Work, Powell, Wyo.	Sep. 25
Oct. 20.	Reclamation Work, Washington, D. C.	Oct. 2
Oct. 20.	Levee Improv., Shawneetown, Ill. Adv. Oct. 16.	Oct. 16
Oct. 20.	Drainage Work, Kansas City, Kan.	Oct. 16
Oct. 20.	Revetment and Dike, Kansas City, Mo.	Oct. 16
Oct. 20.	Concrete Wall, Muscatine, Iowa	Oct. 16
Oct. 21.	Channel Work, Chicago, Ill. Adv. Sept. 25.	Sep. 25
Oct. 21.	Irrigation, Harlingen, Tex.	Oct. 9
Oct. 21.	Dredging, Newark, N. J.	Oct. 9
Oct. 22.	Dry Dock Gate, Louisville, Ky. Adv. Sep. 25 to Oct. 16.	Sep. 25
Oct. 22.	Ditches, Blue Earth, Minn.	Oct. 9
Oct. 22.	Levee Work, Silver City, Miss.	Oct. 16
Oct. 26.	State Canal Work, Albany, N. Y.	Oct. 2
Oct. 27.	Ditch, Henderson, Ky.	Oct. 16
Oct. 28.	Drainage System, Edna, Tex.	Oct. 16
Oct. 28.	Drainage, Bristol, Wis.	Oct. 16
Nov. 1.	Flood Protection, Portsmouth, Ohio.	Oct. 9
Nov. 1.	Irrigation Work, Washington, D. C. Adv. Oct. 9.	Oct. 9
Nov. 1.	Dock Improv., Beaumont, Tex. Adv. Oct. 16.	Oct. 16
Nov. 4.	Irrigation Work, Grand Junction, Col. Adv. Oct. 9.	Oct. 9
Nov. 5.	Irrigation Work, Washington, D. C. Adv. Oct. 9.	Oct. 9
Nov. 5.	Trestles, Pittsburgh, Pa. Adv. Oct. 9, 16.	Oct. 9
Nov. 8.	Dredge, Jacksonville, Fla. Adv. Sep. 11 to 25.	Sep. 11
Nov. 8.	Reclamation Work, Grand Junction, Col.	Oct. 2
Nov. 8.	Dredging, Etc., Jacksonville, Fla. Adv. Oct. 16.	Oct. 16
Nov. 9.	Canal Work, Albany, N. Y.	Oct. 9

PUBLIC BUILDINGS AND SCHOOLS.

Oct. 19.	Norton, Va.	Sep. 11
Oct. 19.	Oxford, Ohio	Sep. 25
Oct. 19.	Brookings, S. D.	Oct. 9
Oct. 19.	Trenton, N. J. Adv. Oct. 9, 16.	Oct. 9
Oct. 19.	Washington, Ind.	Oct. 9
Oct. 19.	Ridgewood, N. J.	Oct. 9
Oct. 19.	Wabasha, Minn.	Oct. 16
Oct. 19.	Milford, Conn.	Oct. 16
[illegible]	[illegible] Mass.	Oct. 16
Oct. 20.	Monmouth, Ill.	Oct. 2
Oct. 20.	Seattle, Wash.	Oct. 9
Oct. 20.	Byers, Kan.	Oct. 9
Oct. 20.	Carlsbad, N. M.	Oct. 16
Oct. 20.	El Paso, Tex.	Oct. 16
Oct. 20.	Trenton, N. J.	Oct. 16
Oct. 21.	Newark, N. J.	Oct. 9
Oct. 22.	New York, N. Y. Adv. Oct. 9, 16	Oct. 9
Oct. 22.	Richmond, Va.	Oct. 16
Oct. 22.	Vineland, N. J.	Oct. 16
Oct. 22.	Chicago, Ill.	Oct. 16
Oct. 22.	St. Croix Falls, Minn.	Oct. 16
Oct. 22.	Lebanon, Pa.	Oct. 16
Oct. 23.	Norfolk, Va.	Oct. 2
Oct. 25.	Washington, D. C.	Oct. 9
Oct. 25.	St. Cloud, Minn.	Oct. 16
Oct. 25.	Elgin, Ill.	Oct. 16
Oct. 26.	Brooklyn, N. Y.	Oct. 2
Oct. 26.	Des Moines, Ia.	Oct. 9
Oct. 26.	Neodesha, Kan.	Oct. 9
Oct. 26.	New York, N. Y. Adv. Oct. 9.	Oct. 9
Oct. 26.	Pittsburgh, Pa.	Oct. 9
Oct. 27.	Newcastle, Ind.	Sep. 25
Oct. 27.	Monongahela, Pa.	Sep. 25
Oct. 27.	Ft. Bliss, Tex. Adv. Oct. 2 to 16.	Oct. 2
Oct. 27.	Seattle, Wash.	Oct. 2
Oct. 27.	Northfield, Ohio	Oct. 2
Oct. 27.	Norman, Okla.	Oct. 9
Oct. 27.	Akron, Ohio	Oct. 16
Oct. 27.	Salina, Kan.	Oct. 16
Oct. 27.	Los Angeles, Cal.	Oct. 16
Oct. 28.	Kirksville, Mo. Adv. Sep. 25, Oct. 2.	Sep. 25
Oct. 28.	Providence, R. I.	Oct. 16
Oct. 29.	Seattle, Wash.	Oct. 9
Oct. 29.	Rinard, Iowa	Oct. 16
Oct. 30.	Seymour, Ind.	Sep. 25
Oct. 30.	Athens, Ohio.	Oct. 9
Oct. 30.	Norfolk, Va.	Oct. 16
Nov. 1.	Merrill, Wis.	Oct. 2
Nov. 1.	Dayton, Ohio	Oct. 16
Nov. 1.	Albany, N. Y.	Oct. 16
Nov. 2.	Live Oak, Fla.	Oct. 16
Nov. 4.	Wilberforce, Ohio	Oct. 9
Nov. 5.	New Braunfels, Tex.	Oct. 2
Nov. 6.	East Pittsburgh, Pa.	Oct. 2
Nov. 6.	Indian Head, Md.	Oct. 16
Nov. 8.	Sidney, Ohio Adv. Oct. 2, 9.	Oct. 2
Nov. 8.	Washington, D. C. Adv. Oct. 16.	Oct. 16
Nov. 9.	El Paso, Tex.	Oct. 9
Nov. 10.	Van Wert, Ohio.	Oct. 2
Nov. 12.	Salamanca, N. Y.	Oct. 9
Nov. 16.	Huntington, W. Va.	Oct. 9
Nov. 18.	Boise, Idaho	Oct. 16
Nov. 19.	Elyria, Ohio	Oct. 16

PRIVATE BUILDINGS.

Oct. 19.	Carlos, Minn.	Oct. 16
Oct. 27.	Omaha, Neb.	Oct. 16
Oct. 28.	St. Joseph, Mo.	Oct. 16

NEW INDUSTRIAL PLANTS.

Oct. 16.	Peking, China.	Oct. 2
Oct. 20.	Algiers (P. O. New Orleans), La.	Oct. 16

MISCELLANEOUS.

Oct. 19.	El. Ry., Philadelphia, Pa. Adv. Sep. 18, 25.	Sep. 18
Oct. 19.	Steel Dome For Sale, Madison, Wis. Adv. Oct. 2 to 16.	Oct. 2
Oct. 19.	El. Rys., New York, N. Y.	Oct. 16
Oct. 20.	Pneumatic Hoists., etc., Panama	Oct. 2
Oct. 20.	Alternators, etc., Slater, Mo. Adv. Oct. 2.	Oct. 2
Oct. 21.	Garbage Disposal, Newark, N. J. Adv. Oct. 9, 16.	Oct. 9
Oct. 21.	Ventilating Skylights, Washington, D. C.	Oct. 16
Oct. 21.	Park Work, New York.	
Oct. 23.	Hoists. Washington, D. C. Adv. Sep. 25 to Oct. 16.	Sep. 25
Oct. 25.	Material for water distilling plant for sale, Fort Caswell, N. C. Adv. Oct. 9, 16.	Oct. 9
Oct. 27.	Cranes, Etc., Panama	Oct. 16
Oct. 29.	Freight Elevator, New Westminster, B. C.	Oct. 16
Nov. 2.	Electric Hoists, Philadelphia, Pa.	Oct. 16
Nov. 3.	Purchase of Steamer, Newport, R. I. Adv. Oct. 9, 16.	Oct. 9
Nov. 3.	Jib Crane, Panama Adv. Sep. 25.	Sep. 25
Nov. 8.	Mail Chutes, Denver, Col.	Oct. 16
Nov. 8.	Fence, Devils Lake, N. D.	Oct. 16
Nov. 17.	Power Plants, Etc., Washington, D. C.	Aug. 28
Nov. 26.	Cranes, Charleston, S. C.	Oct. 16

SEARCHLIGHT SECTION

Official Proposal Announcements

Price, $2.40 an inch.—Copy can be received until Thursday 10 a. m. for issue mailed the next morning

Bids open November 9, 1915.

STATE OF NEW YORK.

OFFICE OF SUPERINTENDENT OF PUBLIC WORKS.

BARGE CANAL TERMINALS

NOTICE TO CONTRACTORS.

ALBANY, N. Y.

Sealed proposals will be received by the undersigned at the office in the Capitol at Albany, N. Y., until 11 o'clock, noon, of Tuesday, November 9, 1915, at which place and hour they will be publicly opened and read, for the construction of barge canal terminals pursuant to the provisions of Chapter 742 of the Laws of 1911, and supplementary laws, as follows:

TERMINAL CONTRACT No. 7-P.

For paving the terminal site, near North Pearl street, Albany. Contract plans, sheet No. 1.

Plans may be seen and detailed specifications, engineer's estimate of quantities, proposal blanks, form of contract and bonds required and other information for proposals may be had at the office of the Superintendent of Public Works at Albany, N. Y., at the office of the Assistant Superintendent of Public Works for the Middle Division at Syracuse, N. Y., at the office of the Assistant Superintendent of Public Works for the Western Division at Rochester, N. Y., and at the canal office, Spaulding's Exchange, Buffalo, N. Y.

Copies of detailed plans or drawings may be obtained from the State Engineer and Surveyor at Albany, N. Y., upon payment in lots of the cost of producing them.

Monthly estimates will be paid of ninety per centum (90 per cent.) of the work done at the contract price. Every proposal for said work must be accompanied by a money deposit in the form of a draft or certified check upon some good banking corporation in the city of Albany, or the city of New York, payable to a national or state bank or trust company in good credit within the state and payable at sight to the Superintendent of Public Works for five per centum (5 per cent.) of the amount of the proposal.

The person whose proposal shall be accepted will be required to execute a contract and furnish bonds within ten days from the date of notice of award delivered to him or them in person or mailed to the address given in the proposal.

Upon execution of the contract and approval of bonds, the certified check or draft will be returned to the proposer unless the same shall have been presented for collection prior to such time, in which case the amount of the deposit will be refunded by the Superintendent of Public Works.

The deposits of bidders other than the one to whom the award of contract shall be made will be returned immediately after the award has been made.

The amount of bond required for faithful performance will be ten per centum (10 per cent.) of the amount of the estimated cost of the work according to the contract price, and an additional bond, known as the labor bond, in the sum of ten per centum (10 per cent.) of the amount of the estimated cost of the work according to the contract price, will be required to secure to the contractor will pay in full at least once in each month all laborers employed by him upon the work specified to be done in the contract.

In the event that more than one surety company is offered as surety on said bonds no instrument will be accepted.

Each proposal must be addressed to the Superintendent of Public Works, Albany, N. Y., and must be endorsed on the envelope with the name of the construction for which the proposal is made.

Award, if made, will be made to the person or persons whose proposal shall be lowest as cost to the State for doing the work, and which shall comply with all provisions required to render it formal. Before any award shall be made the lowest bidder will be required to satisfy the Superintendent of Public Works of his ability to provide suitable equipment and materials for the proper performance of the work.

The right is reserved to reject all proposals and readvertise and award the contract in the regular manner if in the judgment of the undersigned, the interests of the State will be enhanced thereby.

W. W. WOTHERSPOON,
Superintendent of Public Works.

October 5, 1915.

Bids open November 1, 1915.

BOARD OF WHARF AND DOCK COMMISSIONERS' OFFICE, CITY HALL

BEAUMONT, TEX.

Sealed bids will be received by the Board of Wharf and Dock Commissioners for furnishing all tools, material, labor, etc., for the following work at Kirby's Point, City of Beaumont, Texas, namely:

1. Five hundred feet of quays, including dredging, excavation, filling and removal of old piles and decking and paving.

2. The construction of a steel shed and crane runways in length 400 ft., width 60 ft. and clear height under the girders 30 ft., including columns, foundations, filling and flooring.

3. The furnishing and installing two traveling gantry jib cranes, two overhead traveling cranes with movable tracks and overhead carriers with necessary appliances and appurtenances.

A certified or cashier's check in the sum of 2½ per cent on the amount of said bid or bids made payable to Emmett A. Fletcher, Mayor, on some Beaumont bank or trust company, will be required to accompany each bid.

For specifications, plans or other information apply to the office of the Board of Wharf and Dock Commissioners, City Hall, Beaumont, Tex. Said plans and specifications will be furnished for five dollars.

Bids to be considered must be filed on or before Monday, 12 o'clock, noon, November 1, 1915. Said bids should be addressed to J. G. Sutton, City Secretary, City Hall, Beaumont, Tex., and marked:

1. Bid for Quay Construction.
2. Bid for shed construction.
3. Bid for Freight Handling Machinery.

The City Council reserves the right to reject any and all bids.

BOARD OF WHARF AND DOCK COMMISSIONERS
By J. F. KEITH, President,
H. McL. HARDING,
Consulting Engineer.

Bids open October 20, 1915.

SEWERS

PELLA, IOWA.

Sealed proposals will be received by the City Clerk of the City of Pella, Iowa, for the construction of approximately 14,500 ft. sanitary sewers, 15 flush tanks and 19 manholes, as per plans and specifications on file in the office of the City Clerk, the work to be commenced on or before the first day of April, 1916, and completed on or before the first day of July, 1916, all bids to be accompanied, in a separate envelope, with a certified check payable to the order of the Treasurer of the City of Pella, Iowa, in the sum of $500.00, all bids to be filed with the City Clerk not later than 5 o'clock p. m. of the 20th day of October, 1915. Bids will be opened by the Council at 7.30 o'clock p. m. of said day, the right is reserved to reject any or all bids.

A. C. KUPYER,
City Clerk.

Bids open October 22, 1915.

NOTICE TO CONTRACTORS

REPAIRS, STATE ARSENAL

NEW YORK CITY

Sealed proposals for roofing and painting repairs and improvements to State Arsenal, 7th Avenue and 35th Street, New York City, will be received by the undersigned until four o'clock afternoon of Friday, October 22, 1915, and then publicly opened and read. Specifications may be consulted at aforesaid arsenal or below described office of the Commission.

STATE ARMORY COMMISSION,
FRANKLIN W. WARD, Secretary.
Capitol, Albany, N. Y.

Bids open October 20, 1915.

LEVEE REPAIRS

SHAWNEETOWN, ILL.

Sealed proposals will be received at the offices of the Rivers and Lakes Commission, 905 State Building, Chicago, Ill., until noon, October 20, 1915, for levee repairs in the city of Shawneetown, Ill.

Approximate quantities—Levee enlargement and repair 12,000 cu. yd. earth.

A certified check for $500 must accompany the proposal. Drawings, form of contract, specifications, bond, etc., can be secured at the office of the Rivers and Lakes Commission or from Mayor Louis W. Goetzman, Shawneetown, Ill.

The Commission reserves the right to reject any and all bids.

RIVERS AND LAKES COMMISSION.
ARTHUR W. CHARLES, Chairman.
LEROY K. SHERMAN.
THOMAS J. HEALY.
CHARLES CHRISTMANN, Secretary.

Bids open October 26, 1915.

HIGHWAY WORK

OFFICE OF THE STATE COMMISSION OF HIGHWAYS.

ALBANY, N. Y.

Sealed proposals will be received by the undersigned at their office, No. 55 Lancaster Street, Albany, N. Y., at 1 o'clock p. m., on Tuesday, the 26th day of October, 1915, for the improvement of the following highways in the following counties:

Albany (approx. 3.41); Allegany (approx. 5.25); Cayuga (approx. 6.06); Clinton (approx. 3.79); Columbia (two highways, 4.27; 7.77); Cortland (approx. 4.00); Erie (four highways, 9.14, 4.30, 4.50, 5.19); Genesee (approx. 4.53); Livingston (approx. 7.69); Madison (two highways, 3.05, 0.18); Monroe (two highways, 0.73, 2.91); Oneida (approx. 0.70); Onondaga (approx. 0.18); Orange (four highways, 3.64, 3.17, 3.70, 0.38); Schenectady (approx. 5.62); Seneca (approx. 5.01); Steuben (approx. 5.25); Sullivan (approx. 0.43); Tioga (approx. 4.07); Tompkins (approx. 2.48); Ulster (approx. 10.24).

Maps, plans, specifications and estimates may be seen and proposal forms obtained at the office of the Commission in Albany, N. Y., and also at the offices of the division engineers in whose divisions the roads are to be improved. The addresses of the Division Engineers and the counties in which they are in charge will be furnished on request.

The especial attention of bidders is called to "GENERAL INFORMATION FOR BIDDERS" in the itemized proposal, specifications and contract agreement.

EDWIN DUFFEY,
Commissioner.
IRVING J. MORRIS,
Secretary.

Bids open October 21, 1915.

CITY OF NEWARK, N. J.

NOTICE TO CONTRACTORS.

DISPOSAL PLANT

OFFICE OF THE BOARD OF STREET AND WATER COMMISSIONERS.
CITY HALL, NEWARK, N. J.

Sealed proposals will be received by the Board of Street and Water Commissioners at its office in the City Hall from 3.15 to 3.30 o'clock p. m., on Thursday, October 21, 1915, and opened at the last named hour, at a public meeting of the Board, to be held at said time and place.

For the collection, removal and disposal of ashes, rubbish material, paper and garbage in the City of Newark, each bid to be a price per year for each of five years from January 1, 1916, in accordance with the specifications therefor, which are to be made a part of this contract.

In comparing proposals the totals bid for the entire period of five years will be used.

Bids must be made on forms of proposals prepared and printed by the Board, and copies of which are attached to the printed specifications and description of the contract work. Said printed forms of blank proposals and specifications will be furnished persons desiring the same at the office of the Chief Engineer of the Board, in the City Hall, Newark, N. J. Bidders must state in words and figures the gross price per annum for which it is proposed to do the work specified in the proposal.

Each proposal to be accompanied by the consent in writing of a surety company, qualified to do business in New Jersey, who shall, at the time of putting in such proposal, obligate itself to the amount of $100,000 that, if the contract be awarded to the person or persons making the proposal, it will, upon its being so awarded, become his or their sureties for the faithful performance of said work; and that if the said person or persons omit or refuse to execute the contract, said surety company will pay to the City of Newark any difference between the sums to which he or they would have been entitled upon completion of the contract and that which the City of Newark may be obliged to pay the person or persons by whom such contract shall be executed.

The Board of Street and Water Commissioners of the City of Newark reserves to itself the right to accept or reject proposals for the above work, as it may deem best for the interest of the City.

By direction of the
Board of Street and Water Commissioners,
M. R. SHERRERD,
Chief Engineer.

October 4, 1915.

Bids open October 19, 1915.

BUILDING EXTENSION AT STATE HOSPITAL

TRENTON, N. J.

Sealed proposals will be received at the office of the Governor, Trenton, N. J., until 12 o'clock noon, on Tuesday, October 19, 1915, for furnishing all labor and material necessary for the further extension of the House of Detention for Convict and Criminal Insane at the State Hospital, Trenton, N. J., in accordance with plans and specifications on file in the office of the Commissioner of Charities and Corrections, State House, Trenton, N. J.

Each bidder must accompany his proposal with a certified check for ten per centum of the amount of his proposal, payable to his order, properly endorsed, which will be returned to the unsuccessful bidder immediately following the award of the contract.

Proposals must be enclosed in envelopes sealed and marked "Proposals for the further extension of the House of Detention for Convict and Criminal Insane at the State Hospital, Trenton."

E. I. EDWARDS,
Secretary State House Commission.

New Bar Bender Designed Especially for Heavy Work

The new Number 6 bar bender, which is manufactured by the Wallace Supplies Manufacturing Company, 412-420 Orleans Street, Chicago, is designed especially for heavy work, such as bending 1¼ in. square bars, which it will twist to any desired angle or



MACHINE WILL TWIST BAR TO ANY ANGLE

into a U-shape. A socket is arranged for the insertion of a piece of round bar stock or pipe so the machine can be operated by direct pull instead of by ratchet. This latter feature makes it also applicable to light work. The machine can also be arranged for bending other shapes, such as channels and T-iron. In operation an auxiliary ratchet lever operates a pinion against a series of teeth in the frame at a large ratio, thus developing great power. The weight of the machine is about 600 lb.

Light for Night Construction Work Adapted to Intermittent Use

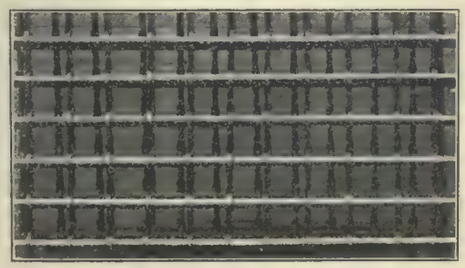
Automatic operation requiring no attention other than recharging, intermittent usage of light without appreciable loss from after-generation when shut off, portability and simplicity of operation are features of the Carbic acetylene light which has recently been placed on the market. Carbide for generating gas is fed to the torch in cakes, which are made from high grade gas producing materials compressed into briquette form. These cakes are placed in a holder which fits into a hood which in turn fits into the water stand. The air in the hood prevents the water from touching the carbic cakes. When the torch is to be used gas is generated by turning a valve which allows the air to escape from the hood through the pipe and out the burner. As the air escapes water rises in the stand and reaches the lowest carbide cake, thus generating gas. When through using, the light is shut off and the generated gas still remaining prevents the water from touching fresh carbide and thus generating more gas. In this manner an intermittent use of the light can be obtained economically. The lights can be charged at one time to operate continuously from four to twelve hours, depending on the size light purchased.

The light, which is made in several sizes and is adapted for night construction work is manufactured by the Carbic Manufacturing Company of Duluth, Minn.

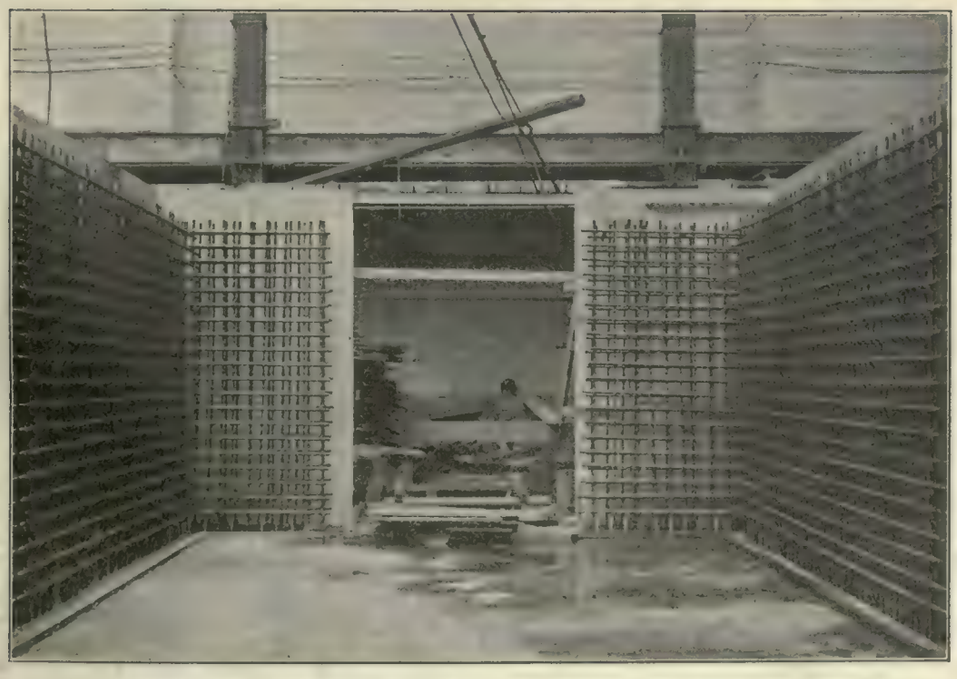
Bank Vault Contains New Shop Fabricated Unit Reinforcement

The new system of reinforcing described in the Enginueering Record of Aug. 21, page 75, following page 244, has been applied in the construction of a burglar-proof bank vault for the Guardian Savings and Trust Company of Cleveland, Ohio. Heavy horizontal rods are held in exact position by the bent 9/16-in. flats gripped by the vertical rods of the special troughed section, as seen in the accompanying photographs.

The reinforcement in the walls of this vault is in two layers, one near the inside and one near the outside of the concrete wall. By securely bracing the vertical rods exactly in position at short intervals, the reinforcing mat as a whole is held in its proper location during the pouring of the concrete.



NEAR VIEW SHOWS LOOP SUPPORTS



SHOP-FABRICATED REINFORCEMENT USED FOR BURGLAR-PROOF BANK VAULT

Business Notes

Robert Allan, formerly attached to the Dallas (Tex.) office of the Burd High Compression Ring Company of Rockford, Ill., has been appointed district branch manager for Northern California for that company, with headquarters at the Phelan Building, San Francisco.

A. D. Wilkins, formerly division superintendent of the Reo Motor Car Company of Lansing, Mich., has been appointed superintendent of the Original Gas Engine Company and of the Ideal Power Lawn Mower Company of Lansing.

Alan A. Wood, formerly at the office of the Builders' Iron Foundry, Providence, R. I., is now connected with Norman B. Livermore & Company, the Pacific coast agent of the company at San Francisco and Los Angeles, in an engineering and sales capacity.

H. J. Seaman, inventor of the rotary kiln, has resigned from the position of general superintendent of the Atlas Portland Cement Company.

The E. I. duPont de Nemours Powder Company of New Jersey will hereafter do business under the name of E. I. duPont de Nemours & Company of Delaware, a corporation organized for the purpose of taking over and carrying on the business. The new company assumes all the liabilities of the old company and will carry out all its contracts, there being no change in the personnel of the management, operations or methods of handling the business.

The Bucyrus Company, manufacturer of shovels, dredges, pile drivers, drag line excavators and wrecking cranes, of South Milwaukee, Wis., has opened an office in the Hiberman Building, Los Angeles, Cal., in charge of G. H. Hutchinson.

The Maher & Byrne Company has changed its corporate name to Anson-Byrne Company. The new company will continue as Chicago representatives for the Blaisdell Machinery Company, manufacturer of air compressors and vacuum pumps, and the Kingsford Foundry & Machine Works, manufacturer of centrifugal pumping machinery.

Trade Publications

Wallace & Tiernan Company, Inc., New York City. Booklet, 4 x 5¾ in., 15 pages, illustrated. Water purification by liquid chlorine for small communities.

Austin Brothers, Dallas, Tex. Catalog and handbook; flexible leather; 4½ x 7 in.; 280 pages, tables and diagrams. This is the first handbook published by this Southern firm, and includes, in addition to the usual reference tables, descriptions and illustrations of steel bridges and structural work, road building machinery and equipment, street-building, street-cleaning and street-maintaining machinery, metal culverts, tanks, sheets, roofing, and many forms of special equipment. The book is well printed, and should prove of unusual general value to engineers and road and building contractors.

Carnegie Steel Company, Pittsburgh, Pa. Shape Book, fifth edition; limp leather; 5 x 8 in.; 312 pages, illustrated; $1 net. Contains complete list of the products manufactured in the shape, plate, bar and rail mills of the Carnegie Company. Among the new lines of manufacture noted are many new sash and casement sections used for metal window frames, skylights, etc., a large number of automobile sections and a line of light-weight beams. The book is printed on thin paper, is well bound and the figures all are exceptionally clear. In addition to the illustrations and tables giving all the elements of the rolled shapes, including the new H-sections, tables of weights of flat rolled steel and round edge flats per linear foot, also square, round and hexagon bars are included. Other helpful tables, such as Birmingham wire gage, weights of ovals, etc., are also given.

CONTRACTING NEWS

Of Special Interest to Engineers, Contractors, Builders and Manufacturers of Engineering and Building Supplies

THE ANNOUNCEMENT, noted in the editorial columns of this issue, that it will be the aim of this administration to protect domestic manufacturers after the present war from cut-throat competition, on the part of foreign firms, of the sort that is already illegal for domestic companies, should result in extension in many industrial lines that would greatly increase construction work. This announcement is a step in the right direction, and if followed by the proper legislation, will make safe investment in a great variety of enterprises involving new construction. This action, however, while insuring the security of capital invested in plants manufacturing products for domestic consumption to replace goods formerly imported, does not touch the danger, alluded to before in this section, that temporarily increased foreign demand will raise our cost of production so high that our goods will be out of the race when Europe begins to produce again. If we are to maintain the prosperity our growing export trade (exports last week reached a new record of nearly $7,000,000) will continue to bring us, until peace is declared in Europe, we **must put ourselves in such an economic condition** that we can afford to undersell the world in the face of what may possibly prove the strongest **competition ever seen. The Nations now at war thoroughly understand that cheap production** will be their only commercial salvation, and will **doubtless bend every effort to that end. Our** natural advantages in cheap supplies of raw **materials will not offset their efforts if a false economic** structure is built up here on the temporary **export business which the war has dropped in our lap. This country produces more of many things than it can consume, and is preparing to** produce still more. If even a part of the surplus **could not be exchanged on a fair basis, a commercial** and financial setback might result that would have an immediate and depressing effect on all classes of construction work.

Buildings

A college dormitory contracted for at Wellesley, Mass., will cost $200,000. Newark, N. J., has **awarded a $100,000 school-building contract.** A university building to be constructed at Baltimore has been contracted for at $150,000. The lowest bid received for erecting the armory at **Akron, Ohio, was $172,000.** A hospital building **contracted for at San Antonio, Tex., will cost $200,000.** A New York company has secured the **general contract for a $5,000,000 ship-building plant, most of the work on which will be sublet.** Bids are desired at Bloomington, Ind., for building a $175,000 gymnasium. Architects have been engaged at Bayonne, N. J., to plan school buildings to cost $335,000. Plans are being prepared for a $200,000 bank building at Philadelphia. A county home to be built at York, Pa., will cost $500,000. It is reported that a $500,000 hotel will be built in Columbus, Ohio. An office building to cost $200,000 is proposed at Dayton, Ohio. It is reported that a manufacturing plant in Chicago will build a $260,000 addition. Plans are being prepared at Jacksonville, Fla., for school buildings, for the construction of which $500,000 bonds have been sold. A $300,000 building for a fraternal order is contemplated at Des Moines, Iowa. The erection of a $200,000 court house is being considered at Woodland, Cal. It has been announced that a new $3,000,000 tin-plate mill is to be built soon at Gary, Ind.

Roads and Bridges

Active letting of construction contracts appears to have fallen off sharply during the past week. Bids were opened on a $72,000 sidewalk contract in New York City. The lowest bids for paving work opened Oct. 14 in Philadelphia totaled $114,800. Bids have been opened on a $75,000 paving contract at Sawtelle, Cal. A bid of $123,000 was received for constructing 16½ miles of road at Arcadia, Cal. Bids are desired Nov. 3 at Wabash, Ind., for constructing a 600-ft. reinforced-concrete bridge for which $40,000 has been appropriated. Plans are being prepared for road work to cost $120,000 at Sussex, N. J. Plans have been approved for a viaduct over the Lake Shore and Erie railroad tracks at Youngstown, Ohio, to cost $600,000. The city council of Cleveland has voted to pave several additional streets. The construction of a road to cost $100,000 is proposed at Columbus, Tex. A contract will soon be let at Portland, Ore., for a $53,000 bridge.

Waterworks and Sewers

Contracts awarded at Mimico, Ont., for constructing waterworks and sewer systems totaled $79,000. A $51,000 sewer contract has been awarded at Mesa, Ariz. Bids are desired in New York City for constructing a large relief sewer in tunnel under West Forty-sixth Street from the Hudson River to Seventh Avenue. Bids are desired for constructing sewer systems and sewage-disposal plants at Vermillion, Ohio, and at Ogden, Iowa. A report has been submitted at Allentown, Pa., on a sewer system and disposal plant estimated to cost $1,300,000. A 75,000,000-gal. reservoir is to be built at Waynesboro, Pa. An engineer's report has been made to Lexington, Ky., on a sewer system and disposal plant to cost $300,000. Ordinances authorizing improvements to storage basins at St. Louis to cost $290,000 have been approved. Austin, Tex., has sold $725,000 bonds, a large part of which will be used for sewer construction. A new waterworks system being considered at Pocatello, Idaho, will cost $400,000.

Miscellaneous

The contract for constructing the $3,000,000 drydock at Boston has at last been signed by the Governor of Massachusetts. Contracts awarded in Philadelphia for constructing a street undercrossing totaled $63,600. Grade-crossing elimination contracts totaling more than $138,000 have been awarded at Cleveland. The lowest bid received at San Francisco for constructing pier 29 was $283,000. It is reported that Boston intends spending $1,000,000 to improve city parks. A report on river and canal improvements submitted at Fall River, Mass., estimates the cost of the work at $3,000,000. Bids will be received in New York City for another section of the east branch of the new Bronx subway as soon as the form of contract has been approved. The construction of a $400,000 garbage-reduction plant is proposed at Kansas City. Permits have been issued in Oregon for the diversion of water for municipal and irrigation purposes on several projects at a total cost of $1,465,000. It is reported that Portland, Ore., will take steps to eliminate several grade crossings at a cost of $750,000.

WATERWORKS

PROPOSED WORK.

Hudson, N. Y.—Common council recently voted to issue $[illegible] bonds for water mains in the new commercial district, and $[illegible] for street improvements including the [illegible] state highway and paving S Prospect Street.

Oneida, N. Y.—The city is considering soft water supply.

Port Byron, N. Y.—The village trustees are seeking a new source for the water supply.

Waynesboro, Pa.—Waynesboro Water Co. will construct a reservoir capacity 75,000,000 gal.

Blackstone, Va.—Reported steps being taken to rebuild water works and electric light plant recently damaged by fire.

St. Augustine, Fla.—S. G. Pollard, 3422 Reed's Avenue, Cincinnati, engaged to make complete investigation of water works.

St. Cloud, Fla.—Chas. H. Keenan, city clerk, writes that plans have been engaged to prepare maps, etc., for the purpose of considering purchase of land to be required for municipal waterworks and sewerage system. A detailed estimate of the cost of same will be prepared.

Citronelle, Ala.—Water works, sewer system and sewage disposal plant will be installed. F. G. Jackson, City Clk.

Citronelle, Ala.—Citizens voted $[illegible] bonds to build a waterworks system and water works.

Mayfield, Ky.—An election is to be held Nov. 2 to vote on question of purchasing the present water and light plant.

East Youngstown, Ohio.—Bonds for $[illegible],000 to be sold Nov. 12 by Carl R. Andersen, Village Clk., for constructing water works.

Lima, Ohio.—Experts are investigating sources of better water supply, and will report in a few weeks.

Middletown, Ohio.—Plans and specifications being prepared by S. G. Pollard, 3422 Reed Avenue, Cincinnati, for improvements to water works, including well piping, low service pumping station, receiving reservoir and additions to present pumping equipment, will be completed within two months.

Zanesville, Ohio.—City Council considering enlarging and relining two reservoirs; estimated cost $25,000.

Birmingham, Mich.—Bond issue amounting to $[illegible] to be used for water main extensions, sanitary sewers system and construction of new bridge has been approved.

Menominee, Mich.—An election will be held Nov. 1 to vote on issuing $285,000 bonds for water improvements. It is proposed to make an offer to the Menominee Water Co. to purchase present plant at a cost of $[illegible],000, and, if refused, to erect a municipal water works.

Saginaw, Mich.—The committee appointed to report on the improvement to the water supply recommend an election to be held probably Dec. 2, to vote on issuance of sale also authorize issue of $[illegible],000 bonds for building a consolidated pumping station for the entire city, with connecting mains and an up-to-date filtration and softening plant.

North Chicago, Ill.—Construction of a complete plant under consideration. Contract for liquid chlorine treatment awarded Wallace & Tiernan Co., Inc., 126 Liberty Street, New York. R. J. Smith, Waukegan, Designing Engr. B. Rause, Clk.

Sheboygan, Wis.—Water Works Comn. favors erecting new stand pipe, installing new pump and additional boiler.

Virginia, Minn.—Reported city is planning improving water works system at a cost of $50,000. No action to be taken until spring.

Worthington, Minn.—Citizens voted to extend the water works and sewers system; about $10,000 is to be spent on the water works and $30,000 on the sewer system, to include a septic tank. No action will be taken until the spring.

Glendive, Mont.—City Council is considering plan to improve and extend water works system, including building of filter plant; estimated cost $70,000.

St. Louis, Mo.—Bd. Pub. Wks. has approved ordinances authorizing construction of steel and concrete covers for two water storage basins at Bissell Point, to cost $200,000, and one basin at Baden, to cost $90,000.

Gravette, Ark.—Reported improvements to the municipal electric light plant and waterworks, including installation of engine, is under consideration by city.

Houston, Tex.—Supreme Court has refused injunction for holding up $5,000,000 water, sewer, harbor and paving improvements.

Lakewood, Wash.—Reported Town Council plans constructing municipal water system to cost $10,000.

Baker, Ore.—Citizens voted $118,000 bonds for extensions to water works, surveys to be made at once.

Oregon.—See "Hydraulic Construction and River Improvements."

San Anselmo, Cal.—Engineering Committee of the Marin Municipal Water District has been authorized to begin construction of roads as the initial step affecting the development of the $3,000,000 municipal water system, which the citizens recently authorized.

Pocatello, Idaho.—The municipal water works system is to cost $400,000, not $40,000, as previously stated. Bannock Engineering Co. of Pocatello, Engrs.

Anchorage, Alaska—The Alaska Engineering Commission, Bell Street Dock, Seattle (C. E. Dole, Purchasing Agent), will construct a waterworks system at Anchorage, Alaska, including installation of a pumping plant on Ship Creek, a 100,000 gal. steel tank on an 80 ft. tower, about 1800 ft. of 8-in. wood stave pipe and several thousand feet of 4-in. w. i. pipe, hydraulic steam pump of 500,000 gal. capacity, etc.

BIDS DESIRED.

Brooklyn, N. Y.—Until Nov. 9 by Bureau Supplies and Accounts, Washington, D. C., for Schedule 8924—Miscellaneous brass cocks, check and gate valves at Navy Yard, Brooklyn.

Buffalo, N. Y.—Until Oct. 30 by Francis G. Ward, Comr. Pub. Wks., for furnishing a 12-in. high pressure pipe line and conduit from present fire line at Main and Perry Streets, through Main Street, to connect with present fire line in the Terrace, and a Y connection at Washington and Exchange Street, including valves, hydrants, etc.

Le Roy, N. Y.—Until Nov. 3 by Bd. Water & Light Comrs. for building a 125,000 gal. elevated tank, advertised in Engineering Record. James P. Wells, Consulting Engr., Le Roy.

Tompkinsville, N. Y.—Until Oct. 27 by Light House Inspector, Tompkinsville, for sanitary pump, water pump, main feed pump, 2 main circulating pumps, etc.

Newark, N. J.—Reported desired until Oct. 28 (readvertisement) by Committee on Pub. Bldgs., Common Council (Thomas J. Lee, Jr., Chmn.) for furnishing material and constructing water supply and fire system at New Alms House, Ivy Hill, South Orange Township. George W. Knight Co., Engrs., 784 Broad Street.

Jacksonville, Fla.—Until Nov. 8 by F. W. Bruce, Ch. Engr. Port Comrs., Jacksonville, for 50,000 gal. water tank, 100 ft. high, erected on a metal tower at Municipal Terminals.

Cleveland, Ohio.—Until Oct. 27 by Commissioner Purchases and Supplies, Cleveland, for steam turbine-driven generating unit, steam engine-driven generating unit and steel reinforcing bars for the Division Avenue pumping station.

Columbus, Ohio.—Until Nov. 11 (extension of date from Oct. 28) by Ohio Bd. of Administration, Oak and Ninth Streets (A. F. Shepherd, Pres.), for furnishing and installing water softening equipment for Institution for Feeble-Minded. H. S. Riddle, Consulting Engr., Ohio Bd. Administration, Columbus.

Germania, Iowa.—Until Oct. 29 by M. H. Stoddard, Town Clk., for furnishing material and constructing approximately 5040 ft. 4-in. and 1620 ft. 6-in. c. i. water pipe, 13 hydrants, valves and valve boxes, pumping station, 40,000 gal. elevated tank and tower, etc.

St. Cloud, Minn.—Reported desired until Oct. 26 by Geo. G. Magnuson, City Clk., for laying water mains on portions of Sixth and Seventh Avenues S., Fourth Avenue S. E., and Third Avenue.

Gallatin, Mo.—Until Oct. 28 by W. R. Handy, City Clk., for water works and electric light plant improvements, to include furnishing material and constructing brick power house, concrete reservoir, 50,000 gal. capacity, furnishing two centrifugal pumps and two deep well pumps with motors, furnishing and laying 14,000 ft. 4-in. c.-i. pipe, miscellaneous valves, hydrants, etc. E. E. Harper, Consulting Engr., Grand Avenue Temple, Kansas City, Mo.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Boston, Mass.—Following are the bids opened Oct. 11 by Commissioner of Public Works for laying 15,000 ft. of 4 to 16-in. water pipe in various streets in Dorchester and Roxbury Districts: John Guarino, 45 Brook Avenue, Roxbury, $10,308; Thomas Burke, 7 Shirley Street, Roxbury, $10,905; John T. Shea, Jr., South Boston, $11,495.

New York, N. Y.—Lowest unofficial bid opened Oct. 19, by Bd. Water Supply, Municipal Building (Chas. Strauss, Pres.), for Contract 166: Erecting two steel frame buildings, galvanized steel covered for drainage chambers at Shafts 11 and 21, City Tunnel, at Catskill Aqueduct, New York. Submitted by Northeastern Constr. Co., 255 Fifth Avenue, at $27,568.

Washington, D. C.—Following are four lowest bids opened Oct. 11 by Comrs D. C. for one steam turbine-driven centrifugal pumping unit for the water department: The De Laval Steam Turbine Co., Trenton, N. J., $12,995, 115 days, and $15,633, 105 days; Alberger Pump & Condenser Co., New York, $17,050, 150 days; Standard Eng. Co., Washington, D. C., $18,690, 180 days; Westinghouse Electric & Mfg. Co., Washington, D. C., $18,888. 4½ months.

★**Cincinnati, Ohio.**—Contract for furnishing pipe castings (bids opened Oct. 13) awarded U. S. Cast Iron Pipe & Fdry. Co., Addiston, Ohio, at $34,807. C. A. Zech, Asst, Secy. Dir. Public Service.

★**Middletown, Ohio.**—Contract awarded J. A. Yingling's Sons, Hamilton, for driving wells at $3,500. S. G. Pollard, Engr., 3422 Burch Avenue, Cincinnati.

★**Attica, Kan.**—Contract awarded by J. C. McCaddon, City Clerk, for constructing water works, consisting of 16,200 ft. 4, 6 and 8-in. c.-i. water pipe, etc., to Bickel Co., Kansas City, Mo.; probable cost $28,000. E. P. Archer, Engineer, Kansas City, Mo.

★**Manhattan, Kan.**—Contract for constructing the relief reservoir awarded George Holland, Manhattan, at $1,983. The other water works improvements to be made with the $69,500 appropriation, will be done by force account, and will include extending of mains, new hydrants, etc. Fred Walters, City Engr.

★**Ord, Neb.**—Contracts for water works machinery awarded as follows: Pumps and pump houses, to Alamo Engine & Supply Co., Omaha, at $3,600, and engine for plant and other equipment, to Market-Hines Co., at $8,975.

Galveston, Tex. — Four lowest bids opened Oct. 14 by City Commissioners for constructing a submerged water main across Galveston Bay: Major & Seagraves, $13,411; William Moore & Co., $21,260; Isaac Heffron, $24,200; Bloggett Construction Co., Galveston, $25,300.

Amity, Ore.—J. P. O'Neill, 1175 Burrace Street, Portland, submitted lowest bid for constructing water works; he bid $11,000 for steel pipe and $9,777 for wood pipe. J. L. Stannard, Lewis Building, Portland, consulting engineer.

SEWERAGE AND SEWAGE DISPOSAL

PROPOSED WORK.

Manchester, Conn.—The sum of $12,000 has been appropriated for the west side storm water sewers. J. Frank Bowen, city engineer, South Manchester.

Savannah, Ga.—Reported citizens voted $400,000 bonds for completion of house drainage and storm sewerage system.

Citronelle, Ala.—See "Water Works."

Cleveland, Tenn.—Contract soon to be let for constructing sewerage system. W. J. Kirkpatrick, Birmingham, Ala., Engr.

Lexington, Ky.—P. H. Norcross, Consulting Engr., Atlanta, Ga., has submitted a report on the proposed sewerage system and disposal plant. An election is to be held Nov. 2 to vote on issuing $300,000 bonds for said purpose.

Owensboro, Ky.—Citizens will vote on issuing $225,000 bonds for constructing a sewer system. Knight & Quayle, Engrs., Chattanooga, Tenn.

Cincinnati, Ohio.—All bids opened Sept. 24 for constructing Duck Creek Interceptor No. 3 rejected Oct. 5 by Director Public Service (C. A. Zech, Asst. Secy.).

Dayton, Ohio.—Sanitary sewer bonds amounting to $40,000, and bridge bonds, $338,000, have been sold by the city.

Portsmouth, Ohio.—Plans will be ready in spring of 1916 for the sewer work contemplated in the northern and southern section of the city. George L. Gabliman, City Aud.

Springfield, Ohio.—Bonds for $6,271 will be sold Nov. 1, by Frank B. Thomas, City Aud., for constructing storm water sewer on Lowry Avenue.

Vermillion, Ohio.—Bonds for $22,000 to be sold Nov. 8 by Lewis Blattner, Village Clk., for sewerage and sewage disposal plant.

Birmingham, Mich. — See "Water Works."

Alton, Ill.—Contract for constructing the East End trunk sewer will not be let until spring. T. H. Landon, City Engr.

Elgin, Ill.—The City Council has directed the corporation council and city engineer to confer with the members of the river and lakes commission of Illinois, relative to working out an intercepting sewer and disposal plant.

Ashland, Wis.—All bids opened Oct. 14 for constructing sewers in Whittlesey Avenue and several alleys have been rejected, and new bids will not be asked until next spring. W. C. Morris, City Clk.

Marengo, Iowa.—Construction of a sewerage system is under consideration.

Loup City, Neb.—An election to be held Nov. 9 on question of issuing bonds to construct sewer system.

Austin, Tex.—Bonds—$425,000 streets, bridges and sewers; $250,000 schools; $50,000 sanitary sewers; have been sold. and improvements will soon begin.

Houston, Tex.—See "Hydraulic."

Uvalde, Tex.—Plans being prepared by N. Werenskiold, Box 511, Dallas, for a sewage disposal plant.

Portland, Ore.—City Commissioners intend rebuilding Mill and Water Streets wood box sewer, at a cost of $10,000.

Pasadena, Cal.—Contract soon to be let for constructing 3200 ft. 11 x 6 ft. concrete storm drain. R. V. Orbison, City Engr.

Kellogg, Idaho.—Reported City Engineer directed to prepare plans for sewer in Pressly Addition; cost about $8,000.

BIDS DESIRED.

Woonsocket, R. I.—Until Nov. 3 by Bd. Aldermen, for constructing surface water drain in Carrigton Avenue and Maple Street, advertised in Engineering Record. Frank H. Mills, City Engr.

Greenwich, N. Y.—Until Nov. 1 by Bd. Trustees (Arthur H. Wilcox, Pres.) for constructing sewers in Elm Avenue, Main and Bridge Streets, advertised in Engineering Record. Charles E. Perry, Engr., 36 State Street, Albany.

New York, N. Y.—Until Nov. 4, by Marcus M. Marks, Pres. Manhattan Borough, for furnishing material and constructing tunnel relief sewer and appurtenances in W. Forty-sixth Street from Hudson River to Seventh Avenue, together with all work incidental thereto. Security $100,000,

New York, N. Y.—See "Electric Railways."

Yorktown, N. Y.—Until Nov. 9 by State Hospital Comn., Capitol, Albany, for sewerage and sewage disposal plant at Mahansic State Hospital, Yorktown, advertised in Engineering Record. Lewis F. Pilcher, State Archt., Albany.

Pittsburgh, Pa.—Until Oct. 29 by City Controller, for constructing sewers in portions of Huntress, Arnold, Rueben and other streets, also for repairing portion of Webster Avenue, repairing Melancthon, Fulton and Plank Street bridges.

Miami, Fla.—Until Nov. 4 (readvertisement), by B. H. Klyce, City Engr., Real Estate Building, for centrifugal pumps and electric motor for sewage pumping station in Riverside.

Canton, Ohio.—Reported desired until Oct. 27 by C. B. Hieber, Clk. to Dir. Pub. Service, for constructing storm water sewers in Brown Avenue N. W., Spring Avenue N. E. and Lafayette Ave. S. E., Second Street N. E., Ninth Street S. W. and other streets.

Cleveland Heights (P. O. Warrensville), Ohio.—Until Nov. 15 by H. H. Canfield, Clk. Village Cleveland Heights, for furnishing material and constructing sanitary sewers in Cedar Dist. No. 3; also for paving with brick asphalt or macadam portions of Coolridge, Corydon, Essex and other roads. F. A. Pease Engr. Co., Marshall Building, Cleveland.

East Cleveland, Ohio.—Reported desired until Oct. 25 by James P. Arter, Clk. to Dir. Pub. Service, for combination of storm and sanitary sewers on Lake Front Avenue, Eddy Road, East 131st and other streets.

Mansfield, Ohio.—Reported desired until Oct. 27 by Orra B. Hursh, Dir. Bd. Pub. Service, for constructing sewers in Sewer Dist. No. 1. W. J. Hazeltine, City Engr.

Vermillion, Ohio.—Until Nov. 16 by Lewis Blattner, Village Clk., for constructing sanitary sewers system and sewage disposal plant, advertised in Engineering Record. Morris Knowles, Engr., 2541 Oliver Building, Pittsburgh, Pa.

Oakland, Ia.—Until Nov. 23 (readvertisement), by Elvin F. Wentz, City Clk., for constructing approximately 13,300 ft. 8 to 15-in. sewers.

Ogden, Iowa.—Until Oct. 26 by Town Comrs. for constructing sewers and disposal plant, advertised in Engineering Record. R. C. Lutzenger, Engr., Perry, Iowa.

Haverlock, Neb.—Reported desired until Nov. 5 by Asher J. Blount, City Clk., for constructing lateral sewers in Dist. Nos. 23 and 14; also connecting sewers in Dist. No. 13 with sewer in Burlington Shop Yards.

El Centro, Cal.—Until Oct. 28 by Lavina Northcott, City Clk., for constructing El Centro-Imperial sewer system. Olmsted & Gillelen, Engrs., Hollingsworth Bldg., Los Angeles.

Ste. Agathe-des-Monts, Que.—Reported desired by Rodolphe Daze, Secy.-Treas., until Oct. 25 for furnishing material and constructing sewerage system, sewage purification system and sewage lifts. Ouimet & Lesage, 76 St. Gabriel Street, Montreal.

Berlin, Ont.—Until Oct. 26 by John Hessenauer, Chmn. Sewerage Committee, for furnishing material and installing two turbine pumps and all piping, 500 gal. per minute, 33 ft. head; two A. C. motors, switchboard and electrical instruments. Chipman & Powers, Consulting Engrs., 204 Mail Building, Toronto.

Toronto, Ont.—Reported desired until Oct. 26 by Board Control for constructing sewers in Blackthorn, Central, Clendenan Avenues, Maria Conolly and other streets.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**South Bound Brook, N. J.**—Following are totals of four lowest bids opened Oct. 11 by Borough Council for constructing 3.8 miles of vitr. pipe sewers and disposal plant (Clyde Potts, Engr., 50 Church Street, New York): Allen Engineering Co., 45 Clinton Street, Newark, $28,020 (awarded contract); Utility Constr. Co., 46 Paterson Street, New Brunswick, $28,068; Louis J. Sieling, 211 Broad Street, Red Bank, $29,733; D. M. Rosser, Kingston, Pa., $30,633.

Washington, D. C.—George Hyman of Washington submitted lowest bid Oct. 12 for constructing Section 5, Anacostia Main Interceptor, at $7,625.

★**Albermarle, N. C.**—Following are unit prices of Acme Plumbing Co., Charlotte, N. C., successful bidder, for constructing sewerage system (bids opened Oct. 15): 430 lin. ft. 20-in., 90.5 cts.; 2480 lin. ft. 18-in., 75. cts.; 1650 lin. ft., 15-in., 60 cts.; 3075 lin. ft. 12-in., 44 cts. and 47 cts., according to depth; 260 lin. ft. 10-in., 38 cts.; 7779 lin. ft. 8-in., 29 cts. and 33 cts., according to depth; 2400 lin. ft. 6-in., 26 cts. and 29 cts., according to depth; 8 M ft. lumber, $20.70; 6450 cu. yd. soft rock, 52 cts.; 1530 cu. yd. hard rock, $2.75; 17 tons cast iron pipe, $34.07; 47 manholes, $30.52; 5 flush tanks, $56.38; 5 flushing M. H., $42.55; total, $20,079. Other bidders: Hewitt Constr. Co., Hickory, $22,283; Dabbs & Myers, Meridian, Miss., $23,669; Municipal Eng. & Constr. Co., Atlanta, Ga., $25,331. J. D. Spinks, Engr.-in-Charge.

★**Marion, Ill.**—Following are four lowest bids opened Oct. 11 by Frank Payne, City Engineer, for constructing sanitary sewers: D. E. Nipp, Flora, $12,953 (awarded contract); H. A. Hall, East St. Louis, $14,379; Hoeffel Bros. Co., Belleville, $14,580; Meyer & Thomas, East St. Louis, $15,437.

Atlantic City, N. J.—Following are unit figures of the four lowest bids opened Oct. 7 by the City Commissioners for constructing a storm water drainage system: (a) James Ferry & Sons, 2411 Madison Avenue, Baltimore, Md., $125,921; (b) M. B. Markland, 1315 Atlantic Avenue, Atlantic City, $147,856; (c) Culp Co., Inc., East Forty-third Street and Twentieth Avenue, Paterson, $150,039; (d) Atlantic Constr. & Supply Co., 925 Mediterranean Avenue, Atlantic City, $159,598.

	(a)	(b)	(c)	(d)
Concrete Drain:				
17 ft. 4 ft. x 2 ft. 6 in	$14.60	$20.00	$11.31	$14.92
355 ft. 4 ft. x 2 ft	12.70	13.69	11.31	13.55
375 ft. 3 ft. 6 in. x 2 ft	10.90	10.00	11.02	12.47
575 ft. 3 ft. x 2 ft	10.80	12.65	10.94	12.63
Brick and Concrete Drain:				
263 ft. 48 in	17.60	16.50	13.92	15.50
520 ft. 39 in	13.10	14.05	11.83	14.70
105 ft. 36 in	16.20	9.45	10.53	12.23
810 ft. 33 in	7.80	8.00	7.18	9.10
2,148 ft. 30 in	6.90	7.90	7.00	8.70
2,282 ft. 27 in	5.50	7.00	6.88	7.74
Terra Cotta Drain:				
2,154 ft. 24 in	4.80	6.75	7.25	7.80
1,726 ft. 22 in	4.40	6.35	6.55	7.00
802 ft. 20 in	4.10	6.15	6.11	6.45
544 ft. 18 in	3.30	6.70	5.86	5.70
1,315 ft. 15 in	2.70	5.55	5.00	4.90
267 ft. 12 in	2.30	4.50	4.00	3.55
2,657 ft. 12-in. terra-cotta inlet pipe	1.90	1.80	2.55	2.35
3,756 ft. 10-in. terra-cotta inlet pipe	1.80	1.60	2.50	2.10
394 vt. ft. manholes	6.00	6.00	5.50	6.50
62 manhole frames and covers	10.00	9.00	9.25	9.00
209 storm water inlets	25.00	20.00	25.00	30.00
209 hood traps	4.00	3.50	3.60	3.60
104 catchbasins	45.00	80.00	80.00	68.00
12,700 ft. underdrain	0.30	0.20	0.36	0.21
21,700 ft. piles	0.30	0.30	0.30	0.30
2 concrete bulkheads (lump sum)	1,000.00	1,000.00	1,000.00	800.00

★**Coatesville, Pa.**—Following are the unit figures of four lowest bids opened Oct. 7 by the Borough Council for constructing Contract D—High Service System: (a) Partridge & Burke, Hohokus, N. J., $23,834 (awarded contract); (b) H. C. Brooks Co., Martinsburg, W. Va., $24,944; (c) The Dunleavy Bros., Coatesville, $25,619; (d) Pugh & Hubbard, Philadelphia, Pa., $28,126. Alexander Potter, Consulting Engineer, 50 Church Street, New York.

	(a)	(b)	(c)	(d)
12.56 tons 10-in. Class A pipe	$24.75	$26.50	$26.75	$26.50
30.36 tons 10-in. Class B pipe	24.75	26.50	26.75	26.50
62.75 tons 8-in. Class B pipe	24.75	26.50	26.75	27.05
243.0 tons 8-in. Class C pipe	24.75	26.50	26.75	27.05
24.15 tons 6-in. Class B pipe	24.75	26.50	26.75	27.05
13.6 tons 6-in. Class C pipe	60.00	65.00	60.00	58.80
10.2 tons c,-i. specials	0.35	0.35	0.35	0.38
1,390 lin. ft. 10-in. c.-i. pipe laid	0.28	0.29	0.35	0.36
11,980 lin. ft. 8-in. c.-i. pipe laid	0.23	0.27	0.35	0.34
2,170 lin. ft. 6-in. c.-i. pipe laid	25.75	27.50	30.00	28.50
1 10-in. gate valve	19.50	21.00	20.00	17.60
8 8-in. gate valves	14.00	16.00	12.75	12.00
18 6-in. gate valves	45.00	50.00	48.00	44.50
30 hydrants with gate valves	0.75	1.00	1.25	1.50
200 cu. yd. excess excavation	0.10	0.10	0.05	0.20
3,000 lin. ft. macadam pavement	0.34	0.60	0.25	1.75
120 lin. ft. brick pavement	3,700.00	3,750.00	3,600.00	3,685.00
250,000-gal. water tank	1,456.00	1,075.00	1,284.00	1,740.00
Equipment for pumping station	650.00	725.00	600.00	706.00
Venturi meter	600.00	700.00	960.00	1,720.00
Superstructure for pumping station	0.45	1.00	0.60	1.00
177 cu. yd. earth excavation	8.00	9.00	8.00	15.00
7 cu. yd. Class A concrete	9.00	8.00	6.00	10.00
55 cu. yd. Class B concrete	0.05	0.06	0.04	0 04
140 lb. of steel reinforcement				

★Sioux City, Iowa.—Contract for constructing the Morningside sanitary sewer, about 1.2 mi. 8 in. sewer awarded F. T. Lawler, Sioux City, at 80½ cts. per ft. Paul J. Wells, City Clk.

★Santa Barbara, Cal.—Contract for constructing concrete pipe sewers, about 42,000 ft. 8 in. and 10 in. pipe, bids opened Sept. 16, awarded Sam Kratz, of Los Angeles, Cal., at $28,300. Next three lowest bidders: Eggert & Chapin, Los Angeles, $30,500; T. J. Shay, $29,500; Hunter & Weimer, $31,954. A. B. Cook, City Engineer.

★Mesa, Ariz.—Following are four lowest bids opened recently for constructing the sewer system in La Loma Precinct, $31,-778 awarded contract to Watson & Spicer, Los Angeles, $32,800; G. M. Thomas & Sons, Phoenix, $33,500, and John Rapida, Los Angeles, $35,000.

Mountain Home, Idaho.—Following are three lowest bids opened Oct. 7 by R. J. Newell, Engineer Sewer District, for constructing sanitary sewers in Sewer Districts Nos. 1 and 2 as set about 14,500 ft. of pipe: Idaho Hardware & Plumbing Co., Boise, $13,500; Wagner Kershaw Co., Boise, $17,621; Charles Mull, Twin Falls, Idaho, $18,000.

★Mimico, Ont.—Contracts for constructing the water works and sewer system awarded as follows: Constructing screens and pumping station, to Harvey Stewart & Co., Nova Scotia, $94,621; disposal tank, F. F. Pipe, Toronto, $31,253 per pipe and segment casting for the system, to Ontario Sewer Pipe Co., Mimico.

BRIDGES

PROPOSED WORK.

Hanover, N. Y.—Citizens voted to spend $[illegible] for constructing bridge over Silver Creek at Hanover Street.

Harrisburg, Pa.—State Water Supply Comm. approved specifications for constructing following bridges:

Luzerne County—Over Laurel Run Creek at Bear Creek Bridge, near Wilkesbarre, over Toby's Creek at Courtdale.

Juniata County—Over Cocolamus Creek in Delaware Township.

Allegheny and Beaver Counties—Over Raccoon Run, near Clinton.

York County—Over Fennett Run, near Goodhart, Newberry Township.

Erie County—Over Spring Brook Creek, near Lavery, over Slaughter Run, near Elgin, and over Walnut Creek, near Kearsarge.

Bucks County—Over Thousand Acre Rd., near Almond; over Snyder Creek, near Perkasie.

Franklin County—Over Rocky Springs Creek, near Chambersburg.

Clarion County—Over Hogan Run, near Perrysville.

Spring City, Pa.—Construction of bridge over Schuylkill River between Royersford and Spring City is contemplated by city and Chester and Montgomery Counties.

Atlanta, Ga.—County Comrs. considering constructing 1,000-ft. viaduct over Southern Ry. to connect North Boulevard with Piedmont Park.

Roswell, Ga.—County Comrs. at Atlanta considering constructing steel bridge over Chattahoochee River at Roswell, cost about $[illegible].

Natchez, Miss.—Bd. Supervs., Franklin County, voted to construct a bridge over Homochitto River, cost about $6,000.

Loudon, Tenn.—County Court granted franchise for constructing toll bridge over Tennessee River near Lenoir Crossing. A. Tipton and T. H. Baker said to be interested.

Dayton, Ohio.—See "Sewerage and Sewage Disposal."

Youngstown, Ohio.—City Engineer and representatives of interested railroads approved plans for viaduct to be constructed over Lake Shore and Erie tracks at E. Federal Street, cost about $[illegible].

Anderson, Ind.—Reported steps being taken to extend Main Street bridge over White River at an approximate cost of $[illegible].

Hartford City, Ind.—Reported a new bridge is to replace Spring St. bridge.

Birmingham, Mich.—See "Water Works."

Red Wing, Minn.—The city and the county are considering replacing a span of the bridge over Mississippi in Red Wing or some other part of the channel and construction of a bond road thereto. A. E. Elstad, city engineer.

Iola, Kan.—Plans being prepared by state engineer, Manhattan, for two 6-ft. concrete bridges, estimated cost $[illegible].

Guthrie, Okla.—Plans and specifications prepared by J. A. Rundle, County Engr., for constructing bridge over Cimarron River near Guthrie, cost about $[illegible].

Oklahoma City, Okla.—County Commissioners have passed resolution authorizing construction of bridges aggregating $11,697.

Aberdeen, Wash.—All bids opened by City Council for constructing steel bridge over Wynoah River rejected. According to reports new bids will soon be received.

Portland, Ore.—Contract will be awarded by Department of Public Works about Oct. 25 for constructing an extension of Union Avenue to the Columbia Slough Load A bridge 250 ft. long and 58 ft. wide, cost $[illegible], and fill 700 ft. long, cost $[illegible], are included in the improvement.

Salem, Ore.—County Court contemplates constructing steel bridge over river at Salem, cost about $[illegible].

Harrison, Idaho.—A. L. Jaqueth, Great Falls, Mont., engaged to estimate cost of constructing concrete structure to replace wooden trestle over Coeur d'Alene River.

BIDS DESIRED.

South Orange, N. J.—Until Nov. 1 by Walter A. Evans, Chmn. Eighth Dist. Bridge Com., Co. Ed. Chosen Freeholders, Newark, for constructing a concrete steel I-beam bridge on Pierson Road over East branch of Rahway River, in Township of South Orange. Frederic A. Reimer, Co. Engr., Newark.

Kennett Square, Pa.—Until Oct. 26, by Isaac Y. Ash, Co. Controller, West Chester, for furnishing material and constructing a stone arch bridge over Red Clay Creek in Kennett Square.

Cumberland, Md.—Until Nov. 18, by Edward L. Williams 10 North Liberty Street, for constructing a reinforced concrete bridge from Rose Hill to Ridgely; cost $2,000.

Kinston, N. C.—Until Nov. 1 by County Commissioners for constructing steel bridge across Neuse River. Address C. W. Pridgen, Register of Deeds.

Woolsey, Ga.—Until Nov. 1 by J. J. Davies, Clk. County Court, Fayetteville, for constructing steel bridge, one 62-ft. and two 20-ft. spans, with 12-ft. roadway, and resting on steel and concrete piers across Flint River at Cut Bank Bridge, between Clayton and Fayette Counties, about one mile from Woolsey.

Columbus, Miss.—Reported desired until Nov. 1 by County Supervisors for constructing 100 ft. steel or concrete bridge and concrete culvert. C. L. Woods, Co. Engr.

Durant, Miss.—By Board Supervisors, Lexington, at November meeting for constructing steel bridge 50 ft. span over Bowles Creek, near Durant. P. H. Murphy, Clk.

Grenada, Miss.—Until Nov. 1 by Bd. Superv. for constructing a steel bridge across Long Creek, Dist. No. 4. John S. King, Clk.

Lakeville, Miss.—Reported desired until Nov. 3 by S. R. McKay, Clk. Co. Bd. Superv., for constructing steel and iron highway bridge over Chickasawhay River.

Osyka, Miss.—By Board Supervisors at Magnolia (Chas. E. Brunsfield, Clk.), at the November meeting for painting iron bridge across Tangipachoa River, near Osyka; rebuilding Terry Creek Bridge, near Osyka, and repairing Hoovers Bridge across Chitto River.

Cleveland, Ohio.—Until Nov. 3, by E. G. Krause, Clk. Co. Comrs., for constructing bridge, also concrete culvert 16 x 5 x 60 ft.

Wabash, Ind.—Until Nov. 3 by Dan Showater, Co. Aud., for constructing a bridge over Wabash River, at Wabash, to consist of six 100-ft. reinforced concrete spans; appropriation $40,000. A. W. Grosvenor, Engr., Fort Wayne.

Illinois.—By State Highway Commission, Springfield, for constructing bridges as follows:

Until Oct. 26, at Jerseyville, for constructing Seagraves steel bridge, 60 ft. span 18 ft. roadway, in Elsah Township. Engineer's estimate 12.2 tn. Chas. E. Warren, Co. Supt. Highways.

Until Nov. 2, at Bader, Bluff City Bridge, steel or reinforced concrete, 60-ft. span, 18-ft. roadway. Engineer's estimate concrete [illegible], steel [illegible]. W. S. Henderson, Co. Supt. Highways, Bader.

Seattle, Wash.—Reported desired until Oct. 27 by Chas. Ivarsmaag Avent for following material needed in construction of approaches to Fifteenth Avenue Northwest bridge, approach to be 3400 ft. long, 60 ft. wide, in all about 2,500,000 ft. untreated lumber, 200,000 ft. creosoted lumber, 55,000 ft. peeled piles, 7000 ft. creosoted piles, etc. Appropriation available $[illegible].

El Centro, Cal.—Reported desired until Nov. 1 by State Highway Commission, Sacramento, for constructing reinforced concrete bridge 300 ft. over 3 hinged arch span of 179 ft., across Myers Creek.

Ventura, Cal.—Reported desired until Nov. 4, by City Clerk, for constructing concrete bridge 42 ft. long, two spans, across the Ellsworth barranca, in Road Dist. No. 5.

Canton, China.—Until Dec. 7 by Robert W. Hunt & Co., Consulting Engineers for Chinese Government Railways, Monongahela Bank Building, Pittsburgh, Pa., for steel bridge work for Canton Hankow Railway, Hupei Hunan Section, advertised in Engineering Record.

PRICES AND LETTINGS.

★Indicates award of contract.

★**Beaufort, S. C.**—Contract for repairs to two piers of Whale Branch Bridge (bids opened Oct. 12) awarded by County Comrs. (W. H. Huff, Secy.) to Carolina Const. Co., Columbia, at $8,953.

Cleveland, Ohio.—See "Railroads."

★**Bedford, Ind.**—Contract awarded Ewing Shields of Greencastle for constructing a 116-ft. span concrete arch over Salt Creek (bids opened Oct. 12), at $13,768. Ezra W. Edwards, County Auditor.

★**Illinois.**—Contract awarded by State Highway Comm., Springfield, to J. J. O'Heron & Co., Chicago, for constructing bridge at Main Street, Carmi Township, White County, three spans, arch, at $21,960. William W. Marr, Ch. State Highway Engr.

Peoria, Ill.—Bid of A. D. Thompson, Anheuser Neil Building, at $4,250, is recommended for award for constructing concrete viaduct over Dry Run, on Elizabeth Street.

★**Waukon, Iowa.**—Contract for constructing three bridges awarded Clinton Bridge Works, Clinton, Iowa.

★**Breckenridge, Minn.** — Contract for constructing six steel culverts and 11 steel bridges (bids opened Oct. 8) awarded by County Commissioners to C. T. Gleason of Minneapolis.

★**Hooper, Wash.**—Contract for constructing the substructure of the bridge over Palouse River near Hooper has been awarded Grant Smith Co. of Seattle. Bridge is to be a deck plate girder, have concrete piers, and three 70 ft. spans.

Spokane, Wash.—Following are bids opened Oct. 14 by City Council for constructing steel bridge across middle channel of Spokane River at Howard Street; also constructing concrete approach at south end of present Monroe Street bridge over Spokane River:

Howard Street Bridge—Beer's Building Co., 1627 Smith Building, Seattle, $18,888; Weymouth Construction Co., 59 Pier No. 1, Seattle, $24,300; Illinois Steel Bridge Co., Hutton Block, Spokane, $24,974.

Monroe Bridge Approach—Beer's Building Co., Seattle, $15,555; Bates & Rogers Co., Spokane, $28,535; Huetter Construction Co., Spokane, $25,605; A. C. Biegle & Co., Spokane, $26,694. Morton MacCarthey, City Engr.

PAVING AND ROADS

PROPOSED WORK.

Orange, Conn.—The Selectmen have postponed action until the December meeting on the proposed bond issue for $100,000 for paving Elm Street and Campbel Avenue, West Haven. Herman O. Collenberg, Chairman of Board.

Waterloo, N. Y.—About $14,000 road improvement bonds sold by county.

Asbury Park, N. J.—Neptune Township Committee considering pavement of Main Street, estimated cost of bitulithic paving $15,000.

Camden, N. J. — Camden County Bd. Freeholders contemplates repaving Camden-Moorestown Turnpike between Thirty-fourth and Thirty-seventh Streets with Belgian block.

Newark, N. J.—Bd. of Works voted to pave Read Street from Market Street to Passaic Avenue.

Sussex, N. J. — County Engineer at Newton has been directed to prepare plans for improving Newton-Sparta and Ross's Corner-Sussex Road; cost about $120,000.

Philadelphia, Pa.—Lower Merion Township about to spend $50,000 for road improvements.

Petersburg, Va.—Common Council considering a bond issue of $90,000 for constructing hard surface road from Petersburg to Hopewell.

Charlotte, N. C.—Expenditure of $14,000 for street improvements being considered by city.

De Land, Fla.—Citizens Oct. 12 voted $250,000 bonds to construct roads. J. B. McCrary Co., engineers, Atlanta, Ga.

The construction of road across county from beach to St. Johns River at Sanford, hardsurfacing road to De Land and the John Anderson Highway from Rose Bay to Brevard County line, being considered by Volusia County Comrs.

Canton, Miss.—Bonds for $135,000 will be sold Nov. 1 by D. C. McCool, Clk. Co. Bd. Superv., for roads.

Columbus, Miss.—See "Public Buildings and Schools."

Kosciusko, Miss.—Bonds for $50,000 will be sold Nov. 1 by J. H. Oliver, Clk. Co. Bd. Superv., for roads in Dist. No. 1.

Morganfield, Ky.—Contract about to be let for constructing Uniontown and Boxville Road, distance 7.1 miles. Plans approved by Fiscal Court.

Cleveland, Ohio.—City Council voted to pave Buckeye, Haddam, Drexmore, Southington, Ashwood, Livingston, Hampton Roads and E. Eighty-second St. Road.

Dayton, Ohio.—County Comrs. approved plans for constructing 4 miles Range Road near Brookville; cost $14,000.

Ironton, Ohio.—About $14,000 sidewalks bonds sold by city.

Fort Wayne, Ind.—All bids opened by Park Bd. for paving Rudisill Avenue rejected. According to reports, new bids will be received.

Reeman, Mich.—Citizens voted $35,000 bonds to construct 6 miles of gravel road in Sheridan Township. (John M. Beem, Township Clerk.)

Austin, Tex.—See "Sewerage and Sewage Disposal."

Belton, Tex.—The Attorney-General at Austin approved $250,000 Bell County Road Dist. No. 10 road bonds.

Columbus, Tex.—Estimated cost of constructing about 40 miles of 15-ft. gravel road between Houston and San Antonio $100,000. Columbus county seat Colorado County.

Okmulgee, Okla.—City Comrs. voted to pave S. Morton Ave., S. Okmulgee and S. Alabama Streets; cost about $50,000.

Aberdeen, Wash.—City Council voted to fill and surface Curtis Street; cost about $16,000.

Oregon.—State Highway Comm., at Salem, made appropriation for road improvements, as follows:

Wasco County—Columbia Highway from Hood River to Mosier, 8 miles, $90,000.

Crook County—Road from Bend to Crater Lake, $10,000.

Columbia County—Improving Ranier Hill, $30,000.

Jackson County—Highway improvements throughout county, $45,000.

Coquille, Wash.—Contracts will soon be let for constructing 4½ miles Coos Bay-Coquille Rd.; cost about $35,000. P. H. Hall-Lewis, Roadmaster, Coquille.

Seattle, Wash.—Contracts will soon be let by King County Comrs. for grading and graveling 1½ miles highway east of Enumclaw to connect with the McClellan Pass Highway and for about 2 miles grading and graveling on highway between Newport and Hazlewood.

Spokane, Wash.—Contracts soon be let by County Comrs. for constructing about 35 miles roads.

Portland, Ore.—City Commission considering extending William Avenue from connection with railway bridge and Broadway Bridge to Interstate Bridge; cost $70,000.

San Rafael, Cal.—City Council contemplates paving San Quentin Road with concrete base and oil macadam; cost about $10,000.

Portland, Ore.—See "Bridges."

Lewiston, Idaho.—Citizens of Lewiston and Road Dists. Nos. 3 and 26 of Nez Prece County voted to construct 11-mile road from Lewiston to Washington State line.

Orofino, Idaho.—Robert Swadener engaged to prepare plans for constructing sidewalks in business district; cost about $11,000.

BIDS DESIRED.

Massachusetts.—Until Oct. 26, by State Highway Commission (William D. Schier, Chmn.), 15 Ashburton Place, Boston, for constructing section of State highway, about 5200 ft. long in city of Woburn.

Fort Slocum, N. Y.—Until Oct. 28, by Capt. F. E. Smith, Quartermaster U. S. A., Ft. Slocum, for constructing concrete sidewalks, macadam roads, etc., at this post.

New York, N. Y.—Until Oct. 28 by Cabot G. Ward, Pres. Park Bd. Manhattan, for paving roadway, including approaches, etc., service road of Riverside Drive with asphalt concrete on cement concrete foundation; total security $15,000.

Until Oct. 28 by Marcus M. Marks, Pres. Manhattan Borough, for improving portions of Arden, W. 161st, Front, E. Thirteenth Streets, Lexington Avenue and other streets, in all about 9380 sq. yd. sheet asphalt and 27,550 sq. yd. granite block pavement, 2600 cu. yd. concrete, etc. Total security, $25,500.

Hackensack, N. J.—Until Oct. 29, by Board Chosen Freeholders (A. V. Morrision, Chmn.) for paving portions of Essex St. with asphalt concrete; also portions of Passaic St. with asphalt concrete, asphalt blocks and granite blocks.

Newark, N. J.—Until Oct. 28, by M. R. Sherred, Ch. Engr., Bd. Street and Water Comrs., for repaving Vesey St., in all about 2300 sq. yd. bitulithic on 6-in. concrete foundation, manholes, basins, etc.

Newton, N. J.—Until Nov. 11 by Bd. Chosen Freeholders, Newton, for improving macadam roads, advertised in Engineering Record. Harvey Snook, Co. Engr., Newton.

Pittsburgh, Pa.—See "Sewers and Sewage Disposal."

Monroe, La.—Reported desired until Nov. 5 by H. D. Apgar, Mayor, for about 37,000 sq. yd. gravel, with tarvia top; 24,800 lin. ft. curb and gutter, etc., on various streets.

Maynardville, Tenn.—Reported desired until Nov. 8 by George M. Taylor, Chmn. Co. Comrs., for constructing macadam roads and bridges.

Sweetwater, Tenn.—Reported desired until Nov. 15 by W. T. Lenoir, Mayor, for street paving; $5,000 available.

Cleveland Heights (P. O. Warrensville), Ohio.—See "Sewerage and Sewage Disposal."

Granville, Ohio.—Until Oct. 28 by Village Council for grading and paving with paving block or sheet asphalt on Broadway, advertised in Engineering Record. Roe E. Morrow, Village Clk.; T. S. Johnson, Engr., Granville.

Newark, Ohio.—Until Oct. 29 by W. C. Christian, Dir. Pub. Service, for furnishing material and resurfacing portions of Hudson Avenue; also roadway of Park Avenue, with bituminous concrete or other material. C. H. Wells, City Engr.

Indiana.—By County Commissioners for constructing roads as follows:
Until Nov. 1:
Newport, gravel roads in Helt and Clinton Township. Roy Slater, Co. Aud.
Williamsport, two gravel roads in Jordan and Pike Townships, 5227 ft. and 10,200 ft. long. D. H. Moffitt, Co. Aud.
Greencastle, a macadam road in Greencastle Township, 10,066 ft. long. C. L. Airhart, Co. Aud.
Goshen, concrete road in Harrison Township. J. W. Brown, Co. Aud.
Until Nov. 2:
Bloomington, roads in Van Buren and Washington Townships. W. F. Kinser, Co. Aud.
Delphi, roads in Jefferson, Deer Creek, Monroe and Rock Creek Townships. M. G. Haum, Co. Aud.
Noblesville, roads in Fall Creek, Wayne, Washington and Noblesville Townships. W. O. Horton, Co. Aud.
Petersburg, rock road in Jefferson Township. John D. Gray, Co. Aud.
Rensselaer, gravel road in Gillman Township. Jos. P. Hammond, Co. Aud.
Bloomfield, macadamized road in Fairplay Township. G. E. Kidd, Co. Aud.
Plymouth, three roads in German Township. Geo. F. McCoy, Co. Aud.
Until Nov. 3:
Shelbyville, two roads in Washington Township, 5330 and 10,981 ft., respectively. F. W. Fagel, Co. Aud.
Muncie, two gravel or macadam roads in Liberty Township. Francis M. Williams, Co. Aud.
Lafayette, 2.93 miles gravel road. Wayne Township. Geo. W. Baxter, Co. Aud.
Until Nov. 4:
Evansville, macadam road in Pigeon Township. C. P. Beard, Co. Aud.
Until Nov. 8:
South Bend, three gravel roads in Madison Township. C. Sedgwick, Co. Aud.
By Co. Commissioners at Peru, concrete road in Peru Township. F. K. McElhenny, Co. Aud.

Des Plaines, Ill.—Until about Nov. 1 (readvertisement) by John A. Bell, City Clk., for 4500 sq. yd. concrete pavt.

Des Moines, Iowa.—Until Oct. 23 by Horace Susong, City Clk., for paving with either sheet asphalt 1½ in. wearing surface, and 2 in. closed binder course, or No. 1 vitri. paving brick or Warren Bros. bitulithic on E. Walnut Street, about 7530 sq. yd.

Duluth, Minn.—Until Oct. 28 by Bd. Pub. Wks. for paving with brick, sandstone, bitulithic, creosoted block and reinforced concrete on Grand Avenue about 55,000 sq. yd., including curbing, etc. Cost, $168,000 to $217,000. Lyonal Ayers, City Engr.

Columbus, Kan.—Until Nov. 1 by the County Commissioners at Columbus for grading and surfacing with gravel seven miles of county road between Columbus and Crestline. C. M. Cooper, County Surveyor.

Sedalia, Mo.—Reported desired until Nov. 1 for 9200 sq. yd. vertical fiber brick paving. F. T. Leaming, City Engr.

Colville, Wash.—Reported desired until Nov. 1 by A. B. Sansburn, Co. Aud., for clearing, grading, grubbing and bridging about 3 miles of Springdale-Hunters Permanent Highway, No. 2A. R. B. Thomas, Co. Engr.

Arcadia, Cal.—Until Nov. 4 (readvertisement) by George E. Grimes, City Clerk, for constructing 16 miles oiled macadam road, and approximately 10,000 ft. concrete curb and gutter.

Bakersfield, Cal.—Reported desired until Nov. 1 by Co. Bd. Superv. for concrete paving on 3 miles Belleview Rd. and one mile of Brundage Lane. Alternate bids on asphalt, asphaltic oil wearing surface. County furnishes cement.

Salt Lake City, Utah.—Reported desired until Oct. 26 by Board City Commissioners for paving with Utah rock asphalt portions of Sixth E., Sixth S., and with sheet asphalt portions of Fifteenth E. Street; with concrete Orchard Square and alley between Fifth and Sixth S. Streets.

PRICES AND LETTINGS.

★Indicates award of contract.

★Massachusetts.—Following are bids opened Oct. 19, by Massachusetts Highway Commission, Boston, for building section of asphalt macadam road in town of Grafton and Upton: Perini Construction Co., Ashland, $48,103 (awarded contract); Charles E. Horne, Millbury, $50,056; Alco Contracting Co., Boston, $54,471.

★Farmingdale, L. I., N. Y.—Contract awarded Oct. 18, by Trustees New York State School of Agriculture of Long Island, for laying cement walks, curbs and crossings on grounds of said school at Farmingdale to Delta Contr. Co. of Jamaica, N. Y.

New York, N. Y.—Following are four lowest bids opened Oct. 14 by Douglas Matthewson, President Bronx Borough, for 21,550 sq. ft. two-course concrete sidewalk, etc., on Powell Avenue from Tremont to Zerega Avenues: Burnside Construction Co., 270 Burnside Avenue, $72,105; J. B. Malatesta, 3169 Jerome Avenue, $13,080; J. Di Menna, 2435 Southern Boulevard, $13,243; Di Menna & Del Baiso, 391 East 149th Street, $13,479.

★Newark, N. J.—Contract for paving Lyons Avenue awarded by Bd. Freeholders to Northern Constr. Co., Newark, at $62,070.

★Contracts for paving awarded by Bd. Public Wks., as follows: Sussex Avenue with asphalt to W. T. Critchfield, Jersey City, at 99 cts. per sq. yd.; Oxford Street with bitulithic to Greenfield Constr. Co.; N. Sixth Street with asphalt to Glenfield Constr. Co.; Front Street and Saybrook Place with granite block to Alex. J. Millmoe.

★New Brunswick, N. J.—Contract for paving South Amboy-Keyport Rd. awarded by Middlesex County Bd. Freeholders to T. H. Riddle, New Brunswick, at $45,349.

Philadelphia, Pa.—Following are low bids opened Oct. 14 by Department of Public Works (William H. Connell, Chief Bureau of Highways):
Grading, 72,697 cu. yd. Low bidders: John Devlin, Jr., Hancock and Thompson Streets; T. P. Lee, 5629 Cherry Street; E. H. Vare, Lincoln Building; George Moehrle 2631 N. Twenty-eighth Street; M. H. Kelly, 1615 S. Twenty-second Street. Average price .239 cts. per cu. yd.; total, $22,818.
Asphalt pavement, including 6-in. concrete base. Low bidders: Barber Asphalt Paving Co., Land Title Building; Eastern Paving Co., Penn Square Building; Union Paving Co., Thirtieth and Locust Streets. Average price, $1.684 per sq. yd.; total $55,045.
Granite block pavement, including 6-in. concrete base. Low bidders: J. J. McHugh, 1430 S. Penn Square; Philadelphia Paving Co., 1345 Arch Street; Alpha Engineering & Construction Co., Heed Building. Average price, $3.576 per sq. yd.; total, $19,801.
Bituminous surfacing, including 5-in. concrete base. Low bidders: Union Paving Co., Thirtieth and Locust Streets. Average price, $1.38 per sq. yd.; total, $17,162.

★Scranton, Pa.—Contract awarded National Paving Company, Scranton, for paving Colfax Avenue (bids opened Oct. 15). W. A. Schunk, City Engr.

★Arcadia, Fla.—Contract for constructing macadam roads in Wauchula Road Dist., De Soto County, awarded to Edwards Constr. Co., Tampa, at $85,000.

★Ackerman, Miss.—Contract for constructing concrete sidewalks awarded by city to W. L. Damon, Okolona, at about $25,000.

★Columbus, Miss.—Contract for surfacing with tarvia 4½ miles Military Road awarded by Highway Comrs. Dist. No. 2 to S. E. Findley Co., Atlanta, Ga.

★Jackson, Miss. — Contract for paving 2 miles Rankin Road with concrete awarded by Hurds County Bd. Supervs. to C. G. Talbutt & Co.

★Cincinnati, Ohio.—Following are the four lowest bids opened Oct. 8 by the County Commissioners for improving Van Zant Road and Wayne Avenue: Henry Westerman, Barnsburg, $14,107 (awarded contract); Elmer E. Nugent, Cleveland, Ohio, $14,377; Paul Menger, 2132 Ohio Avenue, $14,768, and William P. Flynn, 1252 Chase Avenue, $14,848. Albert Reinhart, clerk.

Columbus, O.—Lowest bid opened by County Comrs. for paving Main Street, Bexley, with brick and tar macadam, submitted by George H. Heffner & Son, Celina, at $37,374.

★Toledo, O.—Contract for paving Ontario Street with asphalt awarded by Bd. Control to H. P. Streicher Co., Toledo, at $30,186.

★Bedford, Ind.—Contract for constructing 2½ miles of Dixie Highway (bids opened Oct. 5) awarded Ewing Shields of Greencastle at $48,117. Ezra W. Edwards, County Adutor.

★Franklin, Ind.—Contract for constructing Adcock Rd. on county line awarded by Comrs. Johnson and Marion Counties to John W. Murphy at $11,000.

★Indianapolis, Ind.—Contract for paving Capitol Avenue between Tenth and Sixteenth Streets with asphalt awarded by Bd. Pub. Wks. to Union Asphalt Constr. Co., Indianapolis, at $16,005.
★Contract for paving Nineteenth Street with concrete awarded by City Comrs. to A. L. Tribble, Brazil, at $46,878.

★New Albany, Ind.—Contract for constructing 10,590 ft. Grant Line Rd. awarded by County Comrs. to W. F. Woodruff, Louisville, Ky., at $13,987.

★Fairfield, Mich.—The Township Bd. awarded contract for constructing macadam road from state line north to Jasper to Gray Bros., Bowling Green, O., at $26,900.

★Alton, Ill.—Contract awarded by Board of Local Improvements to Strubel & Helmick for repaving East Second Street at $19,457.

★Ashland, Wis.—Contract awarded by Highway Commission to Fish & O'Connor of Eagle River, for grading 16 miles of road at $8,778.

★Lincoln, Neb.—Contract for paving portion of Ryon Street, awarded Abel & Roberts, Lincoln, at $7,857, and Tenth Street to Burke-Cochrane Constr. Co., Lincoln, at $10,955.

★Conway, Ark.—Contract for about 15,000 sq. yd. concrete pavement in Dist. No. 4 awarded to Halter & McCulloch, Conway, at 89 cts. per sq. yd.

★Fort Worth, Tex.—Contract for paving with poured asphalt macadam on Landrum and Rosedale Streets (bids opened Oct. 12) awarded Roach & Manigan Paving Co. of Fort Worth, at $1.25 per sq. yd., in all about 12,300 sq. yd. F. J. Von Zuben, city engineer.

★Taylor, Tex.—Following are unit figures of the successful bidders for paving, bids opened Sept. 21 by City Commissioners (W. E. Dozier, Engr., Taylor): The work complete requires about 7500 cu. yd. macadam excav.; 35,000 cu. yd. earth excav.; 120,000 cu. yds. paving, 500 lin. ft. combined curb and gutter; 1000 lin. ft. old curb reset; 12,000 sq. ft. concrete sidewalks; 6500 lin. ft. 3x10 and 6500 lin. ft. 3x8 in. oak headers; 200 cu. yd. extra concrete; Uvalde Rock Asphalt Co., San Antonio (approximately 40,000 sq. yd.) macadam excav., 50 cts.; earth excav., 40 cts.; uvalde rock asphalt, 5 in. base, $1.84; combined curb and gutter, 56 cts.; 18 in. gutter, 28 cts.; resetting old curb and gutter, 25 cts.; sidewalks, 13 cts.; headers, 3x10 in., 30 cts.; 3x8 in., 16 cts.; extra concrete, $5.80; Kaw Paving Co., Topeka, Kan. (approximately 100,000 sq. yd.) macadam excav., 32 cts.; earth excav., 27 cts.; asphaltic concrete (Texaco), 4 in., $1.30; 5 in., $1.40; combined curb and gutter, 52 cts.; 18 in. gutter, 25 cts.; resetting old curb and gutter, 30 cts.; sidewalks, 11 cts.; headers, 3x10 in., 12 cts.; 3x8 in., 10 cts.; extra concrete, $5.50.

★Terrell, Tex.—Contract for improving portions of Francis Street, in all about 11,983 sq. yd., awarded Bert Hahn Constr. Co., of Paris, at $1.50 per sq. yd. for rock asphalt, 48 cts. per lin. ft. for curb and gutter. Ardmore Rock Asphalt Company, Ardmore, Okla., bid $1.75 per sq. yd. Herbert Brewster, City Engr.

Seattle, Wash.—Following bids opened by Bd. Pub. Wks. for paving Fourteenth Avenue, south: Holt & Jeffery, Railway Exchange Bldg., $11,169, and Jahn Contr. Co., Pioneer Bldg., $12,569.

Portland, Ore.—Bid of Giebisch & Joplin, Portland, at $13,013 is recommended for award for paving E. Twenty-third, E. Twenty-fourth and Franklin Streets.

★Manhattan Beach, Cal.—Contract for improving Sixth, Seventh and other streets (bids opened Oct. 6) awarded Modern Constr. Co., Los Angeles, at $8,247, for about 15,731 sq. ft. concrete sidewalks, 15,519 sq. ft. oil and screening pavements. Llewllyn Price, City Clerk.

★Sanger, Cal.—Contract for 3 miles macadam pavements awarded to M. Haynes, Oakland, at $23,801.

★Santa Ana, Cal.—Contract for paving with asphalt Garden Grove Road (bids opened Oct. 6) awarded O. & C. Construction Company, Fullerton, at $9,497. W. B. Williams, County Clerk.

Sawtelle, Cal.—Lowest bid for 444,017 sq. ft. Warrenite pavement on Santa Monica Boule., submitted by Clark & Henery Constr. Co., Sacramento, at $75,-

New York, N. Y.—Following are unit figures of four lowest bids opened Oct. 14 by Douglas Mathewson, President Bronx Borough, for regulating, flagging sidewalks, etc., in Walker Avenue: (a) Anable Construction Co., $72,639; (b) States Engineering Corporation, $76,774; (c) P. J. Duffy, $76,894; (d) F. V. Smith, Lafayette Avenue and West Chester Creek, $77,228.

	(a)	(b)	(c)	(d)
36,200 cu. yd. of earth excavation	$0.14	$0.21	$0.10	$0.35
1,000 cu. yd. of rock excavation	1.85	0.60	1.00	2.00
61,900 cu. yd. of filling	0.235	0.24	0.40	0.25
9,680 lin. ft. of new curb	0.92	0.67	0.68	0.75
75 lin. ft. of old curb	0.29	0.24	0.05	..
70 sq. ft. of new bluestone flagging	0.29	0.27	0.22	0.30
300 sq. ft. of old flagging	0.07	0.17	0.05	..
47,600 sq. ft. of two course concrete sidewalk (including maintenance for one year)	0.135	0.13	0.14	0.15
10,900 sq. ft. of new bridgestone	0.54	0.45	0.45	0.40
610 sq. ft. of old bridgestone	0.10	0.12	0.05	0.10
1,950 cu. yd. of dry rubble masonry	4.00	3.16	2.00	2.00
950 cu. yd. of Class A concrete	5.00	11.00	7.00	8.00
350 cu. yd. of Class B concrete	5.00	8.50	6.00	6.00
600 lin. ft. of vitrified pipe 12 in. in diameter	0.52	0.42	1.00	1.50
620 lin. ft. of vitrified pipe 15 in. in diameter	0.52	0.59	1.50	2.00
61,000 ft. b. m. timber	66.00	68.00	34.00	50.00
19,350 lin. ft. of piles	0.325	0.37	0.34	0.29
2,800 lin. ft. of guard rail	0.25	0.23	0.30	0.20
2 tide gates	100.00	60.00	50.00	50.00
60,000 lb. steel reinforcement bars	0.03	0.03	0.04	0.02
1 Type B inlet	150.00	65.00	84.00	50.00
6 manholes	60.00	50.00	50.00	50.00
6 receiving basins, Type B	100.00	50.00	85.00	150.00
5 cu. yd. of brick masonry	7.50	15.00	10.00	20.00
180 lin. ft. of iron railing	3.70	2.00	1.00	3.50
Sinkage, shrinkage and settlement	150.00	800.00	2,000.00	..

STREET CLEANING AND GARBAGE DISPOSAL

PROPOSED WORK.

Providence, R. I.—N. H. Bromston, City Engineer, writes that the city is investigating various methods of disposal of garbage, principally by the reduction method, and would be interested in receiving dimension plans of the various apparatus required for disposing of garbage in that way.

Fort Wayne, Ind.—Site selected on which to erect a garbage incinerator.

Madison, Wis.—The Finance Committee of the Common Council is reported in favor of constructing an incinerator plant.

Duluth, Minn.—City Council considering constructing incinerator plant; cost about $50,000.

Kansas City, Mo.—John C. Bromaugh, Councilman, writes that it is proposed to construct a garbage reduction plant; cost $400,000. Time not yet set for receiving bids.

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS

PROPOSED WORK.

Canal Improvement—Fall River, Mass.—The Watuppa Ponds and Quequechan River Comn. has submitted a report on improving conditions, in which the Engineers, Fay, Spofford & Thorndike, Boston, estimate the cost at $2,942,500; this includes the building of conduit connections and controlling apparatus and the system of sewers and drains for Quequechan Valley.

Creek Improvement—Syracuse, N. Y.—The mayor has appointed a commission of which Commissioner Mather of the Department of Public Works, is a member. to recommend ways for checking flow of the creek.

Dam—Norfolk, Va.—City Council voted to appropriate $18,000 to rebuild Lake Taylor dam and spillway destroyed by the heavy rains.

Flood Protection—Augusta, Ga.—City has sold $250,000 flood protection bonds.

Drainage Improvement—Lafayette, La.—At a recent election in the first and second wards of the parish a drainage district was established and $34,000 bonds will be issued for digging canal and opening natural drains.

Ditch Bonds—New Albany, Miss.—Bonds amounting to $25,000 for the Big Creek Drainage Dist. will be sold Nov. 6 by C. S. Cullen, Clk. Union County Drainage Comrs.

Wharf Improvement — Chattanooga, Tenn. — Wharf improvement bonds amounting to $100,000 will soon be sold by the City Commissioners.

Protection Wall — Portsmouth, Ohio. — Contract soon to be let for constructing flood protection wall. William Gergens, Director of Public Service.

River Improvement — Nebraska.—State Irrigation Board, Lincoln, is considering plans for a system of flood relief by means of levees and cutoffs along Nemaha River where it empties into Missouri River.

Hydroelectric Plant—Polson, Mont.—Montana Improvement Co. has filed a permit with J. B. Girard, Supervisor of Hydroelectric Power, for the development of power on Big Creek in the Kootenai and Flathead Valleys, for furnishing electricity for municipal uses in the town of Polson, as well as to furnish power for local industries.

Flood Prevention—St. Louis, Mo.—The Board of Public Service has submitted a recommendation for the construction of the Levee the Public Service Board mechanical Chief estimated at $8,400,000.

Dry Dock—Beaumont, Tex.—Beaumont Ship Yards, Inc., Nelson, Mgr., reported that the firm plans to erect a dry dock here, capacity 20,000 tons.

Drainage Bonds—Edna, Tex.—Attorney-General has approved $100,000 bonds for Jackson County Drainage Dist. No. 1.

Levee Improvement—Fort Worth, Tex.—Robert C. Jones, Chairman Levee Imp. Comm., has written that he considers the levee improvements almost half mile of levee will be constructed, channels of Trinity River cleared and interior drainage work done in the district.

Seawall—Galveston, Tex.—General H. M. Robert has submitted a report to the Co. Comrs. on the repair of the seawall and boulevard, and recommends that the boulevard be removed and the riprap at the foot of the seawall west of South Street, approximately 14,000 ft., also that a bulkhead be constructed on the rear of the property right of way 200 ft. from the seawall and the extension of the pavement of the boulevard to the bulkhead. The bulkhead to extend the entire length of the proposed park 14,000 ft., from 61st to Third streets, and is to be built of reinforced concrete sheet piling 24 ft. long and 8 in. thick, supported with a reinforced concrete cap 8 in. wide and 12 in. thick at the sides and 15 at the middle.

Drainage, Etc., Harbor Bonds—Houston, Tex.—Bonds for $1,000,000 to be sold Nov. 1 by Ben Campbell, Mayor for harbor improvements, sanitary sewage disposal, parks and school.

Wharf Improvement—Orange, Tex.—Plans being prepared for municipal wharves and docks to be constructed by the city on Sabine River. Plans provides for a dock 1000 ft. long, 200 ft. wide at the bottom, and a slope of a foot and a half. A warehouse 50 ft. wide and 200 ft. further with a bottom of 40 ft. A warehouse 100 ft. long, railroad, docks and other improvements are to be constructed. Probable cost $300,000. F. H. Farwell, Chairman of Committee.

Reclamation Work—Carlsbad, N. M.—L. E. Foster, Project Manager, Carlsbad, writes that no bids were received Oct. 12 by U. S. Reclamation Service for constructing the Avis Canyon pipe line.

Hydroelectric Plant—Prairie City, Ore.—The Prairie Power Company it is reported, plans constructing hydroelectric plant on the John Day River 14 miles west of the city.

Irrigation — Marysville, Cal. — Bd. Supervs. directed Hallwood Irrigation Co. to construct drainage ditches to carry off surplus irrigating water soon to be completed for irrigation season of 1916.

Drainage — Corinne, Utah. — Drainage bonds for $40,000 to be sold Oct. 25 by John J. Cramer, Chmn. Bd. Supervs. Corinne Drainage Dist.

BIDS DESIRED

Jetty—Long Branch, N. J.—Until Oct. 25 by Board City Commissioners for constructing concrete or wooden jetty at Ocean Avenue, including the sewer front. J. W. Morrow, City Clerk.

Wharf, Etc.—Fort Morgan, Ala.—Until Oct. 25 by William M. Bryan, Custodian, U. S. Public Health Service, Marine Quarantine Station, Fort Morgan, for repairs to wharf, etc., at this building.

Levee Improvement—Greenville, Miss.—By Board of Mississippi Levee Comrs. for constructing new top of the Black Bayou Levee, where the levees are raising approximately 125,000 cu. yd.

Dam—Marietta, Ohio.—Until Nov. 1, by U. S. Engineers Office, Cincinnati, for reconstructing in concrete part of abutment at Dam No. 7, Muskingum River, Ohio. Work is at Marietta about ¼ mile above mouth of Muskingum River.

Drains—Williamsport, Ind.—Reported award made Oct. 30 by V. H. Ringer, County Court for constructing drains in Jordan and Steuben Townships and tile drain in Pine Township.

Drainage—Jefferson, Iowa.—Until Oct. 26 by Co. Board Supervisors, for furnishing materials and constructing Drain No. 102, in all about 42,110 ft. 30 to 6 in. tile. Estimated cost $13,787.

Drainage—Morris, Minn.—Until Nov. 3, by C. E. Wheelock Co. Aud., for constructing County Ditch No. 20, in all about 24,441 ft. 18 to 6 in. tile. Estimated cost $4,599.

Drainage—Roseau, Minn.—Until Nov. 1 by C. C. Hartwell, Co. Aud. at Roseau, for constructing Judicial Ditch No. 62, Roseau and Beltrami Counties, in all about 1,433,962 cu. yd. excav. clearing 524 acres, 112 miles road, bridges, culverts etc. Cost $199,173. Geo. A. Ralph, Engr., 16 Fulton Block, St. Paul.

Levee Work—New Madrid, Mo.—Until Nov. 15 by St. John Levee and Drainage Dist. of Missouri, Hunter Bank Building, New Madrid, for levee improvement, advertised in Engineering Record.

Levee Work, etc.—Knobel, Ark.—Until Oct. 25 by Jos. Sellmeyer, Secy. Comrs. Big Cuna Drainage Dist., Clay and Green Counties, at office of Jas. R. Rhyne, Engr., Corning, for excavating 32.75 miles drainage ditches, in all approximately 1,560,000 cu. yd., and constructing 4.25 miles levee about 116,500 cu. yd. embankment.

Irrigation—Donna, Tex.—Reported decided until Nov. 1 by Donna Irrigation Dist. (D. H. Barr, Secy.) for enlargement and completion of present canal system, pumping plant, etc. Open ditch work requires 2,000,000 cu. yd. excav., etc. Probable cost $45,000.

Irrigation—Ysleta, Tex.—Until Nov. 17 by U. S. Reclamation Service, El Paso, for excavation of Leasburg Canal from Station 310 to Station 570 and the Picacho Branch Canal, involving about 162,000 cu. yd. in vicinity of Hill, N. M., and the San Elizario Feed Canal, involving excavation of about 54,000 cu. yd. in vicinity of Ysleta, advertised in Engineering Record.

Irrigation Work—Meadow Creek, Wash.—Until Dec. 1 by U. S. Reclamation Service, Meadow Creek, Wash., for clearing the reservoir site at Lake Keechelus, Wash., of all timber, undergrowth and brush, and for purchase of sawmill machinery at the site also for about 160 M ft. lumber and 200 M ft. logs, advertised in Engineering Record.

Irrigation Bonds—North Yakima Wash.—Bonds for $25,000 will be sold Nov. 6, by C. E. Odell Secy. Union Gap Irrigation Dist., Yakima County, for improvements to irrigation system.

Concrete Wall—San Jose, Cal.—Until Nov. 1, by Henry A. Pfister, Clk. Co. Bd. Supervs., for constructing reinforced-concrete curtain wall on Campbell Creek.

Levee—Santa Paula, Cal.—Until Nov. 4 by J. B. McCloskey, Co. Clk., Ventura, for constructing Santa Paula bridge protection levee on Santa Paula Creek, about ¼ mile from Santa Paula.

PRICES AND LETTINGS.

★Indicates award of contract.

State Canal Work—Albany, N. Y.—Low-est bid opened Oct. 6 by State Superintendent of Public Works for improving Canisteo River near Hornell was submitted by Eastover Constr. Co. at $38,534.

State Canal Work—Albany, N. Y.—Following are the two bids opened Oct. 19 by State Superintendent Public Works, Albany, for improving channel and banks of Mohawk River and West Canada Creek at Herkimer: E. Brown Baker, Herkimer, $7,600, and State Highway Constr. Co., Inc., Mohawk, $6,646.

Dike Improvement—Philadelphia, Pa.—Following are unit figures of four lowest bids opened Oct. 14 by Col. George A. Zinn, Corps Engrs., U. S. A., for furnishing and placing riprap at Mifflin Bar Dike, in Delaware River, approximately 30,000 tons riprap: Coast & Lakes Contr. Corp., New York, $1.36 per ton; Peoples Bros., Inc., Philadelphia, $1.74; C. R. Simpson, New York, $2.21, and Manwaring & Cummins, Philadelphia, $2.25.

★Dredging — Norfolk, Va. — Contract awarded as follows by U. S. Engineer's office for dredging and rock excavation in James River (bids opened Sept. 23): To Maryland Dredging & Contracting Co., Baltimore, Md., at $34,590.

★Dredging — Norfolk, Va. — Contract awarded by Bureau of Yards and Docks, Washington, D. C., for dredging at the Navy Yard (bids opened Oct. 9) to Coastwise Dredging Co., Norfolk, at 19.8 cts.

★Wharf Improvements—Augusta, Ga.—Contract awarded Georgia Contracting Co. for constructing river wharf terminals; cost about $20,000.

★Lock Gates for Dam—Montgomery, Ala.—The bids of Whitehead & Kales Iron Works of Detroit, Mich., at $3,313, recommended for award for two pair of steel lock gates for Lock No. 1, Coosa River, Ala. Bids opened Sept. 20 at U. S. Engineer's Office.

★Levee Improvements—New Orleans, La.—Following contracts awarded by U. S. Engineer's Office, New Orleans, for constructing levee improvements in Lower Tensas and Atchafalaya Levee Districts (bids opened Sept. 28):

★Lower Tensas Levee District.—E. H. Jackson, Natchez, Miss., Dunn Levee, 102,500 cu. yd., 14.98 cts.; W. C. Mullen, Vicksburg, Miss., Hodge Levee, 93,000 cu. yd., 23.40 cts.; Diamond Island, 91,500 cu. yd., 24.70 cts.; Shelula Levee, 110,800 cu. yd., 25.70 cts.; N. C. Williamson, Millikin, La., Bayou Roundaway Levee, 91,700 cu. yd., 16.40 cts.; L. E. Pickett, Natchez, Miss., Hunter Levee, 87,500 cu. yd., 20.90 cts.

★Atchafalaya Levee District.—Gibson, Hamilton & Co., Natchez, Miss., Latenache, Belle Vista, Batchelor, Normandy, and Unique Levees, in all about 516,400 cu. yd., at 9.23 cts. per cu. yd.

★Levee—Greenville, Miss.—Contract for constructing Ben Ledi Levee, near Buck Ridge and Nebletts Spur Levee awarded by Levee Bd. to Burt Bond & McMurray at 18.85 cts. per cu. yd.

★Reconstructing Spillway — Cincinnati, Ohio.—Contract awarded Clifton Brothers of Zanesville for reconstructing in concrete top of spillway at Dam No. 4, Muskegon River, Ohio, at $4,370 (bids opened Oct. 5 by U. S. Engineers, Cincinnati).

★Ditch—Breckenridge, Minn.—Contract for constructing Ditch No. 4 in Wilkin County (bids opened Oct. 12) awarded by Co. Comrs. to G. E. Brown, Litchfield; approximate cost $19,049. P. E. Truax, Co. Aud.

★Bulkhead, Etc.—Montevideo, Minn.—Contract for constructing 15,305 ft. 6 to 22 in. tile, concrete bulkhead, 4,040 cu. yds. earth excav., etc. (bids opened Oct. 11), awarded by Co. Comrs. to Marshall Cement & Sidewalk Co.

Irrigation — St. Ignatius, Mont.—The following are the bids opened Oct. 12 by the U. S. Reclamation Service for constructing ten miles of lateral and appurtenant structure for work on east bank of Fathead River, from one to seven miles northeast of Dixon: Wilson Brothers, Polson, Mont., $16,423; J. E. Hilton, Billings, Mont., $17,386; Nelson Rich, Prosser, Wash., $19,313.

★Drain — Newport, Ark. — Contract awarded W. S. Coleman of Paragould for constructing Cook Slough Drainage Dist. at $24,053.

Guide Wall—Seattle, Wash.—Lowest bid opened by Maj. J. B. Cavanaugh, U. S. Engineer, Burke Building, for constructing guide wall at entrance of Lake Washington Canal submitted by Beers Bldg. Co., Smith Building, Seattle, at $8,021.

★Irrigation — Modesto, Cal.—Contracts awarded by Bd. Directors Modesto Irrigation Dist. as follows: Concrete protecting face and curtain wall on Dam No. 1 of Dallas Reservoir, to John Monk, San Francisco, at $57,971; concrete lining of canal between Morton and Salter, to James Willison of San Mateo.

★Dredging—Oakland, Cal.—Contract for dredging Oakland harbor awarded by U. S. Engineers, San Francisco, to San Francisco Bridge Co., Nevada Bank Building, San Francisco, at 9.87 cts. per cu. yd., estimated total cost, $51,324.

Pier—San Francisco, Cal.—The lowest bids opened by Harbor Comrs. for constructing Pier No. 29, to be 200 x 800 ft., were submitted by Clinton Constr. Co. at $283,000 and Healy-Tibbitts Constr. Co. at $312,000.

★Canal Improvement — Twin Falls, Idaho.—Contracts reported awarded by Twin Falls Canal Company to the Idaho Construction Company, Boise, for improvements to the system, including concrete flume at Cottonwood, and to Smith & Green and Morrison & Knuzsen of Boise, contract for enlarging Highland Canal a distance of 18 miles. Total cost $88,000.

PRICES AND LETTINGS.

★Indicates award of contract.

New York, N. Y.—Upper Hudson Stone Co., 26 Cortlandt Street, submitted the only bid Oct. 15 to the Public Service Commission for ballast portion "C" as follows: Class A, 76,000 cu. yd., 97 cts.; Class "B," 4200 cu. yd., 87 cts.; total, $77,374.

Following are bids opened Oct. 15 by Public Service Commission for special work, order No. 5, frogs and switches: Pennsylvania Steel Co., $23,950; Ramapo Iron Works, 30 Church Street, $24,116, and William Wharton, Jr., & Co., Inc., 30 Church Street, $26,965.

Philadelphia, Pa. — McClintic-Marshall Co. of Philadelphia, reported to have submitted the lowest bid Oct. 19 for constructing the first four sections of the steel superstructure of the Frankford elevated line as follows: Three sections which include from Girard Avenue to Unity Street, Frankford, at $1,455,000, and the fourth section south from Girard Avenue to Callowhill Street, at $261,400.

ELECTRIC RAILWAYS

PROPOSED WORK.

New York, N. Y.—Public Service Commission for the first district has submitted to the Interborough Rapid Transit Company proposed form of contract for the construction of Section No. 2 for Routes Nos. 19 and 22, being a part of the Southern Boulevard and Westchester Avenue branch of the Lexington Avenue subway. As soon as approved contracts will be let.

Pottsville, Pa.—Pottsville & St. Clair Electric Ry. Co. incorporated to construct a line from Pottsville to St. Clair. Capital $13,200. Among incorporators are: W. B. Rockwell, Van Dusen Rickert, Ira G. Walborn, all of Pottsville.

Baltimore, Md.—Right of way being secured for electric railway to be constructed from Hancock to Berkley Springs. Littleton F. Johnson, Baltimore, is interested.

McComb, Miss.—Aldermen granted franchise to Guy M. Walker, 60 Broadway, New York City, to construct electric railway and power plant.

Chattanooga, Tenn.—Central Power Co. applied for franchise to construct an interurban line from Chattanooga to Cleveland. Capital $50,000. Among incorporators: G. B. Adams, M. N. Whittaker.

Cleveland, Ohio.—Cleveland Ry. Co., received franchise from Council to construct railway through Parma Township to Bean Road.

Belleview, Mo.—Belleview & Western Ry. Co. incorporated to construct railway from Graniteville to Belleview, about 3 miles. Capital $40,000. Among incorporators: William R. Orthwein and Louis Hudson.

McAlester, Okla.—Choctaw Railway & Lighting Co. intends extending the line from present terminus at Hartshorn to Gowen and Wilburton.

New Toronto, Ont.—Council of New Toronto passed resolution that the Hydro-Electric Power Comn. of Ontario be requested to investigate and report upon cost of constructing an electric railway from Toronto through New Toronto to London.

BIDS DESIRED.

Albany, N. Y.—Until Oct. 25 by Trustees of Public Buildings, Executive Chamber, Capitol, Albany, for alterations in executive offices, Capitol, advertised in Engineering Record. Lewis F. Pilcher, State Archt., Albany.

New York, N. Y.—Until Nov 3 (extension of date from Oct. 19) by Pub. Service Comn., First Dist., 154 Nassau Street, for storm vitr. pipe drain, manholes, etc., for Queensboro Subway Rapid Transit Railroad, under Queensboro Boulevard.

Front Royal, Va.—Until Nov. 15 by Constructing Quartermaster, for constructing fire station, including plumbing, advertised in Engineering Record.

Pearl City, Hawaii.—Until Nov. 27 (readvertisement) by Bureau Yards and Docks, Navy Dept., Washington, D. C. (H. R. Stanford, Ch.), for constructing a marine railway at the Naval Station, Pearl Harbor. Specification No. 2172.

PRICES AND LETTINGS.

★Indicates award of contract.

New York, N. Y.—Upper Hudson Stone Co., 26 Cortlandt Street, submitted the only bid Oct. 15 to the Public Service Commission for ballast portion "C" as follows: Class A, 76,000 cu. yd., 97 cts.; Class "B," 4200 cu. yd., 87 cts.; total, $77,374.

Following are bids opened Oct. 15 by Public Service Commission for special work, order No. 5, frogs and switches: Pennsylvania Steel Co., $23,950; Ramapo Iron Works, 30 Church Street, $24,116, and William Wharton, Jr., & Co., Inc., 30 Church Street, $26,965.

Philadelphia, Pa. — McClintic-Marshall Co. of Philadelphia, reported to have submitted the lowest bid Oct. 19 for constructing the first four sections of the steel superstructure of the Frankford elevated line as follows: Three sections which include from Girard Avenue to Unity Street, Frankford, at $1,455,000, and the fourth section south from Girard Avenue to Callowhill Street, at $261,400.

RAILROADS

PROPOSED WORK.

Midland, Tex.—Texas and Pacific Railroad intends constructing a line from Midland to Seminole, a distance of 60 miles. New road to be known as the Midland & Northern Railroad. T. J. O'Donnell of Midland is interested.

State Canal Work—Albany, N. Y.—Following are unit prices of four lowest bids opened Dec. 19 by State Superintendent Public Works, Albany, for continuing and completing bridge over Black and Moose Rivers at Lyons Falls (a) Engineer's estimate, $4,182; (b) Walter A. Fay, Elmira, N. Y., $4,911; (c) Lathrop, Shea & Hayward Co., Buffalo, $4,911; (d) Crowley, Earl & Heinbach, Inc., Buffalo, $5,615; (e) Herbert E. Rockwell, Troy, $6,125.

	(a)	(b)	(c)	(d)	(e)
1,200 cu. yd. excavation	$0.50	$0.60	$0.70	$0.70	$0.40
[illegible] cu. yd. [illegible]	1.00	1.00	1.25	1.50	1.00
4,000 lin. ft. [illegible] piles	0.45	0.325	0.30	0.30	0.40
1,000 cu. yd. [illegible] concrete	6.75	6.00	6.50	6.75	7.50
700 M. ft. [illegible]	0.045	0.043	0.042	0.0425	0.044
[illegible]	0.04	0.04	0.04	0.04	0.04
[illegible]	2.00	1.90	1.75	2.00	2.00
1,000 ft. [illegible]	1.25	1.25	1.25	1.25	1.25
[illegible]	0.25	0.25	0.25	0.25	0.25
[illegible]	2.50	2.00	3.00	2.50	2.50
10 M. ft. [illegible]	55.00	48.00	55.00	60.00	55.00
1,000 M. ft. [illegible]	65.00	65.00	70.00	80.00	65.00
[illegible]	1.50	1.00	1.30	1.50	1.50
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	2,800.00	2,800.00	3,000.00
Maintaining highway traffic	[illegible]	[illegible]	1,000.00	1,000.00	1,000.00

Portland, Ore.—City will soon take steps to eliminate the grade crossings at Barr Road, west of Eighty-second Street, at a cost of $750,000.

BIDS DESIRED.

San Francisco, Cal.—Reported desired until Nov. 10 by Board Public Works for constructing railway from Rosasco into Hetchy Hetchy Valley for use in construction of new water supply.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Philadelphia, Pa.**—Contracts in connection with the opening of Emerald Street under the Richmond Branch of the Philadelphia & Reading R.R. awarded as follows: Contract 1, to C. P. Bower, Wayne and Roberts Avenue, at $32,915; Contract 2, to American Bridge Co., 1618 Pennsylvania Building, at $28,414, and Contract 3, to Barber Asphalt Paving Co., 239 N. Thirtieth Street, at $2,389.

★**Baltimore, Md.**—Contracts awarded Maryland Steel Co., Baltimore; Cambria Steel Co., Johnstown, Pa.; Carnegie Steel Co., Pittsburg, Pa., and Illinois Steel Co., Chicago, Ill., for steel rails, in all about 62,500 tons for replacement on main line Baltimore & Ohio R. R.

★**Cleveland, Ohio.**—Contracts awarded by City Board of Control for grade crossing elimination at Union Avenue as follows: For foundation approaches, to Robert Grace Contracting Co., 514 Smithfield Street, Pittsburgh, Pa., at $103,373; steel superstructure, to King Bridge Co., St. Clair Avenue and Sixty-ninth Street, Cleveland, at $34,892. Cornelia A. Filch, Secretary.

PUBLIC BUILDINGS AND SCHOOLS

PROPOSED WORK.

Holyoke, Mass.—Board of Public Works recommends plans for Isolation Hospital be revised so as to keep cost within appropriation.

Bridgeport, Conn.—Frederick A. Cooper, Meigs Bldg., retained to prepare plans for eight-room addition to Garfield School.

Wallingford, Conn.—At a recent town meeting it was decided to erect a new high school. Cost about $100,000.

Bayonne, N. J.—Board of Education engaged McKim, Mead & White, 101 Park Avenue, New York, to prepare plans for proposed additions to Public School No. 3; cost about $75,000; and to Bayonne High School; cost about $260,000.

New Providence, N. J.—John N. Pierson & Son of Perth Amboy, retained to prepare plans for addition to Lincoln School.

Abington, Pa.—George W. Elkins, 412 North Thirty-fourth Street, Philadelphia, Pa., purchased site for erecting nurses' home on York Road for Abington Memorial Hospital.

Duquesne, Pa.—Plans being prepared for fireproof laboratory for Duquesne University.

Lancaster, Pa.—C. Emben Urban, Lancaster, is architect for proposed school. R. M. Bolemins, Secy. Bd. Educ.

Monongahela, Pa.—School Board accepted plans for school to be erected in Second Ward.

Philadelphia, Pa.—A three-story brick school is to be erected at Fifty-fifth and Chestnut Streets, according to plans of J. Horace Cook, City Hall; cost $200,000.

Sayre, Pa.—Gibb & Waltz, Trust Company Building, Ithaca, N. Y., are architects for proposed three-story brick and concrete building to be erected for Robert Packer Hospital.

York, Pa.—The County Home is to be fireproof, two stories, stone and cost $500,000. No contracts yet let. B. F. Willis, Architect, 10 West Market Street; Le Roy Coon, 254 W. Cottage Place, Clerk.

Greenville, S. C.—Erection of new city hall being considered. Probable cost $65,000. Address City Clk.

Jennings, La.—Police Jury appointed committee to select plans for proposed $75,000 courthouse.

Columbus, Miss.—City Council adopted ordinances to issue $50,000 bonds to erect a high school and improve the streets.

Pontotoc, Miss.—Court House bonds amounting to $75,000 will be sold by Board of Supervisors Nov. 1.

Cincinnati, Ohio.—Board of Education approved plans for stadium and workshop for proposed East High School.

Columbus, Ohio.—Plans for the building in Schiller Park are to be revised so as to keep the cost within the appropriation. P. P. Kemper, Secy. Dir. Pub. Service.

Rochester, Mich. — Competitive plans will be received until Nov. 5 for the brick high school, to cost $25,000. Bonds to be sold Nov. 12. J. F. Jackson, Secretary Board of Education.

Bangor, Wis.—School Dist. No. 6 voted to erect new high school; probable cost $30,000.

La Crosse, Wis.—Competitive plans will be received by the State Board of Education, Madison, for a gymnasium to be erected at Normal School, La Cross; appropriation $80,000.

Menasha, Wis.—Plans being prepared for the high school. Jacob Liebl, Secy. Bd. Educ.

Milwaukee, Wis.—The committee on estimates on the budget of the Milwaukee Common Council has voted to include in next year's budget $50,000 for enlarging of the Zoo Building. Peter J. Luech, City Clerk.

School Board contemplates erecting buildings to cost about $960,000. A new school on Green Bay Avenue and one on Franklin Street, each costing $130,000, are desired.

Oneida, Iowa.—Citizens voted $20,000 bonds to erect a school.

Havelock, Neb.—Erection of new school contemplated. Address Bd. of Educ.

Austin, Tex.—See "Sewerage and Sewage Disposal."

Denton, Tex.—All bids opened recently for constructing two wings at College of Industrial Arts have been rejected by state board of rejects. Cost about $80,000.

Ft. Worth, Tex.—Attorney-General approved $35,000 bonds for Diamond Hill Independent School Dist., Tarrant County.

Houston, Tex.—See "Hydraulic."

Sand Springs, Okla.—Reported Charles Page, 415 First National Bank Building, Tulsa, is interested in erecting a $200,000 eye hospital and sanitarium here.

Woodland, Cal.—Erection of $200,000 court house contemplated. Address Co. Commissioners.

Alaska.—Erection of $35,000 sanitarium, together with five small hospitals and five schools, contemplated here by Dept. of Educ., Alaska Division. For further information address Mr. Sinclair, Supt. Disbursing Office, L. C. Smith Building, Seattle, Wash.

BIDS DESIRED.

Agawam, Mass.—Until Nov. 15, by County Commissioners, Springfield, for erecting Hampden County Training School at Agawam. Geo. P. B. Alderman & Co., Archts., 437 High Street, Holyoke.

Danvers, Mass.—Until Oct. 25 by Little & Browne, Archts., 70 Kilby Street, Boston, for erecting Elliot Street school, East Danvers.

Reported desired until Oct. 25 by Lester S. Couch, 70 Kilby Street, Boston, for erecting 2-story school; probable cost $25,000.

Hathorne, Mass.—Reported desired until Nov. 1 by Trus. Independent Agricultural School for erecting 2-story, 55 x 160 ft. school.

Holyoke, Mass.—Until Oct. 29, by Board Public Works, for erecting Isolation Hospital and boiler house. Cost $40,000. W. J. Howes, Archt., 243 High Street, Holyoke.

Brooklyn, N. Y.—Until Oct. 28 by Cabot Ward, Pres. Park Bd., Manhattan, for furnishing material and completing, including ventilating, heating, plumbing and drainage work, etc., laboratory buildings and greenhouses for Brooklyn Botanic Garden, Washington Avenue, Brooklyn. Total security $77,000.

Mount Vernon, N. Y.—Reported desired until Oct. 30 by Bd. Educ. for erecting 2-story 42 x 55 ft. school. Probable cost $35,000.

East Rutherford, N. J.—Until Oct. 28 for erecting a fireproof school costing $34,500. E. P. Hutton, Secretary Board of Education; John T. Simpson, Architect, Newark, N. J.

Pleasantville, N. J.—Reported desired until Oct. 26 (readvertisement) by S. Hudson Vaughn, Archt., Guarantee Trust Building, Atlantic City, for erecting 3-story, 105 x 130 ft., brick and concrete high school; probable cost $40,000.

Clearfield, Pa.—Until Oct. 25, by A. G. Kramer, Secy. School Board, for erecting high school at Market and Front Sts. Harrington & Howard, Archts., Du Bois.

Lebanon, Pa.—Later official reports state bids desired until Oct. 29 by J. H. Seltzer, Secy. Bd. Educ., for furnishing material and erecting high school at Sixth and Chestnut Sts. A. A. Ritcher, Archt., Reading.

Key West, Fla.—Until Nov. 13 by Bureau Yards and Docks, Navy Dept., Washington, D. C. (H. R. Stanford, Ch.); for Spec. 2196—Constructing two officers' quarters, naval station, Key West.

Highland Park, Ky.—Until Oct. 29 by William McGraw, Pres. Bd. Trus., Highland Park Graded Common School Dist. No. 46, for erecting school in Beechmont; also separately for steam heating said building. Henry F. Haws, Archt., Urban Bldg., Louisville.

Canton, Ohio.—Reported desired until Nov. 4 by W. C. Lane, Clk. Bd. Educ., for erecting high school. George F. Hammond, 4220 Prospect Avenue, Cleveland, Archt.

Columbus, Ohio.—Until Nov. 15 by Carl E. Steeb, Secy. Bd. Trus., Ohio State University, Columbus, for furnishing material and erecting homeopathic hospital and new shop buildings. Jos. N. Bradford, University Archt.

Lily Chapel, Ohio.—Reported desired until Oct. 30 by F. M. Stickley, Clk. Bd. Educ., Fairfield Township, Rural School Dist., for erecting 2-story brick and stone school. Also separate bids for heating, plumbing, gasfitting, etc. Howard & Merriam, Archts., 8 Broad Street, Columbus.

Bloomington, Ind.—Until Dec. 1 by Board Trustees Indiana University for erecting gymnasium; cost $175,000.

Kalamazoo, Mich. — Reported desired until Nov. 1 by H. H. Buckhout, Steward, Kalamazoo State Hospital, for erecting 3-story and basement nurses' home for hospital; probable cost $74,000. Wernete, Bradfield & Mead, 441 Houseman Building, Grand Rapids, Archts.

Peoria, Ill.—Until Oct. 28, by C. A. Reed, Chmn. Bd. Co. Superv., for erecting a four-story and basement fireproof county jail. Also for heating, plumbing and electric wiring. Fred. J. Klein, Archt., Peoria.

Woodstock, Ill.—Until Nov. 1 by Third Infantry Armory Comn., care of James B. Dibelka, State Archt., 130 N. Fifth Avenue, Chicago, for erecting addition to said armory.

Osseo, Wis.—Until Nov. 1 by W. K. Lewis, Chmn. Bd. Educ., for erecting school; also separate bids for heating, ventilating, plumbing, wiring, etc. Perkins, Fellows & Hamilton, Archts., 6 North Clark Street, Chicago, Ill.

Boone, Iowa.—Until Nov. 10, by County Board Supervisors, at office of J. R. Curry, Co. Aud., Boone, for erecting a court house and heating plant.

Brighton, Iowa.—Reported desired until Nov. 1 by Board Education for erecting 2-story and basement, 54 x 76 ft., brick and stone school. Proudfoot, Bird & Rawson, Archts., Hubbel Building, Des Moines.

Argentine, Kan.—Reported desired until Oct. 26 by Ross & Peterson, Archts., Barker Bldg., Kansas City, Kan., for erecting 2-story and basement 50 x 75 ft. library. Probable cost $25,000.

Hiawatha, Kan.—Reported desired until Nov. 1 by W. T. Shale, Secy. Bd. Educ., for erecting 2-story and basement, 76 x 106 ft., high school; probable cost $75,000. J. H. Felt & Co., Archts., 800 Grand Avenue Temple, Kansas City, Mo.

Loup City, Neb.—Reported desired until Oct. 28 by William Larson, Secy. Bd. Educ., for erecting 3-story and basement school. Oscar R. Kirscheke, Grand Island, Neb., Archt.

Warrensburg, Mo.—Until Nov. 2 at office of G. E. Hoover, Registrar Missouri State Normal School, Warrensburg, for erecting administration building; also separately for heating, plumbing and electric wiring. Smith, Rea & Lovitt, Archts., Finance Building, Kansas City.

Brenham, Tex.—Until Oct. 27 by James A. Wetmore, Acting Superv. Archt., Washington, D. C., for erecting complete (including mechanical equipment and approaches) (except roof), U. S. Post Office at Brenham.

Navasota, Tex. — Until Nov. 26 by James A. Wetmore, Acting Superv. Archt., Washington, D. C., for erecting (including mechanical equipment) (except lighting fixtures and approaches) U. S. Post Office at Navasota.

Seattle, Wash.—Until Oct. 27 by the Port of Seattle Commissioners, for erecting an addition to port warehouse at Whatcom Avenue, to be fireproof, reinforced-concrete, 257 x 90 ft., four-story, and costing $120,000.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Wellesly, Mass.**—Contract for erecting 4½-story, brick dormitory for Wellesly College awarded J. W. Bishop Co. of Worcester. Cost reported at $200,000. Coolidge & Carlson, Architects, 89 Straight Street, Boston.

★**West Springfield, Mass.**—Contract for erecting library on Elm and Park Streets, bids opened Oct. 6, awarded E. T. Davis & Sons, Springfield, at $22,000. Edward L. Tilton, Architect, 32 Broadway, New York. H. E. Schmuck, Chairman Library Building Committee.

Naugatuck, Conn.—Following are four lowest bids opened Oct. 13 by Supervising Architect, Washington, D. C., for erecting U. S. Post Office: E. T. Abbott Construction Co., 1123 Bway., New York, $47,900; W. H. Fissell & Co., Marbridge, Mass., $50,400; J. S. Rogers Co., Moorestown, N. J., $50,482, and Wm. H. Egan, New York, $50,967.

Little Falls, N. Y.—The following are the four lowest bids opened Oct. 12 by M. A. Leahy, City Clerk, for erecting municipal building (modified bids also were submitted): George B. Wills & Co., Inc., New York, $97,881; Berrigan Contracting Co., Little Falls, $104,525; W. Shelton Swallow Co., New York, $104,200; Hallihan & Snyder, Little Falls, $109,000.

New York, N. Y.—See "Water Works."

★**Belvidere, N. J.**—Contract for erecting two-story high school (bids opened Oct. 11) awarded by Board of Education to S. W. Goodner & Co., Belvidere; cost about $30,000. Rasmussen & Mayland, Archts., 1133 Broadway, New York.

★**Newark, N. J.**—Contracts for erecting Milford School on Eighteenth Avenue awarded by Bd. Educ. included following: Masonry and carpentry, E. M. Waldron & Co., Inc., 84 S. Sixth Street, at $101,090; plumbing, R. B. Schmidt, Inc., 390 Walnut Street, $7,432.

Philadelphia, Pa.—Lowest bid opened by Com. on Property Bd. of Educ., for erecting addition to Fayette School at Bustleton, submitted by Melody & Keating, Bailey Building, at $40,444.

★**Baltimore, Md.**—Contract for erecting the engineers' building at the John Hopkins Univ. awarded Consolidated Eng. Co., Calvert Bldg., at approximately $155,000. John E. Sperry, Archt., Baltimore.

Roanoke, Va.—Following are four lowest bids opened Oct. 8 by Roanoke Auditorium Co. for erecting one-story and basement auditorium and convention hall: C. H. Turner, $41,275; C. F. Fried, $41,840; A. L. Marshall, $42,846; J. F. Barbour & Son, $43,900 (all of Roanoke). H. M. Miller, Architect, Roanoke.

Akron, Ohio.—Following are four lowest bids opened Oct. 12 by Armory Bd., Columbus (Maj. Karl I. Best, Archt. Bd.), for erecting the armory and auditorium here: Clemmer & Johnson, Hicksville, $171,892; Dawson Constr. Co., Pittsburgh, Pa., $176,450; Carmichael Constr. Co., Akron, $184,506, and John Crisp & Sons, Akron, $188,319.

★**Cincinnati, Ohio.**—Contract awarded by Board of Education to Ferro Concrete Constr. Co., Richmond and Harriet Streets, for erecting main buildings of new East High School at $455,469.

★**Marion, Ohio.**—Contract for erecting Marion High School awarded W. C. Handshy & Son of Zanesville at $84,693.

★**Alton, Ill.**—Contract awarded by the State Board of Administrations, Springfield, to S. A. Voorhies Construction Co., Alton, at $71,600, for erecting kitchen and dining-room at the Alton State Hospital; laundry building to John Moroff & Son, Bradley, at $30,248, and bakery, to A. W. Stoolman, Champaign, $17,820.

★**Aurora, Ill.** — Contract awarded Christopher Armbruster & Sons, Aurora, for erecting grade school on Galena Boulevard. Cost, including equipment, $45,000.

Chicago, Ill.—The lowest bid opened Oct. 13 by Department of Public Works for furnishing material and installing cork composition, ceramitic tile flooring and foundation in Contagious Disease Hospital, submitted as follows: In the administration building, by J. W. Snyder Co., 4330 Grand Boule., at $11,300, and in Ward Building, No. 3, by J. J. Brittain Co., 3026 S. Calumet Avenue, at $11,850.

★**Clinton, Ill.**—Contract for erecting Washington School awarded Hagerman & Harchan of Sullivan at $31,700.

Rock Island, Ill.—Following are four lowest bids opened Oct. 11 by School Board for erecting school at Tenth Street and Twelfth Avenue: Building Constr. Co., Chicago, $61,970; Schmidt Bros., $62,075; P. H. Lorenz, Peoples Bank Bldg., Moline, $64,200; H. F. Paulsen, Safety Bldg., $64,436.

Watertown, Wis.—Following are four lowest bids opened Oct. 11 by Board of School Comrs. for general construction of proposed high school: Bailey March Co., Minneapolis, Minn., $79,850; J. P. Cullen Constr. Co., Janesville, $79,995; Clark Constr. Co., Danville, Ill., $81,535; Ford, Brown & Schoof, Janesville, $82,000. Lowest for heating, General Heating & Ventilating Co., Milwaukee, $9,354, and lowest for plumbing, Wm. Owens Co., Madison, $5,925. Parkinson & Dockendorff, Archts., La Crosse.

★**Jefferson, Iowa.**—Contract for erecting court house awarded The Rowles Co. of Onawa, at $127,672. B. S. McCully, county auditor.

★**Minneapolis, Minn.**—Contract awarded J. L. Robinson Co., 511 S. Eleventh Street, for erecting brick addition to Schiller School on Twenty-sixth Avenue, North; cost $55,000. Stebbins & Hoxby, Architects, Masonic Temple.

★Contract for erecting two-story addition to Lyndale School on Lyndale Avenue and Thirty-fourth Street, awarded by Board of Education to J. E. Pilgrim, 2828 Pleasant Avenue, at about $85,000. Stebbins & Hanby, architects.

★**Seward, Neb.**—Contract awarded by School Board for erecting three-story school to Henry Ohlson & Son of David City, at about $43,988.

★**Dallas, Tex.**—Contracts awarded by Board of Education for following schools: City Cliff High School, general construction to Bateman Co., Oklahoma City, Okla., at $[illegible]; plumbing, Hamilton Co., Dallas, $[illegible]; heating and ventilating, Peters-Reister Co., St. Louis, Mo., for both; Oak Cliff and Wilmerding Schools, at total of $[illegible], electrical work for both schools to Wright Lynn, San Antonio, at $[illegible]; Wilmerding School, general construction, Jones & Hartsfield, Fort Smith, Ark., $[illegible]; plumbing, Sullivan & Martyn, Dallas, $[illegible].

★**Nacogdoches, Tex.** — Contract for erecting a high school awarded W. P. Berry, of Lufkin, at $[illegible] and for heating to Lane & Co., at $[illegible]. C. H. Page & Bros., Archts., Austin.

★**Palestine, Tex.**—Contract awarded by City Council to A. W. Flint of Ft. Worth for erecting high school, at $[illegible]. Sanguinet & Staats, Archts. First National Bank Bldg., Ft. Worth.

★**San Antonio, Tex.**—Contract for erecting City and County Hospital, awarded by H. N. Jones Company, Inc., at $[illegible]. Moore Plumbing Co., $[illegible]. Poetter & Harrison, Archts., Frost Building.

★**Sedro Woolley, Wash.** — Contract awarded by State Board of Control, Olympia, for erecting buildings for State Insane Asylum to Wyman Gessel Co., Tacoma. Heating apparatus received bid of Elling Heath & Gove, Architects, National Realty Building, Tacoma.

★**Mountain Home, Idaho.**—Following are four school bids received Oct. 14 by County Commissioners for erecting the court house: C. E. Johnson, Mountain Home, $[illegible] (awarded contract); J. Sullivan, $[illegible]; E. E. Evans, $[illegible]; Jerome Concrete Concrete Co., Ltd., $[illegible]. Contract for heating awarded E. B. Hughes, Heating Engr., at $[illegible]. Frank M. Hoppe, Co. Arch.

PRIVATE BUILDINGS

PROPOSED WORK.

Boston, Mass.—Reported plans prepared by Hutchings & Woods, Boston, for a building to house knights of Columbus will erect in the Fenway.

Hyde Park, Mass.—Myer Dana, it is reported, intends erecting on Hyde Park Avenue, a number of building including theater, garage and store. Total cost about $[illegible].

Springfield, Mass.—S. S. Beman, 331 S. Michigan Avenue, Chicago, Ill., preparing plans for new edifice to be erected on State Street for First Church of Christ (Scientist); cost about $[illegible].

New Haven, Conn.—Contract soon to be let for erecting stone church and parish house for Lutheran Congregation, cost $[illegible]. C. S. Palmer, Architect, 16 Church, St. Rev. A. J. Traxler, Rector.

New London, Conn.—Improvements to Griswold Hotel at Eastern Point contemplated. H. D. Sutton, Mgr.

Albany, N. Y.—Plans prepared for a four-story addition proposed to the Ten Eyck Hotel to provide store, office and hotel accommodations; approximate cost $[illegible]. Albany Hotel Co., owners.

Brooklyn, N. Y.—William A. Parfitt, 26 Court Street, is architect for new edifice to be erected on Schermerhorn Street, for St. Constantine Greek Orthodox Church.

Erection of office and warehouse building at 76 Pearson Street, contemplated by American Exporting & Importing Corp., 11 Park Row, New York.

Plans filed for apartment house to be erected on W. 10th Street and Eighth Avenue, for the 247 Eighth Avenue Co., Inc.; cost $[illegible]. Buchsbaum & Stampan, Archts., 772 Broadway, Brooklyn.

College Point (P. O. Flushing), L. I., N. Y.—College Point Savings Bank contemplates erecting new building on Fourteenth Street.

New York, N. Y.—Plans filed for two five-story brick tenements to be erected at Pitt Avenue and Third Street for D. R. T. Realty Co.; cost $[illegible]. Lyman Simpson, 30 E. 42d Street, Archt.

Plans being prepared by Werner Hunter, 245 West Fifty-fifth Street, for six-story store and loft building to be erected at Lexington Avenue and Twenty-eighth Street for Pierce Building Co., 244 West Forty-fifth Street; cost about $[illegible].

Syracuse, N. Y.—Geo. F. Hosie, 450 Irving Avenue, is preparing plans for a brick and stone addition for Syracuse Hungarian Methodist, to be erected at Geddes Street and Onondaga Avenue.

Newark, N. J.—Plans completed by Nathan Kaplan, 191 Washington Street, for two-story brick store and apartment building to be erected at Spruce and Church streets for Rosenberg, Libe & Perlstadt; cost about $[illegible].

Duncansville, Pa.—Erection of new edifice for Methodist Episcopal Church contemplated here; cost about $[illegible].

Philadelphia, Pa.—Review Club of Oak Lane contemplates erecting club house at Lawndale Avenue and Seventeenth Street; cost about $[illegible].

Horace Trumbauer, Land Title Building, preparing plans for one-story stone building to be erected at Twelfth and Chestnut Streets, for Beneficial Saving Fund Society; probable cost $[illegible].

Wilkes-Barre, Pa.—Sturdevant & Peggi, Reading are architects for proposed four-story brick, stone, concrete and steel Masonic Temple to be erected here.

Washington, D. C.—Plans being prepared for seven-story apartment hotel to be erected at Vermont Avenue and K Street, N. W., for Harry Wardman, 2916 Fourteenth Street, N. W.; probable cost $[illegible].

Atlanta, Ga. Charles H. Hopson, Healey Bldg., is architect for brick office to be erected for Ponce de Leon Methodist Church at Ponce de Leon and Piedmont Avenues; cost $35,000.

Orlando, Fla.—Board of Trade will issue $45,000 bonds for erecting new building.

Columbus, Ohio.—James H. Butler, Columbus Hotel, reported contemplating erecting on Broad Street and Grand Avenue an eleven-story apartment hotel; probable cost $[illegible].

Dayton, Ohio.—Mutual Home & Savings Assoc., 28 N. Main Street, intends erecting ten-story steel and concrete building at Main and Second Streets; cost approximately $200,000.

Middletown, Ohio.—Knights of Pythias contemplate erecting new building; probable cost $35,000.

Youngstown, Ohio.—Children of Israel Jewish Orthodox Congregation contemplate erecting new synagogue; cost about $50,000. Rev. I. M. Davidson, Rabbi.

Detroit, Mich. — St. Agnes' Roman Catholic Church, Twelfth and Bethune Streets, will erect combined church and school; cost about $60,000. Rev. Charles E. Henigan, Pastor.

Chicago, Ill.—Erection of apartment building at 5511 Ingleside Avenue, Hyde Park, is contemplated by Frederick Becklenberg, 4607 Grand Boulevard; cost about $[illegible].

C. E. Fox of the architectural firm of Marshall & Fox, 28 S. Dearborn Street, is reported secretary of the Edgewater Beach Hotel Company which intends erecting at Balmoral Avenue a hotel nine stories high.

Plans being prepared for six-story apartment building which Edward M. Hertha, 1053 Hyde Park Boule., intends erecting on Grand Boule.

West Frankford, Ill.—Architects not selected yet for proposed hospital for West Frankford Medical and Relief Association. Probable cost $30,000. Joseph Somers, secretary.

Milwaukee, Wis.—Courtenay & White, 420 Jefferson Street, intend erecting four-story fireproof apartment building at Grand Avenue and Sixteenth Street; probable cost $55,000.

Des Moines, Iowa.—Masons contemplate erecting temple at Fourteenth and West High Streets; cost approximately $300,000.

St. Paul, Minn.—Plans completed by W. C. Armstrong, chief engineer of the Union Depot Company, for the proposed railway and water terminal improvement.

Minneapolis, Kan.—Plans prepared by H. B. Wetter of Manhattan, for the Odd Fellows Building; estimated cost $20,000.

St. Louis, Mo.—Reported Women's Council contemplate erecting ten-story office building on Market Street. Mrs. William H. Utter, 4408 Forest Park, reported interested.

Erection of moving picture theater on St. Louis Avenue contemplated by Fred Warner, 2238 Red Bud Avenue; probable cost $[illegible].

Dallas, Tex.—Plans of Van Slyke & Woodruff, Ft. Worth, for edifice approved by Oak Cliff Christian Church; cost approximately $40,000. Rev. A. E. Ewell, Pastor.

Contract soon to be let for erecting synagogue at Harwood and Boulevard Streets for Temple Emanu-El; cost $125,000. Rev. W. H. Greenburg, Rabbi.

Waco, Tex.—The Texas Telephone Company intends erecting an exchange building, three story, 55 x 120 ft. Ross & Cassin Waco, architects.

Ardmore, Okla.—Reported owner of the Whittington Hotel intends erecting a $150,000 hotel building. Captain Whittington, owner.

Krebs, Okla.—Brewen & Kiple, Wholesale Grocery Co., will soon let contract for erecting brick store building, 70 x 90 ft.

Seattle, Wash.—Contract soon to be let by W. Marbury Somervell, Archt., White Bldg., for erecting reinforced concrete apartment house for F. S. Stimson; cost about $[illegible].

E. W. Houghton & Son, Collins Building, Seattle, preparing plans for apartment house to be erected on Fifth Avenue for Fifth Avenue Improv. Co.; two a three story buildings costing $40,000 and a six-story cost $40,000, under consideration.

Ogden, Utah.—Reported Ogden, Logan & Idaho Ry. Co. (R. W. Armstrong, Ch. Engr., Ogden), contemplates erecting carhouses, storehouses and repair shops to cost about $145,000.

Toronto, Ont.—Reported Toronto Terminals Co. submitted to city architect plans for new Union Station; estimated cost $3,340,000. In addition to cost of station, it is estimated that viaduct and approaches to station will cost about $12,000,000.

BIDS DESIRED.

New Haven, Conn.—Reported desired until Oct. 25 by H. I. Ballantyne & Louis R. Metcalf, Archts., 2 W. Forty-seventh Street, New York, for erecting 3-story, 50 x 69 ft. addition to Cloister.

Rochester, N. Y.—Reported desired until Oct. 30 by A. Agren, Pres. Labor Temple Assoc., for erecting a 3-story, 40 x 67 ft., labor temple; probable cost $90,000. W. J. Brockett, Archt., 345 Powers Building.

Evansville, Ind.—Reported desired until Nov. 4 by C. P. Beard, Secy. G. A. R. Memorial Coliseum Comn., for erecting 1-story, balcony and basement, 204 x 170 ft. coliseum. C. Shoppell & Co., Archts., 707 Furniture Exchange Building.

Terre Haute, Ind.—Reported desired until Oct. 25 (extension of date from Oct. 15) by William K. Hamilton, 529 S. Fifth Street, Terre Haute, for erecting Masonic Temple; probable cost $90,000. Hubbard & Pankon, Swannell Building, Champaign, Ill., Archts.

Wichita, Kan.—Reported desired until Nov. 1 by H. S. Conrow, Beacon Building, for erecting 4-story, 49 x 140 ft., Y. W. C. A. building; probable cost $65,000.

Bartletsville, Okla.—Reported desired by Y. M. C. Association for erecting a building, according to plans by Shattuck & Hussey of Chicago, Ill. A. J. Diescher, president Board of Trustees.

Bartlesville, Okla. — Reported desired until Nov. 11 by A. J. Diescher, Pres. Bd. Trus., for erecting Y. M. C. A. building; also separately for heating, plumbing and electric work. Shattuck & Hussey, Archts., 19 S. La Salle Street, Chicago, Ill.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**New York, N. Y.**—Contract awarded Underpinning & Foundation Co., 290 Broadway, for foundation work on building at Twenty-fifth Street and Lexington Avenue. Herman Lee Meader, Archt., 2 W. Thirty-third Street.

★**Rochester, N. Y.**—Contracts for erecting two-story and basement, brick, Y. M. C. A. building at Lake and Driving Park Avenues, total cost $50,000, awarded as follows: Masonry, A. Friederich & Sons Co., 106 Mill Street; carpentry, A. W. Hopeman & Sons Co., 569 Lyell Avenue; heating, Howe & Bassett Co., 23 Stillson Street; electrical work, Wheeler-Green Electric Co., 31 St. Paul Street; plumbing, Wright & Alexander Co., 283 State Street.

★**Irwin, Pa.**—Contract for erecting four-story brick building for Eagles Lodge awarded J. E. Myers, of Penn Station; estimated cost $35,000.

★**Philadelphia, Pa.**—Contract for erecting six-story warehouse for W. J. McCahan Sugar Refining Co., awarded Henry E. Baton, Twelfth and Sansom Streets; cost about $50,000.

★**Wilmington, Del.**—Contract for erecting bakery for Freihofer Baking Company, awarded Philip Haibach Contracting Co., Twenty-sixth and Thompson Street, Philadelphia, Pa. Peuckert & Wunder, Engrs. and Archts., 310 Chestnut Street, Philadelphia, Pa.

★**Washington, D. C.**—Contract for erecting five-story office building at Ninth Street and Massachusetts Avenue for American Federation of Labor, awarded R. P. Whitty Co., Union Trust Bldg.; cost about $100,000. Milburn, Heister & Co., Archts., Union Savings Bank Bldg.

★**Louisville, Ky.** — Contract reported awarded by Speed Realty Co., to L. W. Hancock Co., 1412 Lincoln Building, for erecting six-story concrete and steel warehouse on Fourth Street; cost about $60,000.

★**Cincinnati, Ohio.**—Contract for erecting tenement building on Logan Street for Col. William Cooper Proctor, awarded Ferro Concrete Constr. Co., Richmond and Harriet Streets; probable cost $150,000.

★**Cleveland, Ohio.**—Contract for erecting six-story building on Rockwell Avenue for W. Pattison Supply Co., awarded Uhl-Jaster Co., 1900 Euclid Street; cost approximately $100,000.

★**Neenah, Wis.**—Contracts for erecting hotel here in which H. K. Babcock is reported interested awarded as follows: General construction, Mayer & Son, Oshkosh; plumbing, D. Ahern & Son, Fond du Lac; electrical work, Langstad & Mayer Co., Appleton.

★**Tacoma, Wash.** — Contract reported awarded by Heath & Gove, Archt., National Realty Bldg., to Cornell Bros., Savage-Seafield Bldg., for erecting hotel in Rainier National Park; cost $75,000.

NEW INDUSTRIAL PLANTS

PROPOSED WORK.

Lowell, Mass.—Tremont & Suffolk Mills, Lowell, intend erecting five-story brick and steel addition.

New Haven, Conn.—Plans completed for addition to factory of National Folding Box & Paper Co., Alton and James Streets.

Waterbury, Conn.—Plans being prepared for one-story brick and steel machine shop which Waterbury Tool Co., 57 North Main Street, intends erecting.

Buffalo, N. Y.—Plans being prepared for four-story addition to Duffy Silk Mills, 1270 Broadway.

Plans completed for elevator, dryer and bleacher, which Globe Elevator Co., 95 Kentucky Street, will erect by day labor.

New Rochelle, N. Y.—Reported D. & C. Flour Co., 185 Madison Avenue, New York, will erect here four story fireproof brick mill.

Saratoga Springs, N. Y.—Reported State Reservation Commission, Albany, is having plans prepared for a bottling plant which they propose erecting here at a cost of about $162,000.

Troy, N. Y.—Plans being prepared for 8-story factory for Cluett, Peabody & Co., River and Hutton Streets.

Waterport, N. Y.—John G. Ellendt, Cutler Bldg., Rochester, is architect for three-story and basement 98 x 126 ft. reinforced concrete cold storage plant which Growers Cold Storage Co. will erect by day labor.

Bloomfield, N. J.—Eastern Toll & Mfg. Co., 74 Richmond Street, Newark, intends erecting factory here; probable cost $100,000.

Scott & Bowne Co. of Orange Street contemplate erecting addition to plant; cost about $50,000.

Philadelphia, Pa.—Plans being prepared by Day & Zimmerman, 611 Chestnut Street, Philadelphia, for rotary kiln at hydrating lime plant at Cedar Hollow for Charles Warner; probable cost $80,000.

Philadelphia Tapestry Mills, Allegheny and Front Streets, contemplate erecting five-story concrete and steel mill.

Benwood, W. Va.—National Tube Co. of Marshall Street contemplates erecting additional mill.

Great Falls, S. C.—Reported Republic Cotton Mills Co., intends enlarging present plant.

New Orleans, La.—Plans being prepared for three-story brick addition to Alden Mills, 2309 Decatur Street; cost about $28,000.

Memphis, Tenn.—Hudson-Dugger Co., 1404 Memphis Trust Bldg., will improve plant of Kennedy-Heading Co., recently purchased.

Cleveland, Ohio.—Plans completed by S. H. Goldfein, Reserve Trust Building, for three-story brick, steel and reinforced concrete building to be erected at plant on Woodland Avenue, for Miller, Becker & Co.; cost approximately $25,000.

Cary, Ind.—American Sheet & Tin Plate Co., Gary, contemplates erecting 24-mill plant here.

Chicago, Ill.—The Stewart Warner Speedometer Corporation, Lincoln and Wolfram Streets, intends erecting a six-story concrete addition to their plant, costing $250,000.

St. Louis, Mo.—McQuay-Norris Mfg. Co., 2808 Locust Street, will erect addition to factory; cost $35,000.

Sand Springs, Okla.—Charles Page, 415 First National Bank Bldg., Tulsa, reported interested in erecting cotton mill here.

Seattle, Wash.—Plans being prepared by Bradley, Buff & La Barthe of San Francisco, Cal., for proposed smelter which Bunker Hill & Sullivan Mining Co., Kellogg, Idaho, intends erecting here; cost approximately $1,000,000.

Oregon City, Ore.—Reported Willamette Valley Flax Co. will erect a mill within 40 miles of Oregon City; cost about $300,000. John W. Loder, Oregon City, Attorney and City Recorder, and W. C. Elliott, 116 Willamette Boulevard, Portland, are reported interested.

Hamilton, Ont.—W. T. Rawleigh Co., Liberty and Spring Streets, Peoria, Ill., intends erecting factory here.

BIDS DESIRED.

New York, N. Y.—General Electric & Improv. Co., eight floor Yale & Towne Building, 9 E. Fortieth Street, New York, desire lists and quotations on machinery and equipment, which will be installed in the $5,000,000 shipbuilding plant which they will erect for the Continental Dry Dock & Shipbuilding Co. This company has the general contract and will let subcontracts for the greater portion of the work, and would like to correspond with engineers and contractors to this purpose.

PRICES AND LETTINGS.

★Indicates award of contract.

★**Niagara Falls, N. Y.**—Contract awarded by Titanium Alloys Mfg. Co. to Chas. F. Ernst Sons, Buffalo, for erecting a storage building and steel and brick addition to foundry.

★**Rochester, N. Y.**—Contract for erecting additions to plant of Eastman Kodak Co., Kodak Park, awarded Alexander, Shumway & Utz Co., 16 State Street.

★**Syracuse, N. Y.**—Contract awarded W. J. Burns Co., Bastable Building, for erecting six-story and basement factory for Franklin Mfg. Co.; cost $175,000. Robt. J. Reidpath, Archt., Builders' Exchange, Buffalo.

★**Harrison, N. J.**—Contract awarded Turner Construction Company, 11 Broadway, New York, for erecting for the Hyatt Roller Bearing Company of Newark, an eight-story building, 75 x 200 ft. at Middlesex and Fifth Streets and Railroad Avenue, reinforced concrete construction, beam and girder type, with brick curtain walls, pilasters.

MISCELLANEOUS

PROPOSED WORK.

Transmission Line—Hortonville, Vt.—The Hortonia Power Company of Hortonville has decided to extend its transmission line from Hortonville to Orwell, a distance of 5½ miles.

Park Improvements—Boston, Mass.—The city intends improving the city parks and playgrounds at a cost of $1,000,000.

Transmission Line—Providence, R. I.—The Narragansett Electric Light Company of Providence, intends building a high-tension transmission line from its sub-station in East Providence to Phillipsdale.

Transmission Line—Cobleskill, N. Y.—Reported the Mohawk Hydroelectric Company, Ephratah, plans extending a transmission line to supply electricity to the Courter Electric Company.

Elevator—Niagara Falls, N. Y.—H. K. Eckert, Supt. of the Niagara State Reservation, has submitted to Albany his 1916 budget calling for an appropriation of $120,000, which includes $40,000 for building an elevator for the Cave of the Winds.

Transmission Line—Cottonwood Falls, Ky.—The Home Light & Power Company, of Cottonwood Falls, intends extending transmission line into the country east of Cottonwood Falls, a distance of about 5 miles.

Dock—Two Harbors, Minn.—It is reported that the Duluth & Iron Range R.R. (W. A. Clark, Ch. Engr., Duluth) intends constructing a new dock, concrete and steel, to have a capacity of 68,000 gross tons.

Park Bonds—Lincoln, Neb.—Park bonds amounting to $50,000 have been sold. Address City Clerk.

Dam — Powersite, Mo. — Reported the Ozark Power & Water Company of Jackson, contemplates constructing a smaller dam on White River, about 70 ft. below the present reservoir, to cost about $15,000.

Electric Equipment—Morrillon, Ark.—The Arkansas Light & Power Co. of Ardkadelphia will install electric driven pumping equipment in the works recently purchased here.

Park Bonds—Houston, Tex.—See "Hydraulic Construction and River Improvements."

Park Improvement Bond—Bartlesville, Okla.—Citizens voted $45,500 park improvement bonds and $6,500 for an incinerator plant.

Subway — Richmond, Cal.—City is considering building a subway under the tracks of the Santa Fé Ry. to allow an extension of Sixteenth Street; cost $7,000.

Transmission Line—Kingman, Ariz.—Reported the Desert Power and Water Company of Kingman, plans the following improvements: A 44,000-volt transmission line from Palm Reed mine to Black Eagle mine, a distance of one mile, and to the United Eastern mine, also one mile; a 44,000-volt, 3-phase and 60 cycle transmission line from the power plant at Kingman to the Union Basin Mining Company and Golconda, a distance of 14 miles.

BIDS DESIRED.

Cement—Annapolis, Md.—Until Nov. 2 by Bureau Supplies and Accounts, Navy Dept., Washington, D. C., for delivering Portland cement at the Naval Academy, Annapolis.

Shipbuilding Ways, Etc. — Charleston, S. C.—Until Nov. 13 by Bureau Yards and Docks, Navy Dept., Washington, D. C. (H. R. Stanford, Ch.), for Spec. 2201—Shipbuilding ways and roadway to building ways at Navy Yard, Charleston.

Sprinkler System—Jacksonville, Fla.—Until Nov. 8 by F. W. Bruce, Ch. Engr., Port Comrs., for sprinkler system to be installed in cotton compress and storage building now in course of construction.

Retaining Wall—St. Clairsville, Ohio.—Reported desired until Nov. 1 by Emerson Campbell, Co. Aud. Mt. Jewett Lodge, No. 881, I. O. O. F., for concrete retaining wall for a building 40 x 80 ft.

Dryers—Chicago, Ill.—Until Oct. 25 by John Dill Robertson, Comr. of Health, for constructing, delivering and erecting dryers appurtenances and accessories in Dryers Buildings Nos. 4 and 5 at Municipal Reduction Plant.

Heating System in Officers' Quarters—Fort Bliss, Tex.—Until Nov. 17 by Depot Quarter Master, El Paso, for installing hot water heating systems in 13 officers' quarters at Fort Bliss, advertised in Engineering Record.

Cement—Winnipeg, Man.—Until Oct. 25 by S. H. Reynolds, Chmn. Comrs., Boyd Building, Winnipeg, for 200,000 bbl. Portland cement for Greater Winnipeg Water Dist.

Oil Storage Tanks—Panama.—Until Nov. 16 by Maj. F. C. Boggs, Corps Engrs., U. S. A., Genl. Purchasing Office, the Panama Canal, Washington, D. C., for Cir. 981—Furnishing and erecting steel oil storage tanks.

Cable, Etc.—Panama.—Until Nov. 5 by F. C. Boggs, Purchasing Officer, Panama Canal Comn., Washington, D. C., for Cir. 979—Copper cable and wire, steel reinforcing bars, pipe fittings, etc.

PRICES AND LETTINGS.

★Indicates award of contract.

Elevator in Building—Boston, Mass.—Following are two bids opened Oct. 8 by Superv. Archt., Washington, D. C., for installing an electric elevator in U. S. Appraiser's stores: Otis Elevator Co., Washington, D. C., $29,439. and A. B. See Electric Elevator Co., Baltimore, Md., $37,225.

★**Elevator—Augusta, Ga.**—Contract for elevator in new city wharf awarded Link-Belt Co., at $4,500. Contract for steel to Virginia Bridge & Iron Co., Roanoke, Va.

★**Pipe—Howe Sound, B. C.**—Contract awarded J. Erickson, 5812 Woodlawn Avenue, Seattle, Wash., for installing two miles of 36-in. wood stave pipe for power purposes for the Pacific Coast Mining Co., of Vancouver; cost $25,000.

Proposals

For Proposals Advertised, see Pages 46 and 47

WATERWORKS.

Bids Close.		See Eng. Record.
Oct. 26.	Contract 128, New York, N. Y. Adv. Oct. 9.	Oct. 9
Oct. 26.	Pipe, Reservoir, Etc., Peapack, N. J.	Oct. 16
Oct. 26.	Mains, St. Cloud, Minn.	Oct. 23
Oct. 27.	Units, Bars at Pumping Station, Cleveland, Ohio.	Oct. 23
Oct. 27.	Pumps, Tompkinsville, N. Y.	Oct. 23
Oct. 28.	Softening Equipment, Columbus, Ohio	Oct. 16
Oct. 28.	Pumping Unit, Dayton, Ohio	Oct. 16
Oct. 28.	Reservoir, Etc., Gallatin, Mo.	Oct. 23
Oct. 28.	Supply System, Newark, N. J.	Oct. 23
Oct. 29.	Water Works, Germania, Iowa.	Oct. 23
Oct. 30.	Tank and Tower, Indian Head, Md.	Oct. 16
Oct. 30.	Pipe Line, Buffalo, N. Y.	Oct. 23
Nov. 1.	Contracts 14 and 15, Hartford, Conn. Adv. Oct. 16, 23.	Oct. 16
Nov. 2.	Pipe Fittings, Etc., Washington, D. C.	Oct. 16
Nov. 3.	Tank, Le Roy, N. Y. Adv. Oct. 23.	Oct. 23
Nov. 4.	Pumping Engine, Galveston, Tex. Adv. Oct. 2.	Oct. 2
Nov. 8.	Tank, Jacksonville, Fla.	Oct. 23
Nov. 9.	Water Wks., Belleville, Ohio	Sep. 11
Nov. 9.	Valves, Brooklyn, N. Y.	Oct. 23
Nov. 11.	Softening Plant, Columbus, Ohio	Oct. 23
Dec. 1.	Water Works, East Youngstown, Ohio	Oct. 16

SEWERAGE AND SEWAGE DISPOSAL.

Oct. 26.	Mansfield, Ohio	Oct. 16
Oct. 26.	Toronto, Ont.	Oct. 23
Oct. 26.	Ogden, Iowa Adv. Oct. 23.	Oct. 23
Oct. 26.	Berlin, Ont.	Oct. 23
Oct. 27.	Algona, Iowa	Oct. 16
Oct. 27.	Canton, Ohio	Oct. 23
Oct. 27.	Mansfield, Ohio	Oct. 23
Oct. 28.	El Centro, Cal.	Oct. 23
Oct. 29.	Pittsburgh, Pa.	Oct. 23
Nov. 1.	Greenwich, N. Y. Adv. Oct. 23.	Oct. 23
Nov. 3.	Woonsocket, R. I. Adv. Oct. 23.	Oct. 23
Nov. 4.	New York, N. Y.	Oct. 23
Nov. 4.	Miami, Fla.	Oct. 23
Nov. 5.	Havelock, Neb.	Oct. 23
Nov. 9.	Yorktown Heights, N. Y. Adv. Oct. 16, 23.	Oct. 16
Nov. 9.	Yorktown, N. Y. Adv. Oct. 23.	Oct. 23
Nov. 15.	Cleveland Heights (P. O. Warrensville), Ohio.	Oct. 23
Nov. 16.	Vermillion, Ohio Adv. Oct. 23.	Oct. 23
Nov. 23.	Oakland, Iowa	Oct. 23
———	Parkersburg, Pa. Adv. Oct. 9.	Oct. 9

BRIDGES.

Oct. 23.	Illinois	Oct. 23
Oct. 26.	Mankato, Kan.	Oct. 16
Oct. 26.	Kennett Square, Pa. Adv. Oct. 23.	Oct. 23
Oct. 26.	Illinois	Oct. 23
Oct. 27.	Glenfield, Pa.	Sep. 25
Oct. 27.	Seattle, Wash.	Oct. 23
Oct. 28.	Covington, Ky. Adv. Oct. 16, 23.	Oct. 16
Oct. 29.	Illinois	Oct. 2
Oct. 29.	Delphos, Ohio	Oct. 9
Oct. 30.	Dallas, Tex.	Oct. 9
Nov. 1.	Harrisburg, Tex.	Oct. 16
Nov. 1.	Columbus, Miss.	Oct. 23
Nov. 1.	Grenada, Miss.	Oct. 23
Nov. 1.	Woolsey, Ga.	Oct. 23
Nov. 1.	South Orange, N. J.	Oct. 23
Nov. 1.	El Centro, Cal.	Oct. 23
Nov. 1.	Kinston, N. C.	Oct. 23
Nov. 3.	Wabash, Ind.	Oct. 23
Nov. 3.	Lakeville, Miss.	Oct. 23
Nov. 3.	Illinois	Oct. 23
Nov. 3.	Cleveland, Ohio	Oct. 23
Dec. 7.	Canton, China Adv. Oct. 23.	Oct. 23

PAVING AND ROADS.

Oct. 26.	Albany, N. Y. Adv. Oct. 9 to 23.	Oct. 9
Oct. 26.	Salt Lake City, Utah	Oct. 23
Oct. 26.	Boston, Mass.	Oct. 23
Oct. 28.	Granville, Ohio	Sep. 25
Oct. 28.	Terrell, Tex.	Oct. 9
Oct. 28.	Granville, Ohio Adv. Oct. 23.	Oct. 23
Oct. 28.	New York, N. Y.	Oct. 23
Oct. 28.	Newark, N. J.	Oct. 23
Oct. 28.	Duluth, Minn.	Oct. 23
Oct. 29.	Elizabethton, Tenn.	Oct. 16
Oct. 29.	Pittsburgh, Pa.	Oct. 16
Oct. 29.	Hackensack, N. J.	Oct. 23
Oct. 29.	Newark, Ohio	Oct. 23
Oct. 29.	Des Moines, Iowa.	Oct. 23
Nov. 1.	Santa Barbara, Cal.	Oct. 2
Nov. 1.	Pasco, Wash.	Oct. 9
Nov. 1.	Pomeroy, Wash.	Oct. 16
Nov. 1.	Camden, Ala.	Oct. 16
Nov. 1.	Des Plaines, Ill.	Oct. 23
Nov. 1.	Columbus, Kan.	Oct. 23
Nov. 1.	Sedalia, Mo.	Oct. 23
Nov. 1.	Bonds, Greenville, N. C. Adv. Oct. 16, 23.	Oct. 16
Nov. 1.	Colville, Wash.	Oct. 23
Nov. 1.	Indiana	Oct. 23
Nov. 1.	Bakersfield, Cal.	Oct. 23
Nov. 2.	Indiana	Oct. 23
Nov. 3.	Indiana	Oct. 23
Nov. 4.	Ventura, Cal.	Oct. 23
Nov. 4.	Pennsylvania	Oct. 23
Nov. 4.	Indiana	Oct. 23
Nov. 4.	Arcadia, Cal.	Oct. 23
Nov. 5.	Indiana.	Oct. 2
Nov. 5.	Monroe, La.	Oct. 23
Nov. 8.	Euclid, Ohio	Oct. 16
Nov. 8.	Maynardsville, Tenn.	Oct. 23
Nov. 8.	Indiana	Oct. 23
Nov. 15.	Sweetwater, Tenn.	Oct. 23

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS.

Oct. 26.	State Canal Work, Albany, N. Y.	Oct. 2
Oct. 26.	Riprap, Tompkinsville, N. Y.	Oct. 9
Oct. 27.	Ditch, Henderson, Ky.	Oct. 16
Oct. 27.	Jetty, Long Branch, N. J.	Oct. 23
Oct. 28.	Drainage System, Edna, Tex.	Oct. 16
Oct. 28.	Drainage, Bristol, Wis.	Oct. 16
Oct. 28.	Levee Work, Etc., Knobel, Ark.	Oct. 23
Oct. 29.	Ditches, Blue Earth, Minn.	Oct. 23
Oct. 30.	Ditches, Williamsport, Ind.	Oct. 23
Nov. 1.	Flood Protection, Portsmouth, Ohio.	Oct. 9
Nov. 1.	Irrigation Work, Washington, D. C. Adv. Oct. 9.	Oct. 9
Nov. 1.	Dock Improv., Beaumont, Tex. Adv. Oct. 16.	Oct. 16
Nov. 1.	Dam Improv., Marietta, Ohio	Oct. 23
Nov. 1.	Curtain Wall, San José, Cal.	Oct. 23
Dec. 1.	Irrigation Work, Meadow Creek, Wash. Adv. Oct. 23.	Oct. 23
Nov. 1.	Canal System, etc., Donna, Tex.	Oct. 23
Nov. 3.	Drainage, Morris, Minn.	Oct. 23
Nov. 4.	Irrigation Work, Grand Junction, Col. Adv. Oct. 9.	Oct. 9
Nov. 4.	Drainage, Roseau, Minn.	Oct. 23
Nov. 4.	Levee, Santa Paula, Cal.	Oct. 23
Nov. 5.	Irrigation Work, Washington, D. C. Adv. Oct. 9.	Oct. 9
Nov. 5.	Trestles, Pittsburgh, Pa. Adv. Oct. 9 to 23.	Oct. 9
Nov. 8.	Dredge, Jacksonville, Fla. Adv. Sep. 11 to 25.	Sep. 11
Nov. 8.	Dredging, Etc., Jacksonville, Fla. Adv. Oct. 16, 23.	Oct. 16
Nov. 8.	Reclamation Work, Grand Junction, Col.	Oct. 2
Nov. 9.	Canal Work, Albany, N. Y. Adv. Oct. 16, 23.	Oct. 9
Nov. 15.	Levee Improv., New Madrid, Mo. Adv. Oct. 23.	Oct. 23
Nov. 17.	Irrigation Work, Ysleta, Tex. Adv. Oct. 23.	Oct. 23

PUBLIC BUILDINGS AND SCHOOLS.

Oct. 25.	Albany, N. Y. Adv. Oct. 23.	Oct. 23
Oct. 26.	Brooklyn, N. Y.	Oct. 2
Oct. 26.	Des Moines, Ia.	Oct. 9
Oct. 26.	Neodesha, Kan.	Oct. 9
Oct. 26.	New York, N. Y. Adv. Oct. 9.	Oct. 9
Oct. 26.	Pittsburgh, Pa.	Oct. 9
Oct. 26.	Pleasantville, N. J.	Oct. 23
Oct. 26.	Argentine, Ark.	Oct. 23
Oct. 27.	Newcastle, Ind.	Sep. 25
Oct. 27.	Monongahela, Pa.	Sep. 25
Oct. 27.	Ft. Bliss, Tex. Adv. Oct. 2 to 23.	Oct. 2
Oct. 27.	Seattle, Wash.	Oct. 2
Oct. 27.	**Northfield, Ohio**	**Oct. 2**
Oct. 27.	Norman, Okla.	Oct. 9
Oct. 27.	Akron, Ohio	Oct. 16
Oct. 27.	Salina, Kan.	Oct. 16
Oct. 27.	Los Angeles, Cal.	Oct. 16
Oct. 27.	Brenham, Tex.	Oct. 23
Oct. 27.	Seattle, Wash.	Oct. 23
Oct. 28.	Kirksville, Mo. Adv. Sep. 25, Oct. 2.	Sep. 25
Oct. 28.	Providence, R. I.	Oct. 16
Oct. 28.	Loup City, Neb.	Oct. 23
Oct. 28.	Brooklyn, N. Y.	Oct. 23
Oct. 28.	East Rutherford, N. J.	Oct. 23
Oct. 28.	Peoria, Ill.	Oct. 23
Oct. 29.	Seattle, Wash.	Oct. 9
Oct. 29.	Rinard, Iowa	Oct. 16
Oct. 29.	Lebanon, Pa.	Oct. 23
Oct. 29.	Highland Park, Mich.	Oct. 23
Oct. 29.	Holyoke, Mass.	Oct. 23
Oct. 30.	Seymour, Ind.	Sep. 25
Oct. 30.	Athens, Ohio.	Oct. 9
Oct. 30.	Norfolk, Va.	Oct. 16
Oct. 30.	Lily Chapel, Ohio.	Oct. 23
Oct. 30.	Mount Vernon, N. Y.	Oct. 23
Nov. 1.	Merrill, Wis.	Oct. 2
Nov. 1.	Dayton, Ohio	Oct. 16
Nov. 1.	Albany, N. Y.	Oct. 16
Nov. 1.	Woodstock, Ill.	Oct. 23
Nov. 1.	Kalamazoo, Mich.	Oct. 23
Nov. 1.	Osseo, Wis.	Oct. 23
Nov. 1.	Hiawatha, Kan.	Oct. 23
Nov. 1.	Hathorne, Mass.	Oct. 23
Nov. 1.	Brighton, Iowa	Oct. 23
Nov. 2.	Live Oak, Fla.	Oct. 16
Nov. 2.	Warrensburg, Mo.	Oct. 23
Nov. 4.	Wilberforce, Ohio	Oct. 9
Nov. 4.	Evansville, Ind.	Oct. 23
Nov. 4.	Canton, Ohio	Oct. 23
Nov. 5.	New Braunfels, Tex.	Oct. 2
Nov. 6.	East Pittsburgh, Pa.	Oct. 2
Nov. 6.	Indian Head, Md.	Oct. 16
Nov. 8.	**Sidney, Ohio** Adv. Oct. 2, 9.	**Oct. 2**
Nov. 8.	Washington, D. C. Adv. Oct. 16.	Oct. 16
Nov. 9.	El Paso, Tex.	Oct. 9
Nov. 10.	**Van Wert, Ohio**	**Oct. 2**
Nov. 10.	Boone, Iowa	Oct. 23
Nov. 12.	Salamanca, N. Y.	Oct. 9
Nov. 13.	Key West, Fla.	Oct. 23
Nov. 15.	Columbus, Ohio	Oct. 23
Nov. 15.	Agawam, Mass.	Oct. 23
Nov. 15.	Front Royal, Va. Adv. Oct. 23.	Oct. 23
Nov. 16.	Huntington, W. Va.	Oct. 9
Nov. 18.	Boise, Idaho	Oct. 16
Nov. 19.	Elyria, Ohio	Oct. 16
Nov. 26.	Navasota, Tex.	Oct. 23
Dec. 1.	Bloomington, Ill.	Oct. 23

PRIVATE BUILDINGS.

Oct. 27.	Omaha, Neb.	Oct. 16
Oct. 28.	St. Joseph, Mo.	Oct. 16
Oct. 30.	Rochester, N. Y.	Oct. 23
Nov. 1.	Wichita, Kan.	Oct. 23
Nov. 11.	Bartlesville, Okla.	Oct. 23

MISCELLANEOUS.

Oct. 25.	Material for water distilling plant for sale, Fort Caswell, N. C. Adv. Oct. 9 to 23.	Oct. 9
Oct. 27.	Cranes, Etc., Panama	Oct. 16
Oct. 29.	Freight Elevator, New Westminster, B. C.	Oct. 16
Nov. 1.	Retaining Wall, St. Clairsville, Ohio.	Oct. 23
Nov. 2.	Electric Hoists, Philadelphia, Pa.	Oct. 16
Nov. 2.	Cement, Annapolis, Md.	Oct. 23
Nov. 3.	Purchase of Steamer, Newport, R. I. Adv. Oct. 9 to 23.	Oct. 9
Nov. 3.	Jib Crane, Panama Adv. Sep. 25.	Sep. 25
Nov. 3.	Power Plant, Poplar Bluff, Ark.	Oct. 16
Nov. 3.	El. Rys., New York, N. Y.	Oct. 23
Nov. 5.	Cables, Etc., Panama	Oct. 23
Nov. 8.	Mail Chutes, Denver, Col.	Oct. 16
Nov. 8.	Fence, Devils Lake, N. D.	Oct. 16
Nov. 8.	Sprinkler System, Jacksonville, Fla.	Oct. 23
Nov. 10.	Railroad, San Francisco, Cal.	Oct. 23
Nov. 17.	Power Plants, Etc., Washington, D. C.	Aug. 28
Nov. 13.	Shipbuilding Ways, Etc., Charleston, S. C.	Oct. 23
Nov. 16.	Oil Storage Tanks, Panama	Oct. 23
Nov. 17.	Htg. Bldgs., Fort Bliss, Tex. Adv. Oct. 23.	Oct. 23
Nov. 26.	Cranes, Charleston, S. C.	Oct. 16
Nov. 27.	El. Ry., Pearl City, Hawaii	Oct. 23

SEARCHLIGHT SECTION

Official Proposal Announcements

Price $2.40 an inch—Copy can be received until Thursday to a. m. for issue mailed the next morning

Bids open November 9, 1915.

STATE OF NEW YORK.

OFFICE OF SUPERINTENDENT OF PUBLIC WORKS.

BARGE CANAL TERMINALS

NOTICE TO CONTRACTORS.

ALBANY, N. Y.

Sealed proposals will be received by the undersigned at his office in the Capitol at Albany, N. Y., until 12 o'clock, noon, of Tuesday, November 9, 1915, at which place and hour they will be publicly opened and read, for the construction of barge canal terminals pursuant to the provisions of Chapter 746 of the Laws of 1911, and amendatory laws, as follows:

TERMINAL CONTRACT No. 2-P.

For paving the terminal site, near North Ferry Street, Albany. Contract plans, sheet No. 1.

Plans may be seen and detailed specifications, engineer's estimate of quantities, proposal blanks, form of contract and bonds required and other information for proposers may be had at the office of the Superintendent of Public Works at Albany, N. Y., at the office of the Assistant Superintendent of Public Works for the Middle Division at Syracuse, N. Y., at the office of the Assistant Superintendent of Public Works for the Western Division at Rochester, N. Y., and at the canal office, Spaulding's Exchange, Buffalo, N. Y.

Copies of detailed plans or drawings may be obtained from the State Engineer and Surveyor at Albany, N. Y., upon payment to him of the cost of producing them.

Monthly estimates will be paid of ninety per centum (90 per cent) of the work done at the contract price. Every proposal for said work must be accompanied by a money deposit in the form of a draft or certified check upon some good banking institution in the city of Albany, or the city of New York, issued by a national or state bank or trust company in good credit within the state and payable at sight to the Superintendent of Public Works for five per centum (5 per cent) of the amount of the proposal.

The person whose proposal shall be accepted will be required to execute a contract and furnish bonds within ten days from the date of notice of award delivered to him or them in person or mailed to the address given in the proposal.

Upon execution of the contract and approval of bonds, the certified check or draft will be returned to the proposer unless the same shall have been presented for collection prior to such time, in which case the amount of the deposit will be refunded by the Superintendent of Public Works.

The deposits of bidders other than the one to whom the award of contract shall be made will be returned immediately after the award has been made.

The amount of bond required for faithful performance will be ten per centum (10 per cent) of the amount of the estimated cost of the work according to the contract price, and an additional bond, known as the labor bond, in the sum of ten per centum (10 per cent) of the amount of the estimated cost of the work according to the contract price, will be required as security that the contractor will pay in full at least once in each month all laborers employed by him upon the work specified to be done in the contract.

In the event that more than one surety company is offered as surety on said bonds, only two will be accepted.

Each proposal must be addressed to the Superintendent of Public Works, Albany, N. Y., and must be indorsed on the envelope with the name of the construction for which the proposal is made.

Award, if made, will be made to the person or persons whose proposal shall be lowest in cost to the State for doing the work, and which shall comply with all provisions required to render it formal. Before any award shall be made the lowest bidder will be required to satisfy the Superintendent of Public Works of his ability to provide suitable equipment and materials for the proper performance of the work.

The right is reserved to reject all proposals and readvertise and award the contract in the regular manner if in the judgment of the undersigned, the interests of the State will be enhanced thereby.

W. W. WOTHERSPOON,
Superintendent of Public Works.

October 5, 1915.

Bids open November 1, 1915.

PITT COUNTY, NORTH CAROLINA, ROAD BONDS FOR SALE

GREENVILLE, N. C.

Notice is hereby given that the Board of County Commissioners of Pitt County, North Carolina, will receive sealed bids at their office in the Court House at Greenville, North Carolina, until Monday, November 1, 1915, at 12 o'clock, for the sale of $100,000 (One Hundred Thousand Dollars) worth of road bonds for Falkland and Farmville Townships of said county, the issue for each township to be $50,000 (Fifty Thousand Dollars). The bidders are not required to bid on bonds of both townships, said bonds to bear 5 per cent interest, payable semi-annually and to run for a period of thirty (30) years.

A certified check of $500 is required with any and all bids to insure good faith of the bidder.

The Board reserves the right to reject any and all bids. For further information apply to S. J. Everett, County Attorney, Greenville, North Carolina, or the Clerk to the Board of Commissioners.

This the 8th day of October, 1915.

S. A. CONGLETON,
Chairman Board of Comrs.

Attest:
BRASCOE BELL,
Clerk to Board of Comrs.
Greenville, North Carolina.

Bids open Oct. 25, 1915.

NOTICE TO CONTRACTORS.

ALTERATIONS IN EXECUTIVE OFFICES

ALBANY, N. Y.

Sealed proposals for alterations in the Executive Offices, Capitol, Albany, N. Y., Construction, Heating, Plumbing and Electric Work, will be received by the Trustees of Public Buildings, Executive Chamber, Capitol, Albany, N. Y., until 2 o'clock P. M., on Monday, Oct. 25, 1915, when they will be publicly opened and read. Proposals shall be enclosed in an envelope furnished by the State Architect, sealed and addressed, and shall be accompanied by certified check in the sum of [illegible] for Construction Work, $10.00 for Heating Work, $75.00 for Plumbing and Drainage Work, and $15.00 for Electric Work. The contractors to whom the awards are made will be required to furnish surety company bond in the sum of 50% of the amount of contract within thirty days after the official notice of award of contract in accordance with the terms of Specifications Nos. 2339, 2345, 2350 and 2349. The right is reserved to reject any or all bids. Drawings and specifications may be consulted at the New York office of the Department of Architecture, Room 1224 Woolworth Building, or at the Department of Architecture, Capitol, Albany, N. Y. Drawings and specifications and blank forms of proposal may be obtained at the Department of Architecture, Capitol, Albany, N. Y., upon reasonable notice to and in the discretion of the State Architect, Lewis F. Pilcher, Capitol, Albany, N. Y.

Dated Albany, N. Y., Oct. 11, 1915.

Bids open Oct. 26, 1915.

SEWERS AND DISPOSAL PLANT

OGDEN, IOWA.

Bids will be received until Oct. 26, 1915, by the town of Ogden, Iowa, for the construction of sewers and a disposal plant.

R. C. LUTZENGER,
Engineer,
Perry, Iowa.

Bids open Nov. 9, 1915.

NOTICE TO CONTRACTORS.

SEWERAGE AND SEWAGE DISPOSAL PLANT

YORKTOWN, N. Y.

Sealed proposals for Sewerage and Sewage Disposal Plant at Mohansic State Hospital, Yorktown, N. Y., will be received by the State Hospital Commission, Capitol, Albany, N. Y., until Nov. 9, 1915, at 2:30 P. M., when they will be publicly opened and read. Proposals shall be enclosed in an envelope furnished by the State Architect, sealed and addressed, and shall be accompanied by a certified check in the sum of $3,700.00. The contractor to whom the award is made will be required to furnish surety company bond in the sum of 50% of the amount of contract within 30 days after official notice of award of contract and in accordance with the terms of Specification No. 2336. The right is reserved to reject any or all bids. Drawings and specifications may be consulted at the Mohansic State Hospital, Yorktown, N. Y., at the New York office of the Department of Architecture, Room 1224, Woolworth Building, and at the Department of Architecture, Capitol, Albany, N. Y. Drawings and specifications and blank forms of proposal may be obtained at the Department of Architecture, Capitol, Albany, N. Y., upon the deposit of a check in the sum of $10.00, made payable to the State of New York, for each set of plans and specifications, which check will be returned when plans and specifications are sent back in good condition to the State Architect, Lewis F. Pilcher, Capitol, Albany, N. Y.

Dated Albany, N. Y., Oct. 11, 1915.

Bids open December 7, 1915.

CHINESE GOVERNMENT RAILWAYS

CANTON-HANKOW RY.

Hupei-Hunan Section.

Tenders are called for the supply of the following steel bridgework, viz.:

5 deck girders, 15 ft. span.
8 deck girders, 20-ft. span.
18 deck girders, 30-ft. span.
6 deck girders, 40-ft. span.
18 through trusses, 150-ft. span.
9 through trusses, 200-ft. span.

Forms of tender, with conditions of contract and specifications, can be obtained on payment of $2.50 at the offices of Robert W. Hunt & Co., Monongahela Bank Bldg., Pittsburgh, Pa.

Designs are to be substituted with each tender, which must be on the official form supplied, in sealed covers marked "Tenders for Steel Bridge Work, Canton-Hankow Railway, Hupei-Hunan Section," addressed to Robert W. Hunt & Co. Monongahela Bank Bldg., Pittsburgh, Pa.

No tenders will be received after 9 a. m., Dec. 7, 1915, when they will be opened in the presence of tenderers or their representatives.

(Signed) ROBERT W HUNT & CO.,
Consulting Engineers for the Chinese Government Railways.

Bids open Nov. 16, 1915.

LEGAL NOTICE.

SANITARY SEWER SYSTEM AND SEWAGE DISPOSAL PLANT

VERMILLION, OHIO.

Sealed bids will be received by the Village of Vermillion, Erie County, Ohio, at the office of the Village Clerk, until 12 o'clock noon, central standard time, on the 16th day of November, 1915, for furnishing the necessary labor and materials for the construction of a sanitary sewer system and sewage disposal plant, for the Village of Vermillion, Ohio, according to the plans and specifications therefor, now on file in the office of the Village Clerk, and also on file in the office of the Engineer, Morris Knowles, 2541 Oliver Building, Pittsburgh, Pa.

Each bid must contain the full name of every person or company interested therein, and be accompanied by a certified check upon some solvent bank in the sum of *one per cent of the total amount of the bid*, as a guarantee that, if the bid is accepted, a contract will be entered into and its performance properly secured. Should any bid be rejected, such check will be forthwith returned to the bidder, and should any bid be accepted, such check will be returned upon the proper execution and securing of the contract.

Bidders will be required to use the official bidding forms, which will be furnished by the Clerk upon application.

A deposit of $5 will be required on each set of plans and specifications issued, and will be refunded upon the return of same.

Separate bids will be received for the construction of the sewer system and for the construction of the sewage disposal plant.

The right is reserved by the Village Council to reject any or all bids.

By order of the Council of the Village of Vermillion, Erie County, Ohio.

F. W. WAKEFIELD,
Mayor.

LEWIS BLATTNER,
Clerk.

Vermillion, Ohio, Oct. 11, 1915.

Bids open October 26, 1915.

HIGHWAY WORK

OFFICE OF THE STATE COMMISSION OF HIGHWAYS.
ALBANY, N. Y.

Sealed proposals will be received by the undersigned at their office, No. 55 Lancaster Street, Albany, N. Y., at 1 o'clock p. m., on Tuesday, the 26th day of October, 1915, for the improvement of the following highways in the following counties:

Albany (approx. 3.41); Allegany (approx. 5.25); Cayuga (approx. 6.06); Clinton (approx. 3.79); Columbia (two highways, 4.27; 7.77); Cortland (approx. 4.00); Erie (four highways, 9.14, 4.30, 4.50, 5.19); Genesee (approx. 4.53); Livingston (approx. 7.69); Madison (two highways, 3.05, 0.18); Monroe (two highways, 0.73, 2.91); Oneida (approx. 0.70); Onondaga (approx. 0.18); Orange (four highways, 3.64, 3.17, 3.70, 0.38); Schenectady (approx. 5.62); Seneca (approx. 5.01); Steuben (approx. 5.25); Sullivan (approx. 0.43); Tioga (approx. 4.07); Tompkins (approx. 2.48); Ulster (approx. 10.24).

Maps, plans, specifications and estimates may be seen and proposal forms obtained at the office of the Commission in Albany, N. Y., and also at the offices of the division engineers in whose divisions the roads are to be improved. The addresses of the Division Engineers and the counties in which they are in charge will be furnished on request.

The especial attention of bidders is called to "GENERAL INFORMATION FOR BIDDERS" in the itemized proposal, specifications and contract agreement.

EDWIN DUFFEY,
Commissioner.

IRVING J. MORRIS,
Secretary.

CONTRACTING NEWS

Of Special Interest to Engineers, Contractors, Builders and Manufacturers of Engineering and Building Supplies

TRUNK railroads of the East, especially those entering New York City, are said to be handling a tonnage of freight, largely for export, that has seldom or never been exceeded. The increase is of recent date, and means increased revenues that should put some of these roads at least back in a position to take up construction. Exports last week reached $98,777,000, more than $25,000,000 in excess of the record week ended Oct. 16. Of this business, 65 per cent was handled at the port of New York. This volume alone indicates that the ocean freight situation is improving. The immediate effect on Eastern contractors of this increase will be a large reduction in the reserve supply of common labor. Large numbers of additional railroad employees and freight handlers are being put to work. Meanwhile the business of the Western roads is steadily improving, and with the moving of the crops should reach large proportions.

The statement for the quarter ended Sept. 30 just issued by the U. S. Steel Corporation shows net earnings of $38,700,000 and a surplus of more than $18,000,000. This surplus was almost three times the amount needed to pay the usual dividend on the common stock, which, however, was again passed. The volume of the corporation's business continues to show a large progressive increase.

Buildings

Bids have been opened for the construction of the United States appraiser's stores building in Boston, which will cost several hundred thousand dollars. Contracts awarded for constructing a school building at Syracuse, N. Y., totaled $252,000. A county court house contracted for at Rock Rapids, Iowa, will cost $107,000. A contract for building the post office at Tulsa, Okla., has been awarded at $184,000. A $100,000 building contract has been let at Denton, Tex. A publishing building contracted for at Seattle will cost $226,000.

It is reported that a $110,000 apartment house will be built at Lynn, Mass. Plans have been filed in Brooklyn for a $175,000 shop and for a $100,000 school building. A two-story addition to a manufacturing plant contemplated at Utica, N. Y., will cost $100,000. Architects have been selected for a $2,000,000 reinforced-concrete warehouse to be built at Cleveland. A $200,000 addition to a machine shop will be built at Toledo, Ohio. An automobile company intends erecting a $200,000 building at Chicago. Plans have been prepared for a $400,000 high school at Springfield, Ill., and it is reported that a $500,000 powder plant will be built in the same city. The erection of a $350,000 school is being considered at Detroit. Steps are being taken to build a $100,000 foundry at Muskegon Heights, Mich. Plans are being prepared for a $350,000 office building at San Francisco.

Bridges and Roads

A $92,000 contract for building a temporary bridge to Belle Isle has been awarded at Detroit. The steelwork for two bridges at Aberdeen, Wash., has been contracted for at $32,000. Bids were opened Oct. 14 for a $60,000 paving contract in New York City. Two road contracts totaling $83,500 have been awarded at Jersey City. A contract for road work to cost more than $130,000 has been awarded at Newport, Tenn. The State Highway Commission of Idaho has awarded contracts amounting to $54,000. Road work to cost $75,000 has been contracted for at Sawtelle, Cal. Bids were opened in Los Angeles on four sections of road work amounting to more than $140,000, and three contracts were awarded. Low bids opened Oct. 18 by the California State Highway Commission for road work amount to almost $200,000. Paving contracts awarded at Toronto, Ont., total $73,000.

Bids will be opened Nov. 2 at Toronto for constructing a reinforced-concrete bridge. Bids are desired Nov. 16 for building a concrete-incased viaduct at New Orleans. Bids will be opened Nov. 5 for constructing 39,000 sq. yd. of paving in New York City. Bids are desired on considerable paving work at Greensburg, Pa. Titusville, Fla., will let a contract Nov. 9 for constructing 68 miles of road at a cost of $150,000. Bids are desired at Lincoln, Neb., for paving work to cost $42,000. Fifteen miles of gravel road to be built near La Fayette, La., will cost $100,000. Paving work to cost $106,000 is to be let at Seattle.

Waterworks and Sewers

Bids have been opened in Minneapolis for furnishing a large quantity of good-sized pipe. Verona, N. J., has opened bids on sewer work which will cost $125,000. Bids are desired at Miami, Fla., for constructing storm sewers in three districts. Bids will be opened Dec. 2 in Jersey City, N. J., for the large water-supply line from Brookdale, and also for laying a double line of 48-in. pipe under the Passaic and Hackensack rivers. Bids will be opened Dec. 2 at Chicago for constructing the Calumet intercepting sewer. Bids are desired at Sandusky, Ohio, for building a $98,000 intercepting sewer. A $136,000 filtration plant and pumping station is being considered at Batavia, N. Y. Plainfield, N. J., will sell $125,000 sewer bonds Nov. 1. A $325,000 reservoir is to be built at Hagerstown, Md. An engineer has been engaged to prepare plans for a $175,000 sewage-disposal plant at Lakewood, Ohio. Waterworks improvements costing $75,000, including a reservoir, are being considered at Clinton, Okla. Plans have been approved for a $75,000 sewage-disposal plant at Waco, Tex. Surveys are being made for a $400,000 waterworks system to be constructed at Aberdeen, Wash.

Miscellaneous

A subway station-finish contract has been awarded in New York City at about $2,000,000. The construction of the Frankford elevated line in Philadelphia has been contracted for at $1,476,000. The lowest bid received at Chicago for constructing two sections of the Calumet Sag Channel was $1,578,000. Bids opened at Galveston, Tex., for work on repairing the seawall indicate a cost of approximately $200,000. The contract for constructing Pier 29 at San Francisco has been awarded at $283,000. Bids are desired Nov. 11 in Boston for constructing section "G" of the Dorchester tunnel. Bids will be opened Nov. 5 for constructing the station finish for eleven stations on the Fourth Avenue rapid-transit line in Brooklyn. Surveys are being made for a power development near Rutland, Vt. The Chicago Drainage Board has voted to provide $2,000,000 for widening the Chicago River and diverting sewage from it. It is reported that $250,000 will be spent to enlarge a canal at Medford, Ore. Surveys indicate a cost of $1,600,000 for an irrigation project being promoted at Lindsay, Cal. It is reported that an 80,000-hp. hydroelectric development will be built near Waneta, B. C.

WATERWORKS

PROPOSED WORK.

Providence, R. I.—The dam to be constructed in Scituate for the new water supply for this city is to be 3400 ft. in length.

Albion, N. Y.—Reported the village is considering a municipal water supply system and intends constructing a reservoir on Otter Creek.

Batavia, N. Y.—Chester & Fleming of Pittsburgh, Pa., reported to have estimated cost of proposed water pumping station and filtration plant being considered by the city at $135,905.

Yonkers, N. Y.—Water bonds for $100,000 will be sold Nov. 4 by Joseph Miller, City Comptroller.

Jersey City, N. J.—Hudson County Park Commission, 1 Exchange Place, rejected all bids opened Oct. 13 for furnishing 22,500 lin. ft. wrought iron pipe for North Hudson Park, North Bergen.

New Brunswick, N. J.—Contract soon to be let for water works improvements. Asher Atkinson, City Engr.

Charleroi, Pa.—The Tri-Cities Water Co. has engaged Chester & Flemming of Pittsburgh to prepare plans and specifications for a new reinforced concrete settling basin to be constructed at the filtration plant.

Florence, Ala.—An election is soon to be held to vote on the purchase of the present water works.

Oakdale, La.—R. E. L. Ricketts, Secretary Water Works Committee writes that next year improvements costing $25,000 will be made to the water works, including a 100,000-gal. concrete reservoir, 100,000-gal. elevated steel tank, two 75-gal. underwriters' pumps, two 80-hp. combustion engines, and 24 two-way hydrants.

Kingsport, Tenn.—A water system is contemplated here. W. C. Hattan, Engineer, Kingsport.

Sandusky, Ohio—Waterwork extension bonds amounting to $8,300 and sewer intercepting bonds $98,000 have been sold.

Local water company engaged Chester & Felming, Pittsburgh, Pa., to prepare plans and specifications for low service pump to be installed immediately.

Warren, Ohio.—The Trumbull Public Service Co. has engaged Chester & Fleming of Pittsburgh, Pa., to prepare plans for a 2,000,000-gal. concrete filter to be installed at the filtration plant. Cost $20,000.

Warren, Ohio.—Chester & Flemming, Engineers, Pittsburgh, Pa., engaged by the Local Public Service Corporation to prepare plans and specifications for improvements to the filtration plant, involving additional filters.

Albion, Mich.—An election is to be held Nov. 9 to vote $10,000 bonds to complete municipal water works.

Wheaton, Ill.—L. J. Ruddock, city engineer, writes that an election is to be held Nov. 12 to vote on issuing bonds for water works improvements, costing $35,000, to include two centrifugal well pumps, 750 gal. capacity each, 70 ft. head; two 2-stage centrifugal pumps, 500 gal. capacity, 195 ft. head; 1 booster pump, 500 gal capacity; one 200,000-gal. elevated tank and 100-hp. gas-producing gas engine; 1700 ft. 12 in. water main.

Oshkosh, Wis.—The State Railroad Commission has approved general designs of plans for a filter plant proposed in this city. Henry A. Allen of Chicago, consulting engineer. Contract soon to be let. Address Mayor.

Holstein, Iowa.—Citizens Oct. 7 voted $18,000 bonds for constructing water works; bonds will be sold Nov. 16. Bids for construction next spring. M. I. Evinger, Ames, Engineer. Albert G. Merkley, City Recorder.

South St. Paul, Minn.—City Council is reported considering constructing municipal pumping station.

Polson, Mont.—City is considering purchasing water plant of the Northern Idaho & Montana Power Company. H. S. Hanson, clerk.

Thermopolis, Wyo.—At an election Oct. 19 citizens voted $40,000 bonds for improving water works. C. C. Carlisle, Cheyenne, Wyo., Engineer in charge; A. J. Lowry, town clerk.

Lancaster, Tex.—Water works extension and sanitary sewer bonds amounting to $15,000 have been approved by the Attorney-General.

Clinton, Okla.—E. W. Munfield, Supt. Water Works, writes that improvements to water works costing $75,000 contemplated, including construction of a reservoir, 200,000,000-gal. capacity; two filters, 500-gal. capacity, pumps, three miles of mains, transmission lines and motors.

Aberdeen, Wash.—Preliminary surveys being made by L. D. Kelsey, City Engineer, for the proposed water works, to cost $400,000, to be constructed by day labor. A committee is to be appointed by the Mayor to have charge of the work.

Metaline, Wash.—The county commissioner at Newport has granted Harry Lincoln of Metaline, a franchise to construct and maintain a public water system to serve the town. Cost between $12,000 and $15,000.

Seattle, Wash.—Hiram C. Gill, Mayor, vetoed bill passed by City Council, authorizing Bd. Pub. Wks. to proceed by day labor to seal Cedar River Impounding Basin back of masonry dam.

City Architect Daniel Huntington has been instructed by L. D. Young, Superintendent of Water, to prepare plans for a standpipe on Beacon Avenue, near Fountain Street, to cost $50,000.

The City Utility Committee of the City Council has recommended for passing the bill providing for an issue of $75,000 utility bonds for water extensions in the Rainier Valley. L. B. Young, Superintendent of Water.

Twin Falls, Idaho.—City has purchased the plant of the Twin Falls Water Works Co. and it is reported will improve the same.

BIDS DESIRED.

Lynn, Mass.—Until Nov. 9 by Thomas Campbell, 2d. Commissioner of Water and Water Works, for Contract A, constructing pumping station foundations, etc.; Contract B, constructing pumping station superstructure, etc.; Contract C, furnishing and installing pumping and other equipment., etc., for Ipswich River Pumping Station, advertised in Engineering Record.

Jersey City, N. J.—Until Dec. 2 by Board Commissioners for furnishing and laying a double line of 48 in. c. i. pipe under Passaic and Hackensack Rivers; also same time and place separate bids for about 11 miles of 72 in. steel pipe,

extending from Bloomfield, N. J., to Jersey City, plans, proposals advertised in Engineering Record. Michael I. Fagen, City Clerk.

Clarksburg, W. Va.—Until Nov. 26 (Re-advertisement) by Water Works & Sewerage Board (succeeding to Black and Sand), for two gas engines and two pumps at existing pumping station, advertised in Engineering Record.

St. Clairsville, Ohio.—Until Nov. 15, by Eastern Construction Co. Asst. for furnishing material and repairing water reservoirs at Belmont County Infirmary in Richland Township.

Chicago, Ill.—Until Nov. 3, by W. R. Manchester, Outer Park Wks., for furnishing boilers and erecting two boiler feed pumps with accessories and appurtenances complete at the Central Park Avenue pumping station.

Elmhurst, Ill.—Reported desired until Nov. 9 (Re-advertisement) by Arthur H. Kochsiek, City Clk., for constructing reinforced concrete sewer pumping station, tank, reservoir and well house and appurtenances. H. L. Emerson, Engr., 1115 Chamber of Commerce Building, Chicago.

Bayard, Neb.—Until Nov. 11 by City Clerk for 12,000 lin. ft. 4 to 8-in. c.-i. water mains. Finley & Selser, Engrs., Scottsbluffs.

Fort Sam Houston, Tex.—Until Nov. 18, by Constructing Quartermaster, U. S. A., for constructing water distributing system at this post.

Council, Idaho.—Reported desired until Nov. 5 by City Clerk for constructing water works, to consist of reinforced concrete reservoir, 15,000 ft. 4 to 6-in. pipe, 15,000 ft. c.-i. cut trenching. R. F. Wade, Weiser, Engr.

PRICES AND LETTINGS.

★Indicates award of contract.

New York, N. Y.—Following are four lowest unofficial totals of bids opened Oct. 28 by Bd. Water Supply for Contract 128, constructing two stone and brick buildings at the Upper and Downtake chambers of Hill View Reservoir, in city of Yonkers, Westchester: William H. Egan, 147 East 125th Street, $94,499; Mundy Arch Co., 240th Street and Broadway, Bronx; Louis Wechsler, 1123 Broadway, Bronx, and A. L. Goldstone Co., 131 East Twenty-third Street, $99,748.

Jersey City, N. J.—See "Proposed Works."

★Vicksburg, Miss.—Contract for low lift pump awarded De Laval Pump Co., Trenton, N. J., at $3,850.

★Columbia, Tenn.—Contract awarded International Filter Co., 332 First National Bank Building, Chicago, Ill., for a 1,000,000-gal. reinforced concrete filter plant for the Columbia Water & Light Co.

★Shelbyville, Ky.—Reported New York Continental Jewell Filtration Co., 13 Broad Street, New York, manufacturers of filtration plant at water works, has sublet contract for filtration plant building to Armstrong Construction Co., building to be 42 x 70 ft., of concrete and brick construction.

★East Liverpool, Ohio.—Contract awarded by Board of Control as follows: Steel pipe, to Memphis Steel Construction Co., at $4,881; 10-ft. truss shack, to Hendricks Construction Co., at $1,315; filter equipment for a mixing and mechanical filter, to the Pittsburgh Filter Manufacturing Co., Pittsburgh, at $14,324. Chester & Flemming, Pittsburgh, Pa., Engineers.

Contract for 7 miles 16 to 20-in. pipe reported awarded to J. J. Dukas of Stockdale, Pa.

Minneapolis, Minn.—Following is the only bid opened Oct. 7 by K. E. Alexander, City Purchasing Agent, for furnishing 1,675 cast iron mechanical joint pipe and fittings for distribution mains across Mississippi River and the extension of the same on the west side: East Jersey Pipe Company, Pulton and Church streets, New York: 1,284.2 ft. 48 x 1/16-in. lock bar pipe, $4.11 per lin. ft.; 2,091 ft. 48 x 5/16-in. lock bar pipe, $5.46 per lin. ft.; 6 expansion joints for the above pipe, $300 each; sufficient lead bells complete, $47; all specials complete, $197; 71.21 ft. 48 x 5/16-in. riveted steel pipe, $9.15 per lin. ft.; 42.8 ft. 48 x 7/16-in. riveted steel pipe, $9.80 per lin. ft.; 51.71 ft. 48 x 1/2-in. riveted steel pipe, $10.70 per lin. ft.; 7 expansion joints for the above pipe, $295 each; all lead bells complete, $24.

SEWERAGE AND SEWAGE DISPOSAL

PROPOSED WORK.

Batavia, N. Y.—Reported improvements to the sewage pumping plant estimated to cost $15,000 are under consideration by the committee.

Plainfield, N. J.—Sewerage bonds for $[illegible] will be sold Nov. 1. James T. MacMurray, City Clk.

Allentown, Pa.—City Engineer Weibach has submitted a report on the proposed sewerage system and disposal plant, estimating the cost of the system with a disposal plant on Kline Island at $1,487,000, and a plant on Kohler farm at $1,318,260.

Scranton, Pa.—Reported constructing of sewage disposal plant is under consideration.

Lakewood, Ohio—Reported R. Winthrop Pratt, Cleveland, engaged by the Council as consulting engineer to assist E. W. Fisher, engineer of Lakewood, in preparing plans for proposed sewage plant; cost $170,000.

Oakwood, Mich.—A committee appointed to act with the village engineer in investigating advisability of constructing a trunk sewer.

Elgin, Ill.—Reported an agreement has been reached between Corporation Counsel, City Engineer and the State Rivers and Lake Commission whereby a sewage disposal plant costing exclusive of intercepting and double barrel sewers, about $[illegible] is to be constructed. Address City Engineer.

St. Paul, Minn.—Oscar Claussen, city engineer estimated the cost of constructing Capital Avenue sewer at $115,000.

Lake Village, Ark.—Sewer bonds for $15,000 will be sold by A. G. Sims, Chmn. Comrs. Sewer Improvement Dist. No. 1, Nov. 2.

Lancaster, Tex.—See "Water Works."

Waco, Tex.—H. E. Elrod of Dallas and Charles Sayville, Director of the city sanitation, have approved plans for the proposed sewage disposal plant; cost, $75,000.

Seattle, Wash.—The street and sewers committee of the City Council has recommended the installation of sewers in the Sixth Avenue, Northwest, District; cost $98,892.

The street and sewers committee of the Council has postponed for six months action on the resolution for installation of sewers in the Ballard District.

The construction of a sewer system in the Rainier Valley is recommended by the Health and Sanitation Department to the City Council.

Stanwood, Wash.—Reported council has passed resolution of intention to construct a pump sewer on Pearson Street from State Street to Skagit Slough and also laterals on Lindsey, State and Oliver Streets.

BIDS DESIRED.

Boston, Mass.—Until Nov. 1 by Edw. F. Murphy, Comr. Pub. Wks., Boston, for pipe sewers and drains in Saville and Park Streets, St. Rose Street extension, Private land and Newfield Street, West Roxbury.

Binghamton, N. Y.—Reported desired until Nov. 2, by Clerk of Board Contract and Estimates for constructing sewers on Charlotte Street and Phelps Avenue.

Atlantic Highlands, N. J.—Until Nov. 3 by Mayor and Council for constructing 2½ miles of 8 and 10-in. sewer pipe, with necessary manholes, and concrete pit for sewer lift. H. O. Todd, Co. Engr.

Trenton, N. J.—Until Nov. 3 by Frank Thompson, City Clk., for constructing sewers on portion of Dayton Street and Michigan Avenue.

Miami, Fla.—Until Nov. 8, by W. B. Moore, City Clk., for constructing sewers in storm sewer Dists. Nos. 1, 2 and 3.

Alliance, Ohio.—Reported desired until Nov. 1 by James J. Rickard, Dir. Pub. Service, for sewage disposal plant; probable cost $45,000. Chester & Flemming, Engrs., Pittsburgh, Pa.

Sandusky, Ohio.—Until Nov. 18 by John J. Molter, Director Public Service, for constructing Intercepting Sewer No. 2, estimated to cost $53,000, advertised in Engineering Record.

East Chicago, Ind.—Reported desired until Nov. 5 by T. Y. Richards, Clk., for constructing Burnington Addition main sewer system.

Chicago, Ill.—Until Dec. 2 by John McGillen, Clerk, Sanitary District, 700 South Michigan Avenue, for Calumet intercepting sewer, Contract No. 4, advertised in Engineering Record.

Chicago, Ill.—Until Nov. 3 by Edw. Glackin, Secy. Bd. Local Improv., for constructing tile pipe sewers with brick manholes and catchbasins in portions of [illegible] Mansfield Avenues and [illegible] other streets.

San Benito, Tex.—Until Nov. 24 by John H. Lyons, Mayor, for constructing a sanitary sewage disposal plant.

Albuquerque, N. M.—Reported desired until Nov. 1 by City Council for 12-in. vertical volute centrifugal sewage pump, one 25-hp. motor, connecting shafting, 12-in. c.-i. discharge pipe and 12-in. c.-i. gate valve.

Winnemucca, Nev.—Reported desired until Nov. 5 for constructing sewer system for Winnemucca.

Toronto, Ont.—Until Nov. 2, by T. L. Church (Mayor), Chmn. Bd. Control, for constructing sewers in Adrian, Campbell, Lindner Avenues and Miller Street.

PRICES AND LETTINGS.

★Indicates award of contract.

Verona, N. J.—Following are the four lowest bids opened Oct. 20 by the Borough Council for constructing pipe sewers, in all about 17 miles of 8 to 20 in. (Clyde Potts, engineer, 30 Church Street, N. Y.):

Section I.—Petro Scola, Glen Ridge, N. J., $31,233; Joseph Cestone, Montclair, N. J., $32,010; Donato Fusco, Montclair, N. J., $35,771; Charles Ippolito, Orange, N. J., $38,161.

Section II.—Donato Fusco, Montclair, N. J., $17,801; Cestone Construction Co., Montclair, N. J., $20,133; Joseph Cestone, Montclair, N. J., $21,448; Charles Ippolito, Orange, N. J., $21,958.

Section III.—Frank Carozza, Baltimore, Md., $21,633; Charles Ippolito, Orange, N. J., $21,820; Sanitary Construction Co., Paterson, N. J., $22,522; Cestone Construction Co., Montclair, N. J., $22,722.

Section IV.—Cardell & Romano, Montclair, N. J., $17,796; Joseph Cestone, Montclair, N. J., $18,780; Donato Fusco, Montclair, N. J., $20,723; Charles Ippolito, Orange, N. J., $21,364.

Section V.—P. L. Braunworth, Montclair, N. J., $37,292; Harrison & Craig, Newark, N. J., $42,272; Averill-Matthews Co., Newark, N. J., $42,459; John W. Heller, S. Orange, N. J., $44,782.

★Dio, Miss.—Contract awarded O. C. Eure, Hattiesburg, for constructing sewerage system; cost $12,000.

★Cheviot, Ohio.—Contract for constructing trunk sewer awarded J. Ruebel Construction Company. Albert J. Rensing, Village Clerk.

★Dayton, Ohio.—Contract for constructing the sanitary sewers in District No. 6 awarded Worth & Blessing, Dayton, at $30,830.

★Indianapolis, Ind.—Sewer contracts awarded as follows: Main sewer in Michigan Street from Pleasant Run to De Quincy Street to American Construction Company, 1201 Georgia Street, at $26,499, and local sewer in Germania Avenue to George Schauer, 1108 N. Keating Avenue, at $14,256.

★Plymouth, Wis.—Contract for constructing 11,800 ft. 6 to 12 in. sanitary sewers (bids opened Oct. 19) awarded Peter Borst, Port Washington, at $7,569. J. Donahue, Consulting Engr., Sheboygan.

★Elliott, Iowa.—Contract for constructing sanitary sewers (bids opened Oct. 19) awarded William S. Doll, Omaha, Neb., at $5,744. Thomas F. DeLay, Engineer, Clinton.

★Pella, Iowa.—Contract for constructing sewers awarded Henry Rees of Quincy at $9,217. A. C. Kuyper, City Clerk.

★South St. Paul, Minn.—Contract for laying sewer pipes on Third Avenue and Third Street south, awarded O'Neil & Preston, at $25,400.

★Beaumont, Tex.—Contract for constructing sewers awarded H. W. Caldwell Construction Co. of Texarkana, at $21,717.

Compton, Cal.—James Kennedy Washington Bldg., Los Angeles, reported submitted lowest bid for constructing sewer system at $42,408.

★Visalia, Cal.—Contract for constructing sewer extensions reported awarded Michael Murphy, Berkeley, at $40,500.

BRIDGES

PROPOSED WORK.

Watertown, Mass.—Plans submitted to War Dept. for bridge to be constructed over Charles River at N. Beacon Street, Boston, to connect with Watertown. E. S. Runyan, West Somerville, prepared plans; cost about $175,000.

Woonsocket, R. I.—Contract about to be let for constructing 3 concrete bridges in Hamlet and Fairmont sections; cost about $60,000.

Mooresburg, Pa.—Reported Philadelphia & Reading R. R. Co. will erect a concrete and steel bridge in Mooresburg. Wm. Hunter, Ch. Engr., Philadelphia.

Biltmore, N. C.—Bridge is to be constructed over Swannanoa River at Biltmore by city; cost about $13,000.

Miami, Fla.—See "Paving and Roads."

Titusville, Fla.—See "Paving and Roads."

Wathena, Kan.—Plans being prepared by State Engineer, Manhattan, for a 60-ft. concrete arch bridge, 18 ft. roadway, with 5-ft. sidewalk, for the city of Wathena; estimated cost $6,500.

Lexington, Mo.—Citizens of Wellington Special Road District voted $55,000 bonds to construct bridges. Dr. Jamann, member of the board of commissioners for Wellington Special Road District.

Guthrie, Okla.—Plans approved by State Highway Comn. for steel and concrete bridge, 576 ft. long, to be constructed over Cimarron River, at Guthrie; cost, about $18,000.

Metaline Falls, Wash.—County Comrs. at Newport contemplate constructing steel bridge over Pend O' Reille River between Metaline Falls and Metaline; cost about $10,000.

BIDS DESIRED.

Boston, Mass.—Until Nov. 1 by Edw. F. Murphy, Comr. Pub. Wks., for constructing foundation for foot bridge at Grove Street, East Boston.

Paterson, N. J.—Until Nov. 3, by George W. Botbyl, Clk. Co. Bd. Chosen Freeholders, for extension of bridge No. 20, near Bloomfield, also extension of bridge on Paterson and Hamburg townships near Intake.

Johnstown, Pa.—Until Nov. 6 by H. H. Grazier, Superintendent of Highways, for constructing Horner Street Bridge, 225 ft. ribbed arch, 45 ft. wide. G. A. Flink, Engineer, Harrisburg, Pa.

Blue Ridge, Ga.—Until Nov. 4 by W. W. Woody, Co. Ordinary, for furnishing material and constructing steel bridge across Hot House Creek, to consist of a steel beam span 40 ft. long, two steel beam approaches each 40 ft. long, steel or concrete piers, 12 ft. roadway.

Tavares, Fla.—Reported desired until Nov. 1, J. H. Compton, Chmn. Co. Comrs., to construct fill and bridge across marsh at Clermont; also 2½ miles of road. J. B. McCrary, Co. Engr., Atlanta, Ga.

New Orleans, La.—Reported desired until Nov. 16 by A. G. Ricks, Comr. Pub. Finances, Accounting Div., to construct steel frame, concrete covered viaduct at West End Lake, Shore Park.

Lucedale, Miss.—Until Nov. 3 by Co. Bd. Superv. (S. R. McKay, Clk.) for constructing steel and iron bridge across Chickasawhay River on Wayne County Line.

Marshall, Ill.—Until Nov. 11 by State Highway Commission, Springfield, for constructing steel I-beam bridge, reinforced concrete abutments, 40-ft. span, 16-ft. roadway, between Parker and Westfield, known as Sam James Bridge. Engineer's estimate $3,460.

Salina, Kan.—Reported desired until Nov. 4 by A. C. Anderson, Co. Clk., Salina, for constructing 120-ft. steel and reinforced concrete bridge in Walnut Township, 3 miles southeast of Mentor.

Santa Fe, Kan.—Reported desired until Nov. 1, by County Clerk, for constructing Haskell-Seward bridge across Cimarron River on Haskell-Seward county line, to consist of 4 spans, each 17 ft., roadway 16 ft. W. S. Gearheart, State Engr., Manhattan, Kan.

Independence, Mo.—Until Nov. 5 by Allan C. Southern, Co. Surveyor, Independence, for constructing steel and concrete bridge, requiring approximately 8520 lb. structural steel, 5029 lb. reinforced steel, 200 sq. yd. riprap, 130 cu. yd. reinforced concrete abutments, etc.

Durant, Okla.—Until Nov. 4 (readvertisement) by L. Varner Stimson, County Engineer, for constructing five steel bridges, the largest to be an 80-ft. span, on reinforced concrete piers and abutments, over Big Creek, 1 mile east of Bokchito, costing $20,000.

Bakersfield, Cal.—Until Nov. 8 by H. A. Jastro, Chmn. Bd. Co. Superv., for grading, constructing bridges and culverts on Div. 10, Sect. 7, Bakersfield Mojave Road.

Merced, Cal.—At the November meeting bids will probably be received for constructing reinforced concrete bridge over Santa Rita slough in Supervisorial Dist. No. 5. A. E. Cowell, Co. Surv.

Ventura, Cal.—Until Nov. 4 by City Clk. for constructing concrete bridge 30 ft. long, two spans, across the Ellsworth barrance, in Road Dist. No. 5.

Visalia, Cal.—Reported desired until Nov. 4 by County Board Supervisors for constructing 5 reinforced concrete bridges over Cross Creek in Fourth. Supervisorial Dist. to be known as Bridges Nos. 1, 2, 3, 4 and 5. George R. Prestidge, Co. Clk.

Parma, Idaho.—Until Nov. 22 by the County Commissioner at Caldwell for constructing a steel bridge on concrete foundation over Boise River at Parma; cost $16,000. Inland Engineering Co., Caldwell, Engineers; L. C. Knowlton, County Clerk.

Toronto, Ont.—Until Nov. 2 by T. L. Church (Mayor), Chmn. Bd. Control for bridges as follows: Constructing reinforced concrete bridge, supply and erection of structural steel work for combined steel and concrete bridge, concrete masonry work, concrete floor and timber trestle for combined steel and concrete bridge.

PRICES AND LETTINGS.

★Indicates award of contract.

Nantucket, Mass.—The following are the bids opened Oct. 19 by the Massachusetts Highway Commission, Boston, for constructing a pile bridge at Nantucket: Frank C. Taylor, 120 Kempton Street, New Bedford, $12,765; W. H. Ellis & Sons Company, East Boston, $17,570.

★New Hartford, Conn.—Contract for constructing superstructure Satani Kingdom Bridge over Farmington River at New Hartford awarded to Spaulding Co., Suffield, at $8,000.

★**Passaic, N. J.**—Contract for reconstructing Hope Avenue Bridge over Weasel Brook awarded by Passaic County Bd. Freeholders to John Wehrle, Jr.,, at $4,098.

★**Philadelphia, Pa.**—The following are four lowest bidders on contracts 1 and 2 for opening of Emerald Street (bids opened Sept. 27 by city and Philadelphia & Reading Ry.):

★Contract 1—Bridge abutment and removal of core at Emerald Street: C. P. Bower, Philadelphia, $32,915 (awarded contract); McNichol Paving & Construction Co., 1923 Cherry Street, $37,227; John Gall & Co., 1539 Filbert Street, $41,731; Contreil Construction Co., Twenty-first Street and Sedgly Avenue, $45,685.

★Contract 2—Superstructure of bridge at Emerald Street, ready for concrete encasement: American Bridge Co., 1618 Pennsylvania Building, $28,414 (awarded contract); John Goll & Co., 1539 Filbert Street, $28,414; John A. Kelley Co., 52 Pennsylvania Building, $29,829; Pennsylvania Steel Co., Steelton, Pa., $30,015.

★Contract 3—Waterproofing bridge over Emerald Street, awarded to Barber Asphalt Paving Co., 239 North Thirtieth Street, at $2,389.

★**Sharon, Pa.**—Contract awarded Canton Bridge Co., Canton, Ohio, for constructing highway bridge (bids opened Oct. 17. Press reports state this company bid $49,990 for two-span steel structure, including abutments.

★**Lebanon, Ind.**—Contract awarded by the county commissioner to John McGuin of Lebanon for constructing two concrete bridges (bids opened Oct. 18). D. M. Clapp, county auditor.

★**Detroit, Mich.**—Council Com. voted in favor of awarding contract for constructing temporary Belle Isle Bridge to George R. Cooke, Detroit, at $92,225.

★**Aberdeen, Wash.**—Contract awarded Toledo Bridge & Crane Co. for two steel spans, one 118 ft., the other 260 ft. 6 in., for the West Toll Bridge which is to be reconstructed over the Chehalis River. Cost, complete, $32,000. Other work not yet awarded. P. F. Clark, city clerk.

★**Spokane, Wash.**—Contract for constructing steel bridge over middle channel at Howard Street and constructing approach to south end Monroe Street Bridge is reported awarded by City Comn. to Beers Bldg. Co., Smith Bldg., Seattle, at $18,888 and $15,555 respectively.

★**Bertha, Ore.**—The following are the unit figures of the successful bidder, Heinecke Brothers Company, Lumbermen Building, Portland, for constructing the concrete overhead crossing at Bertha, bids opened Oct. 11 by the County Roadway Master, Portland; 350 cu. yd. class A superstructure, $12.25; 55 cu. yd. class A foundation, $11.25; 57,000 lb. of reinfrocing steel, 3.5 cts.; 526 ft. of hand rail, $1.35; total, $7611.

PAVING AND ROADS

PROPOSED WORK.

New York, N. Y.—The following streets are to be repaved:

Asphalt—Arden Street, Nagle Avenue to Sherman Avenue; 161st Street, Fort Washington Avenue to Riverside Drive; Lexington Avenue, Thirty-eighth to Forty-first Street; Broadway, west side, 108th to 110th Street.

Granite—Thirteenth Street, Third to Fourth Avenue; Front Street, Whitehall Street to Coenties Slip, and Old Slip to Fulton Street; Fifty-fifth Street, Eleventh to Twelfth Avenue; Eighteenth Street, Sixth to Seventh Avenue.

McDonald, Pa.—Paving bonds for $7,500 will be sold Nov. 1 by A. V. Campbell, Borough Secy.

Carthage, N. C.—Road improvement bonds for $10,000 will be sold Nov. 1 by Road Comrs. Deep River Township, Moore County; also same time for $10,000 road improvement bonds in Greenwood Township.

Sumter, S. C.—Street and sidewalk bonds for $225,000 will be sold by D. M. Blanding, City Clk., Nov. 23.

Jacksonville, Fla.—City Council voted to pave Davis, Eighth Streets, Kings Road and Durkee Avenue.

Gulfport, Fla.—At the election Oct. 9 citizens voted $10,000 bonds for paving with asphalt and erecting a municipal pier. H. E. Wendell, city clerk.

Miami, Fla.—Road and Bridge Dist. No. 1 bonds for $100,000 will be sold Nov. 12 by J. J. Hinson, Chmn. Co. Comrs.

Titusville, Fla.—Road and Bridge Dist. No. 3 bonds for $150,000 will be sold Nov. 8 by S. A. Osteen, Chmn. Bd. Co. Comrs.

Colfax, La.—About $29,000 road bonds sold by Grant Parish.

La Fayette, La.—Reported 15 miles of gravel roads are to be constructed at La Fayette; cost about $100,000.

Biloxi, Miss.—Bd. Supervs. contemplates constructing beach road from Point Cadet, Biloxi, to Henderson's Point west of Gulfport. Election to be held on $200,000 bond issue for same.

Akron, Ohio.—City Council voted to pave and construct sidewalks on Bank Street and Blaine Avenue.

Findlay, Ohio.—East Sandusky Street paving bonds for $12,000 will be sold Nov. 1 by R. O. Mungen, City Aud.

Girard, Ohio—Main Street paving bonds for $14,000 will be sold Nov. 4 by R. L. Sanford, Village Clk.

Independence, Ohio.—Bonds for $9,500 will be sold Nov. 27 by Arthur J. Goudy, Village Clk., for paving and constructing sidewalks on Breckville Road.

Middletown, Ohio.—Street improvement bonds for $25,000 will be sold Nov. 17, by City Auditor.

Storm Lake, Iowa.—J. E. Buland, City Clerk, writes that about $60,000 to $90,000 paving is contemplated on Geneseo, West Second, Seneca and East Fifth Streets; probably concrete.

Duluth, Minn.—The paving of Sixth Avenue, E., from Fourth to Eleventh Street, has been ordered by the Board of Public Works, sandstone block and reinforced concrete to be used. Estimated cost, $30,219. Lyonal Ayres, city engineer.

Duluth, Minn.—Property owners on First Street, from Sixth Avenue to Twenty-third Avenue East, are circulating petitions asking for paving, probably with brick.

Lake Village, Ark.—Street improvement bonds for $16,000 will be sold Nov. 2 by Commissioners Street Improvement Dist. Nov. 2.

Batesville, Tex.—Citizens voted $15,000 bonds for road improvements. O. A. Stubbs, County Judge. G. C. Jackson, County Clerk.

El Paso, Tex.—Citizens of El Paso County voted $300,000 bonds for road improvements.

Bellingham, Wash.—City Council voted to pave Indian, Kentucky, S. Elk, Eleventh Streets and eastern end of Lake Road.

Seattle, Wash.—Streets and Sewer Com. of City Council voted to pave Railroad Avenue from University to Virginia Street with brick; cost about $30,875.

Contract about to be let by Bd. Public Wks. for paving Seventh Avenue North, Prospect and Bailey Streets; cost about $75,000.

Seattle, Wash.—Plans submitted to Bd. Pub. Wks. by A. H. Dimock, City Engr., for grading and concrete walks on Hinds Street; cost about $15,000.

A. H. Dimock, City Engr., estimates cost of improvements as follows: Paving Seventh Avenue, N., and Prospect Street, $40,000; concrete walks, Twenty-ninth Avenue, $9,000; paving, Twelfth Avenue, N. E., $24,000.

Stevenson, Wash.—Highway Bd. at Olympia voted to construct State Road No. 8, between Cooks and Stevenson, at cost of about $45,000. Work to be done by day labor.

Astoria, Ore.—Plans being prepared by G. T. McClean, City Engineer, for hard surfacing about 32 blocks in business section of city; cost about $200,000.

Pendleton, Ore.—Willard Bradley, County Surveyor, submitted estimate of cost of constructing 40-mile road from Umatilla to Pendleton to County Court, being $1,328 per mile or total of $51,620.

Geary Kimbrell, City Engr., directed to prepare plans and specifications for paving Riverside Drive; cost about $12,000.

Portland, Ore.—County Roadmaster estimates cost of hard surfacing about 9 miles Columbia Boulevard at $18,000 per mile.

Lewiston, Idaho.—Contract about to be let by city for grading, curbing and concrete sidewalks on 20 blocks in Improvement Dist. No. 8.

Toronto, Ont.—In a report submitted to Kingston Road Improvement Com. at Whitby, W. A. McLean, Engr., estimates cost of constructing 26-mile road from Toronto to Oshawa at $310,000.

BIDS DESIRED.

Massachusetts.—By State Highway Commission (William D. Sohier, Chmn.) until Nov. 9 for constructing section of State Highway in towns of Sheffield and Great Barrington, 19,000 ft. in length.

Buffalo, N. Y.—Until Nov. 1 by Francis G. Ward, Comr. Pub. Wks., for paving portions of Halbert Street, Lackawanna Avenue, Roanoke Park, Pembina and other streets.

New York, N. Y.—Until Nov. 5 by Marcus M. Marks, Borough Pres., for improving portions of Lexington Avenue, Broadway, Sixth Avenue, W. Tenth, W. Twenty-fifth, W. Seventy-second and other streets, in all about 39,220 sq. yd. sheet asphalt on concrete foundation, 6950 cu. yd. concrete, etc. Total security $29,000.

Hackensack, N. J.—Until Nov. 12, by Committee Board Chosen Freeholders (A. V. Morrison, Chmn.), Hackensack, for improvement of Cut-Off at Washington and Massachusetts Avenues, by grading, guttering and paving with asphalt concrete.

New Brunswick, N. J.—Until Nov. 9 by Asher Atkinson, City Engr., for 22,000 sq. yd. brick, asphalt block or Warrenite pavt. on seven blocks.

Trenton, N. J.—Until Nov. 9, by John J. Power, Dir. Bd. Chosen Freeholders, for improving by grading, ditching, etc., paving with macadam Hightstown-Princeton Junction Road. Theo. Tobish, Co. Engr., Trenton.

Greensburg, Pa.—Until Nov. 15 by John Sell, County Comptroller, Greensburg, for constructing Harrison City-Export Road, in Penn and Franklin Township, about 4.96 miles long; approximate quantities: 38,000 cu. yd. excav., 1680 lin. ft. pipe, 52,840 lin. ft. concrete curbing and 46,200 sq. yd. brick paving, and Heola-Hurst School House Road, 6200 ft. long, approximate quantities: 10,000 cu. yd. excav., 470 lin. ft. pipe, 12,290 lin. ft. concrete curbing and 10,925 sq. yd. brick paving.

Pittsburgh, Pa.—Until Nov. 12, by Hyatt M. Cribbs, Co. Controller, for improving portion of Glenn Avenue, about 0.6 miles, with telford and macadam, and Wible Run Extension Road, 1.8 miles, with concrete.

Hagerstown, Md.—Until Nov. 4, by County Commissioners (Barry M. Hartle, Clk.), for constructing a section of State Aid Highway in Washington County, along road from Rohrersville toward Boonsboro, a distance of 1.14 miles; also 1.05 miles of road from McCreys Hill toward Mooresville.

Charlotte, N. C.—Until Nov. 11 by Samuel H. Lea, Engineer, City Hall, for approximately 17,500 sq. yd. cement sidewalk on several streets, including North Brevard, West Eleventh and other streets; cost about $20,000.

Miami, Fla.—Until Nov. 8, by W. B. Moore, City Clk., for grading and paving with asphaltic concrete and binder course on concrete foundation portions of Avenue C and Avenue D in Highway Improv. Dists. H 13 and H 14. Approximately 15,000 yd. Also for grading and paving with sand and light asphalt oil portion of Harvard Avenue, Johnson, Waddell, Twentieth and other streets, in all approximately 100,000 yd.

Tavares, Fla.—See "Bridges."

Titusville, Fla.—Until Nov. 9 by S. A. Osteen, Clk. Bd. Co. Comrs., for constructing 68 miles of roadway with shell surfacing with alternate of Ojus or similar local stone surfacing, including bridges, culverts, etc; estimated cost $150,000.

New Orleans, La.—Until Nov. 9 by A. G. Ricks, Comr. Dept. Pub. Finance, to erect asphalt plant on grounds of municipal repair plant.

Lucedale, Miss.—Until Nov. 3 by Co. Bd. Superv. (S. R. McKay, Clk.) for tractor truck, steel wheels beveled to roll gravel to proper crown, 60-hp. capacity, body 5 ton gravel; also 2 leaning wheel load grader and one 1600 lb. 3 way drag.

Cincinnati, Ohio.—Until Nov. 9 by Ernst Von Bargen, City Purchasing Agent, for constructing one five-ton gasoline tractor for city.

Youngstown, Ohio.—Until Nov. 2 by H. C. Fox, Clk. Dir. Pub. Service, for furnishing material and paving Lincoln Park Drive between Sheehy and Rigby Streets; also grading Almira Avenue between Glenwood Avenue and Edwars Street.

Illinois.—Until Nov. 3 by State Highway Commission, Springfield, for constructing a road in Sangamon County, Section G, brick and concrete, length 4140 ft., nearest post office Springfield. Estimated cost $14,460.

Park Rapids, Minn.—Reported desired by Frank Heisel, Co. Aud., until Nov. 2 for constructing State Highway No. 1, 40 acres clearing and grubbing, 26,000 cu. yd. excav., 4310 lin. ft. turnpiking, etc.

Independence, Kan.—Until Nov. 4, by Allen C. Southern, Co. Surv., for constructing Lexington Road, about 1 mile in all, 11,733 sq. yd. bituminous earth pavement, curbing 10,560 lin ft., etc.

Lincoln, Neb.—Until Nov. 15 by H. E. Wells, Co. Clk., for constructing Paving District No. 9. Engineer estimates cost at $47,300 for 3-in. fiber brick, $42,650 for asphaltic concrete and $50,630 for brick block.

Kansas City, Mo.—Until Nov. 2 by Thomas F. Callahan, Secy. Bd. Pub. Wks., for furnishing material and paving with Portland cement concrete, portions of Askew Avenue, Forty-first and Wyoming Streets and an alley, constructing artificial stone sidewalks on portions of Bales Avenue, Forty-first and several other streets.

Beaumont, Tex.—Reported desired until Nov. 8, by Co. Comrs., Beaumont, on 11-mile stretch of road between China and Nome and between Nome and Liberty and Hardin County line. Bids desired on all kinds of material.

Seattle, Wash.—Until about Nov. 5 by Board Public Works for paving with asphalt on Hamlin Street, about 6035 sq. yd. and 4650 lin. ft. concrete curb, estimated cost $17,376, and with brick block on Donald Street, 8960 sq. yd. and 6757 lin. ft. concrete curb, estimated cost $116,312. Fred. T. Matthys, Secy. Street and Sewer Com.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Wareham, Mass.**—The following are the three bids opened Oct. 23 by the county commissioner for building a section of asphalt macadam road: Thomas & Murphy, Middleboro, $9,294 (awarded contract); Davis & Brock, Brookline, $13,007; Alco Contracting Co., Boston, $14,577.

Albany, N. Y.—Following are totals of lowest bids opened Oct. 26 by State Highway Commission, 55 Lancaster Street, for constructing highways by State aid:

Road No. 1279, Dunnsville-Altamont, Albany County, 3.41 miles—George J. Curran, Middletown, Conn., $27,885; Huntoon & Ferguson, Hudson Falls, $29,719; A. N. Hoyt, Albany, $30,000; John B. Dower, Ballston Spa., $31,411.

Road No. 5532, Arkport-Van Scoters Corners, Allegheny and Steuben Counties, 5.25 miles—Kennedy Constr. Co., Albany, $50,882; J. G. Hayes Co., Inc., Rome, $51,976; Greenfield Constr. Co. Hornell, $52,065; Atlanta Constr. Co., Atlanta, $53,134.

Road No. 1327, Fleming-Scipio, Part 2, Cayuga County, 6.06 miles—John H. Gordon, Albany, $52,011; Michael H. Ripton, Rochester, $52,110; John G. Hayes & Co., Inc., Rome, $53,054; Henry P. Burgard, Buffalo, $53,399.

Road No. 5594, Plattsburg-Ingraham, Clinton County, 3.79 miles—Bluff Point Stone Co., Inc., Plattsburgh, $29,160; Boynton & McNally, Keeseville, $30,079; Richard Hopkins, Troy, $31,370; Routley & Summers, Huntingdon, Quebec, Can., $30,755.

Road No. 1331, Claverack-Chatham, Part 1, Columbia County, 4.37 miles—Russo-Parker Constr. Co., Hudson, $39,756; Marks Kearney, Hudson, $39,757; Rumph & Stevens, Lake Placid, $42,290; Samuel Beskin, Beacon, $42,615.

Road No. 1332, Claverack-Chatham, Part 2, Columbia County, 7.77 miles—Marks Kearney, Hudson, $62,186; Russo-Parker Constr. Co., Hudson, $63,957; Gruner & Hollenbeck, Harriman, $66,659; Samuel Beskin, Beacon, $68,582.

Road No. 5595, Broome County Line-Marathon Village, Cortland County, 3.75 miles—T. H. Gill Co., Binghamton, $39,759; Dana W. Robbins Co., Inc., New York City, $40,960; James Rossney, Buffalo, $41,416; S. P. Hull, Cortland, $42,337.

Road No. 1333, Collins Center-Springville, Erie County, 9.14 miles—Shanley Constr. Co., Buffalo, $141,828; Atlanta Constr. Co., Atlanta, $141,895; F. H. Wells Corfu, $142,263; F. J. Mumm Contr. Co., Buffalo, $144,304.

Road No. 1334, Transit, Part 1, Erie County, 4.3 miles—Langan Constr. Co., Albany, $70,049; Henry P. Burgard Co., Buffalo, $74,886; Harry W. Roberts Co., Utica, $73,991; Union Paving Co., Schenectady, $75,033.

Road No. 1335, East Eden, Hamburg, Erie County, 4.6 miles—Stanley Constr. Co., Buffalo, $57,914; Bison City Engineering & Construction Co., Inc., Buffalo, $58,083; F. H. Wells, Corfu, $58,095; Routly & Summers, Huntingdon, Quebec, Can., $58,160.

Road No. 1336, West River Road, Erie County, 5.19 miles—George Nellons, Grand Island, $56,250; John W. Landel, Tonawanda, $59,211; F. J. Mumm Contr. Co., Buffalo, $64,239; Pfohl Brothers, Buffalo, $66,751.

Road No. 5582, Leroy-Pavilion, Part 2, Genesee County, 4.53 miles—Chilson & Gibson, Leroy, $44,893; Greenfield Constr. Co., Hornell, $46,094; Hovey E. Benedict, Williamsport, Pa., $48,066; F. J. Mumm Contr. Co., Buffalo, $48,728.

Road 5593, Caledonia-Mount Morris, Part 1, Livingston County, 7.69 miles; James Anderson, Albany, $63,063; Henrickson-McCabe Constr. Co., Spencerport, $63,556; Ribstine-Holter Co., Rochester, $65,070; William H. Madden, Rochester, $65,558.

Road No. 1110, Oneida-South Bay, Part 1, Madison County, 3.05 miles—Mohawk Engineering Co., Mohawk, $26,151; Fort Schuyler Constr. Co., Oneida, $26,590; Michael O'Brien, Cortland, $27,039; Mondo Constr. Co., Inc., Syracuse, $27,509.

Road No. 1328, Winton Road-North, Monroe County, 0.73 mile—Whitemore-Rauber & Vicinius, Rochester, $12,927; Ribstine-Holter Co., Inc., Rochester, $13,114.

Road No. 1327, East Rochester, Penfield, Monroe County, 2.91 miles—Ribstine-Holter Co., Inc., Rochester, $35,548; Langan Constr. Co., Albany, $37,369; Whitemore-Rauber & Vicinius, Rochester, $38,465; Union Paving Co., Schenectady, $39,121.

Road No. 5547, Whitesboro-Carey Corners, Oneida County, 0.7 mile—Langan Constr. Co., Albany, $17,187; Harry W. Roberts Co., Utica, $18,795; H. B. Sproul Constr. Co., Inc., Peekskill, $19,291; Union Paving Co., Schenectady, $20,345.

Road No. 448, Port Jervis-Sullivan County Line, Part 2, Orange County, 3.64 miles—Armstrong & Trowbridge, Middletown, $29,868; John Arborio, New Haven, Conn., $30,911; Jackson Brothers, Cuddebackville, $31,388; George F. McEvoy, Creek Locks, $31,740.

Road No. 1329, Goshen Village, Church, West Main and Main Streets and Greenwich Avenue, Orange County, 3.7 miles—Samuel M. Seriesine, New York City, $47,269; Heisler & Aldershoff, Albany, $51,575; Belmar Contr. Co., Troy, $52,696; John De Michael & Bro., Torrington, Conn., $54,247.

Road No. 5545, Schenectady-Dunnesburg, Part 2, Schenectady County, 5.62 miles—George J. Curran, Middletown,

Conc., $35,777; John B. Dower, Hampton Bays, $42,065; D. L. Snell & Co., Canandaigua, $46,000.

Road No. 5, Lots Into Lakes, Seneca County.—Let to Groundhog Constr. Co., Hornell, $41,719; Thomas Grady, Rochester, $48,000.

Road No. 2, in A. Bloomingburg-Monticello, Part 1, Sullivan County.—$43 to Barry McNamee, Middletown, $7,347. Road No. 1-b, same road, Part 2, Town of Callicoon.—Peter F. Conway Co., Brooklyn, $20,693; Lane Contr. Co., Meadville, Penn., $22,542; Hoosick Mountain Constr. Co., Speculator, $23,; F. P. Mercer, Long Pond, Pa., $24,000.

Road No. 6, in Town of Fort Plain, Montgomery County.—Let to Hugh Hewitt, Utica, at $6,342.

★Mineola, L. I., N. Y.—Contract for constructing sidewalks at Court House Grounds at Mineola, awarded by Bd. Supervs. to John R. Dalton, Port Washington, at $12,485.

★New York, N. Y.—Contracts awarded Oct. 25 by Marcus M. Marks, President Manhattan Borough, for paving as follows: W. J. Fitzgerald, 547 W. 147th Street, portions of Eastern 7th, Dyckman and Ferry Streets, at a total cost of $71,850; sheet asphalt; Barber Asphalt Paving Co., 165 Broadway, portions of E. 174th and W. 178th Streets, Bronx, E. 161st Street and Columbus Avenue, at a total of $42,000; and with asphalt block on W. 178th Street at $; for sheet asphalt, Arthur Arrigoni Co., 50 West Street, portions of W. 97th Street and W. 98th Street, 9th and 10th Streets and Lexington Avenue, at $12,000; Asphalt Constr. Co., 25 Broadway, on Eastern Avenue, Thirty-fifth, Thirty-seventh and Thirty-eighth Streets, at $6,767; Sicilian Asphalt Paving Co., 41 Park Row, at $24,481.

★Jersey City, N. J.—Contract for road improvement awarded by Bd. Chosen Freeholders as follows: Paterson Plank Road from Secaucus H. R. to Hackensack River Bridge, to Nolan & Manning Constr. Co., West Hoboken, at $41,000; and for Tonnage Avenue, to Kearney to Northern Constr. Co., Newark, at $19,516.

★Newark, N. J.—Contract awarded to Northern Constructing Co., 985 Broad Street, for paving with asphalt on Coldenham Avenue, from South Orange Avenue to city line, at $13,132.

★Wilmington, Del.—Contract for constructing stone road from Centerville School House to Kennett Square Road awarded by Levy Court to I. J. Hollingsworth, Sharon, at $9,316.

★Washington, D. C.—The following contracts have been awarded by the Commissioners, D. C., on bids opened Oct. 19 for paving: Crawford Paving Co., Washington, 6in. sq. yd. of sheet asphalt, $1.[illegible] per square yard; Washington Asphalt Brick & Tile Co., Washington, 5in. sq. yd. asphalt block, $1.62 per square yard; The Potomac Paving Co., Washington, 5in. sq. yd. asphalt block, $1.62 per square yard; The Barber Asphalt Paving Co., Philadelphia, and the Warner Quinlan Asphalt Co., Syracuse, N. Y., $1.55 and $1.57 per square yard, for sheet asphalt.

★The following are the three bids opened Oct. 19 by U. S. Department Agriculture for constructing 2.12 miles of gravel road in Fairfax County: Hamm & Gwynn, Baltimore, Va., $[illegible]; unnamed corporation, Bell & Johnson, Arlington, Va., $[illegible]; Crockett & Crockett of Richmond, at $[illegible]. R. V. Evans, chief clerk, Chairman Board of awards.

★Newport, Tenn.—The contract for grading and macadamizing county roads (bids opened Oct. 16) awarded by county commissioner to R. L. Peters, Bank and Trust Building, Knoxville, Tenn. Following are detail bids on some of the items: 14,250 cu. yd. earth excavation, 20 cts.; 11,400 cu. yd. loose rock excavation, 33 cts.; 6,000 cu. yd. solid rock excavation, 74 cts.; 30,750 cu. yd. macadam, $1.60; 42 acres clearing and grubbing, $40; 360 cu. yd. second-class masonry, $5; 164 cu. yd. box culvert masonry, $5; 492 cu. yd. first-class concrete, $8; 370 cu. yd. second-class concrete, $8. J. C. Thomas, engineer in charge, Newport.

★Cincinnati, Ohio.—Contract for paving W. Sixth Street with granite awarded by Bd. Pub. Service to Henkle & Sullivan, Cincinnati, at $80,818.

★Findlay, Ohio.—Contract for paving Park A cture and Corey with brick (bids opened Oct. 12) awarded C. B. Hall & Sons of Findlay. Joseph Page, city clerk.

★Fort Wayne, Ind.—Contract for paving with asphalt macadam Rudisill Avenue (bids opened Oct. 18) awarded Moeller Construction Co. of Fort Wayne, at $26,612. Charles J. Stein, Secretary Paving Commission.

Logansport, Ind.—The following are the lowest bids opened Oct. 19 by William Bassett, City Clerk, for paving West Broadway and Wheatland Avenue, about 44,[illegible] sq. yd.; Andrews Asphalt Paving Co., Hamilton, Ohio, Trinidad Pitch Lake as Bermudez asphalt, $1.25 per sq. yd.; Paving Shields Greenecastle, Standard Mountain Asphalt, $1.71; Hodson David Construction Co., Aztec asphalt, $1.80; Palmer Moore & Co., Loganasport, brick, $1.90; J. J. Kelleher & Co., Frankfort, reinforced concrete, $1.33; Williston Construction Co., Indian Harbor, bituminous macadam $1.35. H. H. Thompson, Engineer, Logansport.

★Rockford, Ill.—Contract awarded by Board of Local Improvements to A. E. Partridge of Rockford, for paving with macadam portions of Tenth and Eleventh Streets and Seventh and Eighth Avenues, $24,640; also on Fourth Avenue and Thirteenth Streets, at $5,556.

★Duluth, Minn.—Contract for grading Thirtieth Avenue West, and paving with brick, awarded A. Bedin & Sons, at $9721, and paving of Third Avenue East with sandstone blocks to O. H. Clough & Co., at $11,000.

St. Paul, Minn.—The only bid received Oct. 18 by the city purchasing agent for complete work or grading and improving Jessamine Road, including culvert and bridges, was submitted by D. W. Moor, 55 Edmund Street, at $55,000, engineer's estimate $50,000.

★Hardin, Mont.—Contract awarded Doyle & Campbell for constructing four and one half miles of road between Big Horn River bridge and Dry Creek. R. P. Ross, county auditor.

★Independence, Kan.—Contract awarded for paving (bids opened Oct. 21) as follows: To Green & Cullen, Independence, 7126 lin. ft. concrete curb and gutter, 50 cts.; 1653 lin. ft. 6 x 14-in. concrete curb, 25 cts.; 13,661 sq. yd. fiber block paving, $1.31; 210 sq. yd. old paving taken up and relaid, 60 cts.; 5915 cu. yd. earth excavation, 35 cts.; 784 lin. ft. head curb, 25 cts.; for catch basins, each, $20; 140 lin. ft. 24-in. sewer, $1.75; total, $24,768. Other bidder, A. E. Sherwood, $24,956; also contract to Green & Cullen, as follows: 2820 lin. ft. curb and gutter, 50 cts.; 113 lin. ft. concrete curb, 6 x 14-in., 25 cts.; 6[illegible] sq. yd. fiber block pavement on 6-in. macadam base, $1.21; 2394 cu. yd. earth excavation, 35 cts.; 220 lin. ft. head curb, 25 cts.; total, $8,654. Other bidder, A. E. Sherwood, $8,744. George E. Weaver, city engineer.

★Belton, Tex.—Comrs Court on Oct. 15 awarded contract for road improvements to Rogers Constr. Co., Rogers, about $[illegible] available for road improvements in Rogers Dist.

★Seattle, Wash.—Lowest bid opened by Bd. Public Wks. for paving Forty-seventh Avenue N. E. submitted by Independent Asphalt Paving Co., North Bank Building, Seattle.

★Contract for paving Fourteenth Avenue South with asphalt awarded by Bd. Pub. Wks. to Holt & Jeffery, Railway Exchange Building, at $11,169.

★Contract for filling and bulkheading East Marginal Way awarded by Bd. Pub. Wks. to Puget Sound Bridge & Dredging Co., Central Building, at $80,975.

Washington.—Following are lowest bids opened by State Highway Comn., Olympia, for graveling 17.3 miles Inland Empire Highway, Rosalia-Colfax, in Whitmore Highway, Rosalia-Colfax, in Whitman County: W. G. Mulligan & Co., Spokane, $21,129, and for grading, draining and surfacing 6¾ miles Inland Empire Highway, Dayton, Columbia County, General Constr. Co., Spokane, $13,242.

Bakersfield, Cal.—Lowest bids opened by city for paving as follows: 6 miles concrete pavement on Div. 5, Sect. 1, Bakersfield-McKittrick Road. Shattuck-Nimmo Warehouse Co., Bakersfield, $28,802, and 6 miles on Div. 10, Sect. 5, Worswick Street Paving Co., Modesto, $31,460.

California.—Following are bids opened Oct. 18 by State Highway Commission, Sacramento, for State road work:

Sonoma County, Div. 4, Route 8, Section A—Lowest bidder, Bates, Borland & Ayer, Oakland, as follows: 43,500 cu. yd. excavation (ordinary) without classification, 38 cts.; 14 M ft. Oregon pine lumber in place, $32; 19 M ft. Redwood lumber in place, $40; 266 lin. ft. 12-in. corrugated metal pipe, 50 cts.; 120 lin. ft. 15-in. corrugated metal pipe, 50 cts.; 194 lin. ft. 18-in. corrugated metal pipe, 60 cts.; 442 lin. ft. 24-in. corrugated metal pipe, 75 cts.; 264 lin. ft. 30-in. corrugated metal pipe, 75 cts.; 1200 lin. ft. 4-in. tile drain, 10 cts.; 185 cu. yd. cement concrete, class "B" culverts and monuments, $10; 2400 lin. ft. property fences, moving and resetting, 4 cts.; 4200 lin. ft. new property fences (board and wire), 4 cts.; 32,400 lin. ft. new property fences (woven wire), 4 cts.; 76 monuments, hauling and setting, $1; total, $22,183. Next 3 lowest bids: P. H. Hoare, Oakland, $24,869; Moffett & Mead, San Francisco, $25,409; J. A. Marshall, Berkeley, $26,242.

Placer County, Div. 3, Route 3, Section B—Only bidder, Bates, Borland & Ayer, Oakland, as follows: 45,000 cu. yd. excavation (ordinary) without classification, 65 cts.; 480 lin. ft. 12-in. corrugated metal pipe, 50 cts.; 330 lin. ft. 18-in. corrugated metal pipe, 60 cts.; 120 lin. ft. 24-in. corrugated metal pipe, 75 cts.; 235 cu. yd. cement concrete, class "B" culverts and monuments, $10; 8760 cu. yd. cement concrete, class "B" pavement, $3.50; 3120 lin. ft. guard rail, 35 cts.; 88 monuments, each $1; total, $63,935.

Mariposa County, Div. 6, Route 18, Section A—Lowest bidder, George K. Daley, San Diego, as follows: 53,000 cu. yd. excavation (ordinary), 38 cts.; 1700 cu. yd. excavation (solid rock), $1.50; 1024 lin. ft. 12-in. corrugated metal pipe, 80 cts.; 156 lin. ft. 18-in. corrugated metal pipe, 90 cts.; 406 lin. ft. 24-in. corrugated metal pipe, $1; 310 lin. ft. 30-in. corrugated metal pipe, $1.25; 310 cu. yd. cement concrete, class "B" culverts and monuments, $20; 2324 lin. ft. guard rail, 75 cts.; 290 monuments, hauling and setting, $1.25; total, $42,749. Next 3 lowest bids: Toohey & Johnson, Dunsmuir, $45,285; G. W. Conners, Eureka, $46,860; W. J. Schmidt, Berkeley, $47,522.

Placer County, Div. 3, Route 3, Section B—Lowest bidder, C. H. & A. W. Gorrill, San Francisco, as follows: 45,000 cu. yd. excavation (ordinary) without classification, 39 cts.; 480 lin. ft. 12-in. corrugated metal pipe, 55 cts.; 330 lin. ft. 18-in. corrugated metal pipe, 60 cts.; 120 lin. ft. 24-in. corrugated metal pipe, 70 cts.; 235 cu. yd. cement concrete, class "B" culverts and monuments, $9; 8760 cu. yd. cement concrete, class "B" pavement, $2.98; 3120 lin. ft. guard rail, 30 cts.; 88 monuments, hauling and setting, $1; total, $47,340. Next 3 lowest bids: Twohy Brothers Co., San Francisco, $49,114; Whitlock & Gorrill, Durham, $50,582; Taylor & Bertiner, Willows, $53,002.

Sonoma County, Div. 4, Route 8, Section A—Lowest bidder, Spring Construction Co., Berkeley: 42,500 cu. yd. excavation (ordinary) without classification, 36½ cts.; 14 M. ft. Oregon pine, $42,50; 19 M. ft. redwood, $48,20; 266 lin. ft. 12-in. corrugated metal pipe, 53 cts.; 120 lin. ft. 15-in. corrugated metal pipe, 65 cts.; 194 lin. ft. 18-in. corrugated metal pipe, 75 cts.; 442 lin. ft. 24-in. corrugated metal pipe, $1.10; 264 lin. ft. 30-in. corrugated metal pipe, $1.30; 1200 lin. ft. 4-in. tile drain, 30 cts.; 185 cu. yd. cement concrete, class "B" culverts and monuments, $10; 2400 lin. ft. property fences, moving and resetting, 10 cts.; 4200 lin. ft. new property fences, board and wire, 5 cts.; 32,400 lin. ft. new property fences, woven wire, 4½ cts.; 76 monuments, each, $2; total, $22,-852. Next two lowest bids: O'Brien Brothers, Martinez, Cal., $28,205; W. B. Hunt & Sons, Alameda, Cal., $30,903.

Los Angeles, Cal.—Lowest bid opened by city for improving Alameda Street submitted by Conner Contr. Co., 709 Higgins Bldg., at $26,249.

★George R. Curtis, 552 South St. Louis Street, awarded contract for 109,612 sq. ft. asphalt paving on Serrano Avenue.

★Contract for 10,422 sq. ft. asphalt surfacing on Mariposa Avenue awarded to George R. Curtis, 552 South St. Louis Street, at $11,031.

★Contract for paving 260,900 sq. ft. Fourth Street with bitulithic awarded to Fairchild-Gilmore-Wilton Co., Pacific Electric Bldg., at $50,675.

Lowest bid opened for constructing 3 miles concrete paving on Palmdale, Lancaster Road, in Dist. No. 5, submitted by H. E. Cox, Chamber Commerce Bldg., Pasadena, at $24,351.

★Sawtelle, Cal.—Contract for paving 444,017 sq. ft. Santa Monica Boulevard with Warrenite awarded to Clarke & Henery Co., Stockton, at $75,335.

★Idaho.—Contract awarded Oct. 16 by State Highway Commission, Boise, to J. J. Carroll of Pocatello for grading 58 miles of the Idaho-Pacific State Highway in Burley Highway District, Cassia County, at the following detail bid: Earth excavation, 16⅛ cts.; hard pan, 40 cts.; loose rock, 35 cts.; solid rock, $1.50; overhaul per 100 ft., .015 ct.; clearing sage brush, $6 clearing timber, $25; grubbing stumps, $25; machine grading, per mile, $75; riprap, loose, $1.25; concrete end walls for iron culvert pipe, $9; placing corrugated iron pipe culverts, 10 in. to 36 in. per lin. ft., .225 ct.; gravel surfacing per cu. yd., .75 ct.; rolling, per mile of 16-ft. roadway, $50; total, $33,943.

★Contract for 13 steel bridges and 8 reinforced concrete bridges in connection with above work awarded Charles H. Mull of Twin Falls at $15,268. Other bidders: Midland Bridge Co., Salt Lake City, Utah, $16,663; Overhaul Structural Steel Co., Salt Lake City, Utah, $17,346.

★Contract awarded by the State Highway Commission, Boise, to Whittet & Relyea, New Plymouth, for constructing 7 miles of State highway in Washington County, at $4,988.

★Toronto, Ont.—Contracts for asphalt paving awarded as follows: Main Street, to Godson Contr. Co., Toronto, at $20,572, and Quebec Avenue to Constructing & Paving Co., Toronto, at $21,968; bitulithic paving on Alton Avenue and Grace Terrace to Warren Bituminus Paving Co., Toronto, at $11,510 and $19,186 respectively.

STREET CLEANING AND GARBAGE DISPOSAL

PROPOSED WORK.

Wilmington, Del.—Reported contract soon to be let by the Bd. Health (J. Austin Ellison, Secy.) for the collection and disposal of garbage.

BIDS DESIRED.

Wilmington, Del.—Until Nov. 8 by Board of Health (J. Austin Ellison, Secy.), for the disposal of garbage.

Garbage Incinerator — Panama. — See "Miscellaneous."

PRICES AND LETTINGS.

★*Indicates award of contract.*

Newark, N. J.—The following are four lowest bids opened Oct. 21 by the Board of Street and Water Commissioners for the disposal and collection of garbage, ashes, etc., for five years from Jan. 1, 1916: Newark Paving Co., Newark, bid $191,800 first year, and $175,800 each year, the second, third and fourth years, and $179,000 for fifth year, total $898 200. Next three lowest bidders (prices given are first, second, third, fourth and fifth years respectively): Henry Van der Roest, Newark, $249,650, $254,650, $259,650, $264,650, $269,650, total $1 298,250; J. F. Shanley, Neyark, $229,000, $234,000, $239 000, $244,000, $249,000, total $1,195,000; Moloney Contracting Company, Newark, $275,000, $280,000, $285,000, $290,-000, $295,000, total $1,424,000.

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS

PROPOSED WORK.

Gate Houses, Etc.—Buffalo, N. Y.—Reported contract soon to be let by U. S. Engineers' Office, Federal Building, for constructing gate houses and store houses at the U. S. ship canal lock, Black Rock Harbor, concrete, brick, terra cotta and fireproof construction. Architects, Esenwein & Johnson, 781 Ellicott Square Building. Estimated cost $70,000.

Flood Improvement—Norfolk, Va.—W. T. Ham, Clerk of the Flood Commission, writes specifications and plans being prepared by P. E. Dorin, care of the Norfolk City Water Department, for the repairs to two Little Creek dams and spillways. Contract will be let in about thirty days.

Drainage Work—Chicago, Ill.—Drainage Board has voted in favor of issuing $2,000,000 bonds for corporate needs. The proceeds to be used in widening the river south of Van Buren Street and intercepting the sewage in Evanston, also for continuing work of diverting the sewage in Calumet District.

Ditch—Duluth, Minn.—Contract, it is reported, will soon be let by the County Commissioners for digging Ditch No. 4 to cost approximately $150,000.

New York, N. Y.—The following are the unit prices of the four lowest bids opened Oct. 19 by Marcus M. Marks, President Manhattan Borough, for repaving with sheet asphalt on a concrete foundation the pavement of Twenty-fifth and Thirty-second Streets from Fourth Avenue to Park Avenue South: (a) Barber Asphalt Paving Co., Woolworth Building, $[illegible]; (b) Aztec Asphalt Co., 30 West Street, Bayonne; (c) Standard Asphalt Repair Co., 41 Park Row, $63,998; (d) Cleveland Trinidad Asphalt Co., Duryea, L. I., $[illegible]

	(a)	(b)	(c)	(d)
[illegible] cu. yd. earth excavation	$1.00	$1.00	$0.75	$1.00
[illegible] cu. yd. rock excavation	2.00	2.00	5.25	3.50
[illegible] cu. yd. trap rock in excavation	6.00	6.10	9.00	9.50
2,[illegible] lin. ft. new 6-in. granite curbstone	0.75	0.80	0.80	0.95
3,[illegible] lin. ft. new 6-in. granite curbstone	1.10	1.10	1.60	1.32
[illegible] lin. ft. new 8-in. granite corner curbstone	1.55	1.58	1.75	1.75
2,[illegible] lin. ft. old work, reset	0.30	0.45	0.40	0.45
[illegible] sq. ft. concrete sidewalk, Class A	0.25	0.25	0.25	0.30
[illegible] lin. ft. granite [illegible]	1.00	0.95	0.75	1.00
[illegible] lin. ft. temporary [illegible]stone	0.25	0.45	0.50	1.00
1,[illegible] sq. yd. concrete [illegible] of railroad area	3.00	6.90	5.40	6.00
20,[illegible] sq. yd. sheet asphalt, part, outside of railroad area	1.09	1.03	1.25	1.40
[illegible] sq. yd. sheet asphalt, part, in approaches	1.09	1.28	1.25	1.40
[illegible] sewer manhole heads	10.00	10.50	9.00	9.00
[illegible] manhole frames and covers	3.50	3.25	3.00	3.00
[illegible] rings for sewer manholes	4.00	3.25	3.00	3.00
[illegible] lin. ft. brick masonry	15.00	12.00	10.00	12.00
17 receiving basins reconstructed	75.00	100.00	100.00	100.00
[illegible] lin. ft. granite platform [illegible]	0.50	0.40	0.60	0.60
4 chute basins, Type A	70.00	70.00	65.00	70.00
28 chute basins, Type B	65.00	60.00	65.00	70.00
430 lin. ft. 15-in. city pipe	1.00	1.35	1.50	1.50
Work in Railroad Area				
2[illegible] cu. yd. concrete	3.00	4.90	5.40	6.00
1,2[illegible] sq. yd. sheet asphalt [illegible]	1.09	1.03	1.25	1.40

Hydroelectric Plant—Polson, Mont.—Reported franchise granted to J. H. Kline of Polson, for the construction of a hydroelectric plant on Big Creek in Callispel District.

Irrigation—Carlsbad, N. M.—L. E. Foster, Project Manager, writes new bids will not be asked on the construction of the Down Canyon Pipe Line, but will be done by force account. Bids opened Oct. 12 were rejected.

Irrigation—North Yakima, Wash.—Bonds amounting to $35,000 for general improvements will be sold Nov. 6 by C. E. Udell, secretary Union Gap Irrigation District.

Grandview, Ore.—Suttle Lake Irrigation Dist. bonds for $600,000 will be sold Nov. 22 by C. I. Henline, Secy. Bd. Directors.

Irrigation — Grants Pass, Ore.—The State Engineer at Salem has granted a permit to the Rogue River Public Service Corporation of Grants Pass to appropriate water for irrigation of 12,460 acres.

Canal Improvement—Medford, Ore.—Reported Rouge River Canal Co., Medford, will spend $250,000 in enlarging canal three times present size, and in constructing a 10-mile extension to Hopkins Canal, and building laterals and making other improvements. Patrick Welch, railroad contractor of Spokane, is interested in this company.

Irrigation—Oregon.—Permits for appropriation of water for municipal purposes for Amity Halfway, Newport, Port Orchard, Tillamook and Marshfield and for irrigation of 23,143 acres of land have been issued by State Engineer at Salem; 210 miles canals and pipe lines, cost about $891,242, is contemplated; also construction of 15 reservoirs, cost $573,800. Among permits issued was one to Rogue River Public Service Cor. of Grants Pass to divert water from Rogue River for irrigation of 12,640 acres.

Irrigation—Salem, Ore.—Reported surveys will be completed about Dec. 15 for the reclamation of 75 sq. miles on French Prairie. Mr. Chaplin, County Agriculturist, of Marion County, Salem, may be able to give further information.

Irrigation — Lindsay, Cal. — Property owners of Lindsay-Strathmore Irrigation Dist. have formed a company with John Burr, Charles K. Towt and others as a board of directors. Preliminary surveys have been made and engineering estimates place cost at $1,600,000.

Dry-dock—San Francisco, Cal.—Plans of Union Iron Wks., San Francisco, for dry-dock 1000 ft. long and 110 ft. wide to be constructed at Hunters Point, San Francisco, approved by Secretary of Navy, Washington, D. C.

Irrigation — Minersville, Utah. — The Delta Land & Water Company and the Minersville Irrigation Company, at Minersville, are considering the installation of a lateral system of water distribution over 12,000 acres of land in Beaver County. Company contemplates installing a system of concrete and steel weirs.

Hydroelectric Plant—Oneida, Idaho.—An addition is to be erected to the hydroelectric power plant of the Utah Power & Light Co. on Beaver River, and includes enlargement of present power house, installation of additional equipment, construction of new steel penstock connecting power house and reservoir, and construction of a second 10,000 k.w. unit to the present plant. It is estimated that these improvements will cost approximately $250,000.

BIDS DESIRED.

Dredging—New York, N. Y.—Until Nov. 9, by R. A. C. Smith, Comr. of Docks, for Contract 1482, furnishing labor and material for dredging in the Borough of Manhattan. Security $5,000.

Dredging—Philadelphia, Pa.—Until Nov. 22 by U. S. Engineer's Office, Philadelphia, for dredging in Delaware River on Bellevue, Cherry Island and Deep Water Point lighthouse ranges, advertised in Engineering Record.

Dredging—Cleveland, Ohio.—Until Nov. 26 by U. S. Engineer's Office, Cleveland, for dredging in Cleveland Harbor, Ohio, advertised in Engineering Record.

Flood Protection Wall — Portsmouth, Ohio.—Until Nov. 17 by William Gergens, Director Public Service, for constructing second section of flood protection wall, advertised in Engineering Record. George S. Wilhelm, City Engineer.

Levee Work—Cairo, Ill.—Until Nov. 10 by Rivers & Lakes Commission, 905 State Building, Chicago (Charles Christmann, Secy.), for levee repair in Cairo, advertised in Engineering Record.

Levee Work—Council Bluffs, Iowa.—Until Nov. 3 by County Board Supervisors for constructing levee in Lewis Township 2 miles long, to consist of 27,910 cu. yd. embankment, etc. J. D. Hannan, Co. Aud.

Ditch—Sioux City, Iowa.—Until Nov. 9 by Board of Supervisors for constructing upper Wolf Creek ditch and laterals, advertised in Engineering Record. E. E. Hosmer, Co. Auditor.

Ditches—Blue Earth, Minn.—Reported desired until Nov. 5 by Jesse L. Herring, Co. Aud., for constructing county ditches Nos. 35, 36 and 38. Probable cost $40,542. Carl L. Hagger, Calvin N. Krosch and Robert Miller, Engrs. for districts.

Ditches—Marshall, Minn.—Until Nov. 8 by Ernest Sheperd, Co. Aud., for constructing ditches, in all about 118,573 ft. of 5 to 24-in. tile. Estimated total cost $33,125.

Ditch—Princeton, Minn.—Repórted desired until Nov. 8, by W. C. Doane, Co. Aud., Princeton, for constructing County Ditch 11, main ditch and branch 1, 36,-885 yds. Probable cost, $45,094.

Ditch—Slayton, Minn.—By E. V. O'Brien, Co. Auditor, Slayton, for ditch work as follows:

Until Nov. 13—Ditch No. 46. Approximately 49,875 ft. 6 to 24 in. tile, cost $11,-948. Ditch No. 47, approximately 15,400 ft. 6 to 16 in. tile; cost $2,794.

Until Nov. 16—Ditch No. 13. Approximately 81,600 ft. 6 to 26 in. pipe; cost $24,772, and Ditch No. 7, 50,200 ft. 6 to 30 in. tile, cost $2,669.

Retaining Wall—Kansas City, Kan.—Until Nov. 3, by P. J. Broil, Secy. Kaw Valley Drainage Dist., Kansas City, for constructing 1525 cu. yd. reinforced concrete wall along harbor line on west bank of Kansas River near East Kansas Avenue; also for 1411 lin. ft. concrete retaining wall and the enlargement or remodeling of approximately 2700 lin. ft. of present east subway wall along Kansas City Southern Railroad tracks between Central Avenue and Kansas Avenue west bank of Kansas River.

Dam—Albuquerque, N. M.—Until Nov. 10, by A. E. Walker, Co. Clk., for extension of diversion dam on west bank of Rio Grande River above Barelas Bridge by driving 13 piles 35 ft. long and 12 piles 30 ft. long for extending said dam 96 ft.

Retaining Wall—Sanger, Cal.—Reported desired until Nov. 1, D. M. Barnwell, Clk. Bd. Superv., Fresno, for constructing four retaining walls near Sanger.

Gates for Dam—Ottawa, Ont.—Until Nov. 10, by R. C. Desrochers, Secy. Dept. Pub. Wks., Ottawa, for constructing steel gates, towers and operating machinery for regulating dam Big Chaudiere Falls, French River, Ont.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Dry Docks—Boston, Mass.**—Contract awarded Holbrook, Cabot & Rollins Corporation, New York, for constructing the $3,000,000 dry dock has been signed by the port directors.

Shore Protection — Winthrop, Mass.—The following are the four lowest bids opened Oct. 20 by the Harbor and Land Commission, Boston, for protection for Winthrop shore—(a) 2385 cu. yd. of concrete, (b) 518 lin. ft. pile and timber jetty, (c) 60 lin. ft. pile and timber bulkhead, (d) total: W. L. Miller Co., Boston, (a) $6.09, (b) $8, (c) $6.33, (d) $19,030; D. F. Crowley, Quincy, Mass., (a) $6.30, (b) $7.70, (c) $4.90, (d) $19,289; Bay State Dredging Co., Boston, Mass., (a) $6.80, (b) $6.50, (c) $4, (d) $19,805; Coleman Brothers, (a) $8.50, (b) $9.10, (c) $7.70, (d) $20,247.

★**State Canal Work—Albany, N. Y.**—Following are total of four lowest bids opened Oct. 26 by W. W. Wotherspoon State Superintendent Public Works for Terminal Contract 20—constructing a barge canal terminal at Syracuse: Walsh Construction Co., Davenport, Idaho, $419,-659; The Sherman-Statler Co., Lyons, $455,935; James Stewart & Co., Inc., New York, $481.705, and Eastover Construction Co., Utica, $492,622.

★**Retaining Wall—Augusta, Ga.**—Contract for constructing concrete retaining wall on either side of the bridge at Fifth Street awarded by River and Harbor Comn. to Municipal Improvement Co., at $4,900.

★**Levee Improvements — New Orleans, La.**—Contract awarded Don B. Hean & Son by State Bd. Engineers for constructing McCurdy and Deer Range to Junior levees, approximately 170,000 cu. yd. of earthwork, at 17.23 cts. per cu. yd. Work includes clearing, grubbing, placing material, etc.

Cincinnati, Ohio—The lowest bid opened Oct. 15 by U. S. Engineers Office for reconstructing in concrete ton of spillway at dam No. 4, Muskingum River, submitted by Clifton Bros. of Zanesville, at $4,370.

★**Ditches — Mankato, Minn.** — Contract awarded by county commissioner to G. E. Gilbertson, St. James, for 18,209 ft. 8 to 26-in. tile with concrete headwall, etc. (bids opened Oct. 19) at $15,727. C. L. Kennedy, County Auditor.

★**Irrigation — Newell, S. D.**—Contract awarded Oct. 19 by the U. S. Reclamation Service Bureau for constructing approximately 3285 lin. ft. 60-in. and 450 lin. ft. 24-in. wood stave pipe for the Belle Fourche Project to the Pacific Tank & Pipe Co., 318 Market Street, San Francisco, Cal., for redwood unpainted, at $12,454.

★**Irrigation — Malta, Mont** — Contract awarded by the U. S. Reclamation Service for earth works and structure of the Bowdoin Canal, first unit, Milk River irrigation project, Montana, as follows: To James O'Connor, Saco, Mont., schedules 1 and 2, involving 132,410 cu. yd. of excavation and 9000 cu. yd. overhal at $18.618; to Jurgens, Booth & Co. of Glasgow, schedules 3 and 4, involving 81,000 yd. of excavation, 450 cu. yd. of reinforced concrete, 420 sq. yd. dry paving, placing of 30,000 lb. of steel reinforcements, placing in wooden structures about 12 M. ft. lumber. Work is located 17 miles east of Malta on Great Northern Railway.

★**Irrigation — Malta, Mont.** — Contract awarded by the U. S. Reclamation Service to Jurgens, Booth & Co. of Glasgow, Mont., for building structures on the Nelson reservoir, South Canal, Milk River irrigation project, at $34,081. Work involves about 25,000 cu. yd. of excavation, 1700 cu. yd. of concrete, placing of 115,000 lb. steel reinforcement, erection of 450 lin. ft. of metal flume and placing in wooden structures about 85 M. ft. lumber.

Irrigation Work—Powell, Wyo.—The following are the totals of bids opened Oct. 20 by the U. S. Reclamation Service, Powell, for earth work and structures, first unit, Frannie Division of the Shoshone project, Wyoming, (a) first schedule, (b) schedule 2, (c) schedule 3, (d) schedule 4, (e) schedule 5: J. E. Hilton, Billings, (a) $48,315, (b) $33,330, (c) $32,-295: Tibbs & Taggart, Cowley, Wyo., (a) $45,090, (b) $29,600, (c) $32,270; R. M. Lynn, Lovell, (b) $27,076; Threet Brothers & Jolley, Lovell, (a) $46,490, (b) $31,440, (c) $32,270, (d) $11,179, (e) $58,365; Security Bridge Co., (d) $10,458, (e) $54,628; Billings Engineering & Contracting Co., Billings, Mont., (d) $10,520.

★**Levee Improvements—Butler Mo.**—Contract awarded to A. Bennema, 303 W. 111th Street, Chicago, for constructing about 10 miles of levee along Maries-Des Cygnes River, at 8.7½ cts. per cu. yd. In all about 150,000 cu. yd.

★**Drainage—Marion, Ark.**—Contract for cleaning out Big Creek in Drainage Dist. No. 5, from Wapponnoco Outing Club to where it empties into Tyronza River, a distance of 18 miles, awarded E. M. Ford, at $900 per mile.

★**Riprap—Galveston, Tex.**—Contract for furnishing at foot of seawall 20,000 tons rock, weighing not less than 125 lb., awarded Hawley & Fridner, Galveston, at $2.64 per ton. David M. Picton & Co., Galveston, bid $3.95, and William Moore, Texas City, $3.45 per ton for same weight (bids opened Oct. 18 by County Commissioners).

Following are bids opened same time and place as above for filling required for the seawall: Bowers Southern Dredging Co., Galveston, 250,000 cu. yd., 45 cts.; 350,000 cu. yd. 41 cts.; 500,000 cu. yd., 37 cts.; Standard American Dredging Co., Galveston, bid 37.75 cts., 35 cts. and 29.5 cts. respectively. John M. Murch, Co. Aud.

Main Canal & Tunnel—Modesto, Cal.—The following are the unit figures of the four lowest bids opened Oct. 16 by the Board of Directors, Modesto Irrigation District, for enlarging Main Canal & Tunnel: (a) C. W. Richards, Oakdale, $33,539; (b) W. J. Schmidt, Berkeley, $34,569; (c) Peart Brothers, Lagrange, $36,678; (d) F. Rolandi, San Francisco, $39,046:

	(a)	(b)	(c)	(d)
13,000 cu. yd. earth excav.	$0.16	$0.30	$0.46	$0.49
28,900 cu. yd. hardpan excav.	0.81	0.71	0.82	0.84
7,000 cu. yd. tunnel excav.	1.15	1.45	1.00	1.20

★**Main Canal—Modesto, Cal.**—Contract for constructing main canal below dam (bids opened Oct. 16 by the Modesto Irrigation District) awarded Peart Brothers of Lagrange, at $2,500. Contract for constructing lower main canal, five structures, to Barrett & Hilp of San Francisco, at $6,209.

★**Irrigation — Modesto, Cal.** — Contract awarded by Board of Directors of Modesto Irrigation District to Tibbitts Pacific Co., San Francisco, at $9,080, for constructing a reinforced-concrete protecting face and curtain wall on the upstream face of dam No. 6, Dallas reservoir. C. S. Abbott, secretary Board of Directors.

★**Pier — San Francisco, Cal.**—Contract for constructing Pier 29 awarded Clinton Construction Co., at $283.230. Leo Lee, Jr., Secy. Harbor Commissioners.

Bulkhead Shed—San Juan, Porto Rico—Following are the bids opened Oct. 1 by Harbor Board for constructing a bulkhead shed at San Juan: (a) 841-ft. shed; (b) 529-ft. shed; (c) 1 crane; (d) 2 cranes: Engineer's estimate, (a) $79,976, (b) $54,-173, (c) $17,000, (d) $28,000; J. Benitez, (a) $72,975, (b) $51,473, (c) $17,583, (d) $30,498; P. J. Carlin Constr. Co., (a) $78,800, (b) $53,000, (c) $17,000, (d) $29,000; John Monks & Sons, (a) $83,133, (b) $56,957, (c) $19,000, (d) $34,000; Snare & Triest, New York, (a) $84,800, (b) $59,660, (c) $18,300, (d) $33,700.

★**Piers—Honolulu, T. H.**—Contract for constructing reinforced concrete piers Nos. 8, 9 and 10, at foot of Fort Street, awarded Lord Young Engineering Co., Honolulu, at $295,000 (bids opened Sept. 22). Other bidders: Tibbitts Pacific Co., 806 St. Clair Building, San Francisco, Cal., $357,900; Healy-Tibbitts Constr. Co., Market and Main Streets, San Francisco, Cal., $371,000, and Hawaiian Dredging Co., Stragenwald Building, Honolulu, T. H., at $389,771. D. Ellerbrock, Asst. Clerk Board Harbor Commissioners.

ELECTRIC RAILWAYS

PROPOSED WORK.

Milford, Pa.—Construction of railway from Milford to Port Jervis, about eight miles, being considered. Gifford Pinchot, Milford, is interested.

Decatur, Ind.—Fort Wayne, Decatur & Southern Traction Co., plans to build railway from Decatur to Berne, 12 miles.

St. Louis, Mo.—United Railways Co. received permits from Bd. Public Service to construct thirty loops, curves and extensions; cost about $125,000.

Beaumont, Tex.—Plans beting considered by A. R. Crawford, Normangee, to construct an electric railway from Beaumont to Waco, via Normangee, Madisonville, Huntsville and Cold Spring.

San Antonio, Tex.—San Antonio & Austin Interurban Ry. Co. plans to extend railway through New Braunfels, Hunter, San Marcos, Kyle, Buda and Manchaca. V. P. Brown, San Antonio, said to be interested.

Drumright, Okla.—Sapulpa & Field Ry. Co. plans to construct an electric railway from Drumright to Depew or Stroud. J. A. Frates, St. Louis, Mo., Pres.; C. F. Hopkins, Sapulpa, Gen. Mgr.

Ogden, Utah.—Salt Lake and Utah Railway (W. R. Armstrong, Gen. Mgr. & Ch. Engr.), contemplates extension to Payson.

BIDS DESIRED.

Boston, Mass.—See "Miscellaneous."

Brooklyn, N. Y.—Until Nov. 5 (readvertisement) by Public Service Commission, First Dist., 154 Nassau Street, New York (Travis H. Whitney, Secy.) for construction of station finish for 11 stations on the Broadway-Fourth Avenue Rapid Transit Railroad, Borough Brooklyn.

New York, N. Y.—Until Nov. 12, by Public Service Comn. for First Dist. (T. H. Whitney, Secy.), 154 Nassau Street, for installation of tracks for a portion of Steinway Tunnel Rapid Transit Railroad, to be known as Steinway Tunnel Extension, Astoria Line and Corona Line, in Borough of Queens.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Philadelphia, Pa.**—Contract reported awarded by the Department of City Transit to McClintic-Marshall Company, Morris Building, for erecting the steel superstructure of three of the sections of the Frankfort Elevated line extending from Girard Avenue North to Unity Street, Frankfort, at $1,455,000 (bids opened Oct. 19).

★**Newton, Kan.**—Contract for constructing Newton, Kansas & Nebraska Ry. (S. O. Waddell, Ch. Engr., Newton), through Harvey, McPherson, Dickinson, Saline, Clay and Washington Counties, awarded to Newton Constr. Co., Newton.

★**Philadelphia, Pa.**—Following are unit figures of bids opened Oct. 19 by Department of City Transit for Contract 518 (grouping contracts 512, 513 and 514, steel superstructure and appurtenant work in Front Street, Kensington Avenue and Frankford Avenue from south of Girard Avenue to south of Unity Street)—(a) McClintic-Marshall Co., Morris Building, $1,476,555 (awarded contract); (b) E. E. Smith Contracting Co., 101 Park Avenue, New York, $1,744,586; (c) The Conners Brothers Company, Inc., 64 West Eighty-eighth Street, New York, $1,706,485:

	*(a)	(b)	(c)
10,000 lb. riveted steel girders	$0.0315	$0.0425	$0.04
10,000 lb. rolled steel beams	0.029	0.0425	0.04
10,000 lb. steel columns	0.04	0.0425	0.04
10,000 lb. steel rods	0.04	0.03	0.035
10,000 lb. iron castings	0.025	0.04	0.05
100 cu. yd. excavation	1.25	2.00	2.00
100 cu. yd. concrete	10.00	8.00	7.50
100 sq. yd. asphalt paving	4.50	2.50	3.00
100 sq. yd. new granite block paving	4.50	4.00	3.50
100 sq. yd. new vitr. block paving	4.50	3.00	3.00
100 sq. yd. new wood block paving	4.50	4.00	3.50
100 sq. yd. granite, wood or vitr. block repaving, concrete base	2.25	4.00	2.25
100 sq. yd. granite, wood or vitr. block repaving, gravel base	2.00	3.00	1.50
100 sq. yd. granolithic sidewalk paving	1.50	2.00	1.50
100 sq. yd. flagstone sidewalk repaving	0.75	3.00	1.00
100 sq. yd. brick sidewalk paving	1.00	2.00	3.00
100 lin. ft. 6-in. straight granite curb	1.00	1.50	3.25
100 lin. ft. 8-in. straight granite curb	1.20	2.50	3.50
100 lin. ft. 6-in. or 8-in. curved granite curb	2.25	3.00	4.00
100 lin. ft. granolithic curb	0.55	1.00	0.80
100 lin. ft. resetting stone curb	0.50	0.60	0.30
1 M ft. yellow pine lumber	55.00	40.00	65.00

Force account, $10,000: (a) 12½ per cent, (b) 15 per cent, (c) 10 per cent.

Channel Work—Chicago, Ill.—The following are the unit figures of the four lowest bidders opened Oct. 21 by the Trustees Sanitary District of Chicago for Contracts 12 and 14 of the Calumet Sag Channel:

Contract Section 12—(a) James O. Heyworth, Chicago, $720,170. (b) Walsh Construction Co., Davenport, Iowa, $741,616; (c) The Thomas McCarthy Co., Chicago, $794,340; (d) A. Guthrie & Co., Inc., St. Paul, Minn., $795,490.

	(a)	(b)	(c)	(d)
[illegible] cu. yd. glacial drift	$0.254	$0.3325	$0.36	$0.33
[illegible] cu. yd. glacial drift at B. & O.-C. T. W. crossing	0.254	0.35	0.54	0.59
[illegible] cu. yd. glacial drift at Rock Island crossing	0.254	0.35	0.52	0.59
[illegible] cu. yd. solid rock	0.80	0.84	0.85	0.90
[illegible] cu. yd. solid rock at B. & O.-C. T. W. crossing	0.50	1.75	2.00	1.75
[illegible] cu. yd. solid rock at Rock Island crossing	0.50	1.75	2.00	1.75
[illegible] sq. ft. channeling	0.40	0.35	0.30	0.30
[illegible] sq. ft. riprap slopes	2.00	1.25	0.50	1.50
[illegible] cu. yd. No. 1 concrete	7.50	7.40	6.50	6.50
[illegible] cu. yd. No. 1 concrete at B. & O.-C. T. W. crossing	7.50	7.40	6.50	7.10
300 cu. yd. No. 1 concrete at Rock Island crossing	7.50	7.40	6.50	7.10
[illegible] cu. yd. No. 2 concrete	6.75	4.60	5.00	5.10
[illegible] cu. yd. No. 2 concrete at B. & O.-C. T. W. crossing	4.75	5.50	5.75	5.60
5,000 cu. yd. No. 2 concrete at Rock Island crossing	5.15	5.75	5.75	5.60
80 cu. yd. mixing concrete	12.00	8.00	7.00	8.00
40 cu. yd. grouting concrete	15.00	8.00	14.00	9.00
5,400 cu. ft. concrete foundation columns	0.70	0.60	0.60	0.55
[illegible] cu. ft. concrete cylinders at Rock Island crossing	0.90	0.90	0.60	0.55
725 lin. ft. concrete casing	2.50	3.00	1.00	1.60
[illegible] lb. reinforcing metal	0.035	0.0275	0.0325	0.035
[illegible] sq. yd. monolithic pavement	1.25	1.00	1.50	1.10
[illegible] sq. yd. timber sidewalk	0.60	0.20	0.75	1.00
Erection of Ann Street Bridge (lump sum)	3,410.00	3,390.00	1,500.00	3,100.00
Erection of Western Avenue Bridge (lump sum)	5,475.00	5,050.00	2,000.00	5,000.00
Erection of Chicago Street Bridge (lump sum)	3,410.00	3,640.00	1,500.00	3,100.00
Erection of Division Street Bridge (lump sum)	3,680.00	4,000.00	1,500.00	3,300.00
Stony Creek Timber Dome (lump sum)	10,260.00	10,800.00	10,000.00	10,000.00

Contract Section 14—(a) A. Guthrie & Co., Inc., St. Paul, Minn., $829,822; (b) James O. Heyworth, Chicago, $844,644; (c) Webster Brothers Co., Minneapolis, Minn., $861,936; (d) Flick Construction Co., Chicago, Ill., $868,908.

	(a)	(b)	(c)	(d)
[illegible] cu. yd. glacial drift	$0.2825	$0.247	$0.31	$0.31
[illegible] cu. yd. solid rock	0.80	0.80	0.75	0.78
[illegible] sq. ft. channeling	0.75	0.40	0.37	0.33
[illegible] sq. yd. riprap slopes	1.50	2.50	2.00	1.25
[illegible] cu. yd. No. 1 concrete	6.40	7.50	6.25	7.90
[illegible] cu. yd. No. 2 concrete	5.00	5.00	4.85	5.00
[illegible] cu. yd. coping concrete	8.00	12.00	12.00	11.00
[illegible] cu. ft. concrete foundation columns	0.65	0.70	0.90	0.75
[illegible] lin. ft. concrete casing	1.60	2.80	3.25	3.75
[illegible] lb. reinforcing metal	0.03	0.035	0.03	0.0325
[illegible] lin. ft. roadway construction	2.50	2.60	3.00	2.70
Ashland Avenue Bridge (fabrication and erection) (lump sum)	7,500.00	8,400.00	7,500.00	8,154.00
Controlling Works Rd. Bridge (fabrication and erection) (lump sum)	2,400.00	2,800.00	2,500.00	2,588.00
Controlling Works Foot Bridge (fabrication and erection) (lump sum)	1,400.00	1,600.00	1,500.00	1,400.00
Sector gates and collateral work (fabrication and erection) (lump sum)	75,000.00	80,000.00	80,000.00	78,040.00
Miscellaneous work collateral to the controlling works (lump sum)	2,500.00	2,742.00	2,500.00	2,247.00
Miscellaneous work for transformer house and sewage discharge chamber (lump sum)	5,000.00	4,400.00	3,700.00	4,957.00
Electrical equipment (lump sum)	15,000.00	16,500.00	15,600.00	17,068.00
[illegible] lin. ft. 8'-0" concrete sewer	22.00	14,000.00	30.00	28.50
Sewer junctions (lump sum)	1,800.00	3,000.00	3,750.00	2,995.00
Additional structural steel (per lb.)	0.06	0.06	0.0475	0.05
Additional machinery, steel and iron (per lb.)	0.14	0.14	0.10	0.12
Additional steel castings (per lb.)	0.12	0.12	0.08	0.12
Additional iron castings (per lb.)	0.07	0.10	0.07	0.08
Additional bronze and babbitt (per lb.)	0.60	0.60	0.55	0.70

Sections 13 and 14 combined—(a) A. Guthrie & Co., Inc., St. Paul, Minn., $1,[illegible]; (b) Walsh Construction Co., Davenport, Iowa, $1,622,062; (c) Flick Construction Co., Chicago, $1,644,325; (d) Great Lakes Dredge & Dock Co., Chicago, $[illegible].

	(a)	(b)	(c)	(d)
[illegible] cu. yd. glacial drift	$0.289	$0.24125	$0.335	$0.39
[illegible] cu. yd. glacial drift at B. & O.-C. T. W. crossing	0.538	0.35	0.52	0.39
[illegible] cu. yd. glacial drift at Rock Island crossing	0.59	0.35	0.60	0.39
[illegible] cu. yd. solid rock	0.80	0.84	0.85	0.90
[illegible] cu. yd. solid rock at B. & O.-C. T. W. crossing	1.50	1.75	2.00	0.99
[illegible] cu. yd. solid rock at Rock Island crossing	1.50	1.75	2.50	0.99
[illegible] sq. ft. channeling	0.25	0.35	0.30	0.30
[illegible] cu. yd. riprap slopes	1.50	1.25	1.25	1.50
[illegible] cu. yd. No. 1 concrete	6.00	7.20	7.75	10.00
[illegible] cu. yd. No. 1 concrete at B. & O.-C. T. W. crossing	7.00	7.40	9.25	10.00
[illegible] cu. yd. No. 1 concrete at Rock Island crossing	7.00	7.40	9.25	10.00
[illegible] cu. yd. No. 2 concrete	4.60	4.60	4.83	4.90
[illegible] cu. yd. No. 2 concrete at B. & O.-C. T. W. crossing	5.50	5.50	7.50	4.90
1,000 cu. yd. No. 2 concrete at Rock Island crossing	5.60	5.75	7.50	4.90
[illegible] cu. yd. mixing concrete	8.00	7.40	11.00	10.00
[illegible] cu. yd. grouting concrete	5.00	8.00	12.00	12.00
[illegible] cu. ft. concrete foundation columns	0.55	0.60	0.75	0.50
[illegible] cu. ft. concrete cylinders at Rock Island crossing	0.75	0.90	1.00	0.60
[illegible] lin. ft. concrete casing	1.40	3.00	2.75	3.00
[illegible] lb. reinforcing metal	0.03	0.0275	0.0325	0.02
[illegible] sq. yd. monolithic pavement	1.10	1.00	1.25	2.00
[illegible] sq. yd. timber sidewalk	1.00	0.20	1.00	0.65
Erection of Ann Street Bridge (lump sum)	2,100.00	2,390.00	2,410.00	3,700.00
Erection of Western Avenue Bridge (lump sum)	5,800.00	5,050.00	5,478.00	5,975.00
Erection of Chicago Street Bridge (lump sum)	2,700.00	3,640.00	3,410.00	3,750.00
Erection of Division Street Bridge (lump sum)	3,200.00	4,000.00	3,680.00	4,000.00
Stony Creek Timber Dome (lump sum)	16,000.00	10,800.00	9,500.00	9,900.00
[illegible] lin. ft. sundry construction	2.50	2.60	2.70	1.00
Ashland Avenue Bridge (fabrication and erection) (lump sum)	7,500.00	8,850.00	8,154.00	8,500.00
Controlling Works Rd. Bridge (fabrication and erection) (lump sum)	2,400.00	2,675.00	2,588.00	2,775.00
Controlling Works Foot Bridge (fabrication and erection) (lump sum)	1,400.00	1,870.00	1,400.00	1,500.00
Sector gates and collateral work (fabrication and erection) (lump sum)	76,000.00	96,440.00	78,040.00	78,000.00
Miscellaneous work collateral to the controlling works (lump sum)	2,500.00	2,780.00	2,247.00	4,500.00
Miscellaneous work for transformer house and sewage discharge chamber (lump sum)	5,000.00	6,215.00	4,957.00	3,390.00
Electrical equipment (lump sum)	15,000.00	15,458.00	17,068.00	18,470.00
[illegible] lin. ft. 8'-0" concrete sewer	22.00	35.00	28.50	70.00
Sewer junctions (lump sum)	1,800.00	2,900.00	2,995.00	2,650.00
Additional structural steel (per lb.)	0.06	0.06	0.05	0.06
Additional machinery, steel and iron (per lb.)	0.14	0.15	0.12	0.15
Additional steel castings (per lb.)	0.12	0.12	0.12	0.11
Additional iron castings (per lb.)	0.07	0.08	0.08	0.06
Additional bronze and babbitt (per lb.)	0.60	0.60	0.70	1.00

RAILROADS

PROPOSED WORK.

Tulsa, Okla.—J. A. Prates of Springfield, Mo., is reported president of Sapulpa & Oil Fields R.R. Co., with headquarters at Tulsa, which proposes constructing a railroad between Drumright to some point on the Frisco west of Tulsa.

Seattle, Wash.—Reported Northern Pacific R.R. Co. (W. L. Darling, Ch. Engr., St. Paul, Minn.) will soon construct a 1000-ft. pile trestle connecting present right-of-way with the Plummer Street grade; cost $25,000.

Bend, Ore.—Reported Oregon, California & Eastern Ry. has been incorporated with F. B. Ellis, Pres., and William Miller, Secy., and will build a line from Bend, Crook County, to Lakeview, Lake County, with branch lines. Main office of the company to be Carson City, Nev.

BIDS DESIRED.

London, England.—Until Nov. 17 by Peter McBride, Agent General for Victoria, Melbourne Place, Strand, London, W. C., England, for "Contract L 6," furnishing and delivering 768 copper tubes 15 ft. 2¾ in. long and 5 5/16 in. x 6 B. W. G., and 396 copper tubes 13 ft. 7½ in. long x 5 1/16 in. x B. W. G., advertised in Engineering Record. John Coates & Co., Ltd., Consulting Engineers, 115 Victoria Street, London, S. W.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Philadelphia, Pa.—See "Bridges."

PUBLIC BUILDINGS AND SCHOOLS

PROPOSED WORK.

Eastport, Me.—Building Committee appointed, of which the Mayor is a member, to erect Shead High School; probable cost $35,000.

New London, Conn.—Contract soon to be let for erecting three-story and basement, stone dormitory for Connecticut College for Women. Ewing & Chappell, Archts., 101 Park Avenue, New York, N. Y.

Brooklyn, N. Y.—Plans filed for 5-story brick school to be erected at Wilson Street and Bedford Avenue for city of New York, cost $100,000. C. J. B. Snyder, Archt., 500 Park Avenue, New York City.

Trenton, N. J.—All bids opened Oct. 19 for erecting laboratory for Department of Conservation and Development have been rejected, being in excess of the appropriation. Alfred Gaskill, Director.

Abington, Pa.—Bissell, Sinkler & Tilden, Bailey Building, Philadelphia, are architects for proposed nurses' home for Abington Memorial Hospital.

Wilkinsburg, Pa.—Ingham & Boyd, Vandergrift Building, Pittsburgh, selected to prepare plans for two-story fireproof school to be erected at Wallace and Center Streets; cost $30,000.

Farnhurst, Del.—Reported Governor at Dover has sold $60,000 bonds for improvements to State Hospital at Farnhurst.

Washington, D. C.—Naval Consulting Board reported to have recommended erecting naval research and experimental laboratory; cost approximately $5,000,000 for buildings and equipment.

Florence, S. C.—School bonds reported sold. W. J. Wilkins of Florence preparing plans.

Jacksonville, Fla. — School bonds amounting to $500,000 sold. Plans being prepared as follows: By Mark & Sheftall, Clark Building, for South Jacksonville School, 16 rooms, cost about $90,000; M. C. Greeley, 1905 Oak Street, West Riverside School, 12 rooms, cost about $75,000; H. J. Klutho, St. James Building, Panama Park School, 8 rooms, cost about $60,000, and wing to West Riverside School, cost about $50,000; Rutledge Holmes, Duval Building, New Springfield School, 8 rooms, cost about $60,000, and R. A. Benjamin, Bisbee Building, Northeast Springfield School, 8 rooms, cost about $50,000, and wing to West Springfield School, cost about $50,000.

Batavia, Ohio.—School bonds amounting to $30,000 reported sold.

Dayton, Ohio—School Board considering erecting new school on Whittier site, at Essex Street and Chapel Road, Edgemont.

Fremont, Ohio.—Erection of Sandusky County Memorial Hospital contemplated here; cost about $100,000.

Somerville, Ohio.—School bonds for $32,500 will be sold Nov. 6 by F. W. Peter, Clk. Somerville Village Bd. Educ.

Toledo, Ohio.—Erection of fireproof addition to Toledo Hospital contemplated; probable cost $60,000.

Huntington, Ind.—Tentative plans prepared by Elmer E. Dunlap, State Life Bldg., Indianapolis, for proposed high school.

Warsaw, Ind.—School Board contemplates erecting new $40,000 grade school.

Detroit, Mich.—Erection of five or six-story school to cost $350,000 being considered. Dr. Chadsey, Supt. of Schools.

Springfield, Ill.—The detailed plans prepared by W. B. Ittner of St. Louis, Mo., and George H. Helmle of Springfield for the proposed high school have been submitted to the Board of Education; cost $400,000.

Harry Reiger of Springfield selected to prepare plans for the Dubois School; approximate cost $75,000.

Reported plans being laid for a $1,000,000 Centennial Memorial Building to be erected in 1918. Senator E. S. Smith of Springfield member of the Centennial Building Committee.

Alta, Iowa—Plans being prepared by Smith & Keffer, Youngerman Bldg., Des Moines, for proposed consolidated school at Alta; probable cost $80,000.

Claremont, Minn.—All bids opened recently by School Board for remodeling old building and erecting an addition have been rejected as being too high. Bids will be asked again for the remodeling, but the erection of the addition will be postponed for the present.

Lafayette, Minn.—Citizens of Lafayette School District have voted $500,000 for erecting a school.

Carthage, Mo.—Bonds for $100,000 reported to be sold Nov. 11 by L. M. Thomas, Co. Clk., for sanitarium.

Corsicana, Texas—Citizens voted $125,000 bonds for school improvements.

Gainesville, Tex.—Plans approved for two dormitories to be erected at State Industrial School for girls; cost $50,000.

Bellingham, Wash.—Reported contract soon to be let for erecting proposed concrete and brick Central High School; cost $75,000. Heath & Gove, Archts., National Realty Bldg., Tacoma.

Red Bluff, Cal.—Citizens voted $90,000 bonds for erecting new high school, plans for which have been prepared.

BIDS DESIRED.

Danvers, Mass.—Until Nov. 5 by Board Trustees, Independent Agricultural School (James C. Poor, Pres.), at office County Commissioners at Salem, for erecting school at farm of said school in Hathorne, Danvers. John H. Bickford Co., Archts., 110 State Street, Boston.

Fort Terry, N. Y.—Until Nov. 26 by Constructing Quarter Master, Fort H. G. Wright, N. Y., for constructing double set officers quarters at Fort Terry, advertised in Engineering Record.

Napanoch, N. Y.—Until Nov. 13 by State Board Managers of Reformatories, at Elmira Reformatory, Elmira, for furnishing structural steel and interior steel sash for hospital at Eastern Reformatory at Napanoch, advertised in Engineering Record. Lewis F. Pilcher, State Architect, Albany.

Lebanon, Pa.—Reported desired until Nov. 3 by J. H. Selzer, Secy. Bd. Educ., for erecting high school at Sixth and High Streets. Separate bids will be received for plumbing and electric work. A. A. Richter, Archt., Reading.

Pittsburgh, Pa.—Until Nov. 9, by Hyatt M. Cribbs, Co. Controller, and Robert Swan, Dir. Dept. Pub. Wks., for plastering, imitation stone, metal lathing and furring; bronze work; hollow metal doors; interior marble work; structural glass; tile work, etc., for new City and County building. Edward B. Lee and Palmer, Hornbostle & Jones, 345 Fourth Avenue, Pittsburgh, Archts.

Until Nov. 10 by Hyatt M. Cribbs, Co. Controller, and Robert Swan, Dir. Dept. Pub. Wks., for rough carpentry work, cabinet work and setting, etc., for new city and county building. Edw. B. Lee and Palmer Hornbostel & Jones, 345 Fourth Avenue, Pittsburgh, Archts.

Pittsburgh, Pa.—Until Nov. 11, by Hyatt M. Cribbs, Co. Contro.ler, and Robt Swan, Dir. Dept. Pub. Wks., for vault doors; electric elevator and lifts; mail chutes; sidewalks and paving of new County and City Building. Edw. B. Lee and Palmer, Hornbostel & Jones, Archts., 345 Fourth Avenue, Pittsburgh.

Somerville, O.—Until Nov. 20, by F. W. Peter, Clk. Bd. Educ., for furnishing material and erecting fireproof school. E. J. Mountstephen, Archt., U. B. B.dg., Dayton.

Bloomington, Ind.—Until Dec. 1 by Board of Trustees (John W. Craverns, Secretary), at office of R. P. Daggett & Co., Architects, 956 Lemcke Annex, Indianapolis, for erecting a gymnasium at Indiana University, Bloomington, advertised in Engineering Record.

Muskegon, Mich.—Until Nov. 29 by James A. Wetmore, Superv. Archt., Washington, D. C., for extension, remodeling, etc., U. S. Post Office and Court house at Muskegon.

Chicago, Ill.—Until Nov. 1 by Theo. B. Sachs, M.D., Chmn. Bd. Dir. Municipal Tuberculosis Sanitarium, for furnishing masonry, carpentry, sewerage, gas and plumbing, sheet metal and tile roofing, electrical work, etc., for Superintendent's residence of said hospital, at North Crawford and Bryn Mawr Avenues. Otis & Clark Archts., 6 N. Michigan Avenue.

Lincoln, Ill.—Until Nov. 15 by Frank D. Whipp, Fiscal Superv. Bd. Administration, Springfield, for erecting employees building to replace one recently destroyed by fire at Lincoln State School and Colony.

St. Paul, Minn.—Until Nov. 16 by Secy. Bd. Control for erecting Minnesota Historical Society fireproof building, including ventilating, heating and electrical work; probable cost $500,000. C. H. Johnston, State Archt., St. Paul.

Austin, Tex.—Until Nov. 2, by C. H. Page & Bro., Archts., Austin, for erecting and completing an auditorium building for Deaf and Dumb Institute.

Brenham, Tex.—Until Nov. 27, by Jas. A. Wetmore, Superv. Archt., Washington, D. C., for construction complete (including mechanical equipment and approaches) (except roof) U. S. post office at Brenham.

Fort Bliss, Tex.—Until Nov. 27 by Constructing Quartermaster, El Paso, for erecting a rear annex to the hospital at Fort Bliss, advertised in Engineering Record.

Salem, Ore.—Until Nov. 15 (readvertisement) by Dept. Interior, Office of Indian Affairs, Washington, D. C. (Cato Sells, Comr.), for erecting addition to brick Assembly Hall, Salem School. For further information address Superintendent of Salem School.

Pearl City, Hawaii.—Until Nov. 27 at Naval Station, Pearl Harbor, Hawaii, and Bureau Yards and Docks, Navy Dept., Washington, D. C. (H. R. Stanford, Ch.), for constructing reinforced concrete power house and reinforced concrete operating building and a wooden double quarters for chief operators at Naval Station Pearl Harbor.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Boston, Mass.—Following are the bids opened Oct. 19 by the schoolhouse department, Boston, for erecting an addition to the High School of Practical Arts, Roxbury; John J. Flynn, 319 Washington Street, Boston, $69,736; McNeil Construction Co., Boston, $72,731.

The following are lowest bids opened Oct. 15 by the Supervising Architect, Washington, D. C., for the construction, except mechanical equipment, of U. S. Appraiser's Stores Building; George A. Fuller Co., 111 Broadway, New York, for foundation, waterproofing sea wall, etc., $149,890; Laurance J. Rice, 405 Lexington Avenue, New York, $249,200, for superstructure and approaches; P. J. Carlin Construction Co., 1123 Broadway, New York, $611.000 for the entire work.

★**Syracuse, N. Y.**—Contract for erecting the industrial grammar school on the site of the old Delaware School reported awarded by Bd. Educ. as follows: Erecting, including excavating, masonry, steel and carpenter work to Onondaga Building & Construction Co., Syracuse, at $201,458; plumbing, P. J. Sullivan Co., Inc., Syracuse, at $13,990; heating and ventilating, J. R. Shean Co., Schenectady, at $36,985.

Newark N. J.—Lowest bid opened Oct. 21 by Bd. Street and Water Commissioners for erecting a meter repair and testing station at South Eighth and Fourteenth Avenue submitted by Essex Construction Co., Newark, at $19,390.

★**Trenton, N. J.**—Following are four lowest bids opened Oct. 20 by Board Managers N. J. State Hospital for erecting an admission building at said hospital: George B. Wills Co., Inc., 101 Park Avenue, New York, N. Y., $42,887 (awarded contract); De Kimpe Construction Co., 70 Hudson Street, Hoboken, $44,900; Metzger & Fisher, Denckla Building, Philadelphia, Pa., $44,936; Henry L. Brown, 1714 Sansom Street, Philadelphia, Pa., $47,787. Contract for electrical work awarded Strang Electric Co., Philadelphia, at $4,024; heating, to Piper Bros., Trenton, at $4,840; also plumbing, at $6,490. Samuel T. Atchley, Warden.

Wildwood, N. J.—Reported lowest bid received by Bd. of Educ. for erecting two-story brick and stone school submitted by W. A. Richman of Moorestown. Clyde S. Adams, Archt., 1233 Arch Street, Philadelphia, Pa.

★**Pittsburgh, Pa.**—Finance Com. and Property and Supplies Com. of Bd. of Educ. recommend contract for erecting foundation of Westinghouse High School be awarded William J. Payne, Jr., Co., 7 Beltzhoover Avenue, at $39,504.

★**Sayre, Pa.**—Contract for erecting two-story reinforced concrete, brick and tile building for Robert Parker Hospital (H. E. Bishop, Supt.) awarded as follows: Masonry and carpentry, to Corning Building Co., Corning, N. Y., at $37,000; plumbing and heating, to B. G. Carpenter Co. of Wilkes-Barre, at $11,000. Gibb & Waltz, Archts, Ithaca, N. Y.

Norton, Va.—The following are the four lowest bids opened Oct. 19 by Supervising Architect, Washington, D. C., for constructing complete U. S. Post Office: (a) Limestone, (b) sandstone: Richardson & Burgess, Washington, (a) $58,331; E. T. Abbott Construction Co., New York, (a) $58,400, (b) $59,990; J. L. Crouse, Greensboro, N. C., (b) $61,500; Westchester Engineering Co., White Plains, N. Y., (a) $66,897, (b) $61,500; James Devault, Canton, Ohio, (b) $61,060; King Lumber Co., Charlottesville, Va., (a) $58,700.

★**Roanoke, Va.**—Contract for erecting one-story and basement auditorium and convention hall awarded C. H. Turner, Roanoke, at about $41,275. H. M. Miller, Archt., Roanoke.

Wilkesboro, N. C.—The following are the four lowest bids opened by the Supervising Architect, Washington, D. C., for erecting the U. S. Post Office: Richardson Engineering & Construction Co., Bainbridge, Ga., $52,600; King Lumber Co., Charlottesville, Va., $54,700; J. S. Rogers Co., Forrestown, N. J., $56,945; Richardson & Burgess, Washington, D. C., $57,991.

★**Louisville, Ky.**—Contracts awarded by Bd. of Educ. for erecting additions to colored High School, at Eighth and Chestnut Streets, as follows: General construction, Modern Bldg. Co., Louisville, $42,398; heating and ventilating, W. C. Boyd & Co., $9,779.

Logan, Ohio—Following are the four lowest bids opened Oct. 14 by the Supervising Architect, Washington, D. C., for erecting the U. S. Post Office: (a) Limestone, (b) sandstone: A. W. Lane, 19 South La Salle Street, Chicago, (a) $42,820; Colonial Construction & Supply Co., Charlotteville, Va., (a) $43,900, (b) $44,900; J. S. Rogers Co., Morristown, N. J., (a) $43.150, (b) $44.150; George W. Stiles Construction Co., Rookery Building, Chicago, (a) $43.283; The Ohio Building & Construction Co., Cincinnati, (b) $45,200; Charles W. Gindele Co., 3333 La Salle Street, Chicago, (b) $45,500.

★**Oxford, Ohio**—Contract awarded by Bd. Trus. for erecting central pavilion of Ohio State Normal College at Miami University (bids opened Oct. 19) to Sims & Bensing, of Hamilton, at $40.000. Frank L. Packard, Archt., New Hayden Bldg., Columbus.

★**Washington, Ind.**—Contract for erecting city hall (bids opened Oct. 19) awarded T. Frank Willis, Vincennes.

★**Dixon, Ill.**—Contract for erecting three buildings, cold storage, laundry and bakery, at the State Colony for Epileptics awarded by State Board of Administration, Springfield, to A. B. Krauel of Danville at $73.000. and power house to W. M. Allen & Sons of Peoria at $48,000.

★**Geneva, Ill.**—Contract for erecting grade school awarded to C. W. Karr of Clinton, at $29.033; heating to American Furnace and Foundry Company, Bloomington, at $4200, and plumbing to S. Wood & Co., Geneva, at $2600. C. W. Bailey, Secretary Board of Education.

★**Monmouth, Ill.** — Contract awarded English Brothers Construction Co. of Champaign, for erecting City Hall at $37,500.

★**Rock Island, Ill.**—Contract for erecting school at Ninth Street and Thirteenth Avenue, awarded by Board of Education to Building Construction Co. of Chicago, at $61,970.

★**Rock Rapids, Iowa.**—Contract awarded by Bd. of Supervisors for erecting Lvon County Court House to A. M. Wold Constr. Co., Brookings, S. D., at $107,300. Joseph Schwartz, Archt., Sioux Falls, S. D.

★**Brookings, S. D.**—Contract for erecting women's dormitory and pavilion at the State College awarded A. M. Wold Construction Co. of Brookings, at about $75,000, including heating, lighting, etc.

★**Denton, Tex.**—Contract awarded Gilsonite Construction Company, Dallas, for erecting a three-story fireproof, brick and tile building at College Industrial Arts (bids opened Oct. 19). Cost, including equipment, about $100,000. Endress & Watkin, Austin, Archts.

★**Tulsa, Okla.**—Contract for erecting U. S. Post Office awarded M. Yeager & Son, Danville, Ill., at $184,856.

★**Oakland, Cal.**—Following are the four lowest bids opened Oct. 6 by Charles S. Green, Librarian, for erecting Melrose Branch Library: C. Christensen, Oakland, $29.145 (awarded contract); McLaran & Peterson, San Francisco, $29,265; Williams Brothers & Henderson, San Francisco, $29,275; W. G. Thornalley, Oakland, $29.375 Contract for heating and ventilating awarded Seibert Co., San Francisco, at $1,451.

PRIVATE BUILDINGS

PROPOSED WORK.

Chicopee, Mass.—See "Prices and Lettings."

Lynn, Mass.—J. J. Lippitt, 39 Newhall Street, will erect two-story fireproof apartment house at 124 Green Street; estimated cost $110,000.

Brooklyn, N. Y.—Plans filed for following buildings: Two 4-story brick tenements to be erected at Ridge Boulevard and Bay Ridge Avenue for Ridge Boulevard Constr. Co., cost $120,000. Shamnan & Shampan, Archts., 722 Broadway, Brooklyn.

Plans filed for six-story apartment building to be erected at 338 South First Street, for M. B. Evans, 739 Flushing Avenue; estimated cost $45.000. Shampan & Shampan, Archts., 772 Broadway, Brooklyn.

New York, N. Y.—Plans filed for erection of following buildings: Six-story brick apartment house at 172d Street and Audubon Avenue for Donald Robertson, cost $50.000, Schwartz & Gross, Archts., 347 Fifth Avenue; 5-story brick tenement at Wilkins Avenue and Crotona Park East for Foxvale Realty Co., cost $50,000, Kreymborg Architectural Co., Archts., 1029 East 163d Street; 5-story brick tenement at Grant Avenue and 165th Street for Arthur Avenue Realty & Constr. Co., cost $100,000, William A. Faiella, 2398 Lorillard Place, Archt.; alterations to 3-story brick livestock storage at 615 West Fifty-ninth Street for New York Central R. R. Co., cost $52,000, Kemper Peabody, 470 West Thirtieth Street, Archt.

Duquesne, Pa.—Pennsylvania Railroad (Alex. C. Shand, Ch. Engr., Philadelphia) is considering constructing passenger and freight stations here on Monongahela Division, but nothing definite has been done about the matter.

Wilmington, Del.—Contract soon to be let by John D. Thompson, Jr., Archt., Ford Building, for erecting three-story brick and terra cotta lodge building for B P. O. Elks, No. 307.

Huntington, W. Va.—Huntington Tobacco Warehouse Co. will erect brick, wood and concrete, 160 x 160 ft., storage warehouse.

Anniston, Ala.—L. M. Weathers Co., Randolph Building, Memphis, Tenn., engaged to prepare plans for seven-story and basement temple and office building contemplated by Masons.

Samburg, Ky.—Dan S. Atkerson of Samburg reported interested in erection of hotel at Shawes Garden, Samburg; probable cost $25,000.

Cleveland, Ohio.—Plans filed for three-story store and apartment building to be erected at 6200 Superior Avenue for J. R. Swirsky, 5118 Woodland Avenue; cost $30,000. S. H. Weis, Archt., Schofield Building.

Fulton & Taylor, Hippodrome Bldg., are architects for proposed 8 and 12-story, brick, steel and reinforced concrete warehouse to be erected at West Ninth Street and Main Avenue, for West Ninth Street Terminal Co.; a 4-story office building is also to be erected; total cost $2,000,000.

Plans filed for three-story brick and terra cotta tenement to be erected at 10701 Lee Road, for H. L. Shifrin, 2333 East Sixty-third Street; cost $27.000. S. H. Weis, Archt., Schofield Building.

Fremont, Ohio.—Sum of $25,000 has been donated for a site for Y. M. C. A. building.

Tiffin, Ohio.—First Presbyterian Church will erect combined church and parish house on East Perry Street; cost $50,000. Rev. George Douglass Young, Pastor.

Toledo, Ohio. — Evangelical Reformed Church intends erecting Home for Aged; probable cost $30.000. Langdon & Hohly, Archts., Nicholas Building. Dr. Frederick W. Kratz, Pastor of Salem Reformed Church, Toledo, may be able to give further information.

Warren, Ohio—Erection of addition to First Presbyterian Church contemplated; cost approximately $55,000.

Youngstown, Ohio—Meade & Hamilton, 1002 Garfield Bldg., Cleveland, are architects for proposed residence on Oriole Farm for John A. Logan; probable cost $25,000.

Detroit, Mich.—Plans being prepared for five-story mercantile building to be erected at Michigan and Second Avenues for Wolf Bros., 179 Michigan Avenue.

Chicago, Ill.—The Cadillac Automobile Company, 2301 South Michigan Avenue (Charles H. Foster, president), intends erecting at Indiana Avenue and Twenty-third Street an 8-story fireproof building, to cost $200,000.

Reported the Union Petroleum Co., 14 E. Jackson Avenue, intends erecting on Forty-third Street and Western Avenue a two-story building costing $150,000.

DeForrest A. Matteson, 127 N. Dearborn Street, intends erecting apartment building on Broadway and Montrose Avenue; probable cost $250,000.

Decatur, Ill.—The members of the Moose Club propose erecting a club house costing $40,000.

Jacksonville, Ill.—The Jacksonville Railway & Power Co. reported contemplates erecting a car storage terminal and water storage plant.

Springfield, Ill.—The Illinois Federation of Labor plans erecting a labor temple to cost $75,000.

Urbana, Ill.—Reported the University Congregational Church, Matthews Avenue and California Street, considering erecting a $45,000 church.

Beloit, Wis.—International Mausoleum Company, 38 S. Dearborn Street, Chicago, Ill., will erect a Bedford stone and marble mausoleum in the city cemetery to cost about $75,000.

Milwaukee, Wis.—Leenhouts & Guthrie, 424 Jefferson Street, are architects for four-story and basement reinforced concrete and brick apartment house to be erected on Sixteenth Street and Grand Avenue for Jefferson Realty Co.; cost about $80,000.

Plans being prepared by H. L. Lotter, 304 W. Water Street, for erecting brick and reinforced concrete moving picture theater at 155 Third Street for O. L. Meister, 2704 Chestnut Street; cost about $50,000.

Virginia, Minn.—Erection of parochial school at Cleveland Avenue and Poplar Street, contemplated for St. John the Baptist's Polish Catholic Church; estimated cost $25,000.

Minneapolis, Minn.—Reported Chevrolet Company will erect an assembling plant here. B. E. Stimson, 434 Ridgewood Avenue, of the Minnesota Motor Company, represents this firm.

Dorr & Dorr, Lumber Exchange, are architects for a two-story brick store and apartment house to be erected on Nicolet Avenue and Twelfth Street, for Barrett & Zimmerman; estimated cost $50,000.

Hardin, Mont.—T. J. Daniels of Hardin reported interested in erecting two-story brick hotel here; cost about $50,000.

Seattle, Wash.—Reported W. H. Ballard, American Bank Building, intends erecting four-story steel and concrete office building on Second Avenue and University Street; probable cost $75,000.

San Francisco, Cal.—Plans being prepared by Willis Polk & Co., Merchants Exchange Building, for 12-story building to be erected at Pine and Montgomery Streets for McCreery Estate (J. R. Cashman, Secy.), 221 Sansome Street; probable cost $350,000.

Bonners Ferry, Idaho.—G. W. Spoerry contemplates erecting brick, concrete and steel hotel on Main Street; cost $60,000.

BIDS DESIRED.

Danville, Va.—Reported desired until Nov. 1 by Shattuck & Hussy, Archts., 19 S. La Salle Street, Chicago, Ill., for erecting 2-story and basement, 170 x 115 ft., Y. M. C. A., for the Riverside and Dan River Cotton Mills.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Chicopee, Mass.**—Contract for erecting parochial school for St. Stanislaus Polish Church awarded Gagnier & Angiers, 327 Main Street; cost $40,000. A hall in connection with this school costing an additional $40,000 is also to be erected. Bruno Wozny, 381 Main Street, is preparing plans.

★**Buffalo, N. Y.**—Contract awarded Turner Constr. Co., 11 Broadway, New York, for erecting for Robertson Cataract Electric Co. a warehouse and showroom, four stories and basement, 81 x 106 ft., reinforced concrete, terra cotta and brick.

★**New York, N. Y.**—Contract for subway stations along the Jerome Avenue and White Plains Road extension of the present subway awarded Altoria Realty & Construction Co., 3 East Forty-fourth Street. Reported about 23 stations to be constructed at a cost of about $2 000,000.

★**Philadelphia, Pa.**—Contract for erecting city club building awarded A. Raymond Raff of Philadelphia.

★**Harvard, Ill.**—Contract awarded P. J. McCauley of Woodstock for erecting a parochial school at $30,000.

★**Peoria, Ill.**—Contract awarded V. Jobst & Sons of Peoria, for erecting steel and terra cotta seven-story addition to store of Block & Kuhl Co.; cost $150,000.

★**Rockford, Ill.**—Contract for erecting four-story brick and steel building on North Water Street for F. G. Shoudy, awarded Pearce Bros., Rockford, at $25,000.

★**Waco, Tex.**—Contract for erecting building for the Texas Telephone Company awarded J. S. Harrison & Son of Waco; cost about $80,000.

★**Seattle, Wash.**—Contract for erecting five-story, steel and concrete building at Third and Westlake Avenues for Times Publishing Co. awarded A. W. Quist & Co., Hoge Building, at $225,985.

★**Ogden, Utah.**—Contract awarded E. F. Binsmore of Ogden, at $125,000 for erecting a repair shop and car barn at Ogden for the Ogden, Logan and Idaho Railroad Company.

NEW INDUSTRIAL PLANTS

PROPOSED WORK.

Waterbury, Conn.—Waterbury Farrel Foundry Co. contemplates erecting additional mill, two stories, brick and steel construction.

Brooklyn, N. Y.—Plans filed for 3-story brick shop to be erected at Fifty-third Street and First Avenue for E. W. Bliss Co., cost $175,000. Walter Pfaelander, 618 Eleventh Street, Archt.

Utica, N. Y.—Heron Manufacturing Co., 2 Linden Street, contemplates erecting two-story addition to plant; probable cost $100,000.

Newark, N. J.—Clark Reeve Blade Co., 30 Nesbitt Avenue, manufacturer of cutting edges, figures at $50,000, New Jersey Industrial Bureau, 1060 Broad Street, promotes cost factors.

Norristown, Pa.—Plans being prepared by Ermentrout & Wagner, architects and engineers, Fort Dearborn Street, Philadelphia, for a three-story, 40 x 150-ft. brick, steel and concrete factory here to be erected for the Adam Scheidt Brewing Co.; approximate cost, $50,000.

Asheville, N. C.—Reported Asheville Power & Light Co. has been incorporated and will rebuild plant destroyed by fire.

Gainesville, Ga.—Reported H. Clark of Jacksonville, Fla., contemplates erecting $25,000 knitting mill here.

Birmingham, Ala.—Reported American Pipe Co. of East Birmingham, contemplating improvements to plant.

Cleveland, Ohio.—American Steel & Wire Co. reported contemplating improvements including an additional factory.

Toledo, Ohio.—Toledo Machine & Tool Co., 1150 Dorr Street, will erect three-story steel, brick and concrete addition, costing $50,000.

Muskegon Heights, Mich.—Campbell-Wyant & Cannon Co., Muskegon, taking steps to erect $100,000 foundry here.

Springfield, Ill.—Reported Western Cartridge Co. of East Alton will erect powder plant here, cost about $500,000.

Peoria, Ill.—Plans filed for three-story and basement brick factory of sash manufacturing, to be erected at Adams and Maple Streets for Clar Manufacturing Co., 1014 S. Adams Street, estimated cost $40,000. A. W. Harris Architectural Building.

New Richmond, Wis.—The Interstate Power Co. of New Richmond is considering erecting a plant here to cost about $100,000. T. J. Davis, Clear Lake, Iowa, of Consultant.

St. Paul, Minn.—Contract soon to be let by the Merchants Co-operative Exchange, 20 Palmer Bldg., for erecting the St. Paul produce exchange according to plans by Tuttle Engineering Co., 1400 Pioneer Bldg.

Seward, Alaska.—J. T. Frank of Cordova is commissioning erecting $100,000 cement plant here.

Chatham, Ont.—Reported Dominion Sugar Co. of Wallaceburg will erect $1,000,000 beet sugar factory here.

BIDS DESIRED.

Wilkesbarre, Pa.—Reported desired by Pennsylvania Coal Co., Exchange Building, for erecting factory for Lehigh & Wilkesbarre Coal Co., to cost $100,000.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★Buffalo, N. Y.—Contract awarded Turner Concrete Co., 11 Broadway, New York, for erecting a brick and reinforced concrete powerhouse and blacksmith shop for the Automobile Transportation Co. on Main Street.

★Niagara Falls, N. Y.—Contract awarded Turner Concrete Co., 11 Broadway, New York, for erecting for the Carborundum Company an addition to their abs building, to be two-story reinforced concrete construction, 85 x 144 ft., beam and girder construction.

★Parkersburg, N. J.—Contract awarded Bell, Clarke & Co. of Allentown, to the Consumers Co., to erect a factory costing $1,000,000.

★Philadelphia, Pa.—Contract awarded Thomas C. Cochenour, 5th Pentlow Street, for excavating, stone and concrete, 21 x 21 ft. boiler house for Kopka Main Mill, 21 Market Street.

★Camas, Wash.—Contract reported awarded by Camas-Washougal Paper Co., Pittock Block, Portland, Ore., to the Great Northern Railway Co. of San Francisco, Cal., for erecting three-story reinforced concrete paper mill costing about $100,000.

MISCELLANEOUS

PROPOSED WORK.

Power Plant—Rutland, Vt.—Reported ... Rutland Railway Light & Power Co. ... Bridge Street, Rutland, Vt., ... additional ... Ferry Lake, which will be ... of 12½ cubic ... concrete addition ... Bridge Street ... Rutland ... Rutland Railway Light & Power Co. ... Rutland, Vt.

Park Improvements—Louisville, Ky.—Park Commr. and J. C. Olmsted, Architect, of Brookline, Mass., are considering improvements to the parks.

Transmission Line—Madison, Wis.—Wisconsin Power & Light Company will build a transmission line to connect ... with Lima and Columbus.

BIDS DESIRED.

Tunnel, Boston, Mass.—Until Nov. 11 by Boston Transit Commission (B. Loughlin Keal, Secretary) Boston, for building Section "N," Dorchester Tunnel, in Dorchester Avenue, advertised in Engineering Record.

Lamp Posts—Albany, N. Y.—Until Nov. 1, by Isidore Wachsman Secy. Bd. Contract and Supply for lamp posts for Parks.

Philadelphia, Pa.—See "Miscellaneous."

Coal Yards—Philadelphia, Pa.—Until Nov. 10 by Samuel T. Wagner, Ch. Engr. Philadelphia & Reading Ry. Co., 18 Reading Terminal, Philadelphia, for Contract No. 4 reconstructing coal yards at Emerald Street.

Street Signs—Youngstown, Ohio.—Until Nov. 2 by H. C. Fox, Clk. Dir. Pub. Service for furnishing and erecting approximately 4500 street signs and 1000 sign brackets.

Pipe Fittings, Drills, Etc.—Panama.—Until Nov. 10 by Maj. F. C. Boggs, Corps Engrs., U. S. A., General Purchasing Officer Panama Canal, Washington, D. C., for Sch. 286—Wire cable, cable clips, twist drills, sheet copper, lead pipe, pipe fittings, etc.

Pipe Fittings, Etc.—Panama.—Until Nov. 17, by F. C. Boggs, Corps Engrs., U. S. A., General Purchasing Officer, Panama Canal, Washington, D. C., Cir. No. 286—Air-brake intensifier, drill press, steel tubing, pipe fittings, etc.

Piles—Panama.—Until Nov. 5 by Maj. F. C. Boggs, Corps Engrs., U. S. A., Gen. Purchasing Officer, Panama Canal, Washington, D. C., for Cir. 287—Furnishing creosoted piles.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Park Improvement—New York, N. Y.—Following are totals of the four lowest bids opened Oct. 21 by the Park Bd. for improving Isham Park, Boro Manhattan: Lawson Constr. Co., 49 East 169th Street, $35,121; D. G. Picord Granolithic Pavement Co., 147 East 116th Street, $11,177; Thomas Grahwohl Eng. & Constr. Co., 101 Park Avenue, $12,700; D. Menna & Del Rubio, 2336 Cambreling Avenue, $12,682.

★Trap Rock—Jersey City, N. J.—Contract awarded Oct. 13 by the Hudson County Park Commission (Walter G. Moorhead, Secretary), for furnishing 5700 cu. yd. of ¾ to 2½ in. broken trap rock and 500 bbls. of Alpha or Atlas Portland cement, for Bayonne Park, Bayonne, as follows: Charles T. Kavanaugh, Bayonne, 3300 cu. yd. 2½ in., 2100 cu. yd. 1½ in. and 300 cu. yd. ¾ in., each at $1.55 per cu. yd., and to James Brady's Sons Co., Bayonne, 300 bbls of cement, $1.16 per bbl.

★Retaining Walls—Pittsburgh, Pa.—Contracts awarded by Co. Comrs. to William J. Payne, Jr., Co., for constructing various retaining walls along Scotia Hollow Road in Jefferson Township at $20,160.

★Chimney—Toronto, Ont.—Contract awarded Canada's Canadian Company for ... brick chimney with foundations at ... Inspector plant at $7,250 for chimney and $1,487 for foundations.

Proposals

For Proposals Advertised, see Pages 45, 46 and 47.

WATERWORKS.

Bids Close.		See Eng. Record.
Nov. 1.	Contracts 14 and 15, Hartford, Conn. ..... Adv. Oct. 16, 22.	Oct. 16
Nov. 2.	Pipe Fittings, Etc., Washington, D. C.	Oct. 16
Nov. 2.	Tank, Le Roy, N. Y. ..... Adv. Oct. 23.	Oct. 23
Nov. 2.	Tank and Tower, Elmwood, Ill.	Oct. 30
Nov. 4.	Pumping Engine, Galveston, Tex. ..... Adv. Oct. 2.	Oct. 2
Nov. 5.	Reservoir, Pipe, etc., Caldwell, Idaho	Oct. 30
Nov. 5.	Steel Pipe, Chicago, Ill.	Oct. 30
Nov. 8.	Tank, Jacksonville, Fla.	Oct. 23
Nov. 9.	Water Wks., Bellefontaine, Ohio	Sep. 11
Nov. 9.	Valves, Brooklyn, N. Y.	Oct. 23
Nov. 9.	Improvements, Lynn, Mass. ..... Adv. Oct. 30.	Oct. 30
Nov. 11.	Softening Plant, Columbus, Ohio	Oct. 22
Nov. 11.	Water Works, Bayard, Neb.	Oct. 30
Nov. 15.	Reservoir, St. Clairsville, Ohio	Oct. 30
Nov. 18.	Pipe Laying System, Fort Sam Houston, Tex.	Oct. 30
Nov. 26.	Engine and Pumps, Clarksburg, W. Va. ..... Adv. Oct. 30.	Oct. 30
Dec. 1.	Water Works, East Youngstown, Ohio	Oct. 16
Dec. 2.	Steel Pipe, Jersey City, N. J. ..... Adv. Oct. 30.	Oct. 30

SEWERAGE AND SEWAGE DISPOSAL.

Nov. 1.	Greenwich, N. Y. ..... Adv. Oct. 23.	Oct. 23
Nov. 3.	Woonsocket, R. I. ..... Adv. Oct. 23.	Oct. 23
Nov. 3.	Atlantic Highlands, N. J.	Oct. 30
Nov. 3.	Trenton, N. J.	Oct. 30
Nov. 3.	Chicago, Ill.	Oct. 30
Nov. 3.	Binghamton, N. Y.	Oct. 30
Nov. 4.	New York, N. Y.	Oct. 23
Nov. 4.	Miami, Fla.	Oct. 23
Nov. 5.	Havelock, Neb.	Oct. 23
Nov. 5.	East Chicago, Ind.	Oct. 30
Nov. 5.	Winnemucca, Nev.	Oct. 30
Nov. 8.	Miami, Fla.	Oct. 30
Nov. 9.	Yorktown Heights, N. Y. Adv. Oct. 16 to 30.	Oct. 16
Nov. 9.	Yorktown, N. Y. ..... Adv. Oct. 23, 30.	Oct. 23
Nov. 9.	Toronto, Ont.	Oct. 30
Nov. 15.	Cleveland Heights (P. O. Warrensville), Ohio.....	Oct. 23
Nov. 16.	Vermillion, Ohio ..... Adv. Oct. 23, 30.	Oct. 23
Nov. 18.	Sandusky, Ohio ..... Adv. Oct. 30.	Oct. 30
Nov. 23.	Oakland, Iowa	Oct. 23
Nov. 24.	San Benito, Tex.	Oct. 30
Dec. 2.	Contract 4, Chicago, Ill. Adv. Oct. 30.	Oct. 30
———	Parkersburg, Pa. ..... Adv. Oct. 9.	Oct. 9

BRIDGES.

Nov. 2.	Toronto, Ont.	Oct. 30
Nov. 3.	Wabash, Ind.	Oct. 23
Nov. 3.	Lakeville, Miss.	Oct. 23
Nov. 3.	Illinois	Oct. 23
Nov. 3.	Cleveland, Ohio	Oct. 23
Nov. 3.	Paterson, N. J.	Oct. 30
Nov. 3.	Lucedale, Miss.	Oct. 30
Nov. 4.	Durant, Okla.	Oct. 30
Nov. 4.	Ventura, Cal.	Oct. 30
Nov. 4.	Blue Ridge, Ga.	Oct. 30
Nov. 4.	Salina, Kan.	Oct. 30
Nov. 4.	Visalia, Cal.	Oct. 30
Nov. 5.	Independence, Mo.	Oct. 30
Nov. 6.	Johnstown, Pa.	Oct. 30
Nov. 8.	Bakersfield, Cal.	Oct. 30
Nov. 11.	Marshall, Ill.	Oct. 30
Nov. 16.	New Orleans, La.	Oct. 30
Dec. 7.	Canton, China ..... Adv. Oct. 23.	Oct. 23

PAVING AND ROADS.

Nov. 1.	Bonds, Greenville, N. C.. Adv. Oct. 16 to 30.	Oct. 16
Nov. 2	Indiana	Oct. 23
Nov. 2.	Youngstown, Ohio	Oct. 30
Nov. 2.	Park Rapids, Minn.	Oct. 30
Nov. 2.	Kansas City, Mo.	Oct. 30
Nov. 3.	Indiana	Oct. 23
Nov. 3.	Illinois.	Oct. 30
Nov. 4.	Ventura, Cal.	Oct. 23
Nov. 4.	Pennsylvania	Oct. 23
Nov. 4.	Indiana	Oct. 23
Nov. 4.	Arcadia, Cal.	Oct. 23
Nov. 4.	Independence, Mo.	Oct. 30
Nov. 4.	Hagerstown, Md.	Oct. 30
Nov. 5.	Indiana.	Oct. 2
Nov. 5.	Monroe, La.	Oct. 23
Nov. 5.	New York, N. Y.	Oct. 30
Nov. 5.	Seattle, Wash.	Oct. 30
Nov. 8.	Euclid, Ohio	Oct. 16
Nov. 8.	Maynardsville, Tenn.	Oct. 23
Nov. 8.	Indiana	Oct. 23
Nov. 8.	Miami, Fla.	Oct. 30
Nov. 8.	Beaumont, Tex.	Oct. 30
Nov. 9.	Asphalt Plant, New Orleans, La.	Oct. 30
Nov. 9.	Trenton, N. J.	Oct. 30
Nov. 9.	Titusville, Fla.	Oct. 30
Nov. 9.	New Brunswick, N. J....	Oct. 30
Nov. 9.	Massachusetts	Oct. 30
Nov. 9.	Tractor, Cincinnati, Ohio	Oct. 30
Nov. 11.	Newton, N. J. ..... Adv. Oct. 23, 30.	Oct. 23
Nov. 11.	Albany, N. Y. ..... Adv. Oct. 23, 30.	Oct. 23
Nov. 12.	Hackensack, N. J.	Oct. 30
Nov. 13.	Pittsburgh, Pa.	Oct. 30
Nov. 15.	Sweetwater, Tenn.	Oct. 23
Nov. 15.	Greensburg, Pa.	Oct. 30

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS.

Nov. 1.	Irrigation Work, Washington, D. C. ..... Adv. Oct. 9.	Oct. 9
Nov. 1.	Dock Improv., Beaumont, Tex ..... Adv. Oct. 16.	Oct. 16
Nov. 3.	Drainage, Morris, Minn..	Oct. 23
Nov. 3.	Levee, Council Bluffs, Iowa.	Oct. 30
Nov. 3.	Retaining Wall, Kansas City, Kan.	Oct. 30
Nov. 4.	Irrigation Work, Grand Junction, Col. ..... Adv. Oct. 9.	Oct. 9
Nov. 4.	Drainage, Roseau, Minn..	Oct. 23
Nov. 4.	Levee, Santa Paula, Cal..	Oct. 23
Nov. 5.	Irrigation Work, Washington, D. C. ..... Adv. Oct. 9.	Oct. 9
Nov. 5.	Trestles, Pittsburgh, Pa. Adv. Oct. 9 to 30.	Oct. 9
Nov. 5.	Ditches, Blue Earth, Minn.	Oct. 30
Nov. 8.	Dredge, Jacksonville, Fla Adv. Sep. 11 to 25, Oct. 30.	Sep. 11
Nov. 8.	Dredging, Etc., Jacksonville, Fla. ..... Adv. Oct. 16 to 30.	Oct. 16
Nov. 8.	Reclamation Work, Grand Junction, Col.	Oct. 9
Nov. 5.	Ditches, Marshall, Minn..	Oct. 30
Nov. 8.	Ditches, Princeton, Minn.	Oct. 30
Nov. 9.	Canal Work, Albany, N. Y. ..... Adv. Oct. 16 to 30.	Oct. 9
Nov. 9.	Ditch, Sioux City, Iowa.. Adv. Oct. 30.	Oct. 30
Nov. 9.	Ditch, Sioux City, Iowa..	Oct. 30
Nov. 9.	Dredging, New York, N. Y.	Oct. 30
Nov. 10.	Dam, Albuquerque, N. M.	Oct. 30
Nov. 10.	Gates on Dam, Ottawa, Ont.	Oct. 30
Nov. 10.	Levee Work, Cairo, Ill.. Adv. Oct. 30.	Oct. 30
Nov. 13.	Ditch, Slayton, Minn....	Oct. 30
Nov. 15.	Levee Improv., New Madrid, Mo. ..... Adv. Oct. 23, 30.	Oct. 23
Nov. 16.	Ditch, Slayton, Minn. ...	Oct. 30
Nov. 17.	Irrigation Work, Ysleta, Tex. ..... Adv. Oct. 23.	Oct. 23
Nov. 17.	Flood Protection Wall, Portsmouth, Ohio ..... Adv. Oct. 30.	Oct. 30
Nov. 22.	Dredging, Philadelphia, Pa. ..... Adv. Oct. 30.	Oct. 30
Nov. 26.	Dredging, Cleveland, Ohio. ..... Adv. Oct. 30.	Oct. 30
Dec. 1.	Irrigation Work, Meadow Creek, Wash. ..... Adv. Oct. 23.	Oct. 23

PUBLIC BUILDINGS AND SCHOOLS.

Nov. 2.	Live Oak, Fla.	Oct. 16
Nov. 2.	Warrensburg, Mo.	Oct. 23
Nov. 2.	Austin, Tex.	Oct. 30
Nov. 2.	Lebanon, Pa.	Oct. 30
Nov. 4.	Wilberforce, Ohio	Oct. 9
Nov. 4.	Evansville, Ind.	Oct. 23
Nov. 4.	Canton, Ohio	Oct. 23
Nov. 5.	New Braunfels, Tex.....	Oct. 2
Nov. 5.	Danvers, Mass.	Oct. 30
Nov. 6.	East Pittsburgh, Pa.	Oct. 2
Nov. 6.	Indian Head, Md.	Oct. 16
Nov. 8.	Sidney, Ohio ..... Adv. Oct. 2, 9.	Oct. 2
Nov. 8.	Washington, D. C. ..... Adv. Oct. 16.	Oct. 16
Nov. 9.	El Paso, Tex.	Oct. 9
Nov. 9.	Madison Barracks, N. Y.. Adv. Oct. 30.	Oct. 30
Nov. 9.	Pittsburgh, Pa.	Oct. 30
Nov. 10.	Van Wert, Ohio.	Oct. 2
Nov. 10.	Boone, Iowa	Oct. 23
Nov. 10.	Pittsburgh, Pa.	Oct. 30
Nov. 11.	Pittsburgh, Pa.	Oct. 30
Nov. 12.	Salamanca, N. Y.	Oct. 9
Nov. 13.	Key West, Fla.	Oct. 23
Nov. 13.	Napanoch, N. Y. ..... Adv. Oct. 30.	Oct. 30
Nov. 15.	Columbus, Ohio	Oct. 23
Nov. 15.	Agawam, Mass.	Oct. 23
Nov. 16.	Front Royal, Va. ..... Adv. Oct. 23, 30.	Oct. 23
Nov. 15.	Salem, Ore.	Oct. 30
Nov. 15.	Lincoln, Ill.	Oct. 30
Nov. 16.	Huntington, W. Va.....	Oct. 9
Nov. 16.	St. Paul, Minn.	Oct. 30
Nov. 18.	Boise, Idaho	Oct. 16
Nov. 19.	Elyria, Ohio	Oct. 16
Nov. 20.	Somerville, Ohio	Oct. 30
Nov. 26.	Navasota, Tex.	Oct. 23
Nov. 26.	Ft. Terry, N. Y. ..... Adv. Oct. 30.	Oct. 30
Nov. 27.	Brenham, Tex.	Oct. 30
Nov. 27.	Fort Bliss, Tex. ..... Adv. Oct. 30.	Oct. 30
Nov. 27.	Pearl City, Hawaii	Oct. 30
Nov. 29.	Muskegon, Mich.	Oct. 30
Dec. 1.	Bloomington, Ind. ..... Adv. Oct. 30.	Oct. 23

PRIVATE BUILDINGS.

Nov. 11.	Bartlesville, Okla.	Oct. 23

MISCELLANEOUS.

Nov. 2.	Electric Hoists, Philadelphia, Pa.	Oct. 16
Nov. 2.	Cement, Annapolis, Md..	Oct. 23
Nov. 2.	Street Signs, Youngstown, Ohio	Oct. 30
Nov. 3.	Purchase of Steamer, Newport, R. I. ..... Adv. Oct. 9 to 30.	Oct. 9
Nov. 3.	Jib Crane, Panama..... Adv. Sep. 25.	Sep. 25
Nov. 3.	Power Plant, Poplar Bluff, Ark.	Oct. 16
Nov. 3.	El. Rys., New York, N. Y.	Oct. 23
Nov. 5.	Cables, Etc., Panama....	Oct. 23
Nov. 5.	Subway Station, Brooklyn, N. Y.	Oct. 30
Nov. 5.	Piles, Panama.	Oct. 30
Nov. 8.	Mail Chutes, Denver, Col.	Oct. 16
Nov. 8.	Fence, Devils Lake, N. D.	Oct. 16
Nov. 8.	Sprinkler System, Jacksonville, Fla.	Oct. 23
Nov. 10.	Railroad, San Francisco, Cal.	Oct. 23
Nov. 10.	Pipe Fittings, etc., Panama.	Oct. 30
Nov. 10.	Coal Yards, Philadelphia, Pa.	Oct. 30
Nov. 11.	Tunnel, Boston, Mass. ... Adv. Oct. 30.	Oct. 30
Nov. 12.	El. Rys., New York, N. Y.	Oct. 30
Nov. 13.	Shipbuilding Ways, Etc., Charleston, S. C.	Oct. 23
Nov. 16.	Oil Storage Tanks, Panama	Oct. 23
Nov. 17.	Power Plants, Etc., Washington, D. C.	Aug. 28
Nov. 17.	Htg. Bldgs., Fort Bliss, Tex. ..... Adv. Oct. 23, 30.	Oct. 23
Nov. 17.	Copper Tubes for Ry., London, England ..... Adv. Oct. 30.	Oct. 30
Nov. 17.	Pipe Fittings, Etc., Panama.	Oct. 30
Nov. 26.	Cranes, Charleston, S. C.	Oct. 16
Nov. 27.	El. Ry., Pearl City, Hawaii	Oct. 23

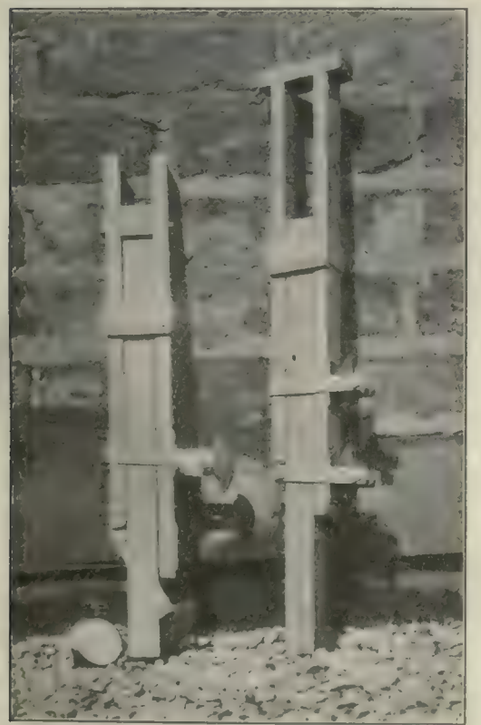
Dies Recede Automatically After This Machine Has Done Its Work

The "Three in One" pipe die, manufactured by the National Pipe Die Machine Company, Archbold, Ohio, reams, faces and cuts the thread in one operation. When it has done its work the dies recede automatically so as to clear the pipe, in which position it locks so that it only requires loosening of the thumb screws holding the die to the pipe to remove the machine. By a light touch of the hand on the front of the machine the dies are ready for the next operation. When the die is to be used for reaming and facing, the thrust plate is removed and a reamer and facer attachment is put in its place. When a straight thread of any desired length is wanted, the bridge plate is removed entirely. The lead screw is held in perfect position with the thumb screw, while cutting the running thread. It is claimed that no other machine has this advantage. When the desired length of thread is obtained, the dies can be released, by a slight operation of the hand on the front of the machine and the machine can then be removed. There is a micrometer adjustment on the front of the machine whereby the operator can adjust the machine to cut a loose or tight-fitting thread. The die once set cuts every thread the same length and thickness. A set of four dies is used for each size of pipe, and also four thrust plates, one for each size of pipe. The machine is portable and cuts pipes ranging in diameter of from 1 to 2 in.

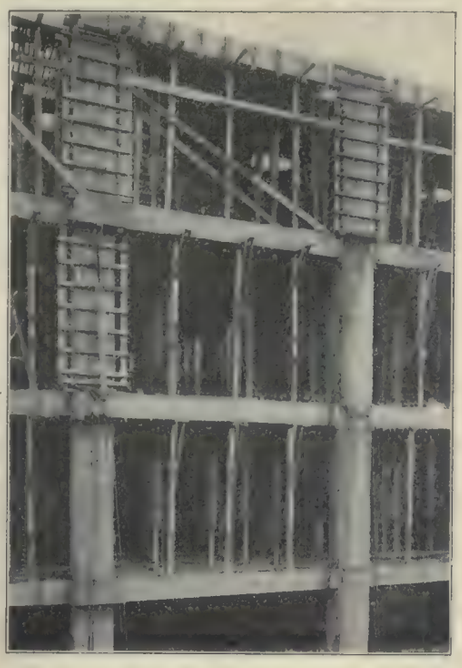
Adjustable Shores for Floor Forms on Concrete Buildings

A positive clamp, which sets itself when the cam is in driving position and the shore is under load, is a feature of the new Hodges forms for concrete building work, sold by Edward O. Keator & Co. of Cincinnati. This new shore also has a detachable head, which may be left on, in setting shores under a beam, or removed, in using the shores for flat slab floors, so that the form stringers rest in a fork made by the two upper pieces of the shore, which makes it unnecessary for a man to climb up and nail cleats on each side of the joist after the shore is in place.

These shores are used with steel-wood adjustable mat forms. They are made from 8-ft. lumber, with a 4 x 4-in. post and two 2 x 4-in.



MODELS SHOW OPERATION OF CLAMPS



SHORES IN PLACE ON BUILDING

side pieces. The positive clamp introduced in the later models has a clamp head which bites into the 4 x 4-in. post and insures a strong grip as soon as the cam is set. The upper clamp stiffens the shore and transfers to the middle timber part of the load from the 2 x 4-in. piece opposite the cams. This 2 x 4 also bears on the head of the lower clamp. The shores are adjustable from 8 to 14 ft., when made of 8-ft. lumber. This range is sufficient for ordinary construction, but longer shores can, of course, be built for special work.

Low Charging Mixer Will Not Splash

A new low charging mixer that is guaranteed not to splash has been placed on the market by the T. L. Smith Company of Milwaukee. The new type is built in four sizes, of which the smallest is the 3-ft. low charging Mixerette.

Splashing is said to be eliminated by an increase in the width of the drum and the addition of a short wing on the feed side of the blades. The wing gathers the materials as they are emptied into the drum and works them over to the center of the drum into the deep scooplike blades, which are used in all Smith-Chicago mixers. These blades are raised slightly above the interior surface of the drum so that there are no corners for the materials to lodge in. In other words, there can be no splashing, nor can the drum clog up. It will clean itself perfectly if given ordinary care and attention.

The new mixer has a dust-proof casing, which encircles the drum completely, enclosing the gear ring and driving pinion. This casing eliminates main rollers, shafts and boxes.

The machine is so designed and constructed that lightness is combined with durability. Another of its features is the rapid discharge. This is secured by means of the concave drum head, which permits the long, steep-angled discharge chute to swing way into the drum and still maintain a steep angle. It penetrates the drum beyond the center so that, as the deep scoop-like blades empty the materials, every particle is caught and discharged with great rapidity.

In the Mixerette the loading platform is only 18 in. high. The barrows can be run up a short plank to the low platform, where they are up-ended and emptied directly into the drum. In order to accomplish this the feed end of the drum is left almost entirely open. A narrow hopper is added, so that, as a wheelbarrow is up-ended, it fits right into the hopper and empties its contents directly into the drum.

Business Notes

The Sullivan Machinery Company of Chicago has moved its St. Louis branch sales office from 705 Olive Street to the Railway Exchange Building.

The Merkle-Hines Machinery Company, manufacturer of waterworks, electric light and power plant equipment, of Kansas City, has moved its office from the Scarritt Building to the Interstate Building.

J. F. Twamley was elected second vice-president and a member of the board of directors of the Bath Portland Cement Company at a meeting of the board of directors, held in New York City, Oct. 27. His headquarters will be at 1182 Broadway, New York City.

Trade Publications

The following companies have recently issued trade literature:

Barber Asphalt Paving Company, Buffalo. Catalog 22, 3½ x 6¼ in., 32 pages, illustrated. Embraces a line of asphalt pavers' tools and supplies from tampers to rollers.

Koehring Machine Company, New York City. Circular, 5½ x 6½ in., illustrated. Koehring pavers as efficient units for road construction and points of their construction that make them such are the subjects of the text.

United States Asphalt Refining Company, New York City. Circular, 5½ in. in diameter, 8 pages, illustrated. A description of Aztec asphalt and its different forms as a paving asphalt, road binder and surfacing asphalt.

Luten Bridge Company, York, Pa. Luten Design Bridges Under Construction, Spring of 1915. Paper, 6 x 9 in., 30 pages of illustrations. Gives short statement of span lengths, contract prices, contractors, location and general dimensions of bridges shown in the photographs of bridges under erection the past season.

Trussed Concrete Steel Company, Youngstown, Ohio. Booklet, 8½ x 11 in., 30 pages, illustrated; on Kahn building products for railroad structures. Explains the Kahn system, and illustrates stations, trainsheds, shop buildings and viaducts, together with minor structures, such as water tanks and flagmen's cabins, using it.

William Powell Company, Cincinnati, Ohio. Booklet, 3½ x 6½ in., 22 pages, illustrated. Contains descriptive and specific data on boiler room valves manufactured by this company. The line embodies blow-off, "Y" blow-off and "Irenew" valves, and "White Star" gate and double automatic non-return check valves, ranging from ⅜ in. to 12 in. in sizes.

Corrugated Bar Company, Buffalo, N. Y. Catalog, 6 x 9 in., 64 pages, illustrated. Describes Corr-Mesh and Corr-Mesh lath in their application to concrete or stucco form construction. The texts treats of partition, floor, wall, roof, ceiling and outbuilding construction, and contains condensed suggestions of design and economy made practicable by Corr-Mesh reinforcement. The illustrations embody typical cases of such construction as well as designing details.

De Laval Steam Turbine Company, Trenton, N. J. Catalog F, 6 x 9 in., 64 pages, illustrated. Deals with De Laval centrifugal blowers and compressors at all pressures from 5 in. water column to 125 lb. per sq. in., arranged for steam turbine, motor or belt drive. A comparative and theoretical discussion on the centrifugal blower and compressor in contrast with the rotary and reciprocating types introduces the subject, a brief summarization of the volume and efficiency of De Laval products with diagrams of characteristic curves follows, and a short description of the machinery and the methods of manufacture completes the catalog. Introduced into the text and throughout the last few pages of the issue are illustrations of various types of centrifugal blowers and compressors.

CONTRACTING NEWS

Of Special Interest to Engineers, Contractors, Builders and Manufacturers of Engineering and Building Supplies

MUNICIPAL bond issues sold during the past ten months have amounted to almost $300,000,000, considerably larger than sales during the same period of any year except 1913, when issues totaling more than $415,000,000 were sold. Issues sold last month totaled $27,000,000 as against $18,141,000 sold in October, 1914. Railroad reports for August, the latest month for which the Bureau of Railway Economics has issued figures, show an increase of 11.4 per cent in operating income as compared with 1914, the average operating income being the largest of any August in the last five years with the exception of August, 1912. Total operating revenue for the same period was greater than in 1911 or 1914, but still about 4 per cent under that for 1912 and 1913. Undoubtedly subsequent reports to be issued will show much larger gains.

Structural steel for immediate delivery is difficult to get. Prices on structural material for next year's delivery range, according to the *Iron Age*, from $1.50 to $1.60 per 100 lb., Pittsburgh. Many consumers of steel products, unable to secure mill deliveries, have paid warehouse prices ranging $12 per ton higher. Railroad buying for bridge work has greatly helped the structural market. Structural contracts placed last month are estimated at 110,000 tons.

The market for steel sheets is very strong, showing advances ranging from $3 to $4 per ton. No. 28 galvanized sheets are now $3.65 to $3.55 per 100 lb., Pittsburgh, and No. 28 black sheets $2.10 per 100 lb.

Average sizes of cast-iron pipe are selling at $26 per ton, tidewater. Wrought-iron pipe has recently advanced $2 per ton, the discounts for lap-welded pipe plain ends, 2 in. to 6 in., giving prices of $60 per ton (Pittsburgh) for black and $81 per ton for galvanized steel pipe. Iron pipe of the same class is quoted at $64 per ton for black and $85 for galvanized. Plain bars are bringing a minimum of $1.50 per 100 lb., Pittsburgh, but only future delivery can be had, the market being sold up.

The cement market is much stronger, and general advances in prices have been made, except in the Southern district, where $1.15 per barrel at the mills to consumers is still quoted. This price does not include containers. Quotations in the Lehigh district have been based on $1.05 per barrel on the same terms, while prices have advanced to $1.15 per barrel in the Hudson, Ohio and Kansas districts.

The lumber business, especially in Southern pine, is showing numerous signs of improvement. It is now said to be necessary to spread single orders of two or three million feet among fifteen to twenty mills, where a month ago five mills could handle such an order. Retail yard prices in Chicago, per 1000 ft. b.m., have been, for No. 1 common hemlock, mixed lengths of 1 in. $22 to $24. Douglass-fir timbers 6 by to 12 by, 12 to 24 ft. long, sold at $35, 14 by at $36, 16 by at $37, 18 by at $40 and 20 by at $42.

Buildings

It is reported that the contract for building the Hudson County jail at Jersey City, N. J., has been awarded at $754,000. The lowest bid opened for erecting the U. S. post office at Harrisburg, Pa., was $113,000. A school building contracted for at Richmond, Va., will cost $89,000. It is reported that the construction of a $300,000 automobile building has been contracted for at St. Louis. All bids opened Oct. 25 at St. Cloud, Minn., for constructing a school building have been rejected as exceeding the appropriation of $150,000.

Bids will be opened Nov. 16 in Buffalo for constructing five hospital buildings. Plans are being prepared at Washington, D. C., for six preparatory school buildings to cost $400,000. It is reported that a $100,000 tobacco warehouse will be built at Winston-Salem, N. C. A contract will be let soon for erecting a $130,000 college building at Grand Rapids, Mich. It is reported that the Chicago, Milwaukee & St. Paul Railway will build a $100,000 passenger station at Twenty-ninth Street and Nicollet Avenue, Minneapolis.

Bridges and Roads

The lowest bid opened Oct. 22 for constructing the Chouteau Avenue viaduct at St. Louis was $139,900. Bids for paving work totaling $60,000 have been opened at Seattle, and one contract has been awarded. Two bridge contracts awarded at Los Angeles amount to $56,000. Concrete road work awarded at Bakersfield, Cal., will cost $53,000. The low bid of $45,000 was received for constructing 11 miles of road at Riverside, Cal. Bids are desired Nov. 23 at Woonsocket, R. I., for constructing three concrete bridges, Greenwood, S. C., will open bids Nov. 10 for constructing 60,000 sq. yd. of paving. Bids are desired at Dothan, Ala., for building 21 miles of road.

Plans have been completed for reconstructing the Galveston causeway. The Board of Estimate of New York City has approved the location of a $1,000,000 boulevard in Queens County. Baltimore estimates that it will spend $660,000 next year for paving. County road bonds amounting to $557,000 are to be sold at Pineville, W. Va. De Land, Fla., will sell $400,000 of bridge and road bonds. A $125,000 road bond issue has been voted at Everglade, Fla. Paving work to cost $300,000 is contemplated for 1916 at Joliet, Ill. An electric railroad contemplates building a $40,000 bridge at Highwood, Ill. The construction of a $275,000 highway is being considered at Albion, Ind. Appropriations of $150,000 at Lansing, and of $124,000 at Marshall, Mich., have been made for road construction. It is reported that the Minnesota Highway Commission will spend $3,000,000 for road construction in 1916. Additional paving work under consideration at Seattle will cost $145,000.

Waterworks and Sewers

Sewer contracts amounting to $94,000 have been awarded at Verona, N. J. A $45,000 waterworks contract has been awarded at Peapack-Gladstone, N. J. A sanitary sewer system contracted for at Ogden, Iowa, will cost $38,000. St. Agathe des Monta, Que., has awarded a contract for building a $70,000 sewer system. Bids are desired at Washington, D. C., for constructing a mile of 2-ft. sewer. Rock Island, Ill., desires bids for constructing a sewer system and disposal plant. The Bureau of Municipal Research at Cincinnati has voted in favor of issuing $400,000 bonds for constructing a high-pressure fire system. The construction of three storm sewers to cost $150,000 is being considered at Elyria, Ohio. Water mains and sewers to be built at Heber Springs, Ark., will cost $90,000. It is reported that $43,000,000 bonds for building the Hetch Hetchy project will be sold next month at San Francisco. Engineers have been retained for a $400,000 pipe line to be built for the Caibarien-Remedios Waterworks Company, Caibarien, Cuba.

Miscellaneous

A New York State Barge Canal contract for $420,000 has been awarded at Albany. The contract for a fourth section of the Frankford elevated line in Philadelphia has been awarded at $268,000. A $75,000 railroad grading contract has been awarded at Dubuque, Iowa. Contracts for dock improvements awarded at Superior, Wis., amount to $90,000. Bids have been asked a second time for dredging work at the Norfolk Navy Yard, for which $145,000 has been appropriated; the first bids were rejected. A $265,000 terminal project is under consideration at Providence, R. I. A dam to be built by the Wisconsin-Minnesota Light & Power Company, at Chippewa Falls, Wis., will cost $500,000. Two new irrigation projects are reported, one at Brewster, Wash., involving $1,000,000, and one at Grandview, Ore., to cost $533,000. A dike to be built at Tacoma, Wash., will cost $200,000.

WATERWORKS

PROPOSED WORK

Pennsylvania.—Following permits have been granted by the Pennsylvania Department of Health, Harrisburg, relative to water works:

Sterling Water Co., Hamlet.—Repairs and extensions to spring collecting system.

Hanover & Manchester Water Co., Hanover.—Application to repair ...

... Water Co., Intersecting ... to Gettysburg Waterworks.

... Water Co., Mifflin Run.

... Water Co., Indiana.—Water ... source of supply ...

... Water Co., Intersecting ... Gettysburg Waterworks.

... Water Co., Intersecting ... Gettysburg Waterworks.

... Water Co., Intersecting ... Gettysburg Waterworks.

ing improvements to the electric light plant and water works system, to cost about $50,000.

Sherman, Tex.—An election soon to be held to vote $150,000 bonds for extensions to the water works, sewer system, improvements of streets and electric light plant. Address City Commissioners.

Clinton, Okla.—Benham Engineering Company, Oklahoma City, engaged to prepare plans for the proposed water works. Both propositions of obtaining water from impounding reservoirs and from wells will be investigated. Probable cost $100,000.

Hillyard, Wash.—All bids opened recently by City Council for water tanks have been rejected, as being too high; cost estimated at $10,350. Sawyer Bros., Consulting Engineers, Spokane.

Los Angeles, Cal.—City Council appropriated $10,000 for preliminary surveys and development work in Owens River Valley, and Water Board will use money to survey dams and power sites in Owens River Gorge, Cottonwood Creek, Lytle Creek, and other tributaries which supply Los Angeles with water.

San Francisco, Cal.—Reported bonds amounting to $43,287,000 for the Hetch Hetchy project will be sold Dec. 6 by Supervisors' Finance Committee.

Aurora, Utah.—Town authorities propose installing a municipal water works. State Board of Health, Salt Lake City, has been requested to investigate source of supply. An election will be held Nov. 16 to vote bonds. Abraham Shaw, Town President.

Aberdeen, Idaho. — Reported Public Utilities Commission at Boise has granted application of this village to install a municipal water system; included in improvements is a 100 ft. steel tank, pumping station and Matheson joint steel main.

Dubois, Idaho.—D. T. Murphy of Pocatello, Idaho, it is reported, plans installing water works and electric light plant here.

Caibarien, Cuba.—The Caibarien Remedios Water Works Co. of Caibarien has appointed their fiscal agents, J. G. White & Co., Inc., 43 Exchange Place, New York, and awarded contract for engineering to J. G. White Engineering Corporation, of 43 Exchange Place, New York, N. Y. Gravity system to be installed and will require approximately 37 miles of pipe line, and cost complete $400,000. J. G. White & Co., Inc., 43 Exchange Place, are purchasing material.

BIDS DESIRED.

Brooklyn, N. Y.—Until Nov. 12 by William Williams, Comr. Water Supply, Gas and Electricity, Manhattan, for furnishing, delivering, unloading, stacking and storing c.-i. pipe; security $2,200.

Ventnor City, N. J.—Until Nov. 22, by Common Council, for erecting complete mechanical equipment for artesian water works plant to consist of new pumping station, one triplex expansion direct-acting pumping engine, one cross compound, two stage air compressor, one surface condenser, with combined air and circulating pumps, suction and discharge mains to pumps and reservoir.

Washington, D. C.—Until Nov. 23 by Bureau Supplies and Accounts, Navy Dept., Washington, D. C., for furnishing at the Navy Yards and Naval Stations supplies as follows: Portsmouth, N. H., Sch. 8968—Miscellaneous composition pipe and fittings. Brooklyn, N. Y., Sch. 8968—Miscellaneous heavy reducing pressure valves; miscellaneous low pressure rough brass screwed regrinding valves. Brooklyn, N. Y., Sch. 8954—26,950 lb. lead pipe; miscellaneous steel tubing. Boston, Mass., Sch. 8961—Miscellaneous extra heavy steel pipe. Norfolk, Va., Sch. 8954—Miscellaneous lead pipe; miscellaneous wrought pipe. Charleston, S. C., Sch. 8956—Miscellaneous brass tubes. Brooklyn, N. Y., Sch. 8956—25 governor valves for pumps; also until Nov. 30, Mare Island, Cal., Sch. 8950—22,800 lb. copper pipe. Applications for proposals should designate schedules desired by number. Samuel McGowan, Paymaster General, U. S. N.

Cincinnati, Ohio.—Until Nov. 12 by Parke S. Johnson, Clk. to Dir. Pub. Service, for erecting tanks for the Eastern Hill service and other miscellaneous work in connection therewith for water distribution system.

Columbus, Ohio.—Until Nov. 19 (readvertisement) by Ohio Board Administration (A. F. Sheperd, Pres.) for furnishing and installing water softener equipment for Institution for Feeble-Minded, Columbus. H. S. Riddle, Consulting Engr., Columbus.

Chicago, Ill.—Until Nov. 12 by W. R. Moorhouse, Comr. Pub. Wks., for two open feed water heaters with appurtenances and accessories at Lake View Pumping Station; also two open feed water heaters with two 10-in. relief valves and one V-notch recording flow meter for Central Park Avenue Pumping Station.

West Frankfort, Ill.—Until Nov. 22, by Orid Dorris, City Clk., for constructing municipal water works to consist of guaranteed water supply from deep wells; vertical centrifugal pumps and electric motors; horizontal centrifugal pumps and electric motors; inclosures and foundations; storage reservoirs; valves and pipes.

Chicago, Ill.—Until Nov. 10, by Board Local Improvements (Edw. J. Glackin, Secy.) for laying water supply pipe in portions of Laflin, Henderson Streets, Parnell Avenue and other streets.

Melrose, Wis.—Until Dec. 1, by Village Board for constructing water works. Z. V. P. Gilbert, Village Clk.

St. Louis, Mo.—Reported desired until Nov. 12 by Board Public Service (Wm. T. Findly, Secy.) for steam piping, valves and fittings for low service pumping station Chain of Rocks.

Toronto, Ont.—Until Nov. 9 by T. L. Church (Mayor), Chmn. Board Control, for construction of valves, steam piping, special steel castings and lagging for main pumping station.

PRICES AND LETTINGS.

★Indicates award of contract.

Hartford, Conn.—Following are four lowest bids opened Nov. 1 by Board Water Commissioners for (a) Contract 14, clearing and grubbing southern portion of Nepaug Reservoir, and (b) Contract 15, northern part of the same: L. I. Fletcher, Akron, Ohio, (a) $26,670; (b) $22,745; Fred T. Ley Company, Springfield, (a) $26,720; (b) $21,895; Roberts Construction Company, Fitchburg, Mass., (a) $26,990; Davis & Brook, Brookline, Mass., (a) $27,220; (b) $23,450; Pierson Engineering & Construction Company, Hartford, (b) $25,900.

★Peapack-Gladstone, N. J. — Contract for constructing municipal water works awarded H. C. Brooks Co. of Martinsburg, W. Va., at about $45,000.

Covington, Ky.—See "Bridges."

★Miller, Ind.—Contracts for constructing municipal water works awarded by Town Board as follows: Pipes and hydrants, to National Tube Company, at $6,255; laying water pipe, Shea & Co., Hammond, $3,869; standpipe, Chicago Bridge & Iron Wks., at $2,785.

★Germania, Iowa.—Contract for constructing approximately 5040 ft. 4-in. and 1620 ft. 6-in. c.-i. water main, 13 hydrants, an elevated tank and tower, 50,000-gal. capacity, etc., awarded C. W. Roland Co., at $8,041. M. H. Stoddard, Town Clerk.

★Kenawha, Iowa.—Contract for constructing city distribution plant awarded Midwest Electric Company, Omaha, Neb., at $4,755.

★Luverne, Iowa.—Contract for tank and tower awarded Memphis Steel Construction Company of Greensburg, La., at $2,584, and for distribution system, pump and mains to Hause & Snyder of Fort Dodge, Iowa, at $3,198 (bids opened Oct. 22).

Galveston, Tex.—See "Proposed Work."

★Loveland, Colo.—Contract for constructing filter plant awarded J. Singer, Fort Collins, at $3,000 (bids opened Oct. 22). G. C. Rest, City Clk.

★Markham, Ont.—Contract for elevated tanks awarded Pittsburg & Des Moines Steel Co. at $5,750, and for pipe, hydrants and valves to National Iron Wks.

SEWERAGE AND SEWAGE DISPOSAL

PROPOSED WORK.

Boston, Mass.—Mayor has approved appropriation of $26,000 for sewer construction on North Beacon Street.

Haverhill, Mass.—City intends constructing a trunk sewer from Primrose Street to North Avenue, requiring about 958 ft. 24 in., 1064 ft. 20 in. and 6632 ft. 18 in. vitri. pipe; cost, $16,000. Work will be done by city. Louis C. Lawton, City Engineer.

Oneonta, N. Y.—A sewage disposal plant costing $45,000 is contemplated. Frank M. Gurney, City Engineer.

Dunkirk, N. Y.—City Engineer has submitted to State Board of Health at Albany plans for the west side park system of sewers which call for sewers along Brooks and Nichols Avenues and East Front Street. The plans for the proposed intercepting sewer and disposal plant will also be submitted to the State Conservation Commission.

Atlantic Highlands, N. J.—It is proposed to construct a sewer system and disposal plant costing $25,000. Address City Clerk.

Columbia, Pa.—An election is to held Nov. 2 to vote $100,000 bonds to install a sewer system.

Pennsylvania.—The following permits have been issued by Pennsylvania Department of Health, Harrisburg, relative to construction of sewerage:

Exeter—Lateral sewer extensions.
Johnstown—Lateral sewer extensions.
Pittston—Lateral sewer extensions.
Punxsutawney—Lateral sewer extensions.
West Pittston—Lateral sewer extensions.
Philadelphia—Lateral sewer extensions.
Dale—Lateral sewer extensions.
East Washington—Lateral sewer extensions.
Selins Grove—Lateral sewer extensions.

Eustis, Fla.—Plans for sewer system contemplated here are to be prepared by Ishman-Randolph Co. of Jacksonville. Cost, $20,000. R. O. Riddle, clerk.

Columbia, S. C.—F. C. Wyse, Engineer and Superintendent, writes that about 5 miles of 15-in. and 5 miles of 8 to 12-in. sewers will be laid early in the new year.

Elyria, Ohio.—City Council reported to be considering constructing three large storm sewers at a cost of $150,000. One territory north of Huron and West Streets to cost $100,000; one on the East Side to cost $35,000, and one in Carlisle Township to cost $15,000.

Lakewood, Ohio.—The sewage disposal plant and sewer improvements contemplated here include two-story tanks, 7,500 outlet to Lake Erie and will cost $50,000 for the sewers and $125,000 for disposal plant. E. A. Fisher City Engr.; R. Winthrop Pratt, Consulting Engr., Cleveland.

Indianapolis, Ind.—Bd. Public Works passed resolution for a main sewer in South Meridian Street and Madison Avenue, with branches from Pleasant Run to Southern Avenue; estimated cost $10,800.

Des Moines, Iowa.—Reported reconstruction of the storm sewer system is under consideration.

Mason City, Iowa.—City Council has passed a resolution providing for a three-mill levy for a period of 20 years, for construction of a Imhoff sewage disposal plant, plans for which are being prepared.

Oskaloosa, Iowa.—A. C. Hawkins, city engineer, writes, Black & Vitch of Kansas City, Mo., engaged to report on a suitable sewage disposal plant.

Whitefish, Mont.—Reported resolutions introduced in City Council for immediate creation of two special sanitary improvements, districts to cover territory north of Second Street and west of Baker Avenue; cost reported at $12,000.

Heber Springs, Ark. — See "Water Works."

Dallas, Tex.—All bids opened Sept. 3 for constructing a sanitary sewer main between Zang's Boulevard and Winnetka Avenue in Oak Cliff, have been rejected by the City Commissioners. Lowest bid submitted was $17,548.

Sherman, Tex.—See "Water Works."

Uvalde, Tex.—Contract soon to be let for a 100,000-gal. filter to be added to the septic tank; also for pumping plant. N. Werenskiold, Engr., Box 511, Dallas.

Seattle, Wash.—City Engineer A. H. Dimock has filed with Board of Public Works reports and estimates for the construction of sewers in West and North Fiftieth Street to cost $68,619.

Seattle, Wash.—Council adopted resolutions for constructing sewers in portions of North and West Fiftieth Streets and Thirteenth Avenue N. W. and Sixth Ave. N. W.

Portland, Ore.—All bids opened recently for constructing Hall Street sewer outfall rejected.

All bids opened recently for Well and Water Street Sewer rejected. New bids to be asked by A. L. Barbour, City Auditor.

Bonners Ferry, Idaho.—Reported council has created local sewer improvement, District No. 1, for the construction of a sewerage system and disposal plant; estimated cost $29,000. C. T. Laschinger, City Clerk.

Ottawa, Ont.—R. S. & W. S. Lea, Consulting Engineers, Montreal, Que., have submitted a report to the city on the Rideau River Intercepting Sewer; estimated cost $400,000.

BIDS DESIRED.

New York, N. Y.—Until Nov. 10 by Douglas Mathewson, Pres. Bronx Borough, for repairing barrel and box sewers at foot of Thirty-seventh, 110th, Stanton and Rivington Streets, East River, and foot of Twenty-sixth and 158th Streets, North River. Total security $5,000.

Until Nov. 11, same place as above, for constructing sewers and appurtenances in portions of Starling Avenue, Unionport Road and McGraw Avenue; also paving with butuminous concrete on concrete foundation roadway of Tiebout Avenue; total security $3,900.

Washington, D. C.—Until Nov. 10 by Commissioners D. C. for constructing sewers, approximately 5300 ft. 12 to 24-in. pipe, advertised in Engineering Record.

Greenwood, S. C.—See "Paving and Roads."

Findlay, Ohio.—Until Nov. 12 by Joseph Page, Clk. to Dir. Pub. Service, for furnishing material and constructing combined sanitary and storm water sewer in Hancock Street, from Main to Park Street.

Cicero, Ill.—Until Nov. 8 by Board Local Improv. (James R. Ryland, Secy.) for sewer in Fourteenth, Sixteenth and Fifty-fifth Court and water pipe in Fifteenth Place and Fifty-fifth Court.

Rock Island, Ill.—Reported desired until Nov. 15 for constructing sewerage system and sewage disposal plant. Wallace Treichler, City Engr.

PRICES AND LETTINGS.

★Indicates award of contract.

New York, N. Y.—Lowest bid opened Nov. 3 by Pub. Service Comn., 154 Nassau Street, for storm vitr. pipe drain, manholes, etc., for Queensboro Subway Rapid Transit Railroad, under Queensboro Boulevard, was submitted by Lawrence Constr. Co., 2409 Walton Avenue, at $9,700.

★Rochester, N. Y.—Contract awarded Whitmore, Rauber & Vicinus, Rochester, for constructing the Thomas Creek overflow sewer at $15,805, and to Frank Lachiusa, 336 North Street, contract for Clinton Avenue, north, sewer at $8,772.

★Verona, N. J.—Contracts awarded as follows for constructing sewers: Section 1—North of Bloomfield Avenue and east of Peckman River, to Petro Scola, Glen Ridge, at $31,253; Section 2—South of Bloomfield Avenue and east of the river, to Donato Fusdo, Montclair, at $17,801; Section 3—North of Bloomfield Avenue and west of the river, to Frank Corrozzo, Baltimore, Md., $21,633; Section 4—South of Bloomfield Avenue and west of the river to Cardell & Roman, Montclair, at $17,796; Section 5—Disposal plant, Percy L. Braunsworth, Montclair, $37,290. Clyde Potts, Engr., 50 Church Street, New York.

Parnassus, Pa.—Borough engaged Chester & Fleming, Pittsburgh, to prepare plans for sewerage system and disposal plant.

★Kent, Ohio.—Contract for constructing a trunk sewer awarded William Hunt & Sons Co. of Akron at $11,555.

Mansfield, Ohio.—Lowest bid opened Oct. 26 by W. J. Hazeltine, City Engineer for constructing 8160 ft. sewers was submitted by Carl Weis, Peru, Ind., at $6,679.

★Fond du Lac, Wis.—Contract awarded August Krueger, Fond du Lac, for constructing sewers in E. Washington, W. Cotton, Morris and Ruggles Streets. J. F. Hohensee, City Clerk.

★Ogden, Iowa.—Contract for constructing disposal plant (bids opened Oct. 26) awarded Zitterel & Sullivan, Webster City, at $10,000. R. C. Lutze, C. E., Perry.

★Lincoln, Neb.—Contract for constructing sewer system awarded Abel & Roberts of Lincoln.

Dallas, Tex.—See "Proposed Work."

★Enterprise, Ore.—Contract for constructing a sewer system reported awarded by City Council to James Kennedy Construction Company of Portland, at $19,435.

Portland, Ore.—Following are bids opened Oct. 20 by the City Auditor for constructing sewers in Water and Mill Streets: Vitri. concrete and reinforced-concrete sewer, Giebisch & Joplin, $19,-941; J. P. O'Neill, $15,185; Alexis Contract Company, $18,871; J. F. Shea, concrete and reinforced-concrete sewer, $15,-324; William Lind, cement pipe and reinforced-concrete, $15,215.

★Algona, Iowa.—Contract for constructing sewers (bids opened Oct. 27) awarded Moors Sieg Constr. Co., Waterloo. S. W. Cromell, City Clerk.

★El Centro, Cal.—Contract for constructing El Centro-Imperial sanitary sewer system (bids opened Oct. 28) reported awarded to James Kennedy, 901 Washington Building, Los Angeles, at $206,199. Olmsted & Gillelen, 1112 Hollingsworth Building, Los Angeles, Engrs.

★Sausalito, Cal.—Contract for constructing sewers in District "F" awarded Heafey & Tobin, 735 Filbert Street, Oakland, at $11,026. Leonard L. Hohl, Town Engineer.

★Idaho Falls, Idaho.—Contract for constructing sewers awarded Lindstrom & Oren of Butte, Mont., at $17,000.

★Ste. Agathe des Monta, Que.—Contract for constructing sewerage system (bids opened Oct. 25) awarded L. Beauchamp, at $70,000. R. Daze, Secy.-Treas

★Ogden, Iowa.—Following are unit figures of four lowest bidders on bids opened Oct. 26 for constructing the sanitary sewer system (R. Z. Lutze, C. E., 1404 Paul Street, Perry): (a) A. Dobson Company, Lincoln, $37,910; (b) George M. King, Des Moines, $41,320; (c) Zitterel & Sullivan, Webster City, $41,861; (d) M. S. Jackson, Cedar Rapids, $42,098:

	(a)	(b)	(c)	(d)
6,411 ft. 15-in. vitrified sewer pipe, laid complete	$1.29	$1.35	$1.25	$1.30
4,270 ft. 12-in. vitrified sewer pipe, laid complete	.80	.90	1.00	.88
6,691 ft. 10-in. vitrified sewer pipe, laid complete	.73	.76	.74½	.78
25,755 ft. 8-in. vitrified sewer pipe, laid complete	.61	.65	.67½	.73
7 flush tanks, built of brick, Miller's automatic sift	90.00	90.00	110.00	80.00
106 manholes	46.00	59.00	59.50	50.00
14 lamp holes, sewer pipe extended to surface	8.75	8.00	10.00	9.00

BRIDGES

PROPOSED WORK.

Kingston, N. Y.—Plans being prepared by Commission of Highways Alliance for bridge [illegible] at Kingston. Nothing definite has been done about the matter.

Huntington, W. Va. — Huntington-Chesapeake Bridge Co. [illegible] organized to construct a steel bridge [illegible] over Ohio River from Huntington, W. Va., to Chesapeake, Ohio. Among incorporators are C. C. Moore, E. P. Lawson and Thomas W. Harvey, Huntington.

Deland, Fla.—See Paving and Roads.

Saginaw, Mich.—See "Paving and Roads."

Highwood, Ill.—Interested Chicago & Milwaukee Electric R.R. Co. of Highwood is [illegible] a bridge to cost $6,000 each, [illegible] Chicago, to be built over the Chicago & Milwaukee Electric R.R. tracks at Sheridan Road, Highwood.

Minneapolis, Minn.—Commissioners Roads and Bridges of the City Council has recommended the issuance of bonds for an ornamental bridge to cost $40,000 to carry West Lake Street over the Chicago, Milwaukee & St. Paul and the Minneapolis & St. Louis Railroad tracks. Cost to be paid for by the railroad companies involved. Plans prepared by the engineer of the railroad and approved by the City Engineer.

Galveston, Tex.—Plans ready to be submitted to Galveston Houston Interurban, T. C. Ry., Gulf, Colorado & Santa Fe R. R. Co. and County Comrs. for reconstructing causeway recently destroyed.

A bridge will be constructed over Halfway Bayou, W. D. Rountree, Gen. Mgr. Gulf, Colorado & Santa Fe R.R. Co., Galveston, may be able to give further information.

Las Cruces, N. M.—Two steel bridges, each 3 spans of 60 ft., are to be constructed in Dona Ana County. J. W. Jenkins, State Highway Engineer, Santa Fe.

Portland, Ore.—Reported an agreement reached between the city and the Southern Pacific Co. (W. Bissell, Ch. Engr., San Francisco) on proposed Hoyt Street viaduct. Bridge is to be constructed under the direction of the railway company and is to be steel, having [illegible] spans and approaches and fill about 800 ft.

Montreal, Que.—See "Miscellaneous."

BIDS DESIRED.

Woonsocket, R. I.—Until Nov. 23 by Board of Aldermen for Comptroller [illegible] Contracting two reinforced concrete bridges and [illegible] on Walnut Avenue, one over Branch Brook and one over Blackstone River and Canal. Building reinforced concrete bridge and approaches over Branch Brook at Fairmount Street. Information may be obtained from Edgar Mills, City Engineer.

Connecticut.—See "Paving and Roads."

Connecticut.—Until Nov. 15 by Charles J. Bennett, State Highway Comr., Hartford, for [illegible] bridges as follows: [illegible] span reinforced concrete T-beam bridge over Housatonic River at Stevenson; 3 20-ft. span reinforced concrete T-beam and one 20-ft. span bridge.

New Brunswick, N. J.—Reported desired [illegible] by A. J. Lockhart, Dir. Co. Bd. Chosen Freeholders, for constructing reinforced concrete road bridge.

Perth Amboy, N. J.—Reported desired [illegible] Board Chosen Freeholders (Arthur W. Edwards, Clk.), for constructing reinforced concrete slag filling on Bridge Avenue. Alex. E. Fox Co., Engr.

Steubenville, Ohio.—Until Nov. 24 by County Commissioners for constructing reinforced concrete bridge across Cross Creek, Steubenville to Mingo Junction, Jefferson County, Ohio, on road leading from East Steubenville to Amsterdam.

[illegible] by County Commissioners as follows for constructing bridges under State Highway supervision:

[illegible] Until Nov. 6 at office of C. A. Fetzer, County Commissioner of Highways, Canton, for constructing Cemetery Bridge, steel [illegible] span, [illegible] ft. long, [illegible] ft. wide, [illegible] Bids for County Bridge, steel [illegible] ft. long, [illegible] ft. wide, [illegible] Canton Township.

Chippewa Falls, Wis.—Reported desired until Nov. 15 by Commissioners Municipal Bridge, W. E. U. R. [illegible] plans, etc., for concrete abutments. Address P. C. Lyon, Chippewa Falls.

Abilene, Kan.—Until Nov. 15 by Kiel Bridge, County Engineer, for constructing [illegible] of one 40-ft. span and one 30-ft. span, [illegible] and wingwalls and bridges for three 16-ft. spans.

Seattle, Wash.—Until about Nov. 15 for constructing timber and concrete bridges with central span 214 ft. long over Lake Washington Canal at Fourth Avenue N. E. for city; estimated cost $150,000. Address Board Public Works.

Parma, Idaho.—Until Nov. 22 by L. C. Kinsman, Co. Auditor, Caldwell, for constructing Boise River Bridge at Parma. Cost $11,000.

PRICES AND LETTINGS.

**Indicates award of contract.*

Massachusetts. — Following are three lowest bids opened Oct. 26 by Massachusetts Highway Commissioner, Boston, for reconstructing a pile trestle in Edgartown: Lundie & Strickland, East Boston, $9,834; Thos. C. Eaton, New Bedford, $9,559, and John B. Burke, Wollaston, $9,590.

***Connecticut.** — Contract awarded by State Highway Commissioner, Hartford, to Middlesex County Co., Suffield, for constructing the New Hartford Bridge over Farmington River at $8,400.

Gloversville, N. Y.—Following are 2 bids received by Town Council for reconstructing concrete steel bridge over East Channel of Hudson River: Keith Construction Co., Schenectady, $25,500, and James F. Leary Constr. Co., Rochester, at $[illegible].

Bethlehem, Pa.—Lowest bid opened for repair to Broad Street Bridge submitted by S. W. Chiles, South Bethlehem, at $[illegible].

Kennett Square, Pa.—Lowest bid opened by County Comm. and Comptroller for constructing stone arch bridge over Red Clay Creek submitted by P. J. Riley, West Chester, at $[illegible].

***DeLand, Fla.**—Contract for steel work on highway bridge, 222 ft. x 16 ft., across St. Johns River between Volusia and Seminole Counties, to be built by Michael Sholtz of Daytona, awarded Virginia Bridge & Iron Co., Roanoke, Va., and for approaches and foundations to Beasley Contracting Co. of Savannah, Ga. Atlantic Engineering Co., Engrs., Savannah, Ga.

Covington, Ky.—Following is the detail bid of D. P. Foley, Cincinnati, Ohio, the lowest bidder on the bids opened Oct. 24 by city, for constructing the piers required for bridge to carry duplicate supply main over Licking River: 720 cu. yd. earth excavation, $2.00; 160 cu. yd. rock excavation, $10.00; 2012 cu. yd. [illegible] concrete, $7.00; 600 ft. concrete piling, $6.00; total, $18,324. Next three lowest bidders: J. K. Browning, Cincinnati, Ohio, $19,834; C. E. Harris, Covington, $23,348; L. Eid Construction Company, Cincinnati, $25,193. Engineer's estimate, $22,427. George Horning, Engr., Wool-Sack Building, Newport, Ky.

***Concordia, Kan.**—Contract for constructing eight concrete bridges (bids opened Oct. 20) awarded by County Commissioners to James Bohannan, Glasco, at $[illegible].

St. Louis, Mo.—Lowest bid opened by Bd. Public Service, Oct. 22, for constructing viaduct over Missouri-Pacific & Iron Mountain R. R. tracks at Chouteau Street, submitted by F. C. Mueller & Co., $[illegible].

***Floresville, Tex.**—Contract for constructing bridge across Claveras Creek on San Antonio-Floresville Road awarded Alamo Construction Company of San Antonio at $10,000. Bridge is to be 480 ft. long and 16 ft. wide.

***Heppner, Ore.**—Contract for constructing steel superstructure of bridge over river for Oregon-Washington Ry. & Navigation Co., Portland, awarded to Grant-Smith & Co., Henry Building, Seattle, at about $10,000.

***Bakersfield, Cal.**—Contract for constructing pile bridges, culverts and concrete head walls on Div. 5, Sect. 4, Bakersfield-McKittrick Rd. awarded by county to M. T. Kean, Bakersfield, at $12,350.

Bakersfield, Cal. — See "Paving and Roads."

Los Angeles, Cal.—Lowest bids for constructing bridges submitted as follows (bids opened Oct. 18 by County Bd. Supervs.): Three span plate girder bridge 247 ft. long, with concrete abutments over Compton Creek, Meamer & Rice, 225 Marsh-Strong Bldg., $20,761, and for 4 span plate girder bridge 244 ft. long over same creek, Meamer & Rice, $[illegible].

***Contract for above work awarded to Meamer & Rice, 231 Marsh-Strong Building.**

***Madera, Cal.**—Following are four lowest bids opened Oct. 18 by W. C. Utter, City Clerk, for constructing bridge over Fresno River: Manning Bros., Fresno, at $[illegible] (awarded contract); Bergen & Johnson, Strathmore, to [illegible]; A. Mattson, San Francisco, $9,950, and Johnson Bros., Kingsburg, $11,350.

***San Diego, Cal.**—Following are four lowest bids opened Oct. 21 by County Supervisors for constructing a concrete bridge over San Luis Rey River on state highway at Oceanside: P. H. C. Sparks, $7,200 (awarded contract); H. W. Petton, $8,479; Halland Constr. Co., $9,277, and F. W. Stuffgen, $[illegible].

Boise, Idaho.—Following are four lowest bids opened Oct. 12 by Commissioners of Ada and Owyhee County for constructing a three-span steel bridge, 432 ft. long, across Lake River at McKeath's Ferry: Missouri Valley Bridge & Iron Co., Denver, Col., $[illegible]; Canal Bridge Co., Portland, Ore., $[illegible]; Midland Bridge Co., $[illegible]; Minneapolis Steel & Machinery Co., $[illegible].

PAVING AND ROADS

PROPOSED WORK.

Buffalo, N. Y.—Common Council voted to pave Evelyn Avenue and Galveston Place and repave E. North Street with asphalt.

Long Island City, N. Y.—Board of Estimate, New York City, has approved layout of the Grand Central Parkway in Queens, extending from Queens Boulevard to Nassau County line at Floral Park; cost estimated at $1,000,000.

Syracuse, N. Y.—Syracuse Planning Comm. approved plan for a State Fair Boule. approach through Lakeview Avenue to connect with a roadway to be constructed by State to State Fair Grounds. Plan provides for connection of W. Genesee Street by way of Lakeview Avenue extended and widened with a proposed highway.

Pittsburgh, Pa.—City Council voted to pave Susquehanna Street and Neuman Way.

Baltimore, Md. — Paving Commission tentative plans for next year embrace about fifteen miles of paving, including approximately 9 miles of sheet asphalt, three miles vitr. block and three miles of granite block. Average cost approximately $44,000 per mile.

Delmer, Del.—Reports state that Col. Du Pont of Wilmington, contemplates constructing boulevard from Delmar to Rehoboth Beach.

Pineville, W. Va.—County road improvement bonds for $550,000 will be sold Dec. 1, by County Court (H. M. Cline, Pres.).

Clinton, N. C.—County road bonds for $25,000 will be sold Nov. 8, by County Commissioners (J. R. Peterson, Chmn.).

Shelby, N. C.—Citizens of No. 3 Township voted $30,000 bonds for building good roads.

Bradentown, Fla.—Venice Road and Bridge Dist. bonds for $250,000 reported to be sold Nov. 20. Address H. W. Parder, Sarasota.

De Land, Fla.—Halifax Special Road and Bridge Dist. bonds for $400,000 will be sold Nov. 22, by Board County Commissioners (Sam'l. D. Jordan, Clk.).

Eustis, Fla.—R. O. Riddle, clerk, writes that Bay, Center and Grove Streets and Orange Avenue are to be paved with penetration and sand asphalt, concrete curbs, and cost about $40,000. Ishman-Randolph Co. of Jacksonville, engineers.

Marco, Fla.—Citizens of Special Road and Bridge District No. 3 voted $125,000 bonds for constructing a hard surface road from Marco to the Dade County line.

Miami, Fla.—Citizens voted to construct rock road along bank of Miami Canal, to Dade County line, also for constructing Tamiami Trail to be continuation of Twentieth Street to Lee County line.

Pensacola, Fla.—All bids opened Oct. 16 by L. Earle Thornton, City Engineer, for three blocks of paving around Pensacola Hospital have been rejected.

Crowley, La.—Arcadia Parish Police Jury contemplates constructing 150 miles gravel roads throughout Parish. Plans provide for 2 18-ft. roads extending north and south and 2 roads extending east and west; cost about $750,000.

Donaldsonville, La.—Citizens voted $15,000 bonds to improve roads. Address County Clerk.

Franklin, La.—Town Council voted to improve Main Street; cost about $17,000.

Akron, Ohio.—Road bonds for $133,125 will be sold Nov. 17, by Jas. McCausland, City Aud.

Greenville, Ohio.—Road bonds for $32,450 will be sold Nov. 6, by G. H. Garrison, Co. Aud.

Youngstown, Ohio.—City Council voted to construct sidewalks on Lennox Avenue, Sheridan Rd. and Kent Street.

Albion, Ind.—Construction of Kendallville-Ligonier highway, distance of 21 miles, contemplated by County Comrs.; estimated cost $274,717.

South Bend, Ind.—Henderson McClellan, County Engineer, estimates cost of paving with brick 2 miles Hamilton Road in Olive Township at $29,304.

Baldwin, Mich.—Election will be held in April to vote $100,000 bonds for good roads.

Corunna, Mich.—County Road Commissioners will ask a vote at the spring election on $200,000 bond issue for State aid road work.

Flint, Mich.—Genesee County Supervs. voted $100,000 bonds for good roads.

Grand Haven, Mich.—Bd. Supervisors appropriated $75,250 for good roads.

Grand Haven, Mich.—Supervisors voted appropriation of $63,250 for constructing roads and $10,000 for repairs to roads.

Marshall, Mich.—County Commissioners have appropriated $124,000 bonds for good roads.

Mason, Mich.—County Bd. Supervisors has appropriated $115,000 for good roads.

Pontiac, Mich.—The Board of Supervisors has decided to submit to a vote next April the $1,000,000 good road bond issue.

Contract soon to be let by County Commissioners for 4½ miles 16-ft. concrete road.

Saginaw, Mich.—Citizens of Saginaw County voted $40,000 bonds for constructing trunk line highway to Owosso. A bridge is to be constructed over Tittibawassee River on the Merrill Rd. in connection with above by the state; cost $40,000.

Chicago, Ill. — State Supreme Court voted against the Cook County bond issue of $2,000,000 for constructing hard roads.

Joliet, Ill.—Asphalt, asphalt macadam and brick pavements contemplated by City Commission during 1916; estimated cost about $300,000.

Milwaukee, Wis.—It is reported Milwaukee County will construct 35 miles of concrete highway next year, at an approximate cost of between $500,000 and $600,000.

Cherokee, Iowa.—About four miles of paving is contemplated but no material selected. Address City Clerk.

St. Paul, Minn.—Minnesota Highway Commission it is reported will, during 1916, expend $3,000,000 on good roads. George W. Cooly, Secy. Commission.

City Council voted to pave Eleventh Street from Jackson to Cedar Street; cost about $15,000.

Walker, Minn.—State Highway Commission St. Paul approved Cass County road program for two roads, one from Cass Lake to Walker, a distance of 70 miles, and the other from Walker to Pillager, a distance of 30 miles; cost of two roads is $301,380, the State to pay $128,684.

Larned, Kan.—L. D. Burgess, city clerk, writes that contract for the 37,000 sq. yd. of pavement, probably vitrified brick, will be let in January or February. Material not yet chosen.

Independence, Mo.—Comrs. Jackson County considering constructing three miles rock road to connect with a road to be built across Johnson County.

Hondo, Tex.—Road Dist. No. 2 bonds for $38,000 will be sold Nov. 8, by Commissioners Court. R. J. Noonan, Co. Judge.

Flatonia, Tex.—An election soon to be held to vote a bond issue for road building.

Sherman, Tex.—See "Water Works."

Seattle, Wash.—City Engineer A. H. Dimock, has filed with Bd. Public Works plans and specifications for paving of Bailey Street; cost $35,000.

Streets and Sewers Committee of City Council considering filling and planking of Ninth Avenue at an estimated cost of $109,712.

San Francisco, Cal.—Bd. of Wks. voted to pave Twentieth Avenue with asphalt; cost $11,226.

Tulare, Cal.—City Trustees have started seventeen blocks of new paving, 5-in. concrete base and 1½-in. asphaltic concrete wearing surface. Alfred P. Bosworth, City Engineer.

Nogales, Ariz.—Citizens of County have voted $150,000 bonds for constructing highways, much of the work to be done by contract. Mrs. L. Ruddock-Wood, Clk. Bd. Supervisors.

Tucson, Ariz.—Citizens voted Oct. 26, $400,000 bonds for good roads. W. C. Goetz, Engr., Tucson; Bertram L. Hitch, Clerk Bd. Supervisors.

Yuma, Ariz.—See "Prices and Lettings."

Lewiston, Idaho.—Surveys are about to be made for constructing macadam highway from Lewiston Orchards to point above Waha; cost about $100,000. Ralph Bonnell, Engr.

BIDS DESIRED.

Connecticut.—Until Nov. 15 by State Highway Commission, Hartford, for constructing section of highways and bridges, advertised in Engineering Record.

Albany, N. Y.—Until Nov. 11 by State Highway Commission, 55 Lancaster Street (I. J. Morris, Secy.), for constructing state highways, in all about 40 miles, advertised in Engineering Record.

Bound Brook, N. J.—Until Nov. 16 by Stanley Brompton, Borough Clerk, for paving with asphalt block on a portion of Main Street, advertised in Engineering Record. F. A. Dunham, Engineer, 105 Park Avenue, Plainfield.

Newton, N. J.—Until Nov. 8 (not Nov. 11, as previously stated) by Bd. Chosen Freeholders at Newton, for improving the macadam surface and stone foundation of the Newton-Sparta Road, advertised in Engineering Record. Surface pavement and foundation each about 47,080 sq. yd. Harvey Snook, Co. Engr., Newton.

Easton, Md.—Reported desired Nov. 9, by County Commissioners (Jos. B. Harrington, Clk.) for constructing section of State Highway with mud shell, macadam or concrete, in all about 8.24 miles.

Huntington, W. Va.—Until Nov. 8, by Board City Commissioners, for paving with vitr. brick portions of Sixth, Eighth, Thirteenth Avenues and other streets. A. P. Maupin, City Engr.

Charlestown, W. Va.—Reported desired until Nov. 17 by County Commissioners (L. C. Massey, Clk.) for 1½ miles brick, macadam or concrete paving in London and Poka Dists. P. J. Walsh, Co. Aud.

Greenwood, S. C.—Until Nov. 10, by A. S. Hartzog, Mayor, for furnishing material and paving, approximately 60,000 sq. yd., constructing 10,000 sq. yd. cement gutter, 12,000 lin. ft. granite curb, 10,000 lin. ft. storm sewers, 12 to 20 in., 25 manholes, 80 intake basins, etc. C. P. Ballenger, Engr., Greenwood.

Dothan, Ala.—Reported desired until Nov. 18 by County Board Revenue (A. C. Crawford, Chmn.) for constructing about 21 miles of road.

Amite, La.—Reported desired until Nov. 9 by J. U. Vining, Clk. Police Jury, for constructing about 4.8 miles road; also about 10½ miles additional. J. E. Kerrigan, Engr., Hammond.

Covington, La.—Reported desired until Nov. 17 by County Parish Road Supervisors, for maintenance of 175 miles roadways, bridges, culverts, etc.

Toronto, Ohio.—Reported desired until Nov. 12, James Connor, Village Clk., for grading, draining, curbing and paving portions of Daniels and Federal Streets. James E. Kelley, Village Engr.

St. Joseph, Mich.—Until Nov. 11 by County Commissioners for 48½ miles of waterbound macadam roads, 12 and 16 ft. wide. Approximate cost $340,000. William J. Cleary, County Highway Engineer.

Chicago, Ill.—Until Nov. 10, by Board Local Improvements (Edw. J. Glackin, Secy.) for paving West Adams, Lafayette Streets, Haynes Court, and several alleys. Bids desired on repressed vitr. paving brick and asphalt.

Until Nov. 13 by Bd. Local Improv. (Edw. J. Glackin, Secy.) for constructing cement sidewalks on portions of West Eighty-eighth, S. La Salle, Roscoe, East Seventy-fifth, Raymond and a number of other streets.

Hastings, Neb.—Reported desired until Dec. 1 for paving with vertical fiber brick or asphaltic concrete, about 50 blocks. W. H. Fuller, City Engr.

Sedalia, Mo.—Until Dec. 6 by F. T. Leaming, City Engineer, for 9200 sq. yd. brick paving.

Austin, Tex.—Until Nov. 19 by City Commission for paving streets; cost about $330,640. P. W. Powell, Commissioner of Streets.

City Engineer estimates cost of paving on various streets at $330,640, including curbing, storm sewers, etc.

Layton, Okla.—Until Nov. 17 by Dept. of Interior, Washington, D. C. (A. A. Jones, First Asst. Secy.), for furnishing material and grading Gore Boule.

Riverside, Cal.—Until Nov. 10 by Co. Bd. Superv. (A. B. Pilch, Clk.) for improving portion of Route No. 18 by grading and paving with concrete 11 miles of roadway 9 ft. wide; alternate bid for macadam 14 ft. wide; also grading about 13-mile roadway.

San Gabriel, Cal.—Until Nov. 16 by Ira H. Stouffer, City Clk., for curb Class "A" grading and oil macadam on portion of Las Tunas Drive.

PRICES AND LETTINGS.

★Indicates award of contract.

Massachusetts. — Following are three lowest bids opened Oct. 26 by Massachusetts Highway Commission, Boston, for constructing a road in Woburn: Palotto & Davis Co., Lowell, 117 Crosby Street, $11,968; Tony Ross & Son, Woburn, $12,-972, and John A. Gaffey, Medford, $13,215.

Boston, Mass.—Following are three lowest bids opened Oct. 29 by city for paving—(a) with asphalt, (b) with bitulithic: James Doherty, 133 Calumet Street, Roxbury, (a) $8,631, (b) $8,659; Charles J. Jacobs Co., 107 Terrace Street, Roxbury, (a) $8,822, (b) $8,650; Central Constr. Co., 6 Beacon Street, (a) $8,914.

★Cranston, R. I.—Contract awarded by Highway Committee to Tracy Construction Company for concrete base on Broad Street asphalt surfacing, 11,000 sq. yd. at $4.85 per cu. yd. for material applied.

★North Haven, Conn.—Contract for 20,-800 yd. bituminous concrete pavement in North Haven awarded by State Highway Dept. at Hartford to Union Paving Co., at 74 cts., and Lane Co., at 70 cts.

Albany, N. Y.—Following are lowest bids opened by State Highway Dept. Oct. 26 for constructing roads as follows:

Road 5532—Arkport-Van Scoters Corners Road, Allegany and Steuben County, 5.25 miles, Kennedy Constr. Co., Albany, $50,881.

Road 5547—Whitesboro-Carey Corners Road, Oneida County, 0.7 mile, Langan Constr. Co., Albany, $17,187.

Road 5589—Lodi-Interlaken Road, Seneca County, 5.01 miles, Greenfield Constr. Co., Hornell, $43,719.

Road 1330—Ithaca-Esty Road, Glen, Tompkins County, 2.48 miles, Greenfield Constr. Co., Hornell, $26,447.

Road 1079 — Spencer-Candor, Part 2 Road, Tioga County, 4.07 miles, Peter F. Connolly Co., Horseheads, $30,602.

★Buffalo, N. Y.—Contract for paving Skillen Street with concrete awarded by Common Council to Henry P. Burgard Co., 1968 Fillmore Avenue, at $10,875.

New York, N. Y.—Following are unit figures of lowest bids opened Oct. 28 by Park Board for improving a portion of service road of Riverside Drive from Ninety-one to 114th Streets, including approaches from Drive to Cathedral Parkway and in the intersection at Seventy-ninth Street

Specification A.—Asphalt Construction Company, 208 Broadway: 3000 cu. yd. excavation, $1; 2030 cu. yd. concrete foundation for roadway, $4.50; 12,800 sq. yd. roadway pavement (Bermudez asphalt), 95 cts.; 20 receiving basins, adjust to grade, $20; 4900 lin. ft. cement curb, 70 cts.; 300 lin. ft. blue stone curb, $1; 1000 lin. ft. old blue stone curb reset, 47 cts.; total $28,895. Next three bidders: Uvalde Asphalt Paving Company, 1 Broadway, $29 332; Sicilian Asphalt Paving Co., 41 Park Row, $29,715. Barber Asphalt Paving Co., 233 Broadway, $30,127. Totals of four lowest bidders on specification "B" were: Sicilian Asphalt Paving Co., $27,155 (Mexican asphalt); Uvalde Asphalt Paving Co., 1 Broadway, $27,856 (Standard Mexican); Asphalt Construction Company, $28,383 (Mexican oil asphalt), and Cleveland Trinidad Paving Co., Flushing, $30,-048 (Montezuma asphalt).

Greensburg, Pa.—Following are four lowest bids opened Oct. 26 by County Commissioners for paving:

★Scottdale - Tyrone Road: Samuel Holmes, Scottdale, $19,958 (awarded contract); Bell-Bockel Co., Altoona, $21,223; C. Goehring, West Newton, $21,993; Hoblityre & Price, Myersdale, $22,004.

Jeannette-Grapeville Road: Luther Edwards, Greensburg, Pa., $21,123; McCrady Bros., Braddock, $21,601; Ridge Bros., Pittsburgh, $22,071; Rhinehart Bros., East Liverpool, Ohio, $22,169.

★Philadelphia, Pa.—Contract awarded Union Paving Co., 112 N. Broad Street, large terminal facilities here at a cost of Jasper Street at $16,978.

★Pittsburgh, Pa.—Contract awarded by County Commissioners as follows for paving: Clinton and Frankfort Roads, 2.4 miles, to D. W. Challis & Son, Sewickley, and Beatty Road, 2.9 miles, to R. H. Cunningham & Sons, Inc., Turtle Creek. Hyatt M. Cribbs, County Comptroller.

★Baltimore, Md.—Contract for grading main driveway and upper driveway of Ellicott Driveway awarded by Bd. Awards to F. B. Beasman & Co., at $21,-015. Contract for paving this portion will be let in the spring.

★Salisbury, Md.—Contract for constructing two miles of highway along Salisbury Anderson Mill Road (bids opened Oct. 12) awarded Juanita Co., Philadelphia, at $13,034. Next three lowest bidders: County Commissioners, Salisbury, $13,782; J. T. Baden, Baden, $14,800; Russo Parker Co., Hudson, N. Y., $14,994. Daniel B. Cannon, Treas., Co. Comrs.

Pensacola, Fla.—J. Gherkin of Pensacola bid $2.295 per sq. yd. for wood block pavement on three blocks around Pensacola Hospital, in all about 4000 sq. yd., and T. T. Powers & Son, Memphis, $2.29.

★Morganfield, Ky.—Contract for constructing improvements to road between Uniontown and Boxville (bids opened Oct. 26) awarded Collins & Pavy, Mt. Vernon, Ill., at $28,508. John Bingham, County Auditor.

★Logansport, Ind.—Contract for paving West Broadway and Wheatland Avenue (bids opened Oct. 19) awarded Andrews Asphalt Paving Company, Hamilton, at $100,228. H. H. Thompson, City Engineer.

★South Bend, Ind.—Contract for paving Leeper Avenue with bituminous filled macadam and glutrin macadam awarded by Bd. Works to H. N. Barnes, South Bend, at $12,437.

★Marshall, Tex.—Contract for paving one-half mile E. Houston Avenue with concrete awarded to Bert Han Constr. Co., Dallas, at $1.62 per front ft. for 27-ft. section and $1.19 per front ft. for 24-ft. section.

★Seattle, Wash.—Contract awarded Independent Asphalt Paving Co., Northern Bank Building, for paving Forty-seventh Avenue N. E. at $26,685.

Lowest bid for concrete walks, etc., on Ferdinand Street submitted by Rowan & Armstrong, 309 Hinckley Block, at $11,676.

Following are four lowest bids opened Oct. 22 by Bd. Pub. Wks. for paving Meridian Avenue and other streets: P. J. McHugh, Third Avenue and North Street, at $21,075; R. G. Stevenson, 1327 Ewing Street, $21,384; Washington Paving Co., L. C. Smith Building, $21,908; City Contracting Co., 1319 Twenty-first Avenue, $22,914.

★Bakersfield, Cal.—Contract for 6 miles concrete pavement on Div. 5, Sect. 1, Bakersfield-McKittrick Rd. awarded by county to Shattuck & Nimmo Warehouse Co., Bakersfield, at $28,802.

★Contract for paving 6 miles on Div. 10, Sect. 5, Weed Patch Loop, ending at Lo Kern, awarded by county to Worswick Street Paving Co., Modesto, at $31,460.

★Bakersfield, Cal.—Contract for grading and constructing culverts on Div. 11, Sect. 2, California-Kernville Rd., about 2½ miles long, awarded to Castro-Blaisdell, Bakersfield, at $12,158.

★Corona, Cal.—Contract for paving with concrete and macadam on portion of North Main and River Streets (bids opened Oct. 19) awarded Johnson Shea Co., Riverside, at $6,970.

★Los Angeles, Cal.—Contract for constructing 3 miles concrete paving on Palmdale-Lancaster Rd. in Road Dist. No. 5 awarded to H. E. Cox, Chamber Commerce Building, at $24,351.

★Los Angeles, Cal.—Contract for 250,000 sq. ft. asphalt pavement in the Pellissier tract awarded to Ford & Stout, Bradbury Bldg., at about $30,000.

★Manhattan Beach, Cal.—Contract for paving Center St., E. Railroad Drive, Fisher and Highland Avenues, etc., with concrete base and oil and screening wearing surface, awarded to Modern Constr. Co., 1008 Wright & Callender Bldg., Los Angeles, at $39,629.

Riverside, Cal.—Following bids opened by County Commissioners for constructing 11 miles roadway on route No. 18: B. R. Davison Constr. Co., Monrovia, concrete, $45,096; macadam, $52,825; Johnson-Shea Co., Riverside, concrete, $52,489, and macadam, $56,889.

San Francisco, Cal.—Two lowest bids opened Oct. 20 by Bd. Wks., for constructing the first section of the beach esplanade, submitted by C. Lamburth at $49,900, and Western Building & Engineering Company at $49,970.

★Contract awarded by Board of Works to C. E. Lamburth, for constructing above work—first section of the ocean beach esplanade.

Yuma, Ariz.—Lowest bid opened for constructing about 16 miles concrete pavements under Contract No. 1 for county submitted by Mesmer & Rice, 231 Marsh-Strong Building, at about $125,000.

All bids opened by County Bd. Supervisors Oct. 25 for constructing about 17 miles of 2 in. macadam surface with cementing gravel base reported rejected.

★Salt Lake City, Utah.—Contract for paving Fifteenth East Street awarded by City Comn. to P. J. Moran, 152 N. Second Street, at $15,860.

★Salt Lake City, Utah. — Contract awarded J. W. Mellen, Auditorium Building, for paving with Utah rock asphalt portions of Sixth E and Sixth S Streets (bids opened Oct. 26) at $85,300. P. J. Moran bid $85,765. Karl A. Scheid, City Recorder.

STREET CLEANING AND GARBAGE DISPOSAL

PROPOSED WORK.

San Marcos, Tex.—Attorney General has approved the $35,000 incinerator bond issue.

Montreal, Quebec.—Superintendent Nantel of the City Incineration Department has submitted a report to Board of Control on the construction of a large incinerator having a daily capacity of 500 tons; estimated cost $200,000.

PRICES AND LETTINGS.

★Indicates award of contract.

★Marquette, Mich.—Contract for constructing an incinerator plant awarded McGuire-Hunter Incinerator Co. of Chicago, Ill., at $8,885.

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS

PROPOSED WORK.

Dock Improvement—Brooklyn, N. Y.—An agreement has been reached between the Public Service Commission and the New York Dock Co., State and Whitehall Streets, New York, whereby the New York Dock Co. will improve the Brooklyn waterfront between Fulton Street and Atlantic Avenue by replacing existing piers with five new piers, from 640 to 750 ft. long.

Wharf Improvements—Buffalo, N. Y.—Reported contract soon to be let by Commissioner of Public Works for constructing a concrete wall paralleling the Bird Island pier 50 to 80 ft. out in the river. Wall will be about 3000 ft. long.

Flood Protection—Erie, Pa.—Report of Farley Gannett for the flood prevention has been accepted by Mayor W. J. Stern.

Canal Improvements — Hagerstown, Md.—Reported Canal Towage Company will make extensive improvements during the winter along the Chesapeake & Ohio Canal, including a concrete lock at Dam. No. 6.

Drainage — Savannah, Ga. — Drainage Committee considering constructing a trunk sewer to drain western part of the city.

Drainage — Savannah, Ga.—Drainage Committee considering constructing an additional trunk sewer to drain western part of city.

Dam—Chippewa Falls, Wis.—Reported Wisconsin Minnesota Light & Power Co. has decided to rebuild the old dam of the C. L. & B. Company in this city at a cost of $500,000.

Drainage—Grand View, Wis.—Reported the White River Drainage District is to be constructed at a cost of $75,000. J. S. Ellis, Secy. Comrs.

Hydroelectric Plant—Shawano, Wis.—Reported an election soon to be held to vote $60,000 bonds for constructing a dam and hydroelectric plant on Wolf River.

Irrigation—Austin, Tex.—E. B. Gore, member of the State Board of Water Engineers, and W. L. Rockwell, Irrigation Engineer, U. S. Department of Agriculture, are reported to be making an investigation of Nueces and Rio Grande valleys, a preliminary step toward making plans for the irrigation of approximately 2,500,000 acres of land in the western part of the state. Major John Wilson, of the State Board of Agriculture, is reported making similar investigations in the northern section of Texas.

Dry Dock, etc.—Galveston, Tex.—Reported J. J. Kane of Galveston has received title to 80 acres of submerged land on Galveston Bay, known as west end flats, and it is reported Mr. Kane and associates intend constructing dry docks at Galveston, and will spend within the next five years $150,000 in improvements.

Drainage Bonds—Houston, Tex.—Drainage bonds amounting to $140,000 have been sold.

Irrigation—Brewster, Wash. — Contract soon to be let for constructing the Brewster Irrigation District Project on the basis of the bonds of the District as pay for the work. Bonds voted amounting to $1,250,000; project estimated to cost $1,069,000. One feature of the project is a long flume for the main canal, 25 miles long, involving between 10,000 and 15,000 M. ft. lumber or metal flume; wood stave

★Stevenson, Wash.—Following are unit figures of bids opened Oct. 23 by Board of County Commissioners, Stevenson, for about nine miles of Stevenson-Collins Road, Skamania County: (a) J. M. Ambrose, Portland, Ore. (reported awarded contract), $48,000; (b) General Construction Co., Spokane, $49,559; (c) Giebisch & Joplin, Portland, Ore., $49,943; (d) Burpee & Co., $50,921.

	(a)	(b)	(c)	(d)
40 acres clearing	$90.00	$35.00	$50.00	$50.00
53,000 cu. yd. earth excavation	0.19	0.18	0.24	0.18
29,000 cu. yd. rock excavation	0.65	0.65	0.60	0.70
13,000 cu. yd. loose rock, excavation	0.32	0.35	0.35	0.34
80 cu. yd. rock fill, hand laid	1.50	0.75	0.75	1.00
100 cu. yd. gravel concrete	5.00	10.00	4.50	8.00
1,500 lb. steel and iron	0.04	0.05	0.06	0.05
50 sq. yd. cobble paving	0.50	0.75	0.75	1.00
1,200 lin. ft. guard rail, wood	0.25	0.20	0.20	0.20
7,120 lin. ft. guard rail, stone	0.10	0.15	0.05	0.20
3,000 cu. yd. riprap	0.75	1.25	1.35	0.75
850 cu. yd. rubble masonry	3.00	4.00	2.50	4.00
850 cu. yd. third-class masonry	0.75	2.00	1.50	1.75
45 M ft. timber	22.00	25.00	22.00	22.00
20,000 overhaul (sta. x cu. yd.)	0.02	0.03	0.02	0.02
10 acres grubbing	120.00	50.00	175.00	200.00
20 cu. yd. loose stone, for drains	1.50	0.75	0.60	1.25
3 bridges, complete, each	400.00	400.00	350.00	330.00
900 lin. ft. cor. iron pipe, 12-in. and 15-in.	0.10	0.20	0.15	0.20
520 lin. ft. cor. iron pipe, 18-in. and 24-in.	0.15	0.25	0.20	0.25
80 lin. ft. cor. iron pipe, 30-in. and 48-in.	0 25	0.30	0.30	0 30
148 lin. ft. conc. pipe, 18-in. and 24-in.	0.50	0.35	0.50	0.50
84 lin. ft. conc. pipe, 36-in.	1.00	0.75	0.60	0.50

...Improvement—Tacoma, Wash.—...

...Irrigation Work—Wenatchee, Wash.—...

...Dredging—Astoria, Ore.—...

...Jetty Improvement—Bandon, Ore.—...

...Irrigation—Burns, Ore.—...

...Irrigation Work—Grandview, Ore.—...

...Drainage—Marshfield, Ore.—E. L. Rob...

...Ditch Bonds—Ontario, Ore.—...

...Irrigation — Dinuba, Cal.—Chamber of...

...Marsh Improvement—Oakland, Cal.—...

...Irrigation Work—Stockton, Cal.—Board...

...Hydroelectric Plant—Wanetta, B. C.—...

BIDS DESIRED

...Dredging—Norfolk, Va.—...

Seawall—Wayland, Miss.—Until Dec. 1, by Sea Wall Commission, Dist. No. 1, Geo. H. Morgan, Pres., Bay St. Louis, for constructing concrete sea wall and filling in space along town's front, from East St. Louis-Wayland bridge line, to southerly line of Ward and Terrace, wall to be about 3500 ft. long.

Lock Bridges — Louisville, Ky.—Until Dec. 5 to U. S. Engineer Office, Louisville, for constructing a swing bridge over Louisville and Portland Canal, ... advertised in Engineering ...

Ditch — Plymouth, Ind. — Reported de... Arthur W. Thompson, ... for constructing Mc... Ditch, requiring about 13,625 cu. yd. ... and open shovel, ... of ... estimated cost $5,552; ... lateral, cost ...

...Contract No. 2, same ditch as above, for ... by Isaac M. Kesson et al as ... Ditch, ... separately, the open ... with $3.50 dredge ... $13.90, McCombs ... M. Kesson lateral, $861. ... lateral, $...

Alexandria, Minn. — Reported desired ... Nov. 12 by C. H. Jensen Co. And., ... with the County Ditch ... Estimated cost, $14,800.

Irrigation — Hood River, Ore.—Until Nov. 9 by George R. Wilcox, Sec'y, East ... Irrigation Dist., Hood Building, for ... of irrigation system ... following: Constructing diversion gates ... Improvement of Neal Creek lateral, ... and repair of intersections where ... Creek ... is separate from Neal Creek; constructing about 10,000 lin. ft. ... enlarging 6500 lin. ft. of canal on ... Contract ... R. A. McClanathan, ... Hood River.

Dredger — Macaco, China.—Until Jan. 8 by Isaac Cowen, Jr., Mgr., General Engineering Co., Shanghai, for a wartime self-propelling dredger, steel hull, for use of Macaco Harbor Works. For further information address Chicago Association of Commerce, Chicago, Ill.

PRICES AND LETTINGS.

★Indicates award of contract.

★Bulkheading—Deal, N. J.—Contract awarded by Borough Council for bulkheading the Deal Casino property between Monmouth Drive and Marine Place to Frank R. Stonewall of Melvin, N. J., at $13,585.

Levee Improvement—Greenville, Miss.—Contract for constructing new loop of ... levee approximately 150,000 cu. yd., awarded Burt, Bond & McMurray at ... per cu. yd. W. S. Tompkins, Chief Engineer, Mississippi River Levee Board.

Mitering Dry Dock Gates—Louisville, Ky.—Lowest bid opened Oct. 22 by U. S. Engineer's office for furnishing and erecting one miter dry dock gate of ... was submitted by American Bridge Company, Union Trust Building, Cincinnati, Ohio, at $8,047.

★Drain — Williamsport, Ind.—Contract for ... in Lyman and Stephen Townships, bids opened Oct. 19, awarded National Drain Tile Company, Terre Haute, at $9,974.

★Dock Improvements—Superior, Wis.—Contracts awarded as follows by M. A. Hanna & Co. for improvements to their ... including about $90,000. Concrete work, Barnett Record Co., and steel work, Mead Morrison Co., Chicago, Ill.

★Ditch—Blue Earth, Minn. — Contract for constructing Ditch No. 9 and 10 (bids opened Oct. 20) awarded Carl C. Knudsen of Blue Earth, at $57,200. Other bidders: Paul Paulsen, Mason City, Ia., $61,800, and P. Axelsen Clear Lake, Ia., $60,250. H. H. Hansen, C. E., Delavan, Minn.

★Ditch—Blue Earth, Minn.—Contract for constructing county ditch No. 32 (bids opened Oct. 20) awarded Otto Milaer, Elmore, at $14,435. J. L. Henning, County Auditor.

★Irrigation — Polson, Mont. — Contract for constructing Mission Lateral H and sub laterals for Flathead irrigation project, Montana, awarded by U. S. Reclamation Service to Wilson Bros. of Polson at $16,423. Contract involves construction of about 10 miles of laterals and appurtenant structures embracing 43,000 cu. yd. of excavation, 140 cu. yd. of concrete, 400 sq. yd. paving, placing of 9000 lb. steel and about 32 M. ft. lumber. Work is situated about 15 miles from Dixon.

★Wall—San Francisco, Cal.—See "Paving and Roads."

Esplanade — San Francisco, Cal.—See "Paving and Roads."

★Sea Wall—Vancouver, B. C.—Contract awarded A. G. Creshman, Vancouver, for constructing a sea wall on Main Street bridge.

ELECTRIC RAILWAYS

PROPOSED WORK.

Waterville, Conn.—Plans being made by Connecticut Co., New Haven, to reconstruct tracks extending through Waterville.

North Tonawanda, N. Y.—International Ry. Co. of Buffalo contemplates constructing double-track line between Buffalo and Niagara Falls. The plans provide for an elevated line through the business and residential sections of North Tonawanda.

Salem, N. J.—Salem-Pennsgrove Traction Co. received franchise from Council in Salem; also from Bd. Chosen Freeholders to operate a line over county roads and bridges.

Collingdale, Pa.—Plans being considered by Philadelphia & West Chester Traction Co. to extend Collingdale Div. from Parker Avenue, Collingdale to Chester Pike in Sharon Hill.

Huntington, W. Va.—Huntington-Chesapeake Bridge Co. incorporated to construct a railway in Huntington W. Va., and Chesapeake, Ohio. Among incorporators R. P. Meshire, Paul Hardy and J. C. Miller.

Atlanta, Ga.—It is reported the Georgia Ry. & Power Co. is considering extending line from Atlanta to Alpharetta via Roswell or Crabapple.

Youngstown, Ohio.—Mahoning & Shenango Ry. & Light Co. plans to reconstruct Wilson Avenue and Federal Street Lines in spring; cost about $175,000.

Boonville, Ind.—Evansville, Chrisney & Eastern Ry. will about January construct a line from Boonville to Chrisney, 13 miles, and from Boonville to Lynnville, 11 miles. J. P. Chrisney, Pres.

Joliet, Ill.—Plans being considered by Joliet & Eastern Traction Co. to extend line from Chicago Heights, Ill., to Hammond, Ind.

Milwaukee, Wis.—Plans being prepared by Milwaukee Electric Ry. & Light Co. to extend electric transmission line to Merton and Lake Drive.

Des Moines, Iowa.—Interurban Railway, Des Moines, reported having surveys made for constructing an extension of the line from Colfax to Newton via Metz, 12 miles, and from Colfax east. An extension from Colfax to Jefferson, and one from Woodward northwest, are also to be constructed within the next two years.

Stephenville, Tex.—Surveys completed by Dallas Southwestern Traction Co. for line from Glen Rose to Stephenville, 80 miles. E. P. Turner, Gaston Building, Dallas, Pres.

Temple, Tex.—Reported arrangements completed for surveying Temple-Marlin Interurban Project.

Henryetta, Okla.—Plans being considered by R. D. Long, Muskogee, to construct an electric railway from Henryette to several small towns.

Tulsa, Okla.—The Sapulpa & Oil Fields R.R. Co. intends constructing an electric road from Drumwright to Depew, a distance of 15 miles. J. A. Prates of Tulsa, Pres.

Linnton, Ore.—O. M. Clark received franchise from City Council. It is proposed to construct line from Portland to Linnton.

San Francisco, Cal.—Patterson & Western R. R. Co., incorporated, to construct railway in Santa Clara and Stanislaus Counties. R. J. Pratt, 3388 Clay Street, San Francisco, said to be interested.

Toronto, Ont.—The Ontario Hydro Electric Power Company (Adam Beck, Chmn.) it is reported intends constructing a hydro electric radial railway between Toronto and Guelph.

Valdez, Alaska.—Peabody Alaska Copper Co. (C. L. Peabody of Seattle, Wash.), it is reported, intends constructing a 15-mile tramway along property near this city; cost $10,000 per mile.

PRICES AND LETTINGS.

★Indicates award of contract.

Brooklyn, N. Y.—New York Municipal Railway Corporation has applied to the Public Service Commission for the First District for permission to enter into a contract with George W. McNulty Co., 2150 Sixty-fifth Street, for the construction of the Coney Island terminal of its elevated railroads.

★Reported Public Service Commission has approved with qualifications contract awarded by Municipal Railway Corporation to American Bridge Company, 30 Church Street, for furnishing steel for third tracking the Fulton Street L from Nostrand Avenue to Adams Street at $43 per ton; total $623,500; Coney Island Terminal, $45 per ton; total $675,000, and East New York third tracking and reconstruction, $48 per ton; total $888,000. The Brighton Beach line will cost $42 per ton; total $88,200.

★State Canal Work—Albany, N. Y.—Following are unit prices of four lowest bids ... for ... by W. W. Wotherspoon, State Superintendent Public Works, for ... channel, ... with a connecting channel; to ... Lock, ... dam, ... a spillway and a highway bridge at Syracuse: ... (a) Wood Construction Co., Davenport, Iowa, ... (b) The Thomas Maher Co., Lyons, ... (d) James ... & Co., 30 Church Street, New York, ... (e) Eastover Construction ...

	(a)	(b)	(c)	(d)	(e)
...	$50.00	$50.00	$50.00	$50.00	$50.00
...	10,000.00	1,500.00	2,500.00	8,400.00	10,000.00
...	0.26	0.156	0.21	0.195	0.21
...	50.00	45.00	50.00	40.00	30.00
...	0.20	0.20	0.15	0.15	0.10
...	0.35	0.26	0.25	0.24	0.40
...	25.00	15.00	25.00	20.00	25.00
...	50.00	34.00	35.00	46.00	35.00
...	65.00	55.00	55.00	65.00	65.00
...	2.00	1.90	1.45	1.70	1.25
...	7.00	6.00	7.00	7.50	7.50
...	0.04	0.04	0.04	0.04	0.04
...	2.00	1.75	2.00	2.00	2.20
...	0.01	0.01	0.032	0.04	0.01
...	1.25	1.00	1.15	1.25	1.25
...	0.035	0.035	0.036	0.02	0.035
...	1.20	1.00	1.20	1.20	1.20
...	1.25	1.00	1.25	1.25	1.25
...	1.50	1.00	1.50	2.00	1.50
...	2.00	2.50	3.10	2.00	2.00
...	1.20	1.00	1.00	1.00	1.20
...	1.50	1.20	1.50	1.50	1.50
...	1.50	1.30	1.35	1.50	1.50
...	0.15	0.12	0.10	0.15	0.15
...	0.30	0.25	0.30	0.30	0.30
...	1,000.00	1,000.00	1,000.00	1,000.00	1,000.00
...	15,000.00	15,000.00	15,000.00	15,000.00	15,000.00

★Philadelphia, Pa.—Following are unit figures opened Oct. 19 by Department of City Transit for Contract 511—steel superstructure and appurtenant work in Front Street, from Callowhill Street to south of Girard Street: (a) McClintic Marshall Company, Morris Building, $256,185, alternate $268,595 (awarded contract); (b) Pennsylvania Steel Company, Steelton, $275,895, alternate $287,455; (c) Connors Brothers Company, Inc., 64 West Eighty-eighth Street, New York, N. Y., $290,475, alternate $311,475; (d) E. E. Smith Contracting Company, 101 Park Avenue, New York, $290,790, alternate $312,590:

	*(a)	(b)	(c)	(d)
Whole work as shown on plans, proposed line (lump sum)	$249,000.00	$265,940.00	$283,000.00	$282,665.00
Whole work as shown on plans, alternate line (lump sum)	261,400.00	279,500.00	304,400.00	304,465.00
10,000 lb riveted steel girders	.0315	.033	.04	.0425
10,000 lb.rolled steel beams	.029	.028	.04	.0425
10,000 lb. steel columns	.04	.042	.04	.0425
10,000 lb. steel rods	.04	.0405	.035	.03
10,000 lb iron castings	.025	.03	.05	.04
100 cu. yd. excavation	1.25	1.10	2.00	2.00
100 cu yd concrete	10.00	11.80	7.50	8.00
100 sq. yd. asphalt paving	4.50	3.00	3.00	2.50
100 sq. yd. new granite block paving	4.50	4.50	3.50	4.00
100 sq. yd. new vitr. block paving	4.50	3.75	3.00	3.00
100 sq. yd. new wood block paving	4.50	4.00	3.50	4.00
100 sq. yd granite, wood or vitr. block repav., concr. base.	2.25	2.50	2.25	4.00
100 sq. yd. granite, wood or vitri. block repav., gravel base.	2.00	1.50	1.50	3.00
100 sq. yd. granolithic sidewalk paving	1.50	2.00	1.50	2.00
100 sq. yd. flagstone sidewalk repav.	.75	.50	1.00	3.00
100 sq. yd brick sidewalk paving	1.00	1.10	3.00	2.00
100 lin. ft. 6" straight granite curb	1.00	1.25	3.25	1.50
100 lin. ft. 8" straight granite curb	1.20	1.50	3.50	2.50
100 lin. ft. 6" or 8" curved gran curb	2.25	2.00	4.00	3.00
100 lin. ft. granolithic curb	.55	.60	.80	1.00
100 lin. ft. resetting stone curb	.50	.50	.30	.60
1 M ft yellow pine lumber	55.00	60.00	65.00	40.00
$16,000 force account, per cent. added	12½%	20%	10%	15%

RAILROADS

PROPOSED WORK.

Providence, R. I.—M. H. Bronsdon, City Engineer, reported to the committee on harbor and engineering that $265,000 will provide necessary terminal facilities at Fields Point, including a double track marginal railroad along city sea wall to connect with New Haven & Southern New England Railroad system; a 600 ft. by 200 ft. one-story steel warehouse costing $180,000; $20,000 traveling crane; a switching locomotive costing $6,000 and six spur tracks permitting loading of cars direct from vessels.

Lansing, Mich.—Reported Lansing and Muskegon Chamber of Commerce are making an organized canvass of prospects of the proposed Lansing & Northern R.R. from Lansing to Muskegon, through territory not at present touched by railroads. Westphalia, Wacousta, Maple Rapids and Carson City are on the proposed route. J. W. Sherman of Cleveland, Ohio, inspecting engineer for capitalists.

Beaumont, Tex.—Kansas City Southern R.R. (C. E. Johnston, Ch. Engr., Kansas City, Mo.), it is reported, will soon construct a new passenger station and enlarge terminal facilities here at a cost of about $100,000.

Galveston, Tex.—Reported Gulf, Colorado & Santa Fé R.R. (F. Merrill, Ch. Engr., Galveston) will rebuild the 26 miles of road damaged by recent storm.

Bellingham, Wash.—The McCloy Loggie Timber Co., Bellingham, will construct a four-mile railroad. George W. Loggie, Pres.

Portland, Ore.—Reported the Oregon-Washington Railroad & Navigation Co. (J. R. Holman, Ch. Engr., Portland) and the city and property owners proposed improving the grade of said road at a cost of $600,000. Seven viaducts and a cut to extend from East Twenty-eighth to East Eighty-second Street are contemplated in the improvements.

Reported Oregon-Washington Railroad & Navigation Company (J. P. O'Brien, Vice-Pres. and General Manager) intends spending about $800,000 in rail renewals on various parts of the main line between Portland and Huntington.

BIDS DESIRED.

Huntington Beach, Cal.—See "Miscellaneous."

PUBLIC BUILDINGS AND SCHOOLS

PROPOSED WORK.

Southbridge, Mass.—Revised plans completed for the $90,000 high school. F. S. Corbin, Supt. Schools.

Providence, R. I.—Martin & Hall, 806 Union Trust Building, are architects for proposed two-story and basement, brick, grammar and high school to be erected at Barrington as a memorial to Leander Remington Peck; cost about $50,000.

Bridgeport, Conn.—School bonds for $200,000 reported will be sold Nov. 5, by City Auditor.

Hamden, Conn.—Reported erection of high school is under consideration.

Wethersfield, Conn.—Preliminary plans being prepared by A. Raymond Ellis, 36 Pearl Street, Hartford, for a three-story fireproof administration building and one-story brick broom shop to be erected at Ridge Road and Jordan Lane for Connecticut Institute for the Blind.

New York, N. Y.—Plans filed for erecting 4-story brick home for Home of Daughters of Jacob, cost $400,000. Louis A. Abramson, 220 Fifth Avenue, Archt.

Rochester, N. Y.—Gordon & Madden, 300 Sibley Block, have completed plans for proposed School No. 37, to be erected at Congress and Post Avenues, one story, twelve rooms, brick and stone construction.

Trenton, N. J.—Plans for eleven new schools and alterations to existing buildings approved by State Board of Education.

Lancaster, Pa.—R. M. Bolemus, Secy. Bd. Education, writes that only condemnation proceedings have been started for high school; plans not yet completed. C. E. Urban, Lancaster, Archt.

Newark, Del.—A gift of $500,000 has been made Delaware College, $200,000 to be spent for improvements. Henry B. Thompson, Chmn., Executive Com.

Plans being prepared by Day & Klauder, 925 Chestnut Street, Philadelphia, Pa., for proposed agricultural building for Delaware College.

Washington, D. C.—Plans being prepared by Marsh & Peters, 520 Thirteenth Street N. W., for proposed preparatory school for Georgetown University, to consist of six buildings; cost $400,000.

Greenville, S. C.—Sketches being prepared for the brick and steel city hall to cost $75,000. Address City Clk.

Lake Charles, La.—Bonds amounting $125,000 for erecting new high school reported sold.

Yazoo City, Miss.—Bonds issued amounting to $60,000 for erecting new high school.

Nashville, Tenn.—Erection of tuberculosis hospital and boys' reformatory being considered by State authorities.

Canton, Ohio.—Plans prepared by Edmund Herrmann, Canton, for proposed school to be erected at Twenty-third Street N. E., to be known as Daniel Worley School, approved by State Board; cost about $80,000.

Lorain, Ohio.—School bonds for $30,000 will be sold Nov. 22 by Board Lorain City School Dist. (E. Bruell, Clk. Bd. Educ.)

Indianapolis, Ind.—Board of School Commissioners intend erecting four-room addition to School No. 58, Linwood Avenue and East New York Street; cost about $25,000.

Detroit, Mich.—Supt. Chas. E. Chadsey recommends erecting twelve new schools and additions to three present buildings to cost approximately $2,000,000.

Grand Rapids, Mich.—Contract soon to be let by Trustees of Calvin College for erecting main building; cost approximately $130,000.

River Rouge, Mich.—Council engaged George J. Haas, Kresge Building, Detroit, to prepare plans for $45,000 municipal building.

Milwaukee, Wis. — City contemplates erecting $60,000 natatorium at Fifth and Hayes Streets early next spring.

Plans completed by Schmidt, Garden & Martin, 104 S. Michigan Street, Chicago, Ill., for proposed four-story, brick, steel and concrete hospital to be erected at Hartford and Maryland Streets to replace present Columbia Hospital, at 830 Sycamore Street; cost $300,000.

Grinnell, Iowa.—Reported next year an Alumni hall is to be erected for Grinnell College; cost about $200,000.

Rochester, Minn. — Reported erection of school to replace Phelps School, destroyed by fire, is under consideration by Bd. Education.

St. Cloud, Minn.—All bids opened Oct. 25 by Bd. Educ. for erecting the high school have been rejected as exceeding the appropriation, which is $150,000.

St. Paul, Minn.—Election will soon be held to vote $500,000 bonds for erecting public school buildings.

Wichita, Kan.—Erection of two-story and basement, brick, reinforced concrete, fireproof school contemplated; estimated cost $60,000.

Austin, Tex.—Reported state has decided to erect the Institute for the Blind in this city, and plans about completed by Atlee B. Ayers, San Antonio; appropriation $300,000.

Houston, Tex. — Following improvements contemplated by School Board: New Taylor School, to be erected at Louisiana and Leeland Streets, plans being prepared; Montrose School; Eastwood School; North Side Junior High School annex, with swimming pool; new school on Lyons and Gregg Strets; industrial annex for Reagan School; new colored school near Emancipation Park and new Hollywood School for colored children.

Tascosa, Tex.—Attorney General has approved $30,000 bond issue for erecting jail and court house.

Carlsbad, N. M. — All bids opened Oct. 20 for erecting the Armory have been rejected as being too high. Robert C. Dow, Secy. Armory Comrs.

Seattle, Wash.—Port Commission, it is reported, has rejected all bids Oct. 27 for erecting the four-story reinforced concrete addition to Whatcom Avenue warehouse, and the matter has been postponed indefinitely.

Ogden, Utah.—Reported Fred. V. Kiesel, Ogden, will erect an armory costing $30,000 for use of Ogden Company of National Guard of Utah.

BIDS DESIRED.

Boston, Mass.—Until Nov. 12 by Schoolhouse Commissioners (Joseph P. Lomasney, Chmn.) for erecting addition to high school of Practical Arts, Dearborn Dist., Greenville and Winthrop Streets.

North Adams, Mass.—Until Nov. 17, by F. J. O'Hara, Secy. pro tem School Com., for erecting the Drury High School Building. E. C. & G. C. Gardner, Archts., 33 Lyman Street, Springfield.

Greenwich, Conn.—Until Dec. 10 by James A. Wetmore, Superv. Archt., Washington, D. C., for constructing, complete (including mechanical equipment and approaches), U. S. Post Office at Greenwich.

Buffalo, N. Y.—Until Nov. 16, by Green & Wicks, Archts., 110 Franklin Street, for erecting service building, two tuberculosis ward buildings, female help building, psycopathic building, connecting corridors and tunnels and garage for hospital at West Farm site; also separately for masonry, fireproofing, structural steel, iron, etc.; electric work including light and power; heating and ventilating, etc.; plumbing and drainage work. Thomas W. Jordan, Secy. Buffalo City Hospital Commission.

Elizabeth, N. J.—Until Nov. 15 by Board Education for furnishing material and erecting addition to grade school. Separate bids for heating and ventilating; electrical work. John Noble Pierson & Son, Archts., 130 Smith Street, Perth Amboy.

Montclair, N. J.—Reported desired until Nov. 23 by Frank J. Taylor, Secy. Bd. Educ. for erecting addition to high school building. Scarrett & Van Vleck, Archts., 8 W. 40th Street, New York.

Newark, N. J.—Reported desired until Nov. 15 by R. D. Argus, Clk. Bd. Educ., for erecting Catlin School; probable cost $142,000. E. E. Guilbert, Archt., City Hall. George W. Knight, 9 Franklin Street, Engr.

Roselle Park, N. J.—Reported desired until Nov. 11 by Board Education for erecting Roselle Park High School; also separate bids on plumbing, gasfitting, heating, electric work, etc. Newman Collins, Archt., 29 Bway., New York, N. Y.

Winder, Ga.—Until Nov. 23, by H. G. Hill, Co. Ordinary, for erecting a jail. Jas. J. Baldwin, Archt., Anderson, S. C.

New Orleans, La.—Until Nov. 23 by Dept. Pub. Finance (A. G. Ricks, Comr.) for erecting isolation hospital in square bounded by N. Rampart and Toulouse Streets.

Columbus, Ohio.—Until Dec. 1 by Bd. County Commissioners (John Scott, Clk.) for furnishing material and erecting a road machinery house on the County Infirmary Farm. W. H. Tremaine, Archt., Chamber of Commerce Building, Columbus.

Rootstown, Ohio.—Until Nov. 22 by Reed H. Deeming, Clk. Bd. Educ., Rootstown Township School Dist., for furnishing material and erecting an 8-room brick school. Miller & Son, Dollar Bank Building, Youngstown, Archt.

West Manchester, Ohio.—Until Dec. 4, by Board Education, Monroe Township Rural School Dist. Preble County, for furnishing material and erecting fireproof grade and high school. Also separate bids on heating, ventilating, plumbing and sewering. F. S. Rusk and Cree Sheets, Archts., 145 N. High Street, Columbus.

West Unity, Ohio.—Until Nov. 26 by Board Education Brady Township, School Dist. (Henry Reifel, Clk.), for furnishing material and erecting building for said Board. Also separate bids for heating and plumbing. M. M. Stophlet, Archt., 608 Nasby Building, Toledo.

Lebanon, Ind.—Reported desired until Dec. 9, by Board Trus. F. J. Whitman Memorial Hospital, for erecting hospital. Probable cost, $30,000. D. A. Bonlen, Archt., Indianapolis.

Detroit, Mich.—Until Nov. 9 by Charles A. Gadd, Secy. Board Education, 50 Broadway, for erecting Goluberg Annex between Vermont Avenue and Piquette Street, bids desired as a whole or separately, for masonry, carpentry, heating, ventilating and plumbing; electric wiring, etc. Malcomson & Higginbotham, Archts., 404 Moffat Building. Ammerman & McColl, Engrs., 1310 Penobscot Building.

East Lansing, Mich.—Until Nov. 17 by A. M. Brown, Secy. State Bd. Agriculture, East Lansing, for furnishing material and erecting gymnasium at Michigan Agricultural College. Edwyn A. Bown, Archt., Lansing.

Chillicothe, Ill.—Until Nov. 17 by Lillian C. Carroll, Secy. Pub. Library Bd., for a one-story and basement library. Bids submitted as a whole or separately on erection; heating; plumbing; electric wiring, etc. A. W. Morrow, Archt., Chicago.

Brighton, Iowa.—Reported desired until Nov. 15 by Independent School Dist. (J. B. Dey, Secy.) for erecting high school, including electric wiring; also separate bids for heating and plumbing. Proudfoot, Bird & Rawson, Archts., 810 Hubbell Building, Des Moines.

Crookston, Minn.—Until Nov. 12, by State Board Control, St. Paul, for furnishing material and erecting, including mechanical equipment, Nurses Home at Tuberculosis Sanitarium for Polk and Norman Counties. Sund & Dunham, Archts., 514 Essex Bldg., Minneapolis.

St. Louis, Mo.—Reported desired until Nov. 19 by W. T. Findly, Secy. Bd. Pub. Service, for erecting first section of Children's building.

Gainesville, Tex.—Until about Nov. 25 by State Board School Trus., Dallas, for erecting a four-story brick, concrete and fireproof dormitory at Girls' Training School to cost, including equipment, $100,000. Contract for equipment will be let about Feb. 1. For information address Earnest & McAnelly, Archts., Dallas.

Marion, Cal.—Until Nov. 11 by Board Education (William A. Sheldon, Secy.), Los Angeles, for furnishing material and making alterations to Marion School, located on Blocks 3 and 4.

Pearl City, Hawaii.—Until Dec. 4, according to later official reports, by Bureau Yards and Docks, Navy Dept., Washington, D. C. (H. P. Stanford, Ch.), for Spec. No. 2200, constructing reinforced concrete power house, reinforced concrete operating building, and a wooden double quarters for chief operators at the Naval Station, Pearl Harbor.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**West Pownall, Me.** — Contract for erecting brick kitchen building for Maine School for Feeble-Minded awarded A. F. Warren & Son of Auburn at $29,900. C. J. Hedin, Superintendent.

★**Bridgeport, Conn.**—Contract for erecting addition to the City Normal School awarded as follows. Masonry, O'Brien Bros., $43,381; carpentry, Schwartz Bros., $13,938; plumbing, Richard & Chard, Stamford, $5,525; also heating, at $2,561. Bluders of Bridgeport unless otherwise stated. Alfred J. Eagen, Clk. Bd. Educ.

★**Naugatuck, Conn.**—Contract for erecting U. S. Post Office awarded W. H. Fissell & Co., New York, at $50,400.

★**New Haven, Conn.** — Contract for erecting addition to the Cloister awarded Sperry & Treat, New Haven.

Brooklyn, N. Y.—Following are totals of four lowest bids opened Oct. 28 by Park Board, New York, for erecting laboratory building and greenhouses for Brooklyn Botanical Garden, Washington Avenue and Crown Street (bidders of New York): Frymier & Hanna Co., 25 W. Forty-fifth Street, $140,228; Thomas McKeown, Inc., 103 Park Avenue, $147,235; P. F. Kenny Co., 33 Old Broadway, $155,000; John T. Brady & Co., 103 Park Avenue, $155,480.

★**Jersey City, N. J.**—Contract for erecting the Hudson County jail reported awarded John T. Brady, New York, at $754,840.

★**Pleasantville, N. J.** — Contract for erecting high school awarded Thompson Brothers; probable cost $40,000. S. Hudson Vaughn, Archt., Atlantic City.

Clearfield, Pa.—Lowest bid opened Oct. 25 for erecting proposed high school submitted by Dawson Constr. Co., Pittsburgh, at $67,775. Harrington & Howard, Archts., Du Bois.

Harrisburg, Pa.—Lowest bid opened Oct. 2 for erecting additions and alterations to U. S. Post Office submitted by H. L. Brown & Co., Mount Vernon, N. Y., at $113,405.

Monongahela, Pa.—Following are four lowest bids opened Oct. 27 by Supervising Architect, Washington, D. C., for erecting U. S. Post Office: Westchester Engineering Co., White Plains, N. Y., $48,180; James Devault, Canton, Ohio, $44,200; W. H. Batson, Moundsville, W. Va., $44,700; J. S. Rogers Co., Moorestown, N. J., $46,299.

Washington, D. C.—Following are four lowest bids opened Oct. 25 by Commissioners D. C. for erecting truck house on New Jersey Avenue between D and E Streets, N. W.: Skinker & Garrett, Washington, $33,929; W. E. Mooney, Washington, $34,653; George E. Wyne, Washington, $34,950, and A. L. Guidone & Son, 131 E. Twenty-third Street New York, $35,000.

Norfolk, Va.—Following are four lowest bids opened Oct. 23 by Bureau of Yards & Docks, Washington, D. C., for erecting a school at the U. S. Navy Yard, Norfolk: R. R. Richardson Co., Bank of Commerce Building, Norfolk, $35,961; Baker & Brinkley, 220 Dixon Building, $38,102; Wise Granite & Construction Company, 921 American National Building, Richmond, $38,200; J. H. Pierce, 505 Seaboard Bank Building, $38,635.

★Contract for erecting three-story and basement marine barracks building at Navy Yard, awarded P. F. Gormley Co., Washington, D. C., at $193,926.

★**Richmond, Va.**—Contract for erecting new three-story Jackson Hall for Virginia Military Institute awarded J. L. Crouse of Greensboro, N. C.; cost about $89,642.

★**Tampa, Fla.**—Contract for erecting attendants' quarters, including mechanical equipment, at U. S. Quarantine Station at Tampa Bay, awarded E. Hart, Norfolk, Va., at $52,110.

★**Covington, Tenn.**—Contract for erecting U. S. Post Office awarded Algernon Blair, Montgomery, Ala., at $33,800.

★**Athens, Ohio.**—Contract for erecting Woman's Dormitory at Ohio University (bids opened Oct. 30) awarded Cullen & Vaughn of Hamilton at $97,796.

New Castle, Ind.—Following are four buildings for which contracts have been awarded by the Architectural Service Co., Chicago, Ill., for erecting C. A. Jones Co. (a) foundry, (b) machine shop, R. F. Pomeroy & Co., Cincinnati, O., (a) $12,000, J. S. Rogers & Co., Muncie, Ind., (a) $6,000, (b) $4,000, Charles W. Hobbs Co., 132 Lasalle Street, Chicago, Ill., (a) $8,000, Indiana Lime & Cement Co., Huntington, Ind., (a) $12,000, Carbon White Co., 30 N. Clark Street, Chicago, Ill., (a) $25,000.

★Peoria, Ill.—Contract for erecting factory and office building for the Avery Co., Peoria, Ill., awarded to Lindquist & Peterson, 1st Nat. Bank Bldg., Peoria, Ill. Work will include a one-story, 100 x 200 ft. machine shop, a two-story, 50 x 100 ft. office building, a one-story, 50 x 100 ft. power house, a one-story, 50 x 100 ft. foundry, a one-story, 50 x 100 ft. pattern shop, a one-story, 50 x 100 ft. blacksmith shop, a one-story, 50 x 100 ft. paint shop, a one-story, 50 x 100 ft. storage building, a one-story, 50 x 100 ft. boiler house, a one-story, 50 x 100 ft. tool room, a one-story, 50 x 100 ft. stock room, a one-story, 50 x 100 ft. shipping

Madison, Wis.—Co-operative Packing Company, Washington Building, will erect a new packing plant to cost $200,000.

Manitowoc, Wis.—Reported Aluminum Goods Mfg. Co. approved plans for proposed addition to factory at Fifteenth and Sixteenth Streets; also contemplates erecting warehouse at Sixteenth and Franklin Streets.

Minneapolis, Minn. — Western States Coke Co., incorporated by Clark Hempstead, 2442 Grand Avenue, and others for purpose of erecting a coke plant.

The Minneapolis Steel & Machinery Company, Twenty-ninth and Minnehaha Streets, will erect at 2906 Minnehaha Street a one-story factory 356 x 140 ft.; cost $60,000.

Melbourne, Australia.—Reported C. R. Makepeace & Co., Boston, Mass., engaged to prepare plans for knitting mills which the Australian Knitting Mills (F. F. Robinson, Pres. and Gen. Mgr.), proposes erecting at Melbourne; cost about $250,000.

BIDS DESIRED.

Norristown, Pa.—By Peuckert & Wunder, Archts. and Engineers, 310 Chestnut Street, Philadelphia, for erecting a three-story brick, steel and concrete bottling house for Adam Scheidt Brewing Company.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Palmer, Mass.** — Contract awarded Flynt Building & Construction Co. of Palmer for erecting three-story brick and reinforced concrete fireproof branch house for Armour & Company, Poughkeepsie, N. Y., to cost $35,000. R. C. Clark, Chicago, Ill., Archt.

★**Waterbury, Conn.**—Contract for erecting two-story brick and steel addition to plant of Waterbury Farrel Foundry & Machine Co. awarded H. Wales Lines Co. of Meriden; cost about $70,000.

★**Buffalo, N. Y.**—Contract awarded by Robertson-Cataract Co., 204 Franklin Street, to Turner Constr. Co., 311 Prudential Building, for erecting four-story and basement reinforced concrete, brick, stone and terra cotta factory and showroom building at Niagara Street and S. Elmwood Avenue.

★**Jersey City, N. J.**—Contract for erecting three-story reinforced concrete and brick factory at Baldwin Avenue and High Street for Durham Duplex Razor Co. awarded John M. Ferguson, Paterson; cost $80,000.

★**Philadelphia, Pa.** — Contract reported awarded for erecting addition to grain elevator at Twenty-sixth and Schuylkill Avenue for Pennsylvania Railroad Co. to James Stewart & Co., Chicago, Ill.; cost $200,000.

★Contract for erecting factory at Torresdale Avenue and N Street for Louis Walther Mfg. Co. awarded M. Ward Easby, Crozer Building, at $56,000.

★**Youngstown, Ohio.** — Contract for erecting steel buildings at plant of Brier Hill Steel Co. reported awarded Lackawanna Bridge Co., Buffalo, N. Y.

★**St. Louis, Mo.** — Contract reported awarded Chapline Constr. Co., Victoria Bldg., for erecting addition to plant of Ford Motor Car Co., Sarah Street and Forest Park Boulevard; cost about $300,000 including equipment.

★**Foreman, Ark.** — Contract awarded Fuller Engineering Co., Allentown, Pa., for the 2000 bbl. per day Portland cement plant for the Consumers Cement Co. Plant to be electrically driven throughout with individual motors.

MISCELLANEOUS

PROPOSED WORK.

Transmission Line — Yonkers, N. Y.—State Public Service Commission has approved franchises granted by New York City to Yonkers Electric Light & Power Co. and the Westchester Lighting Co. for the construction of an electric transmission line along aqueduct lands in Westchester County.

Park Improvement — Baltimore, Md.—Reported Park Board is considering establishing a public park and recreation center in block surrounding sewerage pumping station in East Falls Avenue; probable appropriation $75,000.

Cincinnati, Ohio.—See "Water Works."

Transmission Line—Midland, Mich.—Reported Consumers Power Co., which has purchased the plant of the Bristle Electric Light Co., intends constructing transmission lines from Bay City to Midland and local extensions.

Transmission Line—Cedar Rapids, Iowa.—Iowa Railroad Comn. has granted approval of franchise for erection of an electric transmission line by the Iowa Power & Light Co. from Cedar Rapids to Shellsburg, a distance of 15 miles.

Ornamental Lighting—Williston, N. D.—Contract soon to be let by City Commissioners for furnishing and erecting electric ornamental lights, embracing 50 city blocks.

Sprinkling System—Seattle, Wash.—Reported Chicago, Milwaukee & Puget Sound Ry. Co. (C. F. Loweth, Ch. Engr., Chicago, Ill.) will install an automatic sprinkler system for protection to the Milwaukee docks on the East Waterway; cost $15,000.

Subway—Montreal, Que.—Plans about completed by the city for subway on St. Denis Street over tracks of Canadian Pacific Ry. at De Fleurimont and Carmel Streets, and will linvolve the building of a bridge 500 ft. long with ornamental balustrades and electric light standards. Cost $70,000.

BIDS DESIRED.

Relayer Rail—New Hampton, N. Y.—Until Nov. 9, by Katherine B. Davis, Comr. of Correction, New York City, for furnishing and delivering 80 gross tons relayer rail, New Hampton Farms, New Hampton.

Hoistway, etc.—Jefferson City, Iowa.—Until Nov. 29, by Jas. A. Wetmore, Acting Superv. Archt., Washington, D. C., for installing complete a new hoistway, an electric freight elevator, etc., in the United States courthouse and post office at Jefferson City.

Power Plant—Oakley, Kan.—Until Nov. 23 by J. A. Switzer, City Clk., for furnishing material and constructing power plant, to consist of one 75-hp. oil engine and one 50-kw. engine-driven alternator. George P. Taylor, Engr., Stackton, Kan.

Subway Work—Huntington Beach, Cal.—Reported desired until Nov. 15 by City Clerk for improving portions of Main, Seventeenth, Aracia Avenues and other streets; the work includes reinforced concrete pipe culverts, reinforced concrete and timber subway and approaches, etc., under Southern Pacific tracks.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Tunnel — Boston, Mass.** — Contract awarded M. De Matteo, Roslindale, for constructing concrete underground foot passage in Ainsworth Street, West Roxbury Dist., at $5,435.

★**Subway—St. Clair, Pa.**—Contract for constructing subway under Reading Railway at northern end of Second Street on the line of the new Schuylkill Company Railway, awarded P. J. Campion of Mahoning City.

★**Retaining Wall—Washington, D. C.**—Contract for constructing retaining wall on west side of Meridian Hills Park (bids opened Sept. 20) awarded Boyle Robertson Construction Co., Washington, at $21,522.

★**Pier—Norfolk, Va.**—Contract for constructing pier at City Point on James River for E. I. Du Pont de Nemours Powder Co. was awarded W. D. Murray & Co., Citizens Bank Building; cost about $50,000.

★**Tunnel to Hospital—Alton, Ill.**—Contract awarded by State Board Administration, Springfield, to Strubel & Helmich, Alton, for constructing a tunnel system for the Alton State Hospital for the Insane at $53,850.

★**Grading and Filling Railroad Yards—Dubuque, Iowa.**—Contract reported awarded by Illinois Central R.R. for the grading and filling of the south yards to Nelson Contracting Co. of Chicago, Ill.; cost about $75,000.

Cement—San Francisco, Cal.—Lowest bid opened Oct. 23 by Bd. Works for furnishing cement for construction of the diversion dam at Hetch Hetchy, about 3975 bbl., was submitted by Santa Cruz and Standard Portland Cement Companies, at $10,613. Pacific Portland Cement Co. bid $12,402.

Proposals

For Proposals Advertised, see Pages 40a and 40b.

WATERWORKS.

Bids Close.		See Eng. Record.
Nov. 9.	Water Wks., Bellevile, Ohio	Sep. 11
Nov. 9.	Valves, Brooklyn, N. Y.	Oct. 23
Nov. 9.	Improvements, Lynn, Mass. Adv. Oct. 30.	Oct. 30
Nov. 9.	Valves, Etc., Toronto, Ont.	Nov. 6
Nov. 10.	Laying Pipe, Chicago, Ill.	Nov. 6
Nov. 11.	Softening Plant, Columbus, Ohio	Oct. 23
Nov. 11.	Water Works, Bayard, Neb.	Oct. 30
Nov. 12.	Pipe, Brooklyn, N. Y.	Nov. 6
Nov. 12.	Tank, Cincinnati, Ohio	Nov. 6
Nov. 12.	Meters, Valves, Etc., Chicago, Ill.	Nov. 6
Nov. 12.	Pipe, valves, etc., St. Louis, Mo.	Nov. 6
Nov. 15.	Reservoir, St. Clairsville, Ohio.	Oct. 30
Nov. 18.	Distributing System, Fort Sam Houston, Tex.	Oct. 30
Nov. 22.	Water Works, West Frankfort, Ill.	Nov. 6
Nov. 23.	Pipes, Valves, Etc., Washington, D. C.	Nov. 6
Nov. 23.	Water Works, Ventnor City, N. J.	Nov. 6
Nov. 26.	Engine and Pumps, Clarksburg, W. Va. Adv. Oct. 30.	Oct. 30
Dec. 1.	Water Works, East Youngstown, Ohio	Oct. 16
Dec. 1.	Water Works, Melrose, Wis.	Nov. 6
Dec. 2.	C. I. Pipe, Jersey City, N. J. Adv. Oct. 30.	Oct. 30
Dec. 2.	Steel Pipe, Jersey City, N. J. Adv. Oct. 30.	Oct. 30

SEWERAGE AND SEWAGE DISPOSAL.

Nov. 9.	Yorktown Heights, N. Y. Adv. Oct. 16 to Nov. 6.	Oct. 16
Nov. 9.	Yorktown, N. Y. Adv. Oct. 23 to Nov. 6.	Oct. 23
Nov. 9.	Toronto, Ont.	Oct. 30
Nov. 10.	Washington, D. C. Adv. Nov. 6.	Nov. 6
Nov. 10.	New York, N. Y.	Nov. 6
Nov. 12.	Findlay, Ohio	Nov. 6
Nov. 15.	Cleveland Heights (P. O. Warrensville), Ohio.	Oct. 23
Nov. 15.	Rock Island, Ill.	Nov. 6
Nov. 16.	Vermillion, Ohio Adv. Oct. 23, 30.	Oct. 23
Nov. 18.	Sandusky, Ohio Adv. Oct. 30, Nov. 6.	Oct. 30
Nov. 23.	Oakland, Iowa	Oct. 23
Nov. 24.	San Benito, Tex.	Oct. 30
Dec. 2.	Contract 4, Chicago, Ill. Adv. Oct. 30.	Oct. 30
———	Parkersburg, Pa. Adv. Oct. 9.	Oct. 9

BRIDGES.

Nov. 11.	Marshall, Ill.	Oct. 30
Nov. 11.	Chippewa Falls, Wis.	Nov. 6
Nov. 15.	Connecticut. Adv. Nov. 6.	Nov. 6
Nov. 16.	New Orleans, La.	Oct. 30
Nov. 18.	Abilene, Kan.	Nov. 6
Nov. 22.	Parma, Idaho.	Nov. 6
Nov. 23.	Woonsocket, R. I. Adv. Nov. 6.	Nov. 6
Nov. 26.	Steubenville, Ohio	Nov. 6
Dec. 6.	Louisville, Ky. Adv. Nov. 6.	Nov. 6
Dec. 7.	Canton, China Adv. Oct. 23.	Oct. 23

PAVING AND ROADS.

Nov. 8.	Newton, N. J. Adv. Oct. 23 to Nov. 6.	Oct. 23
Nov. 9.	Asphalt Plant, New Orleans, La.	Oct. 30
Nov. 9.	Trenton, N. J.	Oct. 30
Nov. 9.	Titusville, Fla.	Oct. 30
Nov. 9.	New Brunswick, N. J.	Oct. 30
Nov. 9.	Massachusetts	Oct. 30
Nov. 9.	Tractor, Cincinnati, Ohio	Oct. 30
Nov. 9.	Amite, La.	Nov. 6
Nov. 10.	Greenwood, S. C.	Nov. 6
Nov. 10.	Chicago, Ill.	Nov. 6
Nov. 10.	Riverside, Cal.	Nov. 6
Nov. 11.	Albany, N. Y. Adv. Oct. 23 to Nov. 6.	Oct. 23
Nov. 11.	New York, N. Y.	Nov. 6
Nov. 11.	St. Joseph, Mich.	Nov. 6
Nov. 12.	Hackensack, N. J.	Oct. 30
Nov. 12.	Toronto, Ohio	Nov. 6
Nov. 13.	Pittsburgh, Pa.	Oct. 30
Nov. 13.	Chicago, Ill.	Nov. 6
Nov. 15.	Sweetwater, Tenn.	Oct. 23
Nov. 15.	Greensburg, Pa.	Oct. 30
Nov. 15.	Connecticut. Adv. Nov. 6.	Nov. 6
Nov. 16.	Bound Brook, N. J. Adv. Nov. 6.	Nov. 6
Nov. 16.	San Gabriel, Cal.	Nov. 6
Nov. 17.	Charlestown, W. Va.	Nov. 6
Nov. 17.	Covington, La.	Nov. 6
Nov. 17.	Lawton, Okla.	Nov. 6
Nov. 18.	Dothan, Ala.	Nov. 6
Nov. 19.	Austin, Tex.	Nov. 6
Dec. 1.	Hastings, Neb.	Nov. 6
Dec. 6.	Sedalia, Mo.	Nov. 6

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS.

Nov. 8.	Dredge, Jacksonville, Fla. Adv. Sep. 11 to 25, Oct. 30.	Sep. 11
Nov. 8.	Dredging, Etc., Jacksonville, Fla. Adv. Oct. 16 to Nov. 6.	Oct. 16
Nov. 9.	Canal Work, Albany, N. Y. Adv. Oct. 16 to Nov. 6.	Oct. 9
Nov. 9.	Ditch, Sioux City, Iowa. Adv. Oct. 30, Nov. 6.	Oct. 30
Nov. 9.	Dredging, New York, N. Y.	Oct. 30
Nov. 10.	Dam, Albuquerque, N. M.	Oct. 30
Nov. 10.	Gates on Dam, Ottawa, Ont.	Oct. 30
Nov. 10.	Levee Work, Cairo, Ill. Adv. Oct. 30, Nov. 6.	Oct. 30
Nov. 12.	Tile Ditch, Alexandria, Minn.	Nov. 6
Nov. 13.	Ditch, Slayton, Minn.	Oct. 30
Nov. 15.	Levee Improv., New Madrid, Mo. Adv. Oct. 23 to Nov. 6.	Oct. 23
Nov. 16.	Ditch, Slayton, Minn.	Oct. 30
Nov. 16.	Irrigation System, Hood River, Ore.	Nov. 6
Nov. 17.	Irrigation Work, Ysleta, Tex. Adv. Oct. 23.	Oct. 23
Nov. 17.	Flood Protection Wall, Portsmouth, Ohio Adv. Oct. 30.	Oct. 30
Nov. 22.	Dredging, Philadelphia, Pa. Adv. Oct. 30, Nov. 6.	Oct. 30
Nov. 26.	Dredging, Cleveland, Ohio. Adv. Oct. 30, Nov. 6.	Oct. 30
Nov. 27.	Dredging, Norfolk, Va.	Nov. 6
Nov. 27.	Ditch, Plymouth, Ind.	Nov. 6
Dec. 1.	Irrigation Work, Meadow Creek, Wash. Adv. Oct. 23.	Oct. 23
Dec. 1.	Seawall, Waveland, Miss.	Nov. 6
Jan. 8.	Dredge, Macaco, China	Nov. 6

PUBLIC BUILDINGS AND SCHOOLS.

Nov. 8.	Sidney, Ohio Adv. Oct. 2, 9.	Oct. 2
Nov. 8.	Washington, D. C. Adv. Oct. 16.	Oct. 16
Nov. 9.	El Paso, Tex.	Oct. 9
Nov. 9.	Madison Barracks, N. Y. Adv. Oct. 30, Nov. 6.	Oct. 30
Nov. 9.	Pittsburgh, Pa.	Oct. 30
Nov. 9.	Detroit, Mich.	Nov. 6
Nov. 10.	Van Wert, Ohio.	Oct. 2
Nov. 10.	Boone, Iowa	Oct. 23
Nov. 10.	Pittsburgh, Pa.	Oct. 30
Nov. 11.	Pittsburgh, Pa.	Oct. 30
Nov. 12.	Salamanca, N. Y.	Oct. 9
Nov. 12.	Crookston, Minn.	Nov. 6
Nov. 12.	Boston, Mass.	Nov. 6
Nov. 13.	Key West, Fla.	Oct. 23
Nov. 13.	Napanoch, N. Y. Adv. Oct. 30.	Oct. 30
Nov. 15.	Columbus, Ohio	Oct. 23
Nov. 15.	Agawam, Mass.	Oct. 23
Nov. 15.	Front Royal, Va. Adv. Oct. 23 to Nov. 6.	Oct. 23
Nov. 15.	Salem, Ore.	Oct. 30
Nov. 15.	Lincoln, Ill.	Oct. 30
Nov. 15.	Elizabeth, N. J.	Nov. 6
Nov. 16.	Huntington, W. Va.	Oct. 9
Nov. 16.	St. Paul, Minn.	Oct. 30
Nov. 16.	Buffalo, N. Y.	Nov. 6
Nov. 17.	North Adams, Mass.	Nov. 6
Nov. 17.	East Lansing, Mich	Nov. 6
Nov. 17.	Chillicothe, Ill.	Nov. 6
Nov. 18.	Boise, Idaho	Oct. 16
Nov. 19.	Elyria, Ohio	Oct. 16
Nov. 19.	St. Louis, Mo.	Nov. 6
Nov. 20.	Somerville, Ohio	Oct. 30
Nov. 22.	Rootstown, Ohio	Nov. 6
Nov. 23.	Winder, Ga.	Nov. 6
Nov. 23.	New Orleans, La.	Nov. 6
Nov. 23.	Monclair, N. J.	Nov. 6
Nov. 25.	Gainesville, Tex.	Nov. 6
Nov. 26.	Navasota, Tex.	Oct. 23
Nov. 26.	Ft. Terry, N. Y. Adv. Oct. 30, Nov. 6.	Oct. 30
Nov. 26.	West Unity, Ohio.	Nov. 6
Nov. 27.	Brenham, Tex.	Oct. 30
Nov. 27.	Fort Bliss, Tex. Adv. Oct. 30, Nov. 6.	Oct. 30
Nov. 27.	Pearl City, Hawaii	Oct. 30
Nov. 29.	Muskegon, Mich.	Oct. 30
Dec. 1.	Bloomington, Ind. Adv. Oct. 30.	Oct. 23
Dec. 9.	Lebanon, Ind.	Nov. 6
Dec. 1.	Columbus, Ohio	Nov. 6
Dec. 4.	Pearl City, Hawaii	Nov. 6
Dec. 4.	West Manchester, Ohio.	Nov. 6
Dec. 10.	Greenwich, Conn.	Nov. 6

PRIVATE BUILDINGS.

Nov. 11.	Bartlesville, Okla.	Oct. 23
Nov. 22.	Pottstown, Pa.	Nov. 6
Nov. 22.	Wichita, Kan.	Nov. 6

MISCELLANEOUS.

Nov. 9.	Relayer Rail, New Hampton, N. Y.	Nov. 6
Nov. 10.	Railroad, San Francisco, Cal.	Oct. 23
Nov. 10.	Pipe Fittings, etc., Panama.	Oct. 30
Nov. 10.	Coal Yards, Philadelphia, Pa.	Oct. 30
Nov. 11.	Tunnel, Boston, Mass. Adv. Oct. 30.	Oct. 30
Nov. 12.	El. Rys., New York, N. Y.	Oct. 30
Nov. 13.	Shipbuilding Ways, Etc., Charleston, S. C.	Oct. 23
Nov. 15.	Subway Work, Hunting Beach, Cal.	Nov. 6
Nov. 16.	Oil Storage Tanks, Panama	Oct. 23
Nov. 17.	Power Plants, Etc., Washington, D. C.	Aug. 28
Nov. 17.	Htg. Bldgs., Fort Bliss, Tex. Adv. Oct. 23 to Nov. 6.	Oct. 23
Nov. 17.	Copper Tubes for Ry., London, England Adv. Oct. 30, Nov. 6.	Oct. 30
Nov. 17.	Pipe Fittings, Etc., Panama	Oct. 30
Nov. 23.	Power Plant, Oakley, Kan.	Nov. 6
Nov. 26.	Cranes, Charleston, S. C.	Oct. 16
Nov. 27.	El. Ry., Pearl City, Hawaii	Oct. 23
Nov. 29.	Hoistway and Elevator, Jefferson City, Mo.	Nov. 6
Dec. 2.	Bowling Alley, Fort Totten, N. Y. Adv. Nov. 6	Nov. 6

SEARCHLIGHT SECTION

Official Proposal Announcements

Price, $2.40 an inch. Copy can be received until Thursday 10 a. m. for issue mailed the next morning

Bids open November 9, 1915.

STATE OF NEW YORK
OFFICE OF SUPERINTENDENT OF PUBLIC WORKS.

BARGE CANAL TERMINALS

NOTICE TO CONTRACTORS

ALBANY, N. Y.

Sealed proposals will be received by the undersigned at his office in the Capitol at Albany, N. Y., until 12 o'clock, noon, of Tuesday, November 9, 1915, at which place and hour they will be publicly opened and read for the construction of barge canal terminals pursuant to the provisions of Chapter 346 of the Laws of 1911 and amendatory laws as follows:

TERMINAL CONTRACT No. 2-P

For paving the terminal site, near North Ferry Street, Albany. Contract plans, sheet No. 1.

Plans may be seen and detailed specifications, engineer's estimate of quantities, proposal blanks, form of contract and bonds required and other information for proposers may be had at the office of the Superintendent of Public Works at Albany, N. Y., at the office of the Assistant Superintendent of Public Works for the Middle Division at Syracuse, N. Y., at the office of the Assistant Superintendent of Public Works for the Western Division at Rochester, N. Y., and at the canal office, Spaulding's Exchange, Buffalo, N. Y.

Copies of detailed plans or drawings may be obtained from the State Engineer and Surveyor at Albany, N. Y., upon payment to him of the cost of preparing them.

Monthly estimates will be paid of ninety per centum (90 per cent.) of the work done at the contract price. Every proposal for said work must be accompanied by a money deposit in the form of a draft or certified check upon some good banking institution in the city of Albany, or the city of New York, issued by a national or state bank or trust company in good credit within the state and payable at sight to the Superintendent of Public Works for five per centum (5 per cent.) of the amount of the proposal.

The person whose proposal shall be accepted will be required to execute a contract and furnish bonds within ten days from the date of notice of award delivered to him or them in person or mailed to the address given in the proposal.

Upon execution of the contract and approval of bonds, the certified check or draft will be returned to the proposer unless the same shall have been presented for collection prior to such time, in which case the amount of the deposit will be refunded by the Superintendent of Public Works.

The deposits of bidders other than the one to whom the award of contract shall be made will be returned immediately after the award has been made.

The amount of bond required for faithful performance will be one per centum (1 per cent.) of the amount of the estimated cost of the work according to the contract price, and an additional bond, known as the labor bond, in the sum of ten per centum (10 per cent.) of the amount of the estimated cost of the work according to the contract price, will be required to properly meet the contractor will pay in full all bona fide claims all laborers employed by him upon the work specified to be done in the contract.

In the event that more than one agreement is offered, the capacity of such bonding companies will be considered.

Bids proposals must be addressed to the Superintendent of Public Works, Albany, N. Y., and must be endorsed on the envelope with the name of the contractor and the work for which the proposal is made.

Attach to each bid the name or names of the person or persons whose proposal shall be bound to sign and to file the bond for the work, and which shall comply with all provisions required by statute or contract. Before any award shall be made the lowest bidder will be required to satisfy the Superintendent of Public Works of his ability to provide suitable equipment and materials for the proper performance of the work.

The right is reserved to reject all proposals and readvertise and award the contract in the regular manner if in the judgment of the undersigned, the interests of the State will be enhanced thereby.

W. W. WOTHERSPOON,
Superintendent of Public Works.

October 6, 1915.

Bids open November 15, 1915

NOTICE TO HYDRAULIC DREDGE CONTRACTORS

NEW MADRID, MO.

Sealed proposals will be received by the St. John Levee and Drainage District of Missouri until 2 o'clock P. M., November 15, 1915, at the office of the Secretary, in the South Room of the Hunter Bank Building, in New Madrid, Mo.

The work to begin at the east end of New Madrid, extend along the "front" and down stream to high ground; a total distance of about 8700 ft.; and consists of either 300,000 cu. yds. special hydraulic fill levee, crown 10 ft., slopes 5 to 1 and 10 to 1; or 177,000 cu. yds. special levee combined with 76,500 cu. yds. standard team work levee.

Material for hydraulic fill levee to be obtained from Mississippi River bed or from the immediate bank, part from near each end of the work. Maximum distance to be pumped about 3200 ft. The material for the team work will be obtained at the site.

The conditions on the ground must be examined to be understood. Plans and specifications can be examined in the office of the Secretary at New Madrid or at that of Miller Engineering Co., Little Rock, Ark.

Bids must be accompanied by a certified check in amount equal to 2 per cent of the price bid. The successful bidder will be required to give satisfactory bond in an amount equal to 40 per cent of the contract price.

90 days to begin work; then 12 months to finish.

The right to reject any or all bids is reserved.

W. S. EDWARDS,
Secretary.

October 15, 1915.

Bids open November 10, 1915.

LEVEE REPAIRS

CAIRO, ILL.

Sealed proposals will be received at the offices of the Rivers and Lakes Commission, 905 State Building, Chicago, Ill., until 12 o'clock M., November 10, 1915, for levee repairs in the city of Cairo, Illinois.

[illegible] lineal feet of steel sheet piling
600 lineal feet of steel channel waling
60 anchors to steel sheeting
620 lineal feet of triple Wakefield sheeting
620 lineal feet of wood crib
200 cords of stone
40 round timber piles
2000 cubic yards of earth fill
200 square yards riprap paving

A certified check for $1,000 must accompany the proposal. Drawings, form of contract, specifications, etc., may be secured at the office of the Rivers and Lakes Commission or from Mr. Walter H. Wood, Master of Cairo, Illinois.

The Commission reserves the right to reject any or all bids.

RIVERS AND LAKES COMMISSION OF ILLINOIS.
ARTHUR W. CHARLES,
Chairman.
LE ROY K. SHEHMAN,
THOMAS J. HEALY,
CHARLES CHRISTMANN,
Secretary.

Bids open November 9, 1915.

NOTICE TO DITCH CONTRACTORS

SIOUX CITY, IOWA.

Notice is hereby given that the Board of Supervisors of Woodbury County, Iowa, will receive sealed bids until noon of the 9th day of November, 1915, for the construction of the Upper Wolf Creek Ditch and laterals of said county.

Plans may be had by calling on or addressing E. E. Hosmer, Sioux City, Iowa, Auditor of Woodbury County. All bids must be accompanied by a certified check to the amount of 10 per centum of the bid.

The deposit of the unsuccessful bidders will be returned to them in 24 hours after the bids have been figured and contract awarded. The deposit of the successful bidder will be returned upon the execution and filing with the County Auditor of Woodbury County, Iowa, the contract bond as by law provided. The price must be stated in the bid in words and also in figures. Permission will not be granted for the withdrawal or amendment after once being filed. Contract will be awarded to the lowest responsible bidder for the work as a whole.

The approximate number of cubic yards is 154,408.

The work of construction of the improvement herein described shall commence on or before the first day of March, 1916, and shall be completed on or before the first day of September, 1916.

All bids are to be filed with the Auditor of Woodbury County, in Sioux City, Iowa.

The Board reserves the right to reject any and all bids.

E. E. HOSMER,
Auditor Woodbury County, Iowa.
Sioux City, Iowa, Oct. 25, 1915.

Bids open November 8, 1915.

MACADAM ROADS

NEWTON, N. J.

Notice is hereby given that sealed bids will be received by the Board of Chosen Freeholders for the County of Sussex, at the Freeholders' Room, in the Town of Newton, County of Sussex, State of New Jersey, for improving the macadam surface and stone foundation, the Newton-Sparta Road. Estimated amount of surface pavement, 47,080 square yards; foundation 47,080 square yards. Bids to be opened and read in public at the Freeholders' Room at Newton, N. J., on Monday, November 8, 1915, at 11 A. M.

Drawings, specifications and forms of bids, contract and bond for the work prepared by Harvey Snook, County Engineer, and approved by the State Commissioner of Public Roads, has been filed in the office of said Engineer at Newton, N. J., and of said Commissioner at the State House, Trenton, N. J., and may be inspected by prospective bidders during business hours. Bidders will be furnished with a copy of specifications and blue prints of the drawings by the engineer on proper notice and payment of cost of preparation. Bids must be made on the standard proposal form in the manner designated therein, and required by the specifications.

Bids must be enclosed in sealed envelopes bearing the name and address of bidders on the outside, addressed to the Board of Chosen Freeholders, and must be accompanied by a certified check or cash for not less than $1,000, and be delivered at the place and on the hour above named.

Standard proposal form is attached to the specifications, copies of which will be furnished on application to the engineer.

By order of the Board of Chosen Freeholders of Sussex County, New Jersey.

Signed, R. LEE SLATER, Clerk.

Bids open Nov. 9, 1915.

NOTICE TO CONTRACTORS.

SEWERAGE AND SEWAGE DISPOSAL PLANT

YORKTOWN, N. Y.

Sealed proposals for Sewerage and Sewage Disposal Plant at Mohansic State Hospital, Yorktown, N. Y., will be received by the State Hospital Commission, Capitol, Albany, N. Y., until Nov. 9, 1915, at 2:30 P. M., when they will be publicly opened and read. Proposals shall be enclosed in an envelope furnished by the State Architect, sealed and addressed, and shall be accompanied by a certified check in the sum of $3,700.00. The contractor to whom the award is made will be required to furnish surety company bond in the sum of 50% of the amount of contract within 30 days after official notice of award of contract and in accordance with the terms of Specification No. 2336. The right is reserved to reject any or all bids. Drawings and specifications may be consulted at the Mohansic State Hospital, Yorktown, N. Y., at the New York office of the Department of Architecture, Room 1224, Woolworth Building, and at the Department of Architecture, Capitol, Albany, N. Y. Drawings and specifications and blank forms of proposal may be obtained at the Department of Architecture, Capitol, Albany, N. Y., upon the deposit of a check in the sum of $10.00, made payable to the State of New York, for each set of plans and specifications, which check will be returned when plans and specifications are sent back in good condition to the State Architect, Lewis F. Pilcher, Capitol, Albany, N. Y.

Dated Albany, N. Y., Oct. 11, 1915.

Bids open Nov. 16, 1915.

PAVING

BOUND BROOK, N. J.

Sealed proposals will be received by the Mayor and Council of the Borough of Bound Brook, at the Borough Hall, until Tuesday, Nov. 16, 1915, at 8 o'clock P. M., for paving a portion of Main Street in said borough with asphalt block.

Plans may be examined and specifications obtained at the office of Stanley Brampton, Borough Clerk, Bound Brook, N. J., or at the office of F. A. Dunham, C. E., 109 Park Ave., Plainfield, N. J.

A certified check for $1,000.00 must accompany each bid.

The Mayor and Council reserve the right to reject any or all bids.

Signed STANLEY BRAMPTON,
Borough Clerk.

Bids open November 11, 1915.

OFFICE OF THE STATE COMMISSION OF HIGHWAYS.

HIGHWAY WORK

ALBANY, N. Y.

Sealed proposals will be received by the undersigned at their office, No. 55 Lancaster Street, Albany, N. Y., at 1 o'clock P. M. on Thursday, the 11th day of November, 1915, for the improvement of the highways in the following counties: Cayuga (approx. 8.00); Chautauqua (approx. 0.79); Genesee (approx. 0.40); Greene (two highways—3.98, 2.39); Jefferson (approx. 6.05); Montgomery (approx. 4.59); Oneida (two highways—4.69, 5.34); Schenectady (approx. 4.22).

Maps, plans, specifications and estimates may be seen and proposal forms obtained at the office of the Commission in Albany, N. Y., and also at the offices of the division engineers in whose divisions the roads are to be improved. The addresses of the division engineers and the counties in which they are in charge will be furnished on request.

The especial attention of bidders is called to "General Information for Bidders" in the itemized proposal, specifications and contract agreement.

EDWIN DUFFEY,
Commissioner.

I. J. MORRIS,
Secretary.

Polishing Machine Surface Floors of Technology Buildings

Twenty of the grinding machines illustrated herewith are being used by the Stone & Webster Engineering Corporation to surface the concrete floors of the new buildings for the Massachusetts Institute of Technology in Boston. They are made by E. Cavicchi of



MACHINE GRINDS CONCRETE FLOORS

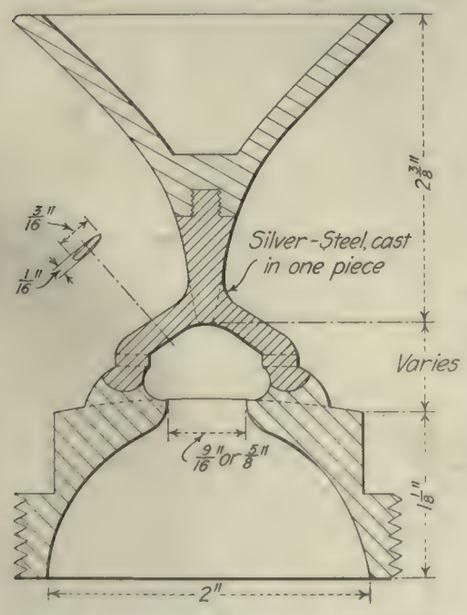
Quincy Adams, Mass., and are similar in operation to the familiar machines used in surfacing cut stone.

Each machine, handled by one man, grinds down 200 sq. ft. of floor a day till the aggregate is exposed. A uniform finish, resembling mosaic, is the result. The concrete ground is a mixture of 1 part of cement, ¾ parts sand, and 1¼ parts crushed granite, which makes a surface four times as hard to finish as Terrazzo and five times as hard to finish as marble.

The machines are each run by a 2-hp. motor, using alternating current at 220 volts, making 1800 r.p.m.

Spraying Nozzle of Circular Orifice Type Minimizes Clogging

A new spraying nozzle of the circular orifice type, which is claimed to minimize clogging due to the removal of all internal clogging features has been developed by the Snow & Petrelli Manufacturing Company, 152-156 Brewery Street, New Haven, Conn. The nozzle is said to have a greater clear opening than any other on the market. The spray is equally heavy on all radii due to the design of the spindle upon which the deflecting cone is attached. Cleaning is done with the nozzle in operation, so that the hands of the attendant are kept out of the sewage.



NOZZLE CAN BE CLEANED WHILE OPERATING

New Small Sized Mixer Will Turn Out Batch in 45 Seconds

A new mixer with a capacity of 10 cu. ft. of unmixed material that, it is claimed, will turn out a batch in 45 sec. has recently been put on the market. It is a one-bag machine with low charging features, but may also be equipped with a power loader and automatic water tank if desired. The charging platform is but 22 in. above the ground, allowing the wheelbarrows to run up an easy incline to charge the mixer drum which has a 21-in. opening. The discharge chute is of the pivoted type and is high enough above the ground to discharge into wheelbarrows. All materials entering into its construction are steel or refined semi-steel, the only timber parts being the tongue and the charging platform. The drum is of cast semi-steel, made in two sections bolted together in the middle. The sprocket teeth are cast in sections which are bolted to the drum. The mixing blades carry the material in a very rapid manner from the large charging opening toward the center of the drum, where it is carried upward by discharging buckets and drawn back again into the mixing blades. The mixing operation is threefold and is said to insure a very rapid mix and a uniform quality of concrete in a few turns of the drum. The drum is supported on large tracker rollers, which are lubricated by means of compression grease cups. The mixer is driven by riveted chain belt. The frame is constructed of heavy steel channels and thoroughly braced. The road wheels are 28 in. in diameter, with a 6-in. face, to facilitate hauling over rough roads. The mixer is known as the No. 10 Rex low charging mixer and is manufactured by the Chain Belt Company, Milwaukee.

Trade Commission to Investigate Question of Export Combinations

With a view to obtaining a yes or no referendum on the advisability of export combinations, the Federal Trade Commission will send out 30,000 letters to manufacturers and other authorities on trade conditions. This is part of the commission's efforts to complete with all possible dispatch an investigation which may assist Congress in determining what action may be required in the public interest for the promotion of American foreign trade.

Business Notes

The Troy Wagon Works Company will have its New York City office and show room in the Motor Mart Building, Broadway and Sixty-second Street, after Nov. 15.

Edward S. Larned has resigned from the position of manager of sales for the New England States for the Lehigh Portland Cement Company of Allentown, Pa.

G. N. Crawford, formerly of the Lidgerwood Manufacturing Company, has become special dragline representative for the Pawling & Harnischfeger Company, Milwaukee.

The Weldless Pile Band Company, 95-97 Nassau Street, New York City, has placed a patented weldless pile band on the market, which, it is claimed, will enable the driving of four times as many piles in a given period of time as can be driven with the old-style solid steel or iron band. It is also claimed that its use eliminates the following items of expense: The bursting of the band under the continued blows of the heavy drop hammer, which necessitates rewelding; the loss of time while another band is being secured and placed in position, and the splitting of the pile occasioned by the bursting of the band.

The Youngstown Steel Car Company of Youngstown, Ohio, organized with a capital stock of $100,000, has taken over the plant and business of the Youngstown Car & Manufacturing Company of Youngstown. The plant is being extended, and the new company will concentrate its efforts on the manufacture of steel cars, portable track, steel buckets, dumping boxes, concrete carts and other pressed and built-up steel specialties. A department will also be started for the repair of steel cars. The officers of the new company are practically the same as those of the old. William Wilkoff is president; L. C. Wilkoff, secretary, and D. J. Wilkoff, treasurer. A. C. Schmohl will continue in charge of the engineering department. J. E. Tessyman, formerly of the Ralston Steel Car Company, has been appointed general manager.

Trade Publications

The following companies have recently issued trade literature:

Ellicott Machine Company, Baltimore, Md. Catalog, 6 x 9 in., 48 pages, illustrated. In its illustrations describes hydraulic pipe-line dredges.

A. L. Drum & Company, consulting and constructing engineers, Chicago. Booklet 13¾ x 10 in., 16 pages, illustrated. An elegantly printed and etched pamphlet describing two proposed underground plazas at Herald Square and Times Square, New York City, in conjunction with the new dual rapid transit system now under construction. The construction proposed involves a general outlay of about $600,000, while it gives additional traffic space of 155,000 sq. ft. and window display valued at $550,000. It is claimed that the investment will return 100 per cent. The illustrations represent architectural perspectives.

The General Fireproofing Company, Youngstown, Ohio, Booklet, 6 x 9 in., 16 pages, illustrated. Under the title "The House That Will Not Burn," the modern fireproof house of moderate cost is fully described and illustrated, and suggestions as to total costs given. A fireproof house and a fireproof bungalow have been erected in Youngstown by the company, and the details of the construction are here outlined. Contractor's estimates of costs are given as $4,200 and $2,800 respectively. These model houses were built with steel frames and of concrete sidewalls, floors, partitions and roofs using waterproofing for roofs and walls, and patented reinforcing.

Trussed Concrete Steel Company, Youngstown, Ohio. Pamphlet, 8½ x 11 in.; 15 pages, illustrated. Fireproof floors and bearing partitions of pressed-steel construction are described in this third edition of this company's illustrated pamphlets on this subject. It gives complete details and methods of using pressed-steel sections with Hy-rib and concrete to produce fire-resistive construction. Tests of pressed-steel I-beams are cited, and tables for strength given.

Great Southern Lumber Company, Bogalusa, La. Booklet, 8 x 10½ in., 28 pages, illustrated. Discussion of yellow pine as a structural material. How and where to get branded yellow pine. Embraces also specifications of Southern Pine Association adopted in October and other standard specifications and tables showing working unit stresses, load limits for actual sizes, and a reprint of article on "A Visual Method of Distinguishing Longleaf Pine" which appeared in the American Lumberman and the Engineering Record, page 319, Sept. 11.

Trus-Con Laboratories, Detroit, Mich. Architect's Handbook of Specifications for Waterproofings, Damp-proofings and Technical Paint Products. Loose-leaf binder, 8½ x 11 in., 30 complete specifications. Covers the use of waterproofing, etc., in general and applications to a number of special conditions. It is expected that further sheets will be added from time to time to cover other special problems. A carefully made index makes it possible to find any particular specification. A limited number are available for free distribution.

CONTRACTING NEWS

Of Special Interest to Engineers, Contractors, Builders and Manufacturers of Engineering and Building Supplies

THE expected capacity freight traffic on all the principal systems centering in the Chicago district, as well as on the Eastern roads, has materialized. While a majority of the Western roads broke their car-loading records during October, receipts of grain at interior points in the week ending Nov. 3 eclipsed all the October figures, and exceeded by 20 per cent the record receipts of the third week of September, 1912. In the Eastern territory the Baltimore & Ohio Railroad reports that it is handling the record business of its history, and is prepared for further expected increases, the end of which is not yet in sight.

The latest statement of the U. S. Comptroller of Currency, given out Nov. 4, shows that the National banking system on Sept. 2 was in the best condition of its history with resources $24,000,000 and deposits $378,000,000 in excess of any previous figures. The bubble of speculation in war stocks was pricked last month on the New York stock exchange without developing any sign of weakness in issues representing the solid business interests of the country. It has long been realized that certain issues have been forced by speculation to prices at which there was no chance of adequate return on the investment, and the decline in these issues has put the market in a much stronger position.

The October pig-iron output passed the 3,000,000-ton mark for the first time in the history of the industry, averaging more than 100,000 tons a day, and the demand still grows. If the Bessemer elevated contracts, not formally awarded by the end of October, be included, the structural steel business booked for that month will reach 214,000 tons, only 4000 tons short of the record made in May, 1909, and about three times the business being booked each month during the last spring.

The rise in price of cement is being followed in the Eastern market by other building materials. Deliveries are difficult to get, as not only are the railroads rapidly becoming crowded, but the available supply of barges for water transportation is seriously curtailed by the use of such vessels for storing and lightering export goods. The demand for money to finance new building operations has increased, especially for projects to be carried out next spring. If construction work develops as this demand indicates, there will be a large increase in the price of building materials by spring, and buying to forestall this rise is said to be under way in some quarters.

A large number of bonds for public construction went from the small town issues to the bonds for completing the New York State barge canal more voted at the recent election, foreshadowing increased construction activity next year.

Buildings

It is reported that a $400,000 building contract has been awarded at Philadelphia. The United States immigration station, to cost $267,000, has been contracted for at Baltimore. The lowest bid opened for erecting a high school at Lebanon, Pa., was $149,000. Contracts amounting to $148,000 have been awarded for the construction of a high school at St. Cloud, Minn. The lowest bid opened at Seattle for erecting a university building was $99,900. Bids are desired Nov. 22 at Providence, R. I., for building a $150,000 school. Emporia, Kan., desires bids Nov. 30 for erecting a $175,000 administration building.

Plans have been filed in New York City for four apartment houses costing from $150,000 to $400,000 each. It is reported that bids will be opened Dec. 1 in New York City for erecting a court and jail building on West Thirtieth Street. Plans have been completed for a $250,000 apartment house at Baltimore. A factory addition contemplated at Columbus, Ga., will cost $200,000. Jacksonville, Fla., has sold $500,000 school bonds. An architect has been engaged to prepare plans for a $450,000 bank building at Seattle.

Bridges and Roads

A contract for building a $38,000 concrete bridge has been awarded at Johnstown, Pa. Bids will be opened Nov. 22 at Boston for constructing a concrete bridge over the Charles River at North Beacon Street. It is reported that a $150,000 bridge will be built over the Susquehanna River at Watsontown, Pa. A contract is to be let at Nashville, Tenn., for building a $48,000 viaduct over the railroad yards. Dallas, Tex., has sold $135,000 bonds for building a bridge over the Trinity River. Plans are being prepared by the Oregon State Highway Department for a $230,000 bridge over the Willamette River at Salem.

The lowest bid opened at Newton, N. J., Nov. 8 for rebuilding the Newton-Sparta road was $57,000. A $180,000 road contract has been awarded at Elizabeth, Tenn. Bridges contracted for on this road will cost $47,000 more. Two contracts for grading Kansas City streets were awarded recently at a total of $364,000. A $195,000 paving contract has been awarded at Yuma, Ariz. Ten miles of road contracted for at Riverside, Cal., will cost $61,000.

The construction of a $250,000 speedway is being considered at Atlantic City, N. J. Bonds in the sum of $300,000 have been voted at Cleveland for extending Carnegie Avenue. Road bonds amounting to $135,000 have been sold at Canton, Miss. It is reported that the Board of Public Works of Duluth will spend $600,000 for paving in 1916. County road bonds amounting to $450,000 have been sold at Bryan, Tex.

Waterworks and Sewers

An $84,000 waterworks contract has been awarded at Heber Springs, Ark. Bids are desired at Henderson, Tenn., for constructing a waterworks system. East Youngstown, Ohio, will soon let a contract for building a mechanical filter plant, pumping station and distributing system. A $300,000 pipe line is being planned at St. Louis. Athens, Ohio, will build a $60,000 reservoir. Waterworks construction to cost $125,000 is being considered at Cleveland, Okla. The City Council of Seattle has authorized issuing $75,000 bonds to construct waterworks extensions. The lowest bid opened for constructing the tunnel relief sewer in West Forty-sixth Street, New York City, was $259,000. A contract for building the Lake Street sewer in Milwaukee has been awarded at $160,000. Bids will be opened Nov. 23 at Cleveland, Tenn., for constructing 16 miles of sewers and two sewage-treatment plants. Bonds in the sum of $350,000 have been voted at Lexington, Ky., for constructing a sewage-disposal plant. Sewer bonds amounting to $60,000 have been sold at Toledo, Ohio, and bids will soon be asked for constructing a sewer to be paid for from them. Sewer bonds amounting to $709,000 have been voted at Dayton, Ohio. Xenia, Ohio, has sold $60,000 sewage-disposal bonds. Plans for a $180,000 sewage-treatment plant have been submitted to Decatur, Ill. The construction of a 1½-mile egg-shaped trunk sewer, an additional intercepting sewer and a sewage-treatment plant is contemplated at Duluth, Minn. Sewer bonds amounting to $974,000 have been sold by Houston, Tex.

Miscellaneous

The award of a $726,000 elevated railroad contract in Brooklyn has been approved by the Public Service Commission. A $316,000 drainage contract has been awarded at Corning, Ark. The construction of a $90,000 coal dock has been contracted for at Duluth, Minn. The construction of an irrigation system contracted for at Eureka, Mont., will cost $130,000. Bids are asked for dredging 1,500,000 cu. yd. in Boston harbor. Bids will be opened Dec. 6 in Philadelphia for building the superstructure of a pier, which will cost $500,000. Cleveland, Ohio, has voted $1,600,000 bonds as its share of the cost of eliminating grade crossings. The dam to be built near Salt Lake City will cost $110,000, and bids will be opened Nov. 24. It is reported that bids will be opened on the same date for constructing the $1,700,000 railroad from Rosasco, Cal., to the Hetch Hetchy dam site. Houston, Tex., has sold $140,000 drainage bonds. Irrigation improvements contemplated at Stockton, Cal., will cost $285,000. The proposition to issue $27,000,000 bonds to complete the New York State barge canal was carried.

WATERWORKS

PROPOSED WORK.

Newport, Del.—Flagg & Hubbard, 721 [illegible] Bldg., Philadelphia, Pa., engineers, to prepare plans, specifications, etc., for constructing water works and sewer systems. All bonds will be sold by vote [illegible] for this purpose. S. W. Fox, Supt.

Homestead, Fla.—Citizens voted $50,000 bonds for improvements including water works pumping plant and electric light plant.

Shreveport, La.—Citizens voted in favor of erecting a municipally owned water works plant and sewer system. Will either purchase holdings of the local water works company at price fixed at $[illegible], or issue bonds to the sum of $ 3[illegible] for constructing new plant.

Athens, Ohio.—A [illegible] gal. reservoir [illegible] and [illegible] Burpee & Lang, Engrs., Columbus, Ohio.

Barnesville, Ohio.—Citizens voted to issue bonds to construct a filtration plant. Morris & Lincoln, Engineers, Pittsburgh, Pa.

Dayton, Ohio.—See "Sewerage and Sewage Disposal."

East Youngstown, Ohio.—Contract soon to be let for a one million gallon mechanical filter pumping station, gas engine driven pumps, distributing system and all appurtenances for a complete water works. Chester & Fleming, Engrs., Pittsburgh, Pa. Plans and specifications can be obtained at the office of the engineers by about a week on a deposit of check for $25.

Salem, Ohio.—Joint Committee of Council and Chamber of Commerce has recommended to Council that the recommendations of the W. J. Sherman Co. of Toledo on the best water supplies be carried out by tapping the underground supply, and that immediate steps be taken to make such tests. The committee also recommended that the water service be metered.

Michigan City, Ind.—Water works bonds for $[illegible] will be sold Nov. 18 by J. J. Riley, City Controller.

Menominee, Mich.—Citizens voted $285,000 bonds to purchase present plant or erect a new municipal plant.

Danville, Ill.—City Council has passed ordinance to lay water mains in nineteen streets.

Galesburg, Ill.—Citizens voted $75,000 bonds for water works and $20,000 for electric light plant.

Rankin, Ill.—Citizens voted bonds to construct water works.

Toledo, Ill.—Village Trustees adopted resolution authorizing plans, specifications and estimates of cost prepared for water works system. A high duty pump and an automatic hypochlorite outfit have been recommended by C. L. James of Madison, Consulting Engineer.

Madison, Wis.—Water Board and Special Committee of Common Council has decided to recommend a lake water connection. E. E. Parker, City Engineer.

Iowa City, Iowa.—Prof. J. H. Dunlap of Iowa University recommends constructing a reservoir for the water system capacity 790,000 gals.

Minneapolis, Minn.—Contract soon to be let by K. E. Alexander, City Purchasing Agent, for two liquid chlorine machines for installation in the water filtration plant.

Heartwell, Neb.—Heartwell Water, Light & Power Co. has been granted a twenty-five-year franchise and will erect a water and light plant. Charles Gilson of Minden Secy. of company.

Glendive, Mont.—Burns & McDonald of Kansas City, Mo., engaged to prepare plans for the filtration plant.

St. Louis, Mo.—Plans are being formulated to construct a 36-in. c. i. pump main from Bissell's Point pumping station to Compton Hill reservoir, approximately 27,000 ft. long, and require about 721 tons pipe, 321 tons special castings, 18 fire hydrants, 17 36-in. stop valves and numerous smaller valves; cost estimated at $300,000. Appropriation not yet made, but it is expected to start work early in the new year. Address Secretary Board Public Service.

Temple, Tex.—Water Commissioners reported to be considering installation of an electric motor driven pump at pumping station.

Cleveland, Okla.—Reported a water works costing about $125,000 is contemplated here to include 50,000 ft. 4 to 10-in. c. i. pipe, 19,000 ft. 10-in. pipe for flow line, 150,000 gal. elevated tank on 80 ft. tower, a 3-mile transmission line, two 500 gal. per minute motor driven centrifugal pumps, 1,000,000,000 mechanical filtration plant, dam 390 ft. long and 25 ft. high, for pipe line crossing the Aransas River. A. C. Moore, Joplin, Mo., Consulting Engineer. An election to issue $125,000 for the purpose will probably be voted upon.

Auburn, Wash.—City Council reported to have passed resolution for improvement District No. 12 by installation of water mains. Water mains are also to be laid in Megg's addition.

Nooksack, Wash.—L. A. Sorber of Nooksack, has filed application for water rights near this city with the intention of constructing two separate water systems to serve the towns of Nooksack and Everson; cost of plants, $10,000 each.

Ridgefield, Wash. — Citizens voted to construct a municipal water works to cost approximately $11,000. Gilbert & Hall, Portland, Ore., Engineers.

Seattle, Wash.—City Council authorized issue of water utility bonds amounting to $75,000 to cover cost of extending municipal water system to Ranier Avenue section; extension to include a 300,000 gal. standpipe on Beacon Avenue, a 16-in. water main from standpipe to intersection of Bangor Street and a 30-in. main on Spokane Street.

City Council also authorized water mains in Dexter Avenue at a cost of $14,000.

Lakeside, Ore.—Milo Pierson and John D. Goss, Lakeside, it is reported, will install a water system to serve the town: cost about $10,000. S. B. Cathcart, Lakeside, making surveys.

Oregon City, Ore.—Estacada, Lawton Heights and Maple Lane Districts have petitioned City Council for right to tap South Fork Supply and extend same to their districts.

Fairview, Idaho.—Citizens will vote Nov. 22 on issuing $10,000 bonds for constructing municipal water works. Charles Gilbert, City Clk.

McCammon, Idaho.—Election soon to be held to vote $20,000 bonds for constructing municipal water system.

Star, Idaho.—McCulloch & Swearinger, Great Falls, Mont., have submitted report and estimates of cost of installing municipal water system.

BIDS DESIRED.

Lynn, Mass.—Until Nov. 16 (extension of date from Nov. 9) by Thomas Campbell, 2d, Commissioner of Water and Water Works, for Contract A, constructing pumping station foundations, etc.; Contract B, constructing pumping station superstructure, etc.; Contract C, furnishing and installing pumping and other equipment, etc., for Ipswich River Pumping Station.

Washington, D. C.—By Bureau Supplies and Accounts, Navy Dept., Washington, D. C., as follows:

Until Nov. 23, Brooklyn, N. Y., Sch. 9001—Miscellaneous steel conduits.

Until Nov. 30, Washington, D. C., Sch. 8981—Miscellaneous wrought and cast iron pipe; cast iron pipe fittings; miscellaneous malleable iron unions; miscellaneous composition unions. Sch. 8982—60 copper expansion joints. Philadelphia, Pa., Sch. 9003—700 steel boiler tubes. Portsmouth, N. H., Sch. 9003—Miscellaneous rough brass gate valves, etc.

Until Dec. 7, Mare Island, Cal., Sch. 8978—Miscellaneous cast iron pipe fittings; lead pipe; wrought pipe; steel tubing; gate valves, etc. Sch. 9008—Miscellaneous angle globes, valves, etc. Applications for proposals should designate schedules desired by number.

Charleston, S. C.—Until Nov. 28 by Lawrence M. Pinckney, 56 Broad Street, for laying terra cotta pipe drains and appurtenances on portions of Romney, King, Poplar and other streets.

Wesson, Miss.—Until Dec. 7 by P. S. Burt, City Clerk, for constructing combined water works and electric light plant. Cost $18,000. M. C. Creeley, Engr., Jackson.

Henderson, Tenn.—Until Dec. 3 by Mayor and Board Aldermen for constructing water works; also separate bids for sewer system, advertised in Engineering Record. Frank L. Wilcox, Engr., Syndicate Trust Building, St. Louis, Mo. E. M. Braden, City Recorder.

Covington, Ky.—See "Bridges."

Brookville, Ind.—Until Nov. 18 by Bd. Town Trus. (Albert Trichler, Clk.), for furnishing and erecting on foundation, a horizontal high duty pumping engine, also a complete unit of 150 hp. water tube boiler, an air compressor and constructing a radial brick or concrete chimney, for Municipal Water Works. John W. Mueller, Engr., Colonial Bldg., Newcastle.

Manitowoc, Wis.—Reported desired until Nov. 16, by John Kelly, City Clk., for constructing pump house, 42 x 45 ft.

Fort Logan, Col.—Until Nov. 19 for constructing pump house and pump, installing necessary machinery, piping, etc. Address Quartermaster.

Moscow, Idaho.—Reported desired until Nov. 20, by Francis Jenkins, Bursar, Univ. of Idaho, bids, including plans, for 60,000-gal. hemispherical bottom steel tank on a tower 79 ft. high to balcony, including 8-in. riser pipe. Bids desired on alternate designs, using patented bottoms, elliptical three-cornered curves, etc.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Hartford, Conn.—Following are unit figures of the lowest bidders on Contracts 14 and 15, clearing and grubbing Nepaug Reservoir (bids opened Nov. 1 by Board of Water Commissioners):

Contract 14—Clearing and grubbing southern portion of the reservoir: Fred. T. Ley & Co., Inc., Springfield, Mass., 440 acres clearing, $28; 75 acres grubbing, $49; 3000 cu. yd. grading, $1; 1000 cu. yd. removal of excrementitious material, $3; 1000 lb. disenfectant, 12 cts.; 50 acres second cutting, $18; total $21,895.

Contract 15—Northerly portion: L. I. Fletcher, Kent, Ohio, 430 acres clearing, $35; 80 acres grubbing, $75; 3000 cu. yd. grading 50 cts.; 2000 cu. yd. removal of excrementitious material, $1; 1000 lb. disenfectant, 12 cts.; 100 acres second cutting, $10; total $25,670.

★**Buffalo, N. Y.**—Dark & Co., 654 Main Street, bid $12,300 for furnishing 12-in. high-pressure pipe line (bids opened Oct. 30). Henry L. Lyon, Deputy Water Commissioner.

★**New York, N. Y.**—Following are unit figures of the North Eastern Construction Company, 225 Fifth Avenue, the successful bidder on Contract 166: Two galvanized steel covered superstructures for drainage chambers at Shafts 11 and 21 of the city tunnel of the Catskill Aqueduct, New York (bids opened by Board Water Supply Oct. 19): 400,000 lb. structural steel, 3.325 cts.; 24,000 tons galvanized sheet steel and miscellaneous iron and steel, 11.4 cts.; 20 M ft. timber and lumber, $63.60; 4000 sq. ft. roofing, 3 cts.; doors and windows in building at Shaft 11, $788.50 (lump sum), and in Shaft 21, $660.16; 17-ton electrically operated crane in building at Shaft 11, $4,200 (lump sum); 18-ton hand crane in building at Shaft 21, $2,184; 20 cu. yd. concrete masonry, $15.60; total, $27,568.

★Contract awarded by Board Water Supply, New York, for Contract 128—Constructing two stone and brick buildings at uptake and downtake chambers of Hill View Reservoir, city of Yonkers, to William H. Egan, 147 E. 125th Street, at $94,409 (bids opened Oct. 26).

Peapack, N. J.—Following are three bids opened Oct. 26 by T. H. Ludlow, Borough Clerk, for work complete, furnishing galvanized w.-i. pipe, constructing reservoir and valve house, etc.: New York Sewage Disposal Co., New York, $74,468; P. W. Ennis, Factoryville, Pa., $64,440, and H. C. Brooks Co., Inc., Martinsburg, W. Va., at $55,750. F. S. Tainter, Borough Engineer.

★**Royersford, Pa.**—Contract for erecting buildings for water works for Home Water Works Co. (W. F. Dreibellis, Treas.) awarded F. H. Keiser & Co., Pottstown. Boilers and pumps not bought yet. William H. Boardman, Engr., 426 Walnut Street, Philadelphia, Pa.

Indian Head, Md.—Lowest bid opened Oct. 30 by Bureau of Yards and Docks, Navy Department, Washington, D. C., was submitted by Pittsburgh-Des Moines Steel Co., Curry Building, Pittsburgh, Pa., at $10,184.

Dayton, Ohio.—Following are four lowest bids opened Oct. 28 by Director of Public Service for a 20,000,000-gal. pump for the water works: Dravo-Doyle Company, Pittsburgh, Pa., $58,150; Cameron Steam Pump Company, New York, $62,550; Allis-Chalmers Company, Milwaukee, Wis., $65,430, and Platt Iron Works, Dayton, $68,050.

★**East Liverpool, Ohio.**—Contract awarded by Board of Control to Pittsburgh Filter Mfg. Co., Pittsburgh, Pa., for transmission line and telemeter recording gages for new water works. Chester & Fleming, Engrs., Pittsburgh, Pa.

★**Virginia, Ill.**—Contract awarded C. P. Bryant & Co. of Chicago and Indianapolis for drilling wells for the Virginia water works. The entire work on the plant, it is estimated, will cost $15,000.

★**Heber Springs, Ark.**—Contract for constructing water works and sewers awarded Inland Construction Co., Chandler, Okla., at $84,750.

SEWERAGE AND SEWAGE DISPOSAL

PROPOSED WORK.

Boston, Mass. — See "Paving and Roads."

Bridgewater, Mass.—Citizens voted to construct sewerage system in business center; cost $10,000.

Winchendon, Mass.—Professor Robert Fletcher of Dartmouth College, Hanover, N. H., estimates cost of constructing a local sewer system bounded by Front, Lincoln, Spring, Beech, Elm and Pond Streets and the railroad at $10,000.

Lackawanna, N. Y. — Constructing of sanitary sewers in portions of various streets under consideration by Council.

Suffern, N. Y.—Citizens voted in favor of constructing a sewer system.

Caldwell, N. J.—Citizens voted in favor of extending the sewer system.

East Orange, N. J.—At Council meeting citizens voted in favor of Imhof sewage disposal plant.

Scranton, Pa.—Dr. Samuel G. Dixon, Supt. State Health Department, Harrisburg, has refused to approve the plans for the sewage disposal system to be built for the city's contagious disease hospital on East Mountain.

Newport, Del.—See "Water Works."

Suffolk, Va.—Sewer, street improvement and school bonds for $70,000 will be sold Nov. 18 by G. A. Harris, Clk. of Council.

Kenova, W. Va.—Citizens voted $55,000 bonds for constructing a sewer system. Address City Recorder.

Eustis, Fla.—Sewer and street improvement bonds for $60,000 will be sold Nov. 30 by R. O. Riddle, Town Clk.

Shreveport, La.—See "Water Works."

Lexington, Ky.—Citizens voted Nov. 2, to issue $300,000 bonds for disposal plant and $50,000 for storm sewers. Norcross Company, Engrs., Atlanta, Ga.

Alliance, Ohio.—James J. Rickard, Director Public Service, writes bids have not yet been asked for the sewage disposal plant.

Dayton, Ohio.—Citizens voted the following bonds: Street and sewers, $457,000; storm sewers, $252,000; water works, $5,000; market house, $17,000; workhouse, $50,000; bridges, $115,000.

East Liverpool, Ohio. — City Council passed resolution to establish sewer District No. 3 in the East End.

East Youngstown, Ohio.—Sewer and road bonds for $45,000 reported will be sold Nov. 12 by Village Clerk.

Findlay, Ohio. — See "Paving and Roads."

Lakewood, Ohio.—Bonds for $9,270 will be sold Nov. 15 by B. M. Cooke, Dir. of Finance, for constructing sewer main in Louis Drive.

Tiffin, Ohio.—State Board of Health has ordered a new sewage disposal plant constructed in this city; probable cost $500,000.

Toledo, Ohio.—Contract soon to be let by County Commissioners for constructing sanitary sewer No. 13 in Home Acre division. Bonds amounting to $60,070 have been sold for said purpose.

Xenia, Ohio.—Sewage disposal bonds amounting to $60,000 have been sold. C. F. Logan, City Auditor.

Decatur, Ill.—J. S. Warterfield of the Sanitation Company of Illinois, has presented to City Commissioners plans for a sewage treatment plant, to cost approximately $180,000.

Elgin, Ill.—Four disposal tanks to cost $75,000 are provided for in plans prepared by City Engineer Morgan Brightman to prevent pollution of Fox River with sewage.

Appleton, Wis.—All bids opened Oct. 26 for constructing the Atlantic Street sewer have been rejected by City Council.

Superior, Wis.—City expects to expend $30,000 on sewer extensions this winter. E. B. Banks, City Engr.

Duluth, Minn.—Board Public Works having surveys made for about 1½ miles 5 ft. x 8 ft. egg-shaped trunk sewer; a large flood tank is also included in the work. Construction will be started in early spring.

Board of Public Works contemplates constructing an intercepting sewer and treatment plant. Surveys will be made this winter. J. A. Farrell, Commissioner.

Winner, S. D.—Citizens voted $10,000 bonds to construct sewer system.

Townsend, Mont.—Election is to be held in the spring to vote $30,000 bonds for installing sewerage system. Louis Poole, City Engr.

Houston, Tex.—Following bonds have been sold by City Council: $487,000 drainage sewers and $487,000 sanitary sewers, $192,000 schools, $213,750 parks, $212,500 harbor facilities.

Bellingham, Wash.—City Council is reported to have passed resolution for construction of 14-in. sewer through Alley B, and 14-in. sewer from Magnolia Street through Alley B to Champion Street to connect with existing trunk sewer. H. J. Korthauer, City Clerk.

Seattle, Wash.—Contract soon to be let for constructing sewers in Alonzo Avenue N. W., from West Seventieth to West Sixty-seventh Street, West Sixty-seventh Street, from Alonzo Avenue northwest to Fourteenth Avenue N. W. A. H. Dimock, City Engr.

BIDS DESIRED.

Newark, N. J.—Until Nov. 24 by Board Street and Water Commissioners (Morris R. Sherrerd, Ch. Engr.) for constructing Valisburg sewers, southwesterly section; Front Street, Arlington Avenue and Greenwood Lake Railroad sewers, in all about 14,885 lin. ft. 6 to 12-in. vitr. salt glazed pipe, together with manholes, etc.

Cleveland, Tenn.—Until Nov. 23 by City Council for constructing about 16 miles of 8 to 20 in. pipe sewers, with manholes, flush tanks, and accessories, together with two sewage treatment plants, each comprising concrete Imhoff tanks and sprinkling filters. Specifications, etc., may be had from Walter G. Kirkpatrick, Engineer, Birmingham, Ala.

Henderson, Tenn.—See "Water Works."

Canton, Ohio.—Until Nov. 17, by C. E. Hieber, Clk. Dir. Pub. Service, for furnishing material and constructing storm water sewers in portions of Yale Avenue, N. W., Eighth Street, N. E., and Carnahan Avenue, N. E.

Columbus, Ohio.—Until Nov. 23 by P. B. Kemper, Clk. Dir. Pub. Service, for constructing the Frambes Avenue relief sewer to consist of approximately 5930 lin. ft. 42, 48, 66 and 84 in. sewer, together with manholes, catchbasin drains, etc.

Columbus, Ohio.—Until Dec. 1 by Paul B. Kemper, Clk., Director Public Service, for furnishing and erecting motor driven centrifugal pumping machinery for East Side Sewage Pumping Station. Prices for labor and material must be stated separately.

Marion, Ohio.—Reported desired until Nov. 24 for constructing sanitary and storm sewers in Gill Avenue, Herman and Senate Streets. J. H. Cheney, Dir. Pub. Service.

Toledo, Ohio.—Until Nov. 26 by Board County Commissioners, Toledo, for constructing Main Sanitary Sewer No. 13, to consist of 7 miles vitr. pipe 8 to 15 in. together with manholes, flush tanks, etc.

Dixon, Ill.—Until Nov. 29 by State Bd. of Administration, Springfield (F. D. Whipp, Fiscal Superv.), for constructing concrete tunnel and accessories and storm water and sanitary sewers and accessories on site of State Epileptic Colony, Dixon. James B. Dibelka, State Archt., 130 N. Fifth Avenue, Chicago.

Oklahoma City, Okla.—Until Nov. 15 by City Clerk for constructing lateral sewer in Harndale sewer district.

Ogden, Utah.—Reported desired until Nov. 18 by Florence O. Stanford, City Recorder, for constructing sewers in Sewer Dist. No. 129.

Toronto, Ont.—Until Nov. 23, by T. L. Church (Mayor), Chmn. Bd. Control, for constructing sewers in Davenport, Weston Roads, East and Prescott Avenues and a number of other streets.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Amherst, Mass.**—Following are three lowest bids opened by town for building 13,000 ft. pipe sewers: Way & Cellilli, 62 Bliss Street, Springfield, $15,000; John E. Palmer, Old South Building, Boston, $14,500; James L. Byrne, 53 State Street, Boston, $11,250 (awarded contract).

New York, N. Y.—Official reports state lowest bid opened Nov. 3, by Public Service Commission, for First District, 154 Nassau Street, New York, for constructing Queensboro storm drain, was submitted by Murphy Brothers, Brooklyn, at $7,421.

Yorktown, N. Y.—Following are four lowest bids opened Nov. 9 by State Hospital Commission, Albany, for sewerage and sewage disposal plant at Mohansic State Hospital, Yorktown: The Sewage Disposal & Water Plant Co., Inc., Schenectady, N. Y., $71,117; F. N. Lewis, 411 Manhattan Avenue, New York City, $73,100; J. E. Bunting Co., Inc., Flushing, N. Y., $74,725; James F. Leary Constr. Co., Inc., 311 Cutler Building, Rochester, N. Y., $75,550.

★**Yorktown Heights, N. Y.**—Contract for constructing the sewerage and sewage disposal plant at the N. Y. State Training School for Boys (bids opened Nov. 9) awarded by Bd. Managers to Frederick N. Lewis, New York, at $31,970.

Atlantic Highlands, N. J.—Following is detail bid of Robert W. Smith Corporation, 30 Church Street, New York, N. Y., for constructing sewer extensions (bids opened Nov. 3): 8-in. pipe 3561 ft. 6 in. depth, 65 cts.; 4071 ft. 7 in. depth, 75 cts.; 2972 ft. 8 in. depth, 85 cts.; 375 ft. 9 in. depth, 95 cts.; 275 ft. 10 in. depth, $1.05; 125 ft. 11 in. depth, $1.15; 83 ft. 12 in. depth, $1.25; 10 in. pipe, 400 ft. 8 in. depth, 98 cts.; 850 ft. 9 in. depth, $1.10; 200 ft. 10 in. depth, $1.22; 500 ft. 11 in. depth, $1.34; 750 ft. 8 in. c. i. pipe in place, $1.46; 450 ft. 6 in. Y branches 80 at 75 cts., and 370 at 65 cts.; 150 deep cut connections, 40 cts.; 48 manholes, $34.50 to $52.00; 125 ft. 1½ in. c. i. pipe in place, 50 cts.; timber in place per M ft. $50.00; piling, including driving per foot, 75 cts.; concrete ejection station, $975; total, $15,402. Next three lowest bidders: Briggs & McLaughlin Co., 337 E. 134th Street, New York, $17,850; Guion Nosttian & Pecora, $17,091; Liddel & Pfeiffer, Perth Amboy, $17,510. H. O. Todd, Borough Engineer.

★**Galesburg, Ill.**—Contract for constructing the South Henderson Street sewer awarded D. E. Keeler Company of Davenport, Iowa, at $18,555.

Appleton, Wis.—See "Proposed Work."

★**Milwaukee, Wis.**—Contract for constructing the Lake Street Sewer awarded A. J. Hewitt, Milwaukee, at $160,000.

Seattle, Wash.—D. Parisi Company, 1506 Sixteenth Avenue South, submitted lowest bid for constructing sewers in North and West Forty-ninth Streets, at $9,531.

New York, N. Y.—Following are unit prices of four lowest bids opened Nov. 4 by Maurice M. Marks, President Manhattan Borough, for constructing a tunnel relief sewer in West Fourteenth Street (by Pinder & Borchardt, 55 Madison Lane, $239,013; (2) James O'Leary, $265,870; (3) Battery Engineering & Contracting Co., 17 Battery Place, $282,430; (4) J. F. Organ, Woolworth Building, $295,494.

Typical Items	(a)	(b)	(c)	(d)
127 cu. yd. excavation of shafts in earth	$10.00	$15.00	$4.50	$5.00
228 cu. yd. rock excav. in shafts	15.00	20.00	10.00	10.00
1,[illegible] cu. yd. excav. in tunnels	8.50	10.00	9.00	10.00
187 cu. yd. backfilling shafts	1.00	1.00	2.00	1.00
54 cu. yd. Class A concrete in shafts and manholes	10.00	9.00	8.00	10.00
1,[illegible] cu. yd. Class A concrete in tunnels	10.00	9.00	8.50	10.00
68 cu. yd. dry packing in tunnels and shafts	2.00	2.00	3.00	2.00
100 cu. yd. additional trimming in shafts	0.50	0.01	0.01	1.00
1,[illegible] cu. yd. additional trimming in tunnels	0.50	0.01	0.50	1.00
2,[illegible] bbl. grout Portland cement in tunnels and shafts	1.50	2.00	2.50	3.00
22[illegible] sq. ft. vitr. shale hollow tile invert blocks in tunnel	0.25	0.20	0.25	0.30
442[illegible] lb. permanent structural steel roof supports in tunnels	0.01	0.005	0.02	0.0025
54.4 M ft. permanent timber and lumber in tunnels and shafts	50.00	0.01	45.00	0.01
Open Cut Items:				
970 lin. ft. double 6 ft. 6 in. x 8 ft. 6 in. concrete sewer	45.00	65.00	67.00	60.00
840 lin. ft. double 7 ft. 6 in. x 7 ft. 6 in. concrete sewer	43.30	64.00	78.00	60.00
22 lin. ft. 4 ft. x 2 ft. 8 in. elliptical brick sewer	15.00	15.00	20.00	12.00
22 lin. ft. 4 ft. x 2 ft. 8 in. egg-shaped brick sewer	15.00	15.00	20.00	12.00
22 lin. ft. 6-in. vitr. pipe sewer	2.00	2.50	4.00	2.00
22 lin. ft. 8-in. vitr. pipe sewer	1.60	2.00	3.00	2.00
Temporary sewage and sanitary branch, including manhole No. 3 at Sta. 9 + 34	2,000.00	2,310.00	250.00	3,000.00
Temporary section at Sta. 15 + 07	1,000.00	1,600.00	250.00	3,000.00
13 manholes	75.00	75.00	40.00	60.00
1[illegible] cu. yd. Class B concrete	6.00	7.00	6.00	8.00
3[illegible] cu. yd. dry rubble masonry	1.00	4.00	3.00	4.00
6[illegible] cu. yd. rock excav.	4.25	2.00	2.25	3.00
1[illegible] lin. ft. 12-in. vitr. drain pipe	1.00	2.00	0.35	1.50
24.1 M ft. timber and bracing in foundation	40.00	0.01	30.00	30.00
1[illegible] M ft. sheeting and bracing	35.00	0.01	30.00	0.01
1,[illegible] lin. ft. piles in place	0.01	0.01	0.20	0.25
General Items (applying to both open cut and tunnel and shaft work):				
45 cu. yd. brick masonry	12.00	10.00	12.00	15.00
1[illegible] cu. yd. vitr. brick masonry	18.00	15.00	18.00	20.00
25 cu. yd. rubble masonry in mortar	4.00	5.00	4.00	5.00
100 cu. yd. stone ballast other than used in concrete	1.50	1.00	1.50	1.50
6,[illegible] lb. structural steel beams and shapes with or without connections	0.04	0.03	0.03	0.04
5,000 lb. miscellaneous cast iron, wrought iron and steel	0.03	0.03	0.04	0.04
25,000 lb. additional steel reinforcement rods embedded in concrete	0.04	0.03	0.03	0.04
1,[illegible] lin. ft. 8-in. vitr. drain pipe	0.40	0.20	0.20	1.00
1,[illegible] lin. ft. 6-in. vitr. drain pipe for house connections	0.35	0.20	0.15	0.75
500 lin. ft. 4-in. vitr. drain pipe for weepers	0.25	0.20	0.15	0.50
1,[illegible] cu. yd. earth excav. in test pits and temporary cutout	1.00	0.40	0.50	3.00

★**Portland, Ore.** — Contract awarded according to latest reports to J. P. O'Neill, [illegible] on a revised bid for constructing East Water and Mill Street sewers at $[illegible].

BRIDGES

PROPOSED WORK.

Holyoke, Mass.—C. C. Perry, Assistant City Engr., Public Works, writes [illegible] preliminary work is being done in connection with the Dwight Street High Bridge.

Watsontown, Pa. — Northumberland County Comrs. [illegible] will erect a bridge over Susquehanna River between Watsontown and White Deer; cost about $[illegible].

Atlanta, Ga.—Reports to Council Bridge contemplated by Fulton and Cobb Counties; cost about $[illegible].

Knoxville, Tenn.—City Comrs. reported voted $[illegible] for widening Gay Street viaduct over railroad tracks and extending same from present terminus to Depot Avenue; probable cost $[illegible].

Nashville, Tenn.—Reported contract will soon be let for constructing viaduct over railroad tracks of Nashville, Chattanooga & St. Louis Ry. on Cedar Street; cost about $[illegible]. Nashville Ry. & Light Co. and Tennessee Terminals and city to share cost.

Pasadena, Tex.—Plans for viaduct to be constructed under the International & Great Northern Ry. between Ayrshire Street and Orchard Road, have been completed. Address City Clerk.

Dayton, Ohio.—See "Sewerage and Sewage Disposal."

Steubenville, Ohio.—Reported the Lake Erie & Western Ry. Co. [illegible] contemplates constructing a bridge over Ohio River to Steubenville, Ohio, to eliminate [illegible] crossings on Ohio side of river; cost about $[illegible].

Benton, Wis.—Contracts will soon be let for constructing [illegible] ft. bridge to Shake Rock and [illegible] bridge to county; estimated cost $[illegible].

Wascott, Wis.—Plans being prepared for a concrete bridge, [illegible] ft. long, to be constructed here. C. J. Dahlman, County Engineer, Superior, has charge of work.

West Point, Wis.—Citizens of Prairie du Sac and West Point voted $[illegible] bonds each for construction of bridge over Wisconsin River at this point. The county is to pay $[illegible] and the state $24,000 of cost.

Yankton, S. D.—Construction of bridge over Missouri River is being considered by Yankton County.

Kansas City, Mo.—See "Paving and Roads."

Wilmot, Ark.—Ashley County Comrs., Hamburg, reported appropriated $8,000 toward constructing a steel bridge over Bayou Bartholomew near Wilmot.

Dallas, Tex.—About $135,000 bonds sold to [illegible] for constructing bridge over Trinity River at Commerce Street. Plans for bridge will be completed about Nov. 16.

Galveston, Tex.—Gulf, Colorado & Santa Fé Ry. Co. Nov. 5 agreed to pay share toward building a temporary bridge in connection with the causeway. F. Merritt, Chief Engineer of Gulf, Colorado & Santa Fé Ry., is Chairman of Board having matter in charge.

Huntsville, Tex. — Construction of bridge over Trinity River, probably at Riverside, is contemplated; cost about $[illegible].

Rockport, Tex.—Reported an injunction has been caused to prevent issue of $300,000 bonds for construction of Rockport-Lamar causeway in Aransas County.

Walsenburg, Col. — A concrete arch bridge, two spans, each 75 ft., is to be constructed over Huerfano River, north of Walsenburg; cost $12,500. Address County Clerk, Walsenburg.

McAlester, Okla.—Comrs. Pittsburg and McIntosh Counties considering purchasing M., K. & T. R.R. bridge over Canadian River and planning to remodel structure for vehicles; estimated cost $[illegible].

Oklahoma.—Plans approved by State Highway Engineer at Oklahoma City for two steel bridges to be constructed in Grant and Caddo Counties. Medford, County seat Grant County, and Anadarko, county seat of Caddo County.

North Yakima, Wash.—County Comrs. and City Comrs. voted to construct a bridge over Block of Pacific Power & Light Co. on N. Sixth Avenue; cost $10,000.

Seattle, Wash.—City Council appropriated $[illegible] for preliminary work in connection with construction of Lake Washington Canal Bridge at Latona. This will include approaches, grading of streets and construction of an overhead bridge from bridge proper to waterfront at Latona.

McMinnville, Ore.—Plans being prepared by State Highway Dept. at Salem for concrete viaduct to be constructed over Cozine Creek in Yamhill County; cost about $[illegible].

Salem, Ore.—Plans prepared by State Highway Dept., at Salem, for bridge to be constructed over Willamette River at Salem; probable cost $[illegible], to be shared by Marion and Polk Counties.

Los Angeles, Cal.—Plans being prepared by City Engineer for fill and bridge over Pacific Electric Ry. tracks at Sherman Drive; probable cost $20,000.

San Francisco, Cal.—Contract soon to be let by Board State Harbor Commissioners for constructing viaduct, about 250 ft. long, 20 ft. high and 12 ft. wide, at Market Street, from second floor of Ferry Building across Embarcadero to the westerly side north of Sacramento Street. Bridge to be of steel encased in wire, lathe and plaster.

BIDS DESIRED.

Boston, Mass.—Until Nov. 22 by Metropolitan Park Comn. (William De Las Casas, Chmn.) for constructing concrete bridge and approaches over Charles River at North Beacon Street, between Boston and Watertown, to consist of 2500 lin. ft. concrete piles, 2400 sq. yd. roadway surfacing, etc. Probable cost $175,000. John R. Rablin, Engr., Boston.

Kennett Square, Pa.—Until Nov. 22 (readvertisement) by Isaac Y. Ash, Co. Controller, West Chester, for furnishing material and constructing a stone arch bridge over Red Clay Creek in Kennett Square. Specifications include removal of present iron bridge and replacing it on new abutments north of Miles' mill, New Garden and East Marlborough Townships.

Grenada, Miss.—Until Dec. 6, by Board County Supervisors (John S. King, Clk.), for constructing steel bridge across Long Creek and levee near Lefiore.

Woodville, Miss.—Until Dec. 6 by Board Supervisors (L. Lewis, Clk.) for constructing three bridges across Buffalo Bayou, in Momichitto Swamp, and driving piles under Buffalo Bridge.

Covington, Ky.—Until Dec. 9, by J. Mason Howk, Commissioner of Public Property, for constructing bridge superstructure to carry duplicate water supply main over Licking River for city, advertised in Engineering Record. George Horung, Consulting Engineer, Wool-Sack Building, Newport.

Illinois.—By State Highway Commission, Springfield, for constructing bridges as follows:
Until Nov. 19 by County Clerk, at Ottawa, Pleasant Hill Bridge, Serena Township, existing steel truss refloored, cleaned and repainted and new reinforced concrete abutments to be built. Engineer's estimate $3,535. George Farnsworth, Co. Supt. Highway, Ottawa.
Until Nov. 27 at office of Co. Supt. Highways, Quincy, for constructing House Bridge, Richfield Township, steel bridge, 100-ft. span, 16-ft. roadway, concrete abutments. Engineer's estimate $4,585, including piles.

Walker, Minn.—Until Nov. 20 by C. D. Bacon, Co. Aud., for furnishing and delivering f.o.b. cars 8522 lin. ft. 12 to 36 in. corrugated metal culverts, to be used in construction of State Rural Highway No. 80. Bids desired on both iron and steel culverts. A. W. Moulster, Engr. in Charge, Pine River.

Osceola, Ark.—See "Hydraulic and River Improvements."

Aberdeen, Wash.—Until Nov. 17 by P. F. Clark, City Clerk, for approaches and false work for repairs of bridge over Chehalis River; cost complete $26,000. C. E. Fowler and L. D. Kelsey, Aberdeen, Engrs.

Portland, Ore.—Reported desired until Nov. 20 for constructing reinforced concrete viaduct 219½ ft. long, 58 ft. wide, with a 16 ft. fill 700 ft. long necessary for extension of Union Avenue. Probable cost of viaduct, $53,000; fill, $13,000. A. L. Barbur, Co. Aud.

Sacramento, Cal.—Reported desired until Nov. 29, for constructing an 80 ft. clear span plate girder bascule bridge near east side of Yolo by-pass causeway. Complete span 141 ft. For further information address State Highway Comn.

PRICES AND LETTINGS.

★Indicates award of contract.

★**Conklin, N. Y.**—Contract awarded Binghamton Bridge Co., Press Building, Binghamton, for constructing 125-ft. span bridge over Little Snake Creek. Charles Van Amburgh, County Superintendent Highways, Binghamton.

★**Johnstown, Pa.**—Contract for constructing Homer Avenue Bridge, a 225-ft. ribbed arch (bids opened Nov. 6) awarded John L. Elder, Ebensburg, at $38,350. C. A. Flink, Engr., Harrisburg.

★**Mooresburg, Pa.** — Contract awarded C. H. Reinard, Bloomsburg, for constructing concrete I-beam bridge for Philadelphia & Reading Ry.

★**Norristown, Pa.**—Contract for constructing two-arch stone bridge over Goshenhoppen Creek in Frederick township awarded by County Comrs. to Jas. Smith, Perkiomenville, at $4.89 per cu. yd.

★**Biltmore, N. C.**—Contract for constructing bridge over Swannanoa River awarded C. W. Requoth Co., Charlotte; cost about $12,000.

★**Columbus, Miss.**—Contract awarded H. C. Terry, Columbus, for constructing a 100 ft. span steel bridge with concrete floor and a concrete culvert (bids opened Nov. 1). C. G. Wood, County Bridge Engineer.

★**Cincinnati, Ohio.**—Contract for widening the bridge over Montgomery Pike awarded by Bd. Control to Runck Bros., First National Bank Building, at $11,994.

★**Indianapolis, Ind.**—Contract awarded to Dunn-MacCarty Co., Indianapolis, by Bd. Pub. Wks. for constructing bridge across Fall Creek at Meridian Street for City and County at $146,378.

★**Caledonia, Mich.**—Contract for constructing a 170-ft. Pratt truss bridge (bids opened Nov. 5) awarded by G. A. Woodward, Clerk Caledonia Township, to Illinois Bridge & Iron Co. of Elkhart, Ind.

★**St. Paul, Minn.**—Contract for constructing steel bridge at Surrey Street awarded to Illinois Steel Bridge Co., Chicago, Ill., at $7,645.

★**Mankato, Kan.**—Contract awarded by County Commissioners for Wilder Bridge to Western Bridge Co., Harrisonville, Mo., for $4,549.

★**Salina, Kan.**—Contract for constructing a 120-ft. steel and reinforced concrete bridge in Walnut awarded Wilmarth & Zerbe, Salina, at $4,643. A. C. Anderson, County Clerk.

★**Santa Fé, Kan.**—Contract for constructing Haskell-Seward Bridge across Cimarron River (bids opened Nov. 1) awarded Western Bridge Co., Harrisonville, Mo. C. E. Beymer, County Clerk.

★**Miles City, Mont.**—Contract for constructing steel bridge over Fallon Creek awarded by County Comrs. to Security Bridge Co., Billings, at $9,480.

Houston, Tex.—Lowest bid opened by County Comrs. for constructing Harrisburg Bridge submitted by Horton & Horton, Houston, at $19,960.

★**Cherokee, Okla.**—Contract for constructing 13 bridges in county awarded by County Comrs. to Kansas City Bridge Co., Kansas City, Mo., at $22,243.

★**Boise, Idaho.**—Contract for constructing 450 ft. steel highway bridge over Snake River in Grand View Valley awarded by County Comrs. to Missouri Valley Bridge & Iron Co., Denver, Col., at $19,850.

PAVING AND ROADS

PROPOSED WORK.

Brattleboro, Vt.—Construction of road from Brattleboro to Bennington is contemplated; cost about $125,000. S. B. Bates, State Highway Comr. at Montpelier.

Boston, Mass.—The Mayor authorized expenditure of $89,000 for widening, paving with wood or granite, and constructing sewers on N. Beacon Street, between Cambridge and Market Streets, in Brighton.

Atlantic City, N. J.—Absecon and Pleasantville City Comrs. voted in favor of constructing Absecon-Atlantic City Speedway. The 4 miles across the meadows will cost $250,000. The state to pay $80,000 of cost. Atlantic City is to construct a parkway 125 ft. wide, of asphalt, to bring boulevard into center of city from its terminus at Venice Park. Address Frederick Schuhardt, Clk. Bd. Freeholders, Egg Harbor.

Baltimore, Md.—John H. Robinette, Pres. Bd. Comrs. for Opening Streets submitted to Board Estimate cost of opening, grading and paving Gwynn's Falls Parkway from Gwynn's Falls Park to Druid Hill Park; cost about $500,000. Work may not be taken up for some time.

Suffolk, Va.—See "Sewerage and Sewage Disposal."

Eustis, Fla.—See "Sewerage and Sewage Disposal."

Canton, Miss.—County Board of Supervisors sold $135,000 gravel road bonds.

Edwards, Miss.—Board of Supervisors at Jackson will issue $50,000 good road bonds for Edwards District.

Bellevue, Ky.—Citizens voted $22,000 bonds for repaving Taylor Avenue.

Cincinnati, Ohio.—Estimates of cost of widening Springdale Pike under tracks of Cincinnati, Hamilton & Dayton Ry. Co. were submitted to County Comrs. by engineers of railroad company. One plan provides for using old abutments to railroad bridge over roadway and raising them 4 ft., cost $22,000. Another plan provides for 40 ft. roadway with sidewalks on each side 10 ft. wide, cost $74,300, and another plan provides for roadway 60 ft. wide with sidewalks 10 ft. wide each side, cost $84,400. Cost of this work may be divided between city, county and railroad company.

Cleveland, Ohio.—Citizens voted $200,000 for extending Carnegie Avenue.
City Council voted to repave with block stone Clark Avenue, S. W., and E. 117th Street.

Dayton, Ohio.—See "Sewerage and Sewage Disposal."

Findlay, Ohio.—About $20,950 street and sewer bonds were sold by City Auditor.

Ohio.—Various counties through state voted tax amounting to $1,000,000 yearly for improving highways to be used with state funds allotted to counties.

Toledo, Ohio.—See "Miscellaneous."

Fort Wayne, Ind.—Road bonds for $15,000 reported to be sold Dec. 1 for road in Wayne Trace County.

Goshen, Ind.—All bids opened by County Comrs. Nov. 1 for constructing four miles concrete road in Harrison Township reported rejected.
Petitions being circulated asking County Commissioners to pave three or four roads with brick.

Greenfield, Ind.—Comrs. Shelby and Hancock Counties ordered building 3 miles of road on county line. G. C. Winslow of Greenfield engineer of construction. Petition has been circulated for presentation to the Commissioners of Hancock County asking paving of the National Road with brick, distance of 3 miles east and west from Greenfield.

Grand Rapids, Mich.—County Commissioners propose constructing two new bridges and 28 miles of good roads.

Lansing, Mich. — Reported Wolverine Pavedway Association (K. M. Whitman, Secy., Lansing) has decided on a transstate paved highway route from Detroit to Grand Haven, a distance of 160 miles.

Peoria, Ill.—Chamber of Commerce of Peoria and citizens of Averyville plan to pave "The Narrows" on Galena Road; estimated cost $22,000.

Quincy, Ill.—Ordinance passed by Board Local Improvements for paving next spring with brick on concrete base on Fourteenth Street, Broadway to State Street; cost $28,737. Duke Schroer, City Clerk.

Streator, Ill.—City Council passed ordinance to pave Penn and Bridge Streets; estimated cost $14,140.

Cherokee, Iowa.—Council adopted a resolution to pave 4 1/3 miles; material not yet decided upon.

Duluth, Minn.—Board Public Works expects to spend about $600,000 on paving next year. J. A. Farrell, Commissioner.

Duluth, Minn.—Lyonal Ayers, City Engineer, writes that the paving of Grand Avenue, about 55,000 sq. yd., has been postponed until early in 1916.

St. Paul, Minn.—See "Public Buildings and Schools."

Grand Forks, N. D.—Reported Grand Forks County contemplates extensive system of road improvements during coming year.

Billings, Mont.—Commissioners of Yellowstone County contemplate constructing hard surface roads in Yellowstone County, near Billings.

Bryan, Tex.—About $450,000 bonds for road improvements sold by County.

Bryan, Tex.—Abney & McCormick of Eagle Lake have been engaged as engineers for $400,000 road building in Brazos County.

Victoria, Tex. — Street improvement bonds amounting to $30,000 have been sold; also $30,000 for additional facilities for Fire Department. J. H. Fleming, Mayor.

Central City, Colo.—A 10-mile road is to be constructed between Idaho Springs and Central City, cost about $35,000, to be shared by citizens of Central City, Idaho Springs and U. S. Forestry Service.

Seattle, Wash.—City Council voted to pave Western and Thirty-fifth Avenues and E. Valley Street.

Astoria, Ore.—City Council voted to pave and construct concrete sidewalks on Duane, Thirty-sixth and Thirty-seventh Streets; cost about $18,000.

Portland, Ore.—A 20-mile road is to be constructed around Mt. Hood. H. S. Graves, United States Forest Service, Portland, is interested.

San Bernardino, Cal.—County highway bonds amounting to $625,000 have been sold.

San Francisco, Cal. — Bd. Supervs. voted to pave Sansome Street and Corbet Avenue with asphalt and construct sidewalks thereon; also construct sidewalks on Bosworth Street.

Idaho.—Edward S. Smith, State Highway Engr., at Boise, completed surveys for constructing 25-mile roadway from Warm River to Buffalo River.

BIDS DESIRED.

Boston, Mass.—Until Nov. 16, by Edw. F. Murphy, Comr. Pub. Wks., for furnishing and laying asphalt or bitulithic pavement on Fernboro and Harwood Streets and Mendon Park, Dorchester, and Kittredge Street, West Roxbury.

Newark, N. J.—Until Nov. 22 by Committee on Roads, Assessments and Speedway, Bd. Chosen Freeholders, Newark, for improvement of South Orange Avenue in Newark and East Orange. Fred. A. Reimer, Co. Engr.

Princeton, W. Va.—Until Dec. 6 by County Clerk for constructing about 6½ miles of waterbound macadam, between Rock and Glatto, in Mercer County, advertised in Engineering Record. George H. Hill, Chief Engineer.

Fort Myers, Fla.—Until Nov. 15 by Board County Commissioners for improving highway from Fort Myers to Marco, approximately 128.53 acres clearing, 115,370 cu. yd. grading, 22,500 lin. ft. pile bridges and 673,456 lin. ft. lumber bridge. P. F. Jenkins, Engr., Fort Myers.

Pensacola, Fla.—Until Dec. 4 by Bureau Supplies and Accounts, Navy Dept., Washington, D. C. (H. R. Stanford, Ch.), for Spec. No. 2204—Concrete pavement at the navy aeronautic station, Pensacola.

Edwards, Miss.—Until Dec. 6, by Highway Commissioners for constructing 6½ miles gravel road. A. J. Lewis, Jr., Treas.

Independence, Ohio.—Until Nov. 27 by Arthur J. Goudy, Village Clk., for furnishing material and laying sidewalks on the easterly and westerly side of Brecksville Road, between Stations Nos. 178 and 230. Prices for labor and material must be stated separately and should include prices on bluestone, sandstone and concrete.

Marysville, Ohio.—Reported desired until Nov. 20 by W. H. Husted, Co. Aud., for reflooring bridge over Mill Creek, 156 ft. span, 18 ft. roadway, with creosote or kreolite plank and lug block.

Toledo, Ohio.—Until Nov. 30, by County Commissioners, Toledo, for furnishing material and improving by grading, draining and macadamizing with waterbound macadam Otter Creek Rd., approximately ¾ miles long in Oregon Township. Gabe Cooper, Co. Aud.

Brookville, Ind.—Until Dec. 6 by County Commissioners (Jonathan Fruits, Chmn.) for grading, draining and paving about 2¾ miles public highway in Bloomington Grove Township.

Winamac, Ind.—Until Dec. 6 by County Commissioners at Winamac, for constructing Otto Heise gravel road, three miles long; cost, $6,607. C. E. Paul, County Surveyor.

Berwyn, Ill.—Until Nov. 16, by Board Local Improvements (Oscar N. Lindahl, Secy.), for paving portion of Twenty-second Street from Lombard and Winfield Avenues, known as Berwyn Special Assessment No. 90; also constructing cement sidewalks on Twelfth, Fourteenth, Fifteenth and other streets, known as Berwyn Special Assessment No. 83.

Excelsior, Minn.—Until Dec. 7 by F. S. Kemp, City Clk., for paving Water Street. Bids desired on vitrified brick, creosote blocks of 3½ in. long leaf yellow pine and 3 in. tamrack. Abbott & Budd, Engrs., Kasota Block, Minneapolis.

Lincoln, Neb.—Reported desired until Nov. 15 by H. E. Wells, Co. Clk., for paving Dist. No. 9. Engineer's estimate: $47,300 for 3-in. fiber brick; $42,650 for asphalt concrete and $50,630 for brick block.

Omaha, Neb.—Reported desired until Nov. 23 by T. J. O'Connor, City Clk., for paving with asphalt, stone, vitr. brick, creosoted wood block, asphaltic concrete, etc., portions of Forty-first, Thirty-fifth, Cummings and other streets.

Kansas City, Mo.—Until Nov. 16, by Board Pub. Works (Thos. F. Callahan, Secy.), for paving with Portland cement concrete portions of Twenty-fourth and Forty-fifth Streets; constructing artificial stone sidewalks on a number of streets.

Walla Walla, Wash.—Reported desired until Nov. 27 by County Commissioners for constructing two miles of highway near Whitmans Station.

PRICES AND LETTINGS.

★Indicates award of contract.

Massachusetts.—Following are two lowest bids opened Nov. 9 by Massachusetts Highway Commission, Boston, for 19,000 lin. ft. concrete road in towns of Sheffield and Great Barrington: J. D. Michael & Bros., Torrington, Conn., $28,382; Powers Bros., Brockton, Mass., $33,615.

★Rensselaer, N. Y.—Contract for paving Riverside Avenue awarded by City Council to James J. Ridney, Rensselaer, at about $48,000.

Schenectady, N. Y.—Lowest bid opened Oct. 27 by Bd. Contract & Supply reported submitted by Union Paving Co., 119 Lafayette Street, at $23,687.

★Hackensack, N. J.—Contract for improving Essex and Passaic Streets awarded by County Roads Com. to E. C. Humphrey, 173 Main Street, at $24,226. Bids opened Oct. 29 by Bd. Chosen Freeholders.

Pennsylvania.—Following are four lowest bids opened Nov. 4, by State Highway Dept., Harrisburg, for reconstructing the following roads (Robert J. Cunningham, State Highway Commissioner):
★Indiana County, Marian Center Borough, 4054 ft. with brick block: M. Bennett & Sons, Indiana, $16,640 (reported awarded); E. H. Brua, Hollidaysburg, $16,680; Simpson & Bradley Co., Punxsutawney, $17,732, and W. H. Lyons, Sunbury, $17,818.
Montgomery County, Narberth Borough, 1756 ft. bituminous or cement concrete. Lowest bidders: Mainwaring & Crimmins, Philadelphia (concrete), $6,243; Frank McInerney, Easton (amiesite), $7,217; Union Paving Co., Philadelphia (Filbertertine), $7,536; Dwyer & Co., Philadelphia (Warrenite), $7,951.
★Lawrence County(Hickory Township, 5508 ft. telford macadam: M. Bennett & Sons, $14,917 (reported awarded); South Shore Construction Co., Erie, $16,389; E. H. Brua, Hollidaysburg; $17,473; Simpson & Bradley Co., Punxsutawney, $17,706.

★Gastonia, N. C.—Contract for constructing 50,000 sq. yd. asphalt pavements awarded by City Council to Noll Constr. Co., Chattanooga, Tenn., at $1.34 per sq. yd.

★Ft. Myers, Fla.—Contract for clearing, grubbing and grading about 28 miles of Fort Myers-Marco Rd. awarded by County Comrs. to C. W. Carlton, M. B. Davis and W. C. Hill.

★Elizabethton, Tenn.—Contract awarded Oliver Hill Construction Company, Knoxville, for grading about 70 miles of road at $180,000, and Luten Bridge Company, Knoxville, contract for fifteen bridges at $47,000. L. D. Gasteiger, Secy. Bd. County Road Commissioners.

★Greencastle, Ind.—Contract for constructing 1 mile water-bound macadam road through this city awarded Earl Hurst by the County Commissioners at $13,000. Other bidders: James Mahoney, $13,040; John Curran, $13,010.

★Indiana.—Contracts for constructing roads awarded by County Comrs. as follows:
Greencastle—10,166 ft. macadam road in Greencastle Township to Earl Hurst, Cloverdale, at $13,000.
Williamsport—Two gravel roads in Jordan and Pike Townships, 5227 and 10,200 ft. long, to Charles L. Irvin, Attica, at total of $11,960.

★Detroit, Mich.—Contracts for paving Drexel and Wabash Avenues with asphaltic concrete awarded by Common Council to Detroit Asphalt Paving Co. at $9,374 and $13,068 respectively.

★Illinois.—Contract awarded by State Highway Commission, Springfield, to Cameron Joyce of Keokuk, Iowa, for extension of Peoria hard road from Springfield, at $13,673. Concrete is to be used.

★Wayzata, Minn.—Contract for grading 1 1/10 miles of roadway between Wayzata and Orno awarded Nov. 3 to McCullough & Cheney at $10,758.

★Columbus, Kan.—Contract for surfacing with gravel seven miles of county road between Columbus and Crestline (bids opened Nov. 4) awarded William Huntsinger, Columbus. Emerson Hull, County Clerk.

★Kansas City, Mo.—Contract for grading on the Paseo from Forty-seventh to Seventy-ninth Street and constructing bridge at Seventy-seventh Avenue, awarded by Park Bd. to H. H. Hanenkratt, Kansas City at about $278,882.
★Contract for grading Meyer Boule. from Swope Park to the Paseo awarded by Park Bd. to McMillan Constr. Co., Kansas Avenue and Railroad Street, at $86,000.

★Beaumont, Tex.—Contract for paving about 5 miles of streets awarded by city to Uvalde Rock Asphalt Co., Beaumont, at about $275,000.

★Magnolia Park (P. O. Houston), Tex.—Contract awarded by city for 15,000 cu. yd. of shell paving as follows: W. D. Haden, shell, at 87.8 cts. per cu. yd.; A. C. Henderson, grading, roadway, 16 cts. per cu. yd., and placing shell, 40 cts. per cu. yd. H. Culpepper, City Engineer.

★Colville, Wash.—Following are four lowest bids opened Nov. 1 by County Commissioners for grading and bridging about three miles of Springdale-Hunters Permanent Highway: Spokane Asphalt Macadam Paving Co., Spokane, $10,000 (awarded contract); Mitchell & Martin, Spokane, $10,100; H. C. Root, Spokane, $10,400, and General Construction Co., Spokane, $10,475. A. B. Sandsburn, Co. Aud.

★Dayton, Wash.—Contract for constructing highway between Dayton and Waitsburg awarded by State Highways Comrs., Olympia, to General Constr. Co., Spokane, at $13,243.

★Pomeroy, Wash.—Contract for constructing Permanent Highway No. 1 awarded by County Comrs. to Tribou & Blackman, Walla Walla, at $9,249. Bids opened Nov. 1.

★Newton, N. J. Following are unit figures of four lowest bids opened Nov. 8 by Board Chosen Freeholders at Newton for improving the macadam surface and stone foundation of Newton-Sparta Road (surface pavement and foundation each about 47,080 sq. yd.): (a) Richard & Gaston, Inc., 143 Liberty Street, New York, $57,163 (awarded contract); (b) Burke & Bonham, Plainfield, $58,872; (c) Sands Kline Co., Morristown, $59,829; (d) Weldon Contracting Co., Rahway, $60,419. Harvey Snook, County Engineer.

	*(a)	(b)	(c)	(d)
47,595 cu. yd. excav. in road	$0.35	$0.37	$0.33	$0.42
100 cu. yd. excav. outside road	0.35	0.75	0.50	0.45
9,147 cu. yd. rock	1.20	1.08	1.14	1.00
47,080 sq. yd. macadam foundation	0.30	0.28	0.32	0.30
47,080 sq. yd. surface waterbound macadam	0.26	0.30	0.33	0.30
5,500 lin. ft. stone underdrain	0.20	0.30	0.20	0.20
Reinforced Concrete Culverts:				
675 cu. yd. 12 in.	0.75	0.75	0.75	1.00
376 cu. yd. 18 in.	1.25	1.50	1.20	1.20
122 cu. yd. 24 in.	1.75	2.30	1.68	1.20
44 cu. yd. 30 in.	2.75	3.25	2.65	2.00
116 cu. yd. 36 in.	3.50	4.25	3.10	2.25
46 cu. yd. 42 in.	4.00	5.00	4.00	2.50

Portland, Ore.—Following bids opened by city for resurfacing pavement on E. Thirty-ninth Street: Oskar Huber, Electric Building, $1.50 per yd. on 2-in. surface, and $1.35 per yd. on 1½-in. surface; Warren Constr. Co., Journal Building, $1.65 per yd. on 2-in. surface, and $1.50 per yd. on 1½-in. surface.

California.—Following are totals of four lowest bids opened Oct. 1 by California Highway Commission, Forum Building, Sacramento, for constructing a state highway in Imperial County, Division VII, Route 12 Section A: Holland Construction Co., San Diego, $15,600; Forest City Paving & Construction Co., Live Oak, $17,885; Robert Sherer & Co., Los Angeles, $28,748; Merceau Bridge & Construction Co., Los Angeles, $31,513.

★Riverside, Cal.—Contract for constructing 10 mile road from Moreno to Beaumont awarded by County Bd. Supervisors to Conner Constr. Co., Los Angeles, at $61,825.

★Santa Barbara, Cal.—Contract for paving Booths Point Road (bids opened Nov. 1) awarded by County Commissioners to F. R. Ritchie & Co., San Francisco, at $15,475. Other bidder, Municipal Improvement Co., Richmond, at $16,480. C. A. Hunt, County Clerk.

★Yuma, Ariz.—Contract for paving 16.4 mile roadway between Yuma and Somerton with bitulithic awarded by County Bd. Supervs. to Osborn & Creswell Constr. Co. of Los Angeles, Cal., at about $190,000.

STREET CLEANING AND GARBAGE DISPOSAL

PROPOSED WORK.

Decatur, Ill.—Alfs Garbage Company, it is reported, plans erection of an incinerator to cost about $10,000.

BIDS DESIRED.

Boston, Mass.—Until Nov. 15, by Edw. Murphy, Comr. Pub. Wks., for removing snow and ice in Dists. Nos. 1 to 7, inclusive.

PRICES AND LETTINGS.

★Indicates award of contract.

Philadelphia, Pa.—Following are lowest bidders for street cleaning (bids opened Oct. 25 by Department of Public Works): District 1A—J. A. Mullen, $99,700; District 1B—James Irwin, $121,800; District 2—Edwin H. Vare, $255,000; District 3—Edwin H. Vare, $310,000; District 4A—Howard D. Ruch, $125,000; District 4B—Thomas L. Flannagan, $97,600; District 5—Frank Curran, $156,000; District 6—David McMahon Estate, $157,900; only bid received for removal of garbage was from Penn Reduction Co., at $373,588.

★San Marcos, Tex.—Contract for constructing an incinerator plant awarded Jones Bros. of Macon, Ga.

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS

PROPOSED WORK.

Shore Protection—Winthrop, Mass.—All bids opened Oct. 20 by Harbor & Land Commission, Boston, for protection of Winthrop shore have been rejected.

Drainage—Providence, R. I.—The committee appointed, of which Frederick V. Waterman is a member, to investigate conditions and submit a plan for draining the swamp lands adjacent to Broadway extending from Ten Mile River on the north to Watchemoket Cove on the south, has submitted a report estimating the cost at $110,135, and with an added cost for incidentals bringing the total to $121,148.

State Canal Work—Albany, N. Y.—Re-

Flood Abatement—Clean, N. Y.—

Retaining Wall—Syracuse, N. Y.—In-

Drainage Bonds—Bradentown, Fla.—

Channel Improvement—Miami, Fla.—

Levee—Port Allen, La.—The Corps

Canal Improvement—Lexington, Tenn.

Creek Bonds—Springfield, Ohio.—Bonds

Drainage—St. Paul, Minn.—See "Public

Drainage—Marion, Ark.—Wilbur E.

Causeway — Galveston, Tex. — See

Harbor Improvements — Houston, Tex.

Drainage—Orange, Tex.—Reported con-

Irrigation—North Yakima, Wash.—It is

Channel Improvement—Astoria, Ore.—

Irrigation—Salem, Ore.—Luther J. Cha-

Irrigation, Stockton, Cal.—Improve-

Irrigation—Boise, Idaho.—The Land

BIDS DESIRED

Dredging—Boston, Mass.—Until Nov.

Bulkhead, Boston, Mass.—Until Nov. 24

Dredging—Brooklyn, N. Y.—Until Nov.

Dredging—New York, N. Y.—Until Dec. 15 by U. S. Engineers Office, Army Building, New York, for dredging in New-town Creek and Harlem River, N. Y., advertised in Engineering Record.

Pier—Philadelphia, Pa.—Until Dec. 6, by James Meyer, Director Department Wharves, Docks and Ferries, 400 Bourse building, for constructing superstructure of Market Street Pier, Nos. 78-80 South, and approach piers and shed in Delaware River, between Market Street and Snyder Avenue, advertised in Engineering Record. Approximate cost $500,000.

Dredging—Jacksonville, Fla.—Until Nov. 16 by Board County Commissioners (L. L. Mayes, clerk), for dredging and loading sand on lighters with floating dipper dredge at the County's Island in Sister Creek.

Wharf, Etc.—New Orleans, La.—Until Nov. 17 by Board Commissioners, Port of New Orleans, Court Building, for constructing a pile and timber wharf 1350 ft. long, 12 ft. wide; bulkhead extend 500 ft. along front; also foundations for conveyors, galleries for grain elevator, on east bank of Mississippi River, between Valence and Leontine Streets.

Grenada, Miss.—See "Bridges."

Flood Protection Wall — Portsmouth, Ohio.—Until Nov. 17 by William Gergens, Director Public Service, for constructing second section of flood protection wall, to cost $150,000, not $7,000, as stated in our advertisement. George S. Wilhelm, City Engineer.

Ditch—Winamac, Ind.—Until Nov. 20 by Construction Commissioner for constructing Luther Thompson Ditch, about 3500 ft. 8 to 15-in. tile, and Marion Land Co. Ditch No. 2, 2677 ft. 8 to 14-in. tile, and Marion Land Ditch No. 4, 2578 ft. 10 and 12-in. tile. C. E. Paul, County Surveyor, Winamac.

Ditch — Spencer, Iowa.—Reported desired until Nov. 23 by A. W. Chamberlain, Co. Aud., for County Ditch 28, to consist of approximately 70,000 ft. 6 to 40 in. tile, 3600 ft. open ditch.

Ditch—Windom, Minn.—Reported desired until Nov. 19 by S. A. Brown, Co. Aud., for constructing judicial ditches 20, 21 and 22. Estimated total cost $45,369.

Ditches and Levee—Osceola, Ark.—Until Nov. 15 to Bd. Improvement Comrs., Drainage Dist. 16 for constructing ditches, levee and steel bridges, to consist of Ditches Nos. 1 to 20 inclusive, total cu. yd., 2,749,925; levee, Sects. 1 and 2, total cu. yd., 2,000,000; steel bridges—twenty-one, 12 ft. roads, 16 ft. and two 30 ft. long. Pride & Fairley, Engrs., Osceola.

Dredging—Orange, Tex.—Until Nov. 30 at office of E. F. Hoopes, City Engr., for dredging about 3500 ft. long, 200 ft. wide and 25 ft. deep, approximately 750,000 cu. yd. material.

Canal—Westminster, Cal.—Reported desired until Dec. 1, by Westminster Drainage District, for main canal and laterals. Probable cost $25,000.

Dam—Salt Lake City, Utah.—Until Nov. 24 by Karl A. Schaad, City Recorder, for constructing the reservoir in Mountain Dell, Parley's Canyon. Cost, $110,000. Solid dam to be 255 ft. long, 105 ft. high, 16,800 cu. yd. of concrete; capacity of reservoir, 200,000,000 gal. Alternatives: Ambursen reinforced concrete and multiple arch, reinforced concrete. Sylvester Q. Cannon, City Engineer.

PRICES AND LETTINGS.

★Indicates award of contract.

★Wharf at Immigration Station—Baltimore, Md.—Contract for constructing wharf, including supports, buffer, etc., at U. S. Immigration Station, awarded Norcross Brothers Co., Worcester, Mass., at $6,000.

Drainage—Bristol, Va.—Following are totals of four lowest bids opened Oct. 23, by Town Supervisors, for drainage system for Bristol Drainage Dist., about 150,000 cu. yd. excavation: Theodore C. Proemming, 1288 Humboldt Avenue, Milwaukee, Wis., $[illegible]; Lewis & Means, Atwood, Ill., $[illegible]; S. A. Sohlberg, Niles, Mich., $[illegible], and Inter-State Drainage Co., Britt, Ia., $[illegible]. William E. O'Brien, Bluff, Kansas.

★Drainage — Silver City, Miss.—Contract for constructing 90,000 cu. yd. of levee on Yazoo River awarded by Board Commissioners of Atchafalaya Drainage and Levee District to C. B. Box, Midnight, Miss., at 20 cts. per cu. yd., and W. F. Hullock Co., Kansas City, Mo., contract for 15 miles of canal, or 495,000 cu. yd., at 7.77 cts. per cu. yd.

★Drainage — Selmer, Tenn.—Contract for constructing the Hurricane Creek Drainage Canal, near McNairy-Hardin County line, awarded P. H. Thrasher of Selmer, about 143,000 cu. yd., to be removed at a cost of 2.275 cts. per cu. yd.

State Canal Work, Contract 2P—Albany, N. Y.—Following are unit figures of four lowest bids opened [illegible] by W. W. Wotherspoon, State Engr. Public Works, for Contract 2P, (1) Engineers estimate, $[illegible]; (2) Patrick Mulcahy, Albany, $[illegible]; (3) M. F. Quillard, Albany, $[illegible]; (4) Joseph Walker Construction Co., Albany, $[illegible]; (5) Commercial Construction Corporation, Albany, $[illegible].

	(1)	(2)	(3)	(4)	(5)
[illegible]	$[illegible]	$[illegible]	$ 3 50	$3 66	$4 75
[illegible]	[illegible]	[illegible]	3 30	3 48	2 47
[illegible]	[illegible]	[illegible]	0 50	0 45	0 20
[illegible]	[illegible]	[illegible]	0 25	0 23	0 20

★Ditch—Bedford, Ia.—Contract awarded O. P. Herrick, Des Moines, for digging ditch in Nodaway Drainage District in Taylor County, at 6.94 cts. per cu. yd., about 365,000 cu. yd.; total cost $36,500.

★Drainage Work—Jefferson, Iowa.—Contract for tile in drainage District No. 108 awarded Jefferson Cement Products Company, Jefferson, at $11,017.

★Drainage — Jefferson, Iowa.—Contract awarded by Board Supervisors as follows: Furnishing tile for No. 102, Mathews-Lyons Ditch, Bristol, awarded Sac City Cement Products Co., Sac City, at $26,336 (later bids rejected), and No. 107, Gotter Project, Scranton Township, to Arthur McHose, Boone, tile at $28,870, and labor, Bert Jones and C. A. Moore, at $20,974.

★Ditches — Blue Earth, Minn. — Contracts awarded as follows for constructing county ditches (bids opened Nov. 5 by County Commissioners): Ditch No. 35 to Nels Stougaard & Edward Nelson, Wells, at $8,470; No. 36, Elmore Cement & Tile Company, Elmore, Minn., at $18,370; No. 38, Absolm Gudah of Bricelyn, at $9,700. Jesse L. Herring, County Auditor.

★Dock — Duluth, Minn. — Contract awarded Barnett & Record Co., Duluth, for constructing dock for M. A. Hanna Coal Co. Cost $90,000.

★Ditch—Roseau, Minn.—Contract for constructing Judicial Ditch No. 62 awarded as follows: Constructing ditch to E. G. Bradenburg Constr. Co., Minneapolis, at 10.48 cts. per cu. yd.; culverts, Berger Mfg. Co., Minneapolis; bridges and leveling, T. L. Jones, Warroad, Minn., and clearing, J. E. Risborg, Salol. S. G. Bertilrud, County Auditor.

★Irrigation — Eureka, Mont. — Contract awarded Nelson Rich, Prosser, Wash., for constructing a $130,000 irrigation project on Tobacco Plains near Eureka. Considerable excavation and concrete work to be done, pipe laid and dam built.

★Drainage—Corning, Ark.—Contract for constructing 52 miles of ditches and 4 miles of levee in Clay and Green Counties awarded Northern Constr. Co. of Cairo, Ill., at $316,300.

★Drainage—Marion, Ark.—Contract for digging Drainage Dist. No. 6 awarded Canal Construction Co. of Memphis, Tenn., at $130,000. Willis B. Ayres, Engr., Memphis, Tenn.

★Drainage Work—Pocahontas, Ark.—Contract for constructing ditches in Tupelo Drainage District and in Big Running Water Drainage District awarded Schweingruler & Powers, of Datto.

★Drainage—Victoria, Tex.—Contract for ditching in Drainage District No. 3 awarded U. D. McCurdy. Citizens voted recently about $190,500 bonds for drainage work in this district.

★Filling In—Oakland, Cal.—Contract awarded by City Council to Charles E. Cotton, Oakland, for filling in the land east of Southern Pacific tracks in West Oakland; about 50,000 cu. yd. of earth required; cost $14,000.

★Canal — Panama. — Contract reported awarded by General Goethals, Governor Panama Canal Zone, to J. A. Walker and W. A. Tolbert for clearing land, aggregating 3414 acres and 68 miles of 20 ft. trail connecting the land defenses of the canal and railroad at $24,157.

ELECTRIC RAILWAYS

PROPOSED WORK.

Mattawamkeag, Me. — Surveys have been prepared for Mattawamkeag & Northern Ry. to be constructed from Mattawamkeag to Millinocket and East Millinocket, 23 miles. Charles W. Mullen of Bangor, I. B. Wood, Bangor, said to be interested.

Albany, N. Y.—State Public Service Commission for Second District, Albany, has appointed an executive committee of which Peter G. Ten Eyck of Albany is a member, to consider means for greater safety at grade crossings of electric railways in this State.

Brooklyn, N. Y.—Public Service Commission for First District adopted recommendation of Counsel and Chief Engineer and denied request of New York Municipal Railway Corporation for permission to let contract for constructing Coney Island Terminal to Geo. W. McNulty Co., without competitive bidding.

Niagara Falls, N. Y.—Public Service Commission for Second Dist. New York received final briefs in petition of Niagara River & Eastern Ry. Co. for permission to build and operate a double track line for passenger and freight service between Lockport and Niagara Falls. This company proposed to connect with trunk lines of steam railroads in Canada by means of a new bridge over river at Lewiston. Charles Hickey, Lockport, Pres.

McComb, Miss.—McComb & Magnolia Ry. & Light Co. incorporated to construct a railway in McComb and an interurban line between McComb and Summit, Fernwood and Magnolia. Capital $500,000. Guy M. Walker, 60 Broadway, New York City, N. Y., Pres., and A. H. Jones, McComb, Gen. Mgr.

Millersburg, Ohio.—Dover, Millersburg & Western Ry. Co. received franchise from City Council to construct electric railway in Millersburg. The company also received franchise from Holmes County Comrs. to construct line from Millersburg to Sugar Creek and Canal Dover.

Chicago, Ill.—Construction of about 8½ miles electric railway to connect various suburban towns in southern part of Chicago and adjacent cities in southern city limits is contemplated. Hammond Chamber Commerce, Blue Island Commercial Club is said to be interested.

Waukegan, Ill.—Waukegan & Woodstock Traction Co. incorporated to construct an interurban railway from Waukegan to Woodstock. Capital $50,000. Among incorporators: L. C. Roberts, C. A. Spenny of Chicago.

Madison, Wis.—Stockholders of Chicago & Wisconsin Valley R.R. Co. voted to change name of company to Wisconsin Interurban system and to begin work next spring on constructing line from Sauk City and Prairie du Sac to Viroqua and northeast from Madison to Fond du Lac.

Mitchell, S. D.—South Dakota Short Line Ry. incorporated to construct an electric railway from Mitchell to Pierre. Capital $2,000,000. G. W. Adams, Council Bluffs, Iowa, is interested.

Kansas City, Mo.—Kansas City and Tiffany Springs Ry. Co. chartered to construct a railway from Kansas City to Tiffany Springs, 15 miles. Capital $500,000. Among incorporators are C. W. Chandler, Kansas City, Mo.; Henry G. Post, Kansas City, Kan., and Robert Engleman, Parkville, Mo.

BIDS DESIRED.

New York, N. Y.—Until Nov. 23 by Public Service Commission, First Dist., 154 Nassau Street (Travis H. Whitney, Secy.), for installation of tracks for White Plains Road Rapid Transit Railroad, Borough of Bronx.

Until Nov. 30 by Public Service Commission for First District, 154 Nassau Street, New York, for constructing Section 2, Routes 19 and 22.

Until Dec. 7, constructing part of Eastern District subway, No. 3, Route No. 8, tunnel, under East River, from Manhattan, at Fourteenth Street, to North Seventh Street, Brooklyn.

PRICES AND LETTINGS.

★Indicates award of contract.

★Brooklyn, N. Y.—Alfred Craven, Ch. Engr. Public Service Commission, for First Dist., approved award of contract by New York Municipal Railway Corporation to Chas. A. Myers Contracting Co., Inc., foot Stagg Street, Brooklyn, for grading, removing existing tracks, laying new tracks and special work, installing contact rail and other electrical works, etc., in improvements now being made by company in its Fresh Pond Road yard in Queens Borough, at $17,123.

★Public Service Commission for First District has approved award by New York Municipal Railway Corporation of a contract to Conners Bros. Co., Inc., Kingsbridge Road, New York, for construction of second section of elevated railroad in Jamaica Ave. for $726,168. The work includes erection of steel work between Walnut Street and Cliffside Avenue.

Brooklyn, N. Y.—Lowest bid opened Nov. 5 by Public Service Commission for First District, New York, for station finish for 11 stations on the Broadway-Fourth Avenue subway submitted by A. L. Guidone & Son, 131 East Twenty-third Street, New York, at $513,654.

★New York, N. Y.—Contract awarded American Bridge Co., 30 Church Street, by New York Municipal Railway Corporation, which has been approved by the Public Service Commission, for furnishing steel to be used in third tracking and reconstructing the elevated railroad, as follows: $43 per ton for Fulton Street line, total $623,509; $45 per ton for Coney Island terminal, total $888,000; $48 per ton for East New York third tracking, and $42 per ton for Brighton Beach reconstruction, total $88,200.

★Lebanon, Tenn.—Contract for constructing Nashville & Eastern Ry. from Lebanon & Smithville, 35 miles, awarded to Myers Constr. Co., Chicago, Ill. C. T. Edwards, Nashville, said to be interested.

RAILROADS

PROPOSED WORK.

Cleveland, Ohio. — At recent election citizens voted $1,600,000 bonds as city's share of cost of eliminating grade crossings. City Engineer has been instructed to prepare plans for eliminating East Side, Pennsylvania and Nickel Plate Railroad grade crossings. Project may not be taken up for several months.

Mount Vernon, Wash.—Reported Puget Sound & Cascade Railway Company will extend line west from Clear Lake to Mount Vernon, a distance of seven miles, and three miles east of present terminus.

North Yakima, Wash.—Cascade Lumber Co., North Yakima, is reported taking steps to construct a logging railroad standard gage, 12 miles long, with 8 miles of branches and spur tracks, to timber holdings in Teanaway Basin.

BIDS DESIRED.

San Francisco, Cal.—Reported desired until Nov. 24 by Board Public Works for constructing a railroad from Rosasco to the Hetch Hetchy dam site; estimated cost $1,700,000. Address City Engineer.

PUBLIC BUILDINGS AND SCHOOLS

PROPOSED WORK.

Boston, Mass.—City Council has appropriated $300,000 for erecting a two-story annex to public library on Bladgen Street.

Marlboro, Mass.—Berry & Davidson, Boston, are architects for 2-story brick high school to cost, with equipment, $38,000. E. D. Howe, Chmn. Construction Committee.

Taunton, Mass.—Governor and Council approved plans for $65,000 armory to be erected here.

East Providence, R. I.—Issue of $75,000 school bonds contemplated.

Providence, R. I.—Erection of $300,000 high school at Pond and Winter Streets contemplated. It may be some time before matter is taken up. City to prepare plans.

Bath, N. Y.—Steuben County voted $30,000 bonds for County Tuberculosis Hospital.

East Aurora, N. Y.—Election to be held Dec. 3 to vote $125,000 bonds to erect high school according to plans by Harris & Merritt, Buffalo. Harry G. Henshaw, City Clk.

Hackensack, N. J.—Citizens of Teaneck voted $40,000 bonds for new school.

Jersey City, N. J.—Bonds amounting to $30,000 for erecting addition to Hudson County Insane Hospital at Snake Hill reported sold.

Newark, N. J.—Citizens voted $1,500,000 bonds to erect city memorial building. Address Memorial Building Committee, City Hall.

Summit, N. J.—Mayor Francis H. Bergen signed ordinance providing $20,000 bond issue for purchasing site for new high school.

Claysville, Pa.—Bonds voted for erecting new school.

Lewistown, Pa.—Citizens voted $100,000 bonds to erect high school. J. Harry Stanton, Secy. Council.

Marcus Hook, Pa.—Erection of school costing $80,000 contemplated.

Philadelphia, Pa.—Contracts about to be let by Bd. Education for erecting Kensington High School and school at Westmoreland and B Streets. J. Horace Cook, Archt., City Hall.

Baltimore, Md.—Board of Estimates considering $1,500,000 bond issue for erecting additional schools.
School Board selected site on Linwood Avenue, Patterson Park, for proposed school; cost about $100,000.

Suffolk, Va.—See "Sewerage and Sewage Disposal."

Jacksonville, Fla.—School bonds amounting to $500,000 sold.

Marion, Miss.—County Board of Supervisors at Meridian will issue $100,000 agricultural high school bonds to erect a school in Marion.

Pontotoc, Miss.—Court House bonds amounting to $75,000 have been sold by Board of Supervisors.

Hopkinsville, Ky.—Citizens voted $100,000 bonds for erecting schools.

Lexington, Ky.—Citizens voted to issue $100,000 bonds for erecting three schools.

Alliance, Ohio.—Citizens voted 100,000 bonds for erecting additions to schools.

Ashtabula, Ohio.—Citizens voted $40,000 bonds for schools.

Bellbrook, Ohio.—Citizens voted $30,000 bonds to erect town hall.

Cleveland, Ohio.—Citizens voted $1,000,000 for new schools and $100,000 for comfort stations.

Columbus, Ohio.—Contracts about to be let by Rusk & Sheets, Archts., of Columbus, for erecting following buildings: Centralized school in Preble County, cost $30,000; town hall at Pataskala, cost $20,000, and school in Urbana Township, Champaign County.

Dayton, Ohio.—See "Sewerage and Sewage Disposal."

Eaton, Ohio.—Citizens voted $250,000 bonds for court house. A three-story and basement, limestone, steel, marble and bronze building is contemplated, but nothing definite has been done about the matter.

Massillon, Ohio.—Plans being prepared by Richard McCarty & Bulford, Hartman Building, Columbus, for cottage to be erected at Massillon State Hospital by Ohio Board Administration, Columbus. Cost $70,000.

Oakwood, Ohio.—Citizens voted $50,000 bonds for school improvements.

Sugarcreek, Ohio.—Citizens voted $20,000 bonds for erecting township hall.

Toledo, Ohio.—Citizens voted $1,000,000 school bonds.

Warwood, Ohio.—Bd. of Educ. of Richland Dist. has voted to annul $50,000 bond election carried last January and to call new election to vote on $85,000 bond issue.

West Richfield, Ohio.—Citizens of Richfield Township voted $40,000 bonds to erect central school on present school site between East and West Richfield.

Xenia, Ohio.—Issue of $135,000 bonds for erecting new high school contemplated.

Joliet, Ill.—Plans prepared by H. E. Hewitt, of Peoria, for proposed Eastern Avenue school; cost about $40,000.

Mendota, Ill.—Citizens voted $75,000 bonds for erecting high school.

Kenosha, Wis.—Kenosha County contemplates erecting insane asylum. Address County Clerk.

Harlan, Iowa.—The high school is to be three stories and basement, brick, with concrete foundation; cost $90,000.

Mason City, Iowa.—Erection of $250,000 high school under consideration. Address Board of Education.

Duluth, Minn.—Plans being prepared by Kelly & Williams, First National Bank Building, for proposed Morgan Park School. Probable cost $100,000.

Minneapolis, Minn.—Dunwoody Inst. considering erecting industrial and mechanical school building between Aldrich Avenue and the railroad. C. A. Prosser Director.
Bd. Trustees St. Barnabas Hospital considering erecting an administration building, pavilion, dispensary and clinical building, at cost of about $350,000.

Northfield, Minn.—Trustees of Carlton College planning to erect men's dormitory; cost approximately $110,000.

St. Paul, Minn.—State Board of Investment approved Nov. 1 loans from the state school fund, aggregating $200,000, the largest are school buildings at Sauk Center, $50,000; four drainage ditches Faribault County, $71,000. Town of Carpenter, $14,000, and Town of Cross River, $9,000, for roads and bridges.

Clark, S. D.—Citizens voted $30,000 bonds for erecting new high school.

Kansas City, Mo. — Mayor has signed ordinances authorizing $125,000 for police, $125,000 for hospitals and $100,000 for improving station park.

Osceola, Ark.—Osceola and Little River Roads Districts have sold $220,000 bonds. It is reported 50 miles of hard surfaced road, 25 miles of which are concrete, are to be built.

Houston, Tex.—See "Sewerage and Sewage Disposal."

Loveland, Col.—Citizens voted Nov. 1, $90,000 bonds for erecting high school. Bids for bonds will be received Nov. 18. Dr. Mary N. Keeler, Secy. Board Education.

Pueblo, Col.—Election soon to be held to vote on question of erecting city hall and auditorium.

Seattle, Wash.—See "Miscellaneous."

Seattle, Wash.—Port Commission (C. E. Remsberg, Secy.), is taking steps to erect four-story reinforced-concrete storage building adjoining grain elevator at foot of Hanford Street; cost $150,000. A. J. West, Chief Engineer.
Plans approved by Port Commission for proposed fish cold storage warehouse to be erected on East Waterway; cost approximately $30,000.

Berkeley, Cal.—Bonds amounting to $1,800,000 for erecting University of California building sold.

Redding, Cal.—Reported plans prepared for school to be erected at Pine and Larkin Streets; estimated cost $82,000.

Richmond, Cal.—J. T. Narbett and J. G. Ogborn, Richmond, engaged to prepare plans for city hall to be erected on Macdonald Avenue and Twenty-third Street.

San Francisco, Cal.—Supervisors Building Committee recommends sale of $250,000 hospital bonds for erecting office building at Grove and Polk Streets for Health Dept. in the Civic Center.

Salt Lake City, Utah.—Reported erection of public bath costing probably $250,000 being considered. Address City Clerk.

Orofino, Idaho.—City engaged Robert B. Swadener, Box 121, Orofino, to prepare plans and estimates for two improvement districts, about 7 or 8 blocks, to be paved with concrete, and sidewalks and curbing included. Contract to be let in the spring.

Rexburg, Idaho.—A stone court house costing $30,000 is to be erected. Contract will probably be let in the spring. John Hegsted, County Clerk.

Long Branch, Ont.—School Trustees having plans prepared for $26,000 school to be erected on Lakeshore Road.

BIDS DESIRED.

Providence, R. I.—Until Nov. 22, according to reports Bd. Contract & Supply, for erecting grammar school on Cole and Luzon Avenues, Second Ward; cost $150,000. Stone, Carpenter & Sheldon, Archts., 49 Westminster Street.

New York, N. Y.—Until Dec. 1, by Marcus M. Marks, Pres. Borough Manhattan, for furnishing material and erecting a building on W. Thirtieth Street to be used as a court, jail and place of detention for women; also plumbing, gasfitting, vacuum cleaning, refrigerating system, etc.; heating and ventilating; electrical work; elevator, dumbwaiter, etc. Griffin & Wynkoop, 30 Church Street, architects. Total security $82,000.

New Providence, N. J.—Until Nov. 15, by Board Education, for furnishing material and erecting addition to grade school; also heating and ventilating and electrical work. John Noble Pierson & Son, Archts., 130 Smith Street, Perth Amboy.

Canton, Ohio.—Reported desired until Nov. 22, by W. C. Lane, Clk. Bd. Educ., for erecting Daniel Worley school, 3-story and basement 55 x 102 ft. Probable cost $80,000. Edmund Herman, Archt., Central Savings Bank Building.

Middletown, Ohio.—Until Dec. 18 by James A. Wetmore, Acting Supervising Archt., Washington, D. C., for construction, complete (including plumbing, gas piping, heating apparatus, electric conduits and wiring, lift and approaches), of U. S. Post Office, Middletown. Advertised in Engineering Record.

Humboldt, Tenn.—Until Dec. 20 by James A. Wetmore, Acting Supervising Archt., Washington, D. C., for construction, complete (including mechanical equipment and approaches), at U. S. Post Office, Humboldt.

Brighton, Iowa.—Reported desired until Nov. 15, by Secy. Board Education, for erecting brick high school. Probable cost $25,000. Proudfoot, Bird & Rawson, Archts., Des Moines.

Rowley, Iowa.—Reported desired until Nov. 29, by Board Education, for erecting school. Probable cost $25,000. Chas. A. Dieman, Co. Archt., 405 Granby Building, Cedar Rapids.

Ortonville, Minn.—Until Dec. 4 by Bd. Educ. (R. B. Hudson, Secy.), for furnishing material and erecting a high school; also plumbing, ventilating and heating and electrical work. E. F. Bromhall, Archt., Alworth Bldg.

Emporia, Kan.—Reported desired until Nov. 30, by E. T. Hackney, Pres. Bd. Administration, Topeka, for erecting 4-story and basement 68 x 268 ft. administration building. Probable cost $175,000. C. H. Chandler, State Archt., Capitol Building, Topeka.

Carlsbad, Tex.—Reported desired until Nov. 20 by Commissioners Texas Tubercular Sanitarium at Carlsbad, for erecting buildings; cost about $100,000.

Cold Spring, Tex.—Until Nov. 20 by William McMurry, County Judge, for erecting three-story and basement fireproof court house. Lane & Dowdy, Archts., Houston.

Fort Mason, Cal.—Until Nov. 24 by Constructing Quartermaster, Fort Mason, for constructing (including plumbing, heating and lighting) addition to Nurses' Dormitory, Letterman General Hospital.

Cavite, P. I.—Until Jan. 4, by Bureau Yards & Docks, Navy Dept., Washington, D. C. (H. R. Stanford, Ch.), for power house and operating building of reinforced-concrete and steel construction and three-quarter wood construction for commanding officers at naval station, Cavite.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Fall River, Mass.—Following are four lowest bids opened Oct. 26 by Mayor for remodeling old county jail into city almshouse: Darling-Slade Constr. Co., Newport, $93,000; John Crowe Co., $98,681; McNally Constr. Co., $102,200; Puleston & McDougall, $103,000 (bidders of Fall River unless otherwise stated).

Holyoke, Mass.—Following are four lowest bids received by Board of Public Works for erecting proposed Isolation Hospital: J. H. Fowles & Son, Holyoke, $36,418; Joseph Lalibertie, $37,989; Louis Carreau & Son, $38,491; A. D. McCormick, $38,500.

★**Providence, R. I.**—Contracts for erecting dormitory at State Home and School (bids opened Oct. 28) awarded as follows: General contract, to Cruise & Smiley, Pawtucket, at $18,500; plumbing, D. F. Holmes, Providence, $3,167; heating, J. J. Hurley & Co., Boston, Mass., $2,875. Clark & Howe, Archts., Turk Head Building.

East Rutherford, N. J.—Lowest bid opened Oct. 28 for erecting school on Vreeland Avenue submitted by Magee Constr. Co., Newark, at $31,581, and for plumbing, William Fleming, East Rutherford, at $2,388. John T. Simpson, Archt., Newark.

★**Newark, N. J.**—Contracts awarded by Public Buildings Committee of Common Council for erecting laboratory at City Hospital as follows: General construction, E. M. Waldron Co., Inc., 207 Market Street, $29,484; plumbing, James F. Kelly, 126 S. Fourteenth Street, $4,990; heating, Jaehnig & Peoples, Inc., 221 Thirteenth Avenue, $1,998; electrical work, Beaver Engineering Co., 59 Mechanic Street, $944.

★**Wildwood, N. J.**—Contract awarded by Board of Education to Richman Constr. Co., Moorestown, for erecting two-story high school. Clyde S. Adams, Archt., 1233 Arch Street, Philadelphia, Pa.

Lebanon, Pa.—Following are four lowest bids opened Nov. 3 by Board of City School Controllers for erecting new high school:
General construction: T. W. Finn, Altoona, $194,300; Titzel & Kuhn, Lancaster, $207,169; Melton Constr. Co., Washington, D. C., $209,995; Dawson Constr. Co., Pittsburgh, $212,000.
Heating and ventilating: Everette & Overdeer, Lancaster, $29,400; Wyoming Engineering Constr. Co., Wilkes-Barre, $29,983; George W. Schreiber, Lebanon, $29,990; National Heating & Ventilating Co., Philadelphia, $31,400.
Plumbing: Everette & Overdeer, Lancaster, $15,650; E. R. Schollenberger, Hamburg, $16,140; John Lowry, Jr., New York, N. Y., $20,080; John G. Schaum, $20,165.
Lowest bid for electrical work by United Electric Constr. Co., Philadelphia, at $12,965.

★**Philadelphia, Pa.**—Melody & Keating, 1218 Chestnut Street, have contract for erecting two-story concrete and stone school on Bustleton Avenue and Welsh Road for Bd. Educ.; cost $40,440.

★**Baltimore, Md.**—Contract for erecting U. S. immigrant station awarded William Dall Co., Cleveland, Ohio, at $267,688.

Charleston, W. Va.—Lowest bid received for erecting addition to court house submitted by George F. Gates Co., at $49,400. David Dick, Archt., 24 Citizens National Bank Building.

★**Dayton, Ohio.**—Contract for excavating, reinforced and common concrete, masonry and cut stone for addition to Steele High School (bids opened Nov. 1) awarded Structural Concrete Co., Dayton, at $23,900. Edward J. Mountstephen, Archt., 803 U. B. Building.

★**Logan, Ohio.**—Contract for erecting U. S. Post Office awarded A. W. Lane, 19 La Salle Street, Chicago, Ill., at $42,820.

Seymour, Ind.—Following are four lowest bids opened Oct. 30 by Supervising Architect, Washington, D. C., for erecting U. S. Post Office—(a) limestone, (b) sandstone: Callahan-Mandl Co., 814 Reaper Block, Chicago, Ill., (a) $47,700, (b) $50,000; J. Fred Beggs, Scottsburg, (a) $49,500; George W. Stiles Constr. Co., Rookery Building, Chicago, Ill., (a) $49,600; Charles W. Gindele Co., 3333 South La Salle Street, Chicago, Ill., (a) $50,500; Dunlap & Co., Columbus, Ind., (b) $53,697; Christ Kanzler & Son, Evansville, (b) $56,445; Bedford Stone & Constr. Co., Indianapolis, (b) $56,700.

★**Oakwood, Ill.**—Contract awarded William Kuntz of Rantoul, for erecting Oakwood township high school at $30,475.

★**Peoria, Ill.**—General contract for erecting jail awarded by Board of Supervisors to Reinhard Iben of Peoria, at $39,827, and cell house to the Van Dorn Iron Works of Cleveland, Ohio, at $35,672.

Merrill, Wis.—Following are four lowest bids opened by Supervising Architect, Washington, D. C., Nov. 1 for erecting U. S. Post Office—(a) limestone, (b) sandstone: John Lauritzen, Fergus Falls, Minn., (a) $53,900; Charles W. Gindele Co., 3333 La Salle Street, Chicago, Ill., (a) $54,500; George W. Stiles Constr. Co., Rookery Building, Chicago, Ill., (a) $54,624; Balkin Constr. Co., 1541 Monadnock Block, Chicago, Ill., (a) $55,467; Callahan-Mandl Co., 814 Reaper Block, Chicago, Ill., (b) $60,000; Northern Constr. Co., 421 Milwaukee Street, Milwaukee, (b) $60,822; James Devault, Canton, Ohio, (b) $60,900; W. H. Fissell & Co., Marbridge Building, New York, N. Y., (b) $61,400.

★**Luthers, Iowa.**—Contract for erecting school (bids opened Oct. 8) awarded W. F. Mitchell & Co., Des Moines. C. H. Patterson, Secy. Bd. Education.

Hiawatha, Kan.—Following are four lowest bids opened Nov. 1 by Board Education for erecting the high school (J. H. Felt & Co., Archts., Kansas City, Mo.): Central Concrete Constr. Co., Kansas City, Mo., $53,650 (awarded contract); E. B. Cosby, Kansas City, $53,790; John E. Anderson & Son, Kansas City, Mo., $57,-

...& Vanderberg & Pauly, Wendell, Kan., $41,247; heating, ventilating and plumbing awarded O'Connor Co., Minneapolis, Minn., W. F. Small Secy. Bd. Educ.

★**St. Cloud, Minn.**—Contract awarded Johnson Construction Co., Minneapolis, on a revised bid of $112,112 for erecting the high school. Heating and plumbing to Henry Company, St. Paul, at $36,596.

...are four low-est bids opened Oct. 29 by Supervising Architect, Washington, D. C., for erect-ing U. S. Post Office: George Wells Sons, Des Moines, Iowa, $75,000; W. S. Kline, Lorraine Arts, Kans., Morrison & Frenchel, Galveston, Tex., $74,000; original Cabinet Co., Evanston, Ill., $68,946.

★**Warrensburg, Mo.**—Contract for erect-ing Missouri State Normal School, bids opened Nov. 2, awarded C. L. Gray Construction Co., Kansas City. G. E. Hover, Registrar.

★**Austin, Tex.**—General contract for erecting auditorium for Deaf and Dumb Institute, bids opened Nov. 21 awarded Trinity Construction Company, Dallas, at $91,000; heating and plumbing to Connolly & Wren, of Austin, at $1,915. C. H. Page & Bro. Archts., Austin.

Norman, Okla.—Following are four low-est bids opened Oct. 27 by State Bd. Pub. Affairs, Oklahoma City, for erecting sci-ence hall for State University: L. W. Lemon Constr. Co., Columbia, Mo., $85,-000; Lane & Dunning, Oklahoma City, $84,000; Rainbow Constr. Co., Oklahoma City, $83,000; W. L. Campbell, Oklahoma City, $82,...

★**Seattle, Wash.**—Following are four lowest bids opened Oct. 25 by Board of Regents for erecting Home Economics building for University of Washington: Price & Lippitt, Northern Bank Building, $...(lowest reported awarded contract); Grant Smith & Co., Henry Building, $101,-...; Sound Constr. & Eng. Co., Lewman Building, $...; W. T. Fuller Constr. Co., Osmic Building, $...; Bebb & Gould, Arcade Building.

J. A. Sharpe submitted lowest bid for heating at $...; and Eastman Plumb-ing & Heating Co., 617 Fourth Avenue, for plumbing, at $6,310.

PRIVATE BUILDINGS

PROPOSED WORK.

Boston, Mass.—Daniel Lennie Mission, 64 Tyler Street, contemplates erecting on Tyler Street a two-story brick building, cost about $40,000.

The Dana Hall Inn, house of Boston, owned by Co. reported destroyed by fire.

Bridgeport, Conn.—N. Meserve, 96 Milk Street, is architect for auditory and basement Episcopal assembling building to be erected at Stratford Avenue and Castle Street, estimated cost about $40,000.

Thomas Fennell Mission, 44 State Street, is interested in a two-story frame office building to be erected on Truman Street on site of old produce court build-ing.

Springfield, Mass.—Reed T. Lay & Co., of Springfield, reported contractors for Christ (Episcopal) Church, to be erected at State and Chestnut Street, cost ap-proximately $...,000.

Hartford, Conn.—Plans prepared for ... parish house to be erected for Christ Episcopal Church as a memorial to ... Goodwin. Rev. Dr. James ... Pastor.

Brooklyn, N. Y.—Plans prepared by ... & Shampan, 162 Broadway, Brooklyn, for two apartment houses to be erected on Pulaski and Bedford Avenues, Bushwick Ave., cost $...,000.

Plans prepared by R. E. McCarthy, 16 Court Street, for two-story brick apart-ment building to be erected on Sterling Place for Sterling Operating Co., cost $...,000.

Plans filed for five 4-story apartment houses to be erected by Williams and Hopkins, Hamilton Ave. Plans filed by Lewis Hopkins, Hamilton Building, total cost $...,000.

Warren Hopkins, 150 Bay Twenty-fifth Street, will erect three four-story brick apartments on 80 Wilbraham Avenue, cost $...,000.

Leechburg, N. Y.—C. E. Vanbury, Sun-shine Block, Pittsburgh, Pa., prepared plans for two-story brick and concrete apartments, 24 x 60 ft., to be erected for Dr. Wm. H. Wilson; estimated cost $50,000.

Long Island City, N. Y.—Plans filed for ... brick and concrete factory, to be erected at Borden and 11th Ave. Plant for American Brewing Association; cost $...,000. Engineer & Builders, Archts., 11 E. Forty-seventh Street, New York City.

New York, N. Y.—Plans filed for ... apartments, 4-story apart-ment house at 11 E. Forty-fourth Street for Akron Building Co., cost $...,000. Plans filed for ... brick and ... apartments, 4-story apartment house at 40 ... Avenue, cost $...,000. Plans filed for Mariano Corp., cost $...,000. Plans filed for ... Ave., cost $...,000. Lyons Inc., 31 Yan-...

...derbilt Avenue, Archt.; 11-story apart-ment house at 139 E. Sixty-ninth Street for Brenton Building Corp., cost $350,000. Emile L. Capell, Archt., 140 W. Seventy-fourth Street. 14-story apartment house at 136 E. Seventy-ninth Street, for Julius Tuchman & Sons, cost $400,000. Schwartz & Gross, Archts., 347 Fifth Avenue. 2-story brick building at Fourth Avenue and Thirteenth Street for Thos. A. Chese-brough estate, cost $50,000, Walter H. Von Kenning, 116 Decatur Street, Brooklyn, and John H. Heller, Jr., 989 Bedford Avenue, Brooklyn, Archts.; 5-story brick tenement at Kelly and 167th Street, for Willamette Constr. Co., cost $50,000, Walter S. Schneider, Archt., 345 Fifth Avenue; 5-story brick tenement at 180th Street and Mapes Avenue for Wm. A. Diamond, cost $60,000, Chas. Schaefer, Jr., Archt., 401 Tremont Avenue; alterations to 5-story brick apartment build-ing at 1676 Broadway for Purchot Estate, cost $15,000, Randolph H. Almiroty, Archt., 220 Fifth Avenue.

Tentative plans reported prepared for addition to store of Bloomingdale Bros., on Lexington Avenue and Sixtieth Street.

Syracuse, N. Y.—Plans being prepared for edifice for All Saints Church, S. Salina Street and McLinan Avenue; cost about $...,000.

Hackensack, N. J.—H. S. Waterbury, 1133 Broadway, New York, engaged to prepare plans for edifice to be erected for Memorial Reformed Church of Bogota; probable cost $35,000.

Spring Lake Beach, N. J.—Watson & Huckle, 1311 Walnut Street, Philadelphia, Pa., are architects for five-story brick ad-dition to be erected to Monmouth Hotel at Spring Lake.

Harrisburg, Pa.—Kesher Israel Congre-gation, Fourth and State Streets, and Chisuk Emuna Congregation, Filbert and North Streets, have united, and it is re-ported, contemplate erecting new syna-gogue in the new year to cost $80,000.

Hershey, Pa.—First United Brethren Church contemplates erecting new edifice and parsonage on Chocolate Avenue; total cost about $60,000.

Philadelphia, Pa.—St. Carthage Roman Catholic Church will erect two-story stone edifice at Sixty-...t and Cedar Avenue. Henon & Boyle, Archts., Fuller Building.

Henry L. Reinhold, 1309 Walnut Street, is architect for ten-story brick and steel apartment house to be erected for Central Estates Corp.

Scottdale, Pa.—Plans being prepared by ... C. Bowler, Arrott Bldg., for one-story brick edifice to be erected for First United Presbyterian Church; cost $...,000.

Baltimore, Md.—Plans completed by Joseph Evans Sperry, Calvert Building, for proposed eleven-story apartment build-ing to be erected on Eutaw Place at Druid Hill for Capt. Emerson; cost about $250,000.

Norfolk, Va.—Plans being prepared for four-story building to be erected for Brambleton Lodge No. 56, Knights of Pythias; cost about $75,000.

Cincinnati, Ohio.—Plans prepared for concrete and reinforced steel Y. M. C. A. building to be erected at Elm and Canal Streets, cost $500,000.

Cleveland, Ohio.—Citizens voted in favor of the union station agreement and the freight terminal for Cleveland & Youngstown R. R.

Evansville, Ind.—Erection of eight or nine story building contemplated by Red Men, cost about $75,000.

Indianapolis, Ind.—Strand Theater Co., ... Michigan Avenue, Chicago, Ill., has leased Lyceum Theater here and intends reconstructing and remodeling at a cost of $...,000.

Detroit, Mich.—Contract will soon be let for erecting theater, store and office building on Gratiot Avenue for Boulevard Theater Co. (J. C. Ritter, 1959 Field Avenue, Secy. and Treas.). C. Howard Crane, Archt., 2323 Dime Bank Building.

Grand Rapids, Mich.—Contract soon to be let for erecting bakery for Grand Rapids Bread Co. Jonas Ahlschlager & Sons, Chicago, Ill., Archts.

Chicago, Ill.—Plans prepared for three-story and basement brick and stone ... to be erected at 6217 Broadway, ... for Joseph Trinz, 4236 Grand ... cost about $140,000.

Plans being prepared by Adolph Wer-ner, 2467 N. Halsted Street, for moving picture theater to be erected at N. Clark Street and North Avenue for Frank ... cost $75,000.

Contract will soon be let by Pennsyl-vania R. R. (Bids to be opened Nov. 8) for erecting a freight station here.

Milwaukee, Wis.—W. F. Neumann, 350 Cedar Street, is architect for three-story and basement apartment building to be erected on Van Buren and Martin Streets for George Adams Building Co., cost $...,000.

Minneapolis, Minn.—Interstate Oil Co., ... Wesley, Mgr., Lee Temple Court, Cleveland, Ohio, or Division Street for erection of oil warehouse and storage tanks.

St. Paul, Minn.—Plans prepared for addition to St. Paul Hotel, Fifth and St. Peter Streets; estimated cost $200,000. Charles G. Roth, Mgr.

Commercial State Bank, 177 W. Seventh Street, will erect two-story brick and stone building at Seven Corners; cost $20,000.

Butte, Mont.—Tripp & Dragstedt, 543 S. Main Street, contemplate erecting apart-ment house at Main and Gold Streets; cost about $75,000.

St. Louis, Mo.—Erection of five addi-tional stories to Shubert Theatre, Twelfth and Locust Streets, contemplated; cost about $250,000. Corner Realty Co. (Festus J. Wade, Pres., 4451 Lindell Avenue), owner.

Galveston, Tex.—Island City Lodge, No. 56, is considering plans for a $30,000 Knight of Pythias Hall on Winnie Street.

Ardmore, Okla.—Reported plans com-pleted by W. H. Keyser and J. R. McAtee of Dallas, Tex., for seven-story brick and stone hotel for Captain Whittington; cost about $150,000.

Muskogee, Okla.—Oklahoma Baptist Hospital intends erecting $40,000 addition to hospital here.

Tulsa, Okla.—Reported Claude Tingley and associates contemplate erecting ten-story reinforced-concrete, steel, brick and terra cotta office building at Third Street and Boulder Avenue; probable cost $150,000.

Bellingham, Wash.—Reported three-story, 55 x 125 ft., concrete building will be erected at 1214 Commercial Street for Trezise Estate; estimated cost $60,000.

Seattle, Wash.—A. Warren Gould, American Bank Building, engaged to pre-pare plans for eight-story, Class A, re-inforced concrete building to be erected at Third Avenue and Cherry Street for James Moses of New York City; cost about $450,000. A. L. Hawley, Central Building, is agent.

J. A. Creutzer, New York Block, en-gaged to prepare plans for three-story, 148 x 111 ft., apartment house to be erected on Ravenna Boulevard and Fif-teenth Avenue for Charles Cowen; cost $110,000.

Portland, Ore.—Central Labor Council contemplates erecting three-story build-ing; approximate cost $175,000.

Menlo Park, Cal.—Plans prepared for new chapel for St. Patrick's Seminary, to be dedicated to memory of Archbishop Patrick W. Riordan; approximate cost $100,000.

Nampa, Idaho.—Oregon Short Line Ry. Company (J. R. Holman, Ch. Engr., Portland, Ore.), intends erecting a round house to cost $25,000.

BIDS DESIRED.

Athens, Ga.—Until Dec. 1 by Building Committee (W. T. Forbes, Secy.) for erecting a Y. M. C. A. building at Athens.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Brooklyn, N. Y.—See "Electric Rail-ways."

★**Troy, N. Y.**—Contract reported award-ed Charles P. Boland Constr. Co., Troy, for erecting freight shed and two-story brick office building, recently destroyed by fire, at Hoosick Street and Seventh Avenue, for Boston & Maine R.R. Co.; cost $30,000.

★**Newark, N. J.**—Contract awarded by Newark Hotel Investment Co. to George A. Fuller Co., 111 Broadway, New York, at $472,000, for completing Park Place Hotel.

★**Germantown (P. O. Philadelphia), Pa.**—Contract for erecting one-story, brick and concrete warehouse for American Ice Co. awarded Turner Concrete Steel Co., 1713 Sansom Street, Philadelphia.

★**Philadelphia, Pa.**—Contract awarded Stacy Reeves & Sons, 1611 Filbert Street, for erecting fifteen-story office building at Sixteenth and Walnut Streets; cost $400,000. Chas. E. Oelschlager, Archt., Harrison Building.

★**Wilkinsburg, Pa.**—Contract awarded Schutz, Schreiner & Clyde, May Bldg., Pittsburgh, for erecting two-story brick office building for Pennsylvania Water Co.; cost $30,000.

★**Gary, Minn.**—Contract awarded Alex Roberts, 1808 Minnesota Avenue, Duluth, for erecting brick hotel here for George A. Fitch, estimated cost $44,000. Vernon J. Peirce & Co., Archts., 608 Palladio Build-ing, Duluth.

★**Houston, Tex.**—Contract for erecting ten-story reinforced concrete office build-ing for Jesse H. Jones awarded American Construction Co., Houston, at Main Street and Rusk Avenue to cost $450,000. A. C. Finn, Archt., Houston.

NEW INDUSTRIAL PLANTS

PROPOSED WORK.

Ware, Mass.—Otis Co., Ware, contem-plates erecting three-story building to replace mill No. 2.

Woonsocket, R. I.—Joseph G. Ray of Franklin, Mass., intends erecting a three-story brick mill on Pond Street, 380 x 80 ft.

Brooklyn, N. Y.—Plans filed for one-story brick shop to be erected at Fifty-third Street and First Avenue for E. W. Bliss; cost $100,000. Walter Pfaelander, Archt., 618 Eleventh Avenue.

Elmira, N. Y.—Plans being prepared for new heating plant for entire group of factories of Morrow Manufacturing Co.; cost approximately $100,000.

Fort Plain, N. Y.—Plans prepared for two-story 50 x 185 ft. factory to be erected for A. A. Warath & Son.

New York, N. Y.—Plans being prepared by J. B. Snook & Sons, 261 Broadway, for ten-story cold storage building to be erected at Sixteenth Street and Eleventh Avenue for Merchants Refrigerating Co.

Gibbstown, N. J.—Reported Du Pont Powder Co., Wilmington, Del., will erect plant No. 2 here.

Irvington, N. J.—Lionel Manufacturing Co., 365 Ogden Street, Newark, contem-plates erecting factory here on South Twenty-first Street, to be two stories, 228 x 235 ft., mill and concrete construc-tion; cost $60,000.

West End, Pa.—A. B. Davidson, West Seventh Avenue, intends erecting two-story grain elevator and warehouse at East Street and West Sixth Avenue.

Durham, N. C.—Durham Steel Products Co. of Durham reported formed for the purpose of erecting a plant for manu-facture of war munitions.

Gastonia, N. C.—Arlington Cotton Mills, Gastonia, contemplates erecting two-story, 205 x 57 ft., addition to plant; cost about $20,000.

Hendersonville, N. C.—J. E. Sirrine of Greenville, S. C., engaged to prepare plans for 80 x 50 ft. mill and 76 x 22 ft. dyehouse to be erected for Hendersonville Hosiery Knitting Mill.

Statesville, N. C.—Statesville Cotton Mill intends installing new machinery and erecting addition to plant; probable cost $70,000.

Columbus, Ga.—Reported Bibb Manu-facturing Co., Thirty-second and River Streets, contemplates erecting addition and installing 18,000 spindles and other machinery, for which plans have been prepared, to cost $200,000.

Sylacauga, Ala.—Avondale Mills, Bir-mingham, it is reported, intends enlarg-ing cotton mill here at a cost of $100,000, and will install 4000 spindles.

East Chicago, Ind.—American Steel Foundries of Hammond contemplates erecting 200 x 330 ft. addition to plant here.

Fenton, Mich.—R. E. Paine, 50 Con-gress Street, Boston, Mass., and others, reported interested in extension and en-largement of plant near Fenton of Aetna Portland Cement Co., 412 Union Trust Building, Detroit.

Flint, Mich.—Chamber of Commerce will erect two-story, 100 x 275 ft., factory for A. L. A. Tire Co.

Contract soon to be let for erecting two-story foundry, 300 x 530 ft., for Buick Motor Co.

Monroe, Mich.—Van Blerck Motor Co. intends enlarging plant.

Muskegon, Mich.—American Enameled Magnet Wire Co. intends erecting a 100 x 380 ft. building, plans for which are being prepared.

Chicago, Ill.—The Illinois Steel Co., 208 S. La Salle Street, is considering propo-sition of making a $2,500,000 extension to South Works plant.

Galesburg, Ill.—The Coulter Disc Co. is to build a plant to replace its $100,000 plant recently destroyed by fire.

Superior, Wis.—The Great Northern Railway (A. H. Hogeland, Ch. Engr., St. Paul, Minn.), also Soo Line (C. N. Kalk, Ch. Engr., Minneapolis), it is reported propose building new elevators here in the spring.

Keokuk, Iowa.—Keokuk Electric Metals Co., it is reported, intends erecting a plant to cost $100,000.

Brainerd, Minn.—Plans prepared by Northwestern Paper Co. (T. T. Whittier, Ch. Engr.) for brick, concrete and steel, 80 x 410 ft. paper and pulp mill to be erected in northeast Brainerd at cost of about $300,000.

St. Paul, Minn.—Citizens Ice & Fuel Co., 8 W. Fourth Street, contemplates erecting new ice storage plant, elevators, office and other buildings at Rice and Sycamore Streets; probable cost $150,000.

Butte, Mont.—Reported Robert Cereal Mill Co. (A. G. Robert, Pres.) contem-plates erecting flour and cereal mill here.

Port Angeles, Wash.—Reported Stand-ard Oil Co. (John McLean, Mgr.), Rail-road Avenue and Whatcom Street, Seat-tle, Wash., will install three steel oil tanks here and erect warehouse and office building; probable cost $75,000.

Seattle, Wash.—U. K. Loose, Lowman Bldg., reported interested in erecting tin plate plant here to cost $2,000,000.

BIDS DESIRED.

San Antonio, Tex.—Until Dec. 1 for enlarging plant of Dixie Oil & Refining Co.; probable cost $40,000.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Torrington, Conn.**—Contract awarded by Coe Brass Branch of American Brass Co., 197 Water Street, to Torrington Building Co., 179 Water Street, for erecting one-story, 220 x 240 ft., brick and steel rod mill.

★**Buffalo, N. Y.**—Contracts awarded to Butler & Mills, Ellicott Square Building, for masonry, and to August Feine & Sons, The Terrace, for steel, for one and two story brick and steel foundry and machine shop to be erected at Grant Street and the New York Central R.R. for Unique Brass Foundry Co., 25 Illinois Street.

★**New York, N. Y.**—Contracts awarded MacArthur Concrete Pile & Foundation Co., 11 Pine Street, New York, for covering concrete pile foundations for the following: Grain elevator, Standard Tilton Milling Co., Alton, Ill.; mill building, Paterson Parchment Paper Co., Passaic, N. J.; factory building, Electric Auto-Lite Co., Toledo, Ohio. Mills, Rhines, Bellman & Nordhoff, Archts., Toledo.

★**Norristown, Pa.**—Contract for erecting three-story brick, steel, concrete and terra cotta bottling house for Adam Scheidt Brewing Co. awarded Philip Haibach Contr. Co., Philadelphia; cost $70,000. Peuckert & Wunder, Archts., 310 Chestnut Street, Philadelphia.

★**Baltimore, Md.**—Contract awarded by Curtis Bay Distilling Co. for erecting 67 steel tanks on factory site at Curtis Bay to Chicago Bridge & Iron Co., 1300 West 105th Street, Chicago, Ill.; approximate cost $250,000.

★**Winter Haven, Fla.**—Contract awarded Steel Products Company, 232 East Broad Street, Savannah, Ga., for constructing a power house and machine shop annex for the Winter Haven Water, Ice & Light Company.

★**Selma, Ala.** — Contracts reported awarded by Proctor & Gamble, Fourth and Main Streets, Cincinnati, Ohio, owners of Buckeye Cotton Oil Co. here to Thomas Purvis of Selma, for additions to plant; cost about $40,000.

New Orleans, La.—Lowest bid received by Sam Stone, Jr., Archt., 602 L & L & G Building, for erecting concrete and brick warehouse and grain elevator for John T. Gibbons Co., 231 Poydras Street, submitted by Julius Koch, 219 Carondelet Street; cost about $250,000.

★**Cleveland, Ohio.** — Crowell-Lundoff-Little Co. are contractors for five-story brick addition to be erected to plant of Warner & Swasey Co., 5809 Carnegie Avenue, S. E.; cost $70,000. Osborn Engineering Co., Engineers Bldg., prepared plans.

★**Detroit, Mich.** — Reported contract awarded Wisconsin Bridge & Iron Co., 505 Moffat Block, for erecting 50 x 350 ft. building adjacent to plant 3 of Studebaker Corp., Brush and Piquette Streets.

★**Grand Haven, Mich.**—Contract for erecting 60 x 120 ft. addition to plant of American Knitting Co. awarded George McIntosh.

★**Springfield, Ill.**—Contract awarded by Western Carbridge Co., for erection and equipment of a $100,000 power plant to Urbauer-Atwood Heating Co., of St. Louis, Mo. About forty other buildings are to be erected on the site of the new plant five miles north of Springfield. Dr. E. F. Hitch, manager.

★**Los Angeles, Cal.**—Contract reported awarded to F. O. Engstrum Co., Los Angeles, and Llewellyn Iron Works, Los Angeles, for work in connection with first unit of borax refining plant, consisting of refinery buildings, boiler and power plant and storage warehouses, contemplated by American Trona Co. at San Pedro. This plant when completed is to consist of five units. Other four units to be erected as needed.

MISCELLANEOUS

PROPOSED WORK.

Park Improvements—Louisville, Ky.—Park Commissioners have provided in the budget $423,800 for extensive additions and improvements to the park system.

Park Bonds—Cincinnati, Ohio.—Citizens voted in favor of $1,250,000 park and playground bonds.

Subway — Cleveland, Ohio. — Citizens voted in favor of the Barber subway grants.

Park Bonds—Toledo, Ohio.—Citizens voted $750,000 park and boulevard bonds.

Park Improvements—Rocky River, Mich.—Citizens voted $40,000 park bonds.

Park Improvements—West Chicago, Ill.—The $1,000,000 park improvement bonds have been sold by the West Chicago Park Commissioners.

Transmission Line—Marengo, Iowa.—Iowa Electric Co., Marengo, applied to State Board of Railroad Commissioners for a franchise to erect and operate a transmission line from Marengo to Victor.

Park Improvement—Kansas City, Mo.—See "Public Buildings and Schools."

Transmission Line—Newport, Ark.—Arkansas Light & Power Co., Newport, it is reported, contemplates constructing a transmission line from Newport to Tuckerman.

Park Bonds—Houston, Tex.—See "Sewerage and Sewage Disposal."

Amphitheatre—Seattle, Wash.—Dr. H. Suzzalo, Pres. University of Washington, plans construction of a permanent concrete amphitheatre for the campus of University. Cost about $50,000.

Steam Heating System—Hailey, Idaho.—E. J. Gordon and others, it is reported, intend installing a hot water heating system, and will bring waters from Hailey Hot Springs to this city for use of the Hailey Hot Springs Hotel Co. and for heating private residences; cost, $40,000.

BIDS DESIRED.

Addition to Electric Light Plant—New Madrid, Mo.—Until Nov. 29 by W. H. Copeland, City Clerk, for additions to electric light plant. H. H. Humphrey, Consulting Engineer, 1312 Chemical Bldg., St. Louis.

Cranes, etc., Seattle, Wash.—Until Nov. 20 at U. S. Engineers' Office, Burke Bldg., one Gantry cantilever crane and two electric hoists.

Subway—Tucson, Ariz.—Until Nov. 27, by C. K. Clarke, City Manager, for constructing subway under railroad tracks at Congress Street, to be reinforced-concrete, 571 ft. long, two 12-ft. roadways and 7-ft. sidewalks; cost $70,000. L. R. Walker, Designing Engineer, Tucson.

Excavating Machinery—Yuma, Ariz.—Until Nov. 16 by U. S. Reclamation Service (S. B. Williams, Ch.), Denver, Col., for furnishing excavating machinery for the Yuma Project, Ariz.

Overhead Line Construction—Toronto, Ont.—By Toronto Electric Commissioners for overhead line construction work. For further information address Purchasing or Engineering Dept., 15 Wilton Avenue.

Iron Casting, Valves, Etc.—Panama.—Until Nov. 26 by F. C. Boggs, Corps Engrs., Genl. Purchasing Officer Panama Canal, Washington, D. C., for Cir. 990—Iron castings, wrought-iron or steel pipe, gate valves, etc.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Elevator in Building—Baltimore, Md.**—Contract for installing elevator in U. S. Immigration Station awarded Standard Plunger Elevator Co., Worcester, Mass., at $10,950.

★**Transmission Line—Dubois, Neb.**—Contract for constructing a transmission line between Pawnee City and Dubois awarded by City to Korsemeyer Company of Lincoln.

★**Electric Light and Power Plant—Poplar Bluff, Mo.**—Contracts awarded Nov. 3, by H. H. Wilcox, City Clk., as follows, for constructing a municipal electric light and power plant building, boilers, engines, generators and construction, to United Eng. Co., Chicago, $46,400; supplies to West Supply Co., St. Louis, $9,480.

Poles, piping, transformers, meters and lamps not yet let. Fuller Coult Co., Engrs., St. Louis.

★**Cement — Winnipeg, Man.**—Contract awarded Canada Cement Co., Winnipeg, for furnishing 200,000 bbl. Portland cement. S. H. Reynolds, Chairman Commissioners.

Proposals

For Proposals Advertised, see Page 47.

WATERWORKS.

Bids Close.		See Eng. Record.
Nov. 16.	Water Works, Manitowoc, Wis.	Nov. 13
Nov. 18.	Distributing System, Fort Sam Houston, Tex.	Oct. 30
Nov. 18.	Pump, Station, Equip., etc., Brookville, Ind.	Nov. 13
Nov. 19.	Waterworks, Fort Logan, Utah.	Nov. 13
Nov. 20.	Reservoir, etc., Moscow, Idaho.	Nov. 13
Nov. 22.	Water Works, West Frankfort, Ill.	Nov. 6
Nov. 23.	Pipes, Valves, Etc., Washington, D. C.	Nov. 6
Nov. 23.	Water Works, Ventnor City, N. J.	Nov. 6
Nov. 23.	Conduit, Washington, D. C.	Nov. 13
Nov. 25.	Laying Pipe, Charleston, S. C.	Nov. 13
Nov. 26.	Engine and Pumps, Clarksburg, W. Va. Adv. Oct. 30.	Oct. 30
Nov. 30.	Pipe Fittings, Etc., Washington, D. C.	Nov. 13
Dec. 1.	Water Works, East Youngstown, Ohio	Oct. 16
Dec. 1.	Water Works, Melrose, Wis.	Nov. 6
Dec. 2.	C. I. Pipe, Jersey City, N. J. Adv. Oct. 30 to Nov. 13.	Oct. 30
Dec. 2.	Steel Pipe, Jersey City, N. J. Adv. Oct. 30 to Nov. 13.	Oct. 30
Dec. 3.	Water Works, Henderson, Tenn. Adv. Nov. 13.	Nov. 13
Dec. 7.	Water Works, Wesson, Miss.	Nov. 13
Dec. 7.	Pipe Fittings, Washington, D. C.	Nov. 13
Dec. 9.	Bridge for main, Covington, Ky. Adv. Nov. 13.	Nov. 13

SEWERAGE AND SEWAGE DISPOSAL.

Bids Close.		See Eng. Record.
Nov. 16.	Vermillion, Ohio Adv. Oct. 23, 30.	Oct. 23
Nov. 17.	Canton, Ohio.	Nov. 13
Nov. 18.	Sandusky, Ohio Adv. Oct. 30, Nov. 6.	Oct. 30
Nov. 18.	Ogden, Utah.	Nov. 13
Nov. 23.	Oakland, Iowa	Oct. 23
Nov. 23.	Columbus, Ohio.	Nov. 13
Nov. 23.	Toronto, Ont.	Nov. 13
Nov. 23.	Cleveland, Tenn	Nov. 13
Nov. 24.	San Benito, Tex.	Oct. 30
Nov. 24.	Marion, Ohio	Nov. 13
Nov. 24.	Newark, N. J.	Nov. 13
Nov. 26.	Toledo, Ohio.	Nov. 13
Nov. 29.	Dixon, Ill.	Nov. 13
Dec. 1.	Columbus, Ohio.	Nov. 13
Dec. 2.	Contract 4, Chicago, Ill. Adv. Oct. 30.	Oct. 30
Dec. 3.	Henderson, Tenn. Adv. Nov. 13.	Nov. 13
———	Parkersburg, Pa. Adv. Oct. 9.	Oct. 9

BRIDGES.

Bids Close.		See Eng. Record.
Nov. 15.	Connecticut. Adv. Nov. 6.	Nov. 6
Nov. 16.	New Orleans, La.	Oct. 30
Nov. 17.	Aberdeen, Wash.	Nov. 13
Nov. 18.	Abilene, Kan.	Nov. 6
Nov. 19.	Illinois	Nov. 13
Nov. 20.	Walker, Minn.	Nov. 13
Nov. 20.	Portland, Ore.	Nov. 13
Nov. 22.	Parma, Idaho.	Nov. 6
Nov. 22.	Kennett Square, Pa.	Nov. 13
Nov. 22.	Boston, Mass.	Nov. 13
Nov. 23.	Woonsocket, R. I. Adv. Nov. 6, 13.	Nov. 6
Nov. 26.	Steubenville, Ohio	Nov. 6
Nov. 27.	Illinois	Nov. 13
Nov. 29.	Sacramento, Cal.	Nov. 13
Dec. 6.	Louisville, Ky. Adv. Nov. 6, 13.	Nov. 6
Dec. 6.	Edwards, Miss.	Nov. 13
Dec. 6.	Woodville, Miss.	Nov. 13
Dec. 6.	Grenada, Miss.	Nov. 13
Dec. 7.	Canton, China Adv. Oct. 23.	Oct. 23
Dec. 9.	Covington, Ky. Adv. Nov. 13.	Nov. 13

PAVING AND ROADS.

Bids Close.		See Eng. Record.
Nov. 15.	Connecticut. Adv. Nov. 6.	Nov. 6
Nov. 16.	Boston, Mass.	Nov. 13
Nov. 16.	Bound Brook, N. J. Adv. Nov. 6.	Nov. 6
Nov. 16.	San Gabriel, Cal.	Nov. 6
Nov. 16.	Berwyn, Ill.	Nov. 13
Nov. 16.	Kansas City, Mo.	Nov. 13
Nov. 17.	Charlestown, W. Va.	Nov. 6
Nov. 17.	Covington, La.	Nov. 6
Nov. 17.	Lawton, Okla.	Nov. 6
Nov. 18.	Dothan, Ala.	Nov. 6
Nov. 19.	Austin, Tex.	Nov. 6
Nov. 20.	Marysville, Ohio.	Nov. 13
Nov. 22.	Newark, N. J.	Nov. 13
Nov. 23.	Omaha, Neb.	Nov. 13
Nov. 27.	Independence, Ohio	Nov. 13
Nov. 27.	Walla Walla, Wash.	Nov. 13
Nov. 30.	Toledo, Ohio.	Nov. 13
Dec. 1.	Hastings, Neb.	Nov. 6
Dec. 4.	Pensacola, Fla.	Nov. 13
Dec. 6.	Sedalia, Mo.	Nov. 6
Dec. 6.	Brookville, Ind.	Nov. 13
Dec. 6.	Princeton, W. Va. Adv. Nov. 13.	Nov. 13
Dec. 6.	Edwards, Miss.	Nov. 13
Dec. 6.	Winamac, Ind.	Nov. 13
Dec. 7.	Excelsior, Minn.	Nov. 13

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS.

Bids Close.		See Eng. Record.
Nov. 15.	Levee Improv., New Madrid, Mo. Adv. Oct. 23 to Nov. 6.	Oct. 23
Nov. 15.	Drainage Bonds, Bradentown, Fla. Adv. Nov. 13.	Nov. 13
Nov. 16.	Ditch, Slayton, Minn.	Oct. 30
Nov. 16.	Irrigation System, Hood River, Ore.	Nov. 6
Nov. 16.	Dredging, Jacksonville, Fla.	Nov. 13
Nov. 17.	Irrigation Work, Ysleta, Tex. Adv. Oct. 23.	Oct. 23
Nov. 17.	Flood Protection Wall, Portsmouth, Ohio Adv. Oct. 30.	Oct. 30
Nov. 17.	Wharf, New Orleans, La.	Nov. 13
Nov. 18.	Dredging, Brooklyn, N. Y.	Nov. 13
Nov. 19.	Ditch, Windom, Minn.	Nov. 13
Nov. 20.	Ditch, Winimac, Ind.	Nov. 13
Nov. 22.	Dredging, Philadelphia, Pa. Adv. Oct. 30 to Nov. 13.	Oct. 30
Nov. 23.	Ditch, Spencer, Iowa	Nov. 13
Nov. 24.	Dredging, Boston, Mass. Adv. Nov. 13.	Nov. 13
Nov. 24.	Dam, Salt Lake City, Utah.	Nov. 13
Nov. 24.	Bulkhead, Boston, Mass. Adv. Nov. 13.	Nov. 13
Nov. 26.	Dredging, Cleveland, Ohio. Adv. Oct. 30 to Nov. 13.	Oct. 30
Nov. 27.	Dredging, Norfolk, Va.	Nov. 6
Nov. 27.	Ditch, Plymouth, Ind.	Nov. 6
Nov. 30.	Dredging, Orange, Tex.	Nov. 13
Dec. 1.	Irrigation Work, Meadow Creek, Wash. Adv. Oct. 23.	Oct. 23
Dec. 1.	Seawall, Waveland, Miss.	Nov. 6
Dec. 1.	Canal, Westminster, Cal.	Nov. 13
Dec. 6.	Pier, Philadelphia, Pa. Adv. Nov. 13.	Nov. 13
Dec. 6.	Levee, Grenada, Miss.	Nov. 13
Jan. 8.	Dredge, Macaco, China	Nov. 6
Dec. 14.	Dredging, New York, N. Y. Adv. Nov. 13.	Nov. 13

PUBLIC BUILDINGS AND SCHOOLS.

Bids Close.		See Eng. Record.
Nov. 15.	Front Royal, Va. Adv. Oct. 23 to Nov. 13.	Oct. 23
Nov. 16.	Huntington, W. Va.	Oct. 9
Nov. 16.	St. Paul, Minn.	Oct. 30
Nov. 16.	Buffalo, N. Y.	Nov. 6
Nov. 17.	North Adams, Mass.	Nov. 6
Nov. 17.	East Lansing, Mich	Nov. 6
Nov. 17.	Chillicothe, Ill.	Nov. 6
Nov. 18.	Boise, Idaho	Oct. 16
Nov. 19.	Elyria, Ohio	Oct. 16
Nov. 19.	St. Louis, Mo.	Nov. 6
Nov. 20.	Somerville, Ohio	Oct. 30
Nov. 20.	Cold Springs, Tex.	Nov. 13
Nov. 20.	Carlsbad, Tex.	Nov. 13
Nov. 22.	Rootstown, Ohio	Nov. 6
Nov. 22.	Canton, Ohio	Nov. 13
Nov. 22.	Providence, R. I.	Nov. 13
Nov. 23.	Winder, Ga.	Nov. 6
Nov. 23.	New Orleans, La.	Nov. 6
Nov. 23.	Monclair, N. J.	Nov. 6
Nov. 24.	Fort Mason, Cal.	Nov. 13
Nov. 25.	Gainesville, Tex.	Nov. 6
Nov. 26.	Navasota, Tex.	Oct. 23
Nov. 26.	Ft. Terry, N. Y. Adv. Oct. 30 to Nov. 13.	Oct. 30
Nov. 26.	West Unity, Ohio.	Nov. 6
Nov. 27.	Brenham, Tex.	Oct. 30
Nov. 27.	Fort Bliss, Tex. Adv. Oct. 30 to Nov. 13.	Oct. 30
Nov. 27.	Pearl City, Hawaii	Oct. 30
Nov. 29.	Muskegon, Mich.	Oct. 30
Nov. 29.	Rowley, Iowa	Nov. 13
Nov. 30.	Emporia, Kan.	Nov. 13
Dec. 1.	Bloomington, Ind. Adv. Oct. 30.	Oct. 23
Dec. 1.	Columbus, Ohio	Nov. 6
Dec. 1.	New York, N. Y.	Nov. 13
Dec. 4.	Pearl City, Hawaii	Nov. 6
Dec. 4.	West Manchester, Ohio.	Nov. 6
Dec. 4.	Ortonville, Minn.	Nov. 13
Dec. 9.	Lebanon, Ind.	Nov. 6
Dec. 10.	Greenwich, Conn.	Nov. 6
Dec. 18.	Middletown, Ohio. Adv. Nov. 13.	Nov. 13
Dec. 20.	Humboldt, Tenn.	Nov. 13
Jan. 4.	Cavite, P. I.	Nov. 13

PRIVATE BUILDINGS.

Bids Close.		See Eng. Record.
Nov. 22.	Pottstown, Pa.	Nov. 6
Nov. 22.	Wichita, Kan.	Nov. 6
Dec. 1.	Athens, Ga.	Nov. 13

MISCELLANEOUS.

Bids Close.		See Eng. Record.
Nov. 15.	Street Cleaning, Boston, Mass.	Nov. 13
Nov. 16.	Oil Storage Tanks, Panama	Oct. 23
Nov. 16.	Excav. machinery, Yuma, Ariz.	Nov. 13
Nov. 17.	Power Plants, Etc., Washington, D. C.	Aug. 28
Nov. 17.	Htg. Bldgs., Fort Bliss, Tex. Adv. Oct. 23 to Nov. 13.	Oct. 23
Nov. 17.	Copper Tubes for Ry., London, England Adv. Oct. 30, Nov. 6.	Oct. 30
Nov. 17.	Pipe Fittings, Etc., Panama	Oct. 30
Nov. 20.	Cranes, etc., Seattle, Wash.	Nov. 13
Nov. 23.	Power Plant, Oakley, Kan.	Nov. 6
Nov. 23.	Electric railways, New York, N. Y.	Nov. 13
Nov. 24.	Railroad, San Francisco, Cal.	Nov. 13
Nov. 26.	Cranes, Charleston, S. C.	Oct. 16
Nov. 26.	Pipes, valves, etc., Panama.	Nov. 13
Nov. 27.	El. Ry., Pearl City, Hawaii	Oct. 23
Nov. 27.	Subway, Tucson, Ariz.	Nov. 13
Nov. 29.	Electric Light Plant Addition, New Madrid.	Nov. 13
Nov. 29.	Hoistway and Elevator, Jefferson City, Mo.	Nov. 6
Dec. 2.	Bowling Alley, Fort Totten, N. Y. Adv. Nov. 6, 13.	Nov. 6
Dec. 8.	Electric lighting, West Hazleton, Pa. Adv. Nov. 13.	Nov. 13
Dec. 15.	Timber, Sault Ste. Marie, Mich. Adv. Nov. 13.	Nov. 13

SEARCHLIGHT SECTION

Bids open December 8, 1915.

TO BRIDGE CONTRACTORS

COVINGTON, KY.

Sealed proposals for the construction of a bridge superstructure [illegible] proposals for bridge will be received by J. Mount Bowe, Commissioner of Public Property of Covington, Ky., until 10 o'clock, Thursday, Dec. 8, 1915.

Said work is for a bridge to be constructed to carry the Duplicate Water Supply Main over the Licking River for the City of Covington, Ky.

Each proposal will have to be accompanied by a cash deposit or certified check in the sum of fifteen hundred ($1,500) dollars as a guarantee that the party making the proposal will, if the contract is awarded to him or them execute the same with approved security. Should any bid be rejected such check will be returned to the bidder and should any bid be accepted such check will be returned upon the proper execution and securing of the contract. In the event of any bidder failing to execute the contract for the work that has been awarded to him, such bidder shall forfeit the sum so deposited. Check to be made payable to the city of Covington, Ky., or order.

The contractor for the bridge work will be required to give an approved Surety or Trust Company Bond for the sum of twenty thousand ($20,000) dollars to insure a faithful completion of the contract.

Copies of specifications will be furnished bidders upon application to the Commissioner of Public Property, or the Consulting Engineer and outline drawings giving the longitudinal elevation and plan of the bridge, also of the piers and their location, can be seen at the office of either.

Bidders must endorse their names and address upon the outside of the envelopes containing their bids.

The Board of Commissioners reserves the right to reject any or all bids.

J. MASON HOWK,
Commissioner of Public Property.
Covington, Ky., Nov. 6, 1915.
GEO. HORNUNG,
Consulting Engineer.
Wool-Savo Building,
Newport, Ky.

Bids open December 6, 1915.

ELECTRIC LIGHTING

WEST HAZLETON, PA.

Bids will be received for the electric lighting of West Hazleton Borough, Pa., during a period of ten years according to the specifications on file with the undersigned. Said bids to be presented on or before 8 o'clock P. M. of December 6th, 1915.

WILLIAM KRAFF, Secy.
137 North Broad Street,
West Hazleton, Pa.

TREASURY DEPARTMENT, Office of the Supervising Architect, Washington, D. C., November 4, 1915.—Sealed proposals will be received at this office until 1 o'clock p. m. of December 21, 1915, and then opened, for the construction, complete (including painting, gas piping, heating apparatus, electric conduits and wiring, lift, and approaches), of the United States post office at Middletown, Ohio. The building is two stories and basement and has a ground area of approximately [illegible] square feet. Fireproof construction, brick facing and concrete roof. Drawings and specifications may be obtained from the custodian of site at Middletown, Ohio, or at the office, at the discretion of the Supervising Architect. JAS. A. WETMORE, Acting Supervising Architect.

U. S. ENGINEER OFFICE, CLEVELAND, Ohio.—Sealed proposals for dredging in Cleveland Harbor, Ohio, will be received here until 12 o'clock (noon) eastern standard time, November 24, 1915, and then opened. Information on application.

PROPOSALS FOR REAR ADJUTANT TO [illegible] Office Depot Quartermaster, El Paso, Texas. Sealed proposals will be received here until 11 a. m., May 27, 1915, and then opened, for constructing a rear adjutant to hospital at Fort Bliss, Texas. Further information on application.

Official Proposal Announcements

Price $2.50 an inch.—Copy can be received until Thursday 10 a. m. for issue mailed the next morning

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Bids open Dec. 2, 1915.

NOTICE TO CONTRACTORS.

STEEL PIPE LINE

JERSEY CITY, N. J.

Sealed proposals will be received by the Board of Commissioners of Jersey City, on

THURSDAY, DECEMBER 2, 1915,

at 2 p. m., in the Assembly Chamber, City Hall, Jersey City, N. J.,

FOR THE CONSTRUCTION OF ABOUT ELEVEN MILES OF SEVENTY-TWO-INCH STEEL PIPE, EXTENDING FROM BROOKDALE, N. J., TO JERSEY CITY, N. J.,

at which time and place they will be publicly opened and read.

The work to be done includes furnishing, coating, delivering and laying the pipe with all appurtenances and connections, including culverts, valves, chambers, meters, and other structures required. The crossings of the Passaic and Hackensack Rivers are not included under this contract.

Proposals must be enclosed in sealed envelopes endorsed "Proposals for the construction of Land Portion of Brookdale Pipe Line," and must be directed to the Board of Commissioners of Jersey City.

A certified check for twenty-five thousand ($25,000) dollars, drawn upon a National or State Bank or Trust Company and to the order of the Director of Revenue and Finance of Jersey City shall be delivered to the City Clerk at the time the bid is deposited.

A satisfactory bond or surety for one hundred thousand ($100,000) dollars will be required of the successful bidder conditioned on the faithful performance of the work.

Specifications, form of proposal, and drawings can be seen and secured at the office of the Chief Engineer, Department of Streets and Public Improvements, City Hall, Jersey City, on payment of ten ($10) dollars which will be returned if the plans and specifications are sent back to the Chief Engineer in good order.

The Board of Commissioners reserves the right to reject any or all bids if it is considered for the best interests of the City so to do.

MICHAEL I. FAGEN,
City Clerk.

Dated City Clerk's Office,
Jersey City, Oct. 25, 1915.

Bids open Dec. 6, 1915.

MACADAM ROAD BIDS ASKED

OFFICE OF CHIEF ENGINEER ROAD CONSTRUCTION.

PRINCETON, MERCER COUNTY, WEST VA.

Bids will be received at the County Clerk's Office, Princeton, West Va., until 12 o'clock noon, Dec. 6, 1915, for the construction of six and one-third miles of water bound macadam, between Rock and Camp in Mercer County, West Virginia.

Plans and specifications on file in the Chief Engineer's office.

A certified check for the sum of $500, payable to the County Court of Mercer County to accompany each bid.

The right is reserved to reject any or all bids.

A minimum time limit, other things being equal, will be considered important in the awards.

GEO. H. HILL,
Chief Engineer.

FORT H. G. WRIGHT, N. Y.—SEALED proposals for constructing Double Set Officers Quarters at Fort Terry, N. Y., will be received until 9 a. m., Nov. 26, 1915. Information on application to Constructing Quartermaster.

Bids open Dec. 2, 1915.

NOTICE TO CONTRACTORS.

CAST IRON PIPE LINE

JERSEY CITY, N. J.

Sealed proposals will be received by the Board of Commissioners of Jersey City, on

THURSDAY, DECEMBER 2, 1915,

at 2 p. m., in the Assembly Chamber, City Hall, Jersey City, N. J.,

FOR FURNISHING AND LAYING A DOUBLE LINE OF FORTY-EIGHT-INCH CAST-IRON PIPE UNDER THE PASSAIC AND HACKENSACK RIVERS, at which time they will be publicly opened and read.

The work to be done includes furnishing, coating, delivering and laying the pipe with all appurtenances and connections, including piles, valves, chambers, and other structures required.

Proposals must be enclosed in sealed envelopes endorsed "Proposal for the construction of Marine Portion of Brookdale Pipe Line," and must be directed to the Board of Commissioners of Jersey City.

A certified check for ten thousand ($10,000) dollars, drawn upon a National Bank or State Bank or Trust Company and to the order of the Director of Revenue and Finance of Jersey City, shall be delivered to the City Clerk at the time the bid is deposited.

A satisfactory bond or surety for forty thousand ($40,000) dollars will be required of the successful bidder conditioned on the faithful performance of the work.

Specifications, form of proposal, and drawings can be seen and secured at the office of the Chief Engineer, Department of Streets and Public Improvements, City Hall, Jersey City, on payment of ten ($10) dollars, which will be returned if the plans and specifications are sent back to the Chief Engineer in good order.

The Board of Commissioners reserves the right to reject any or all bids if it is considered for the best interests of the City so to do.

MICHAEL I. FAGEN,
City Clerk.

Dated City Clerk's Office,
Jersey City, Oct. 25, 1915.

Bids open Nov. 15, 1915.

DRAINAGE DISTRICT BONDS

BRADENTOWN, FLA.

The Board of County Commissioners of Manatee County, Fla., will, on the 15th of November, 1915, open bids for $130,000 of 30-year 6 per cent Drainage District Bonds.

Information from C. A. Tilton, Clerk of the Board of County Commissioners, Bradentown, Fla.

U. S. ENGINEER OFFICE, LOUISVILLE, Ky., Nov. 6, 1915. Sealed proposals will be received here until 12 noon, Central time, Dec. 6, 1915, and then opened, for furnishing and constructing a swing bridge over the locks of the Louisville and Portland Canal, Louisville, Ky. Information on application.

REMOUNT DEPOT, FRONT ROYAL, Va. Sealed proposals for construction, including plumbing of fire station, will be received until 2 p. m., Nov. 15, 1915. Information on application, Constructing Quartermaster.

PROPOSALS FOR BOWLING ALLEYS, Office Quartermaster, Fort Totten, N. Y.—Sealed proposals will be received here until 10 A. M., Dec. 2, 1915, and then opened for furnishing and installing 2 bowling alleys. Further information on application.

Bids open Nov. 23, 1915.

BRIDGE CONSTRUCTION

WOONSOCKET, R. I.

Sealed proposals will be received by the Board of Aldermen of the City of Woonsocket, R. I., at the Aldermen's Chambers, City Hall, Woonsocket, until 8.15 P. M., Tuesday, November 23, 1915, at which time and place proposals will be publicly opened and read. Said Board of Aldermen will be in session at 8 P. M. on said date for the purpose of receiving proposals for the following:

CONTRACT No. 1. For building 2 reinforced concrete bridges and appurtenances on Hamlet Avenue, one (1) over the Hamlet Trench and one (1) over the Blackstone River.

CONTRACT No. 2. For building a reinforced concrete bridge and appurtenances on Fairmount Street and over the Blackstone River.

Certified check for the amount of $1,000 must accompany proposal for bridges on Hamlet Avenue, and certified check for $500 must accompany proposal for bridge on Fairmount Street, as surety that if any proposal is accepted a contract will be entered into. Checks must be drawn to order of the City Treasurer of the City of Woonsocket.

Proposals must be on forms provided. Plans, specifications and form of contract and proposal may be obtained at the office of the City Engineer upon deposit of $15 for each bridge, which amount will be refunded if plans and specifications are returned in good condition.

The right to reject any or all bids is expressly reserved as the interest of the city may appear.

GEORGE H. EMMOTT, President;
TELESPHORE DESROSIERS,
CHARLES D. SOUTHWICK,
JAMES F. CARROLL,
ADRIEN H. SYLVESTRE,
Board of Aldermen.

FRANK H. MILLS,
City Engineer.

Bids open Dec. 6, 1915.

PIER SUPERSTRUCTURE

DEPARTMENT OF WHARVES, DOCKS AND FERRIES,
555 BOURSE BUILDING,
PHILADELPHIA, PA.

Sealed proposals, endorsed "Bids for the construction of the superstructure of McKean Street Pier, No. 78-80 South, and its adjacent bulkhead shed in the Delaware River, between McKean Street and Snyder Avenue," will be received until 12 o'clock noon, Monday, December 6, 1915, at the office of the Director of the Department of Wharves, Docks and Ferries, 555 Bourse Building, Philadelphia, and then publicly opened.

Plans, specifications and blank forms upon which bids must be made can be obtained at the office above mentioned upon the deposit of a certified check in the amount of twenty-five dollars ($25), to cover the cost of making blue prints, etc., which check will be refunded to the bidder upon the return of the plans and specifications in good condition. The successful bidder will be furnished with all necessary blue prints free of charge. Approximate limit of cost $500,000.

No bid will be considered unless accompanied by a certificate from the City Solicitor of the City of Philadelphia, to the effect that the provisions of an ordinance requiring proposal bonds on all bids exceeding in amount five hundred dollars ($500), approved May 25, 1860, have been complied with.

The Director reserves to himself the right to reject any or all bids as he may deem best for the interest of the city of Philadelphia.

JOHN MEIGS,
Director.

Nov. 5, 1915.

CONTRACTING NEWS

Of Special Interest to Engineers, Contractors, Builders and Manufacturers of Engineering and Building Supplies

UNFILLED ORDERS of the U. S. Steel Corporation gained 847,834 tons during October in spite of capacity operation. This gain is the largest made in any month for three years, and the total of unfilled orders on the books of this corporation at the end of October was the largest since May, 1913. On the heels of this gain, due chiefly to heavy domestic buying, especially by the railroads, comes the news that first French and then Canadian quotations have been withdrawn by the corporation. There is no steel available to sell in these markets. Also, it is said that $7,500,000 will be spent at once to enlarge one of the corporation's plants at Gary, Ind.

Building construction during October kept up the recovery over 1914 that set in during September, according to the figures published Nov. 12 by the trade reviews. Not only this, but the figures for the past two months compare well with those for the normal fall of 1913. The Eastern and Southern cities show good gains, with a few exceptions, but the increase in activity in the Middle West is remarkable. The value of building permits almost doubled as compared with October, 1914, in Chicago, placing that city well ahead of New York. The value of building permits more than doubled in Cincinnati, Toledo, Minneapolis and Omaha, nearly tripled in Denver and Kansas City, almost doubled in Detroit and gained heavily in Cleveland, Pittsburgh, Dayton and Youngstown. The average increase for the eighty-six cities reported was 23.7 per cent over the figures for 1914.

Exports for last week reached $81,200,000, not having fallen below $64,000,000 in any week since Sept. 25, and having averaged more than $75,000,000 since that date. Cotton exports since Aug. 1 have totaled 1,500,000 bales. This gives an average rate which is exceeded 63 per cent by the average exports of cotton for the first year of the war. However, since the crop began to move in the latter part of September, exports have averaged 153,000 bales a week, only a little below the rate of the year ending Aug. 1, 1915. This rate, with the greatly reduced crop this year, should prove sufficient to dispose of the surplus and put the South in a better position to buy and build.

Buildings

A $225,000 contract for building a hospital has been awarded at New Haven, Conn. The lowest bid received for erecting a high school at Canton, Ohio, was $113,000. The Masonic temple to be built at Terre Haute, Ind., has been contracted for at $93,000. A contract amounting to $90,000 has been awarded for building a science building at Norman, Okla., for the State university. A high school contracted for at El Paso, Tex., will cost $272,000. Bids are desired Dec. 1 at Seattle for constructing a $90,000 warehouse.

Plans have been filed in New York City for four buildings costing more than $100,000 each. A $350,000 hospital is to be built at Jersey City, and the Board of School Estimates of the same city contemplates spending more than $2,500,000 for new construction. It is reported that the $4,500,000 municipal art museum planned at Philadelphia will be built next spring. A steel mill is said to be planning a $1,000,000 addition at Weirdon, W. Va. Preliminary plans have been approved for a $260,000 high school at Nashville, Tenn. A milling plant to cost $250,000 is contemplated at Little Rock, Ark. Lake Charles, La., will build a $125,000 high school. A high school to cost $300,000 is to be built at Lake Wood, Ohio. The construction of a $150,000 bank building is being considered at St. Paul. A $250,000 medical building is to be erected for the University of Oregon at Portland.

Bridges and Roads

State road contracts awarded at Albany, N. Y., on bids opened Oct. 26 amount to more than $840,000, while the total of low bids opened Nov. 11 at the same place for further road work was $360,000, most of which has also been awarded. The awards included a good number of large contracts. A $55,000 road contract has been awarded at Highstown, N. J. Paving work contracted for at Knoxville, Tenn., will cost $105,000. Columbus, Miss., has awarded a contract for surfacing 30 miles of roads. A $140,000 road contract has been awarded at Longview, Tex., and another contract amounting to $100,000 has been awarded at Pleasanton, Tex. Two road contracts totaling $90,000 have been awarded by the California State Highway Commission. The construction of 16 miles of road has been contracted for at $118,000 by Arcadia, Cal. Bids are desired at New Gretna, N. J., for constructing a 742-ft. pile, concrete and steel bridge. Holly Springs, Miss., will receive bids Dec. 3 for constructing four bridges.

An engineer has been appointed to design and supervise road construction near Pineville, W. Va., for which $550,000 is available. Construction will be started next spring. Plans are to be prepared for a $240,000 bridge at Milwaukee. The State highway department has made plans for a $200,000 highway near El Dorado, Ark. A 22-mile road to cost $200,000 will be built from Biloxi to Pass Christian, Miss. An issue of $150,000 bonds for road construction has been approved at Cleveland, Miss. It is planned to spend $600,000 for road improvements near Osceola, Ark., and the construction of a new road district at a cost of $428,000 is also being considered. Roads which will cost about $400,000 are to be built near Tucson, Ariz. It is reported from Portland, Ore., that $588,000 will be spent on roads by Multnomah County in 1916. An appropriation of $325,000 has been made for constructing a road near Los Angeles.

Waterworks and Sewers

Work contracted for by the New York Board of Water Supply on the uptake and downtake chambers of the Hill View reservoir will cost $94,000. Bids are desired at Baltimore for constructing trunk sewers to cost $50,000. Wooster, Ohio, desires bids for constructing waterworks. Bids will be received Dec. 6 at Manteca, Cal., for constructing a $174,000 reservoir. The immediate construction of sewers to cost $978,000 has been recommended at Montreal. Water bond issues totaling $152,000 have been voted at Batavia, N. Y. An engineer has been engaged to design waterworks for Oneida, N. Y., to cost $503,000. Buffalo has appropriated $97,600 for waterworks and sewer construction. Owensboro, Ky., has voted $200,000 for constructing sewers. Plans have been prepared at Youngstown, Ohio, for sewer construction to cost $300,000. An extension of the Linwood Avenue intake tunnel to be recommended at Milwaukee will cost $200,000. Improvements contemplated at Fargo, N. D., will cost $500,000 and include extensive waterworks and sewer construction. A $65,000 sewer contract is to be let in Seattle. The cost of proposed improvements to the waterworks of Pasadena, Cal., is estimated at $165,000.

Miscellaneous

A contract for constructing section G of the Dorchester tunnel in Boston has been awarded at $382,000. The lowest bid received in New York City for laying track on a part of the new rapid-transit lines in Queens was $204,000. The contract for station finish on the Utrecht Avenue elevated line in Brooklyn has been awarded at $513,000. Contracts for two sections of the Calumet Sag Channel at Chicago, bids for which were noted in Engineering Record of Oct. 30, have been awarded at $720,000 and $828,000 respectively. A contract for the superstructure of an ore dock has been awarded at Two Harbors, Minn., and bids are being received for the substructure. Waxahachie, Tex., will open bids Nov. 25 for levee work to cost $98,000.

Bids will probably be received next month for flood protection work to cost $300,000 at Olean, N. Y. Quincy, Ill., has made plans for a $100,000 river terminal. Three large drainage bond issues have been sold in the South, one of $325,000 at Blytheville, Ark., one of $157,000 at Corpus Christi, Tex., and one of $140,000 at Aldine, Tex. A dam and power plant to cost $100,000 will be built at Fort Dodge, Iowa. A drainage project to cost $100,000 is reported from Ashland, Wis. Additions proposed to the seawall at Galveston, Tex., will cost $189,000. A permit has been granted for a $200,000 irrigation development at Salem, Ore. A logging railroad proposed at Everett, Wash., will cost $250,000. A street-railway line, the construction of which has been authorized at Toronto, will cost $125,000.

WATERWORKS

PROPOSED WORK.

Batavia, N. Y.—Citizens voted in favor of issuing following bonds: $135,000 for modern filtration system; $17,000 to restore sewer pump station and $23,000 for improving electric light plant.

Oneida, N. Y.—J. M. Hutch, Oneida, is designing engineer for water works contemplated here at a cost of $503,000. D. J. Covell, City Clerk.

St. Cloud, Fla.—Wilbur A. Ginn, of Sanford, Fla., engaged as engineer for water works, electric light plant and street improvements contemplated in this city. For further information address Mr. Ginn.

Greenville, Miss.—Water bonds for $65,000 will be sold Dec. 7, by Lyne Starling, City Clk.

Mayfield, Ky.—Citizens recently voted bonds to purchase the electric light plant and water works of the Mayfield Water & Light Company.

Winchester, Ky. — Council appointed committee of which D. T. Matlack, Mayor, is a member, to investigate purchase of present water works and have estimate prepared for extending lines to the river.

Hamilton, Ohio.—Council passed ordinance authorizing $10,000 spent for driving additional wells.

Orleans, Ind.—Test well being driven under supervision of J. B. Marvin of Frankfort, preparatory to building water works.

Menominee, Mich.—Improvements contemplated by city in the recently purchased plant of the Menominee Water Co. include a filtration plant. F. S. Norcross, City Clerk.

Champaign, Ill.—Champaign & Urbana Water Co. will lay 2 miles 14-in. fire main in business district of Champaign and one mile 10-in. fire main in downtown district of Urbana.

Wheaton, Ill.—Citizens voted $35,000 bonds for enlarging and improving water works. La Verne J. Ruddock, City Engineer.

Milwaukee, Wis.—The extension of the new Linnwood Avenue intake tunnel, about 2500 ft., will be recommended by the Board of Engineers; estimated cost $200,000. Address Board Public Works.

Oswego, Kan.—The improvements to the water works for which the citizens recently voted $30,000 bonds will include a 1,000,000 gal. low service pump and boiler feed pump, 1,000,000 gal. mechanical filter plant complete, 1½ miles c. i. pipe, with hydrants and valves, and a 100,000 gal. steel tank on a 100-ft. tower. Albert C. Moore, Engr., Joplin, Mo.

Bismarck, N. D.—The Bismarck Water Supply Company intends making improvements.

Fargo, N. D.—Reported city is considering paving and water and sewer extensions. About $500,000 in improvements contemplated.

Columbia Falls, Mont.—The J. A. Balbott Water Co., Inc., Columbia Falls, reported incorporated and will install a water system for irrigation and domestic use.

Dardanelle, Ark.—I. A. Huckaby, City Recorder, writes improvements costing $15,000 are to be made to the water works. J. R. Halliday, Engineer, McAllister, Okla.

Pocahontas, Ark.—Construction of water works under consideration. Address City Clerk.

Galveston, Tex.—Contract soon to be let for laying submerged water mains across Galveston Bay. A. T. Dickey, City Engineer.

Goldthwaite, Tex.—Citizens voted $31,000 bonds to construct water works.

Seattle, Wash.—Plans and specifications approved and contract about to be let by Bd. Pub. Wks. (L. B. Young, Chairman), for constructing watermains on Forty-third Avenue, N. E.; cost $27,000; also on Twenty-fifth Avenue, N. W., and Fourteenth Avenue, N. W.

City Council has appropriated $15,000 for constructing a 24 in. main through siphon tunnel at Third Avenue West. L. B. Young, Chairman Board Public Works.

Falls City, Ore.—Contract soon to be let, according to reports, for constructing water system. Address City Clerk.

Milwaukie, Ore.—Contract soon to be let for constructing a standpipe and laying mains for completion of Bull Run Water system. J. W. Norris, Engr.

Pasadena, Cal.—Samuel Morris, Ch. Engr. Water Dept., submitted a report estimating cost of improvements to Water Works as follows: Well on north side $11,000 to $15,000; reservoir capacity [illegible] on [illegible] located near Sierra Place, about $40,000; 36 in. main down Fair Oaks Ave. to Colorado and 24 in. main east on Colorado, at [illegible] 16 in. main starting about [illegible] south on Fair Oaks to Orange.

Mendora Idaho—Reported Town Council [illegible] bonds for a Municipal water system. T. A. Cook, Town Clerk.

St. Anthony, Idaho—City Council is reported contemplating purchasing pipe and other works or the construction of a new system.

BIDS DESIRED.

Washington, D. C.—Until Nov. 20 by Commissioners D. C. (Capt. F. Newman, Chief Engr.) for furnishing and delivering 300,000 brass cast locks for use in the Water Dept.

Henderson, Tenn.—Until Dec. 3 by E. M. Bowen, C.E. Engineer for well, advertised in Engineering Record. Frank L. Williams, Engineer. Syndicate Trust Bldg., St. Louis, Mo.

East Youngstown, Ohio.—Until Dec. 10 by Chas. E. Andrews, Village Clerk, for [illegible] electric filter plant, pumps, etc., advertised in Engineering Record. Chester & Shattuck, Engineers, Union Bank Building, Pittsburgh, Pa.

Wilberforce, Ohio.—Until Dec. 14 (readvertisement for Bd. Trs. Combined Normal and Industrial Dept. Wilberforce University (W. A. Chambers, Treas.) for improving water system, gravity supply, to consist of 50,000 gal. steel tank and tower, this will complete 60 ft. deep, two steam pumps, a [illegible] water softening plant, [illegible] steam piping, water mains, etc. Kilbourne Eng. Co., Engrs., 37½ East Long street, Columbus.

Wooster, Ohio.—By Max Bloomsburg, Director Public Service for furnishing city with an independent water supply, advertised in Engineering Record.

Chicago, Ill.—Until Nov. 22 by Board Local Improvements (Edw. J. Glackin, Secy.) for water service pipes in W. Adams, W. Fourteenth, E. Seventy-fifth and several other streets.

Chicago, Ill.—Until Nov. 22 by W. R. Mackenzie, Lieut. Col. Wks. for designing, constructing and delivering on siding at the Central Park Avenue Pumping Station, valves and appurtenances.

Wheaton, Ill.—Until Dec. 2 by Water Supply Commission for an elevated steel tank of 300,000 gal. capacity, advertised in Engineering Record. Lewis Epworth, City Clerk. Lawrence J. Roderick, City Engineer.

Marshalltown, Iowa.—Until Nov. 22 (readvertisement) by M. S. McFarland, Superintendent Water Works Department for [illegible] and capacity per twenty-four hours, cost $15,000. W. H. Steiner, City Engineer.

Seattle, Wash. — See "Paving and Roads."

Manteca, Cal.—Until Dec. 6 for constructing [illegible] reservoir to cost $[illegible] Bids may be handed to Board of Trustees, Engineer Montana, Cal. J. Parisi, Secretary. South San Joaquin Irrigation District, Manteca.

Toronto, Ont.—Until Nov. 22 by T. L. Church, Comr. Works (Council City Hall for [illegible] sewer breaking at Main Pumping Station.

Panama.—Until Jan. 15 by Maj. F. C. Boggs, Supt. Purchasing Office, Panama Canal, Washington, D. C., for Cir. 2045—Acetylene generators, 10 cu. ft. per minute capacity, [illegible] panel board, etc.

San Juan, P. R.—Until Dec. 1 by Quartermaster for excavating lake and material for the laying of 6 in. pipe line from Fort El Morro to point of distribution, port of San Juan.

PRICES AND LETTINGS.

★Indicates award of contract.

★New Bedford, Mass.—Contract for furnishing and [illegible] special castings required [illegible] Company, Boston, for [illegible] tons 6 in., [illegible] 24 tons 4 [illegible] 10 tons special castings, [illegible] Yost Gate Company, Worthington Pumping & Machinery Corporation, 11 Broadway, New York, [illegible] Standard Cast Iron Pipe & Foundry Company, Bristol, Pa., [illegible] 6, 8, 10 and 12 in. [illegible] Chestnut street, Philadelphia, Pa., $24,612.

★Dayton, Ohio.—Contract awarded Delaval Company, Trenton, N. J. for a 20,000,000 gal. steam turbine driven centrifugal pump for water works at $31,000.

★Galveston, Tex.—Contract for furnishing 2600 ft. 24-in. pipe to be used for new [illegible] water main across Galveston bay has been awarded by City Commission to United States Cast Iron Pipe & Foundry Co., Chicago, Ill., at $28,440.

Following bids opened by City Commission Nov. 3 for furnishing air compressor for Alta Loma pumping plant: **Sullivan Machinery Co.**, $15,750; **Randall Lawrence Co.** (3 bids), $16,760, $17,000 and $18,000; A. M. Lockett & Co. (3 bids), $14,612, $14,905 and $17,785.

★Council, Idaho.—Contract for constructing water works awarded E. L. Phelps of Weiser, at $12,000.

★Toronto, Ont. — Contract awarded Dominion Sewer Pipe Co., Toronto, for furnishing stop valves, valve operating mechanism and special castings for Main Pumping Station at $9,530.

SEWERAGE AND SEWAGE DISPOSAL

PROPOSED WORK.

Batavia, N. Y.—See "Water Works."

Buffalo, N. Y.—See "Water Works."

Owensboro, Ky.—Citizens voted $200,000 bonds for constructing sewers. Address Mayor.

Lancaster, Ohio.—Constructing a sewer system is reported under consideration by city officials. C. M. Rowlee, Mayor.

Youngstown, Ohio.—Plans prepared by City Engineer for converting basin of Crab Creek from East Madison Avenue to Oak Street, calling for a concrete trough 40 ft. wide and 12 ft. deep, with two sewers concrete into the side walls; estimated cost $[illegible].

West Chicago, Ill.—An election is to be held Dec. 6 to vote on constructing a sewer system.

Lisbon, Iowa.—Contract will be let in December by H. C. Kuntz, Town Clerk, for constructing a sewer system and disposal plant to cost $30,000; 6 to 12 in. pipe will be required. T. R. Warriner, Engr., Cedar Rapids.

Oskaloosa, Iowa.—Sewer improvements costing $50,000 are to be made, include construction of an Imhoff disposal plant. Horace Hawkins, City Engineer. Black & Veatch, Kansas City, Mo., consulting engineers.

Anoka, Minn.—L. P. Wolff, St. Paul, engaged by city to make a survey and report on sewer extensions for next year.

Fargo, N. D.—See "Water Works."

Manhattan, Mont.—Construction of sewer system costing $20,000 is contemplated.

Seattle, Wash.—Contract will be let by Board of Public Works about January for [illegible] ft. 8 to 18-in. pipe sewer in West and North Fiftieth Street. Cost $[illegible].

Montreal, Que.—Board Control considering report of Chief Engineer recommending appropriation of $978,000 for constructing sewers during winter months.

Beverly, Alta.—Citizens voted to construct sewers.

Bonners Ferry, Idaho.—Contract soon to be let by City Council for constructing a sewerage system to cost $29,000.

BIDS DESIRED.

New York, N. Y.—Until Nov. 23, by Marcus M. Marks, Pres. Manhattan Borough, for extensions and improvements to sewer in Cedar Street, between Broadway and Nassau Street. Security $4,500.

Ocean Grove, N. J.—Until Nov. 22, at office of Neptune Township Committee, 75 S. Main Street, for furnishing material and constructing about 13,200 lin. ft. 4 in. [illegible] vitr. pipe sewer, together with manholes, etc. Frank P. Butcher, Township Clk., Ocean Grove.

Trenton, N. J.—Until Nov. 24, by Frank Thompson, City Clk. for constructing sewer on Bunnett and Park Avenues.

Washington, D. C.—Until Nov. 29, by Commissioners D. C. for constructing involving about 300 lin. ft. trunk sewer 3 ft. and [illegible] ft. 15 to 24 in. pipe sewer, advertised in Engineering Record.

Baltimore, Md.—Until Nov. 24, by Board Awards (John Hubert, Act. Pres.), at office of City Register, for constructing Section No. 1, Waverly trunk sewers and lateral sewers in Dist. No. 34 D, as follows: Sanitary Contract 168, 2800 lin. ft. 18 to 24-in. terra cotta sewer, 700 lin. ft. house connection; Sanitary Contract No. 169, 6425 lin. ft. terra cotta pipe, 3900 lin. ft. house connections.

Mansfield, Ohio.—Reported desired until Dec. 1, for constructing sewage disposal plant. W. J. Hazeltine, City Engr.

Richmond, Ind.—Until Nov. 29, by B. A. Bescher, City Clerk, for constructing about 3700 ft. 12 in. pipe sewers. Frederick R. Charles, City Engineer.

Aurora, Ill.—Until Nov. 24 by Myron J. Tarble, City Engineer, for constructing system of sewers in Sewer District No. 11, advertised in Engineering Record.

Chicago, Ill.—Until Nov. 22 by Bd. Local Improv. (Edw. J. Glackin, Secy.) for constructing drains in S. Ashland Avenue, Eddy, W. Thirty-first, Henderson and several other streets.

Marshall, Ill.—Until Nov. 22 by City Clerk for 4226 feet 6 and 8 in. pipe sewers with 9 manholes. W. R. Paige, Engineer, Terre Haute, Ind.

Strawberry Point, Iowa.—Until about Dec. 21 by J. Schofield, Town Clerk, for constructing sewer system and sewage disposal plant, about 23,000 ft. 6 to 10 in. pipe; cost system $18,000, and plant $7,000. M. Tschirgi & Sons, Engr., Cedar Rapids.

Seattle, Wash.—See "Paving and Roads."

Bonners Ferry, Idaho.—Reported desired until Nov. 20 by W. D. Baxter, Chmn. Sewer Com., for constructing sewerage system and sewage disposal plant. C. T. Laschinger, City Treas.

PRICES AND LETTINGS.

★Indicates award of contract.

Boston, Mass. — Following are bids opened Nov. 12 by Metropolitan Water & Sewerage Board for reconstructing the Malden River siphon between Everett and Medford: George M. Bryne, 166 Devonshire Street, $26,000; Bay State Dredging Co., 241 Atlantic Avenue, $29,110; Charles H. Haskin, West Medford, $31,240.

Following are three lowest bids opened Nov. 15 by Commissioner Public Works for constructing sewer in Canal Street: William Barrett & Co., Roxbury, $9,973; A. Baruffaldi, Somerville, $10,947; J. J. Coughlin & Co., Boston, $14,372.

★New York, N. Y.—Contract for constructing the storm drain for Queensboro subway in Queens Borough awarded Murphy Brothers of Brooklyn at $7,421.

★Atlantic Highlands, N. J.—Contract awarded R. W. Smith Corporation, 30 Church Street, New York, for sewer extensions (bids opened Nov. 3) at $15,402.

Hightstown, N. J.—See "Paving and Roads."

Washington, D. C.—Lowest bid opened Nov. 11 by Commissioners D. C. for constructing the Bennings Road service main was submitted by George Hyman, Washington, at $8,465.

★Toledo, Ohio.—Contract for constructing extension of marsh drainage sewer No. 1139 awarded M. Rabbit & Sons, 115 Nasby, at $9,006.

★East Chicago, Ind.—Contract awarded Shea & Co., 253 Highland Street, Hammond, for constructing Buffington Addition main sewer system at $13,595. Other bidders: Thomas Lavene, $14,373, and Cal. Construction Co., $13,396, both of Hammond.

★Mason City, Iowa.—Contract for constructing sewer on Main Street awarded by city to Intermountain Bridge & Constr. Co., Tecumseh, Neb., at about $23,000.

★Seattle, Wash.—Contract for constructing sewers in North and West Forty-eighth Street awarded by Board Public Works to D. Parisi Co., 1506 Sixteenth Avenue, S, at $9,531.

San Diego, Cal.—Lowest bid received for constructing the Ocean Beach sewer system was submitted by Doran & Armstrong of San Diego, at $48,799. Allen H. Wright, City Clerk.

★Winnemucca, Nev.—Contract awarded E. Reinhart & Co. for constructing extension to sewer system. R. E. Tilden, Engineer, Winnemucca.

BRIDGES

PROPOSED WORK.

Jersey City, N. J.—Bd. Freeholders voted $16,000 bonds toward constructing the Belleville Bridge.

Harrisburg, Pa.—Citizens voted $30,000 bonds to construct bridge. M. B. Cowan, City Engineer.

Johnstown, Pa.—Horner Street bridge bonds for $50,000 will be sold Dec. 13 by Harry W. Slick, City Treasurer.

Rome, Ga.—Bridge bonds for $225,000 will be sold Nov. 24, by Commissioners Roads and Revenue (J. G. Pollock, Chmn.).

Jefferson City, Tenn.—The War Dept. authorized the construction of a steel bridge over Holston River, near Davis Ferry; cost about $11,500. Jefferson County to pay half of cost. Dandridge, county seat.

Milwaukee, Wis.—Bd. Public Works directed to prepare plans for constructing bridge over Milwaukee River at North Avenue; cost about $240,000.

Omro, Wis.—A steel and reinforced concrete bridge is to be constructed over Fox River by Wisconsin Highway Commission, Madison, to have three 90-ft. fixed spans and one 80-ft. lift span; cost $25,000. M. W. Torkelson, Bridge Engineer, Madison.

North Platte, Neb.—Contract to be let some time this winter by Roy Cochrane, County Engineer, McCabe Building, for constructing a concrete bridge and several blocks of brick paving.

Seattle, Wash.—See "Paving and Roads."

Riverside, Cal.—Crescent City Ry. (W. J. Bohon, Gen. Mgr. and Purchasing Agent, Riverside) having plans prepared for concrete bridge 66 ft. span 22 ft. wide under its line at Fairmount Boulevard.

BIDS DESIRED.

New Gretna, N. J.—Until Dec. 8, by Board Chosen Freeholders counties of Atlantic and Burlington, at G. A. R. Hall, New York Avenue, Atlantic City, for constructing a bridge 742 ft. long, to consist of creosoted pile trestle approaches, steel trusses and bascule draw span with wood block floor and concrete substructure, over Mullica River at Chestnut Neck, New Gretna. A. H. Nelson, Engr. Atlantic County, Guarantee Trust Building, Atlantic City, and Jas. Logan, Engr. Burlington County, 11 Main Street, Mount Holly.

Norristown, Pa.—Reported desired until Nov. 22, by County Commissioners, for the Phoenix-Mont Clare bridge over Schuylkill River.

Pennsylvania.—Until Dec. 7 by State Highway Department, Harrisburg, for constructing bridge as follows (Robert J. Cunningham, State Highway Comr.): Erie County, double 50-ft. span plate girder bridge in Harbour Creek Township.

Selma, Ala.—Until Dec. 13, by Board County Commissioners, for furnishing steel and erecting 9 bridges from 12 to 200 ft. long. W. O. Crisman, Co. Engr.

Holly Springs, Miss.—Until Dec. 6, by Board County Superv. (C. H. Wright, Clk.), for constructing 4 bridges, on Red Bank Creek, to be 100, 150, 100 and 380 ft. long, respectively.

Leakesville, Miss.—Reported desired until Dec. 6, by County Supervisors (S. R. McKay, Clk.), for constructing steel and iron bridge over Chickasawhay River.

Jackson, Tenn.—Until Nov. 30, by E. G. Buck, County Engineer, Jackson, for three highway bridges, across 40 ft. canal, advertised in Engineering Record.

Lorain, Ohio.—Until Dec. 8, by Bd. Co. Comrs. (F. L. Ellenberger, Clk.), for furnishing material and constructing cribbing on south side of Erie Ave. bridge, Black River, Black River Township, Lorain. F. P. Crosse, Co. Surv.

Marion, Ill.—Until Nov. 30 at office of P. B. Wilson, Co. Supt. Highways, Marion, for constructing Pigeon bridge, West Marion Township, of steel, 50-ft. span, 16-ft. roadway, on either reinforced concrete or creosoted timber abutments. Engineer's estimate for steel bridge, on concrete abutments, $4,060; on creosoted timber abutments, $2,120.

Wathena, Kan.—Until Dec. 7, by W. L. Privett, Co. Clk., Troy, for constructing Peters Creek bridge over Peters Creek, Wathena, a reinforced-concrete arch structure 60-ft. span, 18-ft. roadway, 5-ft. sidewalk.

Bakersfield, Cal.—Until Dec. 9, by Board Supervisors (I. L. Miller, Clk.), for grading and constructing culverts on Division 11, Section 3, approximately 2.1 miles long, and grading, paving and constructing culverts, Division 5, Section 1 A—Bakersfield-Mc Kittrick Road—approximately 7 miles long.

California.—Until Nov. 29, by California Highway Commission, 515 Forum Building, Sacramento, for constructing a plate girder bascule bridge, 80 ft. clear span, with reinforced-concrete approaches, in Yolo County; total length 141 ft.

PRICES AND LETTINGS.

★Indicates award of contract.

★Arcadia, Fla.—Contract for constructing 10 concrete bridges in county awarded by County Comrs. to Luten Bridge Co., York, Pa., at $20,000.

★Illinois.—Contracts awarded by William W. Marr, chief State Highway Engineer, Springfield, for constructing State Street Bridge, Rockton Township, Winnebago County, as follows: Superstructure to Worden-Allen Company, Milwaukee, Wis., at $8,800 and substructure to Northern Steel & Concrete Company of Freeport, Ill., at $2,499.

★New York, N. Y.—Following are unit figures of four lowest bids opened Oct. 26, by Bd. Water Supply, for Contract 12B—constructing two superstructures for Hill View Reservoir and appurtenant structures in city of Yonkers (by William H. Egan, 147 E. 86th Street, [illegible] Contracting Engineers); (b) Merritt Arch Company, 216th Street and Broadway, Bronx; (c) Louis Wechsler, 1181 Broadway; (d) A. L. Guidone & Son, Inc., 35 East Twenty-third street, $[illegible].

	(a)	(b)	(c)	(d)
1000 bbl. (gross) Portland cement	$[illegible]	$[illegible]	$[illegible]	$[illegible]
200 bbl. White Portland cement	2.20	4.60	2.60	2.60
Hill View Reservoir Chamber superstructure, exclusive of Items 1 and 2, lump sum	35,333.00	39,666.00	25,100.00	37,254.00
Hill View Reservoir Chamber superstructure, exclusive of Items 1 and 2, lump sum	54,556.00	54,000.00	58,100.00	60,184.00

★**Longview, Tex.**—Contract for constructing steel bridge over Sabine River awarded by County Commissioner to Blodgett Construction Company of Kansas City, Mo.; cost $20,000.

★**Spokane, Wash.**—Contract for steel construction work on five viaducts for Northern Pacific Ry. Co. awarded to Poole & Bean, Portland, Ore., at $16,000.

★**Walla Walla, Wash.**—Contract for constructing steel truss bridge 100 ft. span, awarded C. L. Graves of Spokane, at $4,090. G. C. Cookerly, County Engineer.

California—Lowest bid opened Nov. 1 by California Highway Commission, Sacramento for constructing the reinforced concrete 300 ft. bridge across Myers Creek in Imperial County submitted by Holland Construction Company, San Diego, at $15,600.

★**Corunna, Cal.**—Contract for constructing 200-ft. bridge and 300-ft. trestle over Santa Ana River awarded by County Bd. Supervisors, at Riverside, to Hugh G. Purcell, at $11,357.

★**Moncton, N. B.**—Contract for construction superstructure of bridge over Petitcodiac River at Moncton awarded by Provincial Government to Dominion Bridge Co., Montreal, Que., at about $125,000.

PAVING AND ROADS

PROPOSED WORK.

Shelburne Falls, Mass.—About $12,000 to be spent by the town of Shelburne Falls for reconstructing Greenfield and Colrain Road in Shelburne Falls.

Brookhaven, L. I., N. Y.—The town Bd. voted to construct five concrete roads, at cost of $24,000.

Buffalo, N. Y.—George C. Diehl, County Engineer, recommended to Bd. Supervs., Nov. 9, that $100,000 annually be put in the county budget for improvement of county highways.

Common Council voted to pave Camden, E. Woodlawn and Colgate Avenues, Cheltenham Drive, Roanoke Park and Abbott Road.

Mineola, L. I., N. Y.—About $600,000 Nassau County Road improvement bonds sold by Bd. Supervisors.

Asbury Park, N. J.—Reported contract is about to be let by City Commission for paving Main Street from Summerfield Avenue north to Main Street Bridge.

Jersey City, N. J.—Bd. Freeholders voted $20,000 bonds for paving Passaic Avenue, Kearny.

Johnstown, Pa.—Highway improvement bonds for $100,000 will be sold Dec. 13, by Harr W. Slick, City Treasurer.

Mount Penn, Pa.—About $20,000 bonds voted for road improvements.

Pittsburgh, Pa.—All bids opened Sept. 23 by Hyatt M. Cribbs, County Comptroller, for improving Painters Run Road, Mount Lebanon, and Upper St. Clair and Scott Townships, a distance of four miles, have been rejected. Road is not to be built.

Wyomissing, Pa.—City Council considering spending $30,000 for street improvements.

Pineville, W. Va.—Blake Taylor, Pineville, appointed chief engineer of road construction in this county under $550,000 road and bridge bond issue. Location and design well under way and several roads will be ready for contract in early spring.

Taylorville, N. C.—About $150,000 road bonds sold by County Comrs.

Summerville, S. C.—Construction of a concrete road around the park between the park and Southern Ry. station, to improve sidewalks and bridges and to build 4½ miles Augusta gravel road, is contemplated by city.

Auburndale, Fla.—The Freeholders voted to issue $30,000 bonds for constructing hard roads to connect with county hard surface roads.

New Augustine, Fla.—County Commissioners at St. Augustine will pave King Street, New Augustine, to cost $10,000.

Biloxi, Miss.—About $200,000 is to be spent by Harrison County Bd. Supervisors at Gulfport for constructing 22 miles of road from Biloxi to Pass Christian.

Cleveland, Miss.—Road Dist. No. 1 of Bolivar County approved of a bond issue of $150,000 for gravel roads.

Jackson, Miss.—Hinds County Bd. Supervs. voted to issue $50,000 bonds for constructing roads in western part of county.

Bellevue, Ky.—Citizens voted Nov. 2 to issue $23,000 bonds for improving Taylor Avenue. Edward Price, Jr., City Clerk.

Dayton, Ohio.—Citizens voted a good roads tax levy which will provide about $500,000 for road improvement in Montgomery County.

Sandusky, Ohio.—County Comrs. will spend about $64,000 for road improvements during 1916.

Youngstown, Ohio.—City Council considering paving Federal Street between North Avenue and East End Bridge and Wilson Avenue, between viaduct and easterly city limits. Mahoning & Shenango Ry. & Light Co. to pave between the tracks.

Sterling Ill.—Preliminary steps being taken on paving about thirty blocks with paving blocks on Third Street and Sixth Avenue. Harold Ward, City Clerk.

Racine, Wis.—Reported about $70,888 may be available for road improvement in Racine County during 1916.

St. Paul, Minn.—City Council voted to pave Grove Street with creosote blocks; cost $13,333.

Fargo, N. D.—See "Water Works."

Livingston, Mont.—City Council voted to pave Second Street, cost about $12,150.

El Dorado, Ark.—Plans and estimates prepared by State Highway Dept. at Little Rock for constructing 40-mile highway from El Dorado to Felsenthal and Huttig via Strong, estimated cost $200,000, also for road from El Dorado to Junction City.

Ft. Smith, Ark.—The Quorum Court of Ft. Smith Dist. appropriated about $50,000 for road improvements.

Lake Village, Ark.—Construction of 40 miles macadam or concrete road is contemplated by county

Little Rock, Ark.—About 22 miles of roads to be constructed in Pulaski County during 1916; cost about $60,000.

Marshall, Ark.—A 14-mile road is to be constructed in Road Improvement Dist. No. 1, extending from Marshall north; cost about $14,000. V. C. Bratton, Comr.

Osceola, Ark.—Luxora and Osceola Dists. plan to spend about $300,000 each for road improvements.

Osceola and Little River Roads Districts have sold $220,000 bonds. It is reported 50 miles of hard surfaced road, 25 miles of which are concrete, are to be built.

Crystal City, Tex.—Citizens voted $40,000 bonds for road improvements.

Huntsville, Tex. — Comrs. Walker County approved of a bond issue of $100,000 for road improvements.

Ritzville, Wash.—Comrs. Adams County at Ritzville considering extending highway from Lind to Ralston and from Ritzville westerly about 11 miles and southerly to Lind.

Seattle, Wash.—Reports and estimates of cost at $16,160 and $10,376 respectively have been submitted to Bd. Public Wks. by Engineering Dept. for paving Harrison Street with brick and constructing concrete walks on Twenty-ninth Avenue.

Portland, Ore.—About $25,800 street improvement bonds sold by city.

John B. Yeon, Roadmaster Multnomah County at Portland submitted to County Comrs. estimates of cost for constructing roads and maintenance of same, during 1916, at $588,222.

Los Angeles, Cal.—Board of Supervisors has appropriated $325,000 for constructing the Mint Canyon Road.

Mill Valley, Cal.—Bd. Trustees considering expending $10,000 annually for a period of 5 years for street improvements.

Idaho Falls, Idaho.—City Council voted to pave several streets, cost about $15,000.

Jerome, Idaho. — Appleton Highway Dist. reported voted $25,000 bonds for constructing highways. O. H. Albee, Highway Director Appleton Highway Dist.

Orofino, Idaho.—City engaged Robert B. Swadener, Box 121, Orofino, to prepare plans and estimates for two improvement districts about 7 or 8 blocks. Intention to pave with concrete sidewalks and curb included for both districts. Contract to be let in the spring.

Toronto, Ont.—City Council considering grading and paving Yonge Street Hill, cost about $18,000.

BIDS DESIRED.

Long Island City, L. I., N. Y.—Until Nov. 22, by Maurice E. Connolly, Pres. Queens Borough, for paving with wood block on concrete foundation portions of Church Street, asphalt concrete pavement on portions of Broadway, together with sidewalks, etc. Total security $5,500.

New York, N. Y.—Until Nov. 23, by Marcus M. Marks, Pres. Manhattan Borough, for improving portions of W. 145th, W. 178th, E. Ninety-sixth Streets, Exterior, Columbus and Haven Avenues, in all about 25,680 sq. yd. sheet asphalt on concrete foundation, together with sewer, manholes, etc. Total security $19,200.

Mount Holly, N. J.—Until Nov. 29, opened at the office of Jas. Logan, 11 Main Street, Mount Holly, for water-bound macadam paving as follows:

By Southampton Township Committee for improving Vinceton and Buddtown Road about 13,280 sq. yd.

By Southampton and Lumberton Township Committees for Vincetown and Eayerstown Road, about 10,648 sq. yd.

Philadelphia, Pa.—Local press reports state bids will be received until Nov. 23, by Department Public Works, for improving portions of D, Fox, Railway and a number of other streets with asphalt, portions of Rockland Street with vitr. block, and Harvey Street with granite block.

Wauchula, Fla.—Reported desired until Dec. 6, by City Clerk, for approximately 13 miles of sidewalks. Probable cost $20,000.

Edwards, Miss.—Until Dec. 6 by Highway Commissioners of Township 16-5 and 6-4, W. Supervisors Dist. No. 2, addressed to A. J. Lewis, Jr., for constructing certain roads in said district with gravel, approximately 6.25 miles.

Maynardville, Tenn.—Reported desired until Jan. 3 by George M. Taylor, Chmn. Co. Comrs., for constructing macadam roads and bridges.

Albany, Ky.—Bids are wanted by County Fiscal Court (C. B. Parrigin, Chmn.), for constructing 22 miles waterbound macadam road; also 3000 ft. culvert pipe, 100 bbl. Portland cement, one leaning wheel grader, a gasoline or steam road roller, six wheel and five drag scrapers, etc. C. S. Parrigin, Engr., Albany.

Dayton, Ohio.—Local press reports state bids are wanted until Nov. 29, by City Purchasing Department, for 38,000 bbl. of cement to be used in construction of Fifth, Keowee and Webster Streets. Estimated cost $29,000.

Indiana.—Bids desired by County Commissioners for constructing road as follows:

Until Dec. 6:

Tipton, gravel road in Madison and Cicero Townships. Oscar Vanness, Co. Aud.

Kentland, macadam road in McClellan Township. S. R. Sizelove, Co. Aud.

Franklin, gravel road in Franklin and Union Townships. H. L. Knox, Co. Aud.

Greencastle, 11,550 ft. macadam road in Jackson and Floyd Townships, 5459 ft. in Monroe Township and 9763 ft. in Marion Township. C. L. Airhart, Co. Aud.

Until Dec. 7:

Vincennes, gravel road in Washington and Decker Townships, 11,457 and 12,566 ft. in length. Joseph I. Muentzer, Co. Aud.

Brazil, two limestone and gravel roads in Harrison Township. W. O. Graeser, Co. Aud.

Madison, for 10-ton traction roller, new or second hand, with or without scarifier. C. S. Dibler, Co. Aud.

Until Dec. 8:

Muncie, graveling and macadamizing. Edward C. Schwer Road and Thomas Hiatt Road, Mount Pleasant Township. Francis M. Williams, Co. Aud.

Dixon, Ill.—Reported desired until Nov. 23, for 1416 sq. yd. cement roadway, etc., on Lincoln Road, also 2300 ft. cement concrete pavement, etc., on East River St. Probable total cost, $6,329. C. Nesbit, City Engr.

St. Paul, Minn.—Until Nov. 22, by August Hohenstein, Purchasing Agent, for improving portions of Arcade Street, Snelling Avenue and other streets and alleys.

Austin, Tex.—Until Nov. 26, for paving city streets. Cost about $218,000. P. W. Powell, Street Comr.

Seattle, Wash.—Reported desired until Dec. 10 by Board Public Works (L. B. Young, Chmn.) for improving portion of Railroad Avenue by constructing concrete seawall, filling, reconstructing sewers and water mains and paving with brick block, etc.; probable cost $100,000.

Bakersfield, Cal.—See "Bridges."

El Centro, Cal.—Reported desired until Dec. 6 by State Highway, Sacramento, for constructing about 12 miles concrete highway between Dixieland and El Centro, requiring approximately 40,000 to 50,000 cu. yd. excavation, 10,000 and 17,500 cu. yd. concrete pavement, corrugated iron and reinforced concrete culverts.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Massachusetts** — Contract for constructing a section of state highway in town of Woburn (bids opened Oct. 26). awarded by Massachusetts Highway Commission, Boston, to Davis & Pallato, Lowell, at $11,968.

Albany, N. Y.—Following are totals of four lowest bids opened Nov. 11 by State Commission of Highways, 55 Lancaster St., for constructing highways by State aid:

Road 1317—Auburn—Weedsport, Cayuga County, 8 miles; Brayer Bros., Auburn, $123,709; Sullivan Constr. Co., Syracuse, $123,809; John Young, Syracuse, $124,724, and Newport Constr. Co., Herkimer, $129,715.

Road 5596—Mayville Village—Erie St., Chautauqua Co., .79 mile, Edward T. Beck & Co., Warren, Pa., $25,801; Elmer F. Love & Son, Corry, Pa., $26,530; Ontario Roads Co., Inc., Manchester, $26,922, and Kendar Eng'g & Contr. Co., Inc., Buffalo, $27,162.

Road 1339—Leroy—Brockport, Pt. 2—Genesee County, .4 mile, Atlanta Constr. Co., Atlanta, $13,010; Rhodey & Clawson, Albion, $14,120; Parker & Carney, Batavia, $14,031; Peter F. Connolly, Horseheads, $14,745.

Road 1253—Chaumont—Depauville, Jefferson County, 6.05 miles, Henry P. Burgard, Buffalo, $45,249; Richard Hopkins, Troy, $47,454; Gruner & Hollenback, Harriman, $48,248; Hendrickson - McCabe Constr. Co., Spencerport, $48,319.

Road 512—Akin—Johnstown, Pt. 1., Montgomery Co., 4.59 miles, Routley & Summers, Huntingdon, Quebec, $29,528; S. B. Van Wagenen, Inc., Rondout, $31,010; John Arborio, New Haven, Conn., $31,715; Brady-Oltarsch Constr. Co., 49 W. 140th St., New York City, $32,377.

Road 5558 — Oneida — Verona, Oneida County, 4.69 miles, J. G. Hayes Co., Inc., Rome, $36,625; James Rossney, Buffalo, $38,135; Chas. O. McComb, Syracuse, $38,322; Fort Schuyler Constr. Co., Inc., Oneida, $38,493.

Road 5597 — Utica — Poland, Part 3, Oneida County, 5.34 miles, Routley & Summers, Huntingdon, Quebec, $51,592; Hovey E. Benedict, Williamsport, Pa., $51,707; James Rossney, Buffalo, $54,129; Kendar Eng'g & Constr. Co., Inc., Buffalo, $54,759.

Road 1338—Scotia—Saratoga County Line, Pt. 1, Schenectady County, 4.22 miles, De Graffe & Hogeboom, Inc., Kingston, $33,776; S. B. Van Wagenen, Inc., Rondout, $35,081; John Arborio, New Haven, Conn., $36,208; Dana W. Robbins, Inc., New York City, $38,308.

★Contract for paving canal terminal plaza north of North Ferry St., awarded by city to Patrick Mulderry, Albany, at $33,705.

★Contracts for above roads awarded by State Commission of Highways as follows:

Road 5596—Mayville Village-Erie Street, Chautauqua Co., 0.79 mile, Edward T. Beck & Co., Warren, Pa., $25,800.

Road 1253—Chaumont-Depauville, Jefferson County, 6.05 miles, Henry P. Burgard, Buffalo, $45,249.

Road 512 — Akin-Johnstown, Part 1, Montgomery Co., 4.59 miles, Routley & Summers, Huntington, Quebec, $29,528.

Road 5558 — Oneida-Verona, Oneida Co., 4.69 miles, J. G. Hayes Co., Inc., Rome, $36,624.

Road 5597—Utica-Poland, Part 3, Oneida Co., 5.34 miles, Routley & Summers, Huntington, Quebec, $51,591.

★Additional contracts awarded by State Commission Highways as follows:

Bids opened Oct. 26:

Road 5532—Arkport-Van Scoters Corners, Allegheny and Steuben Cos., 5.25 miles, Kennedy Constr. Co., Albany, $50,882.

Road 1327—Fleming-Scipio, Part 2, Cayuga Co., 6.06 miles, John H. Gordon, Albany, $52,010.

Road 5594—Plattsburg-Ingraham, Clinton Co., 3.79 miles, Bluff Point Stone Co., Inc., Plattsburg, $29,160.

Road 1331—Claverack-Chatham, Part 1, Columbia Co., 4.27 miles. Russo-Parker Constr. Co., Hudson, $39,756.

Road 1332—Claverack-Chatham, Part 2, Columbia Co., 7.77 miles, Marks Kearney, Hudson, $62,186.

Road 5595—Broome County Line-Marathon Village, Cortland Co., 3.65 miles, T. H. Gill Co., Binghamton, $39,759.

Road 1334—Transit, Part 1, Erie, Co., 4.3 miles, Langan Constr. Co., Albany, $70,049.

Road 5593 — Caledonia-Mount Morris, Part 1, Livingston Co., 7.69 miles, James Anderson, Albany, $63,063.

Road 5582—Leroy-Pavilion, Part 2, Genesee Co., 4.53 miles, Chilson & Gibson, Leroy, $44,893.

Road 1110—Oneida-South Bay, Part 1, Madison Co., 3.05 miles, Mohawk Engineering Co., Mohawk, $26,150.

Road 1326 — DeRuyter Village-Albany Street, Madison Co., 0.18 mile, Charles E. Nash & Frank G. Griffin, Norwich, $2,282.

Road 1328—Winton Road-North, Monroe Co., 0.73 mile, Whitmore-Rauber & Vicinius, Rochester, $12,927.

Road 1327 — East Rochester-Penfield, Monroe Co., 2.91 miles, Ribstine-Holter Co., Inc., Rochester, $35,548.

Road 5547—Whitesboro-Carey Corners, Oneida Co., 0.7 mile, Langan Constr. Co., Albany, $17,188.

Road 5274—A—Phoenix-Syracuse, Onondaga Co., 0.18 mile, M. J. Gleason & Co., Syracuse, $2,175.

Road 448—Port Jervis-Sullivan County

★**Ontario, Cal.**—Following are unit prices of bids opened Sept. 27 by Board City Trustees for improving east and west roadways of Euclid Avenue, approximately 345,000 sq. ft. (contract signed Nov. 9): (a) Ford & Stout, Bradbury Building, Los Angeles, $57,089 (awarded contract); (b) David Joy, $57,318; (c) Johnson Shea Co., Riverside, $58,638; (d) Highway Constr. Co., Highlands, Cal., $59,302. B. B. Mann, City Engineer.

	*(a)	(b)	(c)	(d)
316,060 sq. ft. paving 4-in. concrete base and asphaltic oil wearing surface	$0.0925	$0.1025	$0.10	$0.10
33,080 sq. ft. same, cement finish at gutters	0.105	0.1025	0.105	1.105
57,888 sq. ft. surfacing cobblestone gutter with cement mortar	0.05	0.05	0.06	0.05
9,520 sq. ft. reconstructing and finishing, same	0.05	0.07	0.075	0.10
152,072 sq. ft. macadam paving, 4 in.	0.085	0.07	0.074	0.077
171,830 sq. ft. resurfacing with oil and screenings	0.01	0.00625	0.005	0.0125
56,390 sq. ft. 5-in. concrete gutters	0.11	0.11	0.13	0.115

Line, Part 2, Orange Co., 2.0 miles, Armstrong & Trowbridge, Middletown, Bidder — Bids for 3 Sections Were Received, Orange Co., $10 miles, A. Lindgren, Engineer, $48,000.

Road Improvement—Goshen Village, Church, East Main and Main Streets and Connecting Streets, Orange Co., 1.17 miles, State Dept. of M. Supervisor, New York City, $47,000.

Road [illegible]—Northern and Centennial Avenues, Saratoga Springs, Saratoga County, Engineer Miles, $5,000.

Road [illegible]—Brookfield, Sherrill, Oneida Co., 4.6 miles Greenfield Constr Co., Hornell, $41,000.

Road [illegible]—A—Harrisburg-Mechanicsville, Part 1, Saratoga Co., Henry McNamee, Engineer, $7,000.

Road [illegible]—Stormer-Candor, Part 2, Tioga Co., 6.6 miles, Peter F. Connolly Co., Syracuse, $40,000.

Road [illegible]—Hibbard-Ely Glen, Tompkins Co., 2.61 miles, Greenfield Constr Co., Hornell, $47,000.

Road [illegible]—Newcomb-Minerva, Ulster Co., 14.5 miles, Armstrong & Trowbridge, Middletown, $45,000.

★Buffalo, N. Y.—Common Council awarded contracts for paving as follows: Abbott Road at $41,716, Broadway Avenue to D avenue, at $41,716; Lovejoy Avenue with asphalt at $9,318, to German Bank Asphalt & Cement Co.; D. S. Morgan Bldg., Spaulding Street with brick, at $4,000, to Commissioner Constr. Co.; Bidwell Avenue with brick, at $4,365, to Con Cantor Co.; S. S. Morgan Bldg., and Spaulding Street, with brick, at $22,490, to Hyde & Frier, Buffalo.

★New York, N. Y.—Contract awarded as follows by Thomas M. Marks, President Manhattan Borough, for paving:

★Concrete-Base Paving—Front Street, from Whitehall Street to Coenties Slip, and Cross Old Slip to Pearl Street, to W. J. Flynn, at $1.49 per Forty-fifth Street, at $1.4[illegible] Fortieth Street, from Third to Fourth Avenues, and Fifty-fifth Street, from Lexington to Twelfth Avenues, to A. J. Sciarra, 31 Union Square, at $1.39 and $1.71[illegible] respectively, and Eighteenth Street, from Sixth to Seventh Avenues, to M. Rapid Co., 633 E. Ninety-second Street, at $1.62.

★Sheet Asphalt—Lexington Avenue, from Thirty-seventh to Forty-first Streets; Twenty-fifth Street, from Sixth to Seventh Avenues, and Seventy-eighth Street, from First to Third Avenues, to Sheehan Asphalt Paving Co., 41 Park Row, at a total of $[illegible]; Seventy-second Street, Lexington Avenue to Central Park West, at $[illegible], and Sixth Avenue, from Eighth to Seventeenth Streets (proposed) Avenue, from Sixth Avenue to Perry Street, and Tenth Street, from Greenwich to Sixth Avenues, at $[illegible] both to Artec Asphalt Co., 30 West Street.

★Hightstown, N. J.—Contract awarded Mottsenberg & Cummings, 1218 Chestnut Street, Philadelphia, Pa., for five miles of road between Hightstown and Princeton; also seven miles extra cement pipe line, cost $[illegible].

★Stone Harbor, N. J.—Contract for constructing board walk awarded by City Council to Pennoyer Engineering Co., Philadelphia, Pa., at $[illegible].

★Connellsville, Pa.—Contract for paving Washington Avenue and E. Apple Street awarded by City Council to J. I. Nash, Connellsville, at about $[illegible].

★Pittsburgh, Pa.—Contract for improving Denniston Avenue about 4 miles, including Duffins Gardens Construction Company, Perrys Avenue, Pittsburgh, at $[illegible]. Hugh M. Cullen, County Comptroller.

New Orleans, La.—Following are bids opened Nov. 8 by Commission on Public Finance for erecting an asphalt plant on grounds of municipal repair plant, Broadway & Dublin, New Orleans, $[illegible], Warren Brothers Company, Boston, Mass., $[illegible] (own specifications) $31,-611.

★Columbus, Miss.—County Bd. Supervisors awarded contract for macadamizing with Bahamian gravel 10 miles of roads to Boone & Co., Columbus.

★Park City (P. O. Knoxville), Tenn.—Council of Park City (Jeffrey Magnolia, Avenue) awarded to Park City Council to County Constr. Co., Knoxville, at about $[illegible].

★Granville, Ohio.—Contract for paving Broadway, granite block (Engineering Co., Lewis, Eng'r Morton, Village Clerk.

★South Bend, Ind.—Contract for constructing 2 gravel roads in Madison Township awarded by County Comrs. to H. S. Reed & Sons, Mishawaka, Ind., at $[illegible].

Independence, Mo.—Following bids opened by County Court for paving Lexington Road [illegible] Avenue, Kansas City, Mo., and Missouri Paving Co., Kansas City, Mo., $14,[illegible].

★Longview, Tex.—Contract awarded by County Commissioners to Orange Construction Company, Vicksburg, Miss., for constructing 8 miles of gravel road and erection of [illegible] at approximately $[illegible]. D. E. Caldwell, County Engineer.

★Pleasanton, Tex.—Contract for improving roads in county awarded to Co Constr. Co., of Atascosa County, to A. N. Dawson, San Antonio, at about $[illegible].

★Seattle, Wash.—Contracts for furnishing material to be used by the construction of approaches to Fifteenth Avenue, N. W., Ballard, at Ballard, awarded by Bd. Pub. Works, as follows: Creosoted piling to Pacific Creosoting Co.; plain piling to C. K. Lloyd, lumber, creosoted and plain, to Pacific Fir Lumber Co., at $11 per M., and hardware and casting, to Seattle Car & Foundry Co.

★Contract for constructing walks on Fauntleroy street awarded by Bd. Public Works to Bowan & Anderson, Transportation Building, at $11,676.

★Arcadia, Cal.—Contract for constructing 14 miles of oiled macadam road (bids opened Nov. 4) awarded by George E. Goldsen, City Clerk to Rogers Bros. Co., Los Angeles, at $115,000.

Bakersfield, Cal.—Following are lowest bids opened for paving 3 miles Belleview Rd.: (a) asphaltic wearing surface; (b) with asphaltic [illegible] price given per sq. ft.): Clarke & Henery Constr. Co., Stockton, (a) 51 cts., (b) 9.2 cts.; Castro & Blaisdell, (a) 8¾ cts., and Federal Constr. Co., San Francisco, (a) and (b) 10.4 cts.

★California.—Contracts awarded by California Highway Commission, Sacramento as follows (bids opened Oct. 18):

★Placer County (between Lincoln and the northerly boundary), Division III, Route 3, Section B, to C. H. & A. W. Cowell, 642 Call Building, San Francisco, $[illegible].

★Mariposa County (between the westerly boundary and Cathay-White Rock Road), Division VI, Route 18, Section A, to Geo. K. Daley, 440 McNeece Building, San Diego, $42,749.

★Hermosa Beach, Cal.—Contract awarded California-Arizona Construction Company, 1700 East Washington Street, Los Angeles, at $[illegible], for concrete and oil paving, ornamental lights, cement curb and gutters.

★Toronto, Ont.—Contract for brick block pavement on Coxwell Avenue from Gerrard Street, east to 1500 ft. north, awarded Grant Contracting Company at $15,795; sheet asphalt on portions of Bleecker Street, Elmwood and Spring Grove Avenues, also a portion of Coxwell Avenue from 1500 ft. north Gerrard Street to Danforth Avenue, to Commissioner Public Works at $22,048.

STREET CLEANING AND GARBAGE DISPOSAL

PROPOSED WORK.

Kingsville, Tex.—City reported to be considering erecting an incinerator plant costing about $20,000.

BIDS DESIRED.

York, Pa.—Until Dec. 2 by C. A. Boyer, Superintendent Streets and Public Improvements, for collection and disposal of organic and inorganic garbage for a period of five and ten years from April, 1916, advertised in Engineering Record.

PRICES AND LETTINGS.

★Indicates award of contract.

★Newark, N. J.—Contract awarded Newark Paving Co., Newark, for collecting garbage for five years at $898,200.

★Decatur, Ill.—Contract for constructing garbage incinerator awarded by Alfa Engineering Co. to Bosker Efficiency Engineering Co., 608 S. Dearborn Street, Chicago; cost $[illegible].

★Toronto, Ont.—Contract for constructing new Don incinerator exclusive of chimney, awarded George Wolof, Toronto, at $84,500.

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS

PROPOSED WORK.

Flood Abatement—Olean, N. Y.—E. W. Bemis and Irving Flood Abatement Commissioners, Olean, writes under date of Nov. 11, plans for Olean Flood Abatement project have been passed upon by State Superintendent Public Works and engineers employed to supervise the contract drawings. The sum of $[illegible] is available and bids may be asked about Dec. 1.

Drainage—New Smyrna, Fla.—The Lake Ashby Drainage District formed, but nothing further done on the matter. Neal H. Wilcox, secy. of the District at New Smyrna.

Ditch Bonds—Greenville, Ohio.—Ditch improvement bonds amounting to $23,400 have been sold.

Levee Improvement—Cairo, Ill.—Oldham & Bradley, Cairo, are engineers for the Log Creek levee and drainage project in Alexander County. L. T. Bartlett, Consulting Engineer, Clarksdale, Miss.; C. O. Fisher, Chief Consultant.

River Improvements—Quincy, Ill.—City Council and Chamber of Commerce have formulated plans for river terminals to cost $[illegible], which call for a 350-ft. concrete sea wall 13 ft. above low water, a freight house 301 x 40 ft., 5525 ft. of tracks, an electric freight engine, a 12-ton electric locomotive and a package freight elevator.

Drainage—Ashland, Wis.—Preliminary steps being taken to drain swamp lands near Grend View at a cost of $100,000. R. S. Owen, of Madison, Engineer; J. S. Ellis, Secy.

Dam—Shawano, Wis.—Citizens voted in favor of constructing a dam and hydro-electric plant on Wolf River to cost $56,-000. Power Engineering Company, Minneapolis, Minn. Designing Engineers, W. E. Eascott, City Clerk.

Drainage—Blytheville, Ark.—Bonds of Drainage District No. 16, amounting to $325,000 have been sold. Nelson Moore, Manila, Ark., Commissioner.

Drainage—Aldine, Tex.—Drainage bonds amounting to $140,000 for improvements in Dist. No. 7, which includes Aldine and Mount Houston, have been sold. W. H. Ward, County Judge, Houston.

Drainage Bonds—Corpus Christi, Tex.—Drainage bonds amounting to $157,000 have been sold, to reclaim land in vicinity of Robstown.

Irrigation—Donna, Tex.—Contract will be let early part of December for enlarging canal system, pumping plant, etc., for Donna Irrigation District (D. H. Barr, Secy.).

Seawall—Galveston, Tex.—To carry out city's part of boulevard protection plan recommended by H. M. Robert it will cost city $189,180, according to a report filed with City Commission by A. T. Dickey, City Engr. Included in the estimate is 282,000 cu. yd. sand fill, 5900 cu. yd. clay embankment, 20,000 cu. yd. shell surfacing, 15,000 cu. yd. mainland soil. The clay embankment to be 10 ft. wide, 3 ft. deep and 4 ft. above seawall, which is to extend from Sixth Street and Avenue "J" to Nineteenth Street and County Boulevard.

Irrigation—North Yakima, Wash.—The Selah Moxee Canal Company intends improving the canal and will replace about 3000 ft. of the flume at a cost of $10,000.

Drainage—Seattle, Wash.—Board of County Commissioners have created a drainage district to reclaim approximately 1000 acres near Issaquah.

Channel Improvement—Tacoma, Wash.—Reported Oregon-Washington R. R. & Navigation Company and the Glasier Fish Company will spend about $140,000 for terminals on the middle waterway including dredging of channel at a cost of $125,000 and erecting a cold storage plant at a cost of $15,000.

Channel Improvement—Astoria, Ore.—Port of Astoria Commission contemplating dredging channel at mouth of Skipanon River at Warrenton, about 400,000 cu. yds., and costing $60,000, but nothing definite has been done about the matter. F. J. Walsh, Chief Engineer Commission.

Irrigation—Holbrook, Ariz.—Contract soon to be let for rebuilding the Woodruff dam and repairing irrigation works. Surveys have been prepared by State Engineer, Phoenix, under whose supervision dam is to be built. Appropriation $10,000. Q. R. Gardner, County Supervisor.

BIDS DESIRED.

Dredging—Brooklyn, N. Y.—Until Dec. 11, by Bureau Yards & Docks, Navy Dept., Washington, D. C. (H. R. Stanford, Ch.), for dredging at the navy yard, Brooklyn, N. Y.

Dredging—New York, N. Y.—Until Nov. 24 by Cabot Ward, Pres. Park Board, for dredging in the North River between 103d and 109th Streets. Security $2,000.

Dredging—New York, N. Y.—Until Nov. 23, by R. A. C. Smith, Comr. of Docks for Contract No. 1475, furnishing labor and material for dredging at foot of E. Ninetieth Street, East River, Borough Manhattan. Security $2,400.

Sea Wall—Bay St. Louis, Miss.—Reported desired until Dec. 1, by Chas. G. Moreau, Pres. Sea Wall Comrs., Dist. No. 1, for sea wall.

Drain—Algona, Iowa.—Reported desired until Nov. 24 by E. H. Beardsley, Co. Aud., for constructing drain No. 114, in all about 102,175 ft. tile from 28 to 6 in.

Drainage—Mason City, Iowa.—Reported desired until Dec. 6 by Geo. E. Frost, Co. Aud., for constructing County Drainage Dist. No. 29, main ditch about 12,600 ft. 6 to 26 in. tile and laterals 29,530 ft. 6 to 12 in.

Ditch—Anoka, Minn.—Reported desired until Nov. 26 by County Commissioners, for repairing County Ditch No. 32. Probable cost, $11,028. H. C. Nolte, Co. Aud.

Kansas City, Kan.—Until Nov. 22, by Kaw Valley Drainage Board, 719 Osage Ave. (P. J. Broll, Secy.), for repairing levees, etc., to consist of approximately 9200 cu. yd. embankment, 2600 cu. yd. rip rap revetment paving, 1120 cu. yd. rock in trench drains, etc.

Levee — Waxahachie, Tex.—Reported desired until Nov. 25, for constructing eighteen miles of levee. Probable cost $98,000. O. W. Finley, Dist. Engr., Ennis.

Seawall—Seattle, Wash.—See "Paving and Roads."

PRICES AND LETTINGS.

★Indicates award of contract.

Board-walk—Stone Harbor, N. J.—See "Paving and Roads.".

★Dock Improvements — Jacksonville, Fla.—Contract for constructing, filling approximately 40,000 cu. yd. of sand beneath docks and warehouses and driving new creosoted piling reinforced by w.-i. rods and extending platforms on south end of terminals awarded by Merchants & Miners Transportation Company to Hillyer & Spearing Company of Jacksonville; cost $75,000.

★Sea Wall—Pascagoula, Miss.—Contract for constructing 5000 ft. of concrete sea wall on pile foundation awarded by County Commissioners to Hancock, Harbin & Hancock, Mobile, Ala. David U. Harris, Engineer in Charge, Mobile, Ala.

★Levee Improvements—Cairo, Ill.—Following are bids opened Nov. 10 by Rivers and Lakes Commission, Chicago, for sheet piling and levee repairs in Cairo: D. F. McCarty Coal Company, Cairo, $23,210 (awarded contract); Hickey Bros., St. Louis, Mo., $31,123, and William T. Bland, Cairo, $23,244.

★Chicago, Ill.—Contract awarded by Sanitary District of Chicago for section 13 of Calumet Sag Channel to J. O. Heyworth & Co., of Chicago, for $720,170 and for section 14 to A. Guthrie & Co., of St. Paul, Minn., for $828,822. For detail bids see Engineering Record of Oct. 30.

★Ditch—Sioux City, Iowa.—Contract awarded Murphy & Hupp, Hornick, for constructing upper Wolf Creek ditch and laterals (bids opened Nov. 9 by Board Supervisors). About 154,408 cu. yds. to be removed.

★Ditch — Alexandria, Minn.—Contract for constructing county ditch No. 17 (bids opened Nov. 12) awarded Carl Christenson, Litchfield, at $17,589. Other bidders: Holmes Stone & Lumber Co., Detroit, Minn., $18,153; A. H. Denniston, Fergus Falls, $17,860. C. H. Jensen, County Auditor.

★Boston, Mass.—Following are unit figures of the four lowest bids opened Nov. 11 by Boston Transit Commissioners, Boston, for constructing Sect. G of Dorchester Tunnel, Contract 588: (a) Coleman Bros., 1 Marginal Street, Chelsea, Mass., $382,-364 (awarded contract); (b) The T. A. Gillespie Company, 50 Church Street, New York, N. Y., $396,833; (c) Lou B. Cleveland, Cleveland Building, Watertown, N. Y., $419,097; (d) Hugh Nawn Contracting Company, 82 Savin Street, Roxbury, $439,521.

Earth excavation per lin ft.	*(a)	(b)	(c)	(d)
224 lin. ft. between Sta. 72+00 and Sta. 74+24..	$200.00	$207.40	$260.00	$229.00
456 lin. ft. between Sta. 74+24 and 78+80.....	155.00	153.55	120.00	175.75
320 lin. ft. between Sta. 78+80 and Sta. 82+00....	130.00	141.30	130.00	206.46
280 lin. ft. between Sta. 82+00 and Sta. 84+80....	139.00	145.90	167.00	165.20
Building complete 620 lin. ft. intercepting sewer..	30.00	30.00	40.00	21.40
Concrete per lin. ft. complete tunnel.				
224 lin. ft between Sta. 72+00 and Sta. 74+24..	168.00	169.40	195.00	177.14
456 lin. ft between Sta. 74+24 and Sta. 78+80....	87.00	88.95	85.00	98.85
320 lin. ft between Sta. 78+80 and Sta. 82+00....	81.00	77.75	81.00	80.07
280 lin. ft between Sta. 82+00 and Sta. 84+80....	90.00	94.40	115.00	102.00
10 cu. yd. cinder concrete	5.00	5.00	8.00	8.00
150 cu. yd. brick masonry	16.00	15.00	16.00	18.00
Laying 750 lin. ft. 6 to 12-in. vitr. pipe per M invert. drain	.40	.90	.75	.50
Laying 1750 lin. ft. 6 to 15-in. vitr. pipe for house connections and catch basins sewers.....	.50	.90	.75	.75
Laying 1250 lin. ft. 18 to 30-in vitr. pipe for sewers	.90	2.00	1.25	1.00
Setting 900 tons reinforcing rods, etc	8.00	8.50	10.00	7.00
Setting 15 tons structural steel, etc.....	16.00	18.00	20.00	16.00
4000 sq. yd. Portland cement plaster.....	.30	.30	.50	.40
Portland cement grout in void spaces outside structures:				
50 cu. yd. mixture neat	15.00	14.00	20.00	20.00
100 cu. yd. mixture, 1 part cement 1½ parts fine sand	10.00	12.00	17.00	12.00
100 cu. yd. mixture, 1 part cement and 4 parts fine sand	7.00	10.00	13.00	6.00
50,000 sq. yd. prepared textile and asphalt.....	.35	.40	.40	.45
Maintaining and protecting Midland div. tracks, bridge, buildings, structures and all other risks	5,000.00	5,000.00	10,000.00	2,500.00
4000 lin. ft. spruce piles.....	.25	.45	.30	.25

★**Ditches—Marshall, Minn.**—Contracts awarded by E. S. Shepard, County Auditor for constructing ditches as follows: No. 17—Tracy Cement Tile Company, Tracy, Minn., $7,100; No. 18—A. Henricksen, Askov, Minn., $16,400, and No. 19—Marshall Tile & Sidewalk Company, Marshall, $10,254.

★**Dock—Two Harbors, Minn.** — Contract for steel superstructure of the concrete ore dock to be constructed for the Duluth & Iron Range R. R. has been awarded American Bridge Company. Bids are now being received for the foundation. W. A. Clark, Chief Engineer.

★**Irrigation — Powell, Wyo.** — Contract awarded by U. S. Reclamation Service, Powell, to Threet Brothers & Jolley, Lovell, Wyo., for Schedules 1 and 3, first unit of Fannie Division, Shoshone Irrigation Project, Wyo., involving excavation of 357,000 cu. yd. material and 117,000 cu. yd. overhaul at $78,760, and to R. M. Lynn, Lovell, contract for Schedule 2, involving 186,000 cu. yd. excavation and 25,000 cu. yd. overhaul at $27,076. (Bids opened Oct. 20.)

Irrigation — Grand Junction, Col.—Totals of lowest bids opened Nov. 4 by U. S. Reclamation Service, Grand Junction for constructing earthwork main canal, Grand Valley Project, Col., are: Reynolds Ely Constr. Co., Springville, Utah, Schedules 1 to 8, inclusive, approximately 188,480 cu. yd. excavation Classes 1 to 4, at a total of $28,584; Schedule 9, approximately 28,900 cu. yd. excav., Henry Wilson, Carl Hicks and N. H. Wilson, Frutia, Col., $3,323; Schedule 10, approximately 21,500 cu. yd. excav. and 2000 cu. yd. overhaul. Kirkendall & Nelson, Fruita, Col., $2,803; Schedule 11, approximately 16,000 cu. yd. excav. and 1000 cu. yd. overhaul, Sam Kloczko, Loma, Col., $1,649; Schedule 12, 22,600 cu. yd. excav. and 3000 cu. yd. overhaul, J. M. Groesbeck, Springville, Utah, $2,937; Schedule 13, 19,100 cu. yd. excav., James O'Bryan, Frutia, $2,364; Schedule 14, 12,600 cu. yd. excav., J. W. Collier, Grand Junction, $1,323; Schedule 15, 14,200 cu. yd. excav., Wade Collier, Grand Junction, $1,420; Schedule 16, 13,150 cu. yd. excav., Charles E. Lutz, Loma, $1,578.

★**Irrigation — Montrose, Col.**—Contract for constructing Schedules 1 and 2 of Ironstone Canal Uncompahgre Valley irrigation project, Colorado, involving excavation of 108,100 cu. yd. material and 25,000 cu. yd. overhaul awarded by U. S. Reclamation, Montrose, to Mendenhall, Bird & Co., Springville, Utah, at $30,006, and for Schedules 3, 4 and 5, including excavation of 101,100 cu. yd. material and 22,000 cu. yd. overhaul awarded C. B. Sherwood, Rockyford, Col., at $16,681. Work is located near Olathe. (Bids opened Oct. 20.)

★**River Improvement—Gallup, N. M.**—Contract awarded Sharp & Gallup, Topeka, Kan., by Santa Fé R.R. for the initial work at Gallup, which is to change the course of Puerco River; appropriation $67,000. This site is to be filled in to be used for shops, roundhouses and tracks.

ELECTRIC RAILWAYS

PROPOSED WORK.

Urbana, Ill.—Kankakee & Urbana Traction Company (T. W. Shelton, Superintendent of Construction, Urbana) will build to Kankakee to connect with an electric line to Chicago.

Wichita, Kan.—Reported plans being considered by Arkansas Valley Interurban Ry. Co. to extend line to Eldorado.

Bartlesville, Okla.—Plans under consideration by Bartlesville Interurban Ry. Co. for the construction of extensions from Bartlesville to Nowata.

Columbus, Okla.—Oklahoma & Interstate Ry. Co. will construct a railway from Columbus to Galena and Commerce.

Tacoma, Wash.—Tacoma Ry. & Power Co. received franchise to construct a railway from Fort Steilacoom Insane Asylum to Steilacoom, about 2 miles.

Los Angeles, Cal.—Preliminary to constructing the subway to beaches, the Pacific Electric Ry. Co. will rearrange its tracks at the Hill Street station.

San Francisco, Cal.—Contract for constructing Church Street extension of Municipal Rys. will soon be let by Bd. Public Wks. M. M. O'Shaughnessy, City Engr.

Clarkston, Idaho. — Lewiston-Clarkston Transit Co. received franchise from City Council to construct an electric railway in Asotin County, from city limits of Clarkston on Sixth to Highland Streets, and on Highland Street to Thirteenth Street, 1¼ miles.

BIDS DESIRED.

New York, N. Y.—Until Nov. 30, by Public Service Commission, First District, 154 Nassau Street (Travis H. Whitney, Secy.), for constructing Section No. 2 of Routes Nos. 19 and 22 in Borough Bronx, a part of the Seventh Avenue-Lexington Avenue Rapid Transit Railroad.

Philadelphia, Pa.—By Department City Transit, Bourse Bldg. (A. M. Taylor, Dir.), for work as follows:

Until Dec. 7: Contr. 502—Concrete column foundations on piers for about 4000 lin. ft. of two-track elevated railway in Frankfort Avenue, from Unity to Dyre Streets.

Until Dec. 14: Contr. 519—Steel superstructure and appurtenant work for two-track elevated railway in Frankford Avenue from Unity to Dyre Streets, comprising about 4000 lin. ft. structure.

Pearl City, Hawaii.—Until Dec. 18 (extension of date from Nov. 27) by Bureau Yards and Docks, Navy Dept., Washington, D. C. (H. R. Stanford, Ch.), for constructing a marine railway at the Naval Station, Pearl Harbor. Specification No. 2172.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**New York, N. Y.**—See "Sewerage and Sewage Disposal."

New York, N. Y.—Two lowest bids opened Nov. 12 by Public Service Commission, for First District, 154 Nassau Street, for constructing the tracks on the Queensboro subway extension the Astoria elevated line and the Corona elevated lines, all in Borough of Queens were submitted by George S. Bennett, 36 Northern Avenue at $204,000 and Thomas Grimmins Contracting Company, 444 East Sixty-ninth Street, at $204,900.

★Contract for station finish on Section 2 of Route No. 39 for the new Utrecht Avenue elevated railroad in Brooklyn awarded A. L. Guidone & Son, Inc., 131 East Twenty-third Street, at $513,656. Next three lowest bidders: Louis Weschler, 1133 Broadway, $528,524; Marble Arch Co., 216th Street and Broadway, $545,197; Connors Brothers Co., Inc., 64 West Thirty-eighth Street, $554,162.

RAILROADS

PROPOSED WORK.

Cumberland, Md. — Reported Western Maryland R.R. (H. R. Pratt, Ch. Engr., Baltimore) contemplates next spring double-tracking the branch between Cumberland and Hagerstown.

Bluefield, W. Va.—Reported Virginia R. R. (H. Fernstrom, Ch. Engr., Norfolk, Va.) intends extending the line from Bluefield, W. Va. through Buchanan, Dickenson County and the Peter and Levisa Fork region of Pike County terminating at Shelby Junction on the Chesapeake & Ohio R. R., a distance of about 65 miles.

Gallup, N. M.—See "Hydraulic Construction and River Improvements," "Prices and Lettings."

Metaline, Wash.—Reported Chicago, Milwaukee & St. Paul Railway Company (C. F. Loweth, Ch. Engr., Chicago, Ill.) will extend line from this city to Northport, a distance of about 30 miles.

PUBLIC BUILDINGS AND SCHOOLS

PROPOSED WORK.

New York, N. Y.—Plans filed for erecting 4-story brick extension to 4-story brick school at 189th Street and Lorillard Place for City of New York, cost $140,000. C. B. J. Snyder, Archt., 500 Park Avenue.

Rochester, N. Y.—Board of Trustees approved plans of Claude F. Bragdon, Cutler Building, for proposed Chamber of Commerce Building, to be erected at Mortimer and St. Paul Streets.

Syracuse, N. Y.—Erection of new Jefferson School on present site being considered by Board of Education.

Camden, N. J.—Plans prepared by Paul A. Davis, 3d, 1713 Sansome Street, Philadelphia, Pa., selected by Board of Education for proposed high school; cost about $35,000.

Jersey City, N. J.—Mayor authorized by City Commission to complete plans and award contract for wing to City Hospital; estimated cost $350,000. John T. Rowland, Jr., Archt., 100 Sip Avenue.

Board of School Estimate contemplating following improvements: New Lincoln High School, $475,000; new High School in Greenville, $400,000; School No. 17, enlargement, $180,000; enlarging School No. 35, $135,000; school for Crippled Children, $100,000; new School No. 4, $475,000; new School No. 14, $170,000; new School No. 6, $400,000; new School No. 16, $175,000; new School No. 10, $203,000; replacing all wooden stairs in schools with fireproof stairs, $40,000.

Easton, Pa.—Plans being prepared by William H. Michler, Drake Bldg., for three-story brick and stone building to be erected for Easton Hospital; cost, $100,000.

Hazleton, Pa.—Citizens voted $140,000 bonds for erecting new schools.

E. E. Jerolamon, 427 Franklin Street, Buffalo, is architect for two brick fireproof schools to be erected in Hazleton School Dist., at a cost of $140,000. Contract will be let about March. D. T. Evans, Secy. District.

Lehighton, Pa.—School Board intends erecting new high school on present site, cost $100,000.

Monongahela, Pa.—School Board Nov. 8 appointed Charles J. Reiger, Germania Bank Bldg., Pittsburgh, architect for Waverly School to be erected on Jackson St.

Philadelphia, Pa. — Municipal Court Judges authorized County Commissioners to spend $50,000 for improvements and additions to Magdalen Home, at Twenty-first and Race Streets, and $40,000 on old Vaux School, at Twelfth and Wood Streets.

Revised plans prepared for Municipal Art Museum to be erected probably in the spring at Green Street entrance to Fairmount Park, total cost about $4,500,000. Eli K. Price, Chmn. Museum Committee.

Pittsburgh, Pa.—A 19-story Chamber of Commerce Building contemplated at Seventh Avenue and Smithfield Street. W. H. Stevenson, Chmn. Building Committee.

Nashville, Tenn.—Board of Education requested Board of Commissioners to pass ordinance appropriating $260,000 for erecting proposed addition to Fogg-Hume High School. Preliminary plans have been prepared and approved.

Lake Charles, La.—High school, costing $125,000 with equipment, to be fireproof, brick and stone, is to be erected. James N. Yeager, Secy. School Board.

Yazoo City, Miss.—School bonds for $45,000 will be sold Dec. 6. E. G. Olden, Clk.

Danville, Ky.—Election soon to be held to vote $50,000 bonds for erecting new school.

Bucyrus, Ohio.—Citizens of Crawford County voted $40,000 bonds to erect new children's home. Address County Clerk.

Cincinnati, Ohio.—E. H. Dornette, Pickering Building, engaged to prepare plans for four-story Nurses' Home to be added to German Deaconess Hospital. Straight Street and Clifton Avenue; cost about $40,000.

Hanover, Ohio.—Contract will be let about January for erecting the two-story fireproof grade and high school to cost $25,000. A. D. Jones, Clerk School Board.

Lakewood, Ohio.—A high school, costing $300,000, to be erected. Address Bd. Education.

Marion, Ohio.—Marion County Medical Society contemplates erecting $100,000 city hospital in Marion.

McCutchenville, Ohio.—Citizens voted $40,000 bonds for new school.

Plain City, Ohio.—Citizens voted to erect centralized school in Canaan Township.

Somerville, Ohio.—Reported School Board sold $32,500 bonds for erecting new school.

St. Bernard, Ohio.—School bonds amounting to $20,000 reported sold by Board of Education.

Tiltonville, Ohio.—Citizens voted $45,000 bonds for new school.

Urichsville, Ohio.—Citizens voted $45,000 bonds for erecting school on Trenton Avenue. Address Board of Education.

Wilmington, Ohio.—Contract will soon be let for erecting court house. Weber, Werner & Adkins, Archts., Library Building, Cincinnati.

Youngstown, Ohio.—Board of Education has asked preliminary plans to be submitted Nov. 29 for sixteen-room school on Pine Hollow site and twelve-room school on Stambaugh site, in Steelton.

Washington, Ind.—City Council taking steps to issue $35,000 bonds to erect city hall.

Galena, Ill.—School bonds amounting to $30,000 reported sold.

Homer, Ill.—Reported Township high school, costing $40,000, contemplated here. Address Clerk Township School trustees.

Sidney, Ill.—Reported Township Board of Education contemplates erecting high school, costing $40,000.

Urbana, Ill.—Plans approved by J. M. White, Supervising Architect, for girls' dormitory to be erected for University of Illinois; cost $100,000.

Reported Alumni plans erecting next year at the University of Illinois a building costing $150,000 as a memorial to the late Dr. Gregory, first regent.

Des Moines, Iowa.—School Board contemplating $350,000 improvement to schools.

Northfield, Minn.—The sum of $100,000 has been given to Carlton College to be used as part of the $400,000 fund. This money is to be used to erect new buildings.

St. Paul, Minn.—Board of Control considering erecting Woman's Reformatory, appropriation, to include site, $80,000.

Havelock, Neb.—Erection of new high school being considered by School Board; estimated cost $25,000.

Orange, Texas.—Plans prepared by C. H. Page & Bro., National Bank Building, Austin, for proposed high school adopted by School Board.

Clayton, N. M.—Board of Education decided to call election to vote $35,000 bonds for new school.

Astoria, Ore.—Election to be held Nov. 29 to vote $100,000 bonds for grade school.

Portland, Ore.—Doyle & Patterson, Worcester Bldg., are architects for proposed building for Medical Department of University of Oregon to be erected in South Portland; cost about $250,000. K. A. J. McKenzie, Dean of Medical Dept.

Fortuna, Cal.—Citizens voted $24,000 bonds for high school.

Montreal, Que.—Protestant School Board contemplates erecting school at Ontario and Dufresne Streets, Terminal Park.

West Hill, Ont. — Scarsboro Township School bonds for $50,000 reported to be sold Dec. 2. J. H. Richardson, Treas., West Hill.

BIDS DESIRED.

Portland, Me.—Until Dec. 4, by Portland High School Commission (Oakley C. Curtis, Chmn.) for rock excavation; also earth excavation, required for the high school building to be erected on Cumberland Ave., Portland. Miller & Mayo, Archts., Fidelity Bldg., Portland.

Attleboro, Mass.—Until Dec. 21, by Jas. A. Wetmore, Acting Superv. Archt., Washington, D. C., for construction complete (including mechanical equipment and approaches) for U. S. Post Office at Attleboro.

Putnam, Conn.—Until Nov. 29 by Special Committee on new buildings for the Putman Trade School, at Rooms of Putman Chamber of Commerce, Union Block, for erecting school on New Providence Street. William T. Towner, Inc., and Constantine Schubert, Archts., 366 Fifth Avenue, New York.

Seymour, Conn.—Until Dec. 28, by Jas. A. Wetmore, Acting Supervising Archt., Washington, D. C., for construction complete (including mechanical equipment, except lighting fixtures and approaches) of U. S. post office at Seymour.

Middletown, N. Y.—Until Nov. 23, by State Hospital Commission (E. S. Elwood, Secy.), Capitol, Albany, for addition and alteration to power house, for power house equipment, at Middletown State Homeopathic Hospital, Middletown, advertised in Engineering Record. Lewis F. Pilcher, State Archt., Albany.

Philadelphia, Pa.—Reported desired until Nov. 22, for erecting a one-story brick, 35 x 104 ft., wing 35 x 50 ft. library at McPherson Park, Philadelphia. Wilson, Eyre & McIlvain, Archt., 1003 Spruce St.

Shamokin, Pa.—Until Nov. 23 by Board Education, Coal Township School Dist. (M. J. McBride, Secy., 100 S. First Street, Shamokin), for erecting 6-room brick school in Ferndale, Coal Township. Thomas Nolan, Archt., May Building, Shamokin.

Washington, D. C.—Until Nov. 30 by Commissioners D. C. (Oliver P. Newman, Chmn.), for erecting an addition to and making alterations to Powell School, School Street, opposite Lamont Street.

St. Petersburg, Fla.—Until Dec. 30 by James A. Wetmore, Acting Supervising Architect, Washington, D. C., for the construction complete (including mechanical equipment and approaches) of the U. S. Post Office at St. Petersburg, advertised in Engineering Record.

Titusville, Fla.—Until Dec. 7, by Co. Board Pub. Instruction (Edwin E. Macy, Secy.) for erecting following schools, in Special Tax School Dist. No. 1, Titusville, graded and high school; graded school at Mims, La Grange, Shiloh, Aurantia and Indian River City. A. E. Lewis, Archt., 24-26 Real Estate Exchange Bldg., Miami.

Cincinnati, Ohio.—Until Dec. 13, by Clerk Board Education for furnishing material and remodeling Fulton school on Eastern Avenue. Bids desired as a whole or separately on excavation, limestone masonry, concrete, brick and cut stone; carpentry work; iron work; plumbing; electric work; heating, etc. Prices for labor and material must be stated separately. C. W. Handman, Bus. Mgr.

Cleveland, Ohio.—Until Dec. 1, by County Commissioners (E. G. Krause, Clk.), for furnishing material and erecting a detention home. Wm. Louge, Archt., 500 Marshall Building.

East Cleveland, Ohio.—Until Dec. 6, by Chas. Ammerman, Clk. Board Education, for furnishing material and erecting brick fireproof addition to Rozelle School on Phillips Ave., East Cleveland. W. H. Nicklas, Archt., Euclid Bldg., Cleveland.

New Berlin, Ohio.—Reported desired until Dec. 1, by Board of Education, Plain Township (D. M. Garman, Clk.), for erecting school at Mapleleaf. Separate bids will be received for plumbing, heating, ventilating and electric work. Herman J. Wagoner Archt., Reichert Bldg., Canton.

New Philadelphia, Ohio.—Until Dec. 14, by Board Education, Goshen Township Rural School Dist. (Jacob W. Seman, Clk.), for fireproof grade school. Bids desired as a whole or separately on construction, heating and ventilating, plumbing, gas fitting and sewerage. Bids for labor and material must be stated separately. Howard & Morrison, Archts., East 9 Broad Street, Columbus.

Colleyville, Kan.—Reported desired until Nov. 25, by Geneva Haden, Sec., School Board, for erecting new 2-story school and auditorium in Garfield, Whitley, Magnolia and Liberty buildings, etc. C. A. Henderson, Archt.

Minneapolis, Kan.—Reported desired until Dec. 4, by C. C. Cook, Clk., for erecting 2-story and basement brick and stone high school building and sheriff residence. Jos. P. Washburn & Sons, Archts., Ottawa.

Aurora, Neb.—Until Dec. 22, by Jas. A. Wetmore, Acting Supervising Archt., Washington, D. C., for construction, complete heating, plumbing and electric equipment and elevator of the U. S. Post Office at Aurora.

Austin, Tex.—Until Nov. 25 for erecting high school building at $111,000. W. H. Cuthbert, Free School Bd.

Houston, Tex.—Until Nov. 25 according to plans on file with registrar, by Civic Secretary, for erecting the Taylor School.

Seattle, Wash.—Reported desired until Jan. 1, by Jos. Duffy Comm., C. E. Armstrong, Supt. Lighting, superintendent of Municipal Avenue freight sheds, 40 x 500 ft. Probable cost $47,000.

PRICES AND LETTINGS.

★Indicates award of contract.

Boston, Mass.—Following are three lowest bids opened Nov. 12 by Schoolhouse Commission for erecting addition to high school of Practical Arts, Greenville and Brookline Streets, Roxbury): J. J. Flynn, 50 West Dedham Street, $48,471; M. F. Kinsley, 114 Clement street, Brookline, $47,200 and John Bowers, Roxbury, $52,900.

Danvers, Mass.—Following are two lowest bids opened June 1, by Essex Agricultural Trustees at Salem, for erecting a gymnasium for the school at Hiawatha, Danvers: Lewis A. McAlman, Saugus, Andover, $44,000 and John A. Driscoll, North Andover, $45,476.

★Milford, Mass.—Contract awarded by Schoolhouse Commission to Dillon Bros., Milford, for erecting school on Spruce Street, at $49,000.

★New Haven, Conn.—Contract awarded George A. Fuller Co., 30 Broadway, New York, N. Y., for erecting fireproof hospital on Cedar Street for General Hospital Society of Connecticut, and complete steam plant, etc., for L. W. Robinson, Archt., 42 Church Street.

★White Plains, N. Y.—Contract for erecting new penitentiary at East View awarded by Westchester County Building Commission to Rogers, Brown & Co., Contracting Engineers, Flushing, L. I., Park Avenue, New York, $1,645,000; plumbing, William Cramp & Sons, 1711 W. Thompson Street, New York, $42,000, and heating, Alpert & Feigl, 37 W. Forty-second Street, New York, $41,000.

★East Rutherford, N. J.—Contract awarded by Board of Education for erecting new Vocational Avenue school to Magee Carpet Co., Newark, at $142,241. John T. Simpson, Archt., Newark.

East Pittsburgh, Pa.—Following are four lowest bids opened Oct. 6 by Supervising Architect, Washington, D. C., for constructing U. S. Post Office: (a) limestone, Westmoreland Contracting & Stone Co., Greensburg, Pa., $49,621; (b) brick, J. E. Ashton Construction Co., St. James Building, N. Y., $51,251; (c) brick, W. H. Powell & Company, Manufacturers Building, New York, $51,500; (d) brick, The George Hagan Company, Pittsburgh, Pa., $51,775, all $51,000.

★Harrisburg, Pa.—Contract for constructing extension to U. S. Post Office awarded H. L. Rouse Company, Mount Vernon, N. Y., at $107,000.

★Swissvale, Pa.—Contract for erecting Carnegie Library at Swissvale and McClure Libraries at Bloomfield and Oakland, Pittsburgh, awarded Turner Construction Co., Rose Building, Pittsburgh, at $125,000.

Washington, D. C.—Lowest bid opened Nov. 1 by Commissioners, D. C., for constructing the engine house on Connecticut Avenue and Twenty-first Street, submitted by Mahon Construction Company, Inc., Washington, D. C., at $21,995.

★Norfolk, Va.—Contract for constructing a two-story brick building at St. Helena, Norfolk, navy station, awarded R. E. Richardson & Company, Bank of Commerce Building, Norfolk, at $26,978.

★Norton, Va.—Contract for erecting U. S. Post Office awarded by Supervising Architect, Washington, D. C., to Westchester Engineering Company, White Plains, at $42,857.

★Wilkesboro, N. C.—Contract for constructing U. S. Post Office awarded Richardson Engineering & Constructing Company, Bainbridge, Ga., at $52,600.

★Canton, Ohio.—Contract for erecting the north school (bids opened Nov. 4) awarded Robert H. Evans & Co., Columbus, at $[illegible] W. C. Lane, Clerk Board Education.

Sidney, Ohio.—Following are four lowest bids opened Nov. 8, by Supervising Architect, Washington, D. C., for constructing U. S. Post Office: (a) limestone, Ohio Building & Construction Company, Cincinnati; (a) marble, $51,500; Charles W. Gindele Company, 2242 La Salle Street, Chicago, Ill., (a) $51,500; E. T. Abbott Construction Company, St. James Building, New York, (a) $52,500, (b) $52,250; James Devault, Canton, (a) $51,500, (b) $52,470; King Lumber Company, Charlottesville, Va., (a) $52,900.

Van Wert, Ohio.—Following are four lowest bids opened Nov. 10 by Supervising Architect, Washington, D. C., for constructing the U. S. Post Office: (a) limestone, the sandstone Charles McCall Company, 1517 Sansom Street, Philadelphia, Pa., (a) $54,000, (b) $57,490; Original Cabinet Company, Evanston, Ill., (a) $54,625, (b) $54,750; Colonial Construction & Supply Company, Charlottesville, Va., (a) $54,852, (b) $56,975; Charles W. Gindele Company, 2242 La Salle Street, Chicago, Ill., (a) $56,000, (b) $56,250.

★New Castle, Ind.—Contract for constructing U. S. Post Office awarded J. S. Rogers Company, Moorestown, N. J., at $52,900.

★Detroit, Mich.—Contracts for erecting building in rear of Goldberg School, Vermont Avenue and Paquette Street, were awarded as follows: (bids opened Nov. 9 by Board of Education) Mason work, Frank N. Cooper, Burns and Charlevoix Streets; carpenter work, Ernst Thiede, Detroit; heating, ventilating and plumbing, James W. Partlan, 51 Park Place; electric wiring system, Iron City Engineering Company, Dime Bank Bldg.; Charles A. Field, Secretary of Board, Malcomson & Higginbotham, Archts., 404 Moffett Building.

West Duluth (P. O. Duluth), Minn.—Following are four lowest bids opened Nov. 2 by City Commissioners for erecting two-story and basement reinforced concrete and brick municipal building at Cody Street and Central Avenue: Hugh Bowen, $26,736; Jacobson Bros., $24,900; F. L. Johnson & Co., $26,446; E. J. Zuaft, $26,700 (bidders all of Duluth). F. G. German, Archt., American Express Building, Duluth.

★Kirksville, Mo.—Contract for constructing U. S. Post Office awarded Charles Weitz Sons, Des Moines, Iowa, at $26,213.

★El Paso, Tex.—Following are four lowest bids opened Oct 29 by Board Trustees Independent School District, for erecting a high school: American Construction Company, Houston, $272,900 (awarded contract); Krueger Mayfield & Shaw, El Paso, $281,915; J. E. Morgan, El Paso, $282,947; James Stewart & Co., Houston, $287,347. Frost & Frost, Architects, Mills Building.

New Braunfels, Tex.—Four lowest bids opened Nov. 1 by Supervising Architect, Washington, D. C., for constructing U. S. Post Office, were as follows (bids on limestone): Weston & Krueger, San Antonio, $40,849; George W. Stiles Construction Company, Rookery Building, Chicago, Ill., $41,750; Algernon Blair, Montgomery, Ala., $42,215, and E. A. Steiringer Construction Company, Victoria Building, St. Louis, Mo., $42,920.

★Norman, Okla.—Contract for erecting science building at State University awarded Holmboe Construction Company, Oklahoma City, at $89,950.

★Los Angeles, Cal.—Contract awarded Robert Jordan, Title Insurance Building, at $24,593, for erecting brick and hollow tile Carnegie Library on Boyle Heights.

PRIVATE BUILDINGS

PROPOSED WORK.

Binghamton, N. Y.—Ansco Co., Washington and Henry Streets, contemplates erecting three-story office building on Lewis and Washington Streets.

A brick and stone $75,000 church is planned for St. John's Parish. Rev. James B. Greene, pastor.

Brooklyn, N. Y.—Reported plans prepared for five-story wing to be erected for Hamilton Club at 144 Remsen St. Address Building Committee.

Corning, N. Y.—Reported Delaware, Lackawanna & Western R. R. Co. (G. J. Ray Co. Engr., Hoboken, N. J.), will erect new fireproof freight house here, cost $75,000.

Lake George, N. Y.—Hulett house reported destroyed by fire, will be replaced by fireproof hotel. H. W. Wyatt, of Troy, owner.

New York, N. Y.—Plans filed for erecting following buildings: Two 5-story brick apartment houses at 170th St. and Haven Avenue, for Namreh Bldg. Co., cost $115,000, Kreymborg Architectural Co., Archts; 1029 E. 163d Street, 6-story warehouse at 181st Street and Audubon Avenue, for South Side Constr. Co., cost $100,000, Gronenberg & Leuchtag, Archts., 303 Fifth Avenue; 12-story brick store and office building at 26 W. Fifty-eighth Street for 25 W Fifty-seventh Street Co., cost $125,000, Mott B. Schmidt, 15 E. Fortieth Street, Archt.; two 5-story brick tenements at Mapes Avenue and 178th Street for Corner Constr. Co., cost $110,000, Frankfort & Kirchner, Archts., 830 Westchester Ave.; 5-story brick tenement at 181st Street and Daly Avenue, for Simonia Realty Cor., cost $150,000, Kreymborg Architectural Co., Archts., 1029 E. 163d Street.

Haddon Heights, N. J.—Methodist Episcopal Church contemplates erecting new edifice at Seventh Ave. and Garden St.; probable cost $30,000.

Bryn Mawr, Pa.—De Armond, Ashmead & Bickley, 618 Chestnut St., Philadelphia, are architects for five-story, brick, terra cotta, steel and concrete, 95 x 165 ft. apartment house to be erected for Norman P. Sinclair, Real Estate Trust Bldg., Philadelphia.

Delaware Water Gap, Pa.—Water Gap House reported destroyed by fire will be rebuilt.

Pittsburgh, Pa.—Plans being prepared by W. E. Snaman, Empire Bldg., for store and apartment building to be erected on Federal Street, north side, for Northern Realty Co.; cost, $40,000.

Albany, Ga.—Plans being prepared by A. Ten Eyck Brown, Realty Trust Bldg., Atlanta, for Citizens' First National Bank Bldg.; cost about $100,000.

Birmingham, Ala.—Plans prepared by Miller & Martin, Title Guarantee Building, for five-story 100 x 140 ft., fireproof, reinforced-concrete, terra cotta building at Second Avenue and Nineteenth Street, for Louis Saks Clothing Co., 1900 First Avenue.

Ashland, Ky.—Erection of $50,000 edifice at Eighteenth and Carter Sts. contemplated by First Methodist Church.

Cleveland, Ohio.—Contract about to be let for erecting five-story store and loft building at High and East Fourth Streets for Frank Osborne Estate; cost $75,000. Engineers, A. M. Allen & Co., 1900 Euclid Street, prepared plans.

Cleveland Columbian Building Co. (Frank P. Toomey, Secy., 1406 East Ninety-fourth Street) contemplates erecting at 1241 Superior Avenue a $100,000 clubhouse for Knights of Columbus.

Wadsworth, Ohio.—Reported plans prepared for $60,000 Lutheran Church to be erected here.

Indianapolis, Ind.—M. Efroymson of Efroymson & Wolf, 360 W. Washington Street, reported interested in erecting moving picture theatre on Monument Place; total cost about $225,000.

Detroit, Mich.—Joseph E. Mills & Sons, Kresge Bldg., are architects for six-story, brick, concrete, steel and terra cotta store building to be erected for Lafer Bros., 9 Cadillac Square.

Chicago, Ill.—Plans nearing completion by Illinois Central R. R. (A. S. Baldwin, Ch. Engr., Chicago) for passenger station at Randolph Street and lake front, to be used by twenty trunk line railroads and to have three decks of tracks.

Urbana, Ill.—Contract soon to be let by Methodists of Illinois for erecting buildings in this city, primarily for students of University of Illinois, including $150,000, church and two dormitories. Rev. J. C. Baker, student pastor.

Milwaukee, Wis.—Martin Tullgren & Sons, 133 Second Street, reported interested in brick and concrete apartment house contemplated at Grand Avenue and Twenty-first Street; cost $50,000.

Mason, Iowa.—Western Telephone Company is planning erecting a building to cost $50,000.

Washington, Iowa.—Washington Telephone Company reported planning erecting a new telephone building to cost about $50,000.

St. Paul, Minn.—A three or four-story bank building, costing about $150,000, is to be erected by the People's Bank of St. Paul on Wabasha Street.

Forrest City, Ark.—Presbyterian Church taking steps to erect $25,000 edifice. Rev. Emmett L. Wilson, Pastor.

Little Rock, Ark.—Bankers Trust Co. (George W. Donaghey, Vice-President) contemplates erecting two additional stories to bank; estimated cost $30,000. Work to begin in spring.

Seattle, Wash.—Central Realty Co., Pantages Theater Building, will erect five-story mill constructed and brick apartment house on Boren Avenue and Pine Street; cost $75,000. Louis Baeder, Archt., White Building.

Portland, Ore.—Plans being prepared by Houghtaling & Dougan, Henry Bldg., for proposed $100,000 Labor Temple to be erected on Stout St., to be three-story, fireproof, of reinforced concrete, brick walls and tile roof.

First Christian Church contemplates erecting edifice on West Side; cost about $50,000. Rev. George Darsie, Pastor.

Los Angeles, Cal.—Reported Pacific Electric Ry. Company (Geo. E. Pillsbury, Ch. Engr., Los Angeles), intends erecting a station on Hill Street to cost $40,000. $250,000.

BIDS DESIRED.

Brownsville, Pa.—Reported desired until Nov. 22, by Conwell, Rowland & Hutchins, Archts., Conestoga Bldg., Pittsburgh, for erecting 2 story and basement, Parochial School at Brownsville for St. Peters R. C. Church. Probable cost $30,000.

Monroe, Mich.—Reported desired until Nov. 24, by Harry J. Rill, Archt., 54 Buhl Blk., Detroit, for erecting 5-story and basement, 150 x 200 ft. college building and power house for Sisters of the Immaculate Heart of Mary, Monroe.

PRICES AND LETTINGS.

★Indicates award of contract.

★Philadelphia, Pa.—Contract awarded John McShain, 1610 North Street, for erecting two-story and basement stone school and chapel on Cedar Avenue; cost $40,000. Henon & Boyle, Archts., Fulier Bldg.

★Pittsburgh, Pa.—Contract awarded Rose & Fisher, Pennsylvania Avenue, for erecting $250,000 Community House at Union Avenue and North Diamond Street for First United Presbyterian Church, Northside, to be fireproof, brick, stone and terra cotta construction.

★Bluefield, W. Va.—Contract reported awarded Central Mfg. Co., Roanoke, Va., for erecting brick and stone edifice for Scott Street Baptist Church; cost, $20,000. Pedigo & Garry, Archts., Bluefield.

★Louisville, Ky.—Contract awarded by Joseph & Joseph, Archts., Great Southern Building, for erecting Western Union Building on Market Street to Alfred Struck Co., Louisville; cost about $45,000.

★Akron, Ohio. — Contract reported awarded Indiana Engineering & Constr. Co., of Ft. Wayne, Ind., for erecting $80,000 business block here.

★Terre Haute, Ind.—Contract awarded A. W. Stoolman, Champaign, Ill., for erecting Masonic Temple at $93,556.

★Danville, Ill.—Contract awarded Yeager & Son of Danville for erecting Masonic Temple; cost $150,000.

★Spokane, Wash.—Reported Hurley-Mason Co., Spokane, are contractors for eight-story, reinforced-concrete office building contemplated at Riverside Avenue and Stevens Street, for J. D. Sherwood; cost about $125,000.

★Visalia, Cal. — Contract reported awarded E. E. Etherton Co. of San Francisco, for erecting new Southern Pacific passenger station here; cost about $20,000.

NEW INDUSTRIAL PLANTS

PROPOSED WORK.

Springfield, Mass.—See "Private Buildings."

Worcester, Mass.—Worcester Woolen Mills Co., 17 Southgate Street, will erect four-story reinforced concrete addition to plant; cost $30,000.

Hartford, Conn.—United States Tire Co. (Charles B. Whittlesey, Gen. Mgr.), Allyn and High Streets, contemplate erecting additions to factory.

Thompsonville, Conn.—Biglow-Hartford Carpet Co., 58 Main Street, intend erecting two additions to plant. In the spring a third addition may be erected.

Long Island City, L. I., N. Y.—Plans filed for six-story concrete factory to be erected on Skillman and Rawson Avenues for Gustave Sandblom, 30 East Forty-second Street, New York; cost $110,000.

New York, N. Y.—Plans filed for erecting of 8-story fireproof factory, to be erected at 513 W. Twenty-fifth Street for Marginal Realty Co., cost $150,000. Francisco & Jacobus, Archts., 200 Fifth Avenue.

Camden, N. J.—Preliminary plans being prepared by Ballinger & Perrot, Methodist Building, Philadelphia, for four-story, reinforced concrete, steel, 274 x 91 ft. and a six-story, reinforced concrete, 76 x 233 ft. factory for Victor Talking Machine Co.

Franklin, Pa.—Chicago Pneumatic Tool Co. (W. O. Duntley, Pres.), 343 S. Dearborn Street, Chicago, Ill., intends doubling capacity of Plant No. 2 here.

Philadelphia, Pa.—Reported contract soon to be let for erecting four-story brick and concrete 89 x 98 ft. electric truck shop at 18th and Buttonwood Streets, for Baldwin Locomotive Works, Broad and Spring Garden Streets.

South Bethlehem, Pa.—Plant of Bethlehem Steel Co., recently reported destroyed by fire, will be rebuilt.

Weirton, W. Va.—Phillips Sheet & Tinplate Co., Weirton, contemplates erecting addition to plant to cost about $1,000,000.

Whitney, N. C.—Aluminum Co. of America, Oliver Building, Pittsburgh, Pa., reported to have taken over plant started by Southern Aluminum Co. at Badin, near Whitney, and will complete it on a larger scale.

Wilmington, N. C.—Reported Wilmington Hosiery Mill will enlarge plant and install additional machinery.

Milwaukee, Wis.—H. J. Esser, Camp Building, is architect for six-story, brick, concrete, steel and wood factory to be erected on Fifth and Hadley Streets for Nunn & Bush Shoe Co., 409 Third Street.

Little Rock, Ark.—Arkadelphia Milling Co. (W. N. Adams, Pres.), Arkadelphia, contemplates erecting milling plant here; probable cost $250,000.

Mountain Home, Ark.—Contract to be let about Jan. 1 for machinery for zinc mine of Pigeon Creek Development Company (R. C. Love, Mgr.), Mountain Home.

St. Joe, Ark.—Oklahoma Consolidated Mining & Milling Co. (William E. Hancock, consulting engineer), to develop forty rice zinc deposits; tables, rollers, elevators, steam drills, turbines or dynamos and air compressor to be installed.

Gallup, N. M.—See "Hydraulic Construction and River Improvements," "Prices and Lettings."

BIDS DESIRED.

Seattle, Wash.—Reported desired until Dec. 1, by Port Seattle Commission (C. E. Remsberg, Secy.) for erecting a fish storage building. Probable cost $35,000.

Seattle, Wash.—Reported desired until Dec. 15, by Port of Seattle (C. E. Remsberg, Secy.) for furnishing and installing equipment for cold storage and apple warehouse at foot of Whatcom Avenue; cost $90,000.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Buffalo, N. Y.**—Contract awarded Charles Berrick's Sons Co., 1151 Main Street, for erecting two-story, 60 x 200 ft., structural steel and tile addition to plant of J. P. Devine Co., 1372 Clinton Street; cost $40,000; also steel and brick addition to plant of King Sewing Machine Co., Welland and Rano Streets.

★**Elmira, N. Y.**—Contract reported awarded W. R. Compton Realty & Building Co., Inc., Elmira, for erecting additions to plant of Morrow Manufacturing Co., to consist of following buildings: One-story, 167 x 450 ft. for heat treating; one-story, 120 x 740 ft. tannery; one-story, 80 x 250 ft. for cooling; 90 x 120 ft. boilerhouse; all of steel frame and brick construction. Mills, Rhines, Bellman & Nordoff, Archts., 1234 Ohio Bldg., Toledo, Ohio.

★**Rochester, N. Y.**—Contract awarded John W. Cowper Co., Fidelity Bldg., Buffalo, for erecting one-story, 120 x 400 ft. brick and steel addition to plant of General Railway Signal Co. at Lincoln Park; cost $80,000. Ferguson Steel & Iron Co., Buffalo, has sub-contract for 500 tons of structural steel required.

★**Philadelphia, Pa.**—Contract reported awarded Smith-Hardicon Co., 1606 Cherry Street, for erecting two-story, brick, 150 x 74 ft. factory at American and Filbert Streets, for J. D. Litt; cost $30,000.

★**Dayton, Ohio.**—Contract for erecting three-story and basement, brick and steel fireproof addition to plant of Ohio Metal Products Co., 39 Edgar Street, awarded John Rouzer Co., 71 Wyandott Street. Thies & Thies, Archts., Davies Bldg.

★**Gary, Ind.**—Contract reported awarded Illinois Improvement & Ballast Co., 208 S. La Salle Street, Chicago, Ill., for erecting concrete foundation for tin mills for American Sheet & Tin Plate Co.; cost $156,000.

★**Foreman, Ark.**—Contract awarded Fuller Engineering Co., 50 Church Street, New York, for erecting plant here for Consumers' Portland Cement Co., 220 South State Street, Chicago. Fuller Dreadnaught mills and individual meters to be installed.

MISCELLANEOUS

PROPOSED WORK.

Transmission Line—Watertown, N. Y.—Among improvements contemplated by Northern New York Utilities, Inc., Watertown, includes steel tower transmission line 45,000 volt from Carthage to Taylorville plant; cost $24,500.

Transmission Line—Peoria, Ill.—Public Utilities Commission has granted Central Illinois Lighting Company a franchise to erect a 13,200 volt transmission line between Maquon and Yates City in Knox County.

Transmission Line—Marengo, Iowa.—Iowa Electric Company, Marengo, has applied to Board Supervisors for a franchise to erect and maintain an electric transmission line along highway of Jones County.

Tunnel—Seattle, Wash.—County Comrs. appropriated $15,000 for constructing a concrete tunnel entrance to county court house and city hall now under construction at Third Avenue and James Street. City of Seattle will also appropriate $15,000.

BIDS DESIRED.

Elevator—Pottsville, Pa.—Until Dec. 8, by James A. Wetmore, Acting Supervising Architect, Washington, D. C., for installing electric freight elevator, etc., in U. S. Post Office.

Memorial—Fort McHenry (Baltimore), Md.—Competitive plans reported desired until April 1 by Col. W. W. Hart, War Dept., U. S. Government, 1729 New York Avenue N. W., Washington, D. C., for erecting the Francis Scott Key Memorial at Fort McHenry; probable cost $75,000.

Conduit in Public Buildings—New Orleans, La.—Until Nov. 22 by Board Port Commissioners, for furnishing and installing underground conduits, including manholes, conduit work, cable work and wiring for multiple and series lighting and power, cabinets, etc., for cotton warehouses and terminals now under construction.

Concrete Steps—Cincinnati, Ohio.—Until Nov. 26 by Parke S. Johnson, Secy. Dir. Pub. Service, for improvement of right-of-way from Kempers Lane to Eastern Avenue, at Rockwood Subway, by constructing concrete steps.

Cement—Chicago, Ill.—Until Nov. 24 by W. R. Moorhouse, Comr. Pub. Wks., for furnishing, delivering and unloading at various locations in city of Chicago, approximately 70,000 bbls. Portland cement.

Pipe Valves, Etc.—Panama.—Until Dec. 1, by Maj. F. C. Boggs, Gen'l Purchasing Officer, Panama Canal, Washington, D. C., for Cir. 991—Steel and iron pipe, pipe fittings, valves, etc.

Steel Towers—Guam.—Until Jan. 8, by Bureau Yards & Docks, Navy Dept., Washington, D. C. (H. R. Stanford, Ch.), for two 400 steel towers at radio station, Island of Guam. Specification No. 2202.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Park Improvement—Philadelphia, Pa.—Lowest bid opened by Board of Recreation for improvements to Westmoreland Recreation Center and Playground was submitted by F. W. Van Loon, at $22,651.

Coal Pockets, Emerald Street—Philadelphia, Pa.—Two lowest bids opened Nov. 10 by Philadelphia & Reading R.R. for constructing coal pockets at Emerald Street submitted by C. P. Bowers of Reading at $65,899, and McNichol Paving & Contracting Co., Philadelphia, at $74,360. Samuel T. Wagner, Chief Engineer.

★**Mechanical Equipment in Immigrant Station—Baltimore, Md.**—Contract for mechanical equipment in the Immigrant Station awarded W. G. Cornell Company, Washington, D. C., at $82,759.

Proposals

For Proposals Advertised, see Pages 43 and 44

WATERWORKS.

Bids Close.		See Eng. Record.
Nov. 23.	Pipes, Valves, Etc., Washington, D. C.	Nov. 6
Nov. 23.	Water Works, Ventnor City, N. J.	Nov. 6
Nov. 23.	Conduit, Washington, D. C.	Nov. 13
Nov. 23.	Valves, Chicago, Ill.	Nov. 20
Nov. 25.	Laying Pipe, Charleston, S. C.	Nov. 13
Nov. 26.	Engine and Pumps, Clarksburg, W. Va. Adv. Oct. 30.	Oct. 30
Nov. 30.	Pipe Fittings, Etc., Washington, D. C.	Nov. 13
Nov. 30.	Brass cocks, Washington, D. C.	Nov. 20
Nov. 30.	Automatic ejectors, Panama.	Nov. 20
Dec. 1.	Water Works, East Youngstown, Ohio	Oct. 16
Dec. 1.	Water Works, Melrose, Wis.	Nov. 6
Dec. 1.	Pipe line, San Juan, P. R.	Nov. 20
Dec. 2.	C. I. Pipe, Jersey City, N. J. Adv. Oct. 30 to Nov. 20.	Oct. 30
Dec. 2.	Steel Pipe, Jersey City, N. J. Adv. Oct. 30 to Nov. 20.	Oct. 30
Dec. 3.	Water Works, Henderson, Tenn. Adv. Nov. 13, 20.	Nov. 13
Dec. 3.	Wells, Henderson, Tenn. Adv. Nov. 20.	Nov. 20
Dec. 6.	Reservoir, Stockton, Cal.	Nov. 20
Dec. 7.	Water Works, Wesson, Miss.	Nov. 13
Dec. 7.	Pipe Fittings, Washington, D. C.	Nov. 13
Dec. 9.	Bridge for main, Covington, Ky. Adv. Nov. 13.	Nov. 13
Dec. 10.	Water works, East Youngstown, Ohio. Adv. Nov. 20.	Nov. 30
Dec. 14.	Improvements, Wilberforce, Ohio	Nov. 20
———	System, Wooster, Ohio. Adv. Nov. 20.	Nov. 20

SEWERAGE AND SEWAGE DISPOSAL.

Nov. 23.	Oakland, Iowa	Oct. 23
Nov. 23.	Columbus, Ohio.	Nov. 13
Nov. 23.	Toronto, Ont.	Nov. 13
Nov. 23.	Cleveland, Tenn	Nov. 13
Nov. 23.	New York, N. Y.	Nov. 20
Nov. 24.	San Benito, Tex.	Oct. 30
Nov. 24.	Marion, Ohio	Nov. 13
Nov. 24.	Newark, N. J.	Nov. 13
Nov. 24.	Baltimore, Md.	Nov. 20
Nov. 24.	Trenton, N. J.	Nov. 20
Nov. 24.	Aurora, Ill. Adv. Nov. 20.	Nov. 20
Nov. 26.	Toledo, Ohio.	Nov. 13
Nov. 29.	Dixon, Ill.	Nov. 13
Nov. 29.	Richmond, Ind.	Nov. 20
Nov. 29.	Washington, D. C. Adv. Nov. 20.	Nov. 20
Dec. 1.	Columbus, Ohio.	Nov. 13
Dec. 1.	Mansfield, Ohio.	Nov. 20
Dec. 2.	Contract 4, Chicago, Ill. Adv. Oct. 30.	Oct. 30
Dec. 3.	Henderson, Tenn. Adv. Nov. 13, 20.	Nov. 13
Dec. 21.	Strawberry Point, Iowa.	Nov. 20
———	Parkersburg, Pa. Adv. Oct. 9.	Oct. 9

BRIDGES.

Nov. 23.	Woonsocket, R. I. Adv. Nov. 6, 13.	Nov. 6
Nov. 26.	Steubenville, Ohio	Nov. 6
Nov. 27	Illinois	Nov. 13
Nov. 29.	Sacramento, Cal.	Nov. 13
Nov. 29.	California.	Nov. 20
Nov. 30.	Jackson, Tenn. Adv. Nov. 20.	Nov. 20
Nov. 30.	Marion, Ill.	Nov. 20
Dec. 6.	Louisville, Ky. Adv. Nov. 6 to 20.	Nov. 6
Dec. 6.	Edwards, Miss.	Nov. 13
Dec. 6.	Woodville, Miss.	Nov. 13
Dec. 6.	Grenada, Miss.	Nov. 13
Dec. 6.	Leakesville, Miss.	Nov. 20
Dec. 6.	Holly Springs, Miss.	Nov. 20
Dec. 7.	Canton, China Adv. Oct. 23.	Oct. 23
Dec. 7.	Wathena, Kan.	Nov. 20
Dec. 7.	Pennsylvania	Nov. 20
Dec. 8.	Lorain, Ohio.	Nov. 20
Dec. 8.	New Gretna, N. J.	Nov. 20
Dec. 9.	Covington, Ky. Adv. Nov. 13, 20.	Nov. 13
Dec. 9.	Bakersfield, Cal.	Nov. 20
Dec. 13.	Selma, Ala.	Nov. 20

PAVING AND ROADS.

Nov. 23.	Omaha, Neb.	Nov. 13
Nov. 23.	Baltimore, Md.	Nov. 20
Nov. 23.	New York, N. Y.	Nov. 20
Nov. 23.	Dixon, Ill.	Nov. 20
Nov. 23.	Philadelphia, Pa.	Nov. 20
Nov. 26.	Austin, Tex.	Nov. 20
Nov. 27.	Independence, Ohio	Nov. 13
Nov. 27.	Walla Walla, Wash.	Nov. 13
Nov. 29.	Mount Holly, N. J.	Nov. 20
Nov. 29.	Dayton, Ohio.	Nov. 20
Nov. 30.	Toledo, Ohio.	Nov. 13
Dec. 1.	Hastings, Neb.	Nov. 6
Dec. 4.	Pensacola, Fla.	Nov. 13
Dec. 6.	Sedalia, Mo.	Nov. 6
Dec. 6.	Brookville, Ind.	Nov. 13
Dec. 6.	Princeton, W. Va. Adv. Nov. 13, 20.	Nov. 13
Dec. 6.	Edwards, Miss.	Nov. 13
Dec. 6.	Winamac, Ind.	Nov. 13
Dec. 6.	Wauchula, Fla.	Nov. 20
Dec. 6.	Edwards, Miss.	Nov. 20
Dec. 6.	Indiana	Nov. 20
Dec. 7.	Excelsior, Minn.	Nov. 13
Dec. 7.	Indiana	Nov. 20
Jan. 3.	Maynardsville, Tenn.	Nov. 20
Dec. 8.	Indiana	Nov. 20
Dec. 6.	El Centro, Cal.	Nov. 20
Dec. 10.	Seattle, Wash.	Nov. 20

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS.

Nov. 22.	Dredging, Philadelphia, Pa. Adv. Oct. 30 to Nov. 13.	Oct. 30
Nov. 23.	Ditch, Spencer, Iowa.	Nov. 13
Nov. 23.	Dredging, New York, N. Y.	Nov. 20
Nov. 24.	Dredging, Boston, Mass. Adv. Nov. 13.	Nov. 13
Nov. 24.	Dam, Salt Lake City, Utah.	Nov. 13
Nov. 24.	Bulkhead, Boston, Mass. Adv. Nov. 13.	Nov. 13
Nov. 24.	Dredging, New York, N. Y.	Nov. 20
Nov. 24.	Ditch, Algona, Iowa.	Nov. 20
Nov. 25.	Levee, Waxahachie, Tex.	Nov. 20
Nov. 26.	Dredging, Cleveland, Ohio. Adv. Oct. 30 to Nov. 20.	Oct. 30
Nov. 26.	Ditch, Anoka, Minn.	Nov. 20
Nov. 27.	Dredging, Norfolk, Va.	Nov. 6
Nov. 27.	Ditch, Plymouth, Ind.	Nov. 6
Nov. 30.	Dredging, Orange, Tex.	Nov. 13
Dec. 1.	Irrigation Work, Meadow Creek, Wash. Adv. Oct. 23.	Oct. 23
Dec. 1.	Seawall, Waveland, Miss.	Nov. 6
Dec. 1.	Canal, Westminster, Cal.	Nov. 13
Dec. 1.	Seawall, Bay St. Louis, Miss.	Nov. 20
Dec. 6.	Pier, Philadelphia, Pa. Adv. Nov. 13, 20.	Nov. 13
Dec. 6.	Levee, Grenada, Miss.	Nov. 13
Dec. 6.	Drainage, Mason City, Iowa.	Nov. 20
Dec. 11.	Dredging, Brooklyn, N. Y.	Nov. 20
Dec. 14.	Dredging, New York, N. Y. Adv. Nov. 13, 20.	Nov. 13
Jan. 8.	Dredge, Macaco, China	Nov. 6

PUBLIC BUILDINGS AND SCHOOLS.

Nov. 23.	Winder, Ga.	Nov. 6
Nov. 23.	New Orleans, La.	Nov. 6
Nov. 23.	Monclair, N. J.	Nov. 6
Nov. 23.	Shamokin, Pa.	Nov. 20
Nov. 23.	Middletown, N. Y. Adv. Nov. 20.	Nov. 20
Nov. 24.	Fort Mason, Cal.	Nov. 13
Nov. 24.	Austin, Tex.	Nov. 20
Nov. 25.	Gainesville, Tex.	Nov. 6
Nov. 26.	Navasota, Tex.	Oct. 23
Nov. 26.	Ft. Terry, N. Y. Adv. Oct. 30 to Nov. 20.	Oct. 30
Nov. 26.	West Unity, Ohio.	Nov. 6
Nov. 27.	Brenham, Tex.	Oct. 30
Nov. 27.	Fort Bliss, Tex. Adv. Oct. 30 to Nov. 20.	Oct. 30
Nov. 27.	Pearl City, Hawaii	Oct. 30
Nov. 29.	Muskegon, Mich.	Oct. 30
Nov. 29.	Rowley, Iowa	Nov. 13
Nov. 29.	Coffeyville, Kan.	Nov. 20
Nov. 29.	Putman, Conn.	Nov. 20
Nov. 29.	Houston, Tex.	Nov. 20
Nov. 30.	Emporia, Kan.	Nov. 13
Nov. 30.	Newark, N. J.	Nov. 20
Nov. 30.	Washington, D. C.	Nov. 20
Dec. 1.	Bloomington, Ind. Adv. Oct. 30.	Oct. 23
Dec. 1.	Columbus, Ohio	Nov. 6
Dec. 1.	New York, N. Y.	Nov. 13
Dec. 1.	Seattle, Wash.	Nov. 20
Dec. 1.	Cleveland, Ohio	Nov. 20
Dec. 3.	New Berlin, Ohio.	Nov. 20
Dec. 4.	Pearl City, Hawaii	Nov. 6
Dec. 4.	West Manchester, Ohio.	Nov. 6
Dec. 4.	Ortonville, Minn.	Nov. 13
Dec. 4.	East Cleveland, Ohio.	Nov. 20
Dec. 4.	Portland, Me.	Nov. 20
Dec. 7.	Titusville, Fla.	Nov. 20
Dec. 8.	Minneapolis, Kan.	Nov. 20
Dec. 8.	Seattle, Wash.	Nov. 20
Dec. 9.	Lebanon, Ind.	Nov. 6
Dec. 10.	Greenwich, Conn.	Nov. 6
Dec. 13.	Cincinnati, Ohio	Nov. 20
Dec. 14.	New Philadelphia, Ohio.	Nov. 20
Dec. 18.	Middletown, Ohio. Adv. Nov. 13, 20.	Nov. 13
Dec. 20.	Humboldt, Tenn.	Nov. 13
Dec. 21.	Attleboro, Mass.	Nov. 20
Nov. 22.	Aurora, Neb.	Nov. 20
Dec. 28.	Seymour, Conn.	Nov. 20
Dec. 30.	St. Petersburg, Fla. Adv. Nov. 20.	Nov. 20
Jan. 4.	Cavite, P. I.	Nov. 13

PRIVATE BUILDINGS.

Nov. 24.	Monroe, Mich.	Nov. 20
Dec. 1.	Athens, Ga.	Nov. 13

NEW INDUSTRIAL PLANTS.

Dec. 15.	Seattle, Wash.	Nov. 20

MISCELLANEOUS.

Nov. 22.	Conduits in Public Building, New Orleans, La.	Nov. 20
Nov. 23.	Power Plant, Oakley, Kan.	Nov. 6
Nov. 23.	Electric railways, New York, N. Y.	Nov. 13
Nov. 24.	Railroad, San Francisco, Cal.	Nov. 13
Nov. 24.	Cement, Chicago, Ill.	Nov. 20
Nov. 24.	Hardware for armory, Buffalo, N. Y. Adv. Nov. 20.	Nov. 20
Nov. 26.	Cranes, Charleston, S. C.	Oct. 16
Nov. 26.	Pipes, valves, etc., Panama.	Nov. 13
Nov. 26.	Concrete steps, Cincinnati, Ohio.	Nov. 20
Nov. 27.	El. Ry., Pearl City, Hawaii	Oct. 23
Nov. 27.	Subway, Tucson, Ariz.	Nov. 13
Nov. 29.	Electric Light Plant Addition, New Madrid.	Nov. 13
Nov. 29.	Hoistway and Elevator, Jefferson City, Mo.	Nov. 6
Nov. 30.	El. Rys., New York, N. Y.	Nov. 13
Dec. 1.	Pipe, etc., Panama.	Nov. 20
Dec. 2.	Bowling Alley, Fort Totten, N. Y. Adv. Nov. 6 to 20.	Nov. 6
Dec. 3.	Garbarge disposal, York, Pa. Adv. Nov. 20.	Nov. 20
Dec. 7.	El. Rys., New York, N. Y.	Nov. 13
Dec. 7.	El. Rys., Philadelphia, Pa.	Nov. 20
Dec. 8.	Electric lighting, West Hazleton, Pa. Adv. Nov. 13, 20.	Nov. 13
Dec. 8.	Elevator in P. O. Bldg., Pottsville, Pa.	Nov. 20
Dec. 14.	El. Rys., Philadelphia, Pa.	Nov. 20
Dec. 15.	Timber, Sault Ste. Marie, Mich. Adv. Nov. 13, 20.	Nov. 13
Dec. 18.	El. Rys., Pearl City, Hawaii	Nov. 20
Dec. 20.	Coal, Norfolk, Va. Adv. Nov. 20.	Nov. 20
Jan. 8.	Steel towers, Guam.	Nov. 20
Apr. 1.	Memorial, Fort McHenry (P. O. Baltimore), Md.	Nov. 20

SEARCHLIGHT SECTION

Official Proposal Announcements

Price $2.40 an inch—Copy can be received until Thursday to a. m. for issue mailed the next morning

Bids open December 10, 1915.

LEGAL NOTICE

PUMPING STATION, FILTER PLANT, PUMPS, GAS ENGINES, PIPE LINES, STAND PIPE, TOOLS AND APPURTENANCES

EAST YOUNGSTOWN, OHIO.

Sealed proposals for the construction of a one (1) million gallon filter plant, pumping station, pumps, gas engines, pipe lines, stand pipe, tools, and other appurtenances for the installation of a complete water works system, will be received by the Village of East Youngstown, Ohio, at the office of the Village Clerk, at the Municipal Building, East Youngstown, Ohio, until twelve (12) o'clock noon, Dec. 10, 1915, and will then be opened and read publicly.

All bids shall be made upon the official proposal blanks attached to the Instructions to Bidders, Specifications, and Form of Contract and Bond, which may be seen at the office of the Clerk, Municipal Building, East Youngstown, Ohio, or may be obtained by loan for bidding purposes upon application to Chester & Fleming, Engineers, Union Bank Building, Pittsburgh, Pa.; Carl R. Anderson, Village Clerk, on deposit of a certified check for twenty-five ($25.00) dollars, which will entitle bidder to one set of plans and specifications, covering the items on which he signifies his intention to bid. Proper receipt for each such deposit will be given and the money will be refunded provided plans and specifications are returned in good condition within ten (10) days after reception of bids.

Each proposal shall be accompanied by a certified check made payable to the order of G. N. Reed, Treasurer of the Village of East Youngstown, Ohio, of not less than three (3%) per cent of the total amount of the bid, but in no case shall this check be less than one hundred ($100.00) dollars. This check is to be conditioned that if bid is accepted, a contract will be entered into and performance of same secured within ten (10) days after notification of acceptance of the bid. In case bid is rejected, or contract entered into, check will be returned. Successful bidders, on amounts in excess of five hundred ($500.00) dollars, will be required to furnish a corporate surety bond in an acceptable surety company in the full amount of the contract.

The right is reserved to reject any or all bids.

By order of Council.

CARL R. ANDERSON,
Village Clerk,
East Youngstown, Ohio.

CHESTER & FLEMING, Engineers,
Union Bank Building,
Pittsburgh, Pa.
Nov. 6, 1915.

Bids open November 24, 1915.

NOTICE TO CONTRACTORS.

HARDWARE FOR ARMORY

BUFFALO, N. Y.

Sealed proposals for furnishing the finishing hardware for the Armory & Stable for Troop I, First Cavalry, N. G. N. Y., Buffalo, N. Y., will be received by Col. Franklin W. Ward, secretary, State Board of Armory Commissioners, Telephone Building, Albany, N. Y., until 4 o'clock P. M., on Wednesday, Nov. 24, 1915, when they will be opened and publicly read. Proposals shall be inclosed in an envelope furnished by the State Architect, sealed and addressed. The right is reserved to reject any or all bids. Copies of the specifications, proposal blanks and envelopes may be secured upon requisition at the Department of Architecture, Capitol, Albany, N. Y., and may be seen at the New York Office of the Department of Architecture, Room 1224, Woolworth Building.

FRANKLIN W. WARD,
Secretary, State Board of Armory Commissioners.
Nov. 9, 1915.

Bids open December 6, 1915.

PIER SUPERSTRUCTURE

DEPARTMENT OF WHARVES, DOCKS AND FERRIES,
555 BOURSE BUILDING,
PHILADELPHIA, PA.

Sealed proposals, endorsed "Bids for the construction of the superstructure of McKean Street Pier, No. 78-80 South, and its adjacent bulkhead shed in the Delaware River, between McKean Street and Snyder Avenue," will be received until 12 o'clock noon, Monday, December 6, 1915, at the office of the Director of the Department of Wharves, Docks and Ferries, 555 Bourse Building, Philadelphia, and then publicly opened.

Plans, specifications and blank forms upon which bids must be made can be obtained at the office above mentioned upon the deposit of a certified check in the amount of twenty-five dollars ($25), to cover the cost of making blue prints, etc., which check will be refunded to the bidder upon the return of the plans and specifications in good condition. The successful bidder will be furnished with all necessary blue prints free of charge. Approximate limit of cost $500,000.

No bid will be considered unless accompanied by a certificate from the City Solicitor of the City of Philadelphia, to the effect that the provisions of an ordinance requiring proposal bonds on all bids exceeding in amount five hundred dollars ($500), approved May 25, 1860, have been complied with.

The Director reserves to himself the right to reject any or all bids as he may deem best for the interest of the city of Philadelphia.

JOHN MEIGS,
Director.

Nov. 5, 1915.

Bids open November 30, 1915.

NOTICE TO CONTRACTORS.

HIGHWAY BRIDGES

JACKSON, TENN.

Bids will be received at the office of the County Engineer until 10 a. m., Nov. 30, 1915, for three highway bridges across 46-ft. canal.

Bidders will be expected to submit plans and bids for material and erection for either concrete or steel, or for both types.

Profile, alignment and general specifications may be had on application to County Engineer.

Right is reserved to reject any and all proposals or to accept the proposal deemed best for Madison County.

(Signed) A. W. STOVAL,
County Judge.
(Signed) E. G. BUCK,
County Engineer.

Nov. 3, 1915.

Bids open December 3, 1915.

10-INCH WELLS

HENDERSON, TENN.

Sealed bids addressed to the City Recorder and endorsed "Proposal for Wells" will be received until 8 P. M., Dec. 3rd 1915, at which time they will be publicly opened and read.

Certified check, $200.00, to the order of the City Treasurer of Henderson. Probable depth of wells 100 to 250 feet. The Board reserves the right to reject any or all bids.

Specifications may be obtained from the Engineer.

E. M. BRADEN,
City Recorder.

FRANK L. WILCOX, Engineer,
Syndicate Trust Bldg., St. Louis, Mo.

Bids open December 3, 1915.

BIDS FOR GARBAGE DISPOSAL

YORK, PA.

Proposals are hereby invited by the City of York, Pa., for the collection and disposal of organic and inorganic garbage in said City for five and ten year periods commencing the first Monday of April, 1916. Contractor must furnish teams for collection and all facilities for disposal. Bidding blanks and specifications may be obtained from C. P. Shreiner, City Clerk, York, Pa., to whom bids must be delivered not later than Friday, Dec. 3, 1915, at 2.00 o'clock P. M. The right is reserved to reject any and all bids.

For further information address
C. A. BOYER,
Supt Streets & Public Improvements.
City Hall, York, Pa.

Bids open December 9, 1915.

TO BRIDGE CONTRACTORS

COVINGTON, KY.

Sealed proposals for the construction of a bridge superstructure, indorsed proposals for bridge will be received by J. Mason Howk, Commissioner of Public Property of Covington, Ky., until 10 o'clock, Thursday, Dec. 9, 1915.

Said work is for a bridge to be constructed to carry the Duplicate Water Supply Main over the Licking River for the City of Covington, Ky.

Each proposal will have to be accompanied by a cash deposit or certified check in the sum of fifteen hundred ($1,500) dollars as a guarantee that the party making the proposal will, if the contract is awarded to him or them execute the same with approved security. Should any bid be rejected such check will be returned to the bidder, and should any bid be accepted such check will be returned upon the proper execution and securing of the contract. In the event of any bidder failing to execute the contract for the work that has been awarded to him, such bidder shall forfeit the sum so deposited. Check to be made payable to the city of Covington, Ky., or order.

The contractor for the bridge work will be required to give an approved Surety or Trust Company Bond for the sum of twenty thousand ($20,000) dollars to insure a faithful completion of the contract.

Copies of specifications will be furnished bidders upon application to the Commissioner of Public Property, or the Consulting Engineer, and outline drawings giving the longitudinal elevation and plan of the bridge; also of the piers and their location, can be seen at the office of either.

Bidders must endorse their names and address upon the outside of the envelopes containing their bids.

The Board of Commissioners reserves the right to reject any or all bids.

J. MASON HOWK,
Commissioner of Public Property.
Covington, Ky., Nov. 6, 1915.
GEO. HORNUNG,
Consulting Engineer,
Wool-Sack Building,
Newport, Ky.

Bids open December 8, 1915.

ELECTRIC LIGHTING

WEST HAZLETON, PA.

Bids will be received for the electric lighting of West Hazleton Borough, Pa., during a period of ten years according to the specifications on file with the undersigned. Said bids to be presented on or before 8 o'clock P. M. of December 8th, 1915.

WILLIAM KRAPF, Sec'y,
107 North Broad Street,
West Hazleton, Pa.

Bids open December 2, 1915.

ELEVATED STEEL TANK FOR WATER SUPPLY

WHEATON, ILL.

Sealed proposals will be received by the Water Supply Committee of the City Council of the City of Wheaton, Du Page County, Illinois, on Thursday, December 2, 1915, at 2 o'clock P. M., in the Council Chambers, City Hall, Wheaton, Illinois, for the furnishing and erection, complete, including foundations, of an elevated steel tank of 200,000 gallons capacity, at which time and place they will be opened and read.

Proposals must be enclosed in a sealed envelope endorsed "Proposals for the construction of an elevated steel tank at Wheaton, Du Page County, Illinois," and must be directed to the Water Supply Committee, City Council of the City of Wheaton, Illinois.

No bid will be considered unless accompanied by a certified check for 10 per cent of the amount bid, drawn upon a National or State Bank and made payable to the City Treasurer of the City of Wheaton, Illinois.

A satisfactory surety bond for the amount of $6,000.00 will be required of the successful bidder conditioned upon the faithful performance of the work.

Specifications, form of proposal, and drawings can be seen and secured at the office of La Verne J. Ruddock, City Engineer, Wheaton, Illinois.

The Water Supply Committee of the City of Wheaton reserve the right to reject any or all bids if it is considered for the best interest of the City of Wheaton so to do.

LEWIS ELLSWORTH, City Clerk.
Dated at the City Clerk's office, Wheaton, Illinois, November 16, 1915.

NOTICE TO CITY WATER PLANT CONTRACTORS

WOOSTER, OHIO

City Water Plant Contractors are hereby notified that the Director of Public Service of the City of Wooster, Ohio, has been authorized by the Council of said city by ordinance passed Sept. 20, 1915, to advertise for and to receive proposals for furnishing said city with an adequate supply of pure water satisfactory to the Ohio State Board of Health for a period not to exceed ten years with the option in said city to purchase or lease said plant at certain specified times. Said proposals are not to be in the nature of legal bids, but are intended to furnish said city with information as to probable cost of such a system, and if the same are satisfactory, regular bids, through proper legislation, will then be asked for.

MAX BLOOMBERG,
Director of Public Service.
G. E. C. BROWN,
Clerk of said Officer.
Wooster, Ohio, Nov. 6th, 1915.

Bids open December 6, 1915.

MACADAM ROAD BIDS ASKED

OFFICE OF CHIEF ENGINEER ROAD CONSTRUCTION.
PRINCETON, MERCER COUNTY, WEST VA.

Bids will be received at the County Clerk's Office, Princeton, West Va., until 12 o'clock noon, Dec. 6, 1915, for the construction of six and one-third miles of water bound macadam, between Rock and Giatto in Mercer County, West Virginia.

Plans and specifications on file in the Chief Engineer's office.

A certified check for the sum of $500, payable to the County Court of Mercer County to accompany each bid.

The right is reserved to reject any or all bids.

A minimum time limit, other things being equal, will be considered important in the awards.

GEO. H. HILL,
Chief Engineer.

CONTRACTING NEWS

Of Special Interest to Engineers, Contractors, Builders and Manufacturers of Engineering and Building Supplies

DOMESTIC ORDERS appear to be the leading feature of the steel market. It is estimated that steel mills during the past week took orders for 250,000 tons to enter into the manufacture of rails, locomotives, cars and structural material. Due to the demand for railroad and export material the lumber industry is shipping in greater quantities.

October exports, according to Government estimate, rose more than $30,000,000 above the previous high mark set in September. This was attained despite the lack of ocean tonnage to accommodate the great mass of merchandise accumulated at the s aboard. Foreign commerce, incoming and outgoing, for the twelve months ended with October, exceeded $5,000,000,000. The call upon banks acting as depositors for the funds realized from the sale of the Anglo-French loan bonds for the payment of the second installment of the proceeds indicates the large rate at which England and France are buying supplies. The call is for 30 per cent of the amount realized, the previous call having been for 15 per cent. The amount involved in the new requisition is approximately $145,000,000.

Structural business has been hampered by the rising cost of plain material. It has been estimated that the structural lettings in October amounted to 78 per cent of the capacity of the country, which is equal to 134,150 tons.

Buildings

A contract was awarded at $150,000 for the construction of a portion of the Chicago & North Western Railroad's new freight depot at Sioux City, Iowa. The lowest bid received for the construction of a municipal building at Milford, Conn., was $118,000. Bids were opened at Huntington, W. Va., for the construction of an extension to the U. S. post office and court house, which resulted in a bid of $121,800. Plans were filed for the erection of several apartment and tenement houses in New York City ranging in cost from $75,000 to $170,000, also for a six-story garage to cost $150,000. Plans are being prepared for the erection of a seven-story brick, stone and concrete hotel at Eddystone, Pa., to cost $175,000. A contract was awarded in Philadelphia for the erection of a new hospital to cost $300,000, and a contract was signed for the erection of a steel and reinforced-concrete foundry for the Maryland Steel Company at Sparrows Point, Md., at $350,000. The Board of Education of Philadelphia is contemplating the erection of a school which will cost $300,000, and the school board of Uniontown, Pa., authorized an election to vote $250,000 in bonds for the erection of schools. Plans are being prepared in Baltimore for a nine-story apartment house to cost approximately $200,000. It is reported that bids are desired for the erection of a twelve-story club house in Chicago to cost $350,000, also that bids are desired for the erection of a four-story and basement administration building at Emporia, Kan., to cost $175,000. Plans are being prepared at Champaign, Ill., for the construction of a newspaper plant to cost $50,000. It is reported that a $100,000 fertilizer factory is to be erected at Greensboro, N. C. Plans are being prepared in Cleveland for the erection of a concrete, steel and brick commercial building to cost about $250,000. Plans are also being prepared for reinforced-concrete natatorium at Seattle, Wash., to cost $250,000. The citizens of Asheville, N. C., voted $200,000 in school bonds, $150,000 of which is to be used for erecting a new high school. The Board of Freeholders of Newark, N. J., are taking steps to erect an eight-story office building and to remodel the court house, involving an expenditure of about $1,000,000. An architect has been engaged to prepare plans for a school at Terre Haute, Ind., to cost $115,000. Chemical and mechanical laboratories, shops and power house are being planned for the Rose Polytechnic Institute, which will cost $1,000,000. The citizens of Flint, Mich., voted $110,000 in school bonds. The commissioners' court of Nolan County, Tex., has ordered an election for Dec. 18 to vote on the proposition of issuing $250,000 in bonds, of which $150,000 is to be used for erecting and equipping a new court house.

Bridges and Roads

The approval of plans for the $2,500,000 bridge over the Thames River at New London for the New York, New Haven & Hartford Railroad stands out as the principal development along bridge building lines during the week. Plans are being prepared for three reinforced-concrete bridges over the Miami River, contract for which will probably be let in January. It is reported that bids are desired for a 110-ft. span steel bridge and two 30-ft. span steel bridges at Linneus, Mo. Bids are wanted until Dec. 8 for the construction of a $30,000 steel bridge at Ada, Mich. The construction of a concrete viaduct to cost about $35,000 is reported to be contemplated at Iowa City, Iowa. Monmouth County, New Jersey, is considering constructing a $35,000 bridge over the Shrewsbury River. The construction of a $20,000 bridge is being considered at Sandpoint, Idaho. The lowest bid for the construction of a concrete bridge over the Charles River at Boston was $117,352.

The State Highway Commission of Ohio has apportioned a total of $237,000 of the highway fund for work in several counties. The county engineer at Miami, Fla., has been directed to prepare plans for the construction of the Tamiami Trail Highway, which will cost about $275,000. The lowest bid opened for paving at Greenwood, S. C., totaled $105,585. A contract for a $75,000 shell road has been awarded at Kountze, Tex. The city of Dumont, Tex., awarded a $275,000 paving contract. The citizens of Pinellas County, Fla., voted $750,000 in bonds for constructing brick highways. Plans have been prepared for about 57 miles of macadam road in Union County, Arkansas, to cost about $350,000, and in Carroll County 22 miles of gravel surface road will be constructed at a cost of $90,000. Bonds were voted for $350,000 for gravel road construction near Globe, Ariz., and about $200,000 in highway bonds were sold at Huntsville, Tenn. The City Council of Richmond, Va., is contemplating the construction of a Northside boulevard, estimated cost of which is about $500,000. Bids are being advertised for by the State highway commissioner of Ohio for about $100,000 worth of highway construction in that State. Bids are also desired at Bellingham, Wash., for the construction of $95,000 worth of asphalt pavement. Santa Cruz County, Arizona, is advertising for bids for $150,000 in road bonds. Bids are desired at Ida Grove, Iowa, for 60,000 sq. yd. of either asphalt or concrete pavement.

Waterworks and Sewers

Waterworks bonds amounting to $250,000 and sewer bonds amounting to $40,000 have been sold at Dana, N. C. The citizens of Florence, Ala., voted in favor of issuing $210,000 in bonds for the purchase of the waterworks and the installation of a filtration plant. The city commissioner of Tyler, Tex., has decided to construct a water system to cost $250,000. The director of the Department of Public Works at Pittsburgh has been instructed to prepare detail estimates of cost of extensions and improvements to the water system which will cost about $1,200,000. This is preparatory to the submission of a bond issue in the sum of $7,000,000 for public work improvements to be submitted to the voters of the city. The City Council of Pullman, Ala., has decided to extend water mains about two miles. Bids are wanted at St. Hyacinthe, Quebec, for the construction of a $75,000 gravity filter. The city of Winchester, Ky., intends to extend its present waterworks system 4 or 5 miles to the Kentucky River, which will necessitate the installation of additional machinery. The City Council of Athens, Ohio, has authorized the issue of $64,000 waterworks bonds.

The construction of storm sewers to cost $175,000 is contemplated for the next year at Clinton, Iowa. The contract for constructing sewers at Owensboro, Ky., for which the citizens voted $225,000, will not be let until January. Fort Branch, Ind., proposes to build a sanitary sewer system and sewage purification plant that will cost about $15,000. The citizens of Greensboro, N. C., will vote on the issue of $75,000 in bonds for laying new sewers, Dec. 14 Sewer improvements to cost $50,000 are contemplated at Lynn, Mass. The construction of two sewers at Toronto, Canada, to cost $56,500 has been recommended. Engineers have estimated the cost of constructing a disposal plant for Bowling Green, Ohio, at $69,000 if built inside the city and $80,000 if built outside the city.

Miscellaneous

A permit has been issued in Oregon for an irrigation project that will cost more than a million dollars. Drainage bonds in the sum of $157,000 have been issued at Corpus Christi, Tex. Bids are desired at Robstown, Tex., for constructing about 45 miles of ditches in Drainage District No. 2, which will require approximately 1,000,000 cu. yd. of earth excavation, and construction of an equal length of lateral ditches, which will require 150,000 u. yd. of excavation, the necessary bridges, culverts, etc. Houston, Tex., has sold $275,000 in harbor bonds. The lowest bid for the filling in the Waiolama reclamation and sanitary project at Hilo, T. H., was $190,600. Contract has been awarded for a $65,536 wharf at Dumont, Tex. About $325,000 in bonds will be issued to enlarge the storage capacity of the Antelope Irrigation District in New Mexico, and to extend ditches into new territory around that district.

A contract has been awarded in Toronto for an $84,000 incinerator, building, bridge, etc., for Don Roadway. Lowest bid open for constructing track on the Queensboro Subway Extension, New York City, was $204,898. It is reported that 44 miles of railway will be constructed between St. Claire and Warrenton, Ga.

WATERWORKS

PROPOSED WORK.

Buffalo, N. Y.—Board of Aldermen appropriated $57,599 for enlarging water system and $40,000 for trunk sewer work.

Atlantic City, N. J.—City Commissioners voted $10,000 for enlarging and improving water supply.

Pittsburgh, Pa.—Robert Swan, Director Department Public Works, has been instructed to prepare detailed estimates of cost of following improvements: for widening and improving Diamond Street between Grant and Smithfield Streets, $300,000; widening, establishing grade and improving East Ohio Street between Heinz Street and the city line, $390,000; raising streets in flood districts on North Side between Federal Street and Allegheny Avenue, $300,000; widening and establishing grade of Warrington Avenue, $120,000; widening of Mount Oliver Street, $90,000; widening and establishing grade of Chartiers Avenue between Corliss Street and Corliss Station, $60,000; widening and changing grade of East Carson Street between Smithfield and Seventh Streets, $90,000; widening and establishing grade of Arlington Avenue between South Twenty-seventh and Clover Streets, $120,000; opening Mount Washington Roadway between Brownsville and Grandview Avenues, $390,000; widening Elmira Street and repaving Howard Street, $60,000; repairing and repaving streets, $750,000; improvements of Saw Mill Run as an open surface water drain between the Ohio River and the city line, $150,000; highways, bridges and viaducts, $450,000; parks and playgrounds, $390,000; extension and improvement of water system, $1,200,000. A bond issue of $7,000,000 is to be submitted to the voters.

Durham, N. C.—Water bonds amounting to $250,000 and sewer bonds $40,000 have been sold.

Charleston, S. C.—Council authorized an election Dec. 14 to vote $1,500,000 for purchase of plant of Charleston Light & Water Company; also an additional $100,000 for repairs and extensions of said plant.

Homestead, Fla.—Citizens voted $40,000 bonds for improvements including street paving, water works, sewers, and town hall.

Cullman, Ala.—City Council has decided to extend the water mains about two miles.

Florence, Ala.—Reported citizens voted in favor of issuing $... bonds for purchasing the present water plant and installing a filter.

Winchester, Ky.—The city intends extending present system 4 or 5 miles to the Kentucky River and will necessitate installation of additional machinery. City formerly purchased local plant. D. T. Mathis, Mayor.

Athens, Ohio.—City Council authorized the issue of $40,000 water works bonds.

Cleveland, Ohio.—Ordinance passed by Council authorizing Director Public Utilities to spend $2,000 for purchase of meters for Division of Water.

Flint, Mich.—Preliminary plans prepared for water softening plant to be constructed at the water works; cost $25,000. Address Water Board.

Galesburg, Ill.—Water bonds amounting to $... have been sold. Contract soon to be let for constructing a well. William L. Huntzelle, City Clerk.

Rock Island, Ill.—Commissioner John A. Morris of Water Works Department advises city to purchase chlorine gas plant to replace hypochlorite as water purifier.

Lawrence, Kan.—City Commissioners reported considering purchasing plant of Lawrence Water Co.

Cape Girardeau, Mo.—Missouri Public Utilities Company, St. Louis, it is reported intends constructing an intake tower to replace present method of piping water out of Mississippi River. Tower to be concrete and cost about $25,000.

Dardanelle, Ark.—Water works bonds amounting to $... have been sold, part of this sum to be used to improve the water works. L. A. Hornaby, City Clerk.

Houston, Tex.—City Council has appropriated $... for extending the 8-in. water main on Washington Avenue, work to be done by Water Department.

Plainview, Tex.—J. R. Kelso, St. Louis, Mo., reported attorney for company planning constructing water electric light and ice plants in this vicinity.

Tyler, Tex.—City Commission has decided to construct a water system costing $25...

Commerce, Okla.—Election soon to be held to vote bonds for constructing water works estimated to cost $..., sewers will be put in later. Engineers, Benham Engineering Co., Oklahoma City. Address Town Clerk.

Seattle, Wash.—Board Public Works has approved plans of A. H. Dimock, City Engr., for water mains in Ninth Avenue N. and Forty-third Avenue, N. E.

Contract soon to be let by Board Public Works for water mains in Michigan and other streets. A. H. Dimock, City Engineer.

City Council has appropriated over the Mayor's veto $... to carry on silting experiments at Cedar River Impounding Basin.

Corcoran, Cal.—Election to be held in February to vote $... bonds for municipal water works. Willard E. Speans, City Clk.

New Plymouth, Idaho.—R. S. White, President New Plymouth Water Co., has petitioned City Council for franchise to construct and operate a water system here. A ... gal. pressure tank, pumping station and mains will be installed.

Montreal, Que.—The enlarging of the aqueduct and other improvements to the water works are contemplated. Address Mr. Cote, City Comptroller.

BIDS DESIRED.

Lyndhurst, N. J.—Until Nov. 29 by Board of Commissioners Union Township at Old Bellows Hall for laying water mains in Lyndhurst Avenue, Van Buck Avenue and in Third Street, Jones & Wesselin Township Engrs., East Rutherford.

Clarksdale, Miss.—See "Miscellaneous."

Louisville, Ky.—Until Dec. 4, by Board Public Works (Hugo H. McCready, Secy.), for erecting ten hydrants at or near intersections of Chester and Murray Avenues, Howard and Twenty-fifth and numerous other streets.

Highland Park, Mich.—Until Dec. 6 by R. Wilcox Ford, Village Clerk, for a sewage pumping station, capacity 3,000,000 gal. per hour, according to plans on file in office of Engineer, L. C. Whitaker, Construction Engineer, 20 Gerald Avenue.

Chicago, Ill.—Until Nov. 30, by Department Public Works (W. B. Moorehouse, Comr.), for furnishing and delivering to city at various locations along streets, 11,000 tons 12- to 48-in. water pipe. Also, some time and plans, for furnishing and delivering 1,000 tons City Pipe Yard, south Kedzie Avenue. Bids for gate valves.

Until Nov. 29 by Board Local Improvements (Edw. J. Glackin, Secy.) for water service pipes in portions of Aberdeen, Augusta, West Division and numerous other streets.

Until Dec. 1 by Board Public Works (W. R. Moorehouse, Comr.) for Contract No. 1, furnishing and delivering f.o.b. Pipe Yards 1500 tons c.-i. 4 to 12-in. water pipe.

Velva, N. D.—Until Nov. 29, by City Council, for improvements to water works system.

Galveston, Tex.—Until Dec. 9 by Bd. City Comrs. (John D. Kelley, Secy.), for complete installation of a submerged 20-in. c.-i. water main across a part of Galveston Bay near Causeway, approximately 9100 lin. ft. in length. City will furnish all pipe, fittings and specials for the work and deliver same to contractor f.o.b. cars Galveston. A. T. Dickey, City Engr.

Panama.—Until Dec. 8 by Maj. F. C. Boggs, Corps Engrs., U. S. A., General Purchasing Officer, Panama Canal, Washington, D. C., for Cir. No. 992—Centrifugal pumps, steel and iron castings, pig iron, gauges, valves, cocks, etc.

St. Hyacinthe, Que.—Until Dec. 14 by City Clerk for constructing gravity filter having 4,000,000 imperial gallons capacity, to cost $... Hector Cadieux, Engr., St. Hyacinthe.

PRICES AND LETTINGS.

★Indicates award of contract.

★Lynn, Mass.—Following are four lowest bids opened Nov. 16 by Thomas Campbell 2d, Commissioner Water and Water Works, for contracts "A," "B" and "C" for Ipswich River Pumping Station:

★Contract "A," constructing pumping station foundation: Bay State Dredging & Contracting Co., Boston, $11,263 (awarded contract); Sanitary Engineering & Contracting Co., Boston, $12,295; H. P. Cummings Construction Co., Ware, $16,364; Hanscom Construction Co., Boston, $16,793.

★Contract "B," pumping station superstructure, etc.: H. P. Cummings Construction Co., Ware, $5,200 (awarded contract); Bay State Dredging & Contracting Co., Boston, $6,200; Sanitary Engineering & Contracting Co., Boston, $6,200; Hanscom Construction Co., Boston, $6,480.

★Contract "C," furnishing and installing pumping and other equipment: awarded Power Equipment Co., Boston, at $11,995 (De Laval). R. J. Newson, Resident Engr.

★Washington, D. C.—Contract for a centrifugal pumping unit of 5,000,000 gal. capacity awarded by Commissioners D. C. to De Laval Steam Turbine Co., Trenton, N. J., at $15,633.

SEWERAGE AND SEWAGE DISPOSAL

PROPOSED WORK.

Lynn, Mass.—Reported improvements to the sewer system, costing $50,000, are contemplated. Address City Engineer.

Caldwell, N. J.—Council is considering the construction of the Brookside Avenue extension to the sewer system for which citizens recently voted $13,000 bonds.

Pitman, N. J.—Contsruction of sewer system costing $90,000 under consideration.

Kenova, W. Va.—Reported contract will be let early in the new year for the proposed sewer system for which the citizens recently voted $65,000 bonds.

Greensboro, N. C.—An election is to be held Dec. 14 to vote $75,000 bonds for laying new sewer lines, and $50,000 for street improvements. Address City Commissioners.

Bowling Green, Ohio.—The W. J. Sherman Co. of Toledo estimate the cost of constructing a disposal plant in the city at $90,125 and outside the city at $80,050.

Cuyahoga Falls, Ohio.—Citizens voted $... bonds to construct sewage disposal plant. R. Winthrop Pratt, Hippodrome Bldg., Cleveland, Engineer; W. F. Winston, Clerk.

Fort Branch, Ind.—Town proposes building sanitary sewer system and sewage purification plant. Estimated cost about $... C. F. Hoffman, Clerk-Treas.

Greencastle, Ind.—City is considering constructing sewage purification system, and will need approximately ... ft. Main sewer from city to Big Walnut Creek. Address City Engr.

Clinton, Iowa.—The construction of storm sewers costing $70,000 is contemplated in the new year. J. G. Thorne, City Engr.

Fort Madison, Iowa.—Contract will be let in charge of bids for two miles sanitary sewers and one and a half miles concrete and one-half mile brick paving. R. J. Lewis City Engr.

Owensboro, Ky.—Contract for constructing sewers, for which citizens voted $... will soon be let, until about Jan. 15. J. H. Heckman, Mayor.

Townsend, Mont.—Town Council is considering constructing a sanitary sewer system.

Columbus, Mont.—City Engineer George Cardozo has completed plans and specifications for sewers in four main business blocks; pipe to be 15 or 16 in. diameter and laterals 6 to 10 in. Work to be done in the spring; cost $15,000.

Corsicanna, Tex.—Sewer bonds amounting to $20,000 will be sold Nov. 30 by J. A. Harper, City Secretary. George A. Duren, Engr., Corsicanna.

Commerce, Okla.—See "Water Works."

Seattle, Wash.—Contract soon to be let by Board Public Works for sewers in Mead Street; also in Fifty-first Avenue S. A. H. Dimock, City Engineer.

Auburn, Cal.—Citizens voted Nov. 16 to issue $15,000 bonds for extending the sewers and installing septic tank. Engineer, Grover Couroy, East Auburn; M. H. Wallace, City Clerk.

Vancouver, B. C.—Contract soon to be let for constructing trunk sewer along False Creek. Address Department Public Works.

BIDS DESIRED.

Boston, Mass.—Until Nov. 29, by Edw. F. Murphy, Comr. Pub. Wks., Boston, for constructing pipe sewers and drains, Washington Street, North, City proper.

Ridgefield Park, N. J.—Until Dec. 7 by Board Village Commissioners (Harry F. Ayers, Chmn.) for constructing sewer system in West View Section, advertised in Engineering Record. M. D. Starker, Village Clerk.

Baltimore, Md.—Reported desired until Dec. 1 by Board of Awards for constructing lateral sewers in Dist. No. 34 C, Sanitary Contract 170, in all about 4100 lin. ft. 8-in. terra cotta sewer and 1300 lin. ft. house connections, and Dist. No. 39 A, Sanitary Contract No. 171, about 6700 lin. ft. of 8 to 18-in. terra cotta sewer, and 3700 lin. ft. house connections. Harry W. Rodgers, Secy. Sewer Com., 904 American Building.

Key West, Fla.—Reported desired until Jan. 4 by Board Public Works for constructing storm sewers with catchbasins, manholes, etc., in portions of Green and Duval Streets. Emory L. Pierce, City Engr.

Cuyahoga Falls, Ohio.—Reported desired until Dec. 1 for constructing about $22,000 ft. 6 to 20 in. sewers. R. W. Pratt, Engr., Hippodrome Bldg., Cleveland.

Indianapolis, Ind.—Until Nov. 29 by Bd. Pub. Wks. (Jos. A. Rink, Chmn.), for constructing a local sewer in Hardin, Market and other streets.

Chicago, Ill.—Until Nov. 29 by Board Local Improvements (Edw. J. Glackin, Secy.) for constructing brick sewers, with manholes, catchbasins, etc., in Ninety-thrid Street, North Menard and Barry Avenues; tile pipe sewers in Oak Park Avenue, Irving Park Boulevard, Dakin and a number of other streets. Also for drains in portions of Aberdeen, South Albany Avenues and other streets.

Muskogee, Okla.—Reported desired until Dec. 1 for constructing sanitary sewer system. Probable cost $22,000. E. F. Peterson, City Engr.

PRICES AND LETTINGS.

★Indicates award of contract.

Boston, Mass.—Following are three lowest bids opened Nov. 18 by Commissioners Public Works for sewers in Woodman, Custer and other streets, West Roxbury: M. De Matteo, 146 Dudley Avenue, Roslindale, $15,400; Antony Cefalo, 316 Belgrade Avenue, West Roxbury, $16,881, and De Sisto, 188 Legrange Street, West Roxbury, $17,607.

★Washington, D. C.—Contract awarded George Hyman, Washington, for constructing Benning Road sewer main at $8,465.

Sandusky, Ohio.—Following are four lowest bids opened Nov. 18 by Director Public Service for constructing the Railroad Street intercepting sewer: J. B. Sheets Co., Pittsburgh, Pa., $69,554; Robert Grace Construction Co., Pittsburgh, $83,270; Duff Construction Co., Cleveland, Ohio, $85,548, and Hadley & Glover, Canton, $91,370.

Houston, Tex.—Lowest bids opened Nov. 15 by City Council for sewers were as follows: Hawthorne Street, F. D. Horton & Son, $16,882. Smith Street, Hunter & Hunter, $1,272. Boghy Street, Hardman & Nelson, $13,810.

★Pasadena, Cal.—Contract for constructing N. W. storm drain (bids opened Nov. 9) awarded by R. V. Orbison, City Engr., to Magenovich & Gillespie of Los Angeles, at $25,299. Next three lowest bidders: Mercereau Bridge Co., Los Angeles, $26,500; J. E. Haddock, Pasadena, $25,400; T. J. Shay, Los Angeles, $30,500.

★Hamilton, Ont.—Contract for constructing subway sewers in McAnulty Boulevard and in Stapleton Avenue awarded Brennan & Hollingsworth, Hamilton.

BRIDGES

PROPOSED WORK.

Salem, Mass.—County Comrs. at Boston, cities of Beverly and Salem considering reconstructing Essex Bridge over Danvers River, between Beverly and Salem.

New London, Conn.—Plans approved by New York, New Haven & Hartford R.R. Co. (Edward Gagel, Ch. Engr., New Haven) for new bridge and approaches over Thames River at New London, to be four-track substructure, two-track superstructure (with accommodations for two additional tracks when needed); have five spans with bascule lift type, being respectively 185, 330, 212, 330 and 330 ft.; about 1000 tons of steel used. Approaches 1300 ft. on west side and 1600 ft. on east side; abutment of reinforced concrete. Four piers to be of concrete with masonry facing. Three piers constructed by open well dredging process and fourth under pneumatic caisson process. Cost, including approaches, approximately $2,500,000.

Silver Creek, N. Y.—The Town of Hanover will construct two concrete bridges in Silver Creek, one to cost $7,000, the other $7,500. J. W. Cockburn, Supt. Highways, R. F. D., Silver Creek.

Seabright, N. J.—Monmouth County Freeholders at Freehold considering construction of a bridge over Shrewsbury River at the Highlands connecting with the Highland-Seabright Drive; cost about $35,000.

Harrisburg, Pa.—The Walnut Street Bridge, for which the citizens recently voted bonds, is to cost $300,000, not $30,000, as previously stated. M. B. Cowan, City Engineer.

Phoenix, Pa.—Plans prepared by B. H. Davis for constructing Phoenix-Mont Clare bridge for Montgomery and Chester Counties. Norristown county seat of Montgomery County.

Roswell, Ga.—Cobb County Commission at Marietta voted to construct a new steel bridge over Chattahooche River at Roswell in the spring.

Akron, Ohio.—Plans prepared by City Engineer for constructing bridge over railroad tracks at Forge Street; city to pay $25,000 and railroad company to pay $75,000 of cost.

Cincinnati, Ohio.—Stockholders of the Cincinnati, New Orleans & Texas Pacific Ry. Co. (C. Dougherty, Ch. Engr., Cincinnati), have approved of the agreement between said company and the Cincinnati Southern Ry. for the reconstruction with double track of the bridge crossing Ohio River between Cincinnati and Ludlow.

Dayton, Ohio.—Designs for three reinforced concrete bridges over the Miami River of seven spans each are being prepared. The steel, 8,000 tons, has been purchased, and contract soon to be let for 40,000 bbls. cement. Contract for construction will probably be let in January, 1916. Howard, Harrington & Ash, Consulting Engineers, Kansas City, Mo. J. E. Barlow, Director Public Works.

Ada, Mich.—County Comrs. at Grand Rapids considering constructing a steel bridge over Grand River; cost $30,000.

Monroe, Mich.—City Commission has been petitioned to issue $20,000 bonds for constructing two bridges across Raisin River.

Milwaukee, Wis.—Plans and specifications for North Avenue Bridge will not be ready until about June, 1916. J. C. Pinney, Jr., Supt. Bridges and Public Buildings.

Des Moines, Iowa.—Construction of bridge at North Street is being considered by City Council.

Epworth, Iowa.—Reported the Illinois Central R.R. Co. (A. S. Baldwin, Ch. Engr., Chicago, Ill.) will construct a concrete viaduct at Epworth.

Iowa City, Iowa.—Construction of concrete viaduct over tracks of Rock Island R.R. Co. on College Hill is reported contemplated; cost about $35,000.

Dallas, Tex.—J. F. Witt, County Engineer, in preparing plans for bridge to be constructed across Trinity River at Commerce Street, at a cost of $135,000. County's part to be 1,000 ft. long, three spans of trusses, 440 ft. and 560 ft. of concrete girder construction.

Fort Smith, Tex.—Kansas City Southern Ry. Co.'s bridge over Poteau River is reported destroyed by fire. C. E. Johnston, Ch. Engr., Kansas City, Mo.

Houston, Tex.—County Commissioners have rejected all bids opened for constructing a reinforced concrete bridge on Harrisburg Road over Brays Bayou, having insufficient funds for that precinct.

Inola, Okla.—See "Paving and Roads."

Sandpoint, Idaho.—County Comrs. considering constructing a bridge over Pend d'Oreille River at Priest River. C. J. Chaffins, County Engr., estimates cost at $20,000.

BIDS DESIRED.

New York, N. Y.—Until Dec. 9, by F. J. H. Kracke, Bridge Comr. Manhattan, for constructing the Unionport bridge over Westchester Creek. Security $50,000.

Pittsburgh, Pa.—Until Nov. 30, by City Controller, for constructing bridge at new Market House in Diamond Square. Robt. Swan, Dir. Dept. Pub. Wks.

Sunbury, Pa.—Until Dec. 14, by Samuel B. Rambo, Superintendent of Public Grounds and Buildings, Harrisburg, for constructing a 175-ft. span steel truss bridge at Sunbury. G. A. Flink, Harrisburg, Engineer.

Fayette, Miss.—Until Dec. 6 by County Board Supervisors for constructing steel bridge over Davenport Bayou. J. C. Shelton, Co. Clk.

Grenada, Miss.—Bids will be opened Dec. 6 by County Board Supervisors for constructing steel bridge across Long Creek. J. S. King, Co. Clk.

Ohio.—See "Paving and Roads."

Warren, Ohio.—Until Dec. 6, by County Commissioners for furnishing material and erecting the South Main Street bridge superstructure. W. F. Harrington, Co. Aud.

Sullivan, Ind.—Until Dec. 7, by County Commissioners for constructing two reinforced concrete bridges. W. S. Bicknell, Co. Aud.

Valparaiso, Ind.—Until Dec. 6, by County Commissioners for constructing corrugated iron culvert and concrete retaining walls. C. A. Blachly, Co. Aud.

Ada, Mich.—Until Dec. 8, according to local press reports by County Road Commissioners, for constructing a steel bridge over Grand River at Ada. Probable cost $30,000.

Chicago, Ill.—Until Dec. 2, by Trustees Sanitary District, Chicago, for furnishing and delivering superstructure metal work for eleven highway bridges across Calumet-Sag Channel; six of the bridges are riveted truss bridges and five plate girder bridges. About 1000 tons metal to be furnished.

Fredonia, Kan.—Reported desired until Dec. 7, by County Commissioners, for constructing two 40 ft. span concrete beam bridges.

Hamilton, Mont.—Reported desired until Dec. 6 by F. E. Robbins, Clk. Bd. County Comrs., for tearing down and removing old bridge which spans Bitter Root River east of Florence and construct two new bridges across East Fork of Bitter Root River.

Linneus, Mo.—Reported desired until Dec. 6, by F. A. Trumbo, Co. Highway Engr., for constructing three steel bridges, as follows: One 110-ft. span with two 30-ft. approaches: one 36-ft. span and one 30-ft. span.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Kingsfield, Me.**—Contract awarded Nov. 19 to Saunders Engineering Co., Portland, to construct concrete and steel bridge across Carrabassett River to replace wire suspension bridge; cost $15,000.

Boston, Mass.—Following are three lowest bids opened Nov. 22 by Metropolitan Park Commission, Boston, for constructing concrete bridge and approaches over Charles River between Boston and Watertown: A. G. Tomasello, 69 Gibson Street, Dorchester Dist., $117,352; Fred T. Ley Co., Springfield, $119,560; Coleman Bros., Chelsea, $124,011.

★**Connecticut.**—Contracts awarded by State Highway Commission, Hartford, as follows:

Haddam, a 21-ft. reinforced concrete "T" beam bridge and one 14½-ft. reinforced concrete slab bridge and widening causeway on Hartford-Saybrook Turnpike, Donahue Bros., Middletown, $6,217. Next three lowest bidders: F. D. Miller, Norwich, $6,708; F. Arrigoni & Bro., Middletown, $7,160, and A. Brazos & Sons, Middletown, $7,053.

Chester, 28-ft. span, reinforced concrete "T" beam bridge with approaches, John G. Holbrook, Westbrook, $6,165. Next two lowest bidders: A. Brazos & Sons, Middletown, $6,439; Charles A. Sibley, New Haven, $10,073.

★**Kennett Square, Pa.**—Following are four lowest bids opened Nov. 22 by Isaac Y. Ash, County Comptroller, West Chester, for constructing stone arch bridge aver Red Clay Creek at Kennett Square: P. J. McCormic & Son, West Chester, $5,598 (awarded contract); Dunleavy Bros., Coatesville, $6,125; Corcoran Constr. Co., West Chester, $6,370, and Kennedy Crossin, New Garden, $6,430.

★**Jefferson City, Tenn.**—Contract for constructing steel bridge over Holston River, near Davis Ferry, awarded by County Comrs. at Dandridge to Virginia Bridge & Iron Co., Roanoke, Va., at about $11,500.

★**Aberdeen, Wash.**—Contract for approaches and false work for repair of bridge over Chehalis River (bids opened Nov. 17) awarded to A. R. Eichler, Seattle, at $4,355. P. F. Clark, City Clerk.

Bakersfield, Cal.—Lowest bid opened for constructing bridges and culverts on Division 10, Section 7, Bakersfield-Mojave Road, distance of 3.07 miles, submitted by Robert Sherer Co., Pacific Electric Building, Los Angeles, at $13,465.

★**Ventura, Cal.**—Contract for grading and constructing culverts on Santa Ana Road, distance of 1½ miles, awarded to C. E. Black, Ventura, at $19,992.

PAVING AND ROADS

PROPOSED WORK.

Tonawanda, N. Y.—Reported about $10,000 will be spent by Town Council in 1916 for bridge and street improvements.

Collingswood, N. J.—Paving of Haddon Avenue from Camden city line to Westmont with Belgian block being considered by City Council; cost about $60,000.

Pittsburgh, Pa.—See "Water Works."

Yardley, Pa.—Citizens voted $10,000 bonds for street improvements.

Norfolk, Va.—Resurfacing of Granby Street is contemplated by city; cost about $24,000.

Petersburg, Va.—City Council voted to appropriate $50,000 toward constructing a permanent highway between Petersburg, Hopewell and City Point.

Richmond, Va.—City Council considering constructing Northside Boulevard; estimated cost probably $500,000.

Charleston, W. Va.—Elk District and Cabin Creek District will sometime this winter vote $400,000 bonds for road improvements. P. J. Walsh, Engineer and General Superintendent Road Construction.

Parkersburg, W. Va.—Contract will be let about middle of January for brick and concrete paving. T. L. Higgs, City Engr.

Greensboro, N. C.—See "Sewerage and Sewage Disposal."

Bartow, Fla.—County Commissioners engaged H. H. Jandon, Engineering Co., Savannah, Ga., to make survey of county and lay out system of roads. Bids will be received on various road materials. Estimated bond issue will reach $1,000,000.

Miami, Fla.—County Engineer directed to prepare plans for constructing Tamiami Trail Highway to Marco and Fort Myers via Twentieth Street. Probable cost $275,000.

Port Gibson, Miss.—Bd. Supervisors of Claiborne County considering issuing $100,000 bonds for constructing 50 miles gravel roads.

Huntsville, Tenn.—About $200,000 Scott County road bonds sold.

Cleveland, Ohio.—City Council voted to pave Coit Road N. E., Scranton Road, Nye Road, Denison, Holmes, E. Eighty-first, E. Eighty-third and E. 140th Streets.

Delaware, Ohio.—Road improvement bonds for $52,400 will be sold Dec. 7 by Board County Commissioners (Guy C. Shoemaker, Chmn.)

Galion, Ohio.—South Market Street improvement bonds for $13,500, South Street, $13,000; Church Street, $32,500, and Jefferson Street for $12,500, will be sold Dec. 8 by J. F. Hogan, City Aud.

Sandusky, Ohio.—City considering paving E. Ninth Street with concrete; estimated cost $13,370.

Elgin, Ill.—County Road and Bridge Committee will recommend to County Board at an election to be held next spring to vote $1,000,000 bonds for permanent improvements to roads.

Elgin, Ill.—City Council voted to repave 11,800 sq. yd. on Grove Street with brick; cost about $16,150.

Geneva, Ill.—An election will probably be held in the spring by county on issuing $1,000,000 bonds for road improvements.

Morrison, Ill.—Election will be probably held in the spring to vote $125,000 bonds for constructing roads in Whiteside County.

Sterling, Ill.—Contract will be let early in the new year for paving with blocks on about 36 blocks, five blocks on concrete foundation and the balance on rubble with tar filler. A. J. Platt, Mayor.

Atlantic, Iowa.—Paving of one-half mile of road leading from Atlantic to cemetery is contemplated; cost about $12,000. Atlantic Commercial Club said to be interested.

Clinton, Iowa.—Contract will be let early in the new year for about 50,000 sq. yd. paving. J. G. Thorne, City Engr.

Fort Madison, Iowa.—See "Sewerage and Sewage Disposal."

Greenfield, Iowa.—Preliminary plans being prepared for paving to be done next year, about 25,000 yd. Roy Delay of Creston, Engineer; H. G. Spooner, Town Clerk.

Missouri Valley, Iowa.—City Council considering paving 3 miles of streets.

Anoka, Minn.—About $31,500 will be spent by County next year to construct 12 miles of grading, 6½ miles surfacing (gravel mixture), and constructing two concrete bridges 24 and 30 ft. span. H. H. Thurston, Supt.

Brainerd, Minn.—About $70,000 will be spent next year for road improvements, consisting mostly of surfacing with sand and clay.

St. Cloud, Minn.—Next spring the city intends paving on Main Street, about 10,000 to 12,000 sq. yd. creosoted wood block pavement and in business district $6,000 to $7,000 storm sewers. C. H. West, City Engr.

Next year county intends spending $70,000 on grading and surfacing roads, repainting and reflooring bridges. R. P. Didlake, Dist. Engr. Highway Commission.

Wadena, Minn.—County will spend $25,000 next year on roads and bridges. Eugene Boss, County Auditor.

Herington, Kan.—Contract will be let about January for 25 blocks of asphaltic concrete paving. Karl Riddle, City Engr.

Kansas City, Mo.—Construction of a motor speedway reported being considered; cost about $100,000. William Huttig and Darius Brown said to be interested.

Arkansas.—Plans have been prepared as follows: For 57 miles macadam road in Union County, cost $350,000; 15 miles graded road in Road District No. 1, White County, cost $8,000, and 22 miles gravel surface road in Road District No. 1, Carroll County, cost $90,000. W. C. Hight, Assistant State Highway Engineer, Little Rock, Ark.

Osceola, Ark.—Pride & Fairley, Osceola, are engineers for the proposed 50 miles of hard-surfaced roads, 25 miles to be concrete.

Sweetwater, Tex.—See "Public Buildings and Schools."

Claremore, Okla.—Citizens voted $223,000 bonds for constructing county roads.

Inola, Okla.—Citizens of Inola Township voted $30,000 road and bridge bonds.

Wister, Okla.—Citizens voted $45,000 bonds for constructing a road to Talihina and Wilburton.

Ellenburg, Wash.—Surveys being made by M. M. Emerson, County Engr., for constructing Vantage Highway; cost about $30,000.

Seattle, Wash.—Plans and specifications submitted to Bd. Pub. Wks. by City Engineer for paving Twelfth Avenue N. E.; cost $25,000.

Bd. Pub. Wks. approved plans of City Engineering Dept. for concrete walks on Second Avenue W.; cost about $12,000.

City Council voted to construct concrete walks on Thirty-first Avenue, E. Howell, E. Pine, E. Olive, E. Pike, W. Fifty-ninth Streets and Sixth Avenue; also pave Thirtieth Avenue, from E. Denny Way to E. Union Street, and other streets.

Tacoma, Wash.—Construction of two boulevards in Rainier National Park contemplated; one from Narada Falls to McClellan Pass Highway and other from entrance of park to Carbon Valley; cost about $50,000. D. L. Reaburn, Supt. Rainier National Park.

County Comrs. contemplate constructing next spring 6 miles Mt. Tacoma Roadway.

Astoria, Ore.—City Council voted to pave Bond Street with bitulithic 34 ft. wide, with strip through center 20 ft. wide with brick on concrete base.

Salem, Ore.—State Highway Comn. appropriated 1916 highway funds as follows: Clatsop County, $20,500; Columbia County, $36,000; Hood River County, $5,000; Hood River and Wasco Counties, $45,000; Crook County, $10,000; Washington County, $11,500; Douglas and Josephine Counties, $20,000; Yamhill and Tillamook Counties, $9,000; Lane County, $5,000; Polk County, $5,000; Jackson County, $45,000; total about $237,000.

San Francisco, Cal.—Bd. Public Wks. voted to pave portions of Alison and Bay View Streets; cost about $25,000.

Globe, Ariz.—Citizens voted Nov. 15 to issue $350,000 bonds for gravel road construction. F. L. Gales, County Clerk.

Nogales, Ariz.—Road bonds amounting to $150,000 will be sold Dec. 4 by Bd. Supervisors, advertised in Engineering Record.

Tucson, Ariz.—W. C. Goetz, County Engineer, writes that about $300,000 commercial roads and $100,000 mountain resort roads, probably of gravel, will be constructed, by the Board of Supervisors.

Wallace, Idaho.—City Council voted to pave Dist. No. 4; cost about $18,000.

BIDS DESIRED.

Hackensack, N. J.—Until Dec. 3 by A. V. Morrison, Chmn. County Road Com. Board Chosen Freeholders, for improving portions of West Saddle River Road and East Meadow and Rutherford Avenues by grading and macadamizing.

Portsmouth, Va.—Reported desired until Dec. 1 by Committee for Purchase and Improvements of Roads for constructing 13.9 miles gravel roads; also creosoted pile and timber bridge over Lafayette River on Jamestown Boulevard; alternate bids on two types of floor construction. G. P. Coleman, State Highway Comr., Richmond.

Charleston, W. Va.—Until Dec. 1 by B. A. Wise, City Manager, for 35,000 yd. street paving; cost $75,000. J. M. Clark, City Engr.

Camden, Ala.—Until Dec. 6, by Blair Hughes, Superv. Co. Road, for constructing about 17 miles sand, clay or clay and gravel roads.

Kosciusko, Miss.—Until Dec. 6 by Board Supervisors and Road Commissioners (J. H. Oliver, Clk.) at Chancery Clerk's office, Kosciusko, for constructing 2 miles gravel road and 30 miles sand clay roads, together with bridges and culverts for same, in Beat No. 1, Attica County. M. D. Smith, Consulting Engr., Kosciusko.

Kosciusko, Miss.—Bids will be opened in December by County Board Supervisors for 30 miles of sand clay and 2 miles gravel roads.

Albany, Ky.—Until Dec. 6 by County Fiscal Court for constructing road 3 miles long, width 24 ft., to be graded and 9 or 14 ft. macadamized. J. G. Sloan, Co. Clk.

Columbus, Ohio.—Until Dec. 2 by Paul B. Kemper, Clk. Dir. Pub. Service, for improving portions of Bryden and Sidney Alleys and Lucas Street with brick.

Ohio.—Until Dec. 3 by Clinton Cowen, State Highway Commissioner, Columbus, for constructing roads as follows (unless otherwise stated, work includes grading roadway, constructing bridges and culverts and paving):

Hamilton County, Section F, of the Cincinnati-West Union (Ohio Pike) Road, Anderson Township, grading roadway and paving with reinforced concrete. Length 1.11 miles. Estimated cost $16,386.

Hamilton County, Section E, Cincinnati-Chillicothe (Madison) Road, in Columbia Township, grading roadway and paving with Warrenite. Length 0.49 mile. Estimated cost $13,144.

Hocking County, Section K, Lancaster-Logan Road, Falls Township, with brick. Length 0.35 mile. Estimated cost $23,839.

Holmes County, Section G, Mansfield-Millersburg Road, Hardy and Monroe Townships, with brick. Length 1.59 miles. Estimated cost $30,812.

Meigs County, Section M, Pomeroy-Jackson Road, Salisbury Township, with brick. Length 0.29 mile. Estimated cost $6,589.

Morgan County, Section H, McConnellsville-Caldwell Road, Morgan Township, with waterbound macadam. Length 0.26 mile. Estimated cost $3,833.

Seneca County, Section M, Findlay-Tiffin Road, London Township, with waterbound macadam. Length 2.59 miles. Estimated cost $18,981.

Seneca County, Section N, Lima-Sandusky Road, Liberty Township, with waterbound macadam. Length 0.25 mile. Estimated cost $1,835.

Union County, Section E, Urbana-Marysville Road, Union Township, constructing 75-ft. steel bridge over Buck Run. Estimated cost $5,457.

Williams County, Section M, West Unity-Montpelier Road, Jefferson and Brady Townships, paving with waterbound macadam. Length 2.09 miles. Estimated cost $19,023. Alternate bids will be received for paving with bituminous macadam. Estimated cost $23,881.

Hamilton County, Section H, Cincinnati-Louisville (Cleves and Bridgetown) Road, Green Township, reshaping old roadway and paving with bituminous macadam. Length 1.74 miles. Estimated cost $12,808.

Hamilton County, Section G, Cincinnati-West Union (Ohio Pike) Road, Anderson Township, reshaping old roadway and paving with bituminous macadam. Length 0.9 mile. Estimated cost $5,648.

Brookville, Ind.—Until Dec. 6 by County Commissioners (Jonathan Fruits, Chmn.) for constructing highway in Bloomington Grove Township, in all about 2¾ miles. Charles G. Reifel, Co. Aud.

Indiana.—By County Commissioners for constructing roads as follows:

Dec. 1:

Indianapolis, improving First Alley, west of Bellefonte Street, Twentieth and Twenty-first Streets; also State Avenue and Belt Railroad to Raymond Street. Jos. A. Rink, Chmn.

Dec. 6:

New Albany, 15,765 ft. road New Albany Township. Julian P. Miller, Co. Aud.

Shoals, road in Perry, Halbert and Center Townships. L. D. Haga, Co. Aud.

Salem, 13,318 ft. road, in Washington Township. I. H. Weatherford, Co. Aud.

Dec. 7:

Delphi, system of road in Clay Township. M. G. Haun, Co. Aud.

Mt. Vernon, gravel roads in Bethel and Point Townships. Jos. R. Haines, Co. Aud.

Spencer, hard sand stone and river gravel road. Jefferson Township. Geo. W. Stwalley, Co. Aud.

Bloomfield, macadam roads in Fairplay and Grant Townships. Geo. E. Kidd, Co. Aud.

Retsmeier stone road, Warsaw Township, 2750 ft. reg. Jos P. Hammond, Co Aud.

Hickman gravel in Honey Creek Township, 1947 ft. reg. Wm. L. Benson, Co Aud.

Dec 8

Lafayette 1.63 mile gravel road in line between Lawrence and Sheffield Townships, Geo W. Baxter, Co Aud.

Dec 9

Greenfield, 21,000 ft. road Hancock-Shelby County Line, Lawrence Weed, Co Aud.

Anderson, 12 gravel roads, 9 concrete roads. I. B. Petefield, Co Aud.

Ida Grove, Iowa.—Until Nov. 20, by George C. Hubbard, City Clerk, for $3,000 6% 5-yr. paving either macadam or asphalt. K. C. Gilpatrick, Engineer, Sioux City.

Kansas City, Mo.—Until Nov. 29 by Board Public Works (Thomas F. Cochran, Secy.) for paving portions of Wyoming Street and Leavy Avenue with Portland cement concrete, North Street with stone block, Fifty-sixth and Central Streets Streets with asphaltic concrete.

Muskogee, Okla.—Reported desired until Dec. 1 for paving roads. Probable cost $20,000. J. P. Curtis, Co. Engr.

Bellingham, Wash.—Until Nov. 29 by C. A. Chadbury, City Engineer, for asphalt paving on Lake Samish Subway, Kenwood & 5th and Lakeway Streets, about 2000 sq. yd. each, and with concrete on Lincoln street, 1000 yd. Total cost about $9,000.

Washington.—Until Dec. 20 by State Highway Commission, Olympia, for following work on Inland Empire Highway: Ilwaco-Nemah, 7 miles, cost $17,000; Pysht-Quillayute, 9½ miles, cost $3,000; Tenmile-Wallicut, 7 miles, cost $8,000; Kennewick, west 13 miles, cost $34,000.

Canyon City, Ore.—Reported desired until Dec. 1 by W. W. Howell, Co. Clk., for constructing Deer Creek Road, a distance of 7 miles.

Pasadena, Cal.—Until about Dec. 13 by H. Isaac, City Clerk, for paving with 4-in. macadam on Hillside Terrace. R. V. Orbison, City Engr.

PRICES AND LETTINGS.

★Indicates award of contract.

Connecticut.—Following are lowest bids opened Nov. 10 by State Highway Commissioner, Hartford, for road work:

Middletown, 4.48 lin. ft. trap rock macadam on Middlefield Road, to Arrigoni & Bro., Middletown, $4,164.

Weston, 1425 sq. ft. native stone macadam, Framingham Contracting Co., South Framingham, Mass., $4,490.

★New Brunswick, N. J. — Contract awarded T. H. Wilde, New Brunswick, for paving with Warrenite or ex streets at $2.48 per sq. yd., a total of $40,148, and Trenton Engineering & Construction Co., New Brunswick, contract for one street with asphalt block at $2.49 per sq. yd., total $1,542. In all about 22,000 sq. yds. to be paved. Asher Atkinson, City Engr.

Greensburg, Pa.—John Herrmann, Latrobe, submitted lowest bid Nov. 15, for constructing Herrmann City-Export Road, in Penn and Franklin Townships, about 4.56 miles long, approximate quantities 28,000 cu. yd. excav., 1400 lin. ft. pipe, 12,840 lin. ft. concrete curbing and 44,300 sq. yd. brick paving at $196,146, and F. T. Evans, Mt. Pleasant, lowest for Hempfield Rural Route Road, 4200 ft. long, approximate quantities 11,000 cu. yd. excav., 750 lin. ft. pipe, 12,200 lin. ft. concrete curbing and 34,000 sq. yd. brick pavement at $29,842. John S. Reed, County Comptroller.

★Adamston, W. Va.—Contract for paving Pike and Chestnut streets awarded to Tom Chestnut, Jr., Cedar & Morris Streets, at about $15,000.

★Fort Myers, Fla.—Contracts for constructing Fort Myers-Manse Road (bids opened Nov. 10) awarded by County Commissioners as follows: To Carlton & Cantu, Fort Myers, clearing and grubbing 16.1 acres, at $40.50 per acre; excavating 10,000 cu. yd. at 30c. per cu. yd.; 1,174 ft. pipe at $1.50 per ft.; to W. B. Wallace & Co., Fort Myers, clearing and grubbing 14.3 acres, at $38.50 per acre; excavating 24,000 cu. yd., 11.95 cts. per cu. yd.; clearing and grubbing 18 acres, at $40 per acre, and grading 13,000 cu. yd. at 30 cts. per cu. yd. Furnishing and spreading limerock rock on both contracts by Wallace & Watson, Fort Myers at $2.50 per ton. For 22,000 lin. ft. piling in place, total $2,750, and 673,456 M ft. creosoted in place, at $28.85 per M ft., total $19,435. P. F. Jenkins, County Engineer.

★Homestead, Fla.—Contract for constructing Ingraham Highway from Homestead, Fla., to Cape Sable, about 40 miles, awarded to J. B. McCrary Co., Atlanta, Ga., at $1,000.

★St. Petersburg, Fla.—Citizens Pinellas County voted $[illegible] bonds for constructing brick highways. Contract for same awarded to Edwards Constr. Co., Tampa.

Charlotte, N. C.—Following are four lowest bids opened Nov. 11 by Samuel H. Lee, City Engineer, for constructing cement sidewalks on several streets about 11,000 sq. yd.: A. H. Caton & Co., Gastonia, $2,000; J. W. Hass, Charlotte, $21,-; Hankenship & McClelland, Charlotte, $21,650; Georgia Contracting Co., Augusta, Ga., $21,195.

Covington, La.—Contract for maintaining 275 miles of roadways, bridges, etc., in the Parish awarded Henry Keller, Slidell, at $60 and $65 per mile. C. R. Schultz, Parish Road Supervisor.

★Kentwood, La.—Contract for constructing road through Kentwood awarded by Police Jury of Tangipahoa Parish to T. G. Womack and Jas. F. Kent, of Kentwood, at about $10,000.

★Monroe, La.—Contract for paving about 37,000 sq. yd. with gravel and tarvia top and 4,500 lin. ft. curb and gutter awarded by City Council (bids opened Nov. 5) to Merrill Road Improvement Co., Chattanooga, Tenn.

★New Albany, Ind.—Contract for constructing Silvercut Knob Road, from New Albany Township line to Paoli Pike, at Mooresville, awarded by County Comrs. to Gaines & Jones, at $9,265.

★Pontiac, Mich.—Contract for constructing 4 miles of road between Pontiac and Birmingham awarded by County Comrs. to R. D. Baker Co., Detroit, $62,090.

★St. Joseph, Mich.—Contracts awarded Nov. 11 by County Commissioners as follows for constructing waterbound macadam roads, 12 and 16 ft. wide, in all 45 miles.

Pipestone Road, Sect. 1, Niles Township. C. Atkinson, Niles, $18,280 for stone; Pipestone Road, Section G, Pipestone Township, and Section H, Berrien Township, to Chas. Thomas, St. Joseph, $73,-560; Three Oaks Sawyer Road, Section C, Chikaming Township, D. W. Boyes, Grand Rapids, $16,999; Galien Stevensville Road, Section E, Nielson Township, and Section F, Galien Township, both to O. L. Zerbe, Three Oaks, at $22,950 and $18,175 (stone) respectively; Lake Shore Road, Section G, Lake and Weesaw Townships, Frank C. Teach, Crown Point, Ind., at $[illegible]; Lake Shore Road, Section E, New Buffalo Township, D. W. Boyes, Grand Rapids, at $17,495; Watervliet South Haven Road, Section 1, Watervliet Township, and Paw Paw River Road, Section G, Hagar Township and Territorial Road, Section F, Bainbridge Township, three to W. W. McCracken, St. Joseph, at $53,260; Niles Road, Section D, Oronoko Township, Section E, Berrien Township, and Section F, Niles Township, all to Fred Cunningham, Martinsville, Ind., at $82,725. Wm. J. Cleary, County Highway Engr.

★Beaumont, Tex.—Contract for paving about 5 miles of streets reported awarded by City Council to Uvalde Rock Asphalt Co., Houston, at about $275,000.

★Kountze, Tex.—Contract for constructing a shell road from Pine Island Bayou to Kountze awarded by Comrs. Court of Hardin County to Cobb & Gregory at about $75,000.

★Lindsay, Cal.—Contract for paving 5 blocks on Hermosa Street awarded to Worswick Street Paving Co., Fresno, at 5⅝ cts. per sq. ft., and $2.50 per lin. ft. for culverts.

★Los Angeles, Cal.—Contract for $11,150 sq. yd. paving on Western Avenue with asphalt awarded to George R. Curtis, 552 St. Louis Street, at $49,266.

★Palm Springs, Cal.—Contract for constructing highway from Palm Springs to Indio awarded by County Supervisors at $[illegible] to R. R. Thompson Constr. Co., of Monrovia, at $11,473 for first 13 miles and at $56,822 for concrete on remaining 11 miles.

Santa Monica, Cal.—Lowest bid opened for improving Central Avenue submitted by National Paving Co., Kansas City, Mo., at $50,610.

Greenwood, S. C.—Following are bids received on four lowest bids opened Nov. 10 by A. H. Harris, Mayor, for 83,000 sq. yd. of paving (bids given are on sheet asphalt): (a) Southern Paving & Construction Co., Chattanooga, Tenn., $[illegible]; (b) Gulf Paving Co., Chattanooga, Tenn., $[illegible]; (c) Bell Construction Co., Chattanooga, Tenn., $111,600; (d) Mid-South Construction Co., Chattanooga, Tenn., $111,600.

	(a)	(b)	(c)	(d)
[illegible] sq. yd. [illegible]	$1.37	$1.29	$1.41	$1.45
[illegible] sq. ft. [illegible] gutter	0.87	0.94	1.15	0.98
[illegible] lin. ft. [illegible] curb	0.24	0.26	0.27	0.345
[illegible] lin. ft. [illegible] curb	0.10	0.09	0.08	0.08
[illegible] lin. ft. [illegible] gutter	0.70	0.66	0.70	0.75
[illegible] lin. ft. [illegible] gutter	0.62	0.48	0.60	0.60
[illegible] lin. ft. [illegible] gutter	0.45	0.52	0.50	0.45
[illegible]	27.00	22.25	30.00	30.00
[illegible]	25.50	17.75	23.00	25.00
[illegible]	25.50	17.75	23.00	25.00

The lowest bidders on other materials were: Asphalt concrete, Gulf Paving Co., Chattanooga, Tenn.; [illegible] brick, Southern Paving & Construction Co., Chattanooga, Tenn.; [illegible] concrete, Tom & Cochran, Atlanta, Ga., $99,122; [illegible] Atlantic Engineering Co., Decatur, Ga., $111,604.

San Francisco, Cal.—J. D. Hannah, Monadnock Block, submitted lowest bid Nov. 13 to Board of Works for constructing first unit of the ocean beach esplanade, at $89.50 per lin. ft. for reinforced concrete work, and $6 per cu. yd. to restore the rubble wall; $48,500 available.

STREET CLEANING AND GARBAGE DISPOSAL

PRICES AND LETTINGS.

★Indicates award of contract.

★Toronto, Ont.—Later official reports state contract awarded E. H. Thomas, 75 Hilton Avenue, for erecting new incinerator, building, bridges, etc., for Don Roadway, at $84,500.

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS

PROPOSED WORK.

Creek Improvements—Buffalo, N. Y.—City Council voted to purchase land 60 ft. wide, running along Genesee Street, to construct a sewer to carry off surplus waters of Scajaquada Creek.

Drydock—New York, N. Y.—Reported Morse Drydock & Repair Co., 17 Battery Place, intends constructing a sectional floating dock at foot of Fifty-eighth Street. Lifting capacity 27,000 tons.

Jetties—Ventnor City, N. J.—City Council has authorized a bond issue of $10,000 to construct jetties from Cambridge to Portland Avenues.

Dam—Ellwood City, Pa.—Mahoning & Shenango Ry. & Light Company has purchased the generating station and transmission lines of the Pennsylvania Power Company, and it is reported intends making improvements in this district costing $150,000, including new dam on site of present dam.

Flood Improvements—Erie, Pa.—City Council has adopted formally plan recommended by Farley Gannett, Telegraph Building, Harrisburg, for prevention of flood damage on Mill Creek. The plan adopted is for a large reinforced concrete conduit about 12,500 ft. long, 22 ft. wide, by 18 ft. high, inside diam., capacity to be 12,000 cu. ft. per second; cost $900,000.

Wharf—Chattanooga, Tenn.—Wharf improvement bonds amounting to $100,000 are to be sold by City Commissioners.

River Improvement—Tiffin, Ohio.—Council has approved issue of $40,000 river improvements bonds to build a retaining wall and widen river.

Creek Improvement—Upper Sandusky, Ohio.—County Commissioners have been petitioned to widen and straighten Tymochett Creek, at a cost of $125,000.

Dam—Waupaca, Wis.—The Wisconsin Railroad Commission, Madison, has granted permission to the city of Waupaca and O. G. Nelson Lumber Co. of Waupaca to build a dam across the Waupaca River. Estimated 150 hp. will be developed.

Dam—Fort Dodge, Iowa—Citizens voted $100,000 bonds for constructing a dam and power plant in this city. Address Mayor.

Ditch—Ottumwa, Iowa.—H. O. Wray of Bloomfield, Iowa., appointed to make a survey of proposed drainage ditch to run through Wapello and Davies Counties and drain Soap Creek. Construction will commence this spring.

Drainage—Anoka, Minn.—County is considering straightening out Coon Creek a distance of 8 miles for drainage. Cost $45,000. W. L. Ridge, Co. Surv.

Ditch Improvements—St. Cloud, Minn.—Contract to be let in about two months for constructing Ditch No. 35, an 18-in. tile ditch. Contract will be let in the spring for Ditch No. 26, approximate cost $15,000. S. S. Chute, County Surveyor.

Drainage—Kearney, Neb.—Citizens voted in favor of the North Dry Drainage District along Platte River. About 46,000 cu. yd. will be removed. Ditch will be about 1 mile long. Hague & Anderbery of Minden, Attorneys; C. F. Johnson of Newark, Neb., Secy. District.

Dock—St. Louis, Mo.—Public Service Committee of the Board of Aldermen is considering dock improvements to cost, including equipment, $285,000.

Drainage — Corpus Christi, Tex.—The $157,000 drainage bonds sold by the county are to be used to build culverts and laterals and build up roads for district comprising about 8000 acres of agricultural lands.

Harbor Bonds, Houston, Tex.—City has sold $275,000 harbor bonds.

Irrigation—Raton, N. M.—Trustees Antelope Irrigation District (L. I. Taylor, Pres.) intend enlarging storage capacity of the district and extending ditches. About $325,000 bonds will be issued.

Irrigation—Grants Pass, Ore.—State Engineer Lewis of Salem has issued a permit to Graves Creek Irrigation Co. of Grants Pass to appropriate sufficient water from Graves and Jumpoff Creeks to irrigate 20,000 acres of land and develop 3000 hp. Two reservoirs are included in the plan and, exclusive of these, the cost is estimated at $1,000,000.

Irrigation—Hood River, Ore.—Irrigation bonds amounting to $25,000 for the East Fork Irrigation District have been sold.

Irrigation—Salem, Ore.—State Engineer has granted to W. B. Sherman of Grants Pass, the right to appropriate 1000 second feet of the waters of Rouge River at Hell Gate for development of an irrigation and power project to cost $200,000.

Dam—Salem, Ore.—State Engineering Department has approved the application of Dobbins Ditch Company of Joseph, for right to construct dam on outlet of Wallowa Lake to be 60 ft. high and will increase storage capacity of lake to 100,000 acre ft.

Irrigation—Silver Lake, Ore.—Reported Silver Lake Water Users' Association, Silver Lake, will immediately take steps toward forming an irrigation district to water 46,000 acres of land. The United States Reclamation Service estimates cost at $28.10 per acre.

Dam—Salt Lake City, Utah.—State Land Board reported considering sites for the new Hatchtown dam. W. B. Beer, State Engineer.

Caldwell, Idaho.—Reported Directors of Glen Lake Irrigation District are considering plans for constructing a concrete dam on Boise River about five miles below Arrowrock Dam. W. W. Peters, Secretary Dist.

Dike—St. Maries, Idaho. — Carscallen Brothers of Coeur d'Alene, will construct a dike four miles long from Hell's Gulch to Chatcolet to reclaim and drain approximately 1000 acres. Cost $17,000.

BIDS DESIRED.

Harbor Work—Miami, Fla.—Local reports state bids will be opened Dec. 20 for city's portion of harbor work, to consist of digging channel through bay, building municipal docks and constructing municipal railway. H. G. Ralston, Committeeman on Docks; E. H. Klyce, City Engr.

Pier—Cleveland, Ohio.—Until Dec. 2 by Commissioner Purchases and Supplies for repairs to pier protection.

Drainage Ditch—Des Moines, Iowa.—Until Dec. 6 by County Board Supervisors for constructing Drainage Ditch No. 17, in Lincoln and Crocker Townships, in all about 30,633 ft. 12 to 30-in. tile, and one bulkhead. Engineer's estimate $26,-100. Also same time and place for Drainage Tile Ditch No. 16, Webster Township, about 13,050 ft. 14, 20 and 24-in. tile, and one bulkhead. Engineer's estimate cost $10,922. F. J. Alber, Co. Aud.

Ditch—Bemidji, Minn.—Until Dec. 15, by J. L. George, Co. Aud., Beltrami County, and L. H. Slocum, Co. Aud., Koochiching County, at their office, Bemidji, for constructing Judicial Ditch No. 36, about 127 miles long, requiring 1,-162,601 cu. yd. dirt excav. Cost $212,195, including highway. Separate bids for clearing, grubbing, excavating, etc.

Ditches — Redwood Falls, Minn. — Reported desired until Dec. 1, by L. P. Larson, Co. Aud., for constructing County Ditches Nos. 27 and 29, of tile. Probable cost $8,490 and $11,991, respectively.

Ditches—Marion, Ark.—Until Dec. 10, by Board Commissioners Drainage Dist. No. 7, at Marion, for constructing about 44 miles ditches, requiring about 1,800,000 cu. yd. earth. Bonds will be sold same date. Morgan Engineering Company, Engrs., Memphis, Tenn.

Robstown, Tex.—Until Dec. 6, by Drainage Commissioners Neuces County, Drainage District No. 2 (L. T. Messer, Chmn.), for constructing about 45 miles of main ditches in said district, requiring approximately 1,050,000 cu. yd. earth excav. and 45 miles lateral ditches, requiring about 150,000 cu. yd. excav., necessary bridges, culverts, etc.

Tunnel—Montour, Idaho.—Reported desired until Nov. 29 by H. Taylor, Secy. Emmett Irrigation Dist. for constructing concrete tunnel.

Drainage—Tempe, Ariz.—Until Dec. 14 by Board of Directors District No. 1 (J. W. Miller, Chmn.), Maricopa County, for constructing 8.4 miles main open drain ditch, northerly portion approximately 40,300 ft. from 6 to 12.5 ft. deep; southerly portion approximately 4000 ft. from 6 to 1 ft. deep; 11 structures, consisting principally of reinforced concrete, at various points where line of proposed ditch intersects highways, canals and ditches. L. G. Knipe, 16 South Second Avenue, Phoenix.

PRICES AND LETTINGS.

★Indicates award of contract.

★Sea Wall—Winthrop, Mass.—Contract for constructing the sea wall along the shore of Broad Sound in Winthrop, near Point Shirley, awarded by Harbor & Land Commission, Boston, to William L. Miller Co., 166 Devonshire Street, on the unit basis.

Dredging—Philadelphia, Pa.—Following are bids opened Nov. 22 by U. S. Engineer's Office, Philadelphia, for dredging in Delaware River on Bellevue, Cherry Island and Deep Water Point lighthouse ranges—(a) Section "F," approximately 800,000 cu. yd.; (b) Section "H," 1,360,000 cu. yd.; (c) Section "J," 1,420,000 cu. yd.; (d) Sections "F" and "J" combined, 2,220,000 cu. yd.; (e) Sections "H" and "J" combined, 2,780,000 cu. yd.; (f) Sections "F," "H" and "J" combined, 3,580,000 cu. yd.: Bowers Southern Dredging Co., Galveston, Tex., (b) 10.45 cts., (d) 10.3 cts., (e) 10.1 cts., (f) 10 cts.; Coastwise Dredging Co., Norfolk, Va., (a) 9.35 cts., (b) 9.35 cts., (c) 9.35 cts.; Home Dredging Co., Mobile, Ala., (e) 8.875 cts.; American Dredging Co., Philadelphia, Pa., (a) 8.9 cts., (b) 9.45 cts., (c) 9.3 cts., (f) 9.2 cts.; Atlantic, Gulf & Pacific Co., New York, N. Y., (a) 11.8 cts., (b) 11.3 cts., (c) 11.3 cts., (d) 11.5 cts., (e) 10.8 cts., (f) 11 cts.

★**Locks — Tallahassee, Fla.** — Contract for constructing three locks and dams in Everglades Drainage District, awarded Savannah Engineering & Construction Co., Savannah, Ga., at about $120,000.

★**Levee Work—New Roads, La.**—Contract awarded by Board State Engineers, New Orleans, for constructing Cocoa Levee, two sections, approximately 60,000 cu. yd., in Parish of Pointe Coupee, Atchafalya Basin Levee Dist., to Hercules Co., New Orleans, at 16 cts. per cu. yd. Cost about $9,600.

Flood Wall—Portsmouth, Ohio.—Lowest bid opened Nov. 17 by Director Public Service, was submitted by Glandorf & Browning, Cincinnati, at $67,779.

★**Dock—Gary, Ind.**—Contract awarded to the Illinois Improvement & Ballast Co. for constructing concrete ore dock for U. S. Steel Co., approximately 150,000 cu. yd. concrete.

★**Ditches—Blue Earth, Minn.**—Contract awarded by County Commissioners as follows for constructing ditches (bids opened Nov. 19): No 29, to Hawkeye Constr. Co., Webster City, Iowa, at $7,943, and No. 40, O. C. Oleson, Blue Earth, at $7,195. Jesse L. Herring, County Auditor.

★**Ditches—New Ulm, Minn.**—Contract for constructing tile and open ditches (bids opened Nov. 19) awarded by L. G. Vogel, County Auditor, to Christopher Nielsen, Sunborn, at $12,345.

★**Ditches—Windom, Minn.**—Contract for constructing Ditch No. 21 (bids opened Nov. 19) awarded by County Commissioners to Hans Trufesen, Live Creek, at $13,-989. S. A. Brown, County Auditor.

★**Wharf — Beaumont, Tex.** — Contract awarded John O. Kelly of San Antonio for constructing the 500-ft. wharf in unit No. 2 of the Beaumont Terminal link at $65,536.

Irrigation—Honolulu, T. H.—Lowest bid opened at office of Superintendent of Public Works, Honolulu, for Waiolama fill for Waiolama reclamation and sanitation project at Hilo was submitted by Lord-Young Engineering Co. of Honolulu at $109,600.

ELECTRIC RAILWAYS

PROPOSED WORK.

Holyoke, Mass.—Plans being considered by Holyoke Street Ry. Co. to construct an extension in South Hadley Falls on W. Main Street to Canal Street, on Canal Street to Taylor Street and on Taylor Street to N. Main Street.

Hartford, Conn.—Hartford, Meriden & New Britain Ry Co. will construct in the spring a railway to connect Meriden and Hartford via Kensington, New Britain and Newington; distance of 20 miles. Louis Fiske, Branford, Pres. and Robt. O. Eaton, North Haven, Secy. and Treas.

Cobleskill, N. Y.—Public Service Commission has approved extensions of lines of Courter Electric Co. through Cobleskill under franchise recently granted.

Cooperstown, N. Y.—Otsego & Herkimer R.R. Co. considering spending about $250,000 for improvements to line.

New York, N. Y.—Until Dec. 7, by Public Service Commission, First District, 154 Nassau Street (Travis H. Whitney, Secy.), for supply of 19 portions of special work (frogs and switches) for use in the construction of Rapid Transit railroads (Lexington Avenue Line), Manhattan Boro.

McKeesport, Pa.—Highland Grove Traction Co. contemplates constructing an extension to East Pittsburg.

Petersburg, Va.—Stuart, James & Cooke, 50 Church Street, New York City, retained as engineers for constructing Petersburg & Appomattox Ry. from Petersburg to Hopewell and City Point.

Charleston, W. Va.—Summers Street Realty Co. chartered to construct an electric railway in Charleston; capital $25,000. Among incorporators are J. S. Hill and R. G. Hubbard, both of Charleston.

Washington, Ind.—Plans being considered to construct an electric railway between Washington and Linton via Bicknell, Frelandville, Pleasantville and Dugger. A. L. Brocksmith, Bicknell, said to be interested.

★**New York, N. Y.**—Following are unit figures of the four lowest bids opened Nov. 12 by Public Service Commission for First District, 154 Nassau Street, for constructing tracks on Queensboro subway extension, the Astoria and Corona Elevated Lines, in Borough of Queens: (a) Thomas Crimmins Contracting Company, 444 E. Sixty-ninth Street, $204,898 (awarded contract); (b) George S. Bennett, 36 Northern Avenue, $206,001; (c) Degnon Contracting Company, 30 E. Forty-second Street, $233,619; (d) Empire Construction Company, 51 E. Forty-second Street, $253,860.

	*(a)	(b)	(c)	(d)
14,500 cu. yd. 3-in. stone for Queens Boulevard Elevated Railroad	$1.50	$1.60	$0.80	$1.20
11,200 9-in. structural channels, 3-in. punctured	0.31	0.15	0.16	0.15
6 bumping posts	370.00	400.00	250.00	420.00
93,200 lin. ft. handrail	0.50	0.55	0.56	0.55
1 M ft. plank walks	9.00	10.00	13.00	15.00
24,800 anti-creepers	0.10	0.10	0.09	0.10
Installation of Type I track complete:				
210 lin. ft. on tangents and curves of more than 2,000 ft. radius	0.91	0.60	0.80	1.30
100 lin. ft. on curves of 2,000 ft. to 701 ft. radius	1.50	1.00	1.25	1.70
450 lin. ft. on curves of less than 701 ft. radius	1.60	1.00	1.60	2.15
Installation of Type II track complete:				
4,500 lin. ft. on tangents and curves of more than 2,000 ft. radius	3.85	1.00	4.50	6.85
100 lin. ft. on curves of 2,000 ft. to 701 ft. radius	4.25	1.25	4.70	7.42
500 lin. ft. on curves of less than 701 ft. radius	4.30	1.50	5.00	9.14
Installation of Type III track complete:				
66,700 lin. ft. on tangents and curves (not superelevated) of more than 2,000 ft. radius	0.55	0.60	0.70	0.70
9,400 lin. ft. on curves of 2,000 ft. to 701 ft. radius	0.85	1.25	1.20	1.09
10,000 lin. ft. on curves of less than 701 ft. radius	0.90	1.40	1.30	1.46
23,600 lin. ft. at and adjoining stations	0.55	0.70	0.77	0.73
9,400 lin. ft. on superelevated tangents and curves of more than 2,000 ft. radius	0.55	0.80	0.72	0.85
Installation of Type IV track complete:				
11,600 lin. ft. on tangents and curves of more than 2,000 ft. radius	0.90	0.45	0.95	1.10
100 lin. ft. on curves of 2,000 ft. to 701 ft. radius	1.50	1.00	1.40	1.50
200 lin. ft. on curves of less than 701 ft. radius	1.50	1.25	1.65	2.25
Installation of special work:				
Portion 95 complete	400.00	250.00	240.00	233.00
Portion 96 complete	400.00	250.00	240.00	233.00
Portion 97 complete	1,300.00	1,000.00	1,750.00	1,296.00
Portion 98	400.00	500.00	240.00	238.00
Portion 99	1,100.00	1,000.00	1,050.00	1,273.00
Portion 100	400.00	250.00	400.00	244.00
Portion 101	2,500.00	2,000.00	2,450.00	2,915.00
Portion 102	1,200.00	1,200.00	1,500.00	1,232.00
Portion 103	1,000.00	1,200.00	1,300.00	1,000.00
Portion 104	2,500.00	2,000.00	3,450.00	2,915.00
Portion 105	900.00	1,000.00	1,200.00	825.00
Portion 106	900.00	1,000.00	1,300.00	850.00
Portion 107	1,200.00	700.00	1,700.00	1,103.00
Portion 108	1,000.00	700.00	1,350.00	975.00
Portion 109	500.00	500.00	500.00	527.00

Fort Madison, Iowa. — Fort Madison Street Ry. Co. will spend about $50,000 to rehabilitate its lines.

Iowa City, Iowa.—Muscatine-Iowa City Interurban Ry. Co. (W. R. Jayne, Secy., Muscatine) contemplates constructing interurban line between Iowa City and Muscatine, via Montezuma and other points.

Mexico, Mo.—Mexico & Santa Fe R. R. Co. incorporated to construct an electric railway from a connection with the Chicago & Alton R. R. at Mexico to a point in Monroe County, 16 miles northeast. Capital $160,000. Among incorporators are J. A. Botts and W. W. Mundy.

San Pedro, Cal.—City Council authorized sale of franchise through O'Farrell, Newport and Bay Streets to Pacific Electric Ry. Co., of Los Angeles.

Lambeth, Ont.—Plans being made by London & Lake Erie Ry. Co. (W. N. Warburton, Gen. Mgr., London) to extend line from Lambeth to Delaware.

Toronto, Ont.—City Council authorized construction of Bloor Street line from Dundas Street to Quebec Avenue for Toronto Civic Ry. Co. (R. C. Harris, Gen. Mgr. City Hall), cost about $125,000.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Payson, Utah.**—Contract for grading Salt Lake & Utah R.R. from Spanish Fork to Payson awarded to Wasatch Const. Co., Provo.

RAILROADS

PROPOSED WORK.

Ithaca, N. Y.—Reported surveys completed by the State Engineer, Albany, of the street junctions and railroad gradings preparatory to the construction of a $40,-000 overhead crossing on Delaware, Lackawanna & Western R. R. in South Aurora Street, South Hill, Ithaca.

St. Clair, Ga.—Reported Savannah & Atlanta Ry. owned by the Savannah & Northwestern Ry. (L. B. Ackerman, Ch. Engr., Savannah) is to be built from St. Clair to near Warrenton, a distance of 44 miles.

Middleton, Tenn.—Extension of the New Orleans, Mobile & Chicago R.R. (B. V. Wright, Ch. Engr., Laurel, Miss.) from Middleton to Jackson, Tenn., is reported contemplated.

Akron, Ohio.—See "Bridges."

Greyville, Ill.—Reported Illinois Central R. R. (A. S. Baldwin, Ch. Engineer, Chicago), will construct a double track road from Grayville to Metropolis, about 100 miles.

Paris, Tex.—Building of a railroad from Paris to New Orleans is under consideration. A. T. Perkins, 401 Locust Street, St. Louis, Pres. Marshall & East Texas Railroad, is interested.

Everett, Wash.—Merrill & Ring Lumber Company of Everett, it is reported intends constructing a logging railroad, beginning at mouth of Pysht River in Clallam County; cost $250,000.

BIDS DESIRED.

Cleveland, Ohio.—Until Dec. 2 by Commissioner of Purchases and Supplies for grading subway at Hamilton Avenue and Pennsylvania Railroad.

PUBLIC BUILDINGS AND SCHOOLS

PROPOSED WORK.

Lynn, Mass.—Steps being taken to erect two-story school on Conomo Avenue, Wyoma; probable cost $100,000. Address Commissioner of Public Property.

North Adams, Mass.—All bids opened Nov. 17 by School Committee for erecting new high school have been rejected as being too high. Revised plans to be prepared by E. C. & G. C. Gardner, 33 Lyman Street, Springfield. F. J. O'Hara, Secy. Pro Tem. School Committee.

Springfield, Mass.—All bids opened for erecting Hampden County Training School have been rejected by County Commissioners. Plans will be revised and new bids called for.

Westfield, Mass.—Architect selected by Building Committee to prepare plans for White Street School.

Hartford, Conn.—Committee appointed to make investigations for improving County Jail. Address County Clerk.

Potsdam, N. Y.—Contract will be let early in 1916 for erecting a brick and stone normal school to cost $240,000. L. F. Pilcher, State Architect, Albany.

Hackensack, N. J.—C. V. R. Bogert, 167 Main Street, Hackensack, and C. W. Brazer, 1133 Broadway, New York, are architects for the two-story school to be erected at Teaneck, at a cost of $4,000.

Newark, N. J.—Board of Freeholders taking steps to erect eight-story county office building at High Street and Springfield Avenue; also intends remodeling court house; total cost about $1,000,000.

Lawrenceville, Pa.—Board of Education (John N. Hotchiss, Secy.) is considering erecting next spring or summer, a two-story school; nothing definite has been done about the matter.

Lehighton, Pa.—Contract will be let in December by Board Education (L. McBeidler, Secy.) for erecting 2-story, 140 x 132 ft., high school. Cost $75,000. E. Z. Scholl, Architect, Reading.

Philadelphia, Pa.—Board of Education contemplating erecting parental school in Byberry; probable cost about $300,000.

Uniontown, Pa.—School Board authorized election to vote $250,000 bonds for erecting schools.

Asheville, N. C.—Citizens voted $200,000 school bonds, of which $150,000 is to be used for erecting new high school. Harry Howell, Superintendent Schools.

Gastonia, N. C.—School bonds for $100,-000 will be sold Dec. 2. Address City Clerk.

Wilmington, N. C.—Erection of annex to James Walker Memorial Hospital reported contemplated by Mr. and Mrs. James Sprunt as a memorial to their daughter; cost about $30,000.

Evansville, Ind.—Bonds sold for erecting $100,000 memorial coliseum. C. P. Beard, County Auditor.

Mishawaka, Ind.—Plans being prepared by Herbert Erickson, Mishawaka, for two-story school to be erected for Penn Township; cost about $25,000.

Terre Haute, Ind.—City School Trustees selected Herbert W. Foltz, Indiana Pythian Building, Indianapolis, to prepare plans for proposed McLean School; probable cost $115,000.

Herbert W. Foltz, Indiana Pythian Building, Indianapolis, is architect for chemical and mechanical laboratories, shops and power house contemplated for Rose Polytechnic Institute on Heilman Farm; cost about $1,000,000.

Flint, Mich.—Citizens voted $110,000 school bonds.

Rochester, Mich.—Contract will be let about January for erecting the two-story and basement brick high school, to cost $25,000. Fisher Brothers, Pontiac, Archts. J. F. Jackson, Secretary Board of Education, School District No. 5.

Rock Island, Ill.—Board of Directors of Augustana College voted to appropriate funds for erecting gymnasium; cost at least $25,000.

Ottawa, Ill.—Jason F. Richardson, Jr., Ottawa, is architect for proposed Illinois Valley General Hospital to be erected on site adjoining Ottawa Tuberculosis Colony. Cost approximately $80,000.

Stratford, Wis.—County Board authorized Special Building Committee to select site and prepare plans for sanatorium to cost $35,000.

Waukesha, Wis.—Election to be held Dec. 6 to vote $150,000 school bonds.

St. Louis, Mo.—Contract soon to be let for erecting $30,000 annex to Memorial Home, 2609 South Grand Avenue. Edward C. Elliott, Chmn. Board Trustees.

Brownsville, Texas.—Election to be held Dec. 11 to vote $100,000 bonds for erecting high school and two ward schools, for which plans have been prepared.

College Station, Tex.—Plans completed for hospital to be erected at the Agricultural and Mechanical College. Appropriation $50,000.

Pharr, Tex.—Attorney General at Austin approved $40,000 bond issue of Hidalgo County Common School Dist. No. 4 for erecting high school here.

Sweet Water, Tex.—Commissioners Court of Nolan County ordered election, Dec. 18, to vote $250,000 bonds, of which $150,000 is to be used for erecting and equipment of new courthouse and $100,-000 for constructing county roads.

Baker, Ore.—Citizens voted $125,000 bonds for erecting high school.

San Francisco, Cal.—Preliminary plans prepared for school in Bernal Heights District. Address Board of Education.

BIDS DESIRED.

Boston, Mass.—Until Dec. 10, by Schoolhouse Commissioners, Boston (Jos. P. Lomasney, Chmn.), for erecting elementary school for upper and lower grades, Oliver Wendell Holmes Dist., Harvard, Glenway and Greenwood Streets, Dorchester.

Albany, N. Y.—Until Dec. 6 (readvertisement) by Board Contract and Supply (Isidor Wachsman, Secy.) for erecting fire alarm station at Delaware and Myrtle Avenues. Separate bids for plumbing and gas work; electric work; and heating.

Farmingdale, L. I., N. Y.—Until Dec. 3 by William Wirth Mills, Secretary Board Trustees, at New York Office of the Department of Architecture, Room 1224, Woolworth Building, New York, for construction work, etc., for garage at New York State School of Agriculture on Long Island at Farmingdale, advertised in Engineering Record. Lewis F. Pilcher, State Architect, Albany.

Wards Island, N. Y.—Until Dec. 2 by State Hospital Commission, Capitol, Albany (E. S. Elwood, Secy.), for power plant, heating system and equipment at Manhattan State Hospital, Wards Island, advertised in Engineering Record. Lewis F. Pilcher, State Architect, Albany.

Ridgway, Pa.—Until Dec. 30, by Jas. A. Wetmore, Acting Supervising Archt., Washington, D. C., for erection complete (including mechanical equipment and approaches) of U. S. Post Office at Ridgway.

Greenville, S. C.—Until Jan. 4 by Court House Commission, (Chester C. Persons, Chmn.) for erecting a 1 x 150 ft., part three-story and part seven-story steel reinforced concrete and tile Hospital; main house, cottages of stone brick and terra cotta. F. Thornton Marye, Archt., Candler Building, Atlanta.

Pontotoc, Miss.—Reported desired until Jan. 6 for erecting county hospital. Plans and Specifications A. Sperling & Jackson, Miss., and Walter A. Broadwell, Memphis, Tenn., Assoc. Archts.

Aaron, Ohio.—Until Dec. 15 to award contract to J. F. Barnhart Co., for furnishing material and erecting Bowen School, North Broadway Street, Harpster & Wilson, Archts., Northern Building. Also proposals will be received Dec. 15 for erecting Jefferson School, East Talmage Avenue and Logan Street. T. Ralph Bellamy, Supervising Archt., Cottage Place, Akron.

St. Joseph, Mich.—Reported desired until Jan. 1 by Board Education, Glen K. Frank, Secy., for erecting high school at Niles, Winchester and Fremont Avenues. Separate bids on masonry, carpentry, structural iron work, plumbing, heating and ventilating. Pilcher & Hamilton, Archts., 6 N. Clark Street, Chicago, Ill.

Chicago, Ill.—Until Dec. 1 by Business Management Board Education, for erecting Polk School, Cortez Avenue and Monon Street, also for furnishing and erecting steel for Bowen School, Forty-ninth Street and St. Lawrence Avenue. A. F. Hussander, Archt., Ed. Value.

Peoria, Ill.—Until Nov. 29 by Board Education (Anna Rittenhouse, Secy.) for furnishing material and erecting 2-story and basement annex to Irving School. Separate bids for heating and plumbing. Jno. F. King, Jr., 907 Central National Bank Building, Peoria.

Rockford, Ill.—Until Dec. 7 by Rockford Park Comrs. (F. J. O'Brien, Secy.) for erecting a public amusement and golf club building in Sinnissippi Park. Eckland & De Arment, Archts., 512 Trust Bldg.

Springfield, Ill.—Until Dec. 6 by State Board Administration, Springfield, for erecting farm cottage at Watertown State Hospital, estimated cost $25,000, and an addition to dining room at Elgin State Hospital, estimated cost $15,000. J. B. Hinslea, Archt., 120 N. Fifth Avenue, Chicago.

Until Nov. 25, by Lewis S. Stevenson, Supt. State Capitol, Springfield, for remodeling south and north wings of State Capitol. James B. Dill, State Archt., 120 N. Fifth Street, Chicago.

Centerville, Iowa.—Reported desired until Jan. 15, for erecting three-story and basement, 62 x 120 ft., brick and stone hospital for Sisters of Mercy. Probable cost $45,000. P. E. Cox, 45 Pottawattamie Building, Archt., Council Bluffs.

Marion, Iowa.—Until Jan. 5, by Board Education (B. B. McPheeters, Secy.) for erecting high school and grade school. John D. Crook, Archt., 160 North Dearborn Street, Chicago, Ill.

Faribault, Minn.—Until Nov. 30, by State Board Control, St. Paul, for alterations in North Wing and fireproofing portion (same) of State School for Feeble Minded. Purchase C. H. Johnston, Archt., 715 Capital Bank Building, St. Paul.

Minneapolis, Minn.—Until Dec. 6 by Board Education for erecting John Ericsson School, including heating, plumbing etc. George P. Wentzell, Business Supt.

Red Wing, Minn.—Until Nov. 30, by State Board Control, St. Paul, for the Dormitory Cottage, State Training School, at Red Wing. C. H. Johnston, Archt., 715 Capital Bank Building, St. Paul.

Emporia, Kan.—Reported desired until Dec. 2 estimates of cost from Nov. 15, by E. T. Hackney, First Nat. Bank, Topeka, for erecting Cottage and basement, 40 x 144 ft., administration building, gymnasium and library. C. H. Squire, State Archt., Capitol Building, Topeka.

Omaha, Neb.—Reported desired about Dec. 1 for erecting a four-story, 60 x 120 ft. brick, University Dormitory at Omaha. John Latenser & Son, Archts., Omaha.

Missoula, Mont.—Until Dec. 29 by James A. Wetmore, Acting Supervising Archt., Washington, D. C., for extensions, remodeling, etc., U. S. Post Office and Court House at Missoula.

Rock Springs, Wyo.—Reported desired until Dec. 1 by Mayor for erecting court house.

Platteburg, Mo.—Reported desired until Dec. 15 by R. Hutchinson, Secy. Board Commissioners, for erecting and furnishing of Court House. Plans and specifications at office of Hackney & Painter, Architects, 711 Reliance Building, Kansas City, Mo.

Galveston, Tex.—Until Dec. 20 by James A. Wetmore, Acting Supervising Archt., Washington, D. C., for remodeling of U. S. Court House and Appraiser's Stores at Galveston.

Oklahoma City, Okla.—Reported desired until Dec. 4 by County Commissioners (H. L. Shadley, Chmn.) for erecting a brick school in East No. 1.

Seattle, Wash.—Reported desired until Dec. 4 (not Dec. 8 as previously stated) by Port Seattle Commissioners (C. E. Remsberg, Secy.) for erecting superstructure, 80 x 700 ft. for Spokane Avenue freight sheds. Probable cost $60,000.

PRICES AND LETTINGS.

★Indicates award of contract.

★Boston, Mass.—Contract awarded by School House Commissioners to J. J. Flynn, 218 Washington Street, at about $56,672 for erecting addition to High School of Practical Arts, Greenville and Winthrop Streets, Roxbury (bids opened Nov. 12).

Milford, Conn.—Norman Kerr, New York, N. Y., submitted lowest bid for erecting town building at $118,000. Citizens Nov. 15 voted to erect the building.

Salamanca, N. Y.—Following are four lowest bids opened Nov. 12 by Supervising Architect, Washington, D. C., for constructing U. S. Post Office.—(a) limestone, (b) sandstone: Dunkirk Stone Co., Buffalo, (a) $54,180, (b) $54,800; Westchester Engineering Co., White Plains, (a) $56,756, (b) $54,800; E. T. Abbott Constr. Co., St. James Building, New York, (a) $57,760, (b) $54,800; King Lumber Co., Charlottesville, Va., (a) $58,000; W. H. Fissell Co., Marbledge Building, Rochester (b) $58,500.

★Clearfield, Pa.—Contract awarded by School Board to W. A. Lukens of Clearfield at $62,979 for erecting high school on Market Street.

★Monongahela, Pa.—Contract for constructing U. S. Post Office awarded James Devault, Canton, Ohio, at $44,200.

★Philadelphia, Pa.—Contracts awarded by Property Committee of Board of Education for following schools:

★Six-room addition to Charles W. Henry School, Germantown, to William R. Dougherty, 1308 Samson Street, at $28,880.

★General Equipment for South Philadelphia High School for Girls and Frankford High School, to William Christy & Sons, 1614 McKean Street, at $29,804 and $10,621 respectively.

★Contract awarded John McShain, 1610 North Street, for erecting new Misericordia Hospital at Fifty-third and Cedar Streets for Sisters of Mercy, to be five stories, stone, concrete, terra cotta and fireproof construction; cost $300,000. E. F. Durang & Son, Archts., 1200 Chestnut Street.

★Pittsburgh, Pa.—Contracts in connection with city and county building awarded as follows: Metal, lathing, etc. (bids opened Nov. 9), to McNulty Bros. Co., Frick Building, at $101,172; carpentry (bids opened Nov. 10), to Charles Peterson, 6537 Darlington Road, at $16,600; vault doors, etc. (bids opened Nov. 11), to Diebold Safe & Lock Co., 336 Fourth Avenue, at $2,497. Hyatt N. Cribbs, County Comptroller.

★Warren, Pa.—Contract awarded Oberle & Smith of Warren for erecting $35,000 maternity ward for Emergency Hospital as a memorial to Mrs. Alice Jefferson.

★Washington, D. C.—Contract for erecting truck house No. 1 on New Jersey Avenue and E Street N. W. awarded Skinker & Garret, Washington, D. C., at $23,956.

**★Contract awarded James L. Marshall, Washington, D. C., for erecting engine house No. 28 on Connecticut Avenue and Quarter Street at $22,300.

Huntington, W. Va.—Following are four lowest bids opened Nov. 16 by Supervising Architect, Washington, D. C., for constructing an extension to U. S. Post Office and Court House: King Lumber Co., Charlottesville, Va., $121,800; Norcross Bros. Co., Worcester, Mass., $122,790; Boyle-Robertson Constr. Co., Washington, D. C., $124,975; Volney E. Taylor, Huntington, $125,000.

★Evansville, Ind.—Contract for erecting coliseum awarded Henry W. Klausman, Indianapolis, at $124,000 (bids opened Nov. 6).

★Seymour, Ind.—Contract awarded Callahan Mandl Co., 511 Reaper Block, Chicago, Ill., for constructing U. S. Post Office at about $47,700.

★Arcola, Ill.—Contract for erecting township high school reported awarded H. B. Krussell of Danville at $85,305 and plumbing and heating to W. T. Delehanty, of Decatur, at $26,300. J. W. Royer, Archt., Indiana.

★Merrill, Wis.—Contract for constructing U. S. Post Office awarded John Lauritzen, Fergus Falls, Minn., at $53,900.

PRIVATE BUILDINGS

PROPOSED WORK.

Springfield, Mass.—Reported Springfield Street Railway Co. (Herbert M. Fletcher, Gen. Mgr., Springfield) intends erecting new car house and shops at Hooker Street; estimated cost $750,000.

Brooklyn, N. Y.—Manhattan Beach Realty Corporation, Shore Boulevard and Ocean Avenue, Coney Island, intends erecting for site of Oriental Hotel, Manhattan Beach, an all-year hotel costing approximately $2,000,000.

Ithaca, N. Y.—Plans prepared for three-story, fireproof, brick building to be erected in the spring on State and Geneva Streets for Lodge 636, B. P. O. Elks; cost $30,000.

New York, N. Y.—Plans filed for erecting following buildings: 9-story apartment house at 106 E. Eighty-fifth Street for 106 E. Eighty-fifth Cor., cost $170,000, Schwartz & Gross, Archts., 347 Fifth Avenue; 3-story stores and apartment house at 9 W. 110th Street for Roseff Realty Co., cost $165,000, Gronenberg & Leuchtag, Archts., 303 Fifth Avenue; 6-story garage at 243 W. Sixty-seventh Street for Hudson Motor Co., cost $150,000, Mulliken & Moeller, Archts., 103 Park Avenue; 2 five-story brick tenements at 181st Street and Vyse Avenue for Parkridge Realty Co., cost $120,000, Kreymborg Architectural Co., Archts., 1029 E. 163d Street; 5-story brick tenement at 179th Street and Corlear Avenue for C. & P. Realty Cor., cost $75,000. George F. Pelham, Archt., 30 E. Forty-second Street.

C. P. H. Gilbert, Twenty-fifth Street and Broadway, is architect for apartment house which the 1067 Fifth Avenue Co. (Bainbridge P. Clark, Pres.) contemplates erecting at Eighty-seventh Street and Fifth Avenue; to be about twelve stories.

Rye, N. Y.—Plans being prepared by Lewis Colt Albro, 2 W. Forty-seventh Street, New York, for $250,000 dwelling contemplated on Lincoln Avenue for George Arents, Jr., 524 Fifth Avenue, New York.

Elizabeth, N. J.—Ballinger & Perrot, Methodist Building, Philadelphia, Pa., are architects for brick and concrete building to be erected here for American Gas Accumulator Co.

Eddystone, Pa.—Plans being prepared by Henon & Boyle, Fuller Building, Philadelphia, for seven-story and basement, brick, stone and concrete hotel for Remington Hotel Co.; cost $175,000.

Lansdale, Pa.—Methodist Episcopal Church, Third and Walnut Streets, contemplates erecting new edifice at Third and Broad Streets; cost about $30,000.

Maltby, Pa.—Holy Trinity Slovak Roman Catholic Church contemplates erecting new brick edifice; cost about $30,000.

Philadelphia, Pa.—Sauer & Hahn, 1112 Chestnut Street, are architects for four-story brick and concrete building to be erected at 1220 Spring Street for M. Rice & Co., 1220 Race Street.

Ballinger & Perrot, Methodist Building, are architects for three-story, stone and reinforced-concrete employees' building, to be erected at Nicetown for American Pulley Co., 4200 Wissahickon Avenue.

Baltimore, Md.—Carnegie Steel Co., 803 Maryland Trust Building, will erect one-story steel warehouse, 692 x 479 ft., at Paca and Elk Streets; cost $24,000.

John Freund, Jr., Hoffman Building, is architect for a nine-story apartment house; cost approximately $200,000.

Kingsville, Md.—Plans being prepared by Thomas Bond Owings, 347 N. Charles Street, Baltimore, for a $20,000 residence contemplated here for J. C. Taliaferro, 209 E. Biddle Street, Baltimore.

Jacksonville, Fla.—R. A. Benjamin, Bisbee Building, is architect for apartment house to be erected on Riverside Avenue for Julian Prewitte, Dyal-Upchurch Building; cost about $60,000.

New Orleans, La.—A four-story, concrete and steel, fireproof building contemplated at Baronne and Gravier Streets. Leo Feliman, 233 Baronne Street, Agent.

Cleveland, Ohio.—Plans being prepared by W. S. Ferguson & Sons, 1900 Euclid Avenue, for five-story, concrete, steel and brick, commercial building to be erected at Euclid Avenue and E. Fifty-fifth Street for William R. Hopkins; cost about $250,000.

Columbus, Ohio.—Franklin Park Methodist Episcopal Church contemplates erecting in spring new edifice at Madison and Auburn Avenues; probable cost $45,000. Rev. Nathaniel E. Butler, Pastor.

Toledo, Ohio.—Central Ohio Paper Co. (K. S. Moening, Mgr.), 412 Huron Street, will erect three-story, fireproof building on Ontario and Monroe Streets; cost approximately $35,000.

Indianapolis, Ind.—An agreement has been reached between the Coliseum Hotel Corporation and F. J. Hughes & Co., of Dayton, Ohio, architects and engineers, with local offices in Hume-Mansur Building, for erecting Indiana Coliseum. Foundation provides for twelve stories, seven to be erected now.

Detroit, Mich.—Plans prepared by George D. Mason, 80 Griswold Street, for Masonic Temple to be erected on Lafayette Boulevard and First Street reported approved; cost $484,000. Fred A. Cooke, Chmn. Building Committee.

Streator, Ill.—Presbyterians contemplating erecting $50,000 church.

Eau Claire, Wis.—Lake Street Methodist Church contemplates erecting in spring new edifice at Lake Street and Fourth Avenue; probable cost $30,000. Rev. F. L. Roberts, Pastor.

Duluth, Minn.—Plans being prepared by Holstead & Sullivan, Palladio Building, for two buildings to be erected at Superior Street and Twenty-first Avenue W. for Black Bros.; total cost $70,000.

Billings, Mont.—Plans reported being prepared for fireproof apartment to be erected for Dedrick & Piper, 222 Stapleton Building; cost $125,000.

Havre, Mont.—Reported contract soon to be let for erecting four-story Masonic Temple here; cost $75,000. Link & Haire, of Helena, and Frank F. Bossout, of Havre, associate architects.

Colorado Springs, Colo.—A business block, to cost about $50,000, contemplated at Pikes Peak and Nevada Avenues, for Vollmer Brothers, 122 N. Cascade Street.

Seattle, Wash.—B. Marcus Priteca, Pantages Building, engaged to prepare plans and award contract about Jan. 1 for erecting 180 x 108 ft. reinforced concrete natatorium for Natatorium Co. at Second Avenue and Lenora Street; cost about $250,000.

Contract soon to be let by Thompson & Thompson, Mutual Life Building, for erecting four-story, 60 x 120 ft., store, hotel and lodge building for Chinese Masons; cost about $50,000.

Tacoma, Wash.—Reported Knights of Columbus contemplate erecting club house on C and Ninth Streets; probable cost $50,000.

Astoria, Ore.—Reported Portland Mausoleum Co., Spalding Building, Portland, will erect $40,000 mausoleum here.

Portland, Ore.—Reported Rasmussen & Co., Second and Taylor Streets, will erect ten-story warehouse in Sullivans Gulch; cost $50,000.

Yosemite, Cal.—Concessions have been granted by Department of the Interior, Washington, D. C., to Desmond Comissary Co. whereby a hotel costing $150,000 is to be erected in the Yosemite Valley. This company will also erect at Glacier Point a $35,000 hotel.

Vancouver, B. C.—Reported plans prepared by Frederick Townley, Vancouver, for proposed depot for Great Northern Railway Co. (A. H. Hogeland, Ch. Engr., St. Paul, Minn.), have been approved. It is to be two-story, L-shaped, 228 x 225 ft., reinforced-concrete construction, brick, granite and terra cotta; cost about $250,000.

BIDS DESIRED.

Chicago, Ill.—Reported desired until Dec. 10, by Ottenheimer, Stern & Reichert, 220 S. State Street, for erecting 12-story and basement, 40 x 102 ft. clubhouse for Chicago Lodge No. 4, B. P. O. E. Probable cost $350,000.

Tyler, Tex.—Reported desired until Dec. 4, at office of Tyler Ice Co., for erecting 2-story brick and concrete building, 88 x 112 ft. Separate bids on carpentry, roofing, plumbing and electric wiring. Bothwell & Shaw, Archts., Tyler.

PRICES AND LETTINGS.

★Indicates award of contract.

★West Haven, Conn.—Contract awarded Charles E. Augur, 449 Washington Avenue, for erecting three-story, brick parish house with steel truss roof, for Congregational Church; cost about $35,000. Rev. A. R. Brown, Pastor. Brown & Von Beren, Archts., 185 Church Street, New Haven.

★Holland, Mich.—Contract awarded Byers & Co. of Kalamazoo for erecting new $50,000 building for First State Bank, to be two stories, stone construction.

★Chicago, Ill.—Contract awarded Geo. A. Fuller Co., 140 S. Dearborn Street, for concrete work in connection with superstructure of the new Pennsylvania freight station.

★Contracts awarded Krahl Construction Company Chicago, Ill., as follows: Alterations to restaurant at 220 N. Clark Street, Chicago, at $20,000; H. R. Wilson & Co., Archts., Chicago. Commissary and restaurant building at 675 Wabash Avenue, Terre Haute, Ind., cost $20,000; Marshall & Fox, Archts., Chicago. Commissary and restaurant building at 1520 Main Street, Dallas, Tex., cost $50,000; Marshall & Fox, Archts., Chicago, Ill.

★Sioux City, Iowa.—Contract awarded The Ginby Co., Chicago, Ill., for major portion of Chicago & Northwestern Railroad's new freight depot at $150,000. Total cost $185,000.

★Minneapolis, Minn.—Contract for erecting two-story store and apartment building for Barrett & Zimmermen, Nicollet and Twelfth Street S., awarded Carlsted Bros., Minneapolis, for $35,000.

★Omaha, Neb.—Contract for erecting three-story and basement Coad Hotel at Seventeenth and Jackson Streets, awarded Alexander Beck, State Bank Building; cost $40,000.

★Butte, Mont.—Contract awarded Hugh Johnston, 1106 W. Broadway, at $32,447, for erecting three-story and basement, brick and terra cotta hotel on West Broadway for B. K. Wheeler.

★Douglas, Ariz.—Contract awarded Paul Neichelsen, Globe, for erecting lodge building for B. P. O. Elks, No. 955, at $26,840. Next three bidders: J. B. O'Reilly, Douglas, $27,077; J. M. Sparks, Fort Huachuca, $28,999, and T. B. Stewart, Douglas, $29,250.

★**Ottawa, Ont.** — Contract reported awarded Norcross Bros. Co. of Worcester, Mass., for erecting eight-story fireproof store and office building at Rideau and Sussex Streets for C. Jackson Booth; cost about $300,000.

NEW INDUSTRIAL PLANTS

PROPOSED WORK.

Watertown, Conn.—Heminway & Bartlett Silk Co. contemplates erecting addition to plant.

Brooklyn, N. Y.—Soss Manufacturing Co., 435 Atlantic Avenue, intends erecting four-story fireproof factory at Grand Avenue and Bergen Street; probable cost $60,000.

Harrison, N. J.—Plans filed for three-story, brick and steel plant, to be erected on Fourth Street, for Crucible Steel Co., 420 Canal Street, New York.

Harrisburg, Pa.—Plans being prepared by C. H. Kain, Arcade Building, for five-story, brick and concrete, fireproof factory to be erected on State and Cameron Streets for Dauphin Cigar Co.; cost about $40,000.

Philadelphia, Pa.—Plans filed for three-story, brick and stone, 100 x 100 ft., ice cream plant for Supplee Alderney Dairies, 3333 Ludlow Street; cost $35,000. Charles H. Caspar, Archt., 48 N. Fifteenth Street.

Pottstown, Pa.—Contract soon to be let by National Rubber Co. for erecting reinforced concrete factory and power house. Engineer, M. Shoemaker, Union Building, Newark, N. J.

Plans prepared for improvements contemplated to plant of McClintic-Marshall Structural Co., to include factory, office building, main shop, 618 x 390 ft., and several smaller shops; traveling cranes and hoists also to be installed; cost reported at $1,000,000.

Granite Falls, N. C.—Citizens' Light & Power Co., of Lenoir, reported will erect knitting mill here.

Greensboro, N. C.—Reported American Agricultural Chemical Co., 2 Rector Street, New York City, contemplates erecting fertilizer factory here; cost about $100,000.

Columbus, Ga. — Reported Hardaway-Cargill Co. will erect plant on Tenth Avenue and Tenth Street; probable cost $100,000.

Dayton, Ohio.—Plans prepared by Peters, Hermann & Brown, Reibold Building, for four-story steel and concrete plant contemplated on Fifth Street for Dayton Pure Milk & Butter Co., 219 E. Fifth Street.

East Liverpool, Ohio.—Plant of Golding & Sons on West Fourth Street destroyed by fire will be rebuilt.

Salem, Ohio.—Andalusia Dairy Co., 105 Ferry Street, contemplates erecting $40,000 addition to plant.

Champaign, Ill.—Plans being prepared for newspaper plant for Champaign News; cost approximately $50,000.

Chicago, Ill.—Excelsior Steel Furnace Co., 517 W. Monroe Street, contemplates erecting plant at Division and Hickory Streets, Goose Island.

Geneva, Ill.—Erection of addition to plant of Burgess-Norton Co. contemplated.

Kewanee, Ill.—Farmers Elevator Co. will erect a 40,000 bu. elevator, sheet iron covered.

North Milwaukee, Wis.—Reported contract soon to be let by A. O. Smith Co., Twenty-seventh Street and Keefe Avenue, Milwaukee, for erecting steel, concrete and brick boiler house here; cost about $35,000.

Cloquet, Minn.—Northwestern Paper Company of Cloquet will erect a paper mill and rebuild dam across Mississippi River. C. I. McNair, Mgr., Cloquet.

Seattle, Wash.—Reported Beaver Co. (W. F. MacGlashan, Pres.), 93 Beaver Road, Buffalo, N. Y., contemplates erecting branch factory here.

Portland, Ore.—American Can Co. (Frederick P. Kendall, Mgr.), Fourteenth and Front Streets, contemplates erecting $600,000 plant on Fourteenth Street.

PRICES AND LETTINGS.

★Indicates award of contract.

★**New Brunswick, N. J.** — Contract awarded Turner Construction Co., 11 Broadway, New York, by the Howe Rubber Co., New Brunswick, for constructing 3-story factory, 70 x 250 ft., of reinforced concrete, skeleton and brick curtain walls, at Fulton and Coastwise Avenues. F. J. Heimle, 190 Montague Street, Brooklyn, Archt.

★**Perth Amboy, N. J.**—Contract awarded Turner Construction Co., 11 Broadway, New York, by the United Lead Co., for constructing a carpenter shop, 62 x 42 ft., of reinforced concrete construction.

★**Philadelphia, Pa.**—Contracts reported awarded by American Ice Co., Sixth and Arch Streets, to Turner Concrete & Steel Co., 1713 Sansom Street, for erecting one-story and basement, reinforced concrete manufacturing building at Bellefield Avenue and High Street; cost $20,000; also for one and two-story reinforced concrete warehouse and engine room; cost $30,000.

★Contract awarded A. L. Carhart, Hale Building, for erecting one-story pump house on Tucker and Bermuda Streets for Barrett Manufacturing Co.; cost $30,000.

★**Sparrows Point, Md.**—Contract awarded West Constr. Co., Knickerbocker Building, Baltimore, for erecting steel and reinforced concrete, 625 x 75 ft., foundry for Maryland Steel Co.; estimated cost about $350,000.

MISCELLANEOUS

PROPOSED WORK.

Cable Extension—Cleveland, Ohio.—Ordinance passed by Council directing Director Public Utilities to spend $75,000 for extending cable of the municipal light plant.

BIDS DESIRED.

Cement, Brick, etc.—Jersey City, N. J.—Until Dec. 2, by City Commissioners, for furnishing and delivering masons' material such as Portland cement, Westchester lime, North River hard burned brick and sand, from date of contract to November, 1916. Michael I. Fagen, City Clerk.

Boilers—Orangeburg, S. C.—Until Dec. 3, by Mayor and Councilmen for two 275 hp. water tube boilers, advertised in Engineering Record.

Power Plant Improvements—Clarksdale, Miss.—Until Dec. 14 by City Commissioners for water tube boiler, steel sack, water heater, centrifugal boiler, feed pump, centrifugal motor-driven water works pump, feed water regulators, etc., advertised in Engineering Record. W. G. Shurger Engineering Co., Consulting Engineer, Meridian, Miss.

Retaining Walls—Valparaiso, Ind.—See "Bridges."

Sand, Gravel, Etc.—Chicago, Ill.—Until Dec. 1 by Department Public Works (W. R. Moorhouse, Comr.) for 9800 cu. yd. torpedo sand, 3600 cu. yd. washed gravel, and 4100 bbls. lime.

Chimney, Elevator, Etc. — Rochester, Minn.—Until Dec. 8, by Public Utility Board (W. F. Lenz, Secy.), for power plant equipment as follows: Two 260-hp. water tube boilers, mecnanical stokers for four boilers, economizers and induced draft fan equipment, chimney, steel breeching and flues, overhead coal bunkers, coal crusher conveying equipment, 750 kw. turbo-generator and condenser, switchboard, condenser for two engines, crane for engine room, electric elevator, etc. L. Pillsbury Company, Engrs., Metropolitan Life Building, Minneapolis.

PRICES AND LETTINGS.

★Indicates award of contract.

★**Elevator and Mechanical Equipment—Boston, Mass.**—Contract for elevator in U. S. Appraisers Storehouse awarded Otis Elevator Co., Washington, D. C., at $31,379, and for mechanical equipment to Standard Engineering Co., Washington, D. C., at $60,500.

Charleston, S. C.—Following are bids opened Nov. 13 by Bureau of Yards and Docks, Washington, D. C., for constructing shipbuilding ways and roadways to buildings ways at U. S. Navy Yard: Clement Walker, 189 E. Bay Street, $38,097; Simons Mayrant Co., People's Office Building, $27,087; P. H. Day, 29 B Street, $29,756, and John B. Wheaton, 222 Maple Avenue, Norfolk, $39,248.

Proposals

For Proposals Advertised, see Pages 30 and 31

WATERWORKS.

Bids Close.		See Eng. Record.
Nov. 30.	Pipe Fittings, Etc., Washington, D. C.	Nov. 13
Nov. 30.	Brass cocks, Washington, D. C.	Nov. 20
Nov. 30.	Automatic ejectors, Panama.	Nov. 20
Nov. 30.	Pipes, Valves, Etc., Chicago, Ill.	Nov. 27
Dec. 1.	Water Works, East Youngstown, Ohio	Oct. 16
Dec. 1.	Water Works, Melrose, Wis.	Nov. 6
Dec. 1.	Pipe line, San Juan, P. R.	Nov. 20
Dec. 1.	Pipe, Chicago, Ill.	Nov. 27
Dec. 2.	C. I. Pipe, Jersey City, N. J. Adv. Oct. 30 to Nov. 27.	Oct. 30
Dec. 2.	Steel Pipe, Jersey City, N. J. Adv. Oct. 30 to Nov. 27.	Oct. 30
Dec. 2.	Tank, Wheaton, Ill. Adv. Nov. 20, 27.	Nov. 20
Dec. 3.	Water Works, Henderson, Tenn. Adv. Nov. 13, 20.	Nov. 13
Dec. 3.	Wells, Henderson, Tenn. Adv. Nov. 20.	Nov. 20
Dec. 9.	Main, Galveston, Tex.	Nov. 27
Dec. 6.	Reservoir, Stockton, Cal.	Nov. 20
Dec. 6.	Fire Hydrants, Louisville, Ky.	Nov. 27
Dec. 6.	Pumps, Highland Park, Mich. Adv. Nov. 20, 27.	Nov. 20
Dec. 7.	Water Works, Wesson, Miss.	Nov. 13
Dec 7.	Pipe Fittings, Washington, D. C.	Nov. 13
Dec. 8.	Pumps, Valves, Etc., Panama	Nov. 27
Dec. 9.	Bridge for main, Covington, Ky. Adv. Nov. 13.	Nov. 13
Dec. 10.	Water Works, East Youngstown, Ohio. Adv. Nov. 20.	Nov. 30
Dec. 14.	Improvements, Wilberforce, Ohio	Nov. 20
Dec. 14.	Filters, St. Hyacinthe, Que.	Nov. 27
———	System, Wooster, Ohio. Adv. Nov. 20.	Nov. 20

SEWERAGE AND SEWAGE DISPOSAL.

Nov. 29.	Washington, D. C. Adv. Nov. 20.	Nov. 20
Nov. 29.	Indianapolis, Ind.	Nov. 27
Dec. 1.	Columbus, Ohio.	Nov. 13
Dec. 1.	Mansfield, Ohio.	Nov. 20
Dec. 1.	Cuyahoga Falls, Ohio.	Nov. 27
Dec. 1.	Muskogee, Okla.	Nov. 27
Dec. 1.	Baltimore, Md.	Nov. 27
Dec. 2.	Contract 4, Chicago, Ill. Adv. Oct. 30.	Oct. 30
Dec. 3.	Henderson, Tenn. Adv. Nov. 13, 20.	Nov. 13
Dec. 7.	Ridgefield Park, N. J. Adv. Nov. 27.	Nov. 27
Dec. 21.	Strawberry Point, Iowa.	Nov. 20
———	Parkersburg, Pa. Adv. Oct. 9.	Oct. 9

BRIDGES.

Nov. 30.	Jackson, Tenn. Adv. Nov. 20, 27.	Nov. 20
Nov. 30.	Marion, Ill.	Nov. 20
Nov. 30.	Pittsburgh, Pa.	Nov. 27
Dec. 2.	Chicago, Ill.	Nov. 27
Dec. 6.	Louisville, Ky. Adv. Nov. 6 to 27.	Nov. 6
Dec. 6.	Edwards, Miss.	Nov. 13
Dec. 6.	Woodville, Miss.	Nov. 13
Dec. 6.	Grenada, Miss.	Nov. 13
Dec. 6.	Leakesville, Miss.	Nov. 20
Dec. 6.	Holly Springs, Miss.	Nov. 20
Dec. 6.	Warren, Ohio	Nov. 27
Dec. 6.	Hamilton, Mont.	Nov. 27
Dec. 6.	Linneus, Mo.	Nov. 27
Dec. 6.	Fayette, Miss.	Nov. 27
Dec. 6.	Grenada, Miss.	Nov. 27
Dec. 6.	Valparaiso, Ind.	Nov. 27
Dec. 7.	Canton, China Adv. Oct. 23.	Oct. 23
Dec. 7.	Wathena, Kan.	Nov. 20
Dec. 7.	Pennsylvania	Nov. 20
Dec. 7.	Fredonia, Kan.	Nov. 27
Dec. 7.	Sullivan, Ind.	Nov. 27
Dec. 8.	Lorain, Ohio.	Nov. 20
Dec. 8.	New Gretna, N. J.	Nov. 20
Dec. 8.	Ada, Mich.	Nov. 27
Dec. 9.	Covington, Ky. Adv. Nov. 13, 20.	Nov. 13
Dec. 9.	Bakersfield, Cal.	Nov. 20
Dec. 9.	New York, N. Y.	Nov. 27
Dec. 13.	Selma, Ala.	Nov. 20
Dec. 14.	Sunbury, Pa.	Nov. 27

PAVING AND ROADS.

Nov. 30.	Toledo, Ohio.	Nov. 13
Nov. 30.	Ida Grove, Iowa	Nov. 27
Nov. 29.	Indianapolis, Ind.	Nov. 27
Nov. 30.	Kansas City, Mo.	Nov. 27
Dec. 1.	Hastings, Neb.	Nov. 6
Dec. 1.	Muskogee, Okla.	Nov. 27
Dec. 1.	Portsmouth, Va.	Nov. 27
Dec. 1.	Canyon City, Ore.	Nov. 27
Dec. 1.	Indiana.	Nov. 27
Dec. 1.	Charleston, W. Va.	Nov. 27
Dec. 2.	Columbus, Ohio	Nov. 27
Dec. 3.	Ohio	Nov. 27
Dec. 3.	Hackensack, N. J.	Nov. 27
Dec. 4.	Pensacola, Fla.	Nov. 13
Dec. 6.	Sedalia, Mo.	Nov. 6
Dec. 6.	Brookville, Ind.	Nov. 13
Dec. 6.	Princeton, W. Va. Adv. Nov. 13, 20.	Nov. 13
Dec. 6.	Edwards, Miss.	Nov. 13
Dec. 6.	Winamac, Ind.	Nov. 13
Dec. 6.	Wauchula, Fla.	Nov. 20
Dec. 6.	Edwards, Miss.	Nov. 20
Dec. 6.	Indiana	Nov. 20
Dec. 6.	Camden, Ala.	Nov. 27
Dec. 6.	Kosciusko, Miss.	Nov. 27
Dec. 6.	Albany, Ky.	Nov. 27
Dec. 6.	Brookville, Ind.	Nov. 27
Dec. 6.	Indiana.	Nov. 27
Dec. 7.	Excelsior, Minn.	Nov. 13
Dec. 7.	Indiana	Nov. 20
Dec. 7.	Indiana.	Nov. 27
Dec. 8.	Indiana	Nov. 20
Dec. 6.	El Centro, Cal.	Nov. 20
Dec. 8.	Indiana.	Nov. 27
Dec. 10.	Seattle, Wash.	Nov. 20
Dec. 10.	Indiana.	Nov. 27
Dec. 13.	Pasadena, Cal.	Nov. 27
Dec. 20.	Washington	Nov. 27
Jan. 3.	Maynardsville, Tenn.	Nov. 20

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS.

Nov. 30.	Dredging, Orange, Tex.	Nov. 13
Dec. 1.	Irrigation Work, Meadow Creek, Wash. Adv. Oct. 23.	Oct. 23
Dec. 1.	Seawall, Waveland, Miss.	Nov. 6
Dec. 1.	Canal, Westminster, Cal.	Nov. 13
Dec. 1.	Seawall, Bay St. Louis, Miss.	Nov. 20
Dec. 1.	Ditches, Redwood Falls, Minn.	Nov. 27
Dec. 2.	Pier, Cleveland, Ohio	Nov. 27
Dec. 6.	Pier, Philadelphia, Pa. Adv. Nov. 13, 20.	Nov. 13
Dec. 6.	Levee, Grenada, Miss.	Nov. 13
Dec. 6.	Drainage, Mason City, Iowa.	Nov. 20
Dec. 6.	Drainage Ditches, Des Moines, Iowa.	Nov. 27
Dec. 6.	Ditches, Robstown, Tex.	Nov. 27
Dec. 10.	Ditches, Marion, Ark.	Nov. 27
Dec. 11.	Dredging, Brooklyn, N. Y.	Nov. 20
Dec. 14.	Dredging, New York, N. Y. Adv. Nov. 13 to 27.	Nov. 13
Dec. 15.	Ditch, Bemidji, Minn.	Nov. 27
Dec. 20.	Harbor Work, Miami, Fla.	Nov. 27
Jan. 8.	Dredge, Macaco, China	Nov. 6

PUBLIC BUILDINGS AND SCHOOLS.

Nov. 30.	Emporia, Kan.	Nov. 13
Nov. 30.	Newark, N. J.	Nov. 20
Nov. 30.	Washington, D. C.	Nov. 20
Nov. 30.	Faribault, Minn.	Nov. 27
Nov. 30.	Red Wing, Minn.	Nov. 27
Dec. 1.	Bloomington, Ind. Adv. Oct. 30.	Oct. 23
Dec. 1.	Columbus, Ohio	Nov. 6
Dec. 1.	New York, N. Y.	Nov. 13
Dec. 1.	Seattle, Wash.	Nov. 20
Dec. 1.	Cleveland, Ohio	Nov. 20
Dec. 1.	Chicago, Ill.	Nov. 27
Dec. 2.	Wards Island, N. Y. Adv. Nov. 27.	Nov. 27
Dec. 3.	New Berlin, Ohio.	Nov. 20
Dec. 3.	Farmingdale, L. I., N. Y. Adv. Nov. 27.	Nov. 27
Dec. 3.	Emporia, Kan.	Nov. 27
Dec. 4.	Pearl City, Hawaii.	Nov. 6
Dec. 4.	West Manchester, Ohio.	Nov. 6
Dec. 4.	Ortonville, Minn.	Nov. 13
Dec. 4.	East Cleveland, Ohio.	Nov. 20
Dec. 4.	Portland, Me.	Nov. 20
Dec. 6.	Pontotoc, Miss.	Nov. 27
Dec. 6.	Oklahoma City, Okla.	Nov. 27
Dec. 6.	Seattle, Wash.	Nov. 27
Dec. 6.	Albany, N. Y.	Nov. 27
Dec. 6.	Minneapolis, Minn.	Nov. 27
Dec. 6.	Springfield, Ill.	Nov. 27
Dec. 7.	Titusville, Fla.	Nov. 20
Dec. 7.	St. Joseph, Mich.	Nov. 27
Dec. 7.	Rockford, Ill.	Nov. 27
Dec. 7.	Omaha, Neb.	Nov. 27
Dec. 8.	Minneapolis, Kan.	Nov. 20
Dec. 8.	Seattle, Wash.	Nov. 20
Dec. 8.	Rock Springs, Wyo.	Nov. 27
Dec. 9.	Lebanon, Ind.	Nov. 6
Dec. 10.	Greenwich, Conn.	Nov. 6
Dec. 10.	Boston, Mass.	Nov. 27
Dec. 13.	Cincinnati, Ohio	Nov. 20
Dec. 13.	Akron, Ohio	Nov. 27
Dec. 14.	New Philadelphia, Ohio.	Nov. 20
Dec. 15.	Centerville, Iowa	Nov. 27
Dec. 15.	Plattsburg, Mo.	Nov. 27
Dec. 18.	Middletown, Ohio. Adv. Nov. 13, 20.	Nov. 13
Dec. 20.	Humboldt, Tenn.	Nov. 13
Dec. 21.	Attleboro, Mass.	Nov. 20
Nov. 22.	Aurora, Neb.	Nov. 20
Dec. 28.	Seymour, Conn.	Nov. 20
Dec. 29.	Missoula, Mont.	Nov. 27
Dec. 30.	St. Petersburg, Fla. Adv. Nov. 20, 27.	Nov. 20
Dec. 30.	Galveston, Tex.	Nov. 27
Dec. 30.	Ridgway, Pa.	Nov. 27
Jan. 4.	Cavite, P. I.	Nov. 13
Jan. 4.	Greenville, S. C.	Nov. 27
Jan. 5.	Harlan, Iowa	Nov. 27

PRIVATE BUILDINGS.

Dec. 1.	Athens, Ga.	Nov. 13
Dec. 4.	Tyler, Tex.	Nov. 27
Dec. 10.	Chicago, Ill.	Nov. 27

NEW INDUSTRIAL PLANTS.

Dec. 15.	Seattle, Wash.	Nov. 20

MISCELLANEOUS.

Nov. 30.	El. Rys., New York, N. Y.	Nov. 13
Dec. 1.	Pipe, etc., Panama	Nov. 20
Dec. 1.	Sand, Gravel, Etc., Chicago, Ill.	Nov. 27
Dec. 2.	Bowling Alley, Fort Totten, N. Y. Adv. Nov. 6 to 27.	Nov. 6
Dec. 2.	Railroad Work, Cleveland, Ohio	Nov. 27
Dec. 2.	Cement, Brick, Etc., Jersey City, N. J.	Nov. 27
Dec. 3.	Garbarge disposal, York, Pa. Adv. Nov. 20, 27.	Nov. 20
Dec. 3.	Boilers, Orangeburg, S. C. Adv. Nov. 27.	Nov. 27
Dec. 7.	El. Rys., New York, N. Y.	Nov. 13
Dec. 7.	El. Rys., Philadelphia, Pa.	Nov. 20
Dec. 7.	El. Ry., New York, N. Y.	Nov. 27
Dec. 8.	Electric lighting, West Hazleton, Pa. Adv. Nov. 13 to 27.	Nov. 13
Dec. 8.	Elevator in P. O. Bldg., Pottsville, Pa.	Nov. 20
Dec. 8.	Chimney, Elevator, Etc., Rochester, Minn.	Nov. 27
Dec. 14.	El. Rys., Philadelphia, Pa.	Nov. 20
Dec. 14.	Power Plant Improv., Clarksdale, Miss. Adv. Nov. 27.	Nov. 27
Dec. 15.	Timber, Sault Ste. Marie, Mich. Adv. Nov. 13 to 27.	Nov. 13
Dec. 18.	El. Rys., Pearl City, Hawaii	Nov. 20
Dec. 20.	Coal, Norfolk, Va. Adv. Nov. 20.	Nov. 20
Jan. 8.	Steel towers, Guam.	Nov. 20
Apr. 1.	Memorial, Fort McHenry (P. O. Baltimore), Md.	Nov. 20

SEARCHLIGHT SECTION

Bids open December 2, 1915.

NOTICE TO CONTRACTORS.

STEEL PIPE LINE

JERSEY CITY, N. J.

Sealed proposals will be received by the Board of Commissioners of Jersey City, on

THURSDAY, DECEMBER 2, 1915,

at 2 p. m., in the Assembly Chamber, City Hall, Jersey City, N. J.,

FOR THE CONSTRUCTION OF ABOUT ELEVEN MILES OF SEVENTY-TWO-INCH STEEL PIPE, EXTENDING FROM BROOKDALE, N. J., TO JERSEY CITY, N. J.,

at which time and place they will be publicly opened and read.

The work to be done includes furnishing, coating, delivering and laying the pipe with all appurtenances and connections, including culverts, valves, chambers, meters, and other structures required. The crossings of the Passaic and Hackensack Rivers are not included under this contract.

Proposals must be enclosed in sealed envelopes endorsed "Proposals for the construction of Land Portion of Brookdale Pipe Line," and must be directed to the Board of Commissioners of Jersey City.

A certified check for twenty-five thousand ($25,000) dollars, drawn upon a National or State Bank or Trust Company and to the order of the Director of Revenue and Finance of Jersey City shall be delivered to the City Clerk at the time the bid is deposited.

A satisfactory bond or surety for one hundred thousand ($100,000) dollars will be required of the successful bidder conditioned on the faithful performance of the work.

Specifications, form of proposal, and drawings can be seen and secured at the office of the Chief Engineer, Department of Streets and Public Improvements, City Hall, Jersey City, on payment of ten ($10) dollars which will be returned if the plans and specifications are sent back to the Chief Engineer in good order.

The Board of Commissioners reserves the right to reject any or all bids if it is considered for the best interests of the City so to do.

MICHAEL I. FAGEN,
City Clerk.

Dated City Clerk's Office,
Jersey City, Oct. 25, 1915.

Bids open November 20, 1915.

NOTICE TO CONTRACTORS

HIGHWAY BRIDGES

JACKSON, TENN.

Bids will be received at the office of the County Engineer until 10 a. m., Nov 20, 1915, for three highway bridges across 46 ft. canal.

Bidders will be expected to submit plans and bids for material and erection for either concrete or steel, or for both types.

Profile, alignment and general specifications may be had on application to County Engineer.

Right is reserved to reject any and all proposals or to accept the proposal deemed best for Madison County.

(Signed) A. W. STOVALL,
County Judge.

(Signed) E. G. BUCK,
County Engineer.

Nov. 2, 1915.

Bids open December 9, 1915.

ELECTRIC LIGHTING

WEST HAZ[illegible], PA.

Bids will be received for the electric lighting of West Hazleton Borough, Pa., during a period of ten years according to the specifications on file with the undersigned. Said bids to be presented on or before 8 o'clock P. M. of December 9th, 1915.

WILLIAM KRAPF, [illegible]
107 North Broad Street,
West Hazleton, Pa.

Bids open December 2, 1915.

Official Proposal Announcements

Price, $2.40 an inch.—Copy can be received until Thursday 10 a. m. for issue mailed the next morning

Bids open December 2, 1915.

NOTICE TO CONTRACTORS.

CAST IRON PIPE LINE

JERSEY CITY, N. J.

Sealed proposals will be received by the Board of Commissioners of Jersey City, on

THURSDAY, DECEMBER 2, 1915,

at 2 p. m., in the Assembly Chamber, City Hall, Jersey City, N. J.,

FOR FURNISHING AND LAYING A DOUBLE LINE OF FORTY-EIGHT-INCH CAST-IRON PIPE UNDER THE PASSAIC AND HACKENSACK RIVERS,

at which time they will be publicly opened and read.

The work to be done includes furnishing, coating, delivering and laying the pipe with all appurtenances and connections, including piles, valves, chambers, and other structures required.

Proposals must be enclosed in sealed envelopes endorsed "Proposal for the construction of Marine Portion of Brookdale Pipe Line," and must be directed to the Board of Commissioners of Jersey City.

A certified check for ten thousand ($10,000) dollars, drawn upon a National Bank or State Bank or Trust Company and to the order of the Director of Revenue and Finance of Jersey City, shall be delivered to the City Clerk at the time the bid is deposited.

A satisfactory bond or surety for forty thousand ($40,000) dollars will be required of the successful bidder conditioned on the faithful performance of the work.

Specifications, form of proposal, and drawings can be seen and secured at the office of the Chief Engineer, Department of Streets and Public Improvements, City Hall, Jersey City, on payment of ten ($10) dollars, which will be returned if the plans and specifications are sent back to the Chief Engineer in good order.

The Board of Commissioners reserves the right to reject any or all bids if it is considered for the best interests of the City so to do.

MICHAEL I. FAGEN,
City Clerk.

Dated City Clerk's Office,
Jersey City, Oct. 25, 1915.

Bids open December 3, 1915.

BIDS FOR GARBAGE DISPOSAL

YORK, PA.

Proposals are hereby invited by the City of York, Pa., for the collection and disposal of organic and inorganic garbage in said City for five and ten year periods commencing the first Monday of April, 1916. Contractor must furnish teams for collection and all facilities for disposal. Bidding blanks and specifications may be obtained from C. P. Shreiner, City Clerk, York, Pa., to whom bids must be delivered not later than Friday, Dec. 3, 1915, at 2.00 o'clock P. M. The right is reserved to reject any and all bids.

For further information address
C. A. BOYER,
Supt Streets & Public Improvements
City Hall, York, Pa.

U. S. ENGINEER OFFICE, LOUISville, Ky., Nov. 6, 1915. Sealed proposals will be received here until 12 noon, Central time, Dec. 6, 1915, and then opened, for furnishing and constructing a swing bridge over the locks of the Louisville and Portland Canal, Louisville, Ky. Information on application.

U. S. ENGINEER OFFICE, 337 FEDeral Building, Detroit, Mich. Sealed proposals for furnishing and delivering at Sault Ste. Marie, Mich., about 110,000 feet, B.M., of white oak timber will be received at this office until 12 m., Dec. 15, 1915, and then publicly opened. Information on application.

Bids open December 2, 1915.

NOTICE TO CONTRACTORS.

HEATING WORK, POWER PLANT, ETC.

WARD'S ISLAND, N. Y.

Sealed proposals for heating work, power plant, heating system and equipment at Manhattan State Hospital, Ward's Island, N. Y., will be received by the State Hospital Commission, Capitol, Albany, N. Y., until 2.30 p. m., on Thursday, Dec. 2, 1915, when they will be publicly opened and read. Proposals shall be enclosed in an envelope furnished by the State Architect, sealed and addressed and shall be accompanied by a certified check in the sum of $1,500. The contractor to whom the award is made will be required to furnish surety company bond in the sum of 50 per cent of the amount of contract within thirty days after official notice of award of contract, and in accordance with the terms of specification No. 2268. The right is reserved to reject any or all bids. Drawings and specifications may be consulted at the Manhattan State Hospital, Ward's Island, N. Y., at the New York office of the Department of Architecture, Room 1224, Woolworth Building, and at the Department of Architecture, Capitol, Albany, N. Y. Drawings and specifications and blank forms of proposal may be obtained at the Department of Architecture, Capitol, Albany, N. Y., upon reasonable notice to and in the discretion of the State Architect, Lewis F. Pilcher, Capitol, Albany, N. Y.

E. S. ELWOOD, Secretary,
State Hospital Commission.

Dated: Albany, Nov. 16, 1915.

Bids open December 6, 1915.

CENTRIFUGAL PUMP

HIGHLAND PARK, MICH.

Proposals will be received at the office of the Village Clerk of Highland Park, Wayne County, Mich., until 5 o'clock P.M., Monday, December 6th, 1915, for one centrifugal pump of a capacity to deliver 3400 gallons of water per minute against a total head of a hundred and twenty feet and the necessary motor for operating this pump. Delivery F.O.B., Highland Park.

The right is reserved by the Village to reject any or all bids and to accept such proposal as will be to the best advantage of the Village.

Plans and specifications may be seen at the office of the Village Clerk, 20 Gerald Avenue, Highland Park, Michigan, and particulars obtained from the Constructing Engineer, L. C. Whitsit, at the same address.

R. MILTON FORD,
Clerk.

PROPOSALS FOR BOWLING ALLEYS, Office Quartermaster, Fort Totten, N. Y.—Sealed proposals will be received here until 10 A. M., Dec. 2, 1915, and then opened for furnishing and installing 2 bowling alleys. Further information on application.

UNITED STATES ENGINEER OFfice, Room 802, Army Building, 39 Whitehall Street, New York City.—Sealed proposals for dredging in Newark Bay and Passaic River, N. J., will be received here until 12 M., December 14, 1915, and then opened. Information on application.

TREASURY DEPARTMENT, SUPERvising Architect's Office, Washington, D. C., November 15, 1915.—Sealed proposals will be opened in this office at 3 p. m., December 30, 1915, for the construction, complete (including mechanical equipment and approaches), of the United States post-office at St. Petersburg, Fla. Drawings and specifications may be obtained from the custodian of site at St. Petersburg, Fla., or at this office, in the discretion of the Supervising Architect. JAS. A. WETMORE, Acting Supervising Architect.

Bids open December 14, 1915.

NOTICE TO BIDDERS.

POWER PLANT IMPROVEMENT

CLARKSDALE, MISS.

On Tuesday, Dec. 14, 1915, the Commissioners of the City of Clarksdale, Miss., will open sealed proposals for furnishing the following material:

One (1) 350-hp. water tube boiler.

One (1) guyed steel stack.

One (1) 500-hp. open feed water heater with metering device.

One (1) 30-g.p.m. centrifugal boiler feed pump with motor drive.

One (1) 500-g.p.m. centrifugal motor driven water works pump.

One (1) CO_2 and draft recorder with low efficiency alarm.

Four (4) feed water regulators.

One (1) one-half-ton-electric delivery type truck.

Industrial railway equipment to consist of the following:

Two (2) one-ton, drop-side, steel charging cars.

One (1) right-hand cast plate switch.

One (1) three-ton cast plate, boiler room scales, with hand registering device.

500 ft. (single) 16-lb. rail, with four-bolt fish plates and bolts. The Commissioners reserve the right to reject any or all bids. Proposals must be in the hands of the City Clerk before 8 o'clock p. m., of Dec. 14, 1915. Must be marked plainly, "Proposals for Power Plant Improvement."

Specifications on file at the office of the City Clerk, and copies may be had upon application there, or of the Consulting Engineer, W. G. Shurger Engineering Co., Meridian, Miss.

M. W. PURNELL,
City Clerk.

Bids open December 14, 1915.

NOTICE OF SALE OF ROAD BONDS FOR SANTA CRUZ COUNTY, ARIZONA

NOGALES, ARIZ.

Notice is hereby given that sealed bids will be received at the office of the Board of Supervisors of Santa Cruz County, in the Town of Nogales, State of Arizona, until 10 o'clock a. m., Tuesday, Dec. 14, 1915, for the purchase of one hundred and fifty (150) forty-year road bonds (with accrued interest) of the denomination of one thousand dollars ($1,000.00) each, dated Dec. 14, 1915, payable in gold coin of the United States of America, at the office of the County Treasurer of said Santa Cruz County, Arizona, and bearing interest payable semi-annually, at the rate of five (5) per cent per annum.

Said bonds being payable forty years after the date of issue, with the privilege reserved to said Santa Cruz County of redeeming all, or any portion of said bonds, at any time after twenty years from the date of their issue.

Said bonds to be delivered to the purchaser thereof in the Town of Nogales, State of Arizona, at the office of the Clerk of the Board of Supervisors of said Santa Cruz County, when the purchase price thereof shall have been paid over to the County Treasurer.

A certified check of five per cent of the amount bid and a copy of this advertisement must accompany each bid.

The Board of Supervisors reserves the right to reject any and all bids. Bids will be opened and considered by said Board in its office in the Town of Nogales, Arizona, on Tuesday, Dec. 14, 1915, at 2.30 p. m.

All bids must be sealed and addressed to Lula Reddoch Wood, Clerk of the Board of Supervisors, Nogales, Arizona, and marked "Proposals for Purchase of Santa Cruz County Road Bonds."

By order of the Board of Supervisors of Santa Cruz County, Arizona, Nov. 9, 1915.

LULA REDDOCH WOOD,
Clerk.

Obituary Notes

COL. EDMUND M. C. WHITNEY, owner and publisher of the *Architect and Engineer* of San Francisco, died in Redwood City, Cal., Nov. 19, at the age of fifty-six.

CARL A. R. LUNDIN, optical expert and maker of some of the largest telescopes in the world, including the 36-in. objective of the Lick Observatory and the 40-in. lens at the Yerkes Observatory, died at Cambridge, Mass., Nov. 28. He was born in Sweden in 1851 and was engaged in optical work in this country since 1874. In addition to his work on the telescopes at the Lick and Yerkes observatories, he installed the 30-in. objective of the Pulkow Observatory in Russia, and lenses of various sizes in other famous observatories. He also devised and put into operation various important optical tests.

ADOLPH GREINER, a prominent steel manufacturer of Belgium, died in that country, Nov. 20.

W. E. BEMIS, vice-president of the Standard Oil Company of New York, died at Port Jervis, N. Y., Nov. 28. He was born at Cleveland in 1864 and entered the employ of the Standard Oil Company in 1882. Ten years later he was placed in control of the company's foreign trade, in which capacity he had direct charge of much of its trade extension work in Europe, India, Burma, Java, Japan and China.

Civil Service Examinations

Alabama.—The State Highway Commission announces the semi-annual examination for county highway engineers to be held Dec. 13 and 14, at Montgomery. Further information may be secured by applying immediately to the State Highway Department at Montgomery.

Chicago.—Two examinations, one for rodman at a salary of from $40 to $75 a month and the other for a construction inspector, salary from $75 to $100 a month, will be held for residents of the town of West Chicago on Dec. 20, 1915. The requirements are of the usual order. Those who wish to take the examination must have their application blank on file Dec. 18.

The Cook County Civil Service Commission will hold an examination Dec. 17 for inspector engineers for the county highway department, open to residents of Cook County only, salary $100 to $125 per month. The duties involve collection of data relative to the proper strength and design of bridges, and assistance in the preparation of plans and specifications.

United States.—The Civil Service Commission announces the following open competitive examinations to be held at the usual places on the days indicated. These examinations are, as usual, open to citizens of all states, and require, in addition to the qualifications enumerated below, certain formal performances relating to securing application blanks and their execution, which makes it entirely necessary for those who expect to take any one of them to apply immediately for detail instructions. The general nature of these examinations is as follows:

MARINE ENGINE AND BOILER DRAFTSMAN, salary from $3.52 to $5.52 a day, to be held Jan. 5 and 6, 1916. The requirements are primarily training and experience, especially in the work of which the title implies, although the physical fitness of the candidate will mean a deciding influence. The general demand is for a man fitted for marine engine and boiler drafting. He must be 18 years or over.

AID, COAST AND GEODETIC SURVEY, salary from $900 to $1,100 a year commencing, promotion $200 each by steps; and deck officers on board the ships of the Coast and Geodetic Survey, salary $900 a year; to be held Jan. 12 and 13. Applicants for these positions must be between the ages of 18 and 25. They must have an education equal to that of any technical college; for the requirements of the examination include mathematics, geometry to calculus; astronomy; physics and surveying. Experience of a practical sort counts in the rating, physical fitness being absolutely essential. There is, besides these examinations, an opportunity of taking examinations for assistants, salaries ranging from $1,200 to $4,000, further information for which must be secured from the commission at Washington.

LABORATORY AID AND ENGINEER, salary $900 a year, in connection with the forest products laboratory at Madison, Wis. The duties in general consist of operating and caring for the mechanical appliances of the laboratories. Special experience with wood-preservation, pulp-mill, woodworking, or timber-testing machinery is necessary, as well as definite knowledge of woods. The applicant need not essentially be a college man; his experience is what counts. The examination is open to those who are 18 years or over. It is to be held Jan. 19.

JUNIOR ENGINEER, salary from $1080 to $1,200, in connection with the water resources branch of the Geological Survey, to be held Jan. 19 and 20. The applicant, being 20 years or over, must prove that he is a technical-school graduate, or that he is a senior in such an institution and expects to graduate within six months from the date of the examination. Two years' experience in civil engineering, in work above the grades of rodman and chainman, will be considered in the rating. The duties of the position are similar in scope to those of hydraulic engineer, only they are more elementary, dealing with irrigation, river drainage and water power.

In applying for any one of the foregoing examinations applicants should ask for form 1312, specifying the title of the examination for which the form is desired. Application may be made to the Civil Service Commission, at Washington, or to any of the civil service boards at the principal cities.

Business Notes

C. W. Reinhardt has severed his connection with the Reinhardt-Winters-Cahill Company, technical illustrators, Times Building, New York City, and has opened an office at 9 Church Street, New York City.

The Buffalo Foundry & Machine Company, jobbing founders and machinists of Buffalo, N. Y., have opened a New York City office at 17 Battery Place.

Place on the Market Sewage Screen for Industrial Wastes

Following the experimental use over a period of two years of traveling inclined fine screens for removing solids from 1,500,000 gal. of sewage from one section of the Chicago stock yards, C. A. Jennings, sanitary engineer of the Union Stock Yard & Transit Co., has decided to put the screen on the market for use in treating domestic and industrial wastes elsewhere. One of these screens, with a capacity of 3,000,000 gal. per day, has been in successful operation at Oklahoma City on packing house sewage for more than a year.

Briefly, the screen is of the band type, with two endless roller chains, to which are attached screen frames. The chains are motor-driven over large sprockets set at both ends. A screen section is made up of two galvanized frames bolted together with the screen and supporting wire between the upper and lower portions. The sides of the upper frame extend several inches above the screen surface to prevent splashing or by-passing of the sewage and the lower edge has an angle iron to prevent solid matter from rolling back into the pit, and also to serve as a seal between adjacent frames or screen sections.



OKLAHOMA CITY SEWAGE SCREEN IS MOTOR DRIVEN AND AIR CLEANED

Monel metal wire cloth of 30 to 40 mesh was finally chosen after experimenting with brass and bronze wire cloth and with perforated plates. Although a less expensive material would serve, the greater tensile strength and resistance to acids and alkalies makes this material more economical. A screen of larger mesh, usually about 1 x 1 in., supports the fine mesh to prevent sagging and stretching. The screen is cleaned continuously by means of a blower, driven by the same motor that drives the screens. This blower supplies air under about 16 oz. pressure through a slotted pipe inside the upper end of the screen with the blast of air directed down and outward through the screen at a point just below the top sprocket. Exhaustive tests indicate that air is more effective than water and the screenings are obtained with a much lower moisture content. Where the sewage carries much grease, provision is made to clean the screen frames intermittently by means of steam.

The screens are supplied in widths ranging from 3 to 6 ft. inclusive, with 12 and 15-in. links. The capacities range from 500,000 to 6,000,000 gal. per day under linear speeds of from 25 to 75 ft. per minute. The average removal of suspended matter obtained at the stock yards was 33 per cent, or 7 per cent above the next type of screen tested at the Sanitary District stock yards testing station.

CONTRACTING NEWS

Of Special Interest to Engineers, Contractors, Builders and Manufacturers of Engineering and Building Supplies

RAILROAD freight congestion in the East has become so serious that, after embargoes had been declared by several trunk lines on export grain and lumber, a meeting of presidents and traffic managers of the lines affected was held Nov. 30 in New York to decide on means for relieving the situation. Although conditions are unprecedented, it was said that no immediate new embargoes were contemplated. The lack of ships and facilities for handling export freight is responsible for the congestion, the Pennsylvania Railroad alone having almost 10,000,000 bu. of grain awaiting shipment at Baltimore and Philadelphia. According to reports of thirteen railroads for the month of October, gross earnings not only show a gain of 14.3 per cent over the same period of last year, but exceed the earnings of 1913 by 4.1 per cent and those of 1912 by 3.7 per cent.

Reports from all over the country, especially the South, show that recovery in trade and business has set in now in earnest. The present good price of cotton, and the fact that the surplus of the 1914 crop was successfully held for the rising prices have been big factors. Everywhere large stocks are being bought for the holidays; mines and industries are reaching capacity operation; railroad earnings, industrial dividends, bank clearings and postal receipts are on the increase. Money is generally easy and collections are good. Bonds are finding a ready market. The sustained good prices being received for our record crops have an important bearing on conditions. Things of this sort spell increased construction. Indeed, it is very likely that contractors and material men will be put to it to meet the demands during the coming season, as has already been indicated by the rising prices of many important materials.

The high price of structural steel has not stopped buying, even for export, according to *The Iron Age*, though these prices are not the result of any abnormal demand for structural material. The explanation of the present minimum of $1.70 per 100 lb. in Pittsburgh, is that the mills are busy on semi-finished steel, which is in great demand at the same or higher profits, with the result that structural output is correspondingly curtailed. Small lots of structural material for early delivery bring $2 per 100 lb. f.o.b. Pittsburgh, and New York warehouse prices are based on $2.40 per 100 lb.

Plates are strong at $2 per 100 lb. in Pittsburgh for large lots. The nominal price of $1.70 is being quoted, but no deliveries can be had inside of four months at that figure. No. 28 galvanized sheets are $4.75 and No. 28 black sheets $2.40 per 100 lb.

Bars are quoted at the nominal price of $1.70 Pittsburgh, with premiums for early delivery. The market generally is sold well into the coming year and mills are holding off second half quotations in expectation of further advances.

Cast-iron pipe has advanced $1 per ton, $27 tidewater being the price for average sizes. Lap-welded steel pipe, in car-load lots, Pittsburgh, plain ends, 2½ to 6 in., is being quoted at about $46 per ton for black and $57 per ton galvanized. Iron pipe of the same class is quoted at $54 per ton for black and $96 per ton for galvanized.

The lumber market is improving, and general advances have been made, though prices are still considerably below the level of 1913, and have not yet reached the level of last year. Orders are exceeding shipments, which in turn considerably exceed production, and stocks are falling close to the low record of previous years. The export demand for lumber has been a factor in the recent improvement in the South, and railroad buying has been a large factor in the lumber market. Retail yard prices in Chicago for dimension Norway pine range from $28.50 for 2 x 6 to $29.50 for 3 x 10 in 10-ft. lengths. Hemlock, 4 by 6 to 8 by sold at $24, and 3 x 12 at $27 in 8-ft. to 16-ft. lengths. Fir up to 12 by was quoted at $35, 14 by $36, 16 by $37, 18 by $40 and 20 by $43, in 12-ft. to 24-ft. lengths.

Cement recorded a further advance of 10 cents a barrel during the month, and it has been predicted that cement at tidewater in the East will reach $2 per barrel by next spring, corresponding to a net mill price of $1.50 in the Hudson district.

Lead is firm at $5.25 per 100 lb. New York, and $5.175 St. Louis, in 25-ton lots, with a continued heavy demand from domestic consumers.

Have You Ever Mixed Concrete—

even a yard of it? If so, you should read the motion-picture article on page 684. It tells some wholesome truths about handling concrete. Two other articles will follow. All three are easy to read—just as interesting as they are valuable.

Next Week:

Two articles showing how contractors have successfully used motor trucks

Buildings

Building work, both actual and proposed for next year, showed a considerable increase last week. Among the large contracts let were a $118,000 school at Providence, R. I., a $135,000 automobile building at Waterloo, Iowa, a $150,000 warehouse at Los Angeles, Cal., and a $225,000 college building at Berkeley, Cal. All bids opened for the general contract for the Jersey City jail were rejected and new bids are asked. Heating and electrical contracts, however, amounting to $102,000, were awarded on these bids. Bids were opened recently for erecting the $400,000 institute buildings at Buffalo. A low bid of $463,000 was received at St. Paul for erecting the building of the Minnesota Historical Society.

Bids are desired on a $140,000 school building at Boston, on a large building project for the Board of Education of Cincinnati, for the construction of a 1,000,000-bu. reinforced-concrete grain elevator at New Orleans, and for building a $200,000 laboratory and a $130,000 hospital for the University of Nebraska at Lincoln. An architect has been selected for a $1,000,000 hospital to be built in New York City. Plans favored by the Justices of the Supreme Court for remodeling the Brooklyn court house involve an expenditure of $600,000. Plans for a $250,000 office building have been prepared at Philadelphia. An industrial plant recently burned at Hickory, N. C., will be rebuilt at a cost of $175,000. The construction of a $200,000 powder plant is proposed at Cincinnati. Plans are being prepared for a $150,000 church at Cleveland. A $125,000 hotel is to be built at Toledo. A two-year building program announced by the University of Illinois, at Urbana, contemplates an expenditure of $615,000. An automobile plant to cost $750,000 is contemplated at Kansas City. Plans are being prepared for a $200,000 hotel at Beaumont, Tex. A contract will be let early next year for erecting the new $650,000 auditorium for Portland, Ore. Contracts will soon be let for two buildings for the University of California at Berkeley, which will cost $600,000. El Centro, Cal., will let next January contracts for erecting a $130,000 school.

Bridges and Roads

Bids are desired for constructing the reinforced-concrete bridge over the Schuylkill River at Phoenixville, Pa., noted recently. Contracts will be let next month at Philadelphia for constructing two bridges to cost $75,000 each and one to cost $48,000. Plans for a bridge to cross the Miami River at Miamisburg, Ohio, have been approved. Plans are being prepared and contracts will soon be let for a large number of bridges on state roads in Iowa. A $55,000 viaduct is to be built by the Southern Pacific Railroad at Portland, Ore. An engineer has been selected to prepare plans for a $50,000 bridge at Pasco, Wash.

Bids have been opened on an $88,000 paving contract at Newark, N. J. A contract for constructing 3 1/3 miles of asphalt road has been let at Lexington, Ky. Bids will be opened Dec. 9 at Clarksville, Tex., for constructing roads to cost $300,000. An engineer has been selected for a $400,000 boulevard to be built at Long Beach, L. I. The annual report of the state road commissioner of New Jersey estimates the cost of repairs to roads at $50,000,000. Road bonds amounting to $400,000 have been sold at De Land, Fla. A $750,000 bond issue has been voted for constructing roads at Clearwater, Fla. A highway to cost $105,000 is to be built at Mobile, Ala. Paving work to cost $300,000 will be undertaken in 1916 at Evanston, Ill. Oak Park, Ill., contemplates spending $490,000 for paving in 1916. St. Paul, Minn., expects to repave 143 blocks next year. Street-paving contracts amounting to 153,000 sq. yd. will be let next spring at Hastings, Neb. Ames, Iowa, expects to let 110 blocks of paving work Jan. 17. Paving work to cost $85,000 is contemplated at North Platte, Neb. The 1916 budget of Tillamook County, Ore., includes $153,000 for road construction. A highway to be built at Ellensburg, Wash., will cost $200,000.

Waterworks and Sewers

It is reported that a $200,000 contract has been awarded for building an intake line at Syracuse, N. Y. A contract for waterworks construction to cost $168,000 has been awarded at Cincinnati. East Liverpool, Ohio, has awarded a $52,000 contract for building a pumping station and filter plant. A filter plant to cost $50,000 has been contracted for at Henderson, Ky. Bids are desired Dec. 14 for constructing a waterworks system at South Charleston, Ohio.

The Long Island towns of Port Washington and Lindenhurst are considering the construction of waterworks systems. An engineer's report recommending the construction of a new reservoir and additions to the water system costing $200,000 has been made to the City Council of Savannah, Ga. East Youngstown, Ohio, has sold waterworks bonds amounting to $165,000 and will soon let contracts. The construction of a $400,000 pipe-line tunnel will be begun about the first of the year near San Rafael, Cal.

A contract for sewer construction to cost $60,000 has been awarded at Sandusky, Ohio. Bids have been opened for sewer work to cost $78,000 in Seattle. Mason City, Iowa, will open bids Jan. 6 for constructing a sewage-disposal plant. Two sewers for which plans have been completed in Philadelphia will cost $145,000. Sewer construction estimated to cost $137,000 has been recommended at Flint, Mich. Plans for the construction of sewer extensions to cost $55,000 have been approved at San Francisco. Sewer work to cost $68,000 will soon be voted on by the City Council of Seattle, and an estimate of additional sewer

work to cost $60,000 has been submitted to the council. The Rideau River intercepting sewer to be built at Ottawa will cost $300,000.

Miscellaneous

It is reported that the lowest bid opened Nov. 30 for a section of rapid transit railroad in the Borough of the Bronx, New York City, was $2,063,877. A bid of $351,000 was received Nov. 24 for dredging work at Boston. Contracts have been awarded for constructing the coal pier of the Baltimore & Ohio Railroad at Baltimore, which will cost $1,500,000. A dam and power house to cost $127,000 have been contracted for at Florence, Ala. A contract has been awarded at $154,000 for constructing a wharf, which is one of the units of the New Orleans terminal. The lowest bid received Nov. 24 for constructing the Hetch Hetchy railroad for the city of San Francisco was $1,620,000. Bids will be received Dec. 22 for constructing a dock at Miami, Fla., to cost several hundred thousand dollars. It is reported that bids will be opened Dec. 10 for constructing the seawall at Seattle, which will cost $100,000.

Permission has been granted to enlarge an electric railroad power house at Hartford, Conn., at a cost of $197,000. A power plant to be constructed at Buffalo will cost $1,500,000. Plans have been submitted for two New York State Barge Canal contracts to cost more than $400,000 each, and for a third to cost $162,000. Improvements contemplated by the Philadelphia & Reading Railroad will cost $250,000. A power station and transmission line to be built at Prescott, Ariz., will cost $300,000. During 1916 San Francisco will let contracts on the Hetch Hetchy development and for municipal improvements amounting to $16,000,000.

WATERWORKS

PROPOSED WORK.

Port Washington, L. I., N. Y.—Reported plans being prepared for a municipal water plant. Address Town Clerk.

Rochester, N. Y.—In the spring the city plans laying 16¼ miles of 37-in. c.-i. water mains. Address City Engineer.

Atlantic City, N. J.—Lincoln Van Gilden, Superintendent and Chief Engineer Bureau Water, has about completed surveys and plans for installation of 20-in. high-pressure water main under boardwalk with 12-in. laterals. As soon as approved by Board Commissioners specifications will be prepared and contract let early in the new year.

Fleetwood, Pa.—Reported $10,000 bonds to be issued to improve water system.

Pennsylvania.—Permits issued as follows by Pennsylvania Department of Health, Harrisburg, for water works improvements:
Allegheny County Water Co., Logan Township, Blair County—Extensions to distributing system.
Johnstown Water Co., Johnstown—Storage reservoir.
Berry Springs Water Co., Upper Paxton Township, Dauphin County—Water works obtaining a source of supply from springs.
Waynesburg Water Co., Waynesburg—Improvements to filter plant.
Renovo—Municipal water works, additional source of supply from drilled wells.

Waynesboro, Pa.—Waynesboro Water Company has engaged Chester & Fleming, Pittsburgh, to make an investigation and report regarding extensions and developing water supply.

Savannah, Ga.—Election soon to be held to vote $150,000 bonds for water works improvements and $50,000 for improvements to the markets.
Chief Engineer E. R. Conant has submitted a report to the Water Committee of City Council on the rehabilitation of the city water works and recommends the construction of a new reservoir, installation of new pumping apparatus, boring of at least six wells, laying new mains and distributing pipes, new force mains and extension of the conduit. Probable total cost $200,000.

Cullman, Ala.—City has decided to spend $10,000 for laying two miles of water mains.

Canal Winchester, Ohio.—Bonds for $12,000 will be sold Dec. 30 by George M. Herbst, Village Clk., for constructing water works.

East Youngstown, Ohio.—Bonds amounting to $165,000 have been sold for the water works. Bids for works are now being received. Chester & Fleming, Engineers, Pittsburgh, Pa.

Aurora, Ill.—Reported city officials considering appropriating $75,000 for improvements to pumping station and power plant. An election will probably be held in the spring.

Oak Park, Ill.—About 4 miles of water mains costing $28,546 and water service pipe costing $5,520 contemplated in the new year. Address Board Local Improvements.

Viola, Ill.—Contract will be let in the spring for erecting tower and laying mains. Wells have been drilled.

Great Falls, Mont.—Reported an election is to be held in January to vote bonds for installing filtration plant at the water works.

Lees Summit, Mo.—Citizens Nov. 23 voted $28,000 bonds for extending water mains. Henrici, Kent & Lowry Co., Engineer, 715 Reserve Bank Building, Kansas City; A. C. Miller, City Clerk.

Houston, Tex.—Contract soon to be let for drilling three wells and installation of pumps and pump houses for the North Side auxiliary to the city water department. Dave Fitzgerald, City Water Commissioner.

Mart, Tex.—Water works extension bonds for $18,000 will be sold Dec. 6 by John L. Vaughn, Mayor.

Trinity, Tex.—H. S. Wilder of Houston engaged as engineer for the proposed water works which city intends installing.

Orchard City, Col.—City Council has authorized $50,000 bonds for constructing water works.

Bremerton, Wash.—City will purchase present water system and in the spring make necessary improvements, costing $70,00. Bonds amounting to $260,000 have been voted for this purpose. E. J. McCall, City Clerk.

Seattle, Wash.—Contract will be let in about 60 days by A. H. Dimock, City Engineer, for 5120 lin. ft. 20 in., 62 lin. ft. 12 in. and 55 lin. ft. 8 in. c. i. pipe mains in Dexter Avenue.
Plans submitted to Board Public Works by A. H. Dimock, City Engineer, for water mains in Forty-third Avenue N. E. and other streets at a cost of $27,000.

Milwaukie, Ore.—Contract soon to be let for constructing municipal water works.

Richmond, Cal.—Municipal Water Commission engaged engineer to submit report on most available water supply for the city.

San Rafael, Cal.—The Marin Municipal Water District recently voted $3,000,000 bonds to acquire and develop all water companies in Southern Marin County, and will about Jan. 1 commence the construction of the Alpine tunnel. The Directors have authorized sale of $600,000 bonds, about $400,000 to be used to construct the main pipe line tunnel.

Logan, Utah.—About $20,000 worth of c. i. distribution main contemplated. Roy Ballen, City Engineer.

BIDS DESIRED.

Providence, R. I.—Until Dec. 6, for furnishing about 18,000 lb. lead pipe and about 672 tons c.-i. pipe. Jos. H. Gainer (Mayor), Chmn. Bd. Control.

Buffalo, N. Y.—Until Dec. 8 by Department Public Works (George H. Norton, Acting Comr.) for furnishing liquid chlorine gas for treatment of water supply for city from Jan. 1, 1916, to Jan. 1, 1917.

Secaucus, N. J.—Until Dec. 9 by County Board Chosen Freeholders, Jersey City (Walter O'Mara, Clk.), for salt water supply pump and fitting for Penitentiary boiler room at county farm, and for laying water pipe line and connections.

Richmond, Va.—Until Dec. 11, by E. E. Davis, Supt. Water Works, for furnishing on one, two and three-year contracts (800 tons per year) aluminum sulphate, high basicity, for water clarification, containing 17 per cent aluminum oxide, delivered f.o.b. cars, Karah Station C .& O. R. Ry., advertised in Engineering Record.

Lakeland, Fla.—Until Dec. 17 by Board Bond Trustees (J. R. Boulware, Secy.) for improving fire, water and electric systems, to consist of water works pump, air compressor and air lifts, artesian well pump, drilling and casing an artesian well, furnishing and laying c.-i. pipe, fittings, valves and hydrants, surfacing condensing equipment, fire alarm system and connections, 7 steam-driven electric generating units, etc. Scofield Engineering Co., Commercial Trade Building, Philadelphia, Pa.

Boonville, Miss.—Reported desired until Dec. 6 by County Supervisors for constructing water works.

Hamilton, Ohio.—Until Dec. 14 by S. D. Nelson, Superintendent Water Works, for driving three 10-in wells to reinforce city's water supply, intake and connection. Joseph B. Myers, Dir. Service Department.

South Charleston, Ohio.—Until Dec. 14 (readvertisement) by W. L. Wentz, Village Clerk. for constructing system of water works, advertised in Engineering Record.

Albion, Mich.—Reported desired until Dec. 15, by City Clerk, for constructing pumping station and boiler house for water works.

Chicago, Ill.—Until Dec. 6 by Department Public Works (W. R. Moorhouse, Comr.) for furnishing steel pipe for Utility Gallery in Canal Street.

Ord, Neb.—Reported desired until Dec. 10, for combined brick chimney and steel stack for water works. O. P. Cromwell, City Clk.

Ridgefield, Wash.—Reported desired until Dec. 10, by Clerk of Council, for constructing municipal water works, to consist of 17,050 ft. 4 to 8 in. wood stave or lap welded steel pipe, 200,000 gal. reinforced concrete lined reservoir, pumping plant, etc. Probable cost $10,000. Gilbert & Hall, Consulting Engrs., Portland, Ore.

Seattle, Wash.—See "Hydraulic and River Improvements."

St. Hyacinthe, Que.—Until Jan. 11 (extension of date from Dec. 14) by Mayor for constructing gravity filter having 4,000,000 imperial gallons capacity, to cost $75,000. Hector Cadieux, City Engr.

Winnipeg, Man.—Until Dec. 15 by Commissioners Greater Winnipeg Water Dist. (S. H. Reynolds, Chmn.) for supply of miscellaneous bronze castings, brass piping, etc., which enter into construction of a Venturi meter.

Panama.—Until Dec. 13 by Maj. F. C. Boggs, Corps Engrs., U. S. A., General Purchasing Officer Panama Canal, Washington, D. C., for Cir. 993—Motor-driven centrifugal pump, c.-i. bollards, etc.

PRICES AND LETTINGS.

★Indicates award of contract.

★Syracuse, N. Y.—Reported contract awarded Great Lakes Dredge & Dock Company, Buffalo, by the Solvay Process Company for extending the intake pipe into deep waters of Onondaga Lake; cost $200,000. Work includes building of a 6 ft. water main.

★Coolidge, Ga.—Contract for constructing water works awarded W. H. Goodloe, Macon, Ga. S. C. Nesmith, City Clerk.

★Henderson, Ky.—Contract awarded Pittsburgh Filter Manufacturing Company, Pittsburgh, Pa., for installing a filter plant costing $50,000.

★Cincinnati, Ohio.—Following are four lowest bids opened November 12 by Parke S. Johnson, Clerk Director Public Service, for erecting tanks for the Eastern Hill Service, and other work in connection therewith for water distribution system: Ferro Concrete Construction Company, Richmond and Harriet Streets, $168,754 (awarded contract); Kirchner Construction Company, 221 W. Ninth Street, $181,237; L. Eid Concrete Steel Company, Beechmont Avenue, and Little Miami River, $202,760, and Thomas P. Struck, $211,900. J. A. Hill, General Superintendent Water Works.

★East Liverpool, Ohio.—Contract awarded by Board of Control to Pitt Construction Company, Pittsburgh, Pa., for superstructure of pumping station and filter plant at about $52,000. Chester & Fleming, Engineers, Pittsburgh, Pa.

★Brockville, Ind.—Contracts in connection with water works awarded as follows: Air compressor, Laidlaw-Dunn-Gordon Co., Cincinnati, Ohio, at $2,340; chimney, Henie Chemical Co., Chicago, Ill., $1,080; also boiler, at $2,927. All bids on the pump have been rejected, and new bids are to be asked.

★West Frankfort, Ill.—Contracts for water works awarded by Orid Dorris, City Clerk, as follows: Wells, to Charles S. Laine, St. Louis, Mo.; construction, Katy Construction Co., Omaha, Neb.

SEWERAGE AND SEWAGE DISPOSAL

PROPOSED WORK.

Pennsylvania.—Permits issued as follows by Pennsylvania Department of Health, Harrisburg, for sewer improvements:
Glen Mills Schools, Darlington, Middletown Township, Delaware County—Improvements to sewage treatment works.
Tyrone—Lateral sewer extensions.
South Fork—Lateral sewer extensions.
Philadelphia—Lateral sewer extensions.

Philadelphia, Pa.—Plans completed by Chief Bureau of Surveys for two main sewers and nine branch sewers: Main sewer in Pecker Street, between Twenty-ninth Street and Schuylkill River, cost $65,000, and main sewer (Rock Run sewer), in Seventh Street, from Nedro to Champlost Street, and in Champlost Street, from Seventh to Ninth Street, and in Ninth Street, from Champlost Street to Godfrey Avenue; cost $80,000.

Kenova, W. Va.—Sewerage bonds for $55,000 will be sold Dec. 20 by Common Council. J. W. Collins, City Recorder.

Donaldsonville, La.—A. W. Jackman has applied to Commission Council for a franchise to construct a sewerage system.

Miami, Fla.—See "Hydraulic Construction and River Improvements."

Park City (P. O. Knoxville), Tenn.—Contract soon to be let for constructing sewer laterals. Address City Clerk.

Painesville, Ohio.—Sanitary sewers costing $35,000 are contemplated in the new year. Address Director Public Service. F. N. Downer, City Engr.

Flint, Mich.—Recommendations of the city engineer, E. C. Shoecraft, for constructing next year storm sewers costing $89,000, and sanitary sewers $48,000, has been adopted by the Common Council, and the city engineer authorized to prepare specifications and plans.

Hillsdale, Mich.—State Board of Health, Lansing, has ordered the city to improve the sewerage system.

Oak Park, Ill.—About 3¾ miles pipe sewers, costing $23,923, contemplated in the new year. Address Board Local Improvements.

Pierce, Neb.—Election to be held Dec. 14 to vote $20,000 bonds to construct a sewer system.

Aurora, Mo.—Election to be held in January to vote bonds to construct sanitary sewer system, erect jail and public park improvements. T. A. Miller, Mayor.

San Marcos, Tex.—San Marcos Sewer Co. has filed plans for approval for a sewage disposal plant to cost $5,000.

Seattle, Wash.—Council has adopted resolutions to construct sewers in Fairmount Avenue and other streets. A. H. Dimock, City Engineer.

Seattle, Wash.—City Engineer A. H. Dimock has submitted to Board Public Works estimate of cost of constructing sewers in Fairmont Avenue at $60,893.
Streets and Sewers Committee of City Council has recommended adoption of resolutions providing sewers in West and North Fiftieth Streets; cost $68,619.

La Grande, Ore.—Contracts will be let early in the new year for extensions to sewer system to cost $16,000. L. D. Howland, City Engineer.

Alhambra, Cal.—Election soon to be held to vote on constructing a sewer system costing $85,246 and a disposal plant costing $400,000 for the use of Alhambra, Pasadena and South Pasadena. Charles E. Hewes, City Engr.

Long Beach, Cal.—Contracts will be let about February for constructing sewers in lateral sewer districts. E. J. Hargis, Commissioner Public Works.

San Francisco, Cal.—Plans approved by Board of Works for sewer system to be constructed in South Bay View District; cost $55,000.

Ottawa, Ont.—The Rideau River Intercepting sewer is to consist of 6700 ft. 48 in., 2195 ft. 54 in. and 6605 ft. 60 in. pipe, and cost $300,000. R. S. & A. Shea, Designing Engineer, 820 New Berks Building, Montreal, Que.; F. C. Askwith, City Engineer.

Toronto, Ont.—Commissioner Harris has submitted a report to the Works Committee recommending construction of two sewers in Queen Street from Pape Avenue to Leslie Street, at a cost of $56,500, one to be a storm sewer.

BIDS DESIRED.

Needham, Mass.—Until Dec. 8 by Metropolitan Water and Sewerage Board, Ashburton Place, Boston, for sewers in Needham: Section 103, a high level sewer, including 5915 ft., 24 x 27-in. concrete sewer, 40 cu yd. brick masonry, 2600 cu. yd. concrete masonry, 200 cu. yd. rock excav. Section 104, concrete sewer, 3370 ft., 24 x 27-in. sewer in trench and embankment, and 930 ft., 27 x 36-in. rock and earth tunnel, 60 cu. yd. brick masonry, 1600 cu. yd. concrete masonry, 650 cu. yd. concrete masonry in tunnel, 2500 cu. yd. rock excav. in trench.

Buffalo, N. Y.—Until Dec. 9 by Department Public Works (George H. Norton, Acting Comr.) for constructing sewers in portions of Holly and Stevens Streets, Norfolk Avenue and other streets.

New Dorp, S. I., N. Y.—Until Dec. 9 by Department Public Charities, New York (John A. Kingsbury, Comr.), for furnishing and delivering material for construction and two sewers at the New York City Farm Colony, Borough of Richmond, including 4,000 ft. sewer pipe and other sewer pipe, portland cement, sand, bricks, etc.

Philadelphia, Pa.—By Department Public Works (M. L. Clothier, Dir.) for following work:

Until Dec. 4 Relief "A" branch sewer, Relief "B" main sewer, Relief "C" reconstruction of observation manhole, and Relief "D" bridge.

Until Dec. 14, Relief "E" bridge.

Baltimore, Md.—Until Dec. 8 by Board of Awards, office of City Register, for Contract No. 17, lateral sewers in Inst. No. 38 A, by request of opening bids on Dec. 15 A to 12 in vitr. pipe sewer and 3,000 lin. ft. vitr. pipe sewer in various parts. Harry W. Rodgers, Secy. Sewerage Comm.

Key West, Fla.—Reported desired until Jan. 4 by Board Public Wks. for constructing sewers from Grinnis and Duval Streets to Front and Caroline streets.

Cincinnati, Ohio.—Until Dec. 14 by Henry Hunt, Director Public Service, for furnishing sewering in Colerain Avenue, from Bracken Street to Mill Creek.

Cuyahoga Falls, Ohio.—Reported desired until Dec. 14 by W. F. Williston, City Clk., for 2,000 ft. 4 to 12-in. vitr. pipe sewer, including one 12-in. R. Wm. Jones Portl. Cement Engr., 709 Hippodrome Building, Cleveland.

Harbor Beach, Mich.—Reported desired until Dec. 8 by W. A. Dressell, City Clk., for improving sewer system and disposal plant, by request of increasing a 2-story concrete tank, one compartment, round filter, one sludge drying bed, and 1,725 ft. 8 to 15-in. pipe sewer. Robert W. Roberts Engr. Saginaw.

Emmetsburg, Iowa.—Reported desired until Dec. 4 for constructing sewers in Seventh and Call Streets. T. F. Rutledge, City Clk.

Hampton, Iowa.—Until Dec. 15, by P. A. Van Pelt, City Clerk, for constructing sanitary sewer system, including about 7,000 ft. 8 to and 12 in. pipe (7 manholes and 7 combined manholes and flush tanks.

Mason City, Iowa.—Until Jan. 4 by J. G. McEwen, City Clerk, for furnishing material and constructing a sewage disposal plant, Imhoff type, advertised in Engineering Record.

Belle Plaine, Minn.—Until Dec. 13, by I. A. Townsend, Borough Clerk, for constructing 12, 10 and 8-in. pipe sewer to cost $4,000. A. E. Starkey, Engineer, St. Paul.

South St. Paul, Minn.—Reported desired until Jan. 4 by J. R. Stevenson, City Engineer, for constructing 4500 ft. 15 to 24-in. sewer.

Cherryvale, Kan.—Reported desired until Dec. 4 by M. Burrell, City Clk., for constructing sewers in Inst. No. 2.

Edgemont, S. D.—Reported desired until Dec. 4 by W. S. Wyatt, City Auditor, for sewers in Inst. No. 1.

Toronto, Ont.—Reported desired until Dec. 7 by Board Control (T. L. Church, Chmn.) Mayor) for constructing sewers in Bolton Street, Isabel Avenue, Ethel Avenue and other streets.

Kirkfield Park, Man.—Reported desired until Dec. 4 by Percy Noel, Clk. Kirkfield Park, for constructing lateral sewers in King Edward, Rosslyn, Hampton and Berry and a number of other streets.

PRICES AND LETTINGS.

**Indicates award of contract.*

Newark, N. J.—Lowest bid opened Nov. 24 by Board Street and Water Commissioners for constructing Vailsburg sewers in and adjoining portion was submitted by Michael Orchard, Newark, at $9.15.

Baltimore, Md.—Following are bids opened Nov. 24 by the Sewerage Commission, Alfred D. Hamilton, Ch. Engr.), for contracts as follows:

Contract Contract 144, Section 3 Lower Jones Improvement—M. O'Herron & Son, $28,117; Smith & Duggan, $28,824. Whiting-Turner Contracting Company, $31,897; and W. H. & C. F. Thompson, $32,454.

Contract Contract 147, Maiden Choice Run Trunk Sewer—Frank Capecchi, $22,-220; Barrett Contracting Company, Inc., $24,600; Whiting-Turner Contracting Company, $27,777; and Smith & Ridgely, $28,888.

***Sandusky, Ohio.**—Contract awarded by Director of Public Service for constructing Intercepting Sewer No. 3, to J. E. Shaw, Inc., Philadelphia, Pa., at $67,554 (bids opened Nov. 16).

***Toledo, Ohio.**—Contract for constructing sewers (including sewer No. 11, sheet asphalt pavement, 7 in. thick, over 6-in. gravel base, 7 in. thick; pipe drain opened Nov. 20 by County Commissioners, was awarded to Lockwood, Green & O'Neil, Nunley Building, Toledo, at $11,000.

***Aurora, Ill.**—Contract for constructing sewers in Sewer District No. 11 (bids opened Nov. 24) awarded by Myron J. Tyrrell, City Engineer, to F. E. Kaminski, Watertown, Wis., at $11,816. Other bidder, R. R. Kuehn, Aurora, $12,106.

***Marshall, Ill.**—Contract for 4226 ft. of 6 to 8-in. pipe sewers awarded L. Pulver, Marshall (bids opened Nov. 22). W. R. Ridge, Engr., Terre Haute, Ind.. F. W. Greenough, Clerk.

Seattle, Wash.—Following are bids opened by Board Public Works for constructing sewers in Sixth Avenue N. W. and other streets: Washington Paving Co., L. C. Smith Building, $7,894; City Contracting Co., 1178 Twenty-first Avenue S., $8,186; N. Fiorito Co., 1630 Twenty-fifth Avenue, $8,196; Russell & Gallagher, Railway Exchange Building, $86,264.

***Bonners Ferry, Idaho.**—Contract for constructing sewer system awarded Hurd, Lansing & Woods of Spokane, Wash., at $24,575.

BRIDGES

PROPOSED WORK.

Lawrence, Mass.—City Council authorized the issue of $300,000 additional bonds for further work in connection with construction of Central Bridge.

Fairfield, N. Y.—Concrete bridge is to be constructed in the spring over Maultsaas Brook. Address Charles N. Richardson, Fairfield.

Perry, N. Y.—Town Board considering rebuilding Borden Avenue Bridge, at cost of about $6,000.

Bowmanstown, Pa.—Reported Lehigh Valley R.R. Co. (E. B. Ashby, Ch. Engr., 143 Liberty Street, New York, N. Y.) will erect a bridge over Lehigh River.

Philadelphia, Pa.—Contracts for constructing following bridges will be let some time in December: At Annsbury Street, under tracks of North Pennsylvania R.R., solid waterproof floor, through girder type, on concrete abutments, cost $48,000; on line of Orthodox Street, over Frankford Creek, steel structure, encased in concrete, 48 ft. wide and 78 ft. between abutments, cost $75,000; removing bridge and erecting new structure on line of Diamond Street over tracks of Connecting R.R., concrete and steel girder type, 170 ft. in length, cost $75,000. Address Chief Bureau of Surveys.

Miami, Fla.—See "Hydraulic Construction and River Improvements."

Miamisburg, Ohio.—Plans of Morgan Engineering Co. of Dayton approved for constructing bridge over Miami River at Sycamore Street, which Flood Conservation Commission propose erecting.

Youngstown, Ohio.—City Council voted to issue $8,500 bonds for painting and repairing Spring Common and Center Street Viaduct.

City Council recently adopted report of Frank Lillie, City Engr., on rebuilding East Federal Street Bridge, and authorizing legislation directing City Solicitor to have present plans substituted for court viaduct plans recently approved. No further action can be taken until previous plans are thrown out. Bridge is to be steel girder and I-beam construction with concrete floor. Width between curbs 42 ft. and sidewalks 8 ft.; cost estimated at about $675,000. Plans being prepared for South Avenue approach; cost of this approach to be shared between city and street railway.

Evansville, Ind.—Plans being prepared by Hermann Lasch, Pittsburgh, Pa., for constructing bridge over Ohio River about 6 miles from Evansville; cost about $500,000. Chamber of Commerce, Evansville, reported interested.

Detroit, Mich.—City Council voted to direct Comr. Public Works to have plans prepared for a temporary and permanent Belle Isle Bridge. Contract recently awarded rescinded.

Monroe, Mich.—Election to be held Dec. 6 to vote on constructing two bridges over River Raisin. Fred M. Kaessbach, City Clerk.

Milwaukee, Wis.—Some time during the next year a bridge is to be built over Upper Milwaukee River at State Street. J. C. Pinner, Jr., Superintendent Bridges and Public Buildings.

Burlington, Iowa.—Construction of bridge across railroad tracks on Dankward Lake is contemplated by city, county, local traction company and Burlington R.R. (T. E. Calvert, Ch. Engr., Chicago, Ill.)

Iowa.—Plans being prepared and contracts soon to be let by Iowa Highway Commission, Des Moines, for constructing following bridges:

Hancock County—26-ft. I-beam bridge; one 70-ft. deck and 40-ft. pony truss bridge, concrete floor and abutments in each case. A. G. Decker, County Engineer, Hampton.

Howard County—Six I-beam spans and one bridge, with concrete floors and abutments. W. L. Richards, County Engineer, Cresco.

Cerro Gordo County—Two 30-ft. concrete deck girder skew, a 40-ft. concrete deck girder and 40-ft. pony truss skew bridge, wood floor and concrete abutments. R. E. Robertson, County Engineer, Mason City.

Winneshiek County—Two 20-ft. I-beam span bridges, concrete floor and abutments. W. M. Lee, County Engineer, Decorah.

Chickasaw County—Three 16-ft. one each 32-ft., 24-ft., 22-ft., 20-ft., 26-ft., 24-ft. I-beam bridges, two 45-ft. and two 50-ft. pony truss bridges, concrete floor and abutments, and four box culverts. A. F. Kemman, County Engineer, New Hampton.

Palo Alto County—One 50-ft. pony truss bridge with concrete floor and abutments. T. R. Martin, County Engineer, Emmetsburg.

Bremer County—Harmon Street bridge to be constructed over Cedar River in Waverly, to consist of three 120-ft. spans, 18-ft. roadway and one 5-ft. sidewalk, with concrete floor and abutments. C. A. Cool, County Engineer, Waverly.

Manchester, Iowa.—Contract to be let some time this winter for constructing a 30-ft. I-beam bridge, 18-ft. roadway, concrete floor and abutments, and two 20-ft. I-beam bridge, 18-ft. roadway, concrete floor and abutments. Henry Klaus, County Engineer, Manchester.

Mount Pleasant, Iowa.—Contract will probably be let in January by County Commissioners for 21 culverts and small bridges, plans for which are now being prepared. C. E. Smith, County Engineer.

Yankton, S. D.—Citizens of city voted $300,000 bonds to aid in constructing a railroad bridge over Missouri River.

Miami, Okla.—Contract will soon be let by County Comrs. for constructing 60 ft. steel span bridge with concrete floor and abutments over Upper Horse Creek. Citizens recently voted $85,000 bonds for constructing bridges.

Purcell, Okla.—County will vote on issuing $100,000 bonds for constructing bridges.

La Center, Wash.—Plans being prepared by W. A. Schwarz, County Engr., at Van Couver, for constructing steel bridge over Lewis River at La Center; cost about $10,000.

Portland, Ore.—The Southern Pacific Company will construct the Holgate Street Viaduct, which is a steel post and plate girder viaduct, with earth fill approaches; cost $55,000.

Salem, Ore.—County Court of Polk and Marion Counties have decided to build a new bridge across Willamette River at Salem. Present bridge is steel, 780 ft. long exclusive of approaches, and it is expected the new bridge will cost approximately $200,000. Max Gehlhar, County Clerk, Salem, will give additional information.

Tillamook, Ore.—See "Paving and Roads."

BIDS DESIRED.

Camptown, Pa.—Until Dec. 14 by Board Commissioners Public Grounds and Buildings, Harrisburg, for constructing bridge over Wyalusing Creek at Camptown in Wyalusing Township, Bradford County, to be 180 ft. span, 18 ft. roadway, one 5-ft. sidewalk, two concrete abutments creosoted, and concrete pavement. David A. Keefe, Consulting Engineer, Athens.

Phoenixville, Pa.—Until Dec. 21, by County Commissioners of Chester and Montgomery Counties at Norristown for constructing a reinforced-concrete arch bridge of five spans over Schuylkill River, connecting Phoenixville and Mont Clare, advertised in Engineering Record.

Philadelphia, Pa.—See "Sewerage and Sewage Disposal."

Atlanta, Ga.—Local reports state until Dec. 21 by Commissioners of Fulton and Cobb Counties, in Fulton Commission Rooms, Atlanta, on both concrete and steel bridge over Chattahoochee River on Mason and Turner Ferry Road. W. A. Hansell, Jr., Supt. Co. Pub. Wks., Atlanta.

Lansing, Mich.—Until Dec. 9 by Frank F. Rogers, State Highway Comr., for constructing trunk line bridge No. 37 over Ford River, Wells Township, Delta County, to consist of two 90-ft., through riveted, Warren trusses, with 18-ft. roadway, two reinforced concrete abutments; one plain concrete pier and reinforced concrete floor. For further information address K. I. Sawyer, Escanaba.

Illinois.—By State Highway Commission, Springfield, for constructing bridges, as follows:

Until Dec. 15, Watseka, Tower Bridge, reinforced-concrete, 50 ft. span, 16 ft. roadway, in Belmont Township. Engineer's estimate $2,800.

Bridge No. 41, reinforced-concrete, 50 ft. span, 18 ft. roadway, Stockland Township. Engineer's estimate $2,790.

Bridge No. 12, reinforced-concrete, 60 ft. span, 18 ft. roadway, Artesia Township. Engineer's estimate $3,430.

Brown Hill Bridge, reinforced-concrete, 16 ft. span, 24 ft. roadway, Loda Township. Engineer's estimate $1,075.

Bridge No. 1 (Centennial) alternate plans for constructing either a reinforced-concrete or steel bridge on reinforced-concrete abutments; 2 concrete spans, 60 ft., or one steel span 120 ft.; 18 ft. roadway, Douglas Township. Engineer's estimate, including piles for reinforced-concrete bridge, $10,410; for steel bridge $7,560.

Reconstruction of Bridge No. 137, between Belmont and Milford Townships, one creosoted timber abutment and one reinforced concrete abutment, steel I-beam approach spans, furnishing and placing new steel joists on present 119 ft. steel span, and reflooring entire bridge with creosoted plank. Engineer's estimate, including piles, $5,990.

Knuth Bridge No. 17, reinforced-concrete, 50 ft. span, 18 ft. roadway, Loda Township. Engineer's estimate, $2,510. Benj. Jordan, Co. Supt. Highways, Watseka.

Until Dec. 18, Bellflower, Becker Bridge, steel, 3 spans 110 ft. each, 16 ft. roadway, Lexington Township. Engineer's estimate $13,690. R. O. Edwards, Co. Supt. of Highways, Bellflower.

Lawrence, Kan.—Reported desired until Dec. 14 by County Commissioners (H. Broeker, Clk.) for constructing 118 ft. span steel truss bridge with concrete floor over Wakarusa River, 6 miles southeast of Lawrence.

Tekamah, Neb.—Reported desired until Dec. 18 for three concrete culverts from the Burt-Washington Drainage Dist., to consist of 1600 cu. yd. concrete and 200,000 lb. steel. Address Towl Engr. Co., 1122 City Natl. Bank Bldg., Omaha.

Clarksville, Tex.—See "Paving and Roads."

San José, Cal.—Until Dec. 6 by County Board Supervisors (Henry M. Ayer, Chmn.) for constructing reinforced concrete culvert on Edmonston Ave. near Morgan Hill.

Visalia, Cal.—Reported desired until Dec. 7 by County Board Supervisors, Visalia, for constructing two concrete bridges, one near Orosi and the other west of Dinuba on Kingsburg Road.

PRICES AND LETTINGS.

**Indicates award of contract.*

Los Angeles, Cal.—Lowest bid for constructing 60-ft. plate girder bridge with concrete floor and abutments over San José Creek, on Lemon Grove Avenue, submitted by Edgar T. Wheeler Co., at $7,190.

San Francisco, Cal.—See "Railroads."

PAVING AND ROADS

PROPOSED WORK.

Long Beach, L. I., N. Y.—Charles H. Higgins, 30 Church Street, New York, is engineer for the boulevard which H. C. Prichard, Room 506, 10 East Forty-third Street, New York, contemplated building from Oceanside to Long Beach, to be 100 ft. wide, having a 20-ft. parkway in center and a 40-ft. roadway at either side. Boulevard is to be carried over Hog Island Channel and Long Beach Channel by steel bridges; cost $400,000. Town Board of Hempstead has been petitioned for right-of-way.

Bladenboro, N. C.—Citizens of Bladenboro Township voted $25,000 bonds for road improvements.

Moorehead City, N. C.—Street improvement bonds for $16,000 will be sold Dec. 9 by M. L. Willis, Secy.-Treas.

Athens, Ga.—City Council voted to construct sidewalks on Cobb, Strong and Dougherty Streets.

Clearwater, Fla.—Citizens of Pinellas County voted $715,000 bonds for road improvements.

***Boston, Mass.**—Following are unit figures of four lowest bids opened Nov. 22 by Metropolitan Park Commission, 14 Beacon Street, Boston (John R. Rablin, Engineer), for constructing a reinforced concrete bridge and approaches over Charles River at North Beacon Street, between Boston and Watertown: (a) A. G. Tomasello, 69 Gibson Street, Dorchester, $117,352 (awarded contract); (b) Fred T. Ley & Co., Inc., Springfield, $119,560; (c) Coleman Brothers, Pearl and Marginal Streets, Chelsea, $124,011; (d) H. P. Converse & Co., 88 Broad Street, Boston, $128,091.

	*(a)	(b)	(c)	(d)
Concrete bridge and approaches	$85,000.00	$95,700.00	$97,000.00	$98,710.00
20,000 cu. yd. filling material				
2,500 lin. ft. concrete piles	0.55	0.48	0.60	0.75
2,400 sq. yd. roadway surfacing	3.00	1.50	1.50	1.30
150 lin. ft. straight edgestone	3.80	2.75	3.20	3.44
300 lin. ft. curved edgestone	1.85	1.85	1.80	1.00
230 sq. yd. granite flagging	2.00	2.25	2.50	1.25
1,200 sq. yd. granolithic walks	1.50	1.25	0.70	0.67
	2.00	1.30	1.10	1.33

De Land, Fla.—Bd. County Commissioners sold about $400,000 Halifax River Special Road Dist. bonds.

Sebring, Fla. — About $350,000 Road Dist. No. 5 De Soto County road bonds sold by Comrs. of Dist.

Mobile, Ala.—Nicol & Hume of Mobile are engineers for proposed highway between Mobile and Baldwin Counties, to cost $105,000, about seven miles of fill, with a bridge and two ferries, are included in the improvement. Mobile County has provided her share of the cost; an election is to be held in Baldwin County to vote her share. J. H. Webb, Chairman Committee, Alabama - Mississippi Gulf Coast Highway Commission.

Palmesville, Ohio—Brick and concrete pavement, costing $45,000, is contemplated in the new year. Address Director Public Service. F. N. Downer, City Engr.

Springfield, Ohio.—Bonds for $7,000 will be sold Dec. 13 by W. J. Barrett, City Aud., for improving portions of East High Street.

Washington C. H., Ohio.—Bonds for $16,300 will be sold Dec. 20 by John N. McFadden, City Aud., for improving portions of East Court Street with asphalt.

Evanston, Ill.—Next year the city contemplates paving about 120,000 sq. yd. with brick, costing $300,000, and three systems of storm water and house drainage sewers, aggregating approximately $150,000. Contract for 82,000 yd. of above paving will probably be let in December. Address I. C. Brower, Comr. Pub. Wks.

Oak Park, Ill.—About 11 miles asphaltic concrete pavement, to cost $480,827; one-quarter mile sheet asphalt, cost $7,085, and three-eighths of a mile of concrete pavement, to cost $7,796, contemplated in the new year. Address Board Local Improvements. W. F. Sargent, City Engr.

Missouri Valley, Iowa.—About forty blocks are to be paved on various streets, including Third, Fourth, Fifth and other streets; material not decided. Price & McCormack, Engineers, Missouri Valley; S. R. Williams, City Clerk.

Storm Lake, Iowa.—Contract will be let about February for the 60,000 sq. yd. of paving; material not yet selected. J. E. Buland, City Clerk.

Fergus Falls, Minn.—Reported city intends purchasing a heavy road roller and probably a rock crusher for street improvements.

Little Falls, Minn.—The sum of $40,000 has been appropriated for constructing roads and bridges in Morrison County during the new year. A. J. Fenn, District Engineer, Highway Commission, Little Falls.

St. Paul, Minn.—City Council reported to be in favor of paving 143 blocks on Twelfth, Temperance and other streets during 1916.

Norfolk, Neb.—In the spring the city plans to pave about 50 blocks. H. H. Tracy, City Engr.

Billings, Mont.—An election will probably held in January to vote on issue of $175,000 bonds for highway improvements in Yellowstone County.

Lexington, Mo.—Citizens voted $49,000 bonds for improving roads in Waverly Special Road Dist. in east end of Lafayette County.

Springfield, Mo.—Citizens of Bolivar Special Road Dist. voted $45,000 bonds for road improvements.

Batesville, Tex.—B. H. Erskine, Sr., Commissioner Precinct No. 3, writes citizens Nov. 2 voted $40,000 bonds for road improvements, but nothing further will be done about the matter until April, 1916.

El Paso, Tex.—Attorney General has approved $300,000 county road bonds.

Galveston, Tex.—Election soon to be held on following bond issues: $250,000 for paving, draining and improving streets; $200,000 repairing, restoring or submerging water mains across Galveston Bay; $300,000 for repairing, restoring and improving streets.

Santa Fé, N. M.—Luna County road bonds amounting to $100,000 have been sold; $25,000 will be available the first of the year for road improvements.

Ellensburg, Wash.—County Engineer, in a report to Kittitas County Comrs., estimates cost of highway to be constructed between Ellensburg and Wenatchee, distance of 20 miles, at about $200,000.

Seattle, Wash.—City Council voted to pave N. Forty-ninth Street, Beacon Avenue, Second Avenue W. with sandstone block; W. Wheeler Street, and for concrete sidewalks on First Avenue N. and Twenty-ninth Avenue N. E.

Plans approved by Bd. Pub. Wks. for paving Prospect Street and Seventh Avenue N. and for concrete walks on Dey Avenue.

Plans and specifications submitted to Bd. Public Wks. by A. H. Dimock, City Engineer, for grade and concrete walks on E. Fiftieth Street and paving Burke Avenue; cost $61,000.

Albany, Ore.—City Council voted to hard surface Washington Street; cost about $9,149.

Astoria, Ore. — Warrenton - Clatsop County Road Dist. voted in favor of a tax levy to raise about $25,000 for constructing section of Columbia Highway.

City Council voted to pave Thirty-sixth, Thirty-seventh and Duane Streets.

Hillsboro, Ore. — Washington County Comrs. considering constructing Beaverton - Hillsboro - Forest Grove Highway; cost about $25,000.

Portland, Ore.—City Council considering paving Ainsworth Avenue; cost about $14,000.

Tillamook, Ore.—County Comrs. have included in the 1916 budget about $173,389 for constructing roads and bridges in Tillamook County.

Warrenton, Ore.—Citizens of Warrenton Road Dist. voted a tax levy to provide $25,000 for road improvements.

Ross, Cal.—Town Trustees are planning street improvements costing $20,000.

Santa Monica, Cal.—City Council voted to construct a concrete road from Colorado Avenue to Santa Monica Canyon, at a cost of about $50,000.

Nogales, Ariz.—Road bonds amounting to $150,000 will be sold Dec. 14 by Bd. Supervisors, advertised in Engineering Record.

Appleton, Idaho.—Citizens voted $25,000 bonds for constructing bridges and roads during the coming year.

Lewiston, Idaho.—C. J. Vassar, County Surveyor, directed to make surveys for the John Kennedy Road on Upper Tom Muriel Creek; cost $20,000.

Preston, Idaho.—County Comrs. considering issuing $150,000 bonds for constructing roads.

BIDS DESIRED.

Buffalo, N. Y.—Until Dec. 7 by Department Public Works (George H. Norton, Act. Comr.) for paving portions of Sussex Street, Exeter and Durham Avenues and other streets.

Tuckahoe, N. Y.—Reported desired until Dec. 6 by John Matthews, Town Supt. of Highways, at office of Town Clerk, Tuckahoe, for improving portions of California Road.

Miami, Fla.—Local reports state bids desired until Dec. 16 for treating with liquid asphalt portions of Avenue H, and Dan, Twenty-fifth and numerous other streets. Address City Clerk.

Bay Minette, Ala.—Until Dec. 14 by County Commissioners for grading, draining and surfacing with sand clay portion of Eastern Shore Road; cost $11,158. W. S. Keller, State Highway Engr.

Bolton, Miss.—Reported until Dec. 13 by Highway Commissioners (C. M. Farr, Secy.) for 5 miles of gravel roads and streets in District No. 2.

Boonville, Miss.—Reported desired until Dec. 6 by County Commissioners for grading and surfacing 7 miles of road.

Starkville, Miss.—Until Dec. 15 by P. G. Sudduth, Mayor and Board of Aldermen, for paving advertised in Engineering Record. E. C. Thomas, Engr. Nash Bldg., Starkville.

Washington C. H., Ohio.—Until Dec. 11, by Ray Maddock, Clk. Dir. Pub. Service, for furnishing material and improving portions of Yeoman, Main and Hinde Streets. Bids desired on boulders, crushed stone, and top dressing, concrete, asphaltic macadam, sheet asphalt, bitulithic, hard burned brick and other material. Bonds for $20,000 for this work will be sold Dec. 20 by John R. McFadden, City Aud.

Angola, Ind.—Until Dec. 15 by Roy Hirst, City Clerk, for 18,000 sq. yd. pavement on North Wayne Street, advertised in Engineering Record. C. F. Powers, City Engr.

Sault Ste. Marie, Mich.—Until Jan. 13 by County Road Commission, as a whole or separately, for constructing approximately 22⅝ miles roads, limestone and trap rock, with 14-ft. metaled roadway, and 24 ft. between side ditches. Herbert L. Parsille, Co. Clk.

Des Moines, Iowa.—Until Dec. 8 by City Council for paving with 8 in. Portland cement concrete portions of Lincoln Place, Thirty-third, Thirty-fourth and other streets, in all about 18,319 sq. yd. Horace Susong, City Clk.

Pine City, Minn.—Reported desired until Dec. 10, by W. H. Hamlin, Co. Aud., for constructing the Elwell Road. Probable cost $53,710.

St. Paul, Minn.—Reported desired until Dec. 13, by Aug. Hohenstein, City Purchasing Agent, for improving portions of Oxford, Rondo, and other streets.

Clarksville, Tex.—Until Dec. 9 by George Morrison, County Judge, for constructing system of highway, including bridges, culverts, etc., for Road Dist. No. 1 Red River County. Probable expenditure $300,000.

Prosser, Wash.—Reported desired until Dec. 20 by State Highway Board, Olympia (William R. Roy, Secy.), for improving about 11½ miles highway between Kiona and Richland, Benton County. T. J. Wright, Co. Engr. Prosser.

Seattle, Wash.—Reported desired until Dec. 21 by County Commissioners (Byron Phelps, Clk.) for constructing Permanent Highway No. 13, between Enumclaw and the La Fromboise Road; probable cost $22,000.

Seattle, Wash.—See "Hydraulic and River Improvements."

Ontario, Cal.—Until Dec. 6 by R. O. Brackenridge, City Clk., for paving with concrete portions of A Street, Bon View and Euclid Avenues, in all about 511,000 sq. ft. B. B. Mann, City Engr.

PRICES AND LETTINGS.

★Indicates award of contract.

★Long Island City, N. Y.—Contract for repaving Rockaway Boulevard, from Park Avenue to Remsen Avenue, Rockaway Beach, with granite block, awarded by Borough President Connolly to Henry J. Mullen Constr. Co., Flushing, at $57,456. Bids for this work received Sept. 30.

★Jersey City, N. J.—Contract for repaving Old Bergen Road with asphalt awarded by City Comrs. to Crichfield Constr. Co.

★Mount Holly, N. J.—Contracts awarded by James Logan, Engineer, 11 Main Street, Mount Holly, for waterbound macadam pavement to Manwaring & Cummins, 1326 Chestnut Street, Philadelphia, Pa., at $5,710 for Vincetown and Buddtown Road, about 13,280 sq. yd., and $4,579 for Vincetown and Eayerstown Road, about 10,648 sq. yd. Other bidders: Joseph F. Burk, Plainfield, N. J., $7,702 and $6,174 respectively; The Juniata Co., Philadelphia, Pa., $8,234 and $6,283 respectively, and Kelley-McFeely Co., Camden, N. J., $9,030 and $7,134 respectively.

Newark, N. J.—Following bids opened Nov. 22 by Roads Com., Bd. Chosen Freeholders for paving South Orange Avenue in Newark and East Orange, Vailsburg section, Glenfield Constr. Co., $87,845 (recommended for award); Northern Constr. Co., 655 Broad Street, $88,140; Newark Paving Co., 133 First Street, $93,000; Ralph Sangiovanni, 78 Hoyt Street, $99,475.

★Contract for paving South Orange Avenue awarded Glenfield Construction Company, at $2.36 per sq. yd. for paving, 27 cts. for excav. and $1.15 for curbing. See totals given above.

Philadelphia, Pa.—Following are low bids opened Nov. 23 by Department of Public Works, Bureau of Highways (William H. Connell, Ch.) for street improvements:

Grading 238,762 cu. yds., John Devlin, Jr., Hancock and Thompson Streets; T. P. Lee, 5639 Cherry Street; E. H. Vare, Lincoln Bldg.; Brenner & Hope, Forty-ninth and Marion Avenue; C. A. Conan, 1345 Arch Street; Harry Magee, 7131 Grays Avenue; S. A. McClay, Allegheny Avenue and Tulip Street; J. Joseph McHugh, 1430 S. Penn Square; P. J. Snyder & Co., 903 Bailey Bldg.; O'Neill Co., 7911 Germantown Avenue; James A. Mullin, 5512 Vine Street; Frank Curran, 3023 Richmond Street; R. P. Bennis, Chew and Price Streets; R. B. Wenner, 137 Manheim Street; average price 31.5 cts. per cu. yd.; total $90,189.

Asphalt pavement, including 6-in. concrete base, Barber Asphalt Paving Co., Land Title Bldg., average price, $1.074 per sq. yd.; total $47,966.

Vitr. block pavement, including 6-in. concrete base, Cunningham Paving & Constr. Co., 1345 Arch Street, average price, $2.440 per sq. yd.; total $13,373.

Granite block pavement, including 6-in. concrete base, D. J. Lynch, 4127 Mantus Avenue, average price, $3.650 per sq. yd.; total $8,615.

Asphalt pavement, including 6-in. concrete base, Barber Asphalt Paving Co., Land Title Bldg., average price, $1.433 per sq. yd.; total $20,340 .

Granite block pavement (old size block), including 6-in. concrete base, average price, $2.923 per sq. yd. (new size block), $3 883 per sq. yd.; J. Joseph McHugh, 1430 S. Penn Square; James Kane, 4840 Mascher Street; total $17,783.

Water-bound macadam, 3-in. on 5-in. broken stone base, Manwaring & Cummins, 522 Hale Bldg.; D. W. Anders, Heed Bldg.; Pugh & Hubbard, 731 Witherspoon Bldg., average price, 91.2 cts. per sq. yd.; total $10,127.

Water-bound macadam, on old base, D. W. Anders, Heed Bldg., average price .42 ct. per sq. yd.; total $4,332.

Bituminous pavement, including 5-in. concrete base, Union Paving Co., Thirtieth and Locust Streets, average price, $1.63 per sq. yd.; total $9,989.

Removal of snow: McNichol Pav. & Constr. Co., 1923 Cherry Street; E. H. Vare, Lincoln Bldg.; Daniel Bader, Forty-eighth and Lincoln Streets; D. W. Anders, Heed Bldg.; J. D. Dorney, 1204 E. Montgomery Avenue; Harry Magee, 7121 Grays Avenue; P. C. Eisele, Lincoln Bldg.; P. J. Snyder & Co., 903 Bailey Bldg.; J. Gonnelli, 1217 Wilder Street; John Devlin, Jr., Thompson and Hancock Streets; T. L. Flanagan, 1204 E. Montgomery Avenue; average price of .454 ct. per cu. yd.

★Lexington, Ky.—Contracts for constructing Nicholasville Road awarded by Fiscal Court, Fayette County, as follows: First section, 3½ miles long, with asphalt, to Carey-Reed Co., Lexington, and for the second section, 1⅝ miles, with tarvia, to James H. Young of Newport, representative of Tarvia Co.

★Toledo, Ohio.—Contract for macadamizing Otter Creek Road, in Oregon Township, awarded by County Commissioners to Breymann & O'Neill, Nasby Building.

★New Albany, Ind.—Bd. County Comrs. on Nov. 24 awarded contract for constructing W. Seventh St. Road in New Albany Township to W. F. Woodruff, Louisville, Ky., at $12,462.

★Oklahoma City, Okla.—Contract for paving Fifteenth and Fourteenth Streets, Harvey and Walnut Avenues awarded by City Comrs. to Western Paving Co., Oklahoma City, at $29,496.

★California. — Contracts awarded by California Highway Commission, Sacramento, as follows for constructing state highways:

Imperial County—Division VII, Route 12, Section A, Holland Constr. Co., 210 Grange Building, San Diego, at $15,600.

Sonoma County—Division IV, Route 8, Section A, to Bates, Borland & Ayer, Oakland Bank of Savings Building, Oakland.

★Los Angeles, Cal.—Contract for paving 233,700 sq. ft. on Wilton Place with asphalt awarded to Clark & Henery Constr. Co., Stockton, at $27,435.

★San Francisco, Cal.—Contract for constructing the first unit of the beach esplanade awarded J. D. Hannah, Monadnock Block at $89.50 per lin. ft. and $5 per cubic yard for rubble wall.

★Santa Ana, Cal.—Contract for paving about 5 miles Placentea Yorba Road awarded to Max L. Huberman, Santa Ana, at $16,459.

STREET CLEANING AND GARBAGE DISPOSAL

PROPOSED WORK.

Bartlesville, Okla.—See "Miscellaneous."

Portland, Ore.—Reported city will purchase two automobile flushing machines for Street Cleaning Department.

BIDS DESIRED.

Bar Harbor, Me.—Local reports state until Dec. 15 by Board of Health, Odd Fellows Block, for a three and five year contract for garbage disposal.

PRICES AND LETTINGS.

★Indicates award of contract.

★Boston, Mass.—Contracts for snow and ice removal (bids opened Nov. 15 by Edward Murphy, Comr. Pub. Wks.), awarded as follows: District 1, to Joseph M. Kiley, Roxbury, at 44 cts. per cu. yd.; No. 2, to Joseph P. McCabe Company, 33 cts.; No. 3, Charles J. Jacobs Company, 107 Terrace Street, 31 cts.; Nos. 4 and 5, Coleman Bros., Chelsea, 37 cts. and 40 cts., respectively; No. 6, Joseph Sprissler, 37 cts., and No. 7, James Driscoll & Son Company, Brookline, 35 cts.

★Atlantic City, N. J.—Farmers Product & Supply Co., Atlantic City, has secured contract for collection and disposal of garbage.

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS

PROPOSED WORK.

Harbor Improvements—Boston, Mass.—The Harbor and Land Commission has submitted annual estimates asking $250,000 per year for next three years for river and harbor improvements.

State Canal Work—Albany, N. Y.—Frank M. Williams, State Engineer, has submitted to the Canal Board plans and specifications for following contracts:

Contract 122, construction of highway bridge over Mohawk River, near Little Falls, at about Barge Canal Center Line Station 4246 + 42. Engineer's preliminary estimate $59,339.

Contract No. 21-A, construction of Barge Canal, Erie Branch, from Station 2449, about 400 ft. west of the Genesee River, near Rochester, to about Station 255 + 58, about 442 ft. from the east end of Contract 6. Engineer's preliminary estimate $415,700.

Contract 29-A, construction of Barge Canal, Erie Branch, Section 4, from Sterling Creek to the Herkimer-Oneida County line east of Utica. Engineer's preliminary estimate $162,005.

Contract 73-A, completing construction of Barge Canal, Champlain Branch, from Northumberland to Stillwater. Engineer's preliminary estimate $432,045.

Terminal Contract 51 — Constructing Barge Canal Terminal at Medina. Engineer's preliminary estimate $6,379.

Channel Improvement — Miami, Fla.—The $645,000 city bond issue recently voted has been validated. The bonds will be used as follows: $360,000 for ship channel in Biscayne Bay, according to plans by Isham Randolph, Harbor Engineer; $40,000 to finance municipal railway from

...west shore of Lowrance Bay to the main line of the C. M. & St. P. Railway. Estimated cost of entire work, including bridges, is $1,000,000. Contract for three bridges, including Superior Avenue, Grand Avenue viaduct and Lake Shore bridge, has been awarded to the Strobel Steel Construction Co., Chicago, at $250,000.

Ditch — Mapleton, Minn. — Taxpayers have authorized spending $40,000 and are constructing the proposed Judicial Ditch running north of Mapleton to Cass River.

Dredging—Devils Lake, N. D.—It is reported that the joint Northern Pacific Railway & Great Northern Railway, Fred Macomber, Engr., St. Paul, Minn., will dredge a route in Sweetwater Lake 100 ft. long, 50 ft. wide and 5 ft. deep to and at a fountain from which they will pump the water for their treatment plant.

Dam—Billings, Mont.—Detailed plans prepared by U. S. Reclamation Service, Denver, Colo., for a 40-ft. dam for the Big Horn Irrigation & Power Co. at Billings, Cost $150,000.

Repairing Bulkhead—Anahuac, Tex.—Chambers Nov. 28 voted $20,000 bonds for repairing bulkhead across Turtle Bay. H. J. Walker, Engineer, Orchard, Tex., A. E. Ayrolle, City secy.

Steel Shed—Beaumont, Tex.—All bids opened recently by Wharf and Dock Commissioners for constructing steel shed in unit No. 1 of the Government terminal link have been rejected.

Dock—Orange, Tex.—Contract will be let about May 1 for constructing dock and for the removal of shoal and warp piles. E. N. Heerd, City Engineer.

Jetty Improvement—Bandon, Ore.—Port of Bandon Commissioners have authorized the sale of $50,000 bonds to construct a rock support to south jetty and to close up entrance which flows from Coquille River channel into breakwater entrance.

Irrigation — Medford, Ore.—The ten miles of Rogue River Canal for Bear Creek Canal Co. (E. F. Cregg, Medford, engineer) is proposed to take water from Lake and build connecting canal to Fish Lake.

Bulkhead — Long Beach, Cal.—Reinforced concrete bulkhead for protection of fill and walks on east and west beaches proposed by J. Harris, Commissioner Public Works.

Irrigation—Los Angeles, Cal.—Supreme Court is requested to have recorded lands appertaining to Hansen, voted by people of Los Angeles County Irrigation District No. 1. J. B. Lippincott, Engineer of the District, and Chief Engineer of the City Water Department have the matter in charge.

Irrigation—Stockton, Cal.—J. W. Squires and E. E. Gilmore of Stockton have been granted permit by the State Water Commissioners to use 10 second's inches of water from La Grange Creek for the purpose of irrigating 240 acres, and it is proposed to construct a timber and earth dam 7 feet high across Littlejohn Creek.

Irrigation — Brunsau, Idaho.—Reported plans being made to complete the Little Owyhee Irrigation Project in Owyhee County. J. J. Gallagher of the Williamson Land & Irrigation Co., Boise, may be able to give information.

BIDS DESIRED.

Dredging — Washington, D. C.—Until [illegible] for U. S. Engineer's Office, 826 Southern Building, for dredging in Anacostia River. Lt.-C. Advertised in Engineering Record.

Breakwater — Fort Taylor, Fla. — Until [illegible] for U. S. Engineer Office, Jacksonville, for repairing breakwater at Fort Taylor, Key West, Fla. Advertised in Engineering Record.

Dock—Miami, Fla.—Until Dec. 22 by W. H. Moore, City Clerk, for constructing a concrete dock and supplying bids for removing a city waterfront dock and a concrete bulkhead between [illegible] and Miami River. Dock [illegible] feet wide and [illegible] feet long, including [illegible] Engineering Department, Miami. Work to be completed and dock and bulkhead ready for use [illegible] days after contract is signed. Contractor must supply [illegible] for [illegible] feet of bulkhead and [illegible] feet of dock. Contractor must supply about 12,000 cu. yds. of earth and sand fill. Contractor must supply and place [illegible] cu. yds. of reinforced concrete and [illegible] cu. yds. of mass concrete. Dock [illegible] 12 in. thick and [illegible] ft. wide and [illegible] ft. long. Bulkhead [illegible] 12 in. thick and [illegible] ft. wide and [illegible] ft. long. Contractor must furnish [illegible] cu. yds. of [illegible] concrete, [illegible] cu. yds. of reinforced concrete, [illegible] cu. yds. of mass concrete, [illegible] cu. yds. of earth fill, [illegible] cu. yds. of rock fill, [illegible] cu. yds. of rock riprap, [illegible] cu. yds. of [illegible] and [illegible] cu. yds. of [illegible]. Plans may be seen at office of City Engineer, Miami, Fla. Certified check for $1,000 must accompany bid. Bonds will be required. Right reserved to reject any or all bids. Advertised in Engineering Record.

Flood Protection Wall — Portsmouth, Ohio.—Until Dec. 4 (Advertisement) by Wilfred Thompson, Director Public Service, for constructing second section of flood protection wall. Address Frank George & Wilhelm, City Engineer.

Clay Puddle Wall—Riverside, Ill.—Until Dec. 11 at office of M. Cormick's Estate, 1912 Stock Exchange Building, Chicago, Ill., for constructing approximately 2,000 lin. ft. clay puddle wall, 20 ft. deep, 4 ft. thick at the base, 2 ft. at the top, and extending from the solid rock on section of ground in the Fifth Division of Riverside.

Ditch—Mankato, Minn.—Reported desired spoil bank bids for Ditch 41, Blue Earth County, to consist of 19,120 lin. ft.; from 8 to 16 in. tile and concrete head wall. Predictive cost $9,343. C. L. Kennedy, Co. Aud.

Levee Work—Kansas City, Mo.—Until Dec. 14 by Board Directors Kaw Valley Drainage District (P. J. Broll, Secy.) for repairing three washouts in the levee and constructing 500 ft. trench drains on the right or east bank of Kansas River, between Fifth Street bridge and Kansas City Terminal bridge, to consist of approximately 2500 cu. yds. embankment for three washouts, 2600 sq. yds. rip rap revetment paving, 980 cu. yds. trench drain excavation, 1150 cu. yds. rock in trench drains; repairing washouts in the levees and constructing about 3000 ft. toe protection rock revetment on right bank of Kansas River, between Turner Bridge and Walnut Grove, approximately 4500 cu. yd. embankment in washouts, 5050 sq. yd. revetment paving, 4500 cu. yd. rock revetment for toe protection and 1500 cu. yd. broken slab, removed to toe protection.

Irrigation—Barstow, Tex.—Reported desired until Dec. 20 for constructing dams, reservoirs, headgates, sluice gates, etc., Ward County Irrigation Dist. No. 1 (Robert L. McKnight, Secy.).

Seawall—Seattle, Wash.—Reported desired until Dec. 18 by L. B. Young, Chmn. Bd. Park Service, for constructing concrete seawall, reconstructing sewers and water mains and paving; probable cost $ [illegible].

Revetment Wall—Campbell, Cal.—Until Dec. 6 by Board County Supervisors, San Jose (Henry M. Ayer, Chmn.), for constructing a reinforced concrete revetment and curtain wall on Los Gatos Creek near Campbell.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Dredging — Boston, Mass. — Only bid opened Nov. 24 by Port Directors, Boston, for dredging 1,500,000 cu. yd. material in East Boston Flats, Contract 46, submitted by H. P. Converse & Co., 88 Broad Street, Boston, at $371,250.

Filling and Dredging—Boston, Mass.—Following are bids opened Nov. 24 by Port Directors, Boston, for Contract 47, dredging and filling around slams in East Boston (a) 2200 lin. ft. bulkhead construction, (b)170,000 cu. yd. dredging and placing filling beneath and around bulkhead: Bay State Dredging Co., 247 Atlantic Avenue, Boston, (a) 23.2 cts., (b) 18.7 cts., total $82,820; Coleman Brothers, Pearl Street, Chelsea, (a) 21 cts., (b) 29 cts., total $95,500; H. P. Converse & Co., 88 Broad Street, Boston, (a) 23.94 cts., (b) 43½ cts., total $123,218.

★**Dredging — Philadelphia, Pa.** — Mayor has signed the contract awarded to Bowers Southern Dredging Co., Galveston, Tex., for dredging Delaware channel opposite Port Richmond, at about $75,000.

★**Pier Improvements—Baltimore, Md.**—Contracts awarded by Baltimore & Ohio R. R. for constructing Curtis Bay Coal Pier as follows: Pier, bulkhead and dredging to H. S. Kerbaugh, Inc., 6 Church Street, New York; grading, Smith-McCormick Co., Northampton Bank Building, Easton, Pa.; coal dumpers, McMyler Interstate Co., Cleveland, Ohio; conveying machinery, Robin Conveying Belt Co., New York. Total cost, according to press reports, about $1,500,000.

★**Dam—Florence, Ala.**—Contract awarded Allentown Construction Company, Birmingham, for constructing the dam and power house on Cypress Creek for Lauderdale Power Company at $127,555.

Wharf Improvements—New Orleans, La. Following are bids opened Nov. 22 by Dock Board for underground conduit, wiring, etc., for cotton warehouse: Marks Electrical Construction Co., $21,690; Barnes Electric Construction Co., Ltd., $21,700, and W. A. Dalzell, $26,900.

★**Wharf—New Orleans, La.**—Following bids were opened Nov. 15 by Board Port Commissioners for piling, timber, etc., for the wharf of the grain elevator, to be 1035 ft. long: Wilson Moore, Texas City, Tex., $ 73,500; Lester F. Alexander, $183,275, and Doullut & Williams, $154,000 (awarded contract). Ford, Bacon & Davis, Engineers for Commission.

★**Levee Improvement—Point a la Hache, La.**—Contract for constructing levee improvement in Plaquemines Parish, Otis reported Nov. 26 by Bd. State Engineers, New Orleans, awarded A. L. Richards, 307 Wells Fargo Building, New Orleans, as follows: 1,715,000 ft. Lower Empire to Jupiter, inclusive, revetment, and 650,000 ft. McCarty to Lower revetment, both at $1.65 per lin. ft. (J. W. Lawes, Secretary Board State Engineers, New Orleans.

★**Dredging—Cleveland, Ohio.**—The bid of the Great Lakes Dredge & Dock Co., 1210 Hanna Building, at 7.5 cents per cu. yd. for dredging in Cleveland Harbor, about 800,000 cu. yd., has been recommended for award (bids opened Nov. 26 by U. S. Engineer's Office, Cleveland). Next three lowest bidders: Duluth-Superior Dredging Co., Duluth, Minn., 10 cents; Duluth Marine Contracting Co., Duluth, Minn., 11 cents; Arthur E. Breymann, Toledo, 11.9 cents.

★**Drain—Algona, Iowa.**—Following are four lowest bids opened Nov. 24 by County Commissioners for constructing drain No. 114, requiring about 102,175 ft. 6 to 28-in. tile: B. E. Morton, Algona, $47,800 (awarded contract); W. H. DeLong Ferrill, $47,900; Longley & Helberg, Algona, $49,646, and John Nordstrom, $50,625. E. H. Beardsley, County Auditor.

★**Ditch — Spencer, Iowa.** — Contract awarded Cement Products Co. of Spencer for constructing county ditch No. 28 (bids opened Nov. 23) requiring about 70,000 ft. 6 to 40 in. tile at $59,780. A. W. Chamberlain, County Auditor.

★**Wharf — Beaumont, Tex.** — Contracts for constructing wharf awarded John O'Kelly, San Antonio, at $65,536, and for freight handling machinery to Heyl & Patterson, Pittsburgh, Pa., at $12,950. O. A. Seward, Jr., Resident Engineer Board Wharf and Dock Commissioners.

Irrigation—Ysleta, Tex.—The only bid, on all schedules, 1 to 9 inclusive, opened Nov. 17 by U. S. Reclamation Service at El Paso for the excavation of Keasburg Canal, from Station 310 to Station 570, and Picacho Branch Canal, involving 162,000 cu. yd. in vicinity of Hill N. M. and San Elizario Feed Canal, involving 54,000 cu. yd. in Ysleta, was submitted by Toohey & Johnson, Box 551, Phoenix, Ariz., at a total of $30,334.

★**Irrigation—Grand Junction Col.**—Contracts awarded by Reclamation Service, Grand Junction, for earthwork on main canal and laterals, Grand Valley Irrigation project, Colorado, awarded as follows: Schedules 1 to 8 inclusive to Reynolds Ely Construction Co. of Springville, Utah, at $28,584; Schedule 9, Henry Wilson, Carl Hicks and N. H. Wilson, Fruita, Col., at $3,323; Schedule 10, C. S. Kirkendall & John E. Nelson, Fruita, Col., $2,801; Schedule 11, Sam Kloczko, Loma, Col., $1,649; Schedule 12, J. M. Groesbeck, Springville, Utah, $2,937; Schedule 13, James O'Bryan, Fruita, Col., $2,364; Schedule 14, J. W. Collier, Grand Junction, Col., $1,323; Schedule 15, Wade Collier, Grand Junction, Col., $1,420, and Schedule 16, Charles E. Litz, Loma, Col., $1,578.

ELECTRIC RAILWAYS

PROPOSED WORK.

Methuen, Mass.—Bay State Ry. Co. (R. S. Goff, Gen. Mgr., Boston) received franchise from City Council to construct double tracks on river boulevard from Lowell Street to Lawrence line.

Hartford, Conn.—Connecticut Co. (J. K. Punderford, Gen. Mgr., Second National Bank Building, New Haven) has been granted permission to rebuild boiler house and engine room and erect an extension to boiler capacity; estimated cost of work, $197,000; four 1000 hp. boilers and coal conveyors are to be installed.

New York, N. Y.—Manhattan & Queens Traction Cor. (S. B. Severson, Gen. Mgr., Queens Plaza Court), expects during 1916 to construct 4 miles single track.

Stroudsburg, Pa.—During 1916 the Slate Belt Electric Street Ry. Co. (L. H. Mountney, Gen. Mgr. Pen Argyl, Pa.), expects to construct 15 miles of railway between Wind Gap and Stroudsburg.

Durham, N. C.—Construction of an interurban railway from Durham to Chapel Hill, distance of 10 miles, is contemplated. To be leased to Alamance, Orange & Durham Electric Ry. Co., who contemplate constructing line from Burlington to Durham. Address Durham Chamber of Commerce.

Miami, Fla.—See "Hydraulic Construction and River Improvements."

Ocala, Fla.—Construction of an electric railway between Ocala and Silver Springs is contemplated. Jake Brown and J. H. Taylor said to be interested.

Cleveland, Tenn.—Construction of electric railway from Cleveland to Chattanooga, Knoxville and Ocoee is contemplated. H. M. Linn, Cleveland, said to be interested.

Lexington, Ky.—The Kentucky Traction & Terminal Co. is completing arrangements for construction of new high tension lines to connect all of present termini by loop systems.

Nashville, Tenn.—Nashville Ry. & Light Co. contemplates constructing a branch line from Nineteenth Street line between Lillian and Rothschild Streets to Shelby Park.

Belleville, Ill.—During 1916 Belleville & Mascoutah Traction Co. plans to construct 10 miles of single track between Belleville & Mascoutah.

Evanston, Ill.—Evanston West Side Ry. Co. incorporated to construct electric railways. Capital $10,000. Among incorporators are: Bertram W. Rosenstone and Henry J. Myerson.

Jefferson City, Ill.—Illinois Traction System (Wm. B. McKinley, Pres. Champaign, Ill.), considering constructing a line to connect Jefferson City and Columbia.

Edmund, Okla. — Oklahoma Ry. Co. (Geo. W. Knox, Gen. Mgr., Oklahoma City), contemplates constructing 16 miles single track between Edmond and Guthrie during 1916.

Oklahoma City, Okla.—Oklahoma Ry. Co. contemplates during 1916 constructing 16 miles of single track.

BIDS DESIRED.

San Francisco, Cal.—Local reports state bids desired until Dec. 8, by Board of Works for grading and track construction of Church Street Municipal Railway, between Eighteenth and Twenty-second Streets.

PRICES AND LETTINGS.

★*Indicates award of contract.*

New York, N. Y.—Following are three lowest bids opened Nov. 23 by Public Service Commission for First District, 154 Nassau Street, New York, for installation of tracks on White Plains Road extension of Lenox Avenue branch of existing subways: Coast & Lake Contracting Co., 41 Broad Street, $53,930; Southeastern Construction & Engineering Corporation, $101,205; T. H. Reynolds Contracting Co., $102,126.

New York, N. Y.—Following are unofficial totals of two lowest bids opened Nov. 30 by Public Service Commission for First Dist., 154 Nassau Street, New York, for construction of Section No. 2 of Routes Nos. 19 and 22, a part of the Seventh Avenue-Lexington Avenue Rapid Transit Railroad, an elevated railroad, in Borough Bronx, extending over and along Whitlock Avenue and Westchester Avenue, from Bancroft Street to Eastern Boulevard. Lawrence C. Manuell, 11 Pine Street, $2,063,877; A. L. Guidone Co., 131 E. Twenty-third Street, New York, $2,072,700.

New York, N. Y.—Following are unit figures of four lowest bids opened Nov. 23 by Public Service Commission for First District, 154 Nassau Street, for installing tracks on White Plains Road extension of Lenox Avenue branch of existing subways: (a) Coast & Lake Contracting Co., 41 Broad Street, $53,930; (b) South Eastern Construction & Engineering Corporation, 43 Exchange Place, $101,206; (c) T. H. Reynolds Contracting Co., Inc., 1480 Broadway, $102,126; (d) George S. Bennett, 36 Northern Avenue, $103,108.

Item	(a)	(b)	(c)	(d)
1017—4,850 9-in. structural channels, 13¼ lb. per ft., 3 in. long, punched	$0.15	$0.16	$0.16	$0.20
1025-A—2 bumping posts, complete, as follows:				
(b) timber posts	100.00	375.00	300.00	375.00
1026—45,000 lin. ft. hand rail	0.52	0.48	0.55	0.50
1027—600 M ft. plank walks, complete	6.00	11.25	12.00	12.00
1028—15,000 anti-creepers, complete	0.04	0.085	0.10	0.09
1053—Type III track complete.				
56,000 lin. ft. on tangents and curves (not superelevated) of more than 2000 ft. radius	0.24	0.60	0.58	0.60
1,750 lin. ft. on curves of 2000 ft. to 701 ft. radius	0.26	0.90	0.85	0.80
6,450 lin. ft. on curves of less than 701 ft. radius	0.26	1.10	1.10	1.25
14,300 lin. ft. at and adjoining stations	0.24	0.63	0.58	0.70
2,200 lin. ft. on superelevated tangents and curves of more than 2000 ft. radius	0.24	0.70	0.58	0.80
1065—Type VI track complete:				
4,100 lin. ft. on tangents and curves of more than 2000 ft. radius	0.48	0.85	0.95	0.80
2,550 lin. ft. on curves of 2000 ft. to 701 ft. radius	0.48	1.10	1.15	0.90
100 lin. ft. on curves of less than 701 ft. radius	0.48	1.25	1.25	1.50
Installation of Special Work:				
2082-A—Portion 83, complete	250.00	900.00	800.00	1,000.00
2084-A—Portion 84, complete	150.00	550.00	750.00	700.00
2085-A—Portion 85, complete	400.00	300.00	700.00	1,250.00
2086-A—Portion 86, complete	100.00	550.00	350.00	400.00
2087-A—Portion 87, complete	60.00	300.00	575.00	300.00
2088-A—Portion 88, complete	60.00	1,150.00	400.00	300.00
2089-A—Portion 89, complete	250.00	900.00	750.00	750.00
2090-A—Portion 90, complete	250.00	1,000.00	750.00	750.00
2091-A—Portion 91, complete	250.00	850.00	1,500.00	1,000.00
2092-A—Portion 92, complete	325.00	1,400.00	800.00	1,500.00
2093-A—Portion 93, complete	250.00	850.00	1,500.00	1,000.00
2094-A—Portion 94, complete	250.00	1,000.00	1,050.00	1,000.00
	250.00	850.00	1,200.00	750.00

RAILROADS

PROPOSED WORK.

Coatesville, Pa.—Reported Philadelphia & Reading R. R. (S. T. Wagner, Ch. Engr., Philadelphia), contemplates improvements on the Washington and Northern branch of the road in the vicinity of Coatesville and other places at a total cost of $250,000.

Pensacola, Fla.—Reported steps being taken to construct about 18 miles of the Pensacola, Mobile & New Orleans R. R. to a connection in Mobile.

Metropolis, Ill.—Reported next spring the Illinois Central R.R. Co. (A. S. Baldwin, Ch. Engr., Chicago) will construct a double-track line from Metropolis to Grayville, a distance of 100 miles.

Green Bay, Wis.—Green Bay & Eastern Ry. Co. incorporated by Charles Frazier, Manitowoc; Rude Stockinger, Manitowoc, and others for the purpose of constructing a railroad from Green Bay through Manitowoc to Sheboygan, a distance of 75 miles.

Cascade, Mont.—Reported Great Northern Railway Co. (A. H. Hogeland, Ch. Engr., St. Paul, Minn.) plans constructing branch line from Cascade to Adel; also that during 1916 will construct a 50-mile line from Scobey Glentana.

Orange, Tex.—See "Hydraulic Construction and River Improvements."

Bartlesville, Okla.—Oklahoma & Interstate Ry. has been granted permission to extend line to Nowata, a distance of 28 miles.

Northport, Wash. — Reported Great Northern Railway Co. (S. H. Hogeland, Chief Engineer, St. Paul, Minn.) has completed surveys for system of sidings, etc., here; cost $35,000.

Portland, Ore. — Plans prepared by George S. Edmondstone for eliminating grade crossings on line of Oregon-Washington Railroad & Navigation Co. (S. Murray, Bridge Engineer, Portland, Ore.) from head of Sullivan's Gulch to city limits, including seven overhead viaducts; cost $750,000. Bridges are plate girder type, reinforced concrete deck. Council has appropriated $65,000 as city's share toward the cost. Commissioner Robert G. Dieck of Dept. Pub. Wks. has recommended Mr. Edmondstone to position of Chief of Design and Construction.

PRICES AND LETTINGS.

★*Indicates award of contract.*

San Francisco, Cal. — Following are four lowest bids opened Nov. 24 by Board of Public Works for constructing the Hetch Hetchy Railway, from Rosasco to Hetch Hetchy dam site, 67 miles, and two extra miles for sidings: F. Rolandi, 55 Montgomery Street, at $8,450 per mile, for track construction exclusive of ballasting, masonry, etc., total, $1,543,080. Mason & Hangar Co., acting for McArthur Brothers, $1,555,376; Utah Construction Co., $1,800,925; Porter Brothers, $1,810,807. Among the contract items are grading through granite, solid rock, soft rock and earth, 1,008,749 cu. yd., 30 miles of common fencing, 10 miles of hog tight fencing and the track construction. Contractor will build a steel truss bridge over the Tuolumne River, span 220 ft., provide steel tanks and redwood tanks, also construct a telephone line 50 miles long, between Rosasco and Hog Ranch (Rolandi bid $575 per mile), placing telephone wires for about 9 miles on the poles already up between Hog Ranch and the dam site.

PUBLIC BUILDINGS AND SCHOOLS

PROPOSED WORK.

Bridgeport, Conn.—Contract soon to be let for two-story and basement, brick and stone addition to Garfield School; probable cost $45,000. H. S. Challenger, Chmn. Special Building Committee.

Brooklyn, N. Y.—Justices of Supreme Court reported in favor of remodeling present court house according to plans of Frank H. Quinby, 99 Nassau Street, New York, which includes new wing at Court and Joralemon Streets; cost $600,000.

City of New York, Department of Public Charities, intends erecting three additional stories to the two one-story wings of Kings County Hospital, used as nurses' home, at New York Avenue and Clarkson Street; cost $75,000.

New York, N. Y.—Henry B. Herts, 345 Fifth Avenue, is architect for proposed $1,000,000 Isaac L. Rice Memorial Hospital for Convalescents. The Beth Israel Hospital, 70 Jefferson Street (Louis J. Frank, Supt.) is interested. The Beth Israel Hospital is also reported contemplating erecting a fifteen-story general hospital on Livingston Place and Stuyvesant Park.

Edgewater, N. J.—Bonds amounting to $40,000 sold for proposed firehouse.

Hoboken, N. J.—City Commissioners considering erecting three new schools to replace Nos. 2, 3 and 4. Daniel A. Haggerty, City Clk.

Succasunna, N. J.—Citizens of Roxbury Township voted $35,000 bonds for high school.

Summit, N. J.—Public Service Corporation, 759 Broad Street, Newark, intends erecting branch office building at Springfield Avenue and Beechwood Road, Summit; cost about $75,000.

Johnstown, Pa.—Steps being taken to erect 3-story Municipal Building at Main and Market Streets. Address Nathan Miller, Supt. Finance Dept.

Kittanning, Pa.—Plans being prepared for eight-room West Kittanning School. Bonds voted last spring.

Philadelphia, Pa.—Contract soon to be let for installing machinery and erecting power house for Misericordia Hospital, at Fifty-third and Cedar Streets. E. F. Durang & Sons, Archts., 1200 Chestnut Street.

South Bethlehem, Pa.—Funds raised for completing reinforced concrete athletic stadium at Lehigh University. Dr. Henry S. Drinker, Pres.

Baltimore, Md.—Alfred Cookman Leach, 323 N. Charles Street, selected by City Architectural Commision to prepare plans for school to be erected in Patterson Park; cost $100,000.

Richmond, Va.—State is considering erecting an office building, a committee having been appointed by Legislature to report on advisability. B. O. James, Secretary of Comonwealth.

Dobson, N. C.—Contract soon to be let for erecting the court house, to cost $75,000. J. B. Sparger, Chairman County Commissioners, Mount Airy, N. C.; J. A. Jackson, County Clerk.

Edenton, N. C.—Citizens Nov. 23 voted $25,000 bonds to erect a school. J. O. Alderman, County School Superintendent.

Gastonia, N. C.—Later official reports state bonds for $100,000 will be sold Dec. 14 by Mayor and Board of Aldermen for erecting schools.

Raleigh, N. C.—Township School Commissioners intend erecting fireproof, reinforced concrete school at Person and Polk Streets; cost about $32,000.

Savannah, Ga.—See "Water Works."

Clearwater, Fla. — Reported County Commissioners have authorized an election to vote $150,000 bonds to erect court house and jail. The erection of a home for delinquent and dependent children is also under consideration.

Miami, Fla.—See "Hydraulic Construction and River Improvements."

Danville, Ky.—Erection of addition to Lakeview Hospital contemplated; cost approximately $60,000.

Atwater, Ohio.—Plans being prepared by L. Thomas, 305 Pythian Temple Building, Cleveland, for fireproof high and grade school. Address Board of Education.

Dayton, Ohio.—Board of Education approved plans for Fairview Park School.

Mansfield, Ohio. — Mansfield General Hospital Association approved Carpenter site for new hospital, to cost $90,000. Stevens & Redding, Mansfield, Architects.

Norwood, Ohio.—Bonds for $45,000 for school improvements will be sold Dec. 13 by Harold Ryland, Clk. Bd. Educ.

Olmsted Falls, Ohio.—Contract will be let by Board Education early next year for erecting fireproof high and grade school costing about $50,000. W. H. Nickolas, Archt., 1900 Euclid Avenue, Cleveland.

Palmyra, Ohio.—School bonds for $30,000 will be sold Dec. 10 at office of Clerk, Palmyra Township, Rural School Dist.

Warren, Ohio. — Howland Township Rural School District bonds for $40,000 will be sold Dec. 18 by Board Education (C. A. Haible, Clk.).

Brazil, Ind.—Contract will be let in January for erecting brick high school, two stories and basement, costing $75,000. Johnson & Miller, Archts., Brazil; Charles P. Keller, Superintendent of Schools.

Gary, Ind.—School bonds amounting $50,000 sold. Address Board of Education.

Huntington, Ind.—Board School Trustees of Huntington County sold $115,000 bonds for erecting school. C. C. Griffith, Secy. School Board.

Peru, Ind.—Schriber-Beelman, Second National Bank Building, Toledo, Ohio, selected to prepare plans for proposed city hall; cost $125,000. Address City Clerk.

Terre Haute, Ind.—Contract will probably be let in February by Board of Education for erecting the McLean School, a 20-room building, costing $115,000. Herbert W. Foltz, Archt., Lemcke Annex, Indianapolis, Ind.; Albert A. Allen, Business Director of Board.

Brooklyn, Mich.—Citizens voted $25,000 bonds to erect new school.

Quincy, Ill.—Plans prepared for Seymour Memorial School to be erected here; estimated cost $30,000.

Urbana, Ill.—Contract will be let about February for erecting fireproof girls' dormitory at University of Illinois. James B. Dibielka, Archt., 130 N. Fifth Avenue, Chicago; J. M. White, Supervising Architect, 256 Administration Building, Urbana.

Following buildings are to be completed during the next two years at the University of Illinois: School of ceramics, $120,000; school of education, $120,000; addition to chemical laboratory, $150,000; administration building, $50,000; vivarium, $175,000.

Duluth, Minn.—Contract will be let about Jan. 20 by Board of Education for erecting the three-story Morgan Park School to cost $110,000. Kelly & Williams, Archts., Duluth.

City Commissioners selected Holstead & Sullivan, Palladio Building, to prepare plans for brick and stone Carnegie Library to be erected at Twenty-third Avenue W. and Second Street; cost about $30,000.

St. Paul, Minn.—Contract soon to be let for erecting branch library No. 2. City Architect, City Hall, in charge.

Ashland, Kan. — Mann & Gerow of Hutchinson selected to prepare plans for $30,000 high school.

David City, Neb.—Citizens voted $50,000 bonds to erect new high school.

Havelock, Neb.—Erection of a high school costing about $24,000 is under consideration, but nothing definite has been done in the matter. Address Board Education.

Harrisburg, Tex.—Harris County School District No. 20, including Harrisburg, Magnolia Park and Park Place, voted $50,000 bonds for new schools.

Orange, Tex.—See "Hydraulic Construction and River Improvements."

Holdenville, Okla. — Bonds for court house and jail amounting to $100,000 will be sold Dec. 8 by County Commissioners. A. J. Johnson, County Auditor.

Miami, Okla.—County Commissioners having plans prepared for court house for which $75,000 bonds were recently voted.

Portland, Ore. — Contract will be let early in the new year for erecting the city auditorium which is to cost about $650,000. Address Department Public Affairs (George L. Baker, Commissioner).

Berkeley, Cal.—Contract soon to be let by University of California for a second unit of the Agriculture group, a fireproof building costing approximately $350,000; first unit of future Chemistry group, fireproof building costing approximately $250,000. Architect, John Galen Howard, Professor of Architecture, University of California. V. H. Henderson, Secretary Board of Regents.

El Centro, Cal.—Contract will be let in January for erecting a brick and concrete high school costing, with equipment, about $130,000. Samuel B. Zimmer, El Centro, National Bank Building, Architect. Address Central Union High School Board.

Los Angeles, Cal.—Reported two-story reinforced concrete market buildings are to be erected on Central Avenue and Hemlock Street. Address City Clerk.

San Leandro, Cal.—Citizens voted $125,000 bonds for purpose of purchasing site and erecting two new district schools.

Victoria, B. C.—City Council considering election to vote $75,000 bonds for erecting public natatorium.

BIDS DESIRED.

Boston, Mass.—Reported desired until Dec. 11 by Schoolhouse Committee, Boston, for Sarah Greenwood Elementary School, Dorchester, to be brick, 3 stories and basement, with assembly hall; probable cost $140,000. Funk & Wilcox, Archts., 120 Boylston Street, Boston.

Jersey City, N. J.—Until Dec. 20 (readvertisement) by Board of Chosen Freeholders, Jersey City, for the general construction of the county jail.

Lebanon, Ohio.—See "Miscellaneous."

Paterson, N. J.—Until Dec. 20 by Board Education (James F. Dunphey, Secy.) for erecting School No. 10. Separate bids for masonry; reinforced concrete work; structural steel and ornamental iron; plumbing; heating and ventilating; electric work, etc. Fred. W. Wentworth, Archt., 502 Citizens Trust Building, Paterson.

Paulsboro, N. J.—Local reports state bids desired until Dec. 7 by Board Education for erecting two-story brick and stone, 36 x 100 ft., school. Clyde S. Adams, 1509 Arch Street, Philadelphia, Pa., Archt.

Philadelphia, Pa.—Until Dec. 10 by Committee on Property Board Education (William Dix, Secy.) for erecting a 31-room school at B and Allegheny Avenues; also 9-room addition to school at Seventieth and Woodland Avenues.

Titusville, Pa.—Until Jan. 10 by James A. Wetmore, Acting Supervising Architect, Washington, D. C., for erecting U. S. Post Office advertised in Engineering Record.

Live Oak, Fla.—Until Dec. 14, by Board Public Instruction of Suwanee County, for erecting a school. Separate bids for heating and plumbing. Mark & Sheftall, 210 Clark Bldg., Jacksonville, Archts.

Nashville, Tenn. — City Commission passed bill appropriating $260,000 to erect east wing of high school. Address Board Education.

Cincinnati, Ohio.—Until Dec. 20 by Clerk Board Education for separate bids for erecting the Industrial Arts building, Tunnel K and power house; gymnasium, Tunnel J and stadium; in new East Side high school, Madison Road and Erie Avenue, Hyde Park. Bids desired as a whole or separately on excav., masonry and reinforced concrete, etc.; brick work; ornamental work; plumbing and gasfitting; electrical work, etc. Bids for labor and material must be stated separately. C. W. Handman, Bus. Mgr.

East Youngstown, Ohio.—Until Dec. 24 by A. C. Robinson, Clk. Board Education, 196 Reed Avenue, Youngstown, for furnishing material and erecting a twelve-room fireproof school in East Youngstown Dist. C. F. Owsley, Archt., Mahoning Natl. Bank Bldg., Youngstown.

Alton, Iowa.—Reported desired until Dec. 21, for erecting a 2-story and basement 63 x 92 ft. high and grade brick school. Probable cost $30,000. Beuttler & Arnold, Archts. Security Bank Bldg.

Arlington, Iowa.—Until Jan. 1, for erecting a three-story and basement 46 x 76 ft. brick and terra cotta school. Probable cost $35,000. H. E. Netcot, Archt., Independence.

Independence, Iowa.—Reported desired until Jan. 1 by Harry E. Netcott, Archt., Independence, for erecting a two-story, 38 x 120 ft., city hall. Probable cost $25,000.

Gaylord, Minn.—Plans and specifications reported desired until Jan. 4, County Board Commissioners, Henderson, for court house, jail and sheriff's residence to be erected at Gaylord. Cost, including furnishing, not to exceed $100,000. Frederick Hoppensted, Co. Aud., Henderson.

Stillwater, Minn.—Until Dec. 20, by State Board Control, St. Paul, for wrecking State Prison buildings at Stillwater.

St. Paul, Minn.—Reported desired until Dec. 13 by August Hohenstein, Purchasing Agent, for erecting Carnegie Library No. 1 in St. Anthony Park North.

Lincoln, Neb.—Until Dec. 15, by Board of Regents of the University of Nebraska, at office of J. S. Dales, Secy. Sta. A, Lincoln, for erecting a chemistry building on city campus of university. Separate bids for heating and ventilating, plumbing and vacuum cleaning, and electric wiring. Cost, including equipment, $200,000.

Same time and place as above for erecting hospital on grounds of University medical college in Omaha. Separate bids for heating and ventilating, plumbing, vacuum cleaning and electric wiring. Cost, including equipment, $130,000. Latenser & Sons, Archts., Omaha.

Houston, Tex.—Until Dec. 13, by City Secretary, for erecting the Montrose School Administration Building. Separate bids for heating, plumbing and wiring. Ben Campbell, Mayor.

Pueblo, Col.—Reported desired until Dec. 15 by Colorado State Board Corrections, Denver (I. B. Allen, Secy.), as a whole or separately, for erecting 3 buildings for Colorado State Insane Asylum, Pueblo. George H. Williamson, Denver; F. Barber, Colorado Springs, and William W. Stickney, Pueblo, Archts.

Los Angeles, Cal.—Until Dec. 9 by Board Education (William A. Sheldon, Secy.) for furnishing material and erecting high school on Thirty-eighth Street and Hooper Avenue, consisting of four buildings, as follows: Science and Art, Academic, Mechanics, and power house.

Norwalk, Cal.—Until Dec. 13 by W. F. McClure, State Engineer, Sacramento, for furnishing material and erecting laundry building at Norwalk State Hospital, near Norwalk.

San Diego, Cal.—Until Dec. 15 by Board Education (S. W. Belding, Secy.), for furnishing material and erecting a school on Block 111, Thirty-first and I Streets. Theo. C. Kistner, Archt., 814 American National Bank Building.

Safford, Ariz.—Plans and specifications reported desired until Dec. 6 by Benj. Blake, Co. Clk., Solomonsville, for 2-story and basement court house and jail. Probable cost $44,000.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Danvers, Mass.—Following are three lowest bids opened Nov. 22 by Essex County Agricultural Trustees at Salem for erecting school at Hathorne, Danvers:

L. H. McAleer, N. Andover, $66,220; Hayden Constr. Co., 9 Court Street, Boston, $64,000; J. A. Driscoll, N. Andover, $64,289.

★**Providence, R. I.**—Contracts for constructing Cole Avenue School (bids opened Nov. 10) awarded by Board Contract and Supply as follows:

★**General Construction**—William Wilkins, Providence, $122,000 (awarded contract). Next three lowest bidders: Horton & Hathaway, $123,200; Norcross Bros., Worcester, Mass., $125,500 and C. H. Tripp Co., Inc.

★**Heating**—Thomas Colgan Co., Providence, $23,974 (awarded contract). Next three lowest: M. F. Murphy, $25,500; P. & J. Thomas Co., $26,400 and Thomas E. Madden, $26,900.

★**Heating and Ventilating**—William E. Durfee, Providence, $14,974 (awarded contract).

★**Electrical Work**—Seamans & Potter, Providence, $7,800 (awarded contract).

Buffalo, N. Y.—Following are lowest bids opened Nov. 14 by Buffalo City Hospital Commission for erecting buildings at West Park, also General contract, Judge Baker Long, Worcester, Mass., $727,000; heating and power plant, Fitzpatrick & Fletcher, Columbus, $67,000; plumbing, Farrell & Gilbert, Buffalo, $45,-000; electrical work, Bass Electrical Co., Buffalo, $25,000. Green & Wicks, Architects, 116 Franklin Street.

★**Salamanca, N. Y.**—Contract for constructing U. S. Post Office awarded Durro-Hite Co., Buffalo, at $47,000.

★**Jersey City, N. J.**—Contracts in connection with the repairs and awarded by the Owners' Freeholders as follows: Heating, W. H. & F. W. Crane, New York, at $43,500; electrical work, Post & Powers, New York, at about $9,000; plumbing laid over until Dec. 6. Bids for general construction readvertised see Bids Desired."

★**Duquesne, Pa.**—Contract awarded Foster-Wagner Company, Hamilton Building, Pittsburgh, for erecting two-story and basement addition to Works on Virginia Street for Duquesne University, cost $25,000.

★**East Pittsburgh, Pa.**—Contract for constructing U. S. Post Office awarded Tarbert Constr. Co., Hampton, Va., at $49,-[illegible].

★**Richmond, Va.** — Contract reported awarded by Police Board to J. T. Sizemore, Richmond, at $41,000 for erecting two-story brick station house in Second East, at South and Marshall Streets.

★**Columbus, Ohio**—Contract awarded by Board Trustees Ohio State University (bids opened June 30) to Dawson Constr. Co., Key Building, Pittsburgh, Pa., for erecting fuel and shop building and $40,000 Home for Nurses' Hospital.

Elyria, Ohio.—Following are four lowest bids opened Nov. 15 by Supervising Architect, Washington, D. C., for constructing U. S. Post Office: (a) Insurance Co. of North America, Philadelphia, Pa., for erecting fuel and shop building, $40,000; Home for Nurses' Hospital, $40,000; (b) Fidelity & Co., Missouri, (a) $39,000; (b) $39,000; Bates Constr. Co., 1141 Monadnock Block, Chicago, Ill., (a) $37,000; (b) $37,000; Charles W. Gindele Co., 1800 S. La Salle Street, Chicago, Ill., (a) $37,000; (b) $37,000; W. P. Fuller & Co., Mercantile Building, New York, N. Y., (a) $36,000; (b) $36,000; Emma L. Johnson & Co., 105 E. Superior Street, Duluth, Minn., (a) $35,000; (b) $35,000.

★**Van Wert, Ohio.**—Contract for constructing U. S. Post Office awarded Charles W. Gindele Co., 1800 S. La Salle Street, Chicago, Ill., at $34,500.

★**Centerville, Iowa.**—Contract rejected awarded H. E. Stone Supply Co. of Centerville to erect at Joseph's Mercy Hospital at about $40,000, including equipment.

St. Paul, Minn.—Lowest bid opened Nov. 16 by State Board of Control for erecting Minnesota Historical Society building approved by Chief Engineer, St. Paul, at $60,000, and for plumbing, C. M. McCrory, St. Paul, at $4,000; C. H. Johnson, Minneapolis, $4,100; Hall

★**Carlsbad, Tex.**—Following are bids opened Nov. 2 by J. E. M. Lenert, Superintendent, for erecting the buildings at the Texas Tuberculosis Sanitarium: H. P. A. C. M. Texas, Dallas, $47,000 (awarded contract); Watson Co., Dallas, $46,000; H. C. Hudgins, Dallas, $45,-000; and P. M. Kinnaman, Fort Worth, $46,200.

★**El Paso, Tex.**—Contract for erecting court house at Pecos awarded to J. H. Morgan, El Paso, at $34,000.

★**New Braunfels, Tex.**—Contract for constructing U. S. Post Office awarded Wagner & Krueger, San Antonio, at $40,000.

★**Berkeley, Cal.**—[illegible] for gymnasium for the University of California, to be erected on the campus at Berkeley, awarded Lindgren & Swinerton, San Francisco, at $[illegible].

★**Los Angeles, Cal.**—Following are four lowest bids opened by Harbor Engineer, San Pedro, for erecting Bathhouse No. 1 on Municipal Pier No. 1, Los Angeles Harbor: Scully & Dennebaum Co., 312 Van Nuys Building, Los Angeles, $117,[illegible]; Lee Lumber Co., Los Angeles, $119,[illegible]; Fred L. Somers, Los Angeles, $120,[illegible]; and Western Pacific Building & Engineering Co., San Francisco, $123,[illegible]. City is to furnish all materials. S. A. Jabb, Assistant Harbor Engineer.

★**Visalia, Cal.**—Contract for erecting Municipal Auditorium reported awarded Trowbridge & Shields of Fresno at $53,000.

Boise, Idaho.—Following are four lowest bids opened Nov. 18 by Supervising Architect, Washington, D. C., for constructing extension, etc., to U. S. Post Office: Welch Bros. & Hannaman, Gridley, Cal., $[illegible]; R. E. Campbell, Salt Lake City, Utah, $44,687; Frank M. Weakley, Portsmouth, Va., $45,[illegible]; North Pacific Constr. Co., Pocatello, $46,125.

PRIVATE BUILDINGS

PROPOSED WORK.

Biddeford, Maine.—Reported warehouse of Pepperell Manufacturing Company, Biddeford recently destroyed by fire, will be rebuilt cost $100,000.

New Haven, Conn.—**A. V. Van Beuren,** 167 E. Rock Road, intends erecting residence on Beaver Hills to be fireproof, hollow tile construction, cost $25,000.

Buffalo, N. Y.—**Plans being prepared by** Brown & Hoffman, 778 Genesee Street, for clubhouse addition, two stories and basement, structural steel and brick, for Columbus Turnverein, estimated cost $65,-000. **Charles North, Secy., 1261 Genesee Street.**

New York, N. Y.—**Plans filed for erection of following buildings:** Nine-story apartment house at 41 W. Eighty-second Street, **for Grey Court Realty Co.,** cost $[illegible],000; Schwartz & Gross, Archts., 347 Fifth Avenue; **seven-story hotel at Thirty-sixth Street and Ninth Avenue, for Wm. S. Coffin,** cost **$95,000, Hill & Stout, Archts., 299 Madison Avenue;** five-story brick tenement at 160th Street and Melrose Avenue, for Samax Constr. Co., cost $50,000, Chas. Schaefer, Jr., Archt., 401 Tremont Avenue; five-story brick tenement at Daly Avenue and 181st Street, for Reva Realty Co., cost $75,000, Goldner & Goldberg, Archts., 391 E. 149th Street; **five-story brick tenement at Crotona Avenue** and 179th Street, for C. & P. Realty Cor., cost $75,000, Geo. F. Pelham, Archt., 30 E. Forty-second Street; five-story brick tenement at Intervale and Westchester Avenues, for Harxton Building Co., cost $50,000, Harry T. Howell, Third Avenue and 149th Street; five-story brick tenement at Olmstead and Haviland Avenues, for John W. Dick Co., cost $55,-000, M. W. del Gaudio, Archt., 401 Tremont Avenue; one-story brick stores and theater at Fordham Road and Grand Concourse, for Fordham Road Cor., cost $75,-000, Gronenberg & Leuchtag, Archts., 303 Fifth Avenue.

Plans being prepared by Shape & Brady, 220 West Forty-second Street, for eight-story studio apartment building to be erected at 42 West Sixty-seventh Street.

Plans completed by N. Serracino, 1170 Broadway, for nine-story brick, limestone and granite office building to be erected at Third and Brook Avenues by A. Pasquini, owner and builder.

Stapleton, S. I., N. Y.—Plans filed for two-story brick theater to be erected at Bay and Wave Streets, for John K. Burke and Lee Plunkett; cost $75,000. Herbert R. Brewster, Archt., 116 Nassau Street, New York City.

West New York (P. O. Weehawken), N. J.—**Oscar Millimet, West New York, intends erecting two five-story brick apartments at Thirteenth Street and Hudson Avenue; cost $63,000.**

Easton, Pa.—Camp No. 542, P. O. S. of A. will erect $16,000 lodge building at Seventeenth and Washington Streets.

New Kensington, Pa.—Janssen & Abbott, Century Building, Pittsburgh, are architects for two-story, brick and stone clubhouse contemplated for employees of Aluminum Company of America, Eleventh Street, cost about $100,000.

Philadelphia, Pa.—**Mount Carmel Methodist Episcopal Church** contemplates erecting edifice at Broad Street and Norrisville Boulevard cost $75,000.

Plans being prepared by Johnson Lea Perot, 24 South Seventeenth Street, for twelve-story, reinforced concrete and steel, 100 x 110 ft., office building, cost $[illegible],000.

Petersburg, Va.—**Eagles contemplating** erecting $20,000 building.

Wellsburg, W. Va.—M. L. Wells, Wellsburg, is architect for three-story, fireproof, brick and stone temple contemplated for Lodge No. 2 A. F. & A. Masons, cost about $45,000.

Cleveland, Ohio.—Plans being prepared by Fulton & Porter, Columbus, Pa., for brick and stone addition to be erected on Pennsylvania Drive and Superior Avenue for Immanuel Baptist Church, cost $150,000. Rev. James McAllister, Pastor.

Toledo, Ohio.—Thomas E. Huber, Nasby Building, is architect for ten-story, fireproof concrete and steel hotel to be erected on site of Niagara Hotel, Summit and Madison Avenues, for Col. Thomas H. Wilson, cost about $[illegible],000. Contract for steel work has been let.

Warsaw, Ind.—Masons contemplating erecting in spring new temple at Center and Washington Streets; probable cost $25,000.

East St. Louis, Ill.—Plymouth Cordage Co., Plymouth, Mass., will erect $100,000 fireproof warehouse at Twenty-second Street and Piggott Avenue.

Urbana, Ill.—Reported Big Four Railroad Co. (C. A. Paquette, Ch. Engr., Cincinnati, Ohio) will erect passenger station here, costing $45,000.

Estherville, Iowa.—Masons considering erecting temple on Lincoln and Ninth Streets.

Waterloo, Iowa.—Mortimer B. Cleveland, Archt., Waterloo, reports contract about to be let for erecting $30,000 Sacred Heart Parochial School on West Fifth Street.

Albert Lea, Minn.—Danish Lutheran Church contemplates erecting new edifice on present site.

Minneapolis, Minn.—Plans being prepared by Chapman & Magney, 84 S. Tenth Street, for automobile warehouse and salesroom to be erected at Hennepin Avenue and Tenth Street for H. E. Pence, 1820 Colfax Avenue S.; cost $250,000.

Melin Brothers Co., 323 Place Street, will erect eight three-story apartment buildings on Powderhorne Terrace; estimated cost $168,000.

Kees & Colburn, Donaldson Building, are architects for twelve-story, steel, granite, brick and terra cotta Pantages Theater to be erected for Hennepin Holding Co. at Seventh and Hennepin Avenues.

Rochester, Minn. — Congregational Church reported planning erecting new edifice; $30,000 available.

Lincoln, Neb.—Lincoln Terminal Co., in which W. E. Sharp, President of Lincoln Traction Co., is interested, intends erecting a ten-story, steel, terra cotta and granite, 142 x 85 ft., building, to be known as "Terminal Building."

Beaumont, Tex. — Plans being prepared by Cooke & Co., Prince Theatre Building, Houston, for $200,000 hotel contemplated here.

Ardmore, Okla.—Reported plans being prepared for new depot to replace one recently destroyed here for Gulf, Colorado & Santa Fé Railway Co. (F. Merritt, Ch. Engr., Galveston, Tex.); cost about $25,000.

Oklahoma City, Okla.—Fort Smith & Western Ry. (B. F. Beckman, Engr., Fort Smith, Ark.) is reported planning constructing a passenger and freight terminal here.

Seattle, Wash.—Plans being prepared by H. Ryan, Northern Bank Bldg., for three-story, 80 x 120 ft., brick apartment house to be erected early next year on Capitol Hill; cost $50,000.

Spokane, Wash.—Reported plans prepared for five-story, 100 x 150 ft., warehouse to be erected early next year for E. H. Stanton Co.; cost $100,000.

Bay City, Ore.—Bay View Hotel, reported destroyed by storm, will be rebuilt.

Portland, Ore.—Reported Multnomah Camp No. 77, Woodmen of the World, will erect fireproof lodge building on East Sixth and East Washington Streets; cost $100,000.

Riverview, Ore.—Reported plans being prepared by Lawrence & Holford, Chamber of Commerce Building, Portland, for proposed mausoleum to be erected here for Portland Mausoleum Co., Spalding Building, Portland; to be reinforced concrete and granite construction; cost $65,000.

BIDS DESIRED.

Davenport, Iowa.—Reported desired until Dec. 15 by George D. Stanhuhar, Archt., 608 Best Building, Rock Island, Ill., for erecting 3-story and basement, 50 x 110 ft., reinforced concrete senior hall, dormitories and chapel, for St. Ambrose College, W. Lucas Street; probable cost $75,000. Rev. William Hannan, Pres. of College.

Colwich, Kan.—Reported desired until Dec. 7 by H. W. Brinkman, Archt., Stout Bldg., Emporia, and Rev. Father Ernst, Colwich, for erecting a story and basement Roman Catholic church at Colwich. Probable cost $25,000.

PRICES AND LETTINGS.

★Indicates award of contract.

★**New York, N. Y.**—William L. Crow Constr. Co., Orange Street and Broadway, Albany, are contractors for six-story store and office building to be erected at 24 East Forty-second Street for William Decatur Parson; estimated cost $50,000. H. L. Walker, Archt., 103 Park Avenue.

★**Baltimore, Md.**—Contract for erecting office building for Consolidated Gas, Electric Light & Power Company, at Liberty and Lexington Streets, reported awarded George A. Fuller Company, 111 Broadway, New York, and for steel to American Bridge Company, 30 Church Street, New York.

★**Charlotte, N. C.**—Contract awarded by Central Realty Co. to Travers-Wood Co., Charlotte, for erecting reinforced concrete automobile building on West Trade Street; cost about $45,000.

★**Athens, Ohio.**—Contract awarded Bart Davidson, Athens, at $29,500 for erecting edifice at Congress and West State Streets for Christian Church.

★**Cincinnati, Ohio.**—Contract awarded H. Harig & Co., 31 East Fourth Street, for erecting ten-story addition to building of Provident Savings Bank & Tust Co., at Seventh and Vine Streets. Harry Hake, Archt., Telephone Building.

★**Fort Wayne, Ind.**—Contract for erecting two and three-story, 220 x 58 ft., brick building on Harrison Street, for Fort Wayne Land & Improvement Co., reported awarded Indiana Engineering & Constr. Co., Fort Wayne.

★**Waterloo, Iowa.**—Contract awarded H. A. Maine Co., Waterloo, to erect four-story and basement, brick, terra cotta, reinforced concrete garage at East Fourth and Franklin Streets for Waterloo Overland Co.; cost $135,000.

★**Wichita, Kan.**—Contract for erecting administration building for Y. W. C. A. awarded Swenson Construction Company, Kansas City, Mo.; cost about $65,000. H. S. Conrow, Archt., Wichita.

★**Havre, Mont.**—Contract for erecting Masonic Temple reported awarded Lease & Richards of Havre; cost $75,000. Link & Hare, Helena, and F. F. Boussout, Havre, Associate Architects.

NEW INDUSTRIAL PLANTS

PROPOSED WORK.

Norwich, Conn.—Joseph Hall, 24 Broad Street, contemplates erecting two-story, 50 x 130 ft., and two-story, 34 x 74 ft., additions to factory at Trading Cove.

Putnam, Conn.—Manhasset Mfg. Co., 83 Canal Street, will erect two-story, 120 x 180 ft. brick addition to plant.

Binghamton, N. Y.—Ansco Co., manufacturer of photographic apparatus, etc., has engaged J. G. White Engineering Corporation, 43 Exchange Place, New York, N. Y., for engineering and construction of extensions and improvements to their power plant.

Buffalo, N. Y.—William H. Donner, President of Cambria Steel Co., Philadelphia, Pa., reported to have purchased plant of New York State Steel Co., on Buffalo River, Lackawanna R. R. and Abbott Road, and will build ore dock and install unloaders.

Dansville, N. Y.—Blum Shoe Company, Spruce and Milton Streets, contemplates erecting four-story addition south of present plant.

Falconer, N. Y.—Plans being prepared for concrete, 50 x 100 ft., brass foundry for Ellison Brass Mfg. Co.

Lockport, N. Y.—Plans being prepared for factory for Fibre Corporation to be erected, next spring, on Mill Street, to replace building destroyed by fire; estimated cost $50,000.

North Tonawanda, N. Y.—Rand Company, 97 Goundry Street, plans erecting additions to plant.

Rome, N. Y.—Rome Wire Works (H. T. Dyett, Pres.) will erect a 100 x 300 ft., one-story, fireproof addition to its plant for purpose of manufacturing copper rods.

Harrison, N. J.—Driver-Harris Wire Co. intends erecting brick and steel addition to plant; cost $24,000.

Danville, Pa.—The reorganization of Danville Structural Tubing Co., remodeling present plant and erecting in spring a new mill to cost $600,000 contemplated.

Oakmont, Pa.—Plans being prepared by Stearns & Castor, Stephen Girard Building, Philadelphia, for three-story, brick and concrete, 150 x 300 ft., factory, to be erected here for Autocar Co. of Ardmore.

Olney, Pa.—Plans completed and contract soon to be let by Puckert & Wunder, Engrs. and Archts., 310 Chestnut Street, Philadelphia, Pa., for erecting ice manufacturing and cold storage plant on Duncannon and Mascher Streets for Olney Ice Mfg. & Cold Storage Co., to be 80 x 140 ft., brick, steel and concrete.

Reading, Pa.—Plans being prepared by F. A. Muhlenberg, of Reading, for factory contemplated on South Eighth and Bingaman Streets for Pennsylvania Optical Company, 125 S. Fifth Street.

Hickory, N. C.—Hickory Manufacturing Company reported will rebuild $175,000 plant destroyed by fire.

New Bern, N. C.—Reported shops of Norfolk Southern R.R. Co., recently destroyed by fire, will be rebuilt. F. L. Nicholson, Ch. Engr., Norfolk, Va.

Cincinnati, Ohio. — Reported Peters Cartridge Company, First National Bank Building, will erect $200,000 building in connection with its powder plant on Little Miami River.

Cleveland, Ohio. — Preliminary plans being prepared by W. C. Owen & Co., 449 Leader-News Building, for reinforced concrete, brick and steel rubber factory; cost $40,000.

Plans being prepared by W. S. Ferguson, 1900 Euclid Avenue, for office and factory building to be erected on Taft Avenue for Great Lakes Refining Company, Beckman Building; cost about $50,000.

Dayton, Ohio.—Plans being prepared by Frank Hill Smith, Dayton, for addition to plant of Reynolds & Reynolds, Washington and Dudley Streets; cost approximately $20,000.

Hamilton, Ohio.—A plant costing $80,000 is contemplated by Hamilton Otto Coke Company for purpose of extracting light oils from tar and ammonia.

Joliet, Ill.—Additions costing about $100,000 contemplated to plant of Bates Machine Co., Henderson Avenue and Jackson Street.

Kansas City, Mo.—Chevrolet Motor Company reported contemplating erecting $750,000 plant here.

Northport, Wash.—Reported Northport Smelting & Refining Co. will erect additional smelter; cost about $200,000.

Spokane, Wash.—Enlarging plant of Western Soap Co. reported contemplated; cost $20,000.

Oakland, Cal.—Reported contract soon to be let for $200,000 factory contemplated here for Chevrolet Automobile Company (Norman De Vaux, Mgr.).

BIDS DESIRED.

New Orleans, La.—Until January 5, by Board Port Commissioners, 200 New Orleans Court Building, for constructing a reinforced-concrete elevator of about 1,000,000 bu. capacity, with its equipment, except as specified and including marine tower, about 1500 ft. of convey galleries on east bank of Mississippi River, between Soniat and Val Mont Streets, advertised in Engineering Record. Ford, Bacon & Davis, Engineers, 921 Canal Street.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Lawrence, Mass.**—L. E. Locke, Lawrence, is contractor for two-story mill to be erected on South Union Street for William Whitman Co.; cost approximately $140,000.

★**New Britain, Conn.** — Contract for erecting $20,000 addition to plant of Hart & Cooley Mfg. Co. reported awarded B. H. Hibbard Co., New Britain.

★**Waterbury, Conn.**—Contract awarded Turner Constr. Co., 11 Broadway, New York, for constructing an oil storage building for Scovill Mfg. Co. on Hamilton Avenue, to be 230 x 25 ft., part one and part two stories, reinforced concrete construction.

★**Buffalo, N. Y.**—Contract awarded Charles F. Ernst Sons Co. for structural steel for two and one-half-story, 60 x 92 ft., brick and steel addition to packing plant of C. Klinck Packing Company, William Street and Erie R. R. Remainder of work to be done by day labor by owners.

★Contract awarded John A. Zoll, 398 Bird Avenue, for erecting grain elevator and four-story, 55 x 71 ft., warehouse addition to plant of Eldad Milling Company, Seneca Street and Nickel Plate R. R.; cost $30,000.

★**Bayonne, N. J.**—Contract awarded Turner Constr. Co., 11 Broadway, New York, by Vacuum Oil Co. for constructing filter building at Bayonne, three stories, octangular in shape, reinforced concrete construction, hollow tile curtain walls.

★**Jersey City, N. J.**—Contract awarded John N. Gill & Co., Philadelphia, Pa., for erecting three-story reinforced concrete factory for Davis-Bournonville Co., Van Wagenen Avenue; cost about $70,000. Nen & Thames, Archts., Philadelphia, Pa.

★**Coatsville, Pa.** — Contract awarded United Engineering & Foundry Co., 234 S. Phelps Street, Youngstown, Ohio, for erecting plate mill here for Lukens Iron & Steel Co.

★**Philadelphia, Pa.**—Contract awarded Irwin & Leighton, 126 N. Twelfth Street, for erecting four-story brick, steel and concrete, 89 x 98 ft., electric truck shop on Eighteenth and Buttonwood Streets, for Baldwin Locomotive Works, Broad and Spring Garden Streets.

★**Wilmington, Del.**—Contract reported awarded Fred A. Havens Co., 845 N. Nineteenth Street, Philadelphia, Pa., for erecting one-story brick and concrete, 50 x 120 ft., paint shop and rigger's loft; repairs to boiler shop; reinforced concrete foundations for crane and brick stacks for Harlan & Hollingsworth; cost $80,000.

★**Columbus, Ga.**—Contract reported awarded T. C. Thompson Company of Greenville, S. C., for erecting additions to plant of Bibb Manufacturing Company, Thirty-second and River Streets; cost, including equipment, about $300,000.

★**Watseka, Ill.**—Contract for erecting 50,000 bu. capacity grain elevator here awarded Burrell Engineering & Constr. Co., 323 S. La Salle Street, Chicago; cost approximately $20,000.

MISCELLANEOUS

PROPOSED WORK.

Subway — Boston, Mass. — All bids opened Oct. 22 for constructing footway, consisting of subway under New York, New Haven & Hartford R. R., with approaches at Ainsworth Street, West Roxbury, have been rejected. Edward J. Murphy, Comr. Pub. Wks.

Power Plant—Buffalo, N. Y.—The Buffalo General Electric Co. (Charles R. Huntley, President) is having plans prepared for an electric power generating plant, to be operated by steam, to be constructed on Niagara River, north of Buffalo; estimated cost $1,500,000 for site, building and equipment. Capacity of plant to be 100,000 hp.

Subway—Meridian, Miss.—The city and the officials of the railroads entering the city have reached an agreement whereby a subway is to be constructed to the south side of Twenty-sixth Street at a cost of $100,000.

Park Bonds—Bartlesville, Okla.—Local reports state bonds for $50,000 will be sold Dec. 14 for park site improving park and constructing incinerator. For further information address City Clerk.

Park Bonds—Cincinnati, Ohio.—Reported Sinking Fund Trustees will sell $1,500,000 park bonds.

Transmission Line—Poplar Grove, Ill.—Reported Illinois Northern Utilities Co., Dixon, will construct an electric transmission line from Capron to Poplar Grove.

Transmission Lines—Prescott, Ariz.—Arizona Power Co. (M. V. Watson, Manager, Prescott) will build power house on Fossel Creek and construct transmission lines; cost $300,000.

BIDS DESIRED.

Fire Escapes—Albany, N. Y.—Until Dec. 6, by Board Contract & Supply (Isidore Wachsman, Secy.), for delivering and erecting fire escapes on Schools Nos. 1 and 17.

Asphalt Tank—Brooklyn, N. Y.—Until Dec. 9 by Louis H. Pounds, Borough President, for furnishing material and constructing a steel tank and fittings having a capacity of 52,800 gals. to be used for storage of liquid asphalt at municipal asphalt plant, Seventh Street Basin, Gomanus Canal. Security, $1,500.

Elevator—New York, N. Y.—Until Dec. 10 by Board of Health (Haven Emerson, M.D., Pres.) for furnishing material and installing, together with all necessary alterations and other work incidental thereto, an additional elevator in the measles pavilion on the grounds of Willard Parker Hospital, foot of E. Sixteenth Street, Borough Manhantaan.

Cleaning Plant—Secaucus, N. J.—Until Dec. 9 by County Board Chosen Freeholders Jersey City (Walter O'Mara, Clk) for constructing cleaning plant at Tuberculosis Hospital and additions, Secaucus.

Cement—Baltimore, Md.—Reported desired until Dec. 8 by Board of Awards for furnishing Portland cement during year 1916. R. F. Cooksey, Highway Engineer.

Elevators — Washington, D. C.—Until Dec. 23 by James A. Wetmore, Superv. Archt., Washington, D. C., for installing complete an electric passenger elevator in each of following post office buildings: Pendleton, Ore.; Brattleboro, Vt., and Ardmore, Okla.

Soldiers' Memorial—Lebanon, Ohio.—Until Dec. 20 by Board County Commissioners (M. E. Rose, Clk.) for erecting Soldiers' and Sailors' Memorial structure. Bids for labor and material must be stated separately. Bausmith & Drainie, Archts., Gerke Building, Cincinnati.

Stairway—St. Paul, Minn.—Reported desired until Dec. 6 by August Hohenstein, Purchasing Agent, for constructing steel stairway on Hall Avenue between Wabasha Street and Prospect Terrace.

Cement—Kansas City, Mo.—Until Dec. 21 by Purchasing Officer for furnishing asphaltic cement for a period of one year, estimated at 1000 tons, advertised in Engineering Record.

Mixing Apparatus—Toronto, Ont.—Until Dec. 7 by T. L. Church (Mayor), Chmn. Bd. Control, for erecting mechanical mixing apparatus for the low level chlorination plant, Eastern Avenue and Don River, and for the high level chlorination plant at Wilton Avenue and Don River.

Proposals

For Proposals Advertised, see Pages 42 and 43.

WATERWORKS.

Bids Close.		See Eng. Record.
Dec. 6.	Pumps, Highland Park, Mich.	Nov. 20
	Adv. Nov. 20, 27.	
Dec. 7.	Water Works, Wesson, Miss.	Nov. 13
Dec. 7.	Pipe Fittings, Washington, D. C.	Nov. 13
Dec. 8.	Pumps, Valves, Etc., Panama	Nov. 27
Dec. 8.	Chlorine Gas, Buffalo, N. Y.	Dec. 4
Dec. 9.	Bridge for main, Covington, Ky.	Nov. 13
	Adv. Nov. 13.	
Dec. 9.	Pump, Pipe, Etc., Secaucus, N. J.	Dec. 4
Dec. 10.	Water Works, East Youngstown, Ohio.	Nov. 30
	Adv. Nov. 20.	
Dec. 10.	Chimney, Ord, Neb.	Dec. 4
Dec. 10.	System, Ridgefield, Wash.	Dec. 4
Dec. 11.	Aluminum Sulphate, Richmond, Va.	Dec. 4
	Adv. Dec. 4.	
Dec. 13.	Pumps, Etc., Panama...	Dec. 4
Dec. 14.	Improvements, Wilberforce, Ohio	Nov. 20
Dec. 14.	System, South Charleston, Ohio.	Dec. 4
	Adv. Dec. 4.	
Dec. 14.	Wells, etc., Hamilton, Ohio.	Dec. 4
Dec. 15.	Pumping Station, Albion, Mich	Dec. 4
Dec. 15.	Piping, Etc., Winnipeg, Man.	Dec. 4
Dec. 17.	Improvements, Lakeland, Fla.	Dec. 4
Jan. 11.	Filter Plant, St. Hyacinthe, Que.	Dec. 4
———	System, Wooster, Ohio..	Nov. 20
	Adv. Nov. 20.	

SEWERAGE AND SEWAGE DISPOSAL.

Jan. 6.	Mason City, Iowa.....	Dec. 4
	Adv. Dec. 4.	
Dec. 7.	Ridgefield Park, N. J....	Nov. 27
	Adv. Nov. 27, Dec. 4.	
Dec. 7.	Toronto, Ont.	Dec. 4
Dec. 8.	Harbor Beach, Mich.....	Dec. 4
Dec. 8.	Philadelphia, Pa.	Dec. 4
Dec. 8.	Baltimore, Md.	Dec. 4
Dec. 8.	Needham, Mass.	Dec. 4
Dec. 9.	New Dorp, S. I., N. Y...	Dec. 4
Dec. 9.	Buffalo, N. Y.	Dec. 4
Dec. 13.	Belle Plaine, Minn.....	Dec. 4
Dec. 14.	Cuyahoga Falls, Ohio....	Dec. 4
Dec. 14.	Cincinnatti, Ohio.	Dec. 4
Dec. 15.	Hampton, Iowa.	Dec. 4
Dec. 16.	Cherryvale, Kan.	Dec. 4
Dec. 21.	Strawberry Point, Iowa..	Nov. 20
Jan. 4.	Key West, Fla.....	Dec. 4
———	Parkersburg, Pa.	Oct. 9
	Adv. Oct. 9.	

BRIDGES.

Dec. 7.	Canton, China	Oct. 23
	Adv. Oct. 23.	
Dec. 7.	Wathena, Kan.	Nov. 20
Dec. 7.	Pennsylvania	Nov. 20
Dec. 7.	Fredonia, Kan.	Nov. 27
Dec. 7.	Sullivan, Ind.	Nov. 27
Dec. 7.	Visalia, Cal.	Dec. 4
Dec. 8.	Lorain, Ohio.	Nov. 20
Dec. 8.	New Gretna, N. J.....	Nov. 20
Dec. 8.	Ada, Mich.	Nov. 27
Dec. 9.	Covington, Ky.	Nov. 13
	Adv. Nov. 13, 20.	
Dec. 9.	Bakersfield, Cal.	Nov. 20
Dec. 9.	New York, N. Y.....	Nov. 27
Dec. 9.	Lansing, Mich.	Dec. 4
Dec. 13.	Selma, Ala.	Nov. 20
Dec. 14.	Sunbury, Pa.	Nov. 27
Dec. 14.	Camptown, Pa.	Dec. 4
Dec. 14.	Philadelphia, Pa.	Dec. 4
Dec. 14.	Lawrence, Kan.	Dec. 4
Dec. 15.	Illinois	Dec. 4
Dec. 17.	Illinois	Dec. 4
Dec. 18.	Tekamah, Neb.	Dec. 4
Dec. 21.	Atlanta, Ga.	Dec. 4
Dec. 21.	Phoenixville, Pa.	Dec. 4
	Adv. Dec. 4.	

PAVING AND ROADS.

Dec. 6.	Princeton, W. Va.....	Nov. 13
	Adv. Nov. 13, 20.	
Dec. 7.	Excelsior, Minn.	Nov. 13
Dec. 7.	Indiana	Nov. 20
Dec. 7.	Buffalo, N. Y.	Dec. 4
Dec. 8.	Indiana	Nov. 20
Dec. 8.	Indiana.	Nov. 27
Dec. 8.	Des Moines, Iowa.....	Dec. 4
Dec. 10.	Seattle, Wash.	Nov. 20
Dec. 10.	Indiana.	Nov. 27
Dec. 10.	Pine City, Minn.....	Dec. 4
Dec. 11.	Washington, Ohio	Dec. 4
Dec. 13.	Pasadena, Cal.	Nov. 27
Dec. 13.	Bolton, Miss.	Dec. 4
Dec. 13.	St. Paul, Minn.	Dec. 4
Dec. 14.	Bay Minette, Ala.....	Dec. 4
Dec. 14.	Bonds, Nogales, Ariz....	Nov. 27
	Adv. Nov. 27, Dec. 4.	
Dec. 15.	Angola, Ind.	Dec. 4
	Adv. Dec. 4.	
Dec. 15.	Starkville, Miss.	Dec. 4
	Adv. Dec. 4.	
Dec. 16.	Miami, Fla.	Dec. 4
Dec. 20.	Washington	Nov. 27
Dec. 20.	Prosser, Wash.	Dec. 4
Dec. 21.	Seattle, Wash.	Dec. 4
Jan. 8.	Maynardsville, Tenn.	Nov. 20
Jan. 13.	Sault Ste Marie, Mich...	Dec. 4

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS.

Dec. 6.	Pier, Philadelphia, Pa. ...	Nov. 13
	Adv. Nov. 13, 20.	
Dec. 8.	Levee Work. New Orleans, La.	Dec. 4
Dec. 8.	Wall, Portsmouth, Ohio.	Dec. 4
Dec. 10.	Ditches, Marion, Ark....	Nov. 27
Dec. 10.	Seawall, Seattle, Wash..	Dec. 4
Dec. 11.	Dredging, Brooklyn, N. Y.	Nov. 20
Dec. 13.	Clay Puddle Wall, Riverside, Ill.	Dec. 4
Dec. 14.	Dredging, New York, N. Y.	Nov. 13
	Adv. Nov. 13 to Dec. 4.	
Dec. 14.	Ditch, Tempe, Ariz.....	Dec. 4
Dec. 14.	Levee, Kansas City, Kan.	Dec. 4
Dec. 15.	Ditch, Bemidji, Minn....	Nov. 27
Dec. 18.	Dredging, Washington, D. C.	Dec. 4
	Adv. Dec. 4.	
Dec. 18.	Ditch. Mankato, Minn..	Dec. 4
Dec. 20.	Harbor Work, Miami, Fla.	Nov. 27
Dec. 20.	Irrigation, Barstow, Tex.	Dec. 4
Dec. 22.	Dock. Miami, Fla.	Dec. 4
	Adv Dec. 4.	
Dec. 31.	Breakwater, Fort Taylor, Fla.	Dec. 4
	Adv. Dec. 4.	
Jan. 5.	Grain Elevator. New Orleans, La.	Dec. 4
	Adv. Dec. 4.	
Jan. 8.	Dredge, Macaco, China...	Nov. 6

PUBLIC BUILDINGS AND SCHOOLS.

Dec. 7.	Titusville, Fla.	Nov. 20
Dec. 7.	St. Joseph, Mich.....	Nov. 27
Dec. 7.	Rockford, Ill.	Nov. 27
Dec. 7.	Omaha, Neb.	Nov. 27
Dec. 8.	Minneapolis, Kan.	Nov. 20
Dec. 8.	Seattle, Wash.	Nov. 20
Dec. 8.	Rock Springs, Wyo.....	Nov. 27
Dec. 9.	Lebanon, Ind.	Nov. 6
Dec. 9.	Los Angeles, Cal.....	Dec. 4
Dec. 10.	Greenwich, Conn.	Nov. 6
Dec. 10.	Boston, Mass.	Nov. 27
Dec. 10.	Philadelphia, Pa.	Dec. 4
Dec. 11.	Boston, Mass.	Dec. 4
Dec. 13.	Cincinnati, Ohio	Nov. 20
Dec. 13.	Akron, Ohio	Nov. 27
Dec. 13.	Sacramento, Cal.	Dec. 4
Dec. 13.	Houston, Tex.	Dec. 4
Dec. 13.	St. Paul, Minn.	Dec. 4
Dec. 14.	New Philadelphia, Ohio..	Nov. 20
Dec. 14.	Gastonia, N. C.	Dec. 4
Dec. 14.	Live Oak, Fla.....	Dec. 4
Dec. 15.	Centerville, Iowa	Nov. 27
Dec. 15.	Plattsburg, Mo.	Nov. 27
Dec. 15.	Lincoln, Neb.	Dec. 4
Dec. 15.	Davenport, Iowa	Dec. 4
Dec. 15.	Pueblo, Col.	Dec. 4
Dec. 15.	San Diego, Cal.	Dec. 4
Dec. 18.	Middletown, Ohio.	Nov. 13
	Adv. Nov. 13, 20.	
Dec. 20.	Humboldt, Tenn.	Nov. 13
Dec. 20.	Cincinnati, Ohio	Dec. 4
Dec. 20.	Paterson, N. J.	Dec. 4
Dec. 20.	Jersey City, N. J.....	Dec. 4
Dec. 21.	Attleboro, Mass.	Nov. 20
Dec. 21.	Alton, Iowa	Dec. 4
Nov. 22.	Aurora, Neb.	Nov. 20
Dec. 24.	East Youngstown, Ohio..	Dec. 4
Dec. 28.	Seymour, Conn.	Nov. 20
Dec. 29.	Missoula, Mont.	Nov. 27
Dec. 30.	St. Petersburg, Fla.....	Nov. 20
	Adv. Nov. 20, 27.	
Dec. 30.	Galveston, Tex.	Nov. 27
Dec. 30.	Ridgway, Pa.	Nov. 27
Jan. 1.	Arlington, Iowa	Dec. 4
Jan. 1.	Independence, Iowa	Dec. 4
Jan. 4.	Cavite, P. I.	Nov. 13
Jan. 4.	Greenville, S. C.	Nov. 27
Jan. 4.	Gaylord, Minn.	Dec. 4
Jan. 5.	Harlan, Iowa	Nov. 27
Jan. 10.	Titusville, Pa.	Dec. 4
	Adv. Dec. 4.	

PRIVATE BUILDINGS.

Dec. 10.	Chicago, Ill.	Nov. 27

NEW INDUSTRIAL PLANTS.

Dec. 15.	Seattle, Wash.	Nov. 20
Jan. 5.	New Orleans, La.	Dec. 4
	Adv. Dec. 4.	

MISCELLANEOUS.

Dec. 7.	El. Rys., New York, N. Y.	Nov. 13
Dec. 7.	El. Rys., Philadelphia, Pa.	Nov. 20
Dec. 7.	El. Ry., New York, N. Y.	Nov. 27
Dec. 7.	Mixing Apparatus, Toronto, Ont.	Dec. 4
Dec. 8.	Electric lighting, West Hazleton, Pa.	Nov. 13
	Adv. Nov. 13 to Dec. 4.	
Dec. 8.	Elevator in P. O. Bldg., Pottsville, Pa.	Nov. 20
Dec. 8.	Chimney, Elevator, Etc., Rochester, Minn.	Nov. 27
Dec. 8.	Track Construction. San Francisco, Cal.	Dec. 4
Dec. 8.	Cement, Baltimore, Md. .	Dec. 4
Dec. 9.	Tank, Brooklyn, N. Y....	Dec. 4
Dec. 9.	Cleaning Plant, Secaucus, N. J.	Dec. 4
Dec. 10.	Cement, Rock, Etc., Los Angeles, Cal.	Dec. 4
Dec. 10.	Elevator, New York, N. Y.	Dec. 4
Dec. 14.	El. Rys., Philadelphia, Pa.	Nov. 20
Dec. 14.	Power Plant Improv., Clarksdale, Miss.	Nov. 27
	Adv. Nov. 27, Dec. 4.	
Dec. 15.	Timber, Sault Ste. Marie, Mich.	Nov. 13
	Adv. Nov. 13 to 27.	
Dec. 15.	Garbage Disposal, Bar Harbor, Me.	Dec. 4
Dec. 18.	El. Rys., Pearl City, Hawaii	Nov. 20
Dec. 20.	Coal, Norfolk, Va.....	Nov. 20
	Adv. Nov. 20.	
Dec. 20.	Memorial, Lebanon, Ohio.	Dec. 4
Dec. 21.	Cement, Kansas City, Mo.	Dec. 4
	Adv. Dec. 4.	
Dec. 23.	Elevators, Washington, D. C.	Dec. 4
Jan. 8.	Steel towers, Guam.	Nov. 20
Apr. 1.	Memorial, Fort McHenry (P. O. Baltimore), Md..	Nov. 20

SEARCHLIGHT SECTION

Official Proposal Announcements

Price, $2.40 an inch.—Copy can be received until Thursday 10 a. m. for issue mailed the next morning

Bids open December 22, 1915.

NOTICE TO CONTRACTORS.

CONCRETE DOCK

MIAMI, FLA.

Sealed proposals for excavating a slip, a turning basin and a channel across Biscayne Bay and separate sealed proposals for building a concrete dock for the City of Miami, Fla., will be received on December 22d, 1915, up to twelve o'clock Noon, Central Standard time, by the city clerk. Said bids will be presented to the city council at a meeting held for that purpose on the said date and will be publicly opened by said council and referred for tabulation and comparison to the Harbor Engineer, who will report the results to the council.

The council will award the contract or contracts, to the lowest and best bidder, or bidders. Each bid must be accompanied by a certified check, on some responsible bank doing business in the State of Florida, for the sum of two thousand ($2,000.00) dollars. These checks will be held until the bidder whose proposal is accepted shall have entered into contract for the performance of the work, after which time the checks of the respective bidders shall be returned to them. Should the bidder to whom the contract is awarded fail to execute the contract within a period of ten (10) days after being duly notified of the award to him his check shall be forfeited to the City of Miami as liquidated damages and the said City may, at its option, award the contract to the next lowest and best bidder and when he shall have executed the contract then all checks except the one forfeited as above provided, shall be returned to the respective bidders.

The City of Miami reserves the right to reject ANY and all bids.

The quantities involved in the dredging contract are:

Earth and sand, one million one hundred and ninety-four thousand (1,194,000) cubic yards.

Rock excavation, four hundred and sixty-seven thousand (467,000) cubic yards.

Concrete dock quantities are:

Four hundred and sixty (460) reinforced concrete piles, averaging twenty-five (25) feet in length. A total length of eleven thousand five hundred (11,500) lineal feet.

Ninety-two (92) reinforced concrete caps each containing eight and six-tenths (8.6) cubic yards.

One hundred and sixty-eight (168) reinforced concrete stringers, each containing one and three-tenths (1.3) cubic yards.

Seventeen thousand five hundred and eighty-four (17,584) square feet of reinforced concrete floor slabs ten (10) inches thick, six hundred and eighty-seven (687) cubic yards.

Eighty-four (84) concrete girders each containing two and three-tenths (2.3) cubic yards.

Sixteen thousand three hundred and eighty (16,380) square feet of reinforced sheet piling four (4) inches thick, two hundred and two (202) cubic yards.

The cubic yard price on all reinforced concrete construction must cover the cost of all metal used and its placing as shown upon the plans.

Wood:

Ninety-two (92) anchor piles twenty (20) feet long.

Seventy-two (72) timber logs ten (10) feet long.

Four

Twenty-two (22) timber rails one and one-quarter (1¼) inch round, twenty-five (25) feet long with two square

pounds.

Twenty-three (23) cast iron mooring posts with base preferred and weighing

These approximate quantities for the

scope of work will be used in determining the bids.

Payments will be based upon the actual volume of material excavated and of work performed.

Bidders will be required in addition to their own names to give the names of any persons, or persons to be financially interested in the contract, upon request of the city council by its president, prior to the execution of the contract.

Specifications and plans can be seen at the offices of Isham Randolph & Company, Harbor Engineers, at either of their offices, viz:

Room 30, Real Estate Building, Miami, Florida.

Suite 1310, Heard National Bank Building, Jacksonville, Fla.

Suite 1827, Continental Bank Building, Chicago, Ill.

Sets of plans will be supplied upon payment of six ($6.00) dollars to cover cost of printing and postage. No refund.

CITY OF MIAMI.

By CASPAR HEFTY,
President City Council of Miami, Fla.

Attest:
W. B. MOORE,
Clerk of the City Council of Miami, Fla.

Bids open December 7, 1915.

NOTICE TO CONTRACTORS.

SEWER SYSTEM

RIDGEFIELD PARK, N. J.

Sealed proposals for the construction of a sewer system in the West View Section of the Village of Ridgefield Park, N. J., will be received by the Board of Commissioners of the Village, at the Municipal Building, 232-234 Hackensack Road, on Tuesday, Dec. 7, 1915, at the hour of 9 o'clock p. m. only.

Said Board of Commissioners reserves the right to reject any or all bids.

APPROXIMATE QUANTITIES.

9515 lineal feet 8 inch vitrified clay pipe sewer.
4671 lineal feet 10 inch vitrified clay pipe sewer.
2865 lineal feet 12 inch vitrified clay pipe sewer.
456 lineal feet 15 inch vitrified clay pipe sewer.
50 lineal feet 36 inch brick sewer rebuilt.
1500 lineal feet 6 inch sub drain.
1200 cubic yards rock excavation.
10 M B M timber and sheathing.
300 cubic yards concrete.
40 manholes.
6 drop manholes.

Plans, profiles, specifications and instructions to bidders are on file in the office of the clerk of the Village and may be examined any day (except Saturday) between the hours of 10 a. m. and 4 p. m.

(Signed) HARRY F. AYERS,
ADOLPH DEXHEIMER,
ERNEST W. WEBBON,
Board of Commissioners of the Village of Ridgefield Park, N. J.

By M. D. STARKER, Village Clerk.
Dated Nov. 19, 1915.

Bids open December 8, 1915.

ELECTRIC LIGHTING

WEST HAZLETON, PA.

Bids will be received for the electric lighting of West Hazleton Borough, Pa., during a period of ten years according to the specifications on file with the undersigned. Said bids to be presented on or before 8 o'clock P. M. of December 8th, 1915.

WILLIAM KRAFF, Sec'y.
107 North Broad Street,
West Hazleton, Pa.

Bids open December 21, 1915.

ASPHALTIC CEMENT

KANSAS CITY, MO

Bids will be received by the Purchasing Agent, Kansas City, Mo., up to 2 p. m., December 21, 1915, for furnishing asphaltic cement for a period of one year, estimated at 1000 tons. Specifications may be obtained from the City Engineer.

Bids open December 14, 1915.

READVERTISEMENT

WATERWORKS

SOUTH CHARLESTON, OHIO

Sealed bids or proposals for the furnishing of all labor, material, and equipment for the installation of a complete water works system for the Village of South Charleston, Ohio, and endorsed Proposal for Contract No. 1, or any other contract for which the bid is being made, will be received at the Council Chamber of the Village of South Charleston, Ohio, until noon, December 14, 1915, and will then be opened and publicly read by the Clerk of the Council of said Village.

Copies of the specifications can be obtained at the office of the Village Clerk by intending bidders.

The entire work comprises five (5) different contracts. Bids will be received by any one bidder on any one or all contracts, by complying with instructions to bidders.

Each proposal for each contract shall be accompanied by a certified check of 5 per cent of the total bid, drawn to the order of the Village of South Charleston, Ohio.

By order of the Council of the Village of South Charleston, Ohio.

L. M. ERVIN,
Mayor.
W. L. WENTZ,
[Seal] Village Clerk.

Bids open January 5, 1916.

REINFORCED CONCRETE ELEVATOR

NEW ORLEANS, LA.

Sealed proposals will be received by the Board of Commissioners of the Port of New Orleans at their office, suite 200 New Orleans Court Building, until January 5, 1916, at 8 o'clock p. m., and then publicly opened, for the construction of a reinforced concrete elevator of about 1,000,000 bushels capacity with its equipment except as specified and including marine tower and about 1500 ft. of conveyor galleries, located in the city of New Orleans, on the east bank of the Mississippi River, approximately between Soniat and Valmont streets.

A deposit of $25,000 in cash or certified check is required with proposal; bond of $300,000 required with contract. Payment monthly to the extent of 90 per cent of the engineer's estimate of work accomplished, including allowance for a reasonable stock of material on and after December 1, 1915.

Plans and specifications will be on file at the office of Ford, Bacon & Davis, 921 Canal Street, New Orleans, LA., by whom full sets will be furnished to prospective bidders on deposit of $100, which will be refunded to depositors who submit proposals and return sets in good condition. To depositors who do not submit proposals $5 will be refunded on return of the sets in good condition.

The right is reserved to reject any and all bids and to waive informalities.

Signed, ERNEST M. LOEB,
President.

Bids open December 14, 1915.

NOTICE TO BIDDERS.

POWER PLANT IMPROVEMENT

CLARKSDALE, MISS.

On Tuesday, Dec. 14, 1915, the Commissioners of the City of Clarksdale, Miss., will open sealed proposals for furnishing the following material:

One (1) 350-hp. water tube boiler.
One (1) guyed steel stack.
One (1) 500-hp. open feed water heater with metering device.
One (1) 30-g.p.m. centrifugal boiler feed pump with motor drive.
One (1) 500-g.p.m. centrifugal motor driven water works pump.
One (1) CO_2 and draft recorder with low efficiency alarm.
Four (4) feed water regulators.
One (1) one-half-ton-electric delivery type truck.
Industrial railway equipment to consist of the following:
Two (2) one-ton, drop-side, steel charging cars.
One (1) right-hand cast plate switch.
One (1) three-ton cast plate, boiler room scales, with hand registering device.
500 ft. (single) 16-lb. rail, with four-bolt fish plates and bolts. The Commissioners reserve the right to reject any or all bids. Proposals must be in the hands of the City Clerk before 8 o'clock p. m., of Dec. 14, 1915. Must be marked plainly, "Proposals for Power Plant Improvement."

Specifications on file at the office of the City Clerk, and copies may be had upon application there, or of the Consulting Engineer, W. G. Shurger Engineering Co., Meridian, Miss.

M. W. PURNELL,
City Clerk.

Bids open December 14, 1915.

NOTICE OF SALE OF ROAD BONDS FOR SANTA CRUZ COUNTY, ARIZONA

NOGALES, ARIZ.

Notice is hereby given that sealed bids will be received at the office of the Board of Supervisors of Santa Cruz County, in the Town of Nogales, State of Arizona, until 10 o'clock a. m., Tuesday, Dec. 14, 1915, for the purchase of one hundred and fifty (150) forty-year road bonds (with accrued interest) of the denomination of one thousand dollars ($1,000.00) each, dated Dec. 14, 1915, payable in gold coin of the United States of America, at the office of the County Treasurer of said Santa Cruz County, Arizona, and bearing interest payable semi-annually, at the rate of five (5) per cent per annum.

Said bonds being payable forty years after the date of issue, with the privilege reserved to said Santa Cruz County of redeeming all, or any portion of said bonds, at any time after twenty years from the date of their issue.

Said bonds to be delivered to the purchaser thereof in the Town of Nogales, State of Arizona, at the office of the Clerk of the Board of Supervisors of said Santa Cruz County, when the purchase price thereof shall have been paid over to the County Treasurer.

A certified check of five per cent of the amount bid and a copy of this advertisement must accompany each bid.

The Board of Supervisors reserves the right to reject any and all bids. Bids will be opened and considered by said Board in its office in the Town of Nogales, Arizona, on Tuesday, Dec. 14, 1915, at 2.30 p. m.

All bids must be sealed and addressed to Lula Reddoch Wood, Clerk of the Board of Supervisors, Nogales, Arizona, and marked "Proposals for Purchase of Santa Cruz County Road Bonds."

By order of the Board of Supervisors of Santa Cruz County, Arizona, Nov. 9, 1915.

LULA REDDOCH WOOD,
Clerk.

CONTRACTING NEWS

Of Special Interest to Engineers, Contractors, Builders and Manufacturers of Engineering and Building Supplies

ENCOURAGING REPORTS continue to come in from the railroads, not the least of which was the eager absorption last week of the Baltimore & Ohio $60,000,000 long-term bond issue for refunding purposes. This indicates that railroads will now be able to secure money on safe terms, instead of having to depend on the dangerous expedient of borrowing short-time loans. It marks a distinct step toward more secure financing that will make possible delayed construction improvements. The fact that the Pennsylvania lines west of Pittsburgh have begun rebuilding bridges weakened by the flood of March, 1913, and only strengthened temporarily at that time, is a further evidence that conditions favoring construction are returning. An interesting side-light on the steel industry is the purchase last week by the Duluth, Missabe & Northern of 1200 cars and by the Duluth & Iron Range of 250 cars and 3 locomotives. The business of these roads consists almost entirely of transporting iron ore. Car orders last month were the heaviest since 1912, and have been estimated at more than 34,000 cars, including those to be built by railroads in their own shops.

Reports from the Federal reserve districts for November show generally improving conditions. In the past two months the improvement has broadened to solid ground, the proportion of new business due to the war having steadily decreased. The actual volume of such business, however, is far from declining, our exports last week, mostly to Europe, being valued at $90,541,451, a figure that has been exceeded but once.

Buildings

A contract for building a $125,000 warehouse has been awarded at Long Island City, N. Y. Contracts based on bids noted recently for constructing a tuberculosis hospital have been awarded at Buffalo. The construction of a $185,000 Masonic temple has been contracted for at Washington, D. C. A college gymnasium contracted for at Lansing, Mich., will cost $149,000. The construction of a reinforced-concrete grain elevator at Duluth, to cost $700,000, has been contracted for. A $650,000 contract for erecting a terminal building has been awarded at Vancouver, B. C.

Items indicating increasing activity for next year in building industrial plants include the report that two paper mills costing $400,000 and $300,000 respectively will be built at Kalamazoo, Mich.; that the Edison Portland Cement Company will make improvements costing $200,000 to its Stewartsville (N. J.) plant; that a $125,000 flour mill will be built at El Reno, Okla; that a complete shipbuilding and repair plant equipped with a masonry and a floating drydock will be built at Galveston, and that a $1,000,000 sugar refinery will be built at Brigham, Utah. Plans have been filed in New York City for a $250,000 Y. W. C. A. building, and plans have been completed in the same city for a $155,000 apartment house.

The bond issue has been approved and a contract will be let this winter for a $125,000 high school in East Aurora, N. Y. The trustees of Delaware College will spend half of a $500,000 legacy for constructing a science hall at Newark. Plans have been completed for a $100,000 addition to a hospital at Birmingham, Ala. The finance committee of the Pittsburgh board of education has passed a resolution favoring a $3,000,000 bond issue to finance an extensive school construction program. Plans for two schools to cost $385,000 have been approved at Jackson, Mich.

Do You Plan Your Work? How?

In Philadelphia the principal operations of the Highway Bureau are converted into a picture by a few colored pins and a city map.

The status of 750 contracts at a glance!

The story on page 714 tells you how it is done.

Preparedness—An Engineering Job

General Wood's message to technical men, page 739, will interest you. Editorials on this subject also.

Bridges and Roads

Contracts for three bridges to cost $93,000 have been awarded at Woonsocket, R. I. A contract will soon be let at Harriman, Tenn., for a bridge estimated to cost from $50,000 to $125,000. A concrete bridge to cost $75,000 will be built at Johnstown, Pa. A company at Huntington, W. Va., has been granted a franchise to construct a bridge with a 900-ft. span over the Ohio River. Plans have been submitted for a bridge over the Red River at Fulton, Ark., 1400 ft. long, with a lift span. Plans are being prepared for the Twenty-third Street viaduct at Kansas City, estimated to cost $200,000. It is reported that bids are being asked for constructing a bridge over the Willamette River at Salem, Ore.

Paving work to cost $100,000 has been contracted for at Greenwood, S. C., and a $286,000 concrete road contract has been awarded at Osceola, Ark. A paving contract amounting to more than $120,000 has been awarded at Austin, Tex. Concrete pavements to cost $81,000 have been contracted for at Huntington Beach, Cal. Omaha, Neb., will open bids Dec. 28 for approximately 5 miles of paving. Bids will be opened Dec. 13 for constructing 10 miles of bitulithic roadway at El Paso, Tex. The California State highway commission will receive bids Dec. 27 for constructing 17 miles of concrete road and building a 1500-ft. bridge with a 148-ft. draw span.

Sumter, N. C., has sold $225,000 paving bonds. Paving work to cost $100,000 is contemplated at Akron, Ohio. Paving work to be done at Sterling, Ill., will cost $80,000. Two road contracts amounting to $104,000 will be awarded in the spring at Lexington, Mo. The portion of the Lincoln Highway within the city limits of Council Bluffs, Iowa, will be paved soon at a cost of $100,000. St. Louis County, Minnesota, in which Duluth is located, will have $400,000 available for road construction in 1916. Pierce County, Washington, in which Tacoma is situated, will spend $450,000 next year on highways, and Spokane County has $205,000 available for the same purpose.

Waterworks and Sewers

The lowest bid opened for constructing a submarine pipe line under the Hackensack and Passaic Rivers for the city of Newark were $193,000 on one design and $124,000 on the other. The lowest bid received Nov. 24 at Salt Lake City, Utah, for constructing the Parley's Canyon dam was $139,000. Providence, R. I., has advertised bids for borings for its proposed extensive water supply system. Bids will be opened Dec. 16 at Elmhurst, Ill., for constructing a reservoir, pumping station, etc. It is reported that Kenosha, Wis., will open bids Dec. 20 for waterworks construction to cost $250,000.

A contract for a filtration plant to cost $135,000 is to be let early in the spring at Batavia, N. Y. The Maryland Public Service Commission has granted permission to the water company at Hagerstown, Md., to raise $550,000 for new construction. A waterworks contract amounting to $65,000 is to be let early next month at Athens, Ohio. Consulting engineers have submitted a report to Fort Worth, Tex., recommending an expenditure of $300,000 for waterworks improvements. Tyler, Tex., is to build a waterworks system to cost $250,000.

Sewer contracts totaling $63,600 have been awarded at Cleveland, Tenn. A sewer contract amounting to $70,000 has been awarded at Seattle. Bids will be received Dec. 23 for constructing a sewer system to cost $43,000 at Kenova, W. Va. East Palestine, Ohio, will open bids Dec. 20 for constructing a sanitary sewer system and disposal works to cost $60,000. Bids will be opened Dec. 14 for constructing a sewer system and disposal plant for the U. S. Army at Fort Sam Houston, Tex. Xenia, Ohio, has sold $60,000 bonds and will let a contract this winter for building a sewage-disposal plant. Sewer work to be let this winter at Omaha, Neb., will cost $100,000.

Miscellaneous

The lowest bid received for constructing the McKean pier at Philadelphia was $480,000. A contract for grading 17 miles of railroad near Maytown, Fla., has been awarded. A hydroelectric plant to cost $127,000 has been contracted for at Florence, Ala. Drainage work to cost $175,000 has been contracted for at Osceola, Ark. A ditch contract has been awarded at Deer River, Minn., at $104,000. Two contracts awarded on drainage work at Corinne, Utah, total $160,000. Bids are desired at Albany, N. Y., on a State barge canal contract estimated to cost $432,000.

The Maryland State public service commission has been asked permission for constructing a railroad line at Hagerstown to cost $110,000. It is reported that plans have been prepared for the $1,500,000 street-car subway proposed at Detroit. Surveys are being made for ditch work on which $300,000 is to be spent near New Ulm, Minn. Contracts are to be let next spring for ditch work costing from $300,000 to $400,000 near Marshall, Minn. Plans are being prepared for a $2,000,000 hydroelectric plant near Albuquerque, N. M. It is reported that a railroad company in Washington will construct 400 miles of line from Bellingham to the Canadian border.

WATERWORKS

PROPOSED WORK.

Albion, N. Y.—State Conservation Commission has approved the project of installing a storage water reservoir four miles southwest of this village, near Mosher Hill, south of Eagle Harbor, with a capacity of 60,000,000 gallons, located on Otter Creek. A reservoir will be formed by an earth dam with reinforced concrete core wall and spillway at north end, and dam will have r. maximum height of 35 ft. and 300 ft. over all on top, 15,000 ft. of 8-in. c.-i. pipe will be laid; cost of dam and pipe will be $23,000. Address Mayor.

Batavia, N. Y.—Contract will be let early in the spring for constructing the filtration plant to cost $135,000. Bids now being received on 12 and 16-in. c. i. pipe. Capacity of plant 3,000,000 gal. Chester & Fleming, Engineers, Pittsburgh, Pa. Roy F. Clark, City Engineer.

Lindenhurst, L. I., N. Y.—W. E. Saxton, Mineola, is engineer for the water works, to cost about $70,000. Frederick Frederick Sheide, Supervisor.

Lindenhurst, L. I., N. Y.—Installation of municipal water works is under consideration; plans have been prepared for water system to cost $100,000 and also for a combined water and electric light plant to cost approximately $125,000. Address Board of Trade.

Oneida, N. Y.—In the report submitted to Board of Water Commissioners by Frank J. Wagner, Engineer, on the proposed new water supply, cost is estimated as follows: Right of way damages, $27,321; pipe line, including valves, meters, etc., $328,945; dam, $55,000; service reservoir, $21,189; and chlorinator, $2,000; total, $434,455; additional for contingencies

and engineer's fees, total cost is estimated at $1,000,000. It is proposed to obtain a gravity supply from Penstock Creek in the town of Ashokan. Henry W. White, Superintendent of Water Works.

Butler, N. J.—The Butler Water Company intends enlarging its system.

Jersey City, N. J.—Reported new specifications have been prepared for the 11 miles 72-in. steel pipe line to be constructed from Boonton to Jersey City. The pipe will have to be special [illegible] Lake Street and Water Commissioners' New bids will be asked.

Lehighton, Pa.—Engineer to prepare estimates of cost of building a water plant advertised in Engineering Record. Applications to be filed by Dec. 15. A. J. Sutter, Borough Secretary.

Hagerstown, Md.—Maryland Public Service Commission has granted permission to Washington County Water Company [illegible] Cove Mountain to have $[illegible] stock, proceeds to be used in building a reservoir on South Mountain near Hagerstown. Permission was also granted to the said company to install meters.

Norfolk, Va.—Plans and specifications being prepared by C. E. Dening, engineer in charge of the water department for Lamb Creek dams and spillways.

Charleston, W. Va.—Construction of [illegible] water works is being considered by City Council.

Camden, Ala.—Construction of water works is reported under consideration by city.

Watervliet, Mich.—Citizens voted $[illegible] bonds for pumping station and extending water system.

Tracy, Minn.—City will install an elevated tank about 75,000 gal. capacity, next spring.

Pocahontas, Ark.—Property owners reported in favor of erecting a water works system and installing a system of water mains. Plans have been prepared for the system and plant is assured.

Fort Worth, Tex.—Hedman & Laird, Engineers, have submitted to the City Commission a report recommending completion of the Lake Worth conduit line to bring the water to city for domestic purposes, general overhaul of the entire system, increasing the source of supply at high points, and voting bonds amounting to $[illegible] for this work.

Grants Pass, Tex.—Election soon to be held to vote [illegible] bonds for constructing a municipal water system.

Tyler, Tex.—Election to be held January 1 to vote $[illegible] bonds to construct municipal water works. H. E. Eloyd, Engineer, Dallas. John Drust, Manager.

Clinton, Okla.—Citizens voted $[illegible] bonds to make investigation for a water supply. Engineers, Bedell Engineering Company, Oklahoma City. A system costing $[illegible] is contemplated and an election will be held later to vote bonds for this purpose.

Olympia, Wash.—Election to be held Dec. 14 to vote on the purchase by the city of the plant of the Olympian Light & Water Company for municipal purposes.

San Francisco, Cal.—During 1916 following improvements will be let: About $[illegible] on Hetch Hetchy development, $1,000,000 heightening dikes and $[illegible] miscellaneous municipal) projects.

Monticello, Utah.—Steps being taken to install electric light and water systems. The stockholders of the Lasal Mountain Irrigation Co. have agreed to finance and install the proposed system.

Galt, Ont.—Installation of two motors (to start about $[illegible]) at the pumping plant of the water works system is under consideration. Address Superintendent Water Works.

The Pas, Man.—Bonds for $[illegible] for construction water works and sewers will be sold Jan. 17 by H. H. Elliott, Town Clk.

Port Moody, B. C.—Reported contract will be let early in February by the city officials for installing the new water system.

BIDS DESIRED.

Providence, R. I.—Until Dec. 22 by Water Supply Board (H. Truman Butler, Chairman) for erection, water and sewer services in town of Johnston and city of Cranston, advertised in Engineering Record. Frank E. Wisser, Chief Engineer, 661 Westminster Street.

Washington, D. C.—At the bureau of Supplies and Accounts, Navy Dept., Washington, D. C., for furnishing at the Navy Yards and Naval Stations supplies as follows: Mare Island, Cal., Sch. 9[illegible], composition pipe fittings, composition unions, Sch. 9[illegible] malleable iron unions, Sch. 9[illegible] standard weight wrought pipe, Norfolk and Charleston, Sch. [illegible] valves, etc. Applications for proposals should designate schedule desired by number.

Lorain, Ohio.—Reported desired until Dec. 1[illegible] by A. Richardson, Director Public Service, for three water tube boilers for the water works pumping stations, 500 hp. each, also for steam piping and other fittings.

Chicago, Ill.—Until Dec. 15, by Department of Public Works (W. R. Moorhouse, Comr.), for furnishing, fabricating, delivering and erecting structural steel and iron works for two steel shells for tunnel shafts for the Torrance Avenue water pipe tunnel.

Elmhurst, Ill.—Until Dec. 16, by Arthur H. Kochalsky, City Clerk, for constructing pumping station, tower and tank, well house and appurtenances, all reinforced concrete; two centrifugal pumps, 500 gal. capacity per minute and one 200 gal. capacity per minute, both direct connected with electric motors. H. L. Emerson, Engr., 118 Chamber of Commerce Building, Chicago.

Galesburg, Ill.—Until Dec. 20 by William L. Lemcke, City Clerk, for constructing a 12-in. deep well not less than 15 in. diam., a depth of 2500 ft., advertised in Engineering Record. F. L. M. Connolly, City Engineer.

Kenosha, Wis.—Reported desired until Dec. 20 by Board Water Commissioners, for constructing water plant on Washington Island, including pumping station, filtration plant and equipment. Probable expenditure, $250,000.

Lincoln, Neb.—Until Dec. 20 by H. E. Wells, City Clerk, for an electric lighting plant and water works at County Poor Farm.

Kansas City, Mo.—Until Jan. 12, by J. F. Langan, Purchasing Agent, City Hall, for a steam turbine reduction gear centrifugal pumping unit advertised in Engineering Record. Burton Lowther, Chief Engineer.

Lees Summit, Mo.—Until Dec. 15, by City Officials and Pipe Line Co., for pipes, hydrants, valves, tower and tank, 25-hp. oil engine or motor, 250-gal. triplex pump, concrete reservoir and brick pumphouse. Hestrict, Kent & Lowry, Engrs., 715 Reserve Bank Building, Kansas City, Mo.

Houston, Tex.—Until Dec. 20, by E. B. Bonney, City Secretary, for constructing a brick power house, a reinforced concrete settling tank and pipe line for the new North Main Street auxiliary pumping station.

Panama.—Until Dec. 22 by Maj. F. C. Boggs, Corps Engrs., U. S. A., General Purchasing Officer the Panama Canal, Washington, D. C., for Cir. 995, steel angles and I-beams, c.-i. pipe, pipe fittings, valves, cocks, floor drains, pipe hangers, flush pipes, water gages, condits etc.

Until Dec. 14, same place as above, for four pieces 4-in. galvanized w.-i. pipe, 3 galvanized malleable iron tees, and one 4-in. galvanized reducing elbow.

PRICES AND LETTINGS.

★Indicates award of contract.

Jersey City, N. J.—See "Proposed Work."

★Ashtabula, Ohio.—Ashtabula Water Supply Co. has awarded contract for constructing river crossing across the Ashtabula River to Gilbert & Co. of Ashtabula. Chester & Fleming, Engineers, Pittsburgh, Pa.

★Cleveland, Ohio.—Contract awarded by Board of Control to George Worthington Company, Cleveland, at about $20,000, for water meters.

★Upper Sandusky, Ohio.—Contract awarded Harris Pump & Supply Co., Pittsburgh, Pa., by Local Water Co., for furnishing [illegible] pump and gas engine. Chester & Fleming, Engineers, Pittsburgh, Pa.

Jersey City, N. J.—Following are said figures of the four lowest bids opened Dec. 1 by board of water commissioners for furnishing and laying a double line of [illegible] pipe, with flanges and fittings for Canoe Brook and Hackensack Lines: (a) Cameron Bros. & Company, [illegible] (b) Phoenix Construction Company, 41 Park Row, New York City, [illegible] (c) Cunningham Contracting Company, [illegible] (d) Warren Foundry and Pipe Company, 50 Church Street, New York City, [illegible] specification, [illegible]

	(a)	(b)	(c)	(d)
[illegible]	[illegible]	$14.79	$[illegible]	$71.50
[illegible]	35.00	24.00	[illegible]	68.50
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	120.00
[illegible]	[illegible]	[illegible]	2.50	2.00
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	40.00	20.00	[illegible]	[illegible]
[illegible]	1.50	1.00	1.00	2.00

★Lincoln, Neb.—Contract awarded American Cast Iron Pipe Company, Birmingham, Ala., for 5,200 ft. of 12-in. c.-i. pipe for water mains at about $8,000.

Houston, Tex.—Following are bids opened Dec. 1 by City Council for deep well pumps to be installed for new auxiliary pumping plant on North Main Street: J. G. Browne Company, $19,948; Layne & Bawler Company, $21,874, and Southern Engine & Pump Company $28,000.

★Hillyard, Wash.—Contract awarded by Water Committee of the City Council for a steel tower and a 200,000 gallon tank for water system to the Chicago Bridge & Iron Works, 1308 West 105th Street, Chicago, Ill., at $8,288, and for the pump, to Fairbanks, Morse & Company, Spokane, at $2,060.

Salt Lake City, Utah.—Following are low bids opened Nov. 24 by City Commission for constructing the Parley's Canyon dam: Parrot Brothers multiple arch type, $75,290 on first unit and $138,839 on completed dam, and an arched concrete type, $88,670 for first unit; P. J. Moran, 152 West Second Street, Ambursen type, $117,052 and $216,587 respectively, and on arched type $226,212 completed dam.

SEWERAGE AND SEWAGE DISPOSAL

PROPOSED WORK.

Syracuse, N. Y.—Reported construction of a sewage disposal plant is under consideration by City Commissioners.

Wappinger Falls, N. Y.—Citizens voted $15,000 bonds to construct sewer system. Bonds will be sold Dec. 16 by R. Borhmer, Village Clerk, H. L. Sterling, Wappinger Falls, Engineer.

Hoboken, N. J.—James H. Fuertes, 140 Nassau Street, New York, N. Y., is engineer for the sewerage system contemplated here.

Miami, Fla.—See "Hydraulic and River Improvements."

Lexington, Ky.—Board City Commissioners has authorized Commissioner of Finance to issue $350,000 bonds for construction of sewage disposal plant which citizens recently voted.

Dayton, Ohio.—Reported contract soon to be let by City Purchasing Agent, Fowler S. Smith, for sewer pipe, about 61,000 ft.; cost about $10,000.

Springfield, Ohio.—Mill Run sewer bonds amounting to $13,500 have been sold.

Toledo, Ohio.—County Commissioners order a survey for the sewer from Sylvania Avenue to Ten Mile Creek. Sewer will be about 1½ miles. L. A. Boulay, County Engineer.

Troy, Ohio.—Bonds for $21,500 sewer improvements reported to be sold Dec. 11. C. F. Rannells, Auditor.

Vermillion, Ohio.—Sewage disposal plant costing $40,000 is to be built in this village. Injunction secured by Mayor has been dissolved by the Common Pleas Court.

Xenia, Ohio—Contract will be let this winter for a sewage disposal plant for which $60,000 bonds have been sold. J. P. Shumaker, City Engineer.

Jackson, Mich.—Plans being prepared for a sewage disposal plant. Albert W. D. Hall, City Engineer.

Chicago, Ill.—No bids accepted by the Sanitary District Board of Trustees for constructing Calumet Intercepting Sewer Contract No. 4, bids for which were opened Dec. 2, because of a lawsuit. Trustees have abandoned work on sewerage construction, awaiting the findings of the Supreme Court of Illinois.

Beloit, Wis.—Storm sewers are to be constructed, Caeb Central Bridge built, and about 6 miles of pavement (material not selected), laid next year. G. E. Heebink, City Engineer.

La Crosse, Wis.—Contracts will be let some time in March for 3550 lin. ft. 46 in. x 69 in. brick, reinforced-concrete and segment block sewers. George P. Bradish, City Engineer.

Benson, Minn.—S. B. Gardner, Benson, engaged by city to make a preliminary survey for sanitary sewer and treatment plant; city has about $16,000 for improvement.

Lincoln, Neb.—Contract soon to be let by city for constructing storm water sewer in J Street, about 1032 ft. 49 in., 486 ft. 39-in., and 44 ft. 24-in. cement block and brick sewer; cost, $6,500. T. H. Berg, City Clerk.

Omaha, Neb.—Contracts will be let January or February for sewer work costing about $100,000. E. E. Bruce, City Engineer.

Olympia, Wash.—Contracts for improving water works to cost $20,000 and street paving costing $11,000 will be let early in the new year. J. B. Weddell, City Engineer.

The Pas, Man.—See "Water Works."

BIDS DESIRED.

Boston, Mass.—Until Dec. 13 by Edw. F. Murphy, Comr. Pub. Wks., Boston, for constructing pipe sewers and drains in portions of Westville, Josephine and Leroy Streets, Dorchester.

New York, N. Y.—Until Dec. 20, by Marcus M. Marks, President Manhattan Borough, for alterations and improvements to sewer in Cedar Street, between Nassau Street and Broadway. Security $4,500.

Kenova, W. Va.—Until about Dec. 23 by J. W. Collins, City Recorder, for sewer system to cost about $46,000. A. B. Maupin, Engineer, Huntington, W. Va.

East Palestine, Ohio.—Reported desired until Dec. 20, by O. L. Butts, Village Clk., for constructing sanitary sewer system and sewage disposal works. Probable cost $60,000. Morris Knowles, Engr., Oliver Bldg., Pittsburgh, Pa.

Chicago, Ill.—Until Dec. 18, by Department Public Works (W. R. Moorhouse, Comr.), for furnishing and delivering sewer pipe to the Bureau of Sewers.

St. Paul, Minn.—Reported desired until Dec. 13, by August Hohenstein, Purchasing Agent, for constructing sewers on portions of Fairview Avenue, Hillis, Annapolis and other streets.

Kansas City, Mo.—Until Dec. 14, by Board Public Works (Thos. F. Callahan, Secy.), for furnishing material and constructing sewers in Sewer Dist. 400, Div. No. 3, Sewer Dist. 417, and 433 in Sewer Div. No. 7.

Fort Sam Houston, Tex.—Until Dec. 14 at office of Quartermaster for constructing sewerage system and sewage disposal plant.

PRICES AND LETTINGS.

★Indicates award of contract.

★Ocean Grove, N. J.—Contract awarded by Neptune Township Trustees for constructing the sewer in District No. 2 to Logan Construction Company, 13 Park Row, New York, N. Y., at $8,957.

Baltimore, Md.—Following are four lowest bids opened Nov. 24 by Sewerage Commission for Sanitary Contract 168, Section No. 1, of the Waverly trunk sewer, and Sanitary Contract No. 169, lateral sewers in District 34-D:

Contract 169, Thomas Hampton Company, $9,889; Frank Carozza, 305 E. Preston Street, $10,241; F. B. Beasman & Company, $10,402; McAleer & Glass, $10,929.

Contract 168, Frank Corozza, $10,126; W. H. & C. F. Thompson, $10,271; F. B. Beasman & Company, $10,323, and Smith & Ruggles, $10,531.

★Cleveland, Tenn.—Contract for constructing 16½ miles of sewers awarded A. C. Brooks & Company, Birmingham, Ala., at $44,000, and for the two septic tanks to Concrete Construction Company, Birmingham, Ala., at $19,600 (bids opened Nov. 23 by City Council). Walter G. Kirkpatrick, Engr., Birmingham, Ala.

★Columbus, Ohio.—Contract for constructing the Frambes Avenue relief sewer, approximately 5930 lin. ft. 42, 48, 66 and 84 in. sewer with manholes, etc., awarded Boyd & Cook, Dayton, at $43,780 (bids opened Nov. 23).

Chicago, Ill.—See "Proposed Work."

★Dixon, Ill.—Contract awarded by State Board of Administration, Springfield, for concrete tunnel work at the State Colony for Epileptics, near Dixon, to Hatch & Montague of Niles, Mich., at $51,555, and for sewers at said colony to Logan & Giertz, Elgin, at $28,700.

★Heber Springs, Ark.—Contract awarded Inland Construction Company, Chandler, Okla., for constructing sewer system at $33,950. B. R. Alexander, Engr.

★Seattle, Wash.—Contract awarded by Board Public Works for constructing sewers in Sixth Avenue Northwest to Washington Paving Co., L. C. Smith Building, Seattle, at $78,694.

BRIDGES

PROPOSED WORK.

Bayonne, N. J.—Freeholders of Hudson and Union Counties and State Commissioner of Public Roads are considering the bridge between Bayonne and Elizabeth across Newark Bay. Thomas A. Wasser, County Engr., Jersey City.

Bound Brook, N. J.—The 406-ft. county bridge over Raritan River between Bound Brook and South Bound Brook reported condemned. City officials and Somerset County Bd. Freeholders at Somerville interested.

Johnstown, Pa.—A concrete bridge, two spans, costing $75,000, is under consideration by the city and county and the Johnstown Traction Company. Nothing will be done for several months. John W. Cramer, City Clerk.

Pittsburgh, Pa.—Construction of a bridge over Greenfield Avenue is reported considered by city; estimated cost of steel structure $65,000, and of concrete $100,000.

Norristown, Pa.—Contract about to be let for constructing a bridge over tracks of Reading R. R. Co. in Abington Township. County Comrs. at Norristown, Comrs. of Abington Township and railway company are interested.

Bristol, Tenn.—Southern Ry. Co. (B. Herman, Ch. Engr., Washington, D. C.), submitted to City Commission plans for a steel bridge over railroad tracks at English Street; cost about $7,000.

Harriman, Tenn.—Contract will be let at January term of Court at Kingston for constructing bridge over Emory River at Harriman; estimated cost on concrete bridge $125,000, and on steel structure with concrete floor, $50,000.

Peoria, Ill.—Illinois Utilities Commission, Springfield, ordered construction of a viaduct over tracks of three railroads on S. Adams Street. City to pay 15 per cent of cost and railways 85 per cent.

Duluth, Minn.—Commissioner of Public Works is arranging to remove all old wooden bridges next year by filling in culverts; appropriation available $30,000.

Minnesota.—George W. Cooley, State Highway Engineer, St. Paul, reported negotiating with Engineering Dept. of Province of Ontario, Canada, about jointly constructing a bridge over Pigeon River, at point where Lake Superior Road meets Canadian Road from Port Arthur.

Fulton, Ark.—Harrington, Howard & Ash, Kansas City, Mo., submitted plans and specifications for bridge to be constructed over Red River to Comrs. of Miller County Road and Bridge Dist. at Texarkana. Bridge to be 6 spans, steel, 1400 ft. long, with vertical lift.

Kansas City, Mo.—Plans being prepared by Harrington, Howard & Ash, Kansas City, Mo., for the Twenty-third Street Viaduct. Bonds amounting to $200,000 voted for said structure.

Bellingham, Wash.—See "Paving and Roads."

Pasco, Wash.—County Comrs. Franklin County at Pasco and of Walla Walla County at Walla Walla have commissioned Charles E. Fowler, Central Building, Seattle, to prepare plans and specifications for constructing steel bridge over Snake River, between Pasco and Burbank. Structure to be 800 ft. long, to rest on concrete piers, approaches 2000 ft. long; cost $50,000.

McMinnville, Ore.—County Commissioners reported to have appropriated $27,500 for bridge work in Yamhill County during 1916.

BIDS DESIRED.

Atglen, Pa.—Until Dec. 13, by County Commissioners, at West Chester, for furnishing material and constructing steel girder highway bridge over Octoraro Creek, from Atglen to Philadelphia and Lancaster Turnpike. Isaac Y. Ash, County Controller.

Pennsylvania—Reported desired until Dec. 15, by R. J. Cunningham, State Highway Comr., Harrisburg, for constructing bridge as follows:
Erie county, a 59½-ft. span plate girder bridge.

Freeport, Ill.—Reported desired until Dec. 14, by Harry Miller, Clk. Silver Creek Township, for constructing superstructure of a 62.5-ft. span steel truss bridge.

Illinois.—By the State Highway Commission for constructing bridges as follows:
Until Dec. 17:
Vandalia, Sproul Bridge, reinforced-concrete, 40 ft. span, 18 ft. roadway, Sharon Township. Engineers estimate $2,690.
Rethorne Bridge, reinforced-concrete, 30 ft. span, 16 ft. roadway, Wilberton Township. Engineers estimate $1,200.
Until Dec. 18:
Schmid Bridge, reinforced-concrete, 22 ft. span, 16 ft. roadway, Kaskaskia Township. Engineers estimate $1,020. J. V. Waddell, Co. Supt. of Highways, Vandalia.

Wadena, Minn.—Until Jan. 4 by County Commissioners at Wadena for constructing the substructure and superstructure of a concrete and steel bridge in Wing River, to have one 70-ft. span. Eugene Boss, County Auditor, Wadena.

Missoula, Mont.—Reported desired until Dec. 18, by W. J. Babington, County Clk., Missoula, for constructing 120 ft. steel bridge over Hell Gate River, at Turah.

Warsaw, Mo.—Reported desired until Dec. 14 for constructing steel and concrete bridge over Pomme-de-Terre River. J. S. Kidwell, Co. Engr., Warsaw.

California.—See "Paving and Roads."

Globe, Ariz.—Reported desired until Dec. 16, by Mayor and City Council, for constructing reinforced concrete bridge across Pinal Creek; also for removing timber railway trestle. R. A. Smith, City Clk.

Sandpoint, Idaho.—Reported desired until Dec. 15, for constructing bridge to take place of ferry across Pend Orellie River at Priest River. Address County Commissioners.

PRICES AND LETTINGS.

★Indicates award of contract.

★Woonsocket, R. I.—Following are four lowest bids opened Nov. 23, by Board of Aldermen for Contract 1, for constructing two reinforced-concrete bridges and appurtenances on Hamlet Avenue, one over Hamlet Trench and one over Blackstone River: E. W. Foley Contracting Company of New York, $71,866 (awarded contract); Green & Bouvier, $73 152; Bruno & Pettine, $90,090; Hanscomb Construction Company, $94,702. Contract 2—Fairmont Street bridge over Blackstone River: R. E. & E. N. Spaulding Company, Suffield, Conn., $21,813 (awarded contract); E. W. Foley Contracting Company, $23,795; E. D. Roberts Construction Company, $24,742, and Green & Bouvier, $26,258.

★Philadelphia, Pa. — Contract for constructing concrete and steel bridge over Ludlow Street, connecting the Bourse Building and building at 406 Market Street, awarded by Bell Telephone Co. to F. W. Van Loon, Denckler Building, Philadelphia, at $20,000.

★Kingston, N. C.—Contract for constructing bridge over Neuse River awarded Virginia Bridge & Iron Co., Roanoke, Va., by County Comrs.

★Dayton, Ohio.—Contract for furnishing 53,000 bbl. Portland cement for constructing bridges awarded by City Commission to Pasadena Lumber & Supply Co., Dayton, at $1.36 per bbl.

★Ludlow, Ill.—Contract for constructing 90 ft. span on Kankakee & Urbana Traction Line, north of Ludlow, awarded to Central State Bridge Co., Indianapolis, Ind.

Seattle, Wash.—Lowest bid opened by Bd. Pub. Wks. for constructing Twenty-third Avenue Bridge submitted by P. Manson, 2407 Boylston Avenue, North, at $5,787.

★Seattle, Wash.—Contract for placing structural and reinforcing steel, including two 40-ton girders and two 15-ton girders in piers of Fremont Avenue Bridge, over Lake Washington Canal, awarded by city to E. Knipe, Northern Bank Building, Seattle.

★California.—Contract for constructing concrete bridge 300 ft. long, with 3 arch spans 170 ft. long, over Myers Creek, in Imperial County, awarded by California Highway Commission, at Sacramento, to Holland Constr. Co., Granger Building, San Diego.
Following are four lowest bids opened Nov. 29 by California Highway Commission, Sacramento, for constructing a plate girder bascule bridge in Yolo County, Division III, Route 5, Section B: Security Construction Company, $24,671; J. D. Hannah, San Francisco, $25,795; C. E. Lamburth, San Francisco, $25,800; Ross Construction Company, $26,949.

★Parma, Idaho.—Contract for constructing a steel bridge over Boise River awarded by County Commissioners at Caldwell to Missouri Valley Bridge & Iron Co., Denver, Col.

PAVING AND ROADS

PROPOSED WORK.

Rochester, N. Y.—Ordinance adopted by City Council providing for widening of roadways around Franklin Square from Andrews to Cumberland Streets, at a cost of $15,000; also for paving with asphalt on Marlborough Road, at a cost of $24,000, and grading, walks and sewer in Raeburn Street, at a cost of $11,000.

Rochester, N. Y. — Common Council voted to widen roadways around Franklin Square; cost about $15,000.

Schoharie, N. Y.—Bd. Supervisors voted to construct following county roads: Summit to Jefferson, 8 miles; Cobleskill to Carlisle, 6¼ miles; Sloanville to Esperance, Montgomery County line, 2¼ miles.

Asbury Park, N. J.—City Commissioners planning to pave Main Street at an estimated cost of $70,000.

Trenton, N. J.—State Road Commissioner Stevens, in his annual report to Governor Fielder, estimates cost of repairs to roads at $50,000,000.

Wildwood, N. J.—Cape May County Bd. Freeholders at Cape May voted to resurface boulevard, from Wildwood to mainland, distance of 3 miles, with improved bituminous material; road to be 60 ft. wide and cost about $80,000.

Baltimore, Md.—Bd. Public Improvements approved an ordinance providing for widening of St. Paul Street from Lexington Street to Hamilton Street.

Abington, Va.—About $18,000 road bonds sold by Bd. Supervisors of Washington County for road work in Kinderhook Dist.

West Virginia.—Improvements to be made as follows: Morgan District, W. S. Downs, Engineer, Morgantown, will let contracts for $300,000 worth of paving this winter. Wyoming County, Blake Taylor, Engineer, Pineville, will let contracts for $550,000 grading the coming winter and spring. Portland District, Preston County, will vote on $282,000 for concrete road paving. Buckhannon District of Upshur County will vote on $225,000 bonds. Kanawha County, P. J. Walsh, Engineer, Charleston, will vote on $900,000 bonds this winter. Cabell County will contract $300,000 worth of paving during the coming year. J. M. Oliver, Engineer, Huntington.

Sumter, S. C.—About $225,000 street paving bonds sold by city.

Thibodaux, La.—Lafourche Parish Police Jury sold $80,000 road improvement bonds.

Cleveland, Tenn.—Reported city intends soon letting contract for paving to cost $65,000.

Akron, Ohio.—The repaving of Exchange Street from E. Market to Portage Path, to cost about $100,000, contemplated by Council.

Canton, Ohio.—City Council voted to grade, curb and construct sidewalks on 8 miles of streets.

Canton, Ohio.—All bids opened Oct. 6 by County Commissioners for constructing the Cadro-Bartsville Road, Plain and Lake Townships, requiring about 58,569 sq. yd. concrete pavt., have been rejected. W. C. Schick, County Clerk.

Cleveland, Ohio.—City Council voted to pave W. 101st Place, E. Sixty-fifth, W. Seventy-fourth, W. Eightieth and E. 128th Streets, Storer, Stanweld, Ignatius, Highee and Bertha Avenues.

East Cleveland, Ohio.—Bonds for $25,000 will be sold Jan. 4, by E. L. Hickey, City Aud., for improving Terrace Road.

Kenton, Ohio.—City Council voted to pave W. Franklin Street; cost $19,500. Work to begin in the spring.

Lima, Ohio.—Election soon to be held in the county to vote to hard surface 40 miles of Lincoln and Dixie Highways.

Troy, Ohio.—Street improvement bonds for $36,700 reported to be sold Dec. 11 by C. F. Rannells, Auditor.

Petoskey, Mich.—City is considering paving one mile with concrete, 16 ft. wide, in south end of city. Robert D. Tripp, City Engineer.

Clinton, Ill.—Paving of one mile of road being considered by De Witt County Officials.

Rock Island, Ill.—Bd. Local Improvements is in favor of paving Eighteenth Avenue from Twelfth to Sixteenth Street with hillside brick, concrete filler along curb and sand filler in center; cost $20,000; also brick paving on Thirty-ninth Street from Fifth to Eighth Avenue; cost $9,600.

Sterling, Ill.—Third Street and Sixth Avenue are to be paved with concrete blocks at a cost of $80,000. Arthur G. Hubbard, Engineer, Sterling; Harold Ward, City Clerk.

Urbana, Ill.—County Board of Supervisors intends authorizing oiling and grading of county highways at a cost of $40,000.

Beloit, Wis.—See "Sewerage and Sewage Disposal."

Kenosha, Wis.—It is proposed to pave with concrete on Sheridan Road a distance of about one mile. William E. O'Brien, Engineer, Kenosha; Russell H. Jones, County Clk.

Ames, Iowa.—Contracts will be let about Jan. 17 for approximately 110 blocks of paving. J. Q. Wickham, City Engineer. W. H. Stultz, Chairman Street and Alley Committee.

Council Bluffs, Iowa. — City Council has passed resolution for paving of Lincoln Highway within city limits with concrete and brick at a cost of $100,000.

Denison, Iowa.—Some time in January contract will be let for 50,000 yd. of paving, material not yet selected. Frank Woolston, City Engineer.

Duluth, Minn.—About $400,000 is to be spent for road improvements in St. Louis County in 1916.

Grants Falls, Minn.—County intends spending about $30,000 on roads next season. H. G. Wilson, County Auditor.

Minneapolis, Minn.—Ellis Dutton, Assistant City Engr., is considering recommendation of city-owned creosoting plant for treatment of pine paving blocks, the necessary building and equipment to be started immediately.
City Council Committee on Paving voted to pave nine streets with creosote block; approximate cost $450,000.

Rochester, Minn.—About 34 miles of roads are to be surfaced with gravel by County Comrs. next spring; cost $750 per mile, according to reports.
North Broadway is to be paved with Tarvia on concrete foundation. J. C. Utton, City Engineer, Rochester.

Willmar, Minn.—County intends spending next year about $30,000 on road improvements which will include three steel spans of 18, 28 and 34 feet.

Erie, Kan.—Paving about 20 blocks on Main Street is under consideration. Four blocks are to be brick. Material for others not yet decided upon. Charles Pratt, Engineer, Chanute, Kan.; P. W. Kyle, City Clerk.

Hastings, Neb.—Probably in the spring contracts will be let for paving about 153,000 sq. yd. on various kinds of pavements. W. H. Fuller, City Engineer.

North Platte, Neb.—Paving of Dewey and Locust Streets, in all about 25 blocks, is contemplated; cost $85,000. C. J. McNamara, City Engineer.

Omaha, Neb.—City Commission has been petitioned to change grade of Dodge Street from Eighteenth to Twenty-second Street, involving removal of about 100,000 cu. yd. of earth, relaying public service pipes and wires and repaving. E. E. Bruce, City Engineer.

Minot, N. D.—City Council directed City Engineer to prepare plans and specifications for about one mile of paving; cost about $100,000.

Bolivar, Mo.—Citizens Nov. 24 voted $25,000 bonds for road improvements. G. M. Upton, Commissioner Bolivar Special Road District, Bolivar.

Lexington, Mo.—Contract will be let in the spring for macadamizing in Welling Special Road District at a cost of $55,000, and in Waverly Special Road District at a cost of $49,000. H. C. Rogers, Engineer, Lexington; G. H. Bates, Deputy County Clerk.

Arkansas.—The Arkansas Highway Commission at Little Rock estimate that about $6,000,000 will be spent within the next two years in road building.

Lake Village, Ark.—Plans completed by State Highway Dept. at Little Rock for highway to be constructed from Louisiana line north through Readland, Eudora, Chicot, Jennie, Lake Village and Dermott, to be earth banked, topped with gravel or crushed rock, with steel or concrete bridges. Harry E. Cook, County Judge.

Little Rock, Ark.—Plans prepared for about 50 blocks in Pulaski Heights and Little Rock. Dickinson & Watkins, State Bank Building, Little Rock, Engrs.

Newport, Ark.—Paving of Main Street with concrete is contemplated by city.

Osecola, Ark.—S. E. Simpson, Osecola, Commissioner of Road District No. 2, reported to have announced that his district intends letting contract next spring for road improvements.

Pine Bluff, Ark.—Plans for road to be constructed from Free Bridge to Lonoke County line, distance of 19 miles in Road Dist. No. 12, approved by C. M. Philpot, County Judge.

Stuttgart, Ark.—S. Main Street and Maple Avenue to be paved with concrete. Address Mayor.

Bellingham, Wash.—City Council voted to pave James Street, construct concrete culverts on G Street, and concrete walks on Lincoln Street.

Chehalis, Wash.—Comrs. of Lewis County at Chehalis, and Pierce County at Tacoma, considering preliminary surveys for constructing road to Mount Rainier and around south side of mountain, road to be about 26 miles long.

Seattle, Wash.—A. H. Dimock, City Engr., submitted estimate of cost for paving Burke Avenue to Bd. Pub. Wks.; cost $50,000.

Seattle, Wash.—City Council voted to pave Harrison Street, cost $16,012, and construct concrete walks on Twenty-ninth Avenue, North; cost, $10,376.

Spokane, Wash.—Plans being prepared for Grand Boulevard paving; cost $26,000. Morton Macarbney, City Engineer.
Reported highways are to be constructed and paved in Spokane County during 1916; appropriation available, $205,000.

Tacoma, Wash.—About $450,000 will be spent by Pierce County next year for pavement and constructing highways.

Los Angeles, Cal.—City Council voted to pave Effie Street and Griffith Avenue.

San Francisco, Cal.—Bd. Supervs. voted to construct sidewalks on Twenty-ninth and Forty-fifth Streets, and for paving Clement, Nineteenth and Twenty-fourth Avenues with asphalt.
Bd. of Wks. approved plans of City Engineer for paving portions of Sanchez and Cumberland Streets.
Bd. Supervisors voted to pave Homestead, Anza and Greenwich Streets with asphalt and construct sidewalks on Greenwich Street.

Logan, Utah.—About 30,000 sq. yd. concrete paving contemplated. Roy Ballen, City Engineer.

BIDS DESIRED.

Massachusetts.—Until Dec. 14, by Massachusetts Highway Commission, Boston (William D. Sohier, Chmn.), for constructing sections of highways as follows:
Town of New Braintree, 5100 ft.
Town of Gloucester, 6900 ft.

New York, N. Y.—Until Dec. 20, by R. A. C. Smith, Comr. of Docks, for Contract No. 1496—furnishing material and repairing asphalt pavement on the marginal street and piers, North, East and Harlem Rivers, Borough of Manhattan. Security $6,000.

Ocean City, N. J.—Until Dec. 21 by County Board Chosen Freeholders (Frank W. Perkins, Clk.), Cape May Co. for constructing road with bituminous macadam beginning at intersection of Landis and Strathmere Avenues (Corson Inlet) and extending across Corson's Inlet to intersection of Fifty-fifth Street and Bay Avenue (Ocean City). Leaming M. Rose Co. Engr.

Wildwood, N. J.—Until Dec. 21 by County Board Chosen Freeholders (Frank W. Perkins, Clk.), Cape May Co. for reconstructing portions of the Ocean Beach Road. Leaming M. Rose Co. Engr.

Opelika, Ala.—Reported deposit until Dec. 27 by County Commrs. for improving with sand clay road top soil Opelika and West Point Road. Frederick Evans Lilly, W. S. Keator, State Highway Engr., Montgomery.

Knoxville, Tenn.—Until Dec. 14 by County Road Improvement Commission, Knoxville, for constructing portions of Kingston Road, Ten Mile to Kingston; Road and four ends on Broadway Road, both graded on concrete, brick and macadam, oiled and penetrating asphalt or other surface material.

Michigan City, Ind.—Reported deposit until Dec. 13 by Board Public Works for paving with brick Center Street and Lake Avenue.

Rockford, Ill.—Until Dec. 22 by W. W. Bennett, president Board Local Improvements, for furnishing material and paving with brick portions of Kishwaukee Street, about 36,000 sq. yd. advertised in Engineering Record.

Rock Island, Ill.—By William Trenchler, city engineer, for paving Eighth Avenue, Twenty-fourth to Twenty-ninth Streets, with asphalt, estimated cost $21,000.

Omaha, Neb.—Until Dec. 28, by City Commission, for approximately five miles of paving in Districts Nos. 1245, 1518 and other districts, asphalt, stone, vitrified brick, wire brick, artificial stone, cemented sand brick, asphalt concrete, macadam and various; three bids will be considered. E. E. Bruce, City Engineer.

Kansas City, Mo.—Until Dec. 14, by Board Public Works (Chas. F. Callahan, Secy.), for paving with asphalt macadam or portions of Oak Street, with Portland cement concrete portions of Seventeenth and Summit Streets and Belleview Avenue.

El Paso, Tex.—Reported deposit until Dec. 31 by County Auditor for paving about 10 miles of county roadway with standard bituminous.

California.—Until Dec. 27, by California Highway Commission, Ferry Building, San Francisco, for constructing portions of State highways as follows with Portland cement concrete:

Fresno County, from Roseville to Penryn, about 7.0 miles, about 7400 cu. yd. part.

Tehama County, from Corning to Proberta, about 10.3 miles, about 14,300 cu. yd.

Sacramento and Marin Counties across Petaluma Creek at Green Point, a bridge consisting of 4 through spans 140 ft., two concrete and steel approach spans each about 40 ft. long and 1132 ft. creosoted pile trestle.

San Francisco, Cal.—Until Dec. 15, by Supervisors Board Public Works, for improving portions of Bay Island, Larkin, Twenty-second and other streets.

Lewiston, Idaho.—Reported deposit until Dec. 20 by City Clerk, for street improvements in Sewer Dist. No. 7 Probable cost, $16,000.

PRICES AND LETTINGS

★Indicates award of contract.

★Perth Amboy, N. J.—Contract for paving Commerce Street with Belgian block, High and Fayette Streets, Hall, Watson, Hopkins and Caroline Avenues with asphalt macadam, awarded by City Council to Thomas W. Bunting, Perth Amboy, at $110,000.

★Greenwood, S. C.—Contract for about 25,000 sq. yd. pavements, costing about $150,000 awarded to Graves Brick Co., Springfield, Ill., and Chas. S. Hallock, Jr., Atlanta, Ga., bids opened by A. S. Herring, Mayor on June 16.

Ohio.—Bids will be received about [illegible] Dec. 4 by the County Commissioners, Columbus, for constructing roads as follows: [illegible] Township, [illegible] Township, [illegible] Township,

Electric Hoists—Philadelphia, Pa.—Until Dec. 20, by John Meigs, Dir. Dept. Wharves, Docks and Ferries, for electric hoists for Southwark piers in Delaware River, between Catharine and Christian Streets.

Power House at Dam—Wheeling, W. Va.—See "Public Buildings and Schools."

Grain Elevator on Wharf—New Orleans, La.—See "New Industrial Plants."

Wharf, Etc.—New Orleans, La.—Until January 5 by Board Port Commissioners (Ernest M. Loeb, Pres.) for constructing the Dumaine Street creosoted wharf and reinforced concrete causeway with creosoted wood block roadway; also separate bids for piling, lumber, etc., for said wharf, both proposals advertised in Engineering Record. J. Devereaux O'Reilly, Engineer.

Ditch—Morganfield, Ky.—Until Dec. 30 by Board Drainage Commissioners, Morganfield (G. W. Holt, chairman) for constructing approximately 13 miles open ditch requiring approximately 670,000 cu. yd. earth excavation, advertised in Engineering Record. Norman R. Orcutt, Chief Engineer, Morganfield.

Ditch—Hartford City, Ind.—Reported desired until Dec. 28, by Frank P. Wallace, Drainage Comr., at office of County Surveyor, for the Delilah Hineker Ditch in Monroe Township, 14,000 ft. long, to consist of 24,438 cu. yd. dirt excavation, furnishing and laying 1500 ft. 14-in. and 820 ft. 18-in. tile, five concrete retaining walls, two catch basins and back filling, grubbing and clearing.

Ditch—Pine City, Minn.—Reported desired until Dec. 23, by W. H. Hamlin, Co. Aud., for constructing Ditch No. 4, including two bridges. Probable cost, $9,870.

Drainage—Newman, Kan.—Until Dec. 14 by Secretary Board Directors Delaware River Drainage Dist. Jefferson County at the office of the Secretary, near Newman, for constructing six stream cut-offs on Rock Creek in Dun-District No. 4, Delaware River Drainage District, total about 31,410 cu. yd. H. B. Walker, State Drainage Engineer, Manhattan.

Drainage — Tekamah, Neb. — Reported desired until Dec. 18 for three concrete culverts for the Burt-Washington Drainage Dist., to include 1600 cu. yds. concrete and 200,000 lbs. steel. Engineers, Towl Engr. Company, 1122 City National Bank Building, Omaha.

Dam—Holbrook, Ariz.—Until about January 1 by Board of Supervisors, for rebuilding Woodruff dam and irrigation system on Little Colorado River; $10,000 appropriated by Legislature. Q. R. Gardner, County Supervisor.

PRICES AND LETTINGS.

★Indicates award of contract.

Dredging — Boston, Mass. — All bids opened Nov. 24 by Port Directors for dredging and filling at East Boston Flats, Contract 46, about 1,500,000 cu. yd. have been rejected. Only one bid submitted.

★Bulkhead — Boston, Mass. — Contract for constructing bulkhead and filling off Jefferson Point, East Boston, Contract 47, awarded Bay State Dredging & Contracting Company, Boston, at $82,830 (bids opened Nov. 24 by Port Directors). Other bidders: Coleman Bros., Boston, $95,500, and A. P. Converse & Company, Boston, $123,218. E. U. Hutchins, Asst. Engr.

★Jetty—Ventnor City, N. J.—Contract for constructing jetty extending from Cambridge to Portland Avenues, awarded Eugene Boehm, Atlantic City, at $4.22 per foot. Probable total cost, $10,000.

★Pier—Philadelphia, Pa.—Contracts for pier 78, McKean Street, awarded to Snare & Treist, Woolworth Building, New York, as follows: Substructure at $516,700 (opened last August); superstructure, $488,600 (opened Dec. 6).

Dredging—Norfolk, Va.—Following are bids opened Nov. 27 by Bureau of Yards and Docks, Washington, D. C., for dredging at navy yard, Norfolk, approximately 703,600 cu. yd.: Bay State Dredging & Construction Co., 247 Atlantic Avenue, Boston, Mass., 13.7 cts. per cu. yd.; P. Sanford Ross, 277 Washington Street, Jersey City, N. J., 18.7 cts.; American Dredging Co., Philadelphia, Pa., 18.8 cts.; Coastwise Dredging Co., Philadelphia, Pa., 14 cts.; Morris & Cummings Dredging Co., 17 State Street, New York, N. Y., 14.89 cts. Appropriation available about $145,000.

★Hydroelectric Plant—Florence, Ala.—Contract awarded Allentown Engineering Company by Lauderdle Power Company for constructing a hydroelectric plant to cost $127,558, and will include dam 410 ft. long, with 190-ft. spillway and 42-ft. lift developing 800 hp.

★Pier Protection—Cleveland, Ohio.—Contract for repairs to pier protection (bids opened Dec. 2) awarded American Construction Company, of Cleveland. Raymond J. Logan, Contract Clerk.

★Ditch—Anoka, Minn.—Contract for repairing County Ditch No. 32 (bids opened Nov. 26) awarded by County Commissioners to K. C. Richardson, Anoka, at $12,741. James Corr, Minneapolis, bid $13,231. Arthur A. Caswill, County Auditor.

Ditch—Deer River, Minn.—Contract awarded P. Seastrand of Cambridge for digging Judicial Ditch No. 3, west of Deer River, at about $104,000.

★Ditch—Redwood Falls, Minn.—Contract for constructing county ditch No. 29 (bids opened Dec. 1), awarded P. B. Jennings of Wanda. Probable cost, $11,991. L. P. Larson, County Auditor.

★Ditch — Tracy, Minn. — Contracts awarded by County as follows: Ditch No. 27, to C. B. Root, of Morgan, at $9,338, and Ditch No. 29, to P. B. Jennings, Landa, at $11,998.

★Drainage—Osceola, Ark.—Contract for removal of 2,794,925 cu. yd. excavation in drainage district awarded Clyde A. Walb, National Bank Building, La Grange, Ind., at 6.29 cts. per cu. yd.

★Dredging — Orange, Tex. — Following are four lowest bids opened Nov. 30 by E. U. Henry, City Engineer, for dredging slip about 750,000 cu. yd.: John Jacobsen, Texas City, 6.2 cts. per cu. yd. (awarded contract); W. D. Haden, Galveston, 10.9 cts.; Home Dredging Company, Mobile, Ala., 11.2 cts., and Atlantic Gulf & Pacific Company, Houston, 11.5 cts.

★Canal Improvements—Richmond, Cal.—Contract awarded Richmond Dredging Company, Richmond, for a pump and sewers in the Canal Subdivision, at $95,845.

★Drainage—Corinne, Utah. — Contract for excavating and laying tile in Corinne Drainage District awarded J. P. O'Neill of Ogden, and for tile and sewer pipe to Corinne Concrete Tile Company, Corinne, two contracts amounting to about $160,000. Bonds amounting to $175,000 have been sold by the district.

Tunnel — Montour, Idaho.—Only bid opened Nov. 29 by Emmett Irrigation District Trustees for constructing concrete tunnel was from Mannry Boise Company, Boise, Idaho, at $44,250. New bids are to be received; probable an open tunnel will be constructed.

ELECTRIC RAILWAYS

PROPOSED WORK.

Jamestown, N. Y.—Rights of way being secured by Jamestown & Buffalo Street Ry. Co. for electric railway from Jamestown to Buffalo.

New York, N. Y. — Public Service Commission for First District, 154 Nassau Street, has disapproved the bids submitted to the Interborough Rapid Transit Company for the construction of the West Farms subway connection, the Webster Avenue extension of the Third Avenue elevated railroad and the Eighth Avenue and 162d Street connection between the existing elevated lines and the Jerome Avenue branch of the Lexington Avenue subway.

Sanford, N. Y.—Champlain & Sanford R. R. Co. secured right-of-way for constructing line from Sanford Lake to Fort Ticonderoga, about 60 miles.

Daytona, Fla.—Central of Florida Ry. Co. plans to build about 2 miles single track during 1916.

Miami, Fla.—See "Hydraulic and River Improvements."

East Liverpool, Ohio.—About $250,000 will be spent by East Liverpool Traction and Light Co. for improving its lines.

Youngstown, Ohio.—Cleveland, Alliance & Mahoning Valley R. R. Co. is considering plans to build a double track extension from Youngstown to Warren via Niles.

Youngstown & Niles Ry. Co., incorporated to construct an electric railway from Mahoning Avenue Line to Niles. Capital $10,000. Among incorporators: James P. Wilson, U. C. De Ford and J. W. Blackburn.

Hobart, Ind.—Gary, Hobart & Eastern Traction Co. plans to build about 12 miles of track between Hobart and Valparaiso during 1916.

Detroit, Mich.—Robert Oakman, Detroit, considering constructing an electric railway from Hamilton Blvd. to Grand River Avenue and between old city limits and Highland Park.

Green Bay, Wis.—Green Bay & Eastern Ry. Co. incorporated to construct a railway from Green Bay to Sheboygan via Manitowoc, 70 miles. Capital $50,000. Among incorporators are Charles Frazier, Manitowoc, and R. P. Mattern, of Milwaukee.

Sheboygan, Wis.—During 1916 Sheboygan Ry. & Electric Co. expects to construct one mile track in Sheboygan.

Boone, Ia.—Fort Dodge, Des Moines & Southern R. R. Co. contemplates constructing about 6 miles line from Swanwood Junction to Des Moines.

Lawrence, Kan.—Lawrence, Topeka & Western Ry. Co. is incorporated to construct an electric railway from Lawrence to Topeka. Capital $100,000. Among incorporators: W. R. Stubbs and J. D. Bowersock, both of Lawrence.

New York, N. Y.—Following are unit figures of four lowest bids opened Nov. 30 by Public Service Commission for First Dist., 154 Nassau Street, New York, for constructing Section No. 2 of Routes Nos. 19 and 22, a part of the Seventh Avenue-Lexington Avenue Rapid Transit Railroad, an elevated railroad in Borough Bronx, extending over and along Whitlock Avenue and Westchester Avenue, from Bancroft Street to Eastern Boulevard: (a) Lawrence C. Manuell, 11 Pine Street, $2,063,877; (b) Rodgers & Hagarty, Inc., Hudson River and 157th Street, $2,089,247; (c) Crenshaw Engineering and Construction Company, Inc., 259 West Thirty-fourth Street, $2,113,957; (d) A. L. Guidone Company, 131 East Twenty-third Street, $2,116,611.

Item		(a)	(b)	(c)	(d)
1B (a)	32,200 cu. yd. col. excavation, earth	$2.40	$1.15	$2.50	$2.35
1B (b)	500 cu. yd. col excavation, rock	4.00	5.00	5.00	4.00
1C (a)	16,600 cu. yd. R. R. duct excav., earth	2.20	1.00	1.00	2.16
1C (b)	500 cu. yd. R. R. duct excav., rock	4.00	5.00	5.00	4.00
6	10,700 cu. yd. concrete masonry	7.25	6.50	7.50	8.25
6B	9,000 sq. yd. sta. conc surface finish	1.05	.70	1.00	.50
6D	1,050 sq. ft. inlaid colored tile	1.55	1.50	1.25	1.60
6G	2,050 cu. yd. sta. conc. masonry	10.75	11.00	15.00	8.00
9	100 cu. yd. brick masonry	15.00	15.00	25.00	1.500
9D	60 cu. yd. removal of old masonry	5.00	8.00	20.00	4.50
12	25,000 lin. ft. timber piles	.12	.40	.55	.35
12C	22,800 lin. ft. concrete piles	2.60	3.00	1.25	1.50
13	2 M B. M. timber foundation	45.00	50.00	75.00	40.00
15 (a)	160 sq. yd. waterproofing, 1-ply	.25	.35	.30	.35
(d)	1,270 sq. yd. waterproofing, 4-ply	1.25	1.25	.75	1.00
17 (e)	590 lin. ft. 4-in. vitrified pipe	.40	.40	.10	.75
17A (a)	100 lin. ft. 3-in. E. H. c. i. pipe and fittings	.50	1.00	.55	.75
(b)	200 lin. ft. 4-in. E. H. c. i. pipe and fittings	.65	1.25	.70	.90
(c)	300 lin. ft. 6-in. E. H. c. i. pipe and fittings	1.05	1.50	1.00	1.10
(d)	200 lin. ft. 8-in. E. H. c. i. pipe and fittings	1.60	2.50	1.50	1.50
18A	440,000 dct. ft. R. R. ducts	1.35	.14	.13	.10
18C	2,500 dct. ft. 3½-in. w. i. pipe ducts	.70	.50	.75	.50
19	26,400 tons riveted steel	56.90	58.60	58.00	60.60
19J	1,150 tons riveted steel for bridges	66.90	65.60	72.00	61.00
20	950 tons steel beams and shapes	56.90	58.60	58.00	61.00
21	60 tons steel rods and bars in conc	59.00	60.00	70.00	60.00
25	300 tons miscel. iron castings	52.00	60.00	65.00	55.00
26	6,500 lb. special wire forms	.12	.10	.10	.10
30 (h)	12,000 sq. yd. all st. surf. rest., any character	.75	1.25	2.00	.10
30 (i)	1,800 lin. ft. new 5-in. bluestone curb	.95	1.00	1.25	.10
(o)	1,250 lin. ft. restoring old curb	.20	.25	.50	.05
31	100 sq. yd. park surf. restored	.80	.50	3.00	1.00
32 (a)	2,250 lin. ft. ¾-in. w. i. elec. cond	.19	.15	.20	.15
(b)	350 lin. ft. 1½-in. w. i. elec. cond	.26	.25	.40	.20
(c)	100 lin. ft. 2-in. w. i. elec. cond	.40	.30	.50	.30
(d)	1,150 lin. ft. 1-in. w. i. elec. cond	.23	.20	.30	.18
33	350 c. i. outlet boxes in sta., each	1.50	1.00	1.00	.65
33A	10 c. i. pull boxes in sta., each	2.60	2.00	3.00	1.75
42	35 tons c. i. pipes for sewers, straight	40.00	40.00	50.00	50.00
43	20 tons c. i. pipes for sewers, special	68.00	75.00	80.00	70.00
75C	41,300 lin. ft. support and recon. elec. trolley	.70	1.00	1.00	.70
75N	1,500 lin. ft. relocating st. surf. R. R.	2.50	4.50	6.00	4.50
78	100 lin. ft. pipes in st. 4-in. water	.40	.30	.55	.50
79	3,100 lin. ft. pipes in st. 6-in. water	.55	.65	.70	.70
80	100 lin. ft. pipes in st. 8-in. water	.85	.50	.80	1.00
81	100 lin. ft. pipes in st. 10-in. water	1.20	.60	.95	1.30
82	200 lin. ft. pipes in st. 12-in. water	1.50	.75	1.20	1.70
84	100 lin. ft. pipes in st. 20-in., water	3.50	1.25	2.10	2.50
90	100 lin. ft. pipes in st. 4-in., gas	.25	.30	.35	.50
91	100 lin. ft. pipes in st. 6-in., gas	.35	.65	.50	.70
92	200 lin. ft. pipes in st. 8-in., gas	.60	.65	.75	1.00
94	100 lin. ft. pipes in st. 12-in., gas	.75	1.25	1.10	1.70
95	100 lin. ft. pipes in st. 16-in., gas	1.50	1.50	1.25	2.00
98	100 lin. ft. pipes in st. 30-in., gas	2.75	2 50	2.25	3.50
100	30 tons new c. i. hub and spigot strt. pipe	41.00	30.00	60 00	55.00
101	20 tons new c. i. hub and spigot special pipe	68.00	65.00	80.00	70.00
127	600 dct. ft. elec. ducts and cond	.80	.50	.50	.50
127A (b)	100 lin. ft. 3-in. w. i. pipe elec. ducts	.80	.75	.80	.55
136	11 electric ground conn., each	5.00	50.00	50.00	10.00

Topeka, Kan.—Kansas City, Lawrence & Topeka Electric R. R., Kansas City, Mo., contemplates constructing 52 miles single track of interurban line between Zarah and Topeka during 1916.

Sherman, Tex.—Sub-station of Texas Traction Co., of Dallas, reported destroyed by fire.

Pocatello, Idaho.—Pocatello Transportation & Interurban Co. contemplates constructing an electric railway. Headquarters of company in Kane Building.

Moncton, N. B.—Moncton Tramways, Electricity & Gas Co. contemplates constructing about 1½ miles of track during 1916.

BIDS DESIRED.

Canal Dover, Ohio.—Bids being received by Dover, Millersburg & Western Ry. Co. for constructing line between Canal Dover and Millersburg via Sugar Creek. The line will cross Wheeling and Lake Erie R. R. at grade and the Baltimore & Ohio and Pennsylvania R. R. on an overhead line. Benjamin George, Canal Dover, said to be interested.

PRICES AND LETTINGS.

★Indicates award of contract.

★New York, N. Y.—Contract awarded by Public Service Commission for First District, 154 Nassau Street, New York, for installation of tracks on White Plains Road extension of Lenox Avenue branch of existing subways (bids opened Nov. 23) to Coast & Lake Contracting Co., 41 Broad Street, New York, at $53,930.

Lowest unofficial total of bids opened Dec. 7, by Public Service Commission, 154 Nassau Street, were as follows:

Order No. 6—Nineteen portions of special work (frogs and switches) for use in the construction of rapid transit railroad (Lexington Avenue Lines), Ramapo Iron Wks., 30 Church Street, $46,195.

Construction Section No. 3, Route No. 8, a part of the Fourteenth Street-Eastern Rapid Transit Railroad, Booth & Flinn, 17 Battery Place, at $6,631,000.

★West Point, Va.—Contract for constructing Richmond, Rappahannock & Northern Ry. from West Point to Urbana, 17 miles, awarded to Central Constr. Co., Harrisburg. C. L. Ruffin, 514 American National Bank Bldg., Richmond, Ch. Engr.

★Barboursville, Ky.—Contract for constructing and track laying on line from Barbourville to Manchester awarded by Cumberland & Manchester R. R. Co. to Read Constr. Co., Philadelphia, Pa.

RAILROADS

PROPOSED WORK.

Taunton, Mass.—Reported steps being taken to eliminate grade crossings on New York, New Haven & Hartford R. R. (Edward Gagel, Ch. Engr., New Haven, Conn.)

Niagara Falls, N. Y.—Reported contracts soon to be let by Grade Crossing Commission for eliminating crossings in Lockport Street, Whirlpool Avenue, and Portage Road, which John L. Harper, Engineer of the Commission, estimates at $485,000. A subway costing $195,000 is planned for Portage Road, a subway in Whirlpool Avenue costing $120,000, and an overhead crossing midway between Lockport and Sugar Streets at a cost of $170,000.

Newark, N. J.—Agreement has been reached between the city and the Pennsylvania R. R. (A. C. Shand, Ch. Engr., Philadelphia, Pa.) whereby the railroad will allow the city to open Mechanic Street through elevation of the railroad, at a cost of $70,000.

Hagerstown, Md.—Washington County Railroad has applied to the Public Service Commission for permission to construct a single track from Hagerstown to Security, a distance of about 3½ miles and estimated to cost $110,000.

Huntington, W. Va.—Until about Jan. 10, according to local press reports, by the Pond Fork Ry. Company for constructing about 12 miles of the railroad along Pond Creek of Little Coal River in Boone County.

Indianapolis, Ind.—Reported B. A. Worthington, President of the Cincinnati, Indianapolis & Western R. R., which has taken over the Indianapolis division of the Cincinnati, Hamilton & Dayton line, states extensive improvements are contemplated which include $79,520 for strengthening bridges between Hamilton, Ohio and Indianapolis; between Indianapolis and Montezuma, $8,665; Montezuma and Hume, $6,875; between Hume and Decatur, $29,125, and between Decatur and Springfield, $2,740. In connection with the track elevation at Indianapolis $500,000 will be spent on freight house development and $43,860 for improvements to the Moorefield engine house.

Champaign, Ill.—Wabash R. R. Company (A. O. Cunningham, Ch. Engr., St. Louis, Mo.), is considering extending line from Champaign to Gibson City, thirty miles.

Weatherford, Tex.—Chicago, Weatherford & Gulf Ry. Co., incorporated with headquarters at Weatherford. It is the purpose of the road to construct a railroad from Gainesville to Wise through Cook, Wise, Parker, Hood and McLennan Counties. E. L. Tanner, Middletown, Vice-Pres. and Gen'l Manager of the road.

North Yakima, Wash.—Union Pacific Company [E. L. Huntley, Ch. Engr., Omaha] will construct extension from North Yakima to Tacoma.

San Francisco, Cal.—Reported Western Pacific R. R. Co. [T. J. Wyche, Ch. Engr., San Francisco] intends constructing several branches.

Lewiston, Idaho. — City Council has granted a franchise to Lewiston, Nez Perce & Eastern Ry. Company [C. A. Hawkins, Supt., Lewiston] adjacent to the river, for terminal purposes.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Maytown, Fla.**—Contract for the grading on extension of Chamberlain Division of Florida East Coast Railway Company's line from Maytown to a connection with the main line at New Smyrna, a distance of about 14½ miles, has been awarded to J. M. Clark of Jacksonville. The bridge work and track laying will be done by company's forces and all material, including rock, piles and other heavy materials, have been purchased. All surveys have been completed and J. H. Wyeth appointed resident engineer. Cost of extension $100,000. S. B. Carter, Chief Engineer St. Augustine.

PUBLIC BUILDINGS AND SCHOOLS

PROPOSED WORK.

Lynn, Mass.—Contract will be let early in the next year for erecting the two-story, semi-fireproof brick school on Lynnfield Avenue. George A. Cornet, Commissioner Public Works. L. E. Tompson, Secy. Bd. Educ.

Quincy, Mass.—Citizens has been instructed by Council to appropriate $220,000 for erecting two 16-room schools.

Wallingford, Conn.—Reported plans and specifications being prepared for high school to be erected next summer on South Main and Prince Streets.

Amsterdam, N. Y.—Board of Education taking steps to erect $35,000 school.

Baldwin, L. I., N. Y.—Citizens voted $4[illegible] to erect new school at Church Street and Grand Boulevard. Baldwin Harbor. Address School Board.

East Aurora, N. Y.—Bond issue for $[illegible] for the high school approved. Contract will be let in February. Harris & Morris, Archts., Erie County Bank Building, Buffalo.

Syracuse, N. Y.—Plans for Madison School submitted to Board of Education by James A. Fairchild, 211 Midland Avenue, cost approximately $[illegible].

Syracuse, N. Y.—Board Education considering erecting a school on Madison Street to cost $[illegible].

Watertown, N. Y.—Board of Supervisors of Jefferson County appropriated $25,000 to augment to $[illegible] already appropriated, for erecting tuberculosis hospital.

Freehold, N. J.—Citizens Nov. 30 voted $[illegible] bonds for erecting town hall.

Montclair, N. J.—At bids recently opened for remodeling Spring School have been rejected by Board of Education as exceeding the appropriation, which is $[illegible].

Newark, N. J.—Memorial Building Commission and the Committee of One Hundred appointed taking steps to erect $1,[illegible] Memorial Building. Forrest F. Dryden, 70 Broad Street, member of the Committee.

Teaneck (P. O. Hackensack), N. J.—Contract will be let early in February for erecting a two-story and basement brick school with slate roof to cost $[illegible], with equipment. Engineers W. Fraser Hackenbush and C. V. E. Rogers, Archts., 1133 Broadway, New York.

Brackenridge, Pa.—John H. Phillips of McKeesport Board, selected by Board of Education to prepare plans for school to be erected next spring.

Darlington, Pa.—[illegible] & Page, 216 Wright Street, Philadelphia, are architects for township high school to be erected on Gas Mills Schools.

Erie, Pa.—Contemplated preliminary plans submitted to Board of Education by William S. Hays, Board of Education Building, to Lees, Mc., for high school to be erected at Twenty-ninth and State Streets.

Lewistown, Pa.—Woodnutt & Schmehl, [illegible], selected by Board of Education to prepare plans for high school, cost $[illegible].

Philadelphia, Pa.—Reported contracts soon to be let by County Commissioners for following improvements: Three-story brick addition to Misdemeanants Court, Twelfth and Wood Streets, Philip H. Johnson, Archt., Land Title Bldg.; and three-story brick and stone addition to courthouse at Twenty-first and Race Streets, J. T. Windrim, Archt., Commonwealth Building.

Pittsburgh, Pa.—Finance Committee of Board of Public Education passed resolutions favoring $2,[illegible],000 bond issue to be used for work contemplated as follows: Sheridan High School, $[illegible],000; addition to Peabody High School, $434,410; changes in Central High, $6[illegible]; South Hills auditorium and gymnasium, $[illegible],000; Fifth Avenue auditorium and gymnasium, $157,[illegible]; new Greenfield elementary school, $340,000; addition to Gladstone elementary school, $[illegible]; new Perry elementary school, $[illegible]; new Northside Junior High School, $350,000; addition to Beechview elementary school, $217,000; addition to McCleary elementary school, $140,000; new Hays Grove elementary $230,000; site for new Boggs Avenue elementary school, $[illegible].

Sewickley, Pa.—A $50,000 library is to be erected at Broad and Thorn Streets as a memorial to Mrs. W. L. Clause. Address Board of Directors of Public Schools.

Slatington, Pa.—Plans being prepared for the high school, to cost $65,000; contract will be let early in the new year. E. Z. Scholl, Architect, Reading. P. N. Snyder, Secy. School Bd.

Newark, Del.—Trustees of Delaware College have adopted the report of H. Rodney Sharp, Chairman of Plans and Development Committee, providing $250,000 for erecting the science hall, plans for which have been prepared by Day & Klauder, of Philadelphia, Pa.; and $75,000 for remodeling old dormitory.

Warwood, W. Va.—Two fireproof schools are to be erected in Richland District, Ohio County, one a $65,000 building, the other $20,000. $85,000 bonds have been voted, but nothing further has been done about the matter. J. E. Evans, Secy. Bd. Educ., 116 Nineteenth Street, Warwood.

Asheville, N. C.—School bonds for $200,000 will be sold Dec. 20 by Board City Commissioners. F. L. Conder, City Secy.-Treas.

Birmingham, Ala.—Plans completed for $100,000 addition to be erected to Birmingham Infirmary at West End. Address Dr. Charles M. Nice, Woodward Building.

Bristol, Tenn.—Citizens voted $60,000 bonds for erecting central high school.

Knoxville, Tenn.—Plans for erecting group of buildings for King College under consideration by Board Trustees.

Covington, Ky.—School improvement bonds for $165,000 will be sold Dec. 27 by Board Education.

Cleveland, Ohio.—Plans being prepared for eighteen-room addition to Tremont School, at W. Tenth Street and Tremont Avenue, twelve rooms to East Clark and sixteen rooms to Memorial School.

Columbus, Ohio.—Reported Isolation Hospital costing $25,000 to be erected here by city.

East Cleveland, Ohio.—Bonds for $27,000 will be sold Jan. 4, by E. L. Hickey, City Aud., for erecting and equipping engine house.

Mansfield, Ohio.—Plans being prepared for fireproof hospital to be erected for the Mansfield General Hospital, to contain 60 beds.

Olmstead Falls, Ohio.—A brick and concrete high and grade school is to be erected and bonds amounting to $45,000 will be sold Dec. 15 by F. R. Gallagher, Clk. Board Education Rural School District of Olmstead Township, Olmstead Falls.

Orient, Ohio.—See "Bids Desired."

Waterville, Ohio.—Erection of $30,000 school contemplated. Address Board of Education.

Willoughby, Ohio.—Franz C. Warner, Hippodrome Building, Cleveland, and Electus D. Litchfield, 477 Fifth Avenue, New York, engaged to prepare plans for first group of buildings to be erected in the spring for Andrews Institute for Girls; cost, about $400,000. Address Board of Trustees.

Terre Haute, Ind.—Plans prepared by H. W. Johnson and Warren D. Miller for district school which School Board intends erecting at Twenty-fourth Street and Fourth Avenue to cost $70,000. Albert Allen, Business Director.

Albion, Mich.—Erection of new school under consideration. Address Board of Education.

Highland Park, Mich.—Citizens voted $275,000 bonds for new schools and school sites. Address Board of Education.

Jackson, Mich.—Plans approved for two schools, one to cost $[illegible] and the other $230,000. Address Board of Education.

Rock Island, Ill.—Contract will be let in the early spring for erecting at Augustana College a gymnasium costing $25,000. Rev. Alfred Appell, Sec. Bd. Directors, Burlington.

Tuscola, Ill.—Citizens voted $145,000 bonds to erect Township High School. Address School Board.

Milwaukee, Wis.—Reported sketches being prepared by Van Ryn & De Gelleke, Caswell Block, for proposed Girls' Trade School, to be three stories, brick and stucco, cost about $160,000. Address Board of Education.

Eldora, Iowa.—Citizens Nov. 23 voted to erect new school; cost about $93,000. Address Board of Education.

Appleton, Minn.—Plans prepared by Edwin & Edwin, Minneapolis, for high school to cost $65,000. O. P. Carlson, Secy. School Board.

Eveleth, Minn.—Tentative plans prepared by W. T. Brady of Duluth for $200,000 High School submitted to Board of Education.

Minneapolis, Minn.—City Council Committee on Recreation and Amusements has directed City Building Inspector's Department to prepare plans for new public bath house on Hall's Island at Plymouth Avenue.

Virginia, Minn.—Carl Nystrom of Duluth selected to prepare plans for proposed new high school; cost, $150,000.

David City, Neb.—A two-story brick and concrete high school is to be erected here, the citizens having voted $60,000 bonds for same. Architect will not be selected for about a month, and nothing further will be done until that time. H. C. Schaaf, Secy. Bd. Educ.

Guide Rock, Neb.—Citizens voted $23,000 bonds for erecting new school. Address School Board.

Omaha, Neb.—Reported Board of Education will soon let contracts for school improvements to cost about $500,000.

Joplin, Mo.—Citizens voted $300,000 bonds for erecting $50,000 high school and for improvements to grade schools. C. P. M. Wiley, Secy. Bd. Educ.

Fort Smith, Ark.—Plans completed for new main building for St. Edwards Infirmary; cost $100,000. Dr. Patrick F. Horan, Pastor of Church of Immaculate Conception, may be able to give further information.

Kansas City, Mo.—Hospital bonds for $125,000 will be sold Dec. 13 by Henry L. Yost, Mayor, and M. A. Flynn, City Controller.

Oklahoma City, Okla.—Hawk & Parr, Security Building, are architects for proposed $250,000 fireproof Baptist Hospital contemplated for First Baptist Church at Ninth Street and Robinson Avenue. One wing, costing $100,000, is to be erected early next year. Rev. H. H. Hulten, Pastor.

Loveland, Colo.—Plans being prepared by Reusch Roeschlamb & Fuller, Foster Building, Denver, Col., for two semi-fireproof brick and cement high schools, 196 x 60 ft., to cost $80,000. M. M. Keeley, Secretary School Board.

Baker City, Ore.—High School bonds for $125,000 will be sold Jan. 6, by W. S. Bowers, Clk. School Dist. No. 5.

Montpelier, Idaho.—Boyer & Rogers, of Pocatello, are architects for proposed $30,000 combined city hall, public library and commercial club; said building to form a civic center 200 ft. square.

BIDS DESIRED.

East View, N. Y.—Until Dec. 14, by Building Commission Westchester County (Robt. S. Brewsters, Chmn.), jail work in connection with White Plains penitentiary and workhouse at East View.

Hornell, N. Y.—Until Jan. 19, by Jas. A. Wetmore, Acting Supervising Archt., Washington, D. C., for construction complete (including mechanical equipment and approaches) for U. S. Postoffice at Hornell.

Hackensack, N. J.—Until Jan. 17, by Jas. A. Wetmore, Acting Supervising Archt., Washington, D. C., for construction complete U. S. Post Office at Hackensack.

New Brunswick, N. J.—Reported desired until Dec. 16 by School Board, Raritan Township (J. W. Leston, Pres.) for, erecting two-story and basement brick addition to School No. 3 on Woodbridge Avenue. Alexander Merchant, Archt., 363 George Street, New Brunswick.

Wheeling, W. Va.—Until Dec. 13, by Frank Stanton, Clk. Board Education, for erecting Madison school, on Zane Street. F. S. Faris, Archt., Schmulbach Building. Until Jan. 6, by U. S. Engineers, Wheeling District, Wheeling, for building a fireproof power house at Dam No. 14, Ohio River, advertised in Engineering Record.

Durham, N. C.—Reported desired until Jan. 12 for erecting 4-story and basement, 72 x 156-ft. courthouse. Probable cost, $250,000. Milburn, Heister & Co., Archts., Union Savings Bank Building, Washington, D. C.

East Point, Ga.—Until Dec. 20, by East Point School Board Comrs., at office of Jas. T. Settle, Secy., East Point Lumber Company, for erecting two graded schools. Edwards & Sayward, Archts., 633 Candler Bldg., Atlanta.

Akron, Ohio.—Reported desired until Dec. 15, by Board Education, for erecting 3-story, basement and sub-basement, brick, stone, concrete and terra cotta, 69 x 124 ft. school. Harpster & Bliss, Archts., Akron.

Cleveland, Tenn.—Until Dec. 14 by County High School Board for erecting the high school; cost $25,000.

Orient, Ohio.—Until Dec. 28 by J. W. Lane, Clk. Bd. Educ., Scioto Township, R. F. D. Orient, for erecting fireproof consolidated school at Commercial Point and a consolidated school at Orient, including heating, plumbing, ventilating, etc. Howard & Merriam, Archts., 8 E. Broad Street, Columbus. School bonds amounting to $45,000, it is reported, will be sold by Clerk Dec. 13.

Pataskala, Ohio—Reported desired until Dec. 20 for erecting a 2-story and basement town hall. Probable cost, $25,000. Rusks & Sheets, 145 North High Street, Columbus, Archts.

Somerville, Ohio.—Local reports state bids desired until Dec. 30, by village, for erecting school. Probable expenditure $32,500.

Charleston, Ill.—Until Dec. 17, by County Board Supervisors, for erecting two-story, brick and stone fireproof, 37 x 80 ft. almshouse. Cost $20,000. John S. Goodyear, Chmn. Bldg. Com., Mattoon, Ill.

Chicago, Ill.—Until Dec. 15, at office of Business Manager Board Education, 730 Tribune Building, for erecting following schools: Hibbard School, W. Ainslie Street and N. Sawyer Avenue; Choppin School, Rice Street and N. Campbell Avenue, including heating, plumbing, etc., and steel platform for Lawson School, South Hooman Avenue and W. Twelfth Street. A. F. Hussander, Archt., Bd. Education. John Howatt, Ch. Engr.

Centerville, Iowa. — Reported desired until Dec. 15, by Sisters of Mercy, for erecting 3-story and basement brick and stone, 42 x 120-ft. hospital. F. E. Cox, Archt., Baldwin Building, Council Bluffs, Iowa.

Anoka, Minn.—Until Jan. 18, by Jas. A. Wetmore, Acting Supervising Archt., Washington, D. C., for construction complete (including mechanical equipment, except lighting fixtures and approaches) of U. S. Post Office at Anoka.

Chatfield, Minn.—Until Dec. 16, by E. J. Sutherland, Secy. Bd. Educ., Chatfield School Dist., for erecting high school. Separate bids for plumbing, electric work, heating, ventilating, vacuum (heating), etc. Tyrie & Chapman, Archts., 320 Auditorium Building, Minneapolis.

Crookston, Minn.—Reported desired until Jan. 4 by Downer Mullen, Secy. Board Control, St. Paul, for erecting 2-story and basement nurses' home. Sund & Dunham, Archts., 512 Essex Building, Minneapolis. Rose & Harris, Engrs., Auditorium Building, Minneapolis.

Duluth, Minn.—Reported desired until Jan. 15, by Board Education, for erecting 3-story, 165 x 202-ft. brick fireproof school. Kelly & Williams, Archts., Duluth.

Sidney, Neb.—Reported desired until Jan. 16 (readvertisement) by City Clk., for erecting 2-story and basement city hall. Probable cost, $20,000. Bert M. Reynolds, Archt., North Platte.

College Station, Tex.—Until Dec. 22, by R. Adelsperger, Prof. of Architecture, for erecting hospital at Agricultural and Mechanical College. Probable cost $50,000.

Fulton, Mo.—Until Dec. 21 by Board Education of Fulton School Dist. (J. W. McIntire, Secy.) for erecting high school; separate bids for heating; plumbing; and electric wiring. M. F. Bell, Archt., Fulton.

Gainesville, Tex.—Until Dec. 20, by Ernest McAnnelly, Archt., Dallas, for erecting two cottages at State Training School for Girls. Probable cost $35,000.

Houston, Tex.—Until Dec. 13 by City Secretary for erecting administration building for Montrose School, including heating, plumbing, etc. Ben Campbell, Mayor.

Tulsa, Okla.—Until Dec. 20, by Board Education (R. S. Fellows, Secy.), at office of Superintendent of Schools, High School Building, for erecting a high school. Separate bids for heating and ventilating, plumbing, and electrical work. Geo. Winckler, Archt., Tulsa.

Bellingham, Wash.—Reported desired until Dec. 13, by F. B. Graves, Clk. Bellingham School Board, for erecting addition to North Side high school. Probable cost, $100,000. Heath & Gove, National Realty Building, Tacoma, and T. F. Doan, Sunset Block, Bellingham, Archts.

Motherwell, Ont.—Reported desired until Jan. 1 by George Thompson, Chmn. School Board (W. W. Rogers, Secy.), for erecting school.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Danvers, Mass.**—Contract awarded by Essex County Agricultural Trustees at Salem to L. H. McAloon, N. Andover, at about $65,320, for erecting school at Hathorne, Danvers.

★**Buffalo, N. Y.**—Aldermanic Finance Committee has adopted recommendation of Hospital Commission accepting following bids fr erecting Tuberculosis Hospital on West Farm site: General construction, George Baker Long, Worcester, Mass., $383,500; heating and power plant, Fitzpatrick & Hoepfner, Columbus, Ohio, $67,500; plumbing, Barna & Geiger, Buffalo, $43,628; electrical work, Bison Electric Company, Buffalo, $22,900. Green & Wicks, Archts., 110 Franklin Street.

★**Fort Wadsworth (P. O. Red Bank), S. I., N. Y.**—Contract awarded Chris. Schneider & Son, 1251 De Kalb Avenue, Brooklyn, to erect 3-story and basement, fireproof, brick and terra cotta, 75 x 147-ft. orphan asylum here for Bethlehem Orphans' Home; cost, about $100,000; Rev. Wm. F. Koepchen, 431 West Forty-third Street, New York, Chairman Building Committee. Mason R. Strong and David Kofs, 7 Wall Street, New York, associate architects.

Newark, N. J.—Following are lowest bids opened Nov. 30 by Bd. Education on various parts of work for John Catlin School, to be erected on Ann Street: Masonry, De Kimpe Constr. Co., $78,900; heating and ventilating, James F. Kelly, $27,889; carpentry, Austin J. Waldron, $25,694; William G. Sharwell submitted lowest bid on masonry and carpentry combined, at $107,239 (bidders all of Newark).

Washington, D. C.—Following are four loyest bids opened by Commissioners D. C. Nov. 30 for remodeling and constructing an extension to School No. 174: Burgess & Parsons, $60,000; A. L. Guidone & Son, $60,450; Melton Constr. Co., $61,295; Richardson & Burgess, $61,420 (bidders all of Washington).

★**Florence, S. C.**—Contract awarded by Board of Education for erecting new school in East Florence to Taylor Waters Construction Company of Columbia, at $25,395. and heating and ventilating to Eitchberger Heating Company, Atlanta, Ga., at $2,787.

New Orleans, La.—Following are four lowest bids opened Nov. 23 by Department Public Finance for erecting Isolation Hospital at N. Rampart and Toulouse Streets: J. A. Pelz, $32,956; Lionel Favrot, $34,429; M. Chease Co., $34,700; Joseph O. Chisler Co., $35,140.

★**Canton, Ohio.**—Contract for erecting Daniel Worley School (bids opened Nov. 22) awarded by Bd. of Education to Indiana Engineering & Construction Co., Fort Wayne, Ind., at $47,725, and plumbing to Chapman Plumbing & Supply Co., at $2,837. W. C. Lane, Clk.

★**Cleveland, Ohio.**—Contract awarded Robinson Contr. Co., 803 W. Superior Avenue, for erecting brick, stone and reinforced concrete dental school for Western Reserve University, at Adelbert and Cummington Roads; cost, $125,000. Franz C. Warner, Archt., 715 Prospect Avenue.

★**Sidney, Ohio.**—Contract for constructing U. S. Post Office awarded Ohio Building & Construction Co., Reading Road and Burnet Avenue, Cincinnati, at $51,650.

★**Lansing, Mich.**—Contract for erecting gymnasium at Michigan Agricultural College awarded Hoerst Construction Company, Grand Rapids, at $149,000.

★**Rinard, Iowa.**—Contract awarded by Board of Education for erecting Consolidated School to N. D. Garner, of Des Moines; cost, $26,000.

★**St. Paul, Minn.**—Contract awarded Nov. 30, by Board of Control, to George J. Grant Construction Company, New York Life Building, at $397,324, for erecting Minnesota Historical Society Building. Sauk Rapids granite to be used.

★**West Duluth (P. O. Duluth), Minn.**—Contract for erecting municipal fire hall, police station and court building at Cody Street and Central Avenue awarded Hugh Fawcett, Duluth, at about $24,500.

★**Florence, Neb.**—Contract awarded Thomas Herd, New York Life Building, Omaha, for erecting main building for House of Hope; cost, with equipment, $50,000.

★**Little Rock, Ark.**—Contract for erecting service building for Little Rock College awarded T. T. Reddick Co., Fort Smith, cost $22,427, and science hall to Burkes Construction Co., Hattiesburg, Miss., cost $35,000. Frank M. Blaisdell, Archt., Little Rock.

★**Austin, Tex.**—Contract for erecting high school (bids opened Nov. 24) awarded by School Board (W. H. Cullen, president) to VanHorn Shaw Construction Company, Ft. Worth, at $100,970. Next three lowest bidders: Watson Company, Dallas, $102,000; Wiston & Kroeger, San Antonio, $112,450, and J. O. Polhemus, Austin, $113,019.

Brenham, Tex.—Following are four lowest bids on limestone opened Nov. 27 by Supervising Architect, Washington, D. C., for constructing U. S. Post Office: W. G. Carter Co., Chicago, Ill., $44,834; George W. Stiles Constr. Co., Rookery Building, Chicago, Ill., $45,200; Algernon Blair, Montgomery, Ala., $46,285; Mayben & Fruechtel, Gadsden, Ala., $47,202; V. E. Taylor, Marlin, Tex., only bidder on sandstone, at $55,000.

Houston, Tex.—Following are four bids opened by City Council, Nov. 29, for erecting Taylor School: Shaws, Reinhardt & Donovan, Oklahoma City, Okla., $56,000; F. Heidelberg, $59,889; Central Contracting Company, $59,991, and James Stewart & Company, $60,433. Lowest bid for heating was from Warren Company, Houston, at $4,820, and for electric wiring, Newberry Electric Company, Houston, $1,100.

Navasota, Tex.—Following are four lowest bids on limestone opened Nov. 26 by Supervising Architect, Washington, D. C., for constructing U. S. Post Office: Algernon Blair, Montgomery, Ala., $41,836; W. D. Lovell, Minneapolis, Minn., $42,000; George W. Stiles Constr. Co., Rookery Building, Chicago, Ill., $42,200; Frank M. Weakley, 403 Middle Street, Portsmouth, Va., $42,973; V. E. Taylor, Marlin, Tex., only bidder on sandstone, at $53,000.

Boise, Idaho.—All bids opened Nov. 8 by Supervising Architect, Washington, D. C., for remodeling extension to U. S. Post Office were rejected, considered excessive. Specifications will be revised and supplemental bids asked.

PRIVATE BUILDINGS

PROPOSED WORK.

Binghamton, N. Y.—Redmen contemplate erecting $50,000 building. P. A. Greenman, Chairman of Building Committee.

Brooklyn, N. Y.—Plans completed by W. T. McCarthy, 16 Court Street, for two four-story brick apartment buildings to be erected for Fifty-fourth Street and Fourteenth Avenue Co., Inc., at Fourteenth Avenue and Fifty-fourth Street; total cost, $75,000.

New York, N. Y.—Plans completed by George and Edward Blum, 505 Fifth Avenue, for six-story apartment house to be erected at Riverside Terrace and 181st Street for Great Northern Const. Co.; cost $175,000.

Plans filed for erecting following buildings: 12-story fireproof apartment house at 590 West End Avenue, for 590 West End Avenue Inc., cost $525,000, Neville & Bagge, Archts., 105 West Fortieth Street; 5-story brick tenement at Vermilyea Avenue and Isham Street, for Vandalia Realty Corp., cost $75,000, Geo. & Edw. Blum, Archts., 505 Fifth Avenue; 7-story fireproof club and assembly room at 74 W. 124th Street, for Young Women's Christian Assoc., cost $250,000, Louis E. Jallade, Archt., 37 Liberty Street; 13-story fireproof store and showrooms at 26 Union Square, for Union Square Building Cor., cost $225,000, Wm. G. Pigueron, Archt., 59 Pearl Street; 2-story telephone exchange at 615 W. 175th Street, for New York Telephone Co., cost $93,000, McKenzie, Voorhees & Gmelin, Archts., 1123 Broadway; two 5-story brick tenements at Van Buren Street and Morris Park Avenue for Van Buren Constr. Co., cost $100,000, Kreymborg Architectural Co., Archts., 1029 E. 163d Street; 5-story brick tenement at Hornaday Place and Crotona Park for H. M. Constr. Co., cost $50,000, Kreymborg Architectural Co., Archts., 1029 E. 163d Street; four 5-story brick tenements at Jerome Avenue and 192nd Street for Jerome Avenue Constr. Co., cost $310,000, Andrew J. Thomas, Archt., 2526 Webster Avenue; 5-story brick tenement at Field Place and Creston Avenue for 2333 Creston Avenue Co., cost $65,000, Goldner & Goldberg, Archts., 391 E. 149th Street; 5-story brick tenement at 190th Street and University Avenue for Wm. M. Moore, cost $70,000, Somerfeld & Steckler, Archts., 31 Union Square; three 5-story brick tenements at Liggit Avenue and Fox Street for Macy Constr. Co., cost $155,000, Kreymbold Architectural Co., Archt., 1029 E. 163d Street; two 5-story brick tenements at Valentine Avenue and 184th Street for Ensign Improv. Co., cost $100,000, Kreymborg Architectural Co., Archts., 1029 E. 163d Street; 1-story brick theater at 195th Street and Webster Avenue for Bedford Park Amusement Co., cost $75,000, Geo. F. Pelham, Archt., 30 E. Forty-second Street; three 5-story brick tenements at College Avenue and 169th Street, for Valhalla Cor., cost $120,000, Moore & Landseidel, Archts., Third Avenue and 148th Street.

Ocean Grove, N. J.—Executive Committee of Ocean Grove Camp Meeting Association taking steps to erect new pavilion; cost, $30,000.

Delaware Water Gap, Pa.—Plans being prepared by S. H. Vaughn, Atlantic City, N. J., for new Water Gap House.

Lancaster, Pa.—Erection of a dormitory at Lancaster Theological Seminary, costing about $50,000, contemplated.

Homestead, Pa.—Malta Temple Association contemplating erecting building at Ninth Avenue and Dickson Street; cost, about $30,000.

Baltimore, Md. — Clyde M. Friz, Munsey Building, is architect for four-story and basement reinforced-concrete garage to be erected at 27 S. Charles Street for Mid-City Garage & Motor Supply Company (John W. Frick, Pres., 309 Keyser Building); cost $90,000.

Plans being prepared by Clyde N. Friz, Munsey Building, for one-story stone edifice to be erected at Rosedale and Walbrook Avenues for Temple Baptist Church; cost, $20,000. Rev. Paul P. Watlington, Pastor.

Tentative plans prepared for three-story building to be erected for Auto Club of Maryland at Mount Royal Avenue and Cathedral Street; cost, about $65,00. John S. Bridges, Chairman Building Committee, 3505 N. Charles Street.

Plans being prepared by Louis Levi, Munsey Building, for 4-story and basement, granite and terra cotta building to be erected on German Street for Immediate Benefit Life Insurance Company, 900 North Eutaw Street; cost, approximately $70,000.

Washington, D. C.—Plans being prepared by Hunter & Bell, Southern Building, for seven-story fireproof apartment building to be erected on Columbia and Belmont Roads for Bates Warren, Southern Building; cost, about $250,000. Thomas J. Fisher & Co., 738 Fifteenth Street, Agents.

Macon, Ga.—Plans being prepared for hotel to be erected at Cherry and Fifth Streets for J. S. Shingler, of Ashburn; cost about $125,000.

Tampa, Fla.—Fred J. James, Tampa, is architect for five-story, concrete and brick apartment and store building to be erected on Lafayette and Parker Streets; cost, about $75,000.

Cleveland, Ohio.—Plans being prepared by A. C. Edwards, 614 Union Building, for two-story, brick and stone motion picture building to be erected at St. Clair Avenue and E. Eighty-second Street for Yale Theater Co.; cost $40,000.

Wilmington, Ohio.—Reported Charles W. Murphy, 4122 N. Kedzie Avenue, Chicago, Ill., will erect theater here to cost about $100,000.

Battle Creek, Mich.—Reported Michigan Railway Company (J. F. Collins, Vice-Pres. and Gen. Mgr., Jackson) considering site for new passenger station.

Kalamazoo, Mich.—Y. M. C. Assoc. building, costing $75,000, to be erected.

Marquette, Mich.—Plans being prepared by Charlton & Kuenzil, Camp Building, Milwaukee, Wis., for two-story and basement, 46 x 100 ft., brick and reinforced concrete, fireproof, two stores and office building to be erected for J. M. Longyear; cost about $30,000.

Peoria, Ill.—Erection of $35,000 building contemplated here for National Duroc Jersey Association (G. W. Hockett, of Manning, Iowa, Pres.).

Duluth, Minn.—Contract will be let early next year for new Pilgrim Congregational Church to be erected in East End; cost about $100,000. F. G. German, Archt., American Express Building.

Plans being prepared for two-story brick hotel, which O. Pearson, 5023 Tioga Street, contemplates erecting at Sixteenth Avenue West and Superior Street.

Minneapolis, Minn.—Dayton Dry Goods Company (Geo. D. Dayton, Pres.), will erect early next spring four-story addition to dry goods store.

New Ulm, Minn.—Dr. G. B. Wiser, New Ulm, contemplates erecting a three-story 25 x 140 ft. brick building.

H. P. Bastian, New Ulm, contemplates erecting a two-story brick building 25 x 100 ft.

Tracy, Minn.—Citizens State Bank is taking steps to erect a bank building in the spring. J. A. Rickert, cashier.

Lincoln, Neb.—Contract will be let about Dec. 15 by Lincoln Terminal Company for erecting a 10-story building for the Lincoln Traction Company's offices.

Flandreau, S. D.—Roman Catholic Church will erect $25,000 edifice here.

Butte, Mont.—Chicago, Milwaukee & St. Paul R. R. (C. F. Loweth, Ch. Engr., Chicago, Ill.), intends erecting a new passenger station.

Stamps, Ark.—Bodcaw Lumber Company intends erecting brick or cement warehouses to replace buildings destroyed by fire. Address company.

Seattle, Wash.—Plans reported being prepared by W. H. Milner, Haight Building, for 60 x 125 ft. three and five-story apartment house; cost about $60,000.

Reported contract will be let about Dec. 15 for proposed four-story, brick, Class A, 120 x 180 ft. warehouse to be erected on Juneau & Atlantic Streets for Oregon-Washington Railway & Navigation Company (J. R. Holman, Ch. Engr., Portland, Ore.); cost $50,000.

Contract about to be let by A. Warren Gould, Archt., American Bank Building, for 11-story Arctic Club building to be erected at Third Avenue and Cherry Street; cost, about $400,000.

Merced, Cal.—Congregation of Central Presbyterian Church approved plans prepared by Cowell & Bedesen, Merced, for $20,000 edifice to be erected at Twentieth and L Sts.

Lewiston, Idaho.—See "Railroads."

Payette, Idaho.—Plans prepared by J. R. Walker, Payette, for three-story brick hotel to be erected early next year for H. E. Dunn; cost, $50,000.

BIDS DESIRED.

Detroit, Mich.—Local reports state bids desired until Dec. 15 for erecting a 15-story brick, stone, terra cotta and hollow tile 52 x 81 ft. addition to Gray Estates Company hotel. Smith, Hinchman & Grylls, Archt., Detroit.

Beaumont, Tex.—Until Dec. 27 by Cook & Company, Archts., Theatre Building, Houston, for erecting a 9-story reinforced concrete building to be known as Hotel Jefferson for the Jefferson Hotel Company.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Long Island City, L. I., N. Y.—See "New Industrial Plants."

★**New York, N. Y.**—Contract for erecting Presbyterian Church on East 187th Street and Tiebout Avenue awarded Building Violation Corporation, New York. Building is to be limestone, terra cotta and brick and roof asbestos shingles and copper. N. Serracino, Archt., 1170 Broadway.

★**Atlantic City, N. J.**—Contract awarded Cramp & Co., Denckla Building, Philadelphia, Pa., for erecting twelve-story, fireproof, addition to St. Charles Hotel, at St. Charles Place, on Boardwalk, for Newlin Haines Co. Hewitt & Paist, of Philadelphia, Archts.

★**Donora, Pa.**—Contract for erecting Faller Building on McKean Avenue awarded Marston-Gass Lumber Company, Sixth and Meldon Streets; cost, approximately, $50,000.

★**Washington, D. C.**—Contract awarded William A. Kimmel, 1508 Columbia Road, N. W., for erecting 5-story brick, limestone temple at Tenth and U Streets, N. W., for colored Masons; cost about $185,000. N. T. Haller, Archt., Corcoran Building.

★**Cleveland, Ohio.**—Contract awarded Bolton & Pratt, Columbia Building, for erecting clubhouse at 2097 E. Twenty-first Street, for Bricklayers' Association, 735 Prospect Avenue; cost about $35,000. William S. Lougee, Archt., Marshall Building.

Samuel Austin & Sons, 14230 Euclid Avenue, are contractors for four-story and basement, brick and steel building to be erected at 2012 Euclid Avenue for Stuyvesant Motor Co.; cost about $60,000.

★**Duluth, Minn.** — Contract awarded George Lounsberry, Duluth, for erecting foundation for proposed $60,000 Y. M. C. A. building, at Lake Avenue and Second Street.

★**Minneapolis, Minn.**—Contract awarded M. Schumacher, 39 Dell Place, for erecting moving picture theater at 733 East Lake Street for E. J. Philps; cost about $27,000.

★Contract for erecting moving picture theatre for C. E. Marr at 1021 East Franklin Avenue reported awarded Chas. E. Hoagland; cost about $40,000.

★**Wichita, Kan.**—Contract for erecting Y. W. C. A. administration building at 140 North Topeka Avenue awarded Swenson Construction Company, Finance Building, Kansas City, Mo.; cost, about $50,000.

★**Newport, Ark.**—Contract awarded by Arkansas Bank & Trust Company to Burkes Constr. Co., Little Rock, for erecting bank and office building; cost $27,000. Mann & Stern, Archts., Little Rock.

★**Vancouver, B. C.**—Contract awarded Coast Construction Company, Vancouver, by Great Northern Ry. Company for erecting the joint terminal building to cost $750,000

NEW INDUSTRIAL PLANTS

PROPOSED WORK.

Wilmington, Vt.—Plant of Ludington Woodenware Co., reported destroyed by fire, will be rebuilt.

Flushing, L. I. N. Y.—F. G. Bradford, Mgr. of Gaumont Company, 110 West Fortieth Street, New York, announced that his company contemplated spending $300,000 for improvements to Flushing moving picture plant.

Owego, N. Y.—Reported A. H. Mallory and C. S. Mallery, Binghamton, have purchased plant of Owego Bridge Company, and will remodel and use as fabrication plant for Binghamton Bridge Company and Syracuse Bridge Company.

Bladenboro, N. C.—Bladenboro Cotton Mill (J. L. Bridger, Gen. Mgr.) will erect addition to plant and install machinery costing $50,000. Equipment has been ordered.

Great Falls, S. C.—Reported R. S. Mebane, of Great Falls, interested in a company which will build cotton mills here and absorb present plant of Republic Cotton Mills.

Altoona, Pa.—Altoona Overall Company, 1422 Eleventh Avenue, will erect new three-story fireproof factory in the spring at 1117 Seventeenth Street.

Stewartsville, N. J.—The Edison Portland Cement Company intends making improvements at a cost of $200,000 and will install latest machinery in the raw and finishing departments.

New Castle Pa.—A two-story, fireproof brick and steel, 75 x 100 ft., addition to be erected at plant of Alan-Wood Iron & Steel Hardware Company, Mercer Street.

Sumter, S. C.—Plans of Grinnell & Company, recently reported destroyed by fire will be rebuilt.

Birmingham, Ala.—Plans completed by Jas. Bowron, Engineer, Empire Building, for factory to be erected at Magnolia Avenue and Third Avenue, South, for Birmingham Bread Company; cost $50,000.

Union Springs, Ala.—Storehouse, Cotton Gin Company and several offices and factory reported destroyed by fire.

Cleveland, Ohio.—Baker, Smith & Long Company, 1135 West Twenty-fifth street, plan enlarging new plant on Madison Avenue and West 112th Street.

Euclid, O., White, East Boyle, Shaker Heights, reported interested in organizing with Lake county factory in the Euclid and Lloyd Avenues, Euclid, for manufacture of farm implements and motor vehicle machinery; Thomas and Pickering, Painesville, to be head of group; capital $200,000, and temporary buildings will be erected at once.

Girard, Ohio.—Thomas McDonald, Dist. Supt. of Carnegie Steel Company, Youngstown, has announced that his company intends erecting plant here.

Springfield, Ohio.—Bookwalter & Myers Co., Engineers, Arcade and Fulton Street, interested in erecting entire new plant and also to install new equipment, including equipment, $250,000.

Kalamazoo, Mich.—Reported Everyware Cereal Paper Company will erect addition to plant in near future.

Reported Kalamazoo Paper Company intends erecting $100,000 addition to plant.

Reported Gardnie Company intends erecting a foundry.

Plymouth, Mich.—Plymouth Motor Castings Company, recently destroyed by fire, will be rebuilt of concrete.

Des Moines, Iowa.—Farmers' Co-operative Telephone Company, West Sixth and Elm streets, will erect three-story, 50-ft. brick and concrete structure to cost $50,000. Mr. Jones, secretary.

Galveston, Tex.—The Galveston Dry Dock & Construction Co. (Charles N. Lowell, Manager) will install a ship building and repair plant. Fully equipped, and will include a 1,000-ton Creole, Russ Calhoun city dock and a floating dry dock, which will have an ultimate lifting capacity of 10,000 tons.

El Reno, Okla.—El Reno Mill & Elevator Co. will erect four-unit cost $40,000.

Globe, Ariz.—Arizona Commercial Mining Co. is preparing a consolidating company and will erect a power house to cost $50,000.

Brigham, Utah.—Utah-Idaho Sugar Company of Salt Lake City will erect plant near Tremonton City. Cost reported. Address T. R. Cutler, Gen. Mgr.

BIDS DESIRED

New Orleans, La.—Until Jan. 10 (Bids were to be received Dec. 15) by Board Port Commissioners for furnishing and delivering 1,000 tons of steel rails, for replacement of existing rails on the Inner Harbor Navigation Canal, Industrial Canal, Gentilly Road, Florida Avenue, Florida Walk, Claiborne Avenue, Bayou St. John, Bayou Road and Tchoupitoulas Street, substantially as specified by Engineer in Charge, Room 6, Levee Building, Canal Street.

PRICES AND LETTINGS

★*Indicates award of contract.*

★Castro Falls, R. I.—Contract for building addition to plant of Lonsdale Manufacturing Company awarded Stephen H. Smith, Providence, Industrial Trust Building.

★Long Island City, L. I., N. Y.—Contract for erection of factory, Davis & Cox, East Hampton, Long Island, New York, for erection of factory, offices and warehouse of the Standard Oil Company, Long Island City, reported cost $10,000. Warren & Westbrook, Architects, 17 East Forty-seventh Street, New York.

★Elizabeth, N. J.—Contract awarded Welsh Engineering Company, 4 West Fortieth Street, New York, for three-story brick and concrete factory to be erected here for American Gas Accumulator Company, Harry Bentley, Philadelphia, Pa. Bentley & Perry, Architects, Philadelphia, Pa.

★Shadyside, N. J.—Contract awarded John J. Ferguson, Inc., 1 Broadway, New York, for General Chemical Company for erection of three-story addition to their plant here, 100 x 100 ft., which is to be of brick and steel construction and to cost $100,000. Engineering work in charge of Mr. Ferguson.

★Norristown, Pa.—Contract for erection of temporary brick factory on Tenth and Spring Mill streets for Standard Sanitary Co. Plans and specifications prepared by Engineering Department of Standard Sanitary Co., East End, reported Jones & Hemmer, of Norristown.

★Philadelphia, Pa.—Contract awarded by Midvale Steel Company to Barclay White & Co., 1530 Chestnut Street, for erecting one-story, brick and steel, 60 x 100 ft. machine shop at Nicetown.

★South Bethlehem, Pa. — Contract awarded by Bethlehem Steel Company for concrete work in connection with three-story, 75 x 100 ft. machine shop No. 2 to be erected by Wilson Street & Sons Company, 1006 Arch Street, Philadelphia, total cost $75,000.

★Cleveland, Ohio.—Contract awarded W. J. Thompson & Son Co., 6110 Euclid Avenue, for erecting $20,000 brick, ice storage unit at the W. Sixty-fifth Street for City Ice Delivery Co.

★Chicago, Ill.—J. H. Sutter, Contracting Engineer, 1 N. La Salle Street, Chicago, has contract for $75,000 leather factory, of mill, steel and brick construction, to be erected either at North Chicago or Waukegan.

★Sheboygan, Wis.—Contract for erection of addition to plant of Myers Machine Company awarded Frank Gelb, Sheboygan.

★Duluth, Minn.—Contract awarded by Capitol Elevator Company to Barnett-Record Company, Duluth, for erecting $700,000 reinforced-concrete addition, capacity 1,750,000 bushels.

Seattle, Wash.—Following are four lowest bids opened Dec. 1 by Port of Seattle Commission (C. E. Remsberg, Secy.) for erecting fish and ice storage building at foot of Whatcom Avenue: Booker, Kiel & Whipple, Central Building, $32,867; Kieburtz & Smith, Railway Exchange Building; Beers Building Company, Pittock Building, Portland, Ore., $36,200; H. D. Stewart, Seattle, $36,494.

MISCELLANEOUS

PROPOSED WORK.

Elevated Railways—Mobile, Ala.—Preliminary plans prepared by Magnolia Compress & Warehouse Company for constructing system of elevated railways or overhead conductors between warehouses and water front.

Subway—Detroit, Mich.—Reported plans prepared for a subway for Woodward Avenue cars from Grand Circus Park to river, length 3400 feet, cost $1,500,000.

Transmission Line—Merrill, Wis.—Merrill Ry. & Lighting Company will erect a high-tension transmission line from Merrill to Wausau.

Transmission Line—Dodge City, Kan.—Midland Water, Light & Ice Company, Dodge City, contemplates constructing an extension to the transmission line to Bucklin and Ford, a distance of 30 miles.

Park Grading—Kansas City, Mo.—Station park grading bonds for $100,000 will be sold Jan. 15 by Henry L. Yost, Mayor, and M. A. Flynn, City Comptroller.

The Pas, Man.—See "Water Works."

BIDS DESIRED.

Conduit—Boston, Mass.—Until Dec. 15, by Edw. F. Murphy, Comr. Pub. Wks., Boston, for Davenport Brook conduit, approximately 3 miles, from Magdala to Washington Street, Dorchester.

Hoists—Philadelphia, Pa.—See "Hydraulic Construction and River Improvements."

Elevating Machinery—Chicago, Ill.—Until Dec. 15 by John Dill Robertson, Commissioner of Health for furnishing and erecting elevating and conveying machinery for the new Mill Building at Municipal Reduction Plant at Thirty-ninth and Iron Streets.

Transmission Towers—Los Angeles, Cal. Reported deferred until Dec. 21, by Board Public Service Commissioners, for furnishing city with steel transmission towers.

Subway—Tucson, Ariz.—Until Dec. 17 by C. K. Clarke, for constructing a subway under railroad tracks at Congress Street.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Tunnel—Dixon, Ill.—See "Sewerage and Sewage Disposal."

Proposals

For Proposals Advertised, see Pages 25 and 25A.

WATERWORKS.

Bids Close.		See Eng. Record.
Dec. 14	Improvements, Wilberforce, Ohio	Nov. 20
Dec. 14	Water, etc., Hamilton, Ohio.	Dec. 4
Dec. 14	System, South Charleston, Ohio. Adv. Dec. 4, 11.	Dec. 4
Dec. 14	Pipe, Panama.	Dec. 11
Dec. 15.	Pumping Station, Albion, Mich	Dec. 4
Dec. 15.	...ing, Etc., Winnipeg, Man.	Dec. 4
Dec. 15.	Pipe, valves, etc., Lees Summit, Mo.	Dec. 11
Dec. 15.	Boilers, Lorain, Ohio	Dec. 11
Dec. 15.	Steel for Tunnel, Chicago, Ill.	Dec. 11
Dec. 16.	Reservoir, tower, tank, etc., Elmhurst, Ill.	Dec. 11
Dec. 17.	Improvements, Lakeland, Fla.	Dec. 4
Dec. 20.	Water works, Kenosha, Wis.	Dec. 11
Dec. 20.	Power house, tank, etc., Houston, Tex.	Dec. 11
Dec. 20.	Water Works, Lincoln, Neb.	Dec. 11
Dec. 20.	Well, Galesburg, Ill. Adv. Dec. 11.	Dec. 11
Dec. 22.	Borings, Providence, R. I. Adv. Dec. 11.	Dec. 11
Dec. 22.	Pipe, etc., Panama	Dec. 11
Jan. 11.	Filter Plant, St. Hyacinthe, Que.	Dec. 4
Jan. 12.	Pumping Unit, Kansas City, Mo. Adv. Dec. 11.	Dec. 11

SEWERAGE AND SEWAGE DISPOSAL.

Dec. 14.	Cuyahoga Falls, Ohio	Dec. 4
Dec. 14.	Cincinnati, Ohio	Dec. 4
Dec. 14.	Fort Sam Houston, Tex.	Dec. 11
Dec. 14.	Kansas City, Mo.	Dec. 11
Dec. 15.	Hampton, Iowa.	Dec. 4
Dec. 16.	Cherryvale, Kan.	Dec. 4
Dec. 18.	Chicago, Ill.	Dec. 11
Dec. 20.	East Palestine, Ohio	Dec. 11
Dec. 20.	New York, N. Y.	Dec. 11
Dec. 21.	Strawberry Point, Iowa	Nov. 20
Dec. 23.	Kenova, W. Va.	Dec. 11
Jan. 4.	Key West, Fla.	Dec. 4
Jan. 6	Mason City, Iowa. Adv. Dec. 4.	Dec. 4

BRIDGES.

Dec. 14.	Sunbury, Pa.	Nov. 27
Dec. 14.	Camptown, Pa.	Dec. 4
Dec. 14.	Philadelphia, Pa.	Dec. 4
Dec. 14.	Lawrence, Kan.	Dec. 4
Dec. 14.	Freeport, Ill.	Dec. 11
Dec. 14.	California.	Dec. 11
Dec. 14.	Warsaw, Mo.	Dec. 11
Dec. 14.	Illinois	Dec. 11
Dec. 15.	Illinois	Dec. 4
Dec. 15.	Sandpoint, Idaho	Dec. 11
Dec. 16.	Globe, Ariz.	Dec. 11
Dec. 17.	Illinois	Dec. 4
Dec. 17.	Illinois	Dec. 11
Dec. 18.	Tekamah, Neb.	Dec. 4
Dec. 18.	Missoula, Mont.	Dec. 11
Dec. 18.	Illinois	Dec. 11
Dec. 20.	New York, N. Y.	Dec. 11
Dec. 21.	Atlanta, Ga.	Dec. 4
Dec. 21.	Phoenixville, Pa. Adv. Dec. 4, 11.	Dec. 4
Dec. 22.	Rockford, Ill. Adv. Dec. 11.	Dec. 11
Dec. 28.	Omaha, Neb.	Dec. 11
Jan. 4.	Wadena, Minn.	Dec. 11

PAVING AND ROADS.

Dec. 14.	Bay Minette, Ala.	Dec. 4
Dec. 14.	Bonds, Nogales, Ariz. Adv. Nov. 27, Dec. 4.	Nov. 27
Dec. 14.	Michigan City, Ind.	Dec. 11
Dec. 14.	Massachusetts.	Dec. 11
Dec. 14.	Kansas City, Mo.	Dec. 11
Dec. 15.	Angola, Ind. Adv. Dec. 4, 11.	Dec. 4
Dec. 15.	Starkville, Miss. Adv. Dec. 4, 11.	Dec. 4
Dec. 15.	San Francisco, Cal.	Dec. 11
Dec. 15.	Knoxville, Tenn.	Dec. 11
Dec. 16.	Miami, Fla.	Dec. 4
Dec. 20.	Washington	Nov. 27
Dec. 20.	Prosser, Wash.	Dec. 4
Dec. 20.	Lewiston, Idaho.	Dec. 11
Dec. 21.	Seattle, Wash.	Dec. 4
Dec. 21.	Wildwood, N. J.	Dec. 11
Dec. 21.	Ocean Grove, N. J.	Dec. 11
Dec. 27.	Opelika, Ala.	Dec. 11
Dec. 27	California.	Dec. 11
Jan. 3.	Maynardsville, Tenn.	Nov. 20
Jan. 13.	Sault Ste. Marie, Mich.	Dec. 4

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS.

Dec. 14.	Dredging, New York, N. Y. Adv. Nov. 13 to Dec. 4.	Nov. 13
Dec. 14.	Ditch, Tempe, Ariz.	Dec. 4
Dec. 14.	Levee, Kansas City, Kan.	Dec. 4
Dec. 14.	Drainage, Newman, Kan.	Dec. 11
Dec. 15.	Ditch, Bemidji, Minn.	Nov. 27
Dec. 16.	Dredging, New York, N. Y.	Dec. 11
Dec. 17.	Jetties and bulkhead, Seagirt, N. J. Adv. Dec. 11.	Dec. 11
Dec. 18.	Dredging, Washington, D. C. Adv. Dec. 4, 11.	Dec. 4
Dec. 18.	Ditch, Mankato, Minn.	Dec. 4
Dec. 18	Culverts, Tekamah, Neb.	Dec. 11
Dec. 20	Irrigation, Barstow, Tex.	Dec. 4
Dec. 20.	Electric Hoist, Philadelphia, Pa.	Dec. 11
Dec. 20	Dredging, New York, N. Y.	Dec. 11
Dec. 22.	Dock, Miami, Fla. Adv. Dec. 4, 11.	Dec. 4
Dec. 23.	Ditch, Pine City, Minn.	Dec. 11
Dev. 28.	Ditch, Hartford City, Ind.	Dec. 11
Dec. 29.	Grain Elevator. New Orleans, La. Adv. Dec. 4, 11.	Dec. 4
Dec. 30.	Drain, Morganfield, Ky. Adv. Dec. 11.	Dec. 11
Dec. 31.	Breakwater, Fort Taylor, Fla. Adv. Dec. 4, 11.	Dec. 4
Jan. 4.	State Canal, Contract 73-A, Albany, N. Y.	Dec. 11
Jan. 5.	Wharf, etc., New Orleans, La. Adv. Dec. 11.	Dec. 11
Jan. 5.	Piling, lumber, etc., for wharf, New Orleans, La. Adv. Dec. 11.	Dec. 11
Jan. 6.	Power house at dam, Wheeling, W. Va. Adv. Dec. 11.	Dec. 11
Jan. 8.	Dredge, Macaco, China	Nov. 6

PUBLIC BUILDINGS AND SCHOOLS.

Dec. 14.	New Philadelphia, Ohio	Nov. 20
Dec. 14.	Gastonia, N. C.	Dec. 4
Dec. 14.	Live Oak, Fla.	Dec. 4
Dec. 15.	Centerville, Iowa	Nov. 27
Dec. 15.	Plattsburg, Mo.	Nov. 27
Dec. 15.	Lincoln, Neb.	Dec. 4
Dec. 15.	Davenport, Iowa	Dec. 4
Dec. 15.	Pueblo, Col.	Dec. 4
Dec. 15.	San Diego, Cal.	Dec. 4
Dec. 15.	Chicago, Ill.	Dec. 11
Dec. 15.	Akron, Ohio	Dec. 11
Dec. 15.	Centerville, Iowa	Dec. 11
Dec. 16.	New Brunswick, N. J.	Dec. 11
Dec. 16.	Chatfield, Minn.	Des. 11
Dec. 17.	Charleston, Ill.	Dec. 11
Dec. 18.	Middletown, Ohio. Adv. Nov. 13, 20.	Nov. 13
Dec. 20.	Humboldt, Tenn.	Nov. 13
Dec. 20.	Cincinnati, Ohio	Dec. 4
Dec. 20.	Paterson, N. J.	Dec. 4
Dec. 20.	Jersey City, N. J.	Dec. 4
Dec. 20.	Pataskala, Ohio	Dec. 11
Dec. 20.	Gainesville, Tex.	Dec. 11
Dec. 20.	Tulsa, Okla.	Dec. 11
Dec. 20.	East Point, Ga.	Dec. 11
Dec. 21.	Attleboro, Mass.	Nov. 20
Dec. 21.	Alton, Iowa	Dec. 4
Dec. 21.	Fulton, Mo.	Dec. 11
Dec. 22.	College Station, Tex.	Dec. 11
Dec. 24.	East Youngstown, Ohio.	Dec. 4
Dec. 28.	Orient, Ohio	Dec. 11
Dec. 28.	Seymour, Conn.	Nov. 26
Dec. 29.	Missoula, Mont.	Nov. 27
Dec. 30.	St. Petersburg, Fla. Adv. Nov. 20, 27.	Nov. 20
Dec. 30.	Galveston, Tex.	Nov. 27
Dec. 30.	Ridgway, Pa.	Nov. 27
Dec. 30.	Somerville, Ohio	Dec. 11
Jan. 1.	Arlington, Iowa	Dec. 4
Jan. 1.	Independence, Iowa	Dec. 4
Jan. 1.	Motherwell, Ont.	Dec. 11
Jan. 4.	Cavite, P. I.	Nov. 13
Jan. 4.	Greenville, S. C.	Nov. 27
Jan. 4.	Gaylord, Minn.	Dec. 4
Jan. 4.	Crookston, Minn.	Dec. 11
Jan. 4.	East Cleveland, Ohio	Dec. 11
Jan. 5.	Harlan, Iowa	Nov. 27
Jan. 6.	Wheeling, W. Va. Adv. Dec. 11.	Dec. 11
Jan. 10.	Titusville, Pa. Adv. Dec. 4, 11.	Dec. 4
Jan. 12.	Durham, N. C.	Dec. 11
Jan. 15.	Duluth, Minn.	Dec. 11
Jan. 16.	Sidney, Neb.	Dec. 11
Jan. 17.	Hackensack, N. J.	Dec. 11
Jan. 18.	Anoka, Minn.	Dec. 11
Jan. 19.	Hornell, N. Y.	Dec. 11

PRIVATE BUILDINGS.

Dec. 15.	Lincoln, Neb.	Dec. 11
Dec. 15.	Detroit, Mich.	Dec. 11
Dec. 27.	Beaumont, Tex.	Dec. 11

NEW INDUSTRIAL PLANTS.

Dec. 15.	Seattle, Wash.	Nov. 20
Dec. 29.	New Orleans, La. Adv. Dec. 4, 11.	Dec. 4

MISCELLANEOUS.

Dec. 14.	El. Rys., Philadelphia, Pa.	Nov. 20
Dec. 14.	Power Plant Improv., Clarksdale, Miss. Adv. Nov. 27 to Dec. 11.	Nov. 27
Dec. 15.	Timber, Sault Ste. Marie, Mich. Adv. Nov. 13 to 27, Dec. 11.	Nov. 13
Dec. 15.	Garbage Disposal, Bar Harbor, Me.	Dec. 4
Dec. 15.	Conduit, Boston, Mass.	Dec. 11
Dec. 16.	Incinerator, Chicago, Ill.	Dec. 11
Dec. 17.	Subway, Tucson, Ariz.	Dec. 11
Dec. 18.	El. Rys., Pearl City, Hawaii	Nov. 20
Dec. 18.	Elevating Machinery, Chicago, Ill.	Dec. 11
Dec. 20.	Coal, Norfolk, Va. Adv. Nov. 20, Dec. 11.	Nov. 20
Dec. 20.	Memorial, Lebanon, Ohio.	Dec. 4
Dec. 21.	Cement, Kansas City, Mo. Adv. Dec. 4, 11.	Dec. 4
Dec. 21.	Transmission Towers, Los Angeles, Cal.	Dec. 11
Dec. 22.	Electric Light Fixtures in Senate Chamber, Albany, N. Y. Adv. Dec. 11.	Dec. 11
Dec. 23.	Elevators, Washington, D. C.	Dec. 4
Jan. 3.	Garbage Incinerator, Fort Wayne, Ind. Adv. Dec. 11.	Dec. 11
Jan. 8.	Steel towers, Guam.	Nov. 20
Apr. 1.	Memorial, Fort McHenry (P. O. Baltimore), Md.	Nov. 20

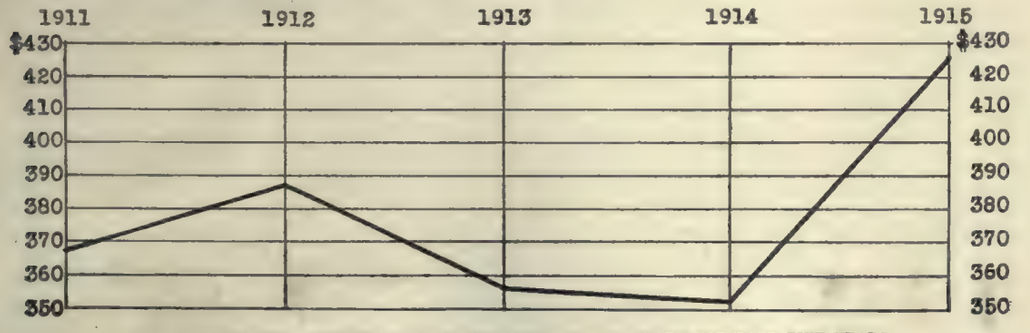
CONTRACTING NEWS

Of Special Interest to Engineers, Contractors, Builders and Manufacturers of Engineering and Building Supplies

A GLANCE at the accompanying diagrams, taken from the latest monthly report of the Bureau of Railway Economics, will convince one that the transportation business is showing marked improvement. Were the figures for October and November plotted on these charts a still better showing would probably be made. It will be observed that operating income per mile for September was nearly $40 in excess of the best figures for the same month in the past four years. Export traffic is continuing very heavy. In both the first two weeks of December exports passed the $90,000,000 mark, and those for the week ended Dec. 11 came very close to equaling in value the exports for the record week ended Oct. 23.

The U. S. Steel Corporation made a million-ton gain in unfilled orders last month, which lacked only 20,000 tons of being a new record. It now has on its books the largest unfilled tonnage since March, 1913. All the orders now being taken have specifications attached, and no open contracts are being made.

Many Southern and Central lumber mills are refusing to take orders because of the congested condition of order files, and, although shipments during the first week of the month from 153 of these mills exceeded production by 25 per cent, orders were reduced only 3 per cent from the total of the week previous. Stocks, however, are fast reaching a low point, and it is inevitable that prices, which have been very low for some time past, will continue to rise. Retailers' stocks are also thought to be at a low point, which indicates further need of anticipating requirements on the part of consumers.

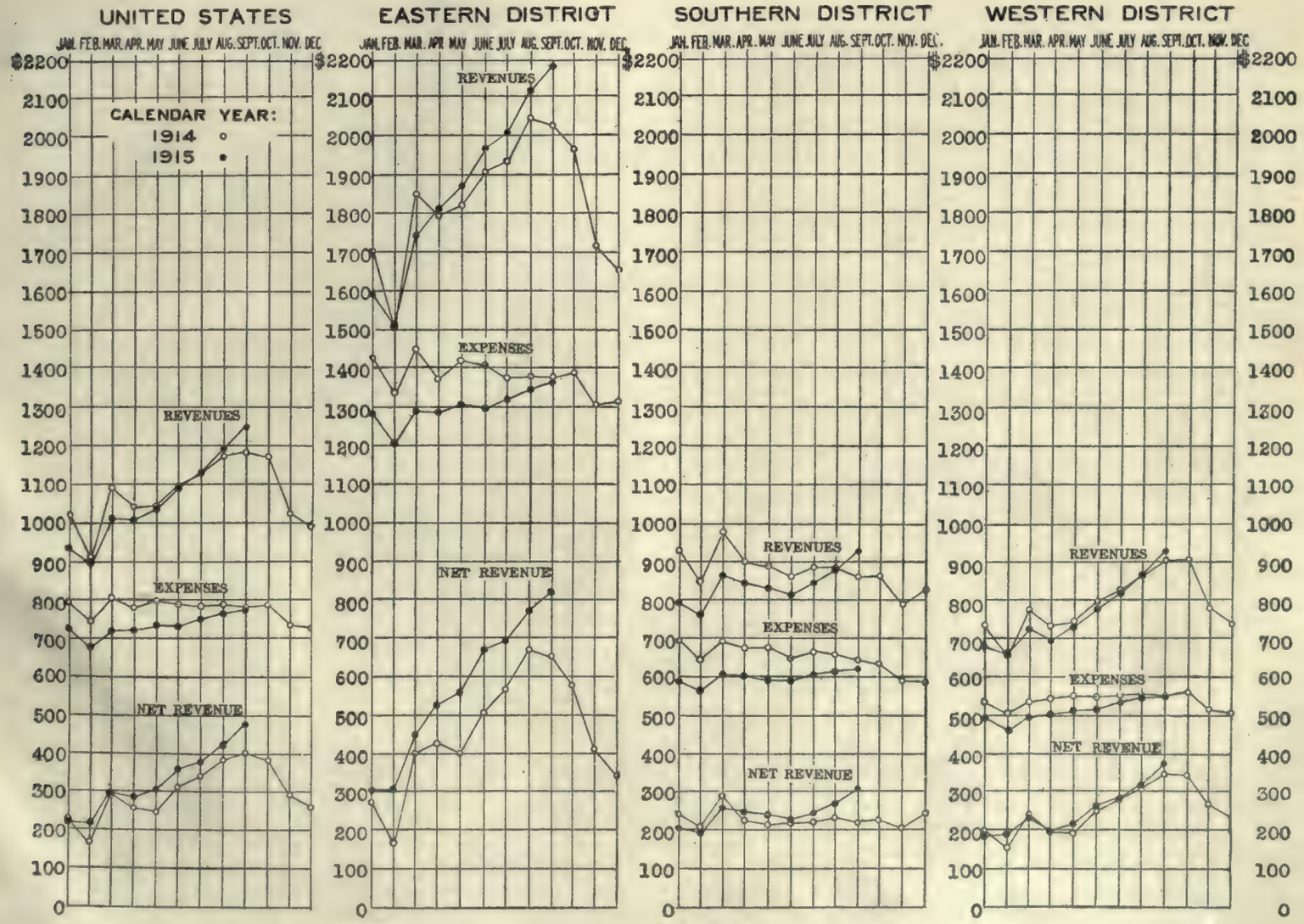


HOW SEPTEMBER OPERATING INCOMES PER MILE COMPARE FOR PAST FIVE YEARS

Buildings

Building work is holding up well, considering the lateness of the season, and the volume of prospective work for next year continues to grow. Bids have been opened at Boston for constructing a $160,000 school, and a contract for building a 12-story hotel has been awarded at Atlantic City, N. J. Contracts amounting to $156,000 for constructing a high school have been awarded at Lebanon, Pa. An office building to cost $400,000 has been contracted for at Sioux City, Iowa. A $350,000 contract for building a public library has been awarded at San Francisco. Bids will be opened Dec. 20 for erecting a $150,000 high school at Belmont, Mass.

Plans for a $450,000 apartment house have been completed in New York City. The Philadelphia Board of Education is considering a $2,000,000 building program for next year. Akron, Ohio, has sold school bonds amounting to $400,000. Architects have been selected for a $500,000 office building to be constructed in Chicago. An automobile factory to cost $500,000 is to be built at St. Paul. Kansas City, Mo., has been bequeathed $300,000 which will be used to erect an art museum. A contract will be let next month for erecting a $200,000 building at Lincoln for the University of Nebraska. An interurban terminal to cost $1,500,000 is to be built at Dallas, Tex. It is reported that a $200,000 contract for erecting a school building will be let soon at Portland, Ore. Plans are being prepared at Seattle for school buildings for which $750,000 has been voted.



UPWARD TREND OF GROSS AND NET REVENUES PROMISES COMING UPTURN IN EXPENSES DUE TO INCREASED APPROPRIATIONS FOR CONSTRUCTION

Bridges and Roads

The lowest bid received Dec. 9 for constructing the Unionport bridge in New York City was $195,000. Bids have been opened in Philadelphia on two bridges to cost $66,000. Bids will be opened Jan. 18 at Knoxville, Iowa, for bridge work to cost $85,000. Sulphur, Okla., desires bids Dec. 20 for constructing a bridge of 200-ft. span. Bids are to be opened Dec 23 at Portland, Ore., for a viaduct to cost $66,000, and Salem, Ore., will receive bids Dec. 24 for constructing the Willamette River bridge, which will cost $200,000. Plans have been approved for a $50,000 bridge to be built at Sharon, Pa. An engineer has been selected for the 450-ft. concrete bridge to be built over the Minnesota River at Mankato, Minn. Marshall, Tex., has voted $50,000 for constructing a viaduct. Plans are being prepared for a $100,000 bridge to be built at Santa Barbara, Cal.

A large paving contract has been awarded at Ida Grove, Iowa. Asphalt paving to cost $48,000 is contracted for at Los Angeles. The lowest bid received Dec. 6 by the State of California for constructing a highway in Imperial County was $72,000. Bids are desired for concrete road work by the State of Connecticut, and for 124,000 sq. yd. of concrete paving by Belleville, Ill. Albright, W. Va., has voted $250,000 for concrete roads. Morgantown, W. Va., has sold $304,000 road bonds. A $250,000 bond issue for road construction has been validated at Sanford, Fla. Road work to cost $200,000 will be undertaken at Gulfport, Miss. A county-road levy voted at Dayton, Ohio, will amount to $230,000 annually for two years. A contract will be let soon at Little Rock, Ark., for paving to cost $50,000. Road contracts amounting to $150,000 are to be let soon at Spokane. Ritzville, Wash., will let a contract for road work for which $59,000 is available.

Waterworks and Sewers

Bids have been opened at Needham, Mass., for constructing sewers to cost $94,000. The lowest bid received at Houston, Tex., for constructing a storm-sewer system was $63,900. All bids for constructing a reservoir at Manteca, Cal., were rejected, the lowest being $180,000, and new bids will be opened Jan. 6. Bids are desired Jan. 3 for laying 6 miles of pipe to extend the water system of Baker, Ore. Sewer work to cost $123,000 will be let Dec. 27 at Vincennes, Ind.

Rochester, N. Y., is to spend $450,000 for waterworks improvements and a sewage-disposal plant. Salisbury, N. C., has sold $200,000 bonds, a large part of which will be spent for waterworks and sewers. Plans for a $100,000 storm sewer are being prepared at Grand Island, Neb. Plans are being prepared for a large storm sewer at St. Paul, and that city and Pocatello, Idaho, have each sold $400,000 waterworks bonds.

Miscellaneous

Two elevated railway contracts have been awarded in New York City, one at $352,000 and the other at $2,063,000. Several contracts for the construction of a large power plant near Wellsburg, W. Va., have been awarded. A contract for grading 10 miles of railroad has been let at Henryetta, Okla. The contract for constructing the Hetch Hetchy Railroad has been awarded for $1,543,000 at San Francisco. Plans are now available for another section of New York state barge canal work, estimated to cost $432,000. Ditch work planned, partly surveyed, and partly about to be let, reported from the Minnesota towns of Mankato, Windom, Fairmount and Jackson, will cost $1,200,000. Canal improvements to cost $350,000 are contemplated at Wenatchee, Wash.

WATERWORKS

PROPOSED WORK.

Rochester, N. Y.—City is about to sell $1,[illegible] bonds of this amount $[illegible] will be for water works improvements and $[illegible] for sewage disposal plant.

Greenville, Pa.—Reported improvements to be made by the Greenville Water Company which will include the construction of a steel pipe between the borough limits, tanks to have permanent supply of 200,000 gal.

Lancaster, Pa.—City Council adopted recommendations of committee that electrically driven centrifugal pumps be installed in the water works plant and that James W. Armstrong, of Baltimore, Md., be employed as consulting engineer and A. B. [illegible] as assistant to supervise the improvement.

Ringtown, Pa.—Borough Council authorized a bond issue of $12,000 for constructing water works.

Windsor, Pa.—State Department of Health has authorized city to construct a reservoir and install a water system.

Baltimore, Md.—Mayor Preston is reported in favor of installing water meters in all buildings with exception of two-story dwellings.

Salisbury, N. C.—Bonds amounting to $[illegible] for water, sewer and street improvements have been sold.

Fort Pierce, Fla.—Bonds amounting to $[illegible] for refunding and improving the electric, water, sewer and light systems will be sold Jan. 1 by W. B. Jackson, City Clk.

Camden, Ala.—Citizens voted $15,000 bonds for constructing water works. B. Matthews, Clerk. L. B. Kay, Tuscaloosa, Ala., Engineer.

Cullman, Ala.—Contract will be let about April for laying five miles of 6 in. water mains to cost [illegible]. A. G. Coe, City Clerk.

Crowley, La.—City Council contemplates issuing $[illegible] bonds for improvements to the water works and electric light plants.

Bowling Green, Ky.—Board Public Works has authorized Council to secure plans and specifications for a sedimentation basin.

Athens, Ohio.—Contract will be let early in January for constructing water works to cost $[illegible] and to include 1,000,000-gal. reservoir, [illegible] C. I. pipe, 10,000-gal. elevated tank on 50-ft. tower and two 150-hp. boilers and air compressor. Philip Bergen, Engineer, Columbus Fund Board, for Public Service.

Cleveland, Ohio.—Council passed $500,000 water works bond issue.

Janesville, Ohio.—Plans being prepared for refloating and enlarging two reservoirs. W. W. Brush, Director of Public Service.

Orleans, Ind.—Council has granted a franchise for water works to be privately owned and operated.

Waukegan, Ill.—Board of Local Improvements having preliminary steps to lay 16-in. water pipe to cost $14,404 and 12-in. sewer pipe to cost $[illegible].

Crosby, Minn.—Contract soon to be let by Crosby Water Light & Power Company for constructing about two miles of 6, 8 and 10 in. water mains.

McKinley, Minn.—Citizens voted in favor of extending the water works at a cost of $8,500. Address Village Clerk.

St. Paul, Minn.—Water works bonds amounting to $400,000 have been sold.

Swanville, Minn.—Contract will be let about spring for constructing water works for which the citizens recently voted $[illegible] bonds. Walter Anderson, Village Clerk.

Broadview, Mont.—All bids opened Nov. 27 for water system here have been rejected by the County Commissioners at Billings. Probable cost $30,000.

Dardanelle, Ark.—J. F. Halliday, McAlester, Okla., is engineer for the improvements contemplated to the water works at a cost of $15,000. J. F. Stevenson, Secretary Board Commissioners. I. A. Hucklaby, Recorder.

Hartford, Ark.—Construction of municipal water works under consideration. Address City Clerk.

Henryetta, Okla.—Citizens voted $100,000 bonds for constructing a 12 and 16-in. water main to Canadian River and for improvement to present municipal water system.

Welch, Okla.—Water works and electric light plant to be installed and $32,000 bonds for same will soon be sold. B. M. Booton, City Clerk. Wm. McIntosh, Engr., Oklahoma City.

Castle Rock, Colo.—A municipal water works costing $40,000 is under consideration, to include a 500,000-gal. reservoir and an 8-in. pipe flow line. George H. Sethman, Engineer, Equitable Building, Denver; H. G. Johnson, City Clerk.

Seattle, Wash.—Council adopted resolutions for constructing water mains in several streets, including, Twenty-fifth Avenue, Oscar Street, Fifty-first Avenue, Fourteenth Avenue, and Fifty-sixth Street.

City Engineer, A. H. Dimock, has asked Frederick P. Stearns, Boston, Mass., William Mulholland, Los Angeles, Cal., and R. H. Thompson, Seattle, to investigate and report on best method of sealing Cedar River impounding basin back of dam.

Water mains requiring about 13,940 lin. ft. 4, 8 and 12 in. Class C c. i. pipe will be laid in 43 Street. Address Board of Public Works.

Seattle, Wash.—See "Paving and Roads."

Portland, Ore.—City Commission is considering the extension of the Bull Run system throughout the district at a cost of $[illegible] or the purchase of the water works plant at St. Johns of the St. Johns Water & Lighting Company of St. Johns.

Banning, Cal.—Board of Supervisors at Riverside authorized new specifications and plans prepared for the water works to be constructed in District No. 1, Banning. Bids opened recently rejected because of irregularities.

Centerville, Utah.—Election to be held Jan. 22 to vote $15,000 bonds for installing a water system. Address Town Clerk.

Pocatello, Idaho.—Water works bonds amounting to $400,000 have been sold.

Port Coquitlam, B. C.—Reported city's application for water right on Gold Creek has been accepted by the Dominion Water Commission. A system costing $35,000 is to be constructed. John Smith, City Clerk.

BIDS DESIRED.

New York, N. Y.—Until Dec. 24, by William Williams, Comr. Water Supply, Gas & Electricity, for furnishing and delivering and installing apparatus and appurtenances for applying liquid chlorine to Croton water supply at Dunwoodie, Yonkers, N. Y.

Wesson, Miss.—Until Jan. 4 by P. S. Bush, City Clerk, for constructing water works and electric light plant.

Cleveland, O.—Reported desired until Dec. 22, by A. R. Callow, Comr. Purchases and Supplies, for chemical lime and sulphate of iron for filtration plant at Division Ave. Pumping Station.

Columbus, Ohio.—Until Dec. 28, by Paul B. Kemper, Secy., Dir. Pub. Service, for additional equipment to present alum plant of the Water Purification Works.

Columbus, O.—Reported desired until Dec. 23, by Geo. A. Borden, Dir. Pub. Service, for 1,500 tons sulphuric acid for Water Department.

Danville, Ill.—Until Jan. 10, by Board Water Commissioner for one reinforced concrete rapid sand filter of 300,000 gallons capacity advertised in Engineering Record. Chester & Fleming, Engineers, Union Bank Building, Pittsburgh, Pa.

Lafayette, Col.—By city for constructing nine miles 8-in. pipe. J. C. Lawler, Engineer, 824 Majestic Building, Denver.

Beebee, Ark.—Until Jan. 1 for constructing water system to cost $15,000. Address City Clerk.

Manteca, Cal.—Until Jan. 6 (readvertisement) by South San Joaquin Irrigation District (E. D. Brown, Assistant Engineer), Manteca, for constructing Woodward reservoir.

Baker, Ore.—Reported desired until Jan. 8, by James Cunning, City Clk., for furnishing material and constructing extension to water system to consist of 34,780 ft. of 12, 14 and 16 in. pipe. Concrete or vitr. pipe to be used.

PRICES AND LETTINGS.

★Indicates award of contract.

★Providence, R. I.—Contract for furnishing 672 tons of c. i. pipe awarded Warren Foundry & Machine Company, New York, N. Y., at $26.50 per ton, and for 18,000 lb. of lead pipe to Phillips Lead & Supply Company, Providence, at $1,035. Other bidders on c. i. pipe were: R. D. Wood & Company, Philadelphia, Pa., $27.75 to $31.75; Standard C. I. Pipe & Foundry Company, Bristol, Pa., $28.20 to $31.20; U. S. Cast Iron Pipe & Foundry Company, Philadelphia, Pa., $27.70 to $30.50. William C. Pelkey, Clerk Board Contract and Supply.

★Secaucus, N. J.—Contract awarded by Board Chosen Freeholders, Jersey City, to Culligan & Machanska, Bayonne, for constructing a pipe line connecting county institution at Laurel Hill, Secaucus, at 65 per cent of the engineer's estimate of $11,000, and to Theodore Smith & Sons Co., Jersey City, contract for a salt water supply pump for said institution, at $7,600.

★Spartanburg, S. C.—Contract for constructing a 3,000,000-gal. pumping engine awarded Hooven Owens Rentschler Company of Hamilton, Ohio, at $13,250. S. A. Bush, Supt. Water Works.

★Citronelle, Ala.—Contract for constructing water works and sewers awarded J. W. Gurley & Company, Mobile, at $23,658. Other bidders: Sullivan, Long & Hagarty, Bessemer, $23,153, and B. F. Roberts, Malin, Ga., $23,202. Contract for tank and tower awarded Walsh & Windim, Chattanooga, Tenn. Edgar B. Kay, Engineer, Tuscaloosa.

★Columbus, Ohio.—Contract awarded by State Board of Administration to William Graver Tank Works, East Chicago, Ind., for furnishing and installing water softener equipment for Institute for Feeble Minded.

★East Liverpool, Ohio.—Contracts awarded by Board of Control as follows for water works improvements: Two 10-kw. turbine-driven electric light generators to Kerr Turbine Company, Wellsville, N. Y., at $1,820, and for feed water heater, boiler feed pumps and coal handling apparatus to Steam Equipment Mfg. Company, Pittsburgh, Pa., at $2,968. Chester & Fleming, Engineers, Pittsburgh, Pa.

Wheaton, Ill.—Lowest bid opened Dec. 2 by Water Supply Committee for water tank was submitted by Memphis Steel Construction Company of Pittsburgh, Pa., at $9543 for hemispherical bottom, and $10,851 for elliptical bottom.

★Marshalltown, Iowa.—Following are bids opened by City Council, Nov. 22, for a 4,000,000 gallon pump: Allis-Chalmers Company, Milwaukee, Wis., $14,485 (awarded contract); Murray Iron Works, Burlington, $14,700; Effing Carpenter, $16,253, and International Steam Pump Company, $15,545.

Manteca, Cal.—Lowest bid opened Dec. 6 by South San Joaquin Irrigation District for constructing the Woodward Reservoir submitted by Ross Construction Company, Sacramento, at $180,160. All bids rejected, new bids to be received. See "Bids Desired."

SEWERAGE AND SEWAGE DISPOSAL

PROPOSED WORK.

Rochester, N. Y.—See "Water Works."

Rockville, Md.—Plans being prepared by Ezra B. Whitman, 1319 Fidelity Building, Baltimore, for sewer system to be constructed in Bethesda District; work to include Imhoff tanks and sprinkling filters. Berry E. Clark, Co. Clerk.

Salisbury, N. C.—See "Water Works."

Dayton, Ohio.—Plans and estimates for storm sewers to be constructed with recent bond issue are being prepared by Director of Public Service.

Delaware, Ohio.—City Council is reported considering new sewage disposal plant.

Geneva, Ohio.—State Board of Health is considering the sewage disposal plant contemplated here at a cost of $27,000. M. C. Goddard, City Engineer.

Painesville, O.—Sewer bonds for $46,000 will be sold Dec. 27, by F. L. Kelly, City Clk.

Toledo, Ohio.—Contract soon to be let by Board Public Service for constructing the East Side sewer No. 1268 to be 1½ miles long and cost $18,000.

Toledo, Ohio.—Plans prepared by L. A. Boulay, County Sanitary Engineer, for sewage pumping station to cost $40,000. Work will probably be taken up next spring.

Batavia, Ill.—The East Batavia Improvement Association reported taking steps to construct a sewer system.

McHenry, Ill.—P. E. Green, Engineer of Chicago, estimates cost installing complete sanitary sewer system at $27,000 and recommends awarding of contract by next April. David G. Wells, Mayor.

West Chicago, Ill.—Citizens Dec. 6 voted in favor of a $130,000 sewer system.

Superior, Wis.—City Council passed resolutions providing for condemnation proceedings, the preliminary step toward constructing between $40,000 and $50,000 sewer improvements this winter.

Woodbine, Iowa.—Construction of a sewer system is under consideration. Bruce & Standwear, Engineers, Omaha, Neb. C. C. Haas, City Clerk.

Mankato, Minn.—A vitri. pipe and circular concrete storm sewer costing $6,000 is to be constructed in N. Fifth, Rock and other streets, 18 to 42 in. in diameter. H. F. Blomquist, City Engineer.

St. Paul, Minn.—City Engineer preparing plans for a storm water sewer for St. Anthony Hill section, covering an area of four square miles, and to cost between $500,000 and $1,000,000.

Grand Island, Neb.—Plans and estimates to be prepared for a storm sewer system to cost $100,000. H. E. Clifford, City Clerk; William Grant, Special Engineer, Lincoln.

Halleyville, Okla.—Election soon to be held to vote bonds for constructing sanitary sewer system costing about $50,000 for mains and laterals. Benham Engineering Company, Oklahoma City, Engineers.

Baker, Ore.—Contract soon to be let by City Commissioners for furnishing pipe as follows: 17,000 ft. 12-in., 12,700 ft. 14-in., 4800 ft. 15-in., both vitri. and concrete pipe. L. R. Stockman, City Engineer.

Beverly, Alberta.—Construction of a sewer system to cost $15,000 under consideration. H. W. Ormerod, Secretary-Treasurer.

BIDS DESIRED.

Columbus, Ohio.—Until Dec. 28, by Paul B. Kemper, Clk. Dir. Pub. Service, for constructing sewers in Richardson Avenue, Essex Street and a number of alleys.

Painesville, Ohio.—Reported desired until Dec. 22 by F. A. Tuttle, Dir. of Service, for sewers to consist of 14,990 ft. of 8 to 20-in. vitr. pipe sewer, and 20,000 cu. yd. trenching in clay, soft shale, gravel and sand; depth of cut runs from 7 to 22½ ft. Probable cost $38,750. F. N. Downer, City Engr.

Vincennes, Ind.—Until Dec. 27 by H. F. Watts, City Engineer, for 50,000 ft. storm and sanitary sewers, 50,000 ft. 8 to 24-in. pipe and 12,900 ft. 30 to 60-in. brick sewer; cost $123,700.

Lincoln, Neb.—Until Dec. 22, by Theo. H. Berg, City Clk., for constructing a circular sewer either concrete, two ring brick, or vitr. radial blocks or for a reinforced concrete sewer, rectangular in form, for the main sewer, and one ring vitr. radial block or vitr. tile for 30-in. sewer. Engineers estimated cost $5,600.

Wausa, Neb.—Until Jan. 1 for constructing sewer system and sewage disposal plant. Probable cost $12,000. Address City Clerk.

Enid, Okla.—Until Dec. 18, by W. C. Rogers, City Clk., for constructing sanitary sewers in Dists. Nos. 60, 61 and 62, also extension Dist. Nos. 34 and 35. B. F. Lewis, City Engr.

Loveland, Colo.—Until Jan. 4, by Georgia C. Rist, City Clerk, for constructing a sanitary sewer trunk line, about 3700 ft. 10 and 12-in. sewer, advertised in Engineering Record.

Rogers, Ark.—Reported desired until Dec. 20, by Board Sewers Improvement, Dist. No. 3 (Chas. S. Applegate, Secy.) for about 5550 ft. 12-in. pipe line extension, sewage disposal plant, septic tank, etc. M. A. Earl & Co., Engrs., Muskogee, Okla.

Toronto, Ont.—Until Dec. 21 by T. L. Church (Mayor), Chmn. Board Control, for constructing sewers in portions of Cawthra Avenue, Indian Road, Keele Street and Woodville Avenue.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Needham, Mass.—Following are bids opened Dec. 8 by Metropolitan Water & Sewerage Board, Boston, for constructing sewers in Needham:

High level sewer, Section 103—Bruni & Pettitti, 18 Tremont Street, Boston, $34,011; Daddario & Booth, 49 Edgewater Drive, Mattapan, $35,312; M. DeSisto, 188 Legrange Street, West Roxbury, $37,793.

High level sewer, Section 104—Bay State Dredging Company, 247 Atlantic Avenue, Boston, $59,055; Thomas Russo & Company, 240 North Street, Boston, $64,272; Bruni & Pettitti, 18 Tremont Street, Boston, $67,250.

★**Yonkers, N. Y.**—Contracts awarded by Board of Contract & Supply for sewer in Saw Mill River Road to James J. Corbalis, 811 Clover Street, at $9,760.

Philadelphia, Pa.—Following are four lowest bids opened Dec. 8 by Department of Public Works for constructing an 8-ft. x 12-in. concrete sewer in Packer Street: Contrell Construction Company, Philadelphia, $72,876; Robert Lombard, $74,385; P. Deliesse, $83,766, and Peoples Brothers, $90,840.

Houston, Tex.—Following are unit figures of four bids opened Dec. 6 by city for constructing the Burnett Street storm sewer system: (a) Horton & Horton, Houston, $63,974; (b) Freund & Quay, $64,403; (c) H. C. Gass, $70,758; (d) T. A. Garvin, $73,563.

		(a)	(b)	(c)	(d)
100	cu. yd. extra excavating	$1.00	$1.00	$1.00	$1.00
50	ton mile hauling	.30	.40	.50	.25
200	man hour extra work, labor	.30	.30	.40	.50
200	team hour extra work, teams	.70	.70	.50	.75
5	per M timber in foundations	30.00	40.00	20.00	30.00
300	pc. timber ordered left in trenches	15.00	20.00	22.00	20.00
10	cu. yd. extra class I concrete	10.00	8.00	15.00	9.00
10	cu. yd. extra class II concrete	12.00	9.00	16.00	10.50
10	cu. yd. extra class III concrete	15.00	10.00	17.00	12.00
10	cu. yd. extra brick masonry	15.00	15.00	15.00	12.00
1,000	lb. extra castings	.05	.05	.10	.03
1,000	lb. extra reinforcing steel	.10	.06	.10	.10
100	cu. yd. road gravel	2.25	2.50	2.00	3.00
100	cu. yd. road shell	2.00	2.50	2.00	2.00
20	standard manhole, type "A," each	40.00	48.00	45.00	40.00
55	extra depth manhole, type "A," per ft.	5.00	6.00	5.00	5.00
6	standard manhole, type "B," each	45.00	50.00	60.00	50.00
92	extra depth manhole, type "B," per ft.	9.00	6.00	6.00	6.00
50	supplying and setting std. inlet, type "A," each	30.00	25.00	35.00	25.00
50	supplying and setting std. inlet, type "B," each	23.00	25.00	25.00	25.00
5	supplying and setting std. inlet, type "C," each	65.00	40.00	65.00	50.00
	100 ft. additional piling	.50	2.00	.50	.50
1	outfall complete according to plan	800.00	1,120.00	900.00	900.00
870	lin. ft. 12" d. s. vit. pipe, 0'- 6' deep	.90	.80	.90	.95
870	lin. ft. 12" d. s. vit. pipe, 6'- 8' deep	1.05	.95	1.10	1.08
100	lin. ft. 12" d. s. vit. pipe, 8'-10' deep	1.35	1.25	1.30	1.23
25	lin. ft. 12" d. s. vit. pipe, 10'-12' deep	1.50	1.60	2.00	1.53
870	lin. ft. 15" d. s. vit. pipe, 0- 6' deep	1.15	1.35	1.20	1.25
870	lin. ft. 15" d. s. vit. pipe, 6'- 8' deep	1.25	1.25	1.40	1.40
100	lin. ft. 15" d. s. vit. pipe, 8'-10' deep	1.70	2.00	1.60	1.60
25	lin. ft. 15" d. s. vit. pipe, 10'-12' deep	2.00	2.25	2.00	2.00
220	lin. ft. 18" d. s. vit. pipe, 0'- 6' deep	1.50	1.80	1.70	1.50
400	lin. ft. 18" d. s. vit. pipe, 6'- 8' deep	1.65	1.80	1.90	1.75
369	lin. ft. 18" d. s. vit. pipe, 8'-10' deep	2.05	2.00	2.10	2.10
340	lin. ft. 18" d. s. vit. pipe, 10'-12' deep	2.30	2.00	2.30	2.60
140	lin. ft. 18" d. s. vit. pipe, 12'-14' deep	2.60	2.00	2.75	3.20
50	lin. ft. 18" d. s. vit. pipe, 14'-16' deep	3.00	2.85	3.50	4.00
10	lin. ft. 20" d. s. vit. pipe, 6'- 8' deep	2.10	2.85	2.00	2.25
50	lin. ft. 20" d. s. vit. pipe, 8'-10' deep	2.35	2.85	2.20	2.45
180	lin. ft. 20" d. s. vit. pipe, 10'-12' deep	2.60	2.85	2.40	2.70
80	lin. ft. 20" d. s. vit. pipe, 12'-14' deep	3.00	2.85	2.60	3.25
50	lin. ft. 20" d. s. vit. pipe, 14'-16' deep	3.40	3.85	3.50	4.10
100	lin. ft. 22" d. s. vit. pipe, 0'- 6' deep	2.10	2.45	2.20	2.20
490	lin. ft. 22" d. s. vit. pipe, 6'- 8' deep	2.25	2.60	2.40	2.35
290	lin. ft. 22" d. s. vit. pipe, 8'-10' deep	2.75	2.60	2.60	2.55
50	lin. ft. 22" d. s. vit. pipe, 10'-12' deep	3.05	3.00	3.50	2.90
75	lin. ft. 24" d. s. vit. pipe, 6'- 8' deep	2.50	2.60	2.50	2.25
420	lin. ft. 24" d. s. vit. pipe, 8'-10' deep	2.75	2.60	2.70	2.40
240	lin. ft. 24" d. s. vit. pipe, 10'-12' deep	3.20	3.00	2.90	2.60
50	lin. ft. 24" d. s. vit. pipe, 12'-14' deep	3.65	4.00	3.50	3.00
90	lin. ft. 27" d. s. vit. pipe, 6'-8' deep	2.75	3.00	2.70	3.25
420	lin. ft. 27" d. s. vit. pipe, 8'-10' deep	2.90	3.00	2.90	3.50
190	lin. ft. 27" d. s. vit. pipe, 10'-12' deep	3.25	3.20	3.10	3.75
50	lin. ft. 27" d. s. vit. pipe, 12'-14' deep	3.60	4.00	3.50	4.25
50	lin. ft. 30" pipe, 8'-10' deep	2.90	3.50	3.00	3.50
310	lin. ft. 30" pipe, 10'-12' deep	3.25	3.50	3.20	3.75
350	lin. ft. 30" pipe, 12'-14' deep	3.60	3.95	3.40	4.00
50	lin. ft. 30" pipe, 14'-16 deep	4.00	3.95	4.00	4.50
50	lin. ft. 33" pipe, 6'- 8' deep	3.00	3.70	3.00	3.60
260	lin. ft. 33" pipe, 8'-10' deep	3.20	3.70	3.50	3.85
90	lin. ft. 33" pipe, 10'-12' deep	3.50	3.85	4.75	4.60
100	lin. ft. 33" pipe, 12'-14' deep	3.95	3.85	5.00	5.10
280	lin. ft. 33" pipe, 14'-16' deep	4.40	3.85	5.50	5.50
40	lin. ft. 33" pipe, 16'-18' deep	4.95	4.30	6.00	6.50
40	lin. ft. 33" pipe, 18'-20' deep	5.30	4.60	6.50	7.50
50	lin. ft. 33" pipe, 20'-22' deep	6.00	4.80	8.00	8.50
50	lin. ft. 36" pipe, 8'-10' deep	3.60	3.80	3.75	5.00
210	lin. ft. 36" pipe, 10'-12' deep	3.80	4.20	4.00	5.25
160	lin. ft. 36" pipe, 12'-14' deep	4.25	4.60	5.50	5.75
50	lin. ft. 36" pipe, 14'-16' deep	4.80	5.05	6.00	6.25
50	lin. ft. 39" pipe, 8'-10 deep	4.00	4.80	4.00	5.10
50	lin. ft. 39" pipe, 10'-12' deep	4.25	4.80	5.25	5.35
190	lin. ft. 39" pipe, 12'-14' deep	4.50	5.30	5.75	5.85
480	lin. ft. 39" pipe, 14'-16' deep	5.05	5.40	6.00	6.20
100	lin. ft. 39" pipe, 16'-18' deep	5.60	5.40	6.50	6.75
50	lin. ft. 42" pipe, 14'-16' deep	6.00	5.65	7.00	6.25
120	lin. ft. 42" pipe, 16'-18' deep	6.70	5.65	7.50	6.75
140	lin. ft. 42" pipe, 18'-20' deep	7.20	5.80	8.00	7.25
25	lin. ft. 42" pipe, 20'-22' deep	7.80	5.80	9.50	7.75
50	lin. ft. 48" pipe, 0'- 6' deep	4.80	6.80	4.50	5.50
50	lin. ft. 48" pipe, 6'- 8' deep	5.00	6.80	4.75	5.75
10	lin. ft. 48" pipe, 8'-10' deep	5.70	6.80	5.00	8.00
50	lin. ft. 48" pipe, 10'-12' deep	6.00	6.80	6.50	8.00
100	lin. ft. 48" pipe, 12'-14' deep	6.40	6.80	7.00	8.00
25	lin. ft. 48" pipe, 14'-16' deep	6.90	7.00	8.00	8.00
25	lin. ft. 48" pipe, 16'-18' deep	7.40	7.60	8.00	8.00
100	lin. ft. 48" pipe, 18'-20' deep	7.75	7.60	9.00	8.50
10	lin. ft. 48" pipe, 20'-22' deep	8.20	7.60	10.00	9.00
20	lin. ft. 48" pipe, 22'-24' deep	9.00	8.10	12.00	9.50
440	lin. ft. 48" pipe, 24'-26' deep	9.30	9.50	10.50	10.00
340	lin. ft. 48" pipe, 26'-28' deep	9.85	9.75	10.50	10.50
60	lin. ft. 48" pipe, 28'-30' deep	10.80	10.90	11.50	11.00
25	lin. ft. 51" pipe, 16'-18' deep	8.20	7.70	8.50	10.50
260	lin. ft. 51" pipe, 18'-20' deep	8.40	8.10	8.50	11.15
25	lin. ft. 51" pipe, 20'-22' deep	9.00	9.10	9.50	11.75
25	lin. ft. 54" pipe, 16'-18' deep	8.30	7.90	8.50	10.50
160	lin. ft. 54" pipe, 18'-20' deep	8.80	8.60	8.50	11.15
300	lin. ft. 54" pipe, 20'-22' deep	9.30	9.40	10.00	11.75
400	lin. ft. 54" pipe, 22'-24' deep	9.80	9.80	11.00	12.40
25	lin. ft. 54" pipe, 24'-26' deep	10.70	11.40	12.00	13.00

★**Washington, D. C.**—Contracts awarded by Commissioners D. C. for constructing sewers as follows: To Charles H. Tompkins Company, Washington, D. C., for Petworth sewer at $2,008, and to Harper & Voigt Company, Washington, Kenilworth sewer at $15,145.

★**Park City (P. O. Knoxville), Tenn.**—Contract for constructing 21 sewer laterals awarded J. A. Ahler, Knoxville. Cost about $10,500.

★**Harbor Beach, Mich.**—Contract awarded Whaley & Edwards, Milan, for improving the sewage system and sewage disposal plant at $16,210.

Houston, Tex.—Lowest bid opened Dec. 6 by city for constructing storm sewer in Paschal Street submitted by Horton & Horton, Houston, at $15,952.

★**Los Angeles, Cal.**—Contract for constructing sewer in Griffin Avenue awarded Peter S. Tomich, 311 N. Hill Street, at $11,500.

BRIDGES

PROPOSED WORK.

Atglen, Pa.—No contract awarded on bids opened Dec. 13 by County Commissioners at West Chester for constructing steel highway bridge over Octoraro Creek as they were considered too high. Isaac Y. Ash, County Comptroller.

Harrisburg, Pa.—State Water Supply Commissioners approved application for constructing following bridges:

Huntington and Fulton Counties to construct a bridge over Sidling Hill Creek, north of Dublin Mills in Fulton County. McConnellsburg, county seat Fulton County.

Montgomery County to construct a bridge over Goshen Hopper Creek at Zieglersville. Norristown, county seat Montgomery County.

Sharon, Pa.—City Council and Mercer County Comrs. approved tentative plans for a steel and concrete bridge 182 ft. long, to be constructed over Shenango River at State Street, to cost about $50,000.

Huntington, W. Va.—City Commission granted franchise to Huntington-Chesapeake Bridge Co. to construct a bridge over Ohio River at Main Street, to be steel with a 900-ft. span. R. P. Aleshire, J. C. Miller, members bridge company.

Pineola, N. C.—Contract soon to be let by County Highway Commission, Newland, for a steel highway bridge to be constructed across Linville River at Pineville. Masonry contract has been awarded but steel is still to be awarded. Geo. Love, Engr., Pineola.

Dayton, Ohio.—Plans have been prepared for bridge to be constructed at Fifth Street by city.

Amboy, Minn.—County will construct a 120-ft. span concrete arch bridge over Blue Earth River outside of Amboy. C. L. Kennedy, County Auditor, Mankato.

Mankato, Minn.—D. D. Price, Lincoln, Neb., is engineer for the concrete arch bridge of five spans, 90 ft. each, which is to be constructed over Minnesota River at Main Street.

York, Neb.—Construction of a viaduct over Chicago & Northwestern R. R. Co. Yards reported being considered. W. H. Finley, Ch. Engr., Chicago, Ill.

Denver, Col.—All bids opened recently by County Commissioners for constructing bridge over Huerfano River have been rejected, new bids will be received.

Marshall, Tex.—Citizens voted $50,000 bonds for constructing a viaduct over Texas & Pacific Ry. yards and tracks.

Wenatchee, Wash.—Plans and specifications being prepared by Fred A. Warren, County Engineer, for constructing a steel bridge over the Wenatchee River at Wenatchee Avenue.

Salem, Ore.—Marion and Polk County Comrs. asking for bids for constructing Willamette River Bridge at Salem between Marion and Polk Counties. Contractors asked to submit figures for both steel and concrete construction. Max Gehlur, County Clerk, Salem.

Los Angeles, Cal.—Reported an agreement has been reached between the Board of Supervisors and the Pacific Electric Ry., whereby a reinforced-concrete trestle is to be constructed over the railroad tracks at Western Avenue, to cost $13,000.

Santa Barbara, Cal.—Plans being prepared by A. V. Saph of the engineering department of the University of California, Berkeley, for the Cuesta Zaca Bridge across Santa Ynez River, estimated to cost $100,000 to $125,000, of which the State will pay about $75,000.

BIDS DESIRED.

Pittsburgh, Pa.—Until 12 M. Dec. 28 by Beaver and Allegheny Counties Commissioners, duplicate bids to be opened 2 p. m. at a joint meeting in office of Hyatt M. Cribbs, Controller Allegheny County, Pittsburgh, for constructing reinforced concrete stone-faced elliptical arch bridge over Sewickley Creek between Economy and Sewickley Townships.

Bryson City, N. C.—Until Dec. 20, by the Swain Highway Commission for constructing four 40 ft. span and one 300 ft. span concrete bridges. T. M. Howerton, Engr., Bryson City.

Defiance, Ohio.—Until Dec. 20, by County Commissioners, as a whole or separately, for constructing creosoted wood block floor, new floor beams, painting, tightening, etc. Second Street bridge over Auglaize River. Roger Daoust, Co. Aud.

Houghton, Mich.—Until Dec. 23, for constructing steel superstructure for bridge 150 ft. riveted Pratt truss 18 ft. roadway No. 24, crossing Sturgeon River, Sect. 4, 53 N. R. 33 W. Chassell Township. Frank P. Rogers, State Highway Comr. Lansing.

Knoxville, Iowa.—Until Jan. 18, by J. D. Schlotterback, Co. Aud., for bridge work in county as follows: Four truss spans, 18-beam spans and 90 reinforced-concrete box culverts. Total cost $85,000. W. O. Price, Co. Engr.

Lawrence, Kan.—Reported desired until Jan. 3, by Herman Broeker, County Clk., for constructing 118 ft. span steel truss bridge concrete floor over Wakarusa River, 6 miles southeast of Lawrence.

Sulphur, Okla.—Until Dec. 20, for constructing a 200 ft. span bridge across Washita River. Boyd B. Horsman, Co. Clk.

Portland, Ore.—Reported desired until Dec. 29, for constructing viaduct 219½ ft. long, 58 ft. wide with 16 ft. fill 700 ft. long Probable cost viaduct $53,000; fill $13,000. A. R. Barbur, City Auditor.

Salem, Ore.—Until Dec. 24, by Board of Viewers, care of Max Gehlar, Co. Clk., plans and estimates for Willamette River bridge. Plans on both concrete and steel. Probable cost $200,000.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Hollis, L. I., N. Y.**—The bridge to be constructed by the Long Island R. R. here is being erected by the force of the railroad and steel work by American Bridge Company. The bridge is to be a four-track, 101 x 52 ft. and a two-track 94 x 27 ft. through plate girder type bridge, with I-beam and concrete jack arch floor. J. R. Savage, Chief Engineer, Jamaica.

Louisville, Ky.—[illegible] are four lowest bids opened Dec. 6 by U. S. Engineer Office [illegible] for constructing a swing bridge over locks at Louisville & Portland Canal [illegible] of Milwaukee Bridge Co., 1st Twenty-fourth Street, Milwaukee, Wis. [illegible] the King Bridge Co., Cleveland, Ohio; [illegible] Lorain Bridge Co., Lorain, Ohio, [illegible] the American Bridge Company of New York, Union Trust Building, Cincinnati, Ohio, [illegible]:

	(a)	(b)	(c)	(d)
[illegible] structural steel	[illegible] lbs.	[illegible]	[illegible]	$0.05
[illegible] cast steel	[illegible] lbs.	[illegible]	[illegible]	.1235
[illegible] cast iron	[illegible] lbs.	12	1 5	.1235
[illegible] lb. forged steel, working and bolts	[illegible] lbs.	11	104	.1265
[illegible] steel forge bolts	[illegible] lbs.	6	08	.091
[illegible] lb. rocker shoes	[illegible] lbs.	40	20	.60
[illegible] lb. expansion bronze	[illegible] lbs.	70	55	1.00
[illegible] lb. [illegible]	[illegible] lbs.	50	.60	.60
1 [illegible] concrete	1 lump sum	2,200.00	4,000.00	2,700.00
1 approach [illegible] concrete, except [illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1 [illegible]	[illegible]	[illegible]	700.00	900.00
1 [illegible]	1 lump sum	1,200.00	950.00	1,550.00

New York, N. Y.—Lowest bid opened Dec. 4 by Commissioner of Bridges for constructing the Concourse Bridge in Borough of Bronx is reported to have been submitted by Gunning & Hennig, 166 Grand Ave. and Cliff St., at $[illegible].

Pennsylvania.—Lowest bid opened Dec. 7 by State Highway Department, Harrisburg, for constructing two bridges across Four Mile Creek in Harbor Township in the County was submitted by Thomas McDonald, Union City, at $[illegible].

★**Philadelphia, Pa.**—Following contracts awarded by Department Public Works for constructing bridges were opened Dec. 6: At Lansdowne Street, under tracks of North Pennsylvania R. R. to be through girder type with concrete abutments and steel waterproofing floor. Depressed Boulevard and Lansdowne Street, over Frankford Creek, steel superstructure erected in basement, 60 ft. wide, Rogers, Walsh & Son, 5022 Tarony Street, $24,85[illegible].

★**Reading, Pa.**—Contract for constructing two bridges over Lebanon Valley tracks, each 100 ft. long, 60 ft. wide, with 12-ft. sidewalks, one at Fourth Street and other at Seventh Avenue, awarded by Reading Ry. Co. to John Donahue, Mahonoy City.

★**Warren, Ohio.**—Contract for constructing superstructure of Main Street bridge (bids opened Dec. 4) awarded Uhrichsville Bridge Company, Lebanon, Ohio.

★**California.**—Contract awarded by California Highway Commission for constructing a plate girder bridge, 80 ft. clear span bridge with reinforced concrete approaches, to Jackson Hill Route 4, Section B, of Yolo County, to Security Construction Company, Thirty-eight and Alameda Streets, Los Angeles, at $24,671.

PAVING AND ROADS

PROPOSED WORK.

Union Hill, N. J.—Board of Council has decided to improve portions of Fulton, First, West, Lewis, Palisade and other Streets, Palisade and Hudson Avenues.

Albright, W. Va.—Preston District voted $[illegible] bonds for concrete roads in Preston County.

Pineola, N. C.—County planning extensive road building.

Salisbury, N. C.—See "Water Works."

Sanford, Fla.—The Circuit Court validated the $[illegible],000 bond issue for constructing [illegible] roads.

Gulfport, Miss.—About $[illegible],000 bonds are to be sold by Bd. Supervisors for constructing two roads, one from Gulfport north to county line and another a beach highway the length of the county.

Lexington, Ky.—About $[illegible],000 street paving bonds will be sold.

Owensboro, Ky.—About $[illegible],000 will be spent by Fiscal Court of Daviess County for road improvements during coming year.

Canton, Ohio.—Contract will be let about next April for paving portions of Lawrence Avenue at a cost of $[illegible],000, and Harper Avenue at a cost of $[illegible],000. William R. Hamer, Engineer Canton. H. F. Foust, City Clerk.

Dayton, Ohio.—Citizens of county voted a $[illegible],000 levy for permanent road building which will amount to about $[illegible],000 a year for a period of two years.

Defiance, Ohio.—Fiscal Court of County voted to issue $[illegible],000 bonds for improving county roads.

Delaware, Ohio.—Voters [illegible] Delaware County Road bonds submitted [illegible].

Lockland, Ohio.—Bonds for $[illegible] will be sold Dec. 16, by the Village Clerk, for improving [illegible] paved by macadam with new bases on concrete foundations, and [illegible].

Painesville, O.—[illegible] improvement bonds for $[illegible],000 will be sold Dec. 22, by F. L. Kohl, City Clk.

Brighton, Mich.—[illegible] reported [illegible] for macadamizing [illegible] of Grand River Avenue, from [illegible].

Edwardsville, Ill.—Construction of [illegible] roads in Madison County is now completed.

Highland Park, Ill.—Plans being prepared for considerable paving, etc. Address Board Local Improvements. Charles S. Russell, City Engr.

Eldora, Iowa.—About 12 blocks are to be paved with concrete, bitulithic or asphaltic concrete with cement concrete curb. Contract will be let about February 1. L. J. Stout, City Clerk.

Fairmount, Minn.—About $55,000 will be spent next season in road building. George A. Tober, Deputy Engineer of Highways. H. C. Nolte, County Auditor.

Jackson, Minn.—About $40,000 will be spent next season in road improvements, to include a 75-ft. steel bridge. W. E. Matters, District Engineer, Highway Commission, Jackson.

Mankato, Minn.—County will spend about $30,000 next year in road improvements, greater part grading. C. L. Kennedy, County Auditor.

Windom, Minn.—About $30,000 will be spent next season in improving roads. D. R. Savage, County Road Engineer.

Worthington, Minn.—About $25,000 will be spent next season in improving roads in this county, to include three small bridges. D. E. Davidson, District Engineer, Highway Commission, Worthington.

Stuttgart, Ark.—S. Main Street and Maple Avenue are to be paved at a cost of $18,000. Material not selected and nothing very definite done about the matter. H. Towl, City Engineer.

Bastrop, Tex.—The Attorney General at Austin approved $50,000 bonds issue of Bastrop County Road Dist. No. 2.

Orange, Tex.—See "Hydraulic Construction and River Improvements."

Chehalis, Wash.—County Comrs. voted to construct one mile hard surface paving on Pacific Highway near Toledo, also to pave highway west of Centralia to Lewis County line, next spring and an additional mile east from Forrest. J. D. Neville, County Engineer, is preparing surveys.

Ritzville, Wash.—Contract will soon be let for constructing 24 miles of road between Ritzville and Spray, appropriation available $59,000. Wm. R. Roy, State Highway Comr. at Olympia. O. J. De Spain, County Engr., Ritzville.

Seattle, Wash.—Plans and specifications for paving and constructing water mains in East Marginal Way submitted by A. H. Dimmick, City Engr. to Bd. Public Works. About 48,000 sq. yd. brick block paving, 6,500 ft. concrete side tops and 20,000 ft. 12-in. c. i. pipe.

Spokane, Wash.—City Council directed Morton MacCartney, City Engr., to prepare plans for paving 4 blocks of East Trent Avenue.

Gresham, Ore.—County Commissioners at Portland considering an appropriation of $[illegible],000 toward constructing hard surface highway from Gresham to Fairview.

Hood River, Ore.—County Court considering voting $[illegible],000 for constructing roads during 1916.

Globe, Ariz.—Local press reports state highway bonds for $[illegible],000 will be sold Dec. 31 by County Board Supervisors.

Salt Lake City, Utah.—State Road Commission considering constructing State road to connect Ephraim, Sanpete County, and Castle Dale, Emery County.

Contract about to be let by City Commissioners for paving road in Parley's Canyon to make way for city reservoir.

Boise, Idaho.—Plans being prepared by F. W. Haserl, State Highways Engineer, for about 125 miles roads to be constructed by State.

Coeur d'Alene, Idaho.—County Commissioners reported to have appropriated $[illegible] toward constructing State highway through mouth of Pole Canyon. The State and National Forest Reserve will appropriate $[illegible] each.

Lewiston, Idaho.—Reported an election will be held to vote $[illegible],000 bonds for constructing [illegible] Lewiston Hill to State Highway by Lewiston Highways Dist.

Ottawa, Ont.—Following paving work contemplated in 1916: [illegible] sq. yd. asphalt pavement, cost [illegible] per sq. yd.; [illegible] sq. yd. wood block pavement, cost [illegible] per sq. yd.; [illegible] ft. of concrete curbing, cost [illegible] (day labor). W. Hamer Bradley Engineer.

BIDS DESIRED.

Massachusetts.—Until Dec. 21, by State Highway Commission, 15 Ashburton Pl., Boston (Wm. D. Sohier, Chmn.), for constructing roads as follows:

Town of Barnstable, section of state highway about 9,400 ft.

Connecticut—Until Dec. 21 by Charles K. Bennett, State Highway Commissioner, Hartford, for following paving work:

Branford—Reinforced concrete, 14,250 lin. ft. on Pine Orchard Road, 10,765 lin. ft. on Short Beach Road, 11,900 lin. ft. on Stony Creek Road.

Thompson—Native stone macadam, 5230 lin. ft. on Bradley Hill Road.

Cornwall—9300 lin. ft. grading on Cornwall Hollow Road.

Norwalk—Brick widening, Armory Hill Road.

Portland—13-ft. reinforced concrete culvert with approaches; also about 5600 lin. ft. wood guard railing in Barkhamsted and Guilford.

Albany, N. Y.—Until Jan. 11, by W. W. Wotherspoon, State Superintendent Public Works, Albany, for improving the N. Y. State Canal by constructing two connecting highways, Muck Road to James Street and Whitesboro to Mill Streets, in city of Rome, advertised in Engineering Record.

Buffalo, N. Y.—Until Dec. 23, by Department Public Works (Geo. H. Norton, Acting Comr.) for paving portions of Lombard, Algonquin, Dakota and other streets.

New York, N. Y.—Until Dec. 21, by R. A. Smith, Com. of Docks, for Contract No. 1495, furnishing material and installing wood block pavement in the team gangways and wagon way spaces of municipal ferryboats Manhattan, Brooklyn, Queens, Bronx and Richmond. Security, $2,800. Also Contract 1499, same work, on ferryboats Bayridge, Gowanus and Nassau. Security, $2,600.

Until Dec. 23, by Douglas Mathewson, Pres. Bronx Borough, for improving portions of Odell Street, Waterbury and Newbold Avenues, in all about 21,690 sq. ft. two course sidewalk, 6900 cu. yd. earth excavation, together with sewer pipe, basins, etc. Total security $14,100.

Until Dec. 27, for improving portions of Odell Street, Waterbury and Newbold Avenues, to consist of 24,530 sq. ft. two-course concrete sidewalk, 6,900 cu. yd. earth excav., together with all necessary curbing, sewer piping, basins, etc. Total security $14,100.

Chelsea (P. O. Atlantic City), N. J.—Reported desired until about Jan. 1 by County Board Freeholders, Mays Landing, for paving Meadow Boulevard from Pleasantville to Chelsea, with hard material, Warrenite preferred.

Newark, N. J.—Until Dec. 23 by Board Street & Water Commissioners for annual flagging contract for year 1916, with option to extend for the years 1917 and 1918. Estimated quantities: 10,000 sq. ft. 4-ft., 30,000 sq. ft. 5-ft., and 1000 sq. ft. 6-ft. bluestone flagging, 8000 sq. ft. flagging relaid, 1000 sq. ft. artificial stone walk, etc.

New Brunswick, N. J.—Until Dec. 20, by Board Freeholders, for constructing 8 miles of Cranbury turnpike between city line and Kingston Lane.

Florence, S. C.—Until Jan. 11, by City Council, for constructing approximately 4275 sq. yd. street roadway and 2½ miles concrete sidewalk. C. H. Carlisle, City Engr.

Tampa, Fla.—Reported desired until Dec. 20, by Commissioners Public Works (D. B. McKay, Chmn.) for constructing 112,650 sq. yd. asphalt block pavement and 3500 sq. yd. concrete pavement, etc. Allen Thomas, City Clk.

Dothan, Ala.—Reported desired until Dec. 30, by Houston County Board of Revenue (A. C. Crawford, Chmn.) for constructing road from Dothan to dividing line between Houston and Dale Counties, a distance of 7 miles.

Huntsville, Ala.—Until Jan. 4, by Marion S. Bingham, Road Supervisor, for constructing 3¼ miles water bound macadam.

New Orleans, La.—Until Jan. 3 by Highway Department of the Bd. State Engineers of Louisiana, Room 104, New Orleans Court Building, New Orleans (W. E. Atkinson, State Highway Engineer), for constructing a section of the Gretna-Belle Chasse Highway in Plaquemine Parish, a distance of 2.5 miles.

Lisbon, O.—Reported desired until Dec. 27, by T. R. Morris, Township Clerk, for road improvements to consist of 4461 sq. yds. brick pavement on concrete base, 2,738 cu. yds. excav. H. C. Armstrong, Engr., Lisbon.

Painesville, Ohio.—Reported desired until Dec. 22, for 5942 sq. yd. brick pavement on Richmond Street, 3860 cu. yd. excav., etc. F. N. Downer, City Engr.

Toledo, Ohio.—Until 12 M., Dec. 20, by Department Public Service, for 70,000 sq. yd. pavement, including vitrified brick, sheet asphalt and wood block. H. McKechnie, Chief Engineer Department.

Belleville, Ill.—Until Dec. 23, by Board Local Improvements, for paving West Main Street, approximately 124,900 sq. yd. reinforced concrete paving and 55,500 lin. ft. concrete curbing, advertised in Engineering Record. W. C. Wolf, City Engr.

Bolivar, Mo.—Reported desired until Dec. 20, by Bolivar Special Road Dist. (G. M. Upton, Comr.), for constructing roads. Probable cost $20,000.

Fort Worth, Tex.—Until Dec. 21, by F. J. Vonzuben, City Engr., for improving portions of Fifteenth Street, in all about 18,000 sq. yd., with either bitulithic, rock asphalt or vitr. brick pavement.

The Dalles, Ore.—Reported desired until Jan. 6, by F. S. Gunning, County Judge, for constructing roads to consist of approximately 25,500 cu. yd. hard rock, 8500 cu. yd. loose rock, etc.

Los Angeles, Cal.—Reported desired until Dec. 27, by County Board of Supervisors, for paving with concrete 5 miles of Unit Canyon Road, in Road Dist. No. 5. Probable cost, $68,000.

Tucson, Ariz.—Reported desired until Jan. 3, by Board Supervisors, for one 11 ton steam roller and one 25 yd. gravel bunker complete and one 15 h. p. oil engine.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Buffalo, N. Y.**—Contract for paving Peckham Street wtih asphalt awarded by city to German Rock Asphalt & Cement Co., D. S. Morgan Building, at $13,140.

★**Yonkers, N. Y.**—Contract awarded by Board of Contract & Supply to Hannifan Company for improving Ellsworth Avenue at $8,498, and Amberson Avenue at $6,297.

★**Bayonne, N. J.**—City Commissioners awarded Illinois Surety Company, 170 Broadway, New York, contract for completing improvement of Avenue A at $6,668.

★**Hackensack, N. J.**—Contract for improving Meadow Road and Rutherford Avenue awarded by Board Chosen Freeholders to Franklin Van Roden, East Rutherford, at $18,560.

★**Philadelphia, Pa.**—The award of contract for grading and paving Passyunk Avenue from Twenty-third Street to Twenty-eighth Street approved by Mayor Blankenburg.

★**Princeton, W. Va.**—Contract for constructing 6 1/3 miles of water-bound macadam road awarded Sullivan Tilson. L. G. Bowling, County Clerk.

★**Princeton, W. Va.**—Contract for about 6½ miles water bound macadam road from Rock to Giatto (bids opened Dec. 6) awarded Sullivan, Tilson & Carter, Bluefield, W. Va., at about $29,000. George H. Hill, Chief Engineer.

★**Charlotte, N. C.**—Contract for constructing 17,500 sq. yd. sidewalks awarded A. H. Guion, Gastonia, at $20,050. A. H. Wearn, City Clerk.

★**Westfield, N. C.**—Contract for constructing roads in Westfield Township awarded to C. C. Jordan. About $30,000 is to be spent on road construction in Westfield.

★**Edwards, Miss.**—Contract awarded Hinds County Highway Construction Company, Clinton, Miss., for constructing roads in 16-5 and 6-5 supervisors district.

★**Brazil, Ind.**—Contracts for paving Blaine and Alabama Streets with brick awarded by City Council to Pfizenmayer Constr. Co., Terre Haute, at $1.17 per square yard and $1.35 respectively.

★**Brookville, Ind.**—Contract awarded T. F. Wilson & Son, Brookville, for constructing highway in Bloomington Grove Township (bids opened Dec. 6) at $12,052. Charles F. Reifil, County Auditor.

★**Indianapolis, Ind.**—Contract for constructing south drive of Pleasant Run Parkway from Raymond Street to Beecher Street awarded by Park Board to C. C. King Sons, Indianapolis, at about $22,986.

★**Muncie, Ind.**—Contract for constructing Edward C. Schwer Rd. in Mt. Pleasant Township awarded by County Commissioners (bids opened Dec. 8) to F. Hines, Muncie, at $10,290.

★**Ida Grove, Iowa.**—Contract awarded National Roofing Company, Omaha, Neb., for 58,742 sq. yd. sheet asphalt pavement at $1.58 per sq. yd.; 10 blocks of concrete alleys, $1.38, and 18,650 lin. ft. curbing at 44cts. K. C. Gaynor, Engineer, Sioux City.

★**Sedalia, Mo.**—Contract for 9200 sq. yd. of brick paving (bids opened Dec. 6) awarded Joseph W. Menefee, Sedalia, at $1.64 per sq. yd. F. T. Leaming, City Engineer.

★**San Antonio, Tex.**—Contract for paving River Avenue with bitulithic awarded by City Council to Texas Bitulithic Co.

Portland, Ore.—Following are lowest bids opened by City Council for paving: East Twenty-eighth Street, Kenilworth Avenue, East Twenty-ninth Street, East Thirtieth Street and East Thirty-first Street, Oregon Hassam Paving Co., Portland, $41,366; Oskar Huber, Portland, $42,671, and Oregon Independent Paving Co., Portland, $42,213; for Union Avenue, Oregon Independent Paving Co., Portland, $29,557.

★**Portland, Ore.**—Following the two lowest bids opened by city for paving Ainsworth Avenue with bitulithic: Oskar Huber, Portland, $11,108, and Clark & Henry Co., Portland, $11,405.

California—Following are unit figures of four lowest bids opened Dec. 6 by California Highway Commission, Sacramento, for constructing a State highway in Imperial County, Division VII, Route 12, Section C: (a) Engineer's estimate, $100,408; (b) Fred Hoffman, Long Beach, $72,089; (c) Doran, Armstrong & Daley, San Diego, $83,099; (d) Messmer & Rice, Los Angeles, $87,572; (e) Leigh G. Garnsey, Los Angeles, $88,895.

	(a)	(b)	(c)	(d)	(e)
47,300 cu. yd. excavation without classification	$0.40	$0.38	$0.45	$0.38	$0.35
496 lin. ft. 18-in. corrugated iron pipe	.55	.50	.40	.50	.40
46 lin. ft. 24-in. corrugated iron pipe	.70	.75	.50	.75	.60
148 lin. ft. 36-in. corrugated iron pipe	1.00	2.00	.75	.90	.90
30 cu. yd. cement concrete for culverts and manholes (Class B)	14.00	15.00	12.00	12.00	9.56
11,610 cu. yd. cement concrete (Class B)	5.75	4.45	5.20	5.85	6.10
1,544 lin. ft. guard rail	.75	.75	.40	.50	.48
132 monuments	1.00	2.00	1.00	1.00	1.06

★**Los Angeles, Cal.**—Contract for 216,255 sq. ft. asphalt paving on Dayton Avenue awarded to Benj. F. Ford and Fred H. Stout, Bradbury Building, at $43,178.

Lowest bid opened recently for constructing 2.4 miles macadam roads in Los Angeles County submitted by John L. Frazer, Long Beach, at $19,495; quantities include: 4530 cu. yd. excavation, 12,660 ft. shaping roadbed, 9288 tons crushed rock, etc. Next three lowest bidders: J. H. Shafer, $19,998; J. Hein, $21,778, and Brashear Burns Company, $22,872.

Lowest bid opened recently for about 2½ miles of macadam road in Los Angeles County was submitted by M. L. Shafer, 220 W. Thirty-third Street, at $7,495.

★**Manhattan Beach, Cal.**—Contract for 6634 sq. ft. concrete sidewalks, 35,775 sq. ft. concrete pavements on Twenty-fourth, Twenty-fifth and Twenty-sixth Streets awarded by city to Municipal Improvement Co., Berry Building, Richmond, at $11,954.

STREET CLEANING AND GARBAGE DISPOSAL

PROPOSED WORK.

Lincoln, Neb.—Reported $50,000 bonds will soon be sold by City Council for a garbage disposal plant.

BIDS DESIRED.

Newark, N. J.—Until Dec. 23 by Board Street & Water Commissioners for five street sweeping machines.

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS

PROPOSED WORK.

Dam—Belmont, N. Y.—Reported Allegheny County Electric Light & Power Company is considering constructing a concrete dam in Genesee River and installation of an electric power plant and a cold storage plant here. Julius G. Berger, Potsdam, N. Y., is interested.

Drain—Buffalo, N. Y.—Captain Norton of the Board of Public Works has been directed to prepare plans for the covered drain from Main to Genesee Street along bed of Scajaquada Creek, and has applied to Council for authority to employ a consulting engineer to pass on the plans and to advise.

Pier—Wildwood, N. J.—Casino Pier Company (Heber Crane, Pres.) will erect a pier and auditorium on ocean side of boardwalk at Oak and Cedar Avenues; also will erect on Atlantic Avenue side of property a theater to seat 1200.

Levee Improvements—New Orleans, La.—Reported repairs to the levees on Mississippi River below New Orleans will cost the Mississippi River Commission $750,000.

Protection Wall—Portsmouth, Ohio.—All bids opened Dec. 8 for constructing second section of the floor protection wall have been rejected. New administration may ask new bids. William Gergens, Director Public Service.

Widening River, Etc.—Tiffin, Ohio.—Bonds for $40,000 will be sold Dec. 23 by Albert J. Hafley, City Auditor, for widening, deepening and straightening Sandusky River.

Ditches — Fairmount, Minn. — About $200,000 will be spent on drainage ditches in this county. At January meeting contract will be let for three ditches. H. C. Nolte, County Auditor.

Ditches—Jackson, Minn.—Contract soon to be let for constructing Judicial Ditch No. 35, estimated cost $76,647. Other ditches to be constructed, for which surveys are now being made, include Judicial Ditches No. 38, 41 to 48 inclusive, 50 to 54 inclusive, and 61. Ditch improvements for next season will cost about $300,000. P. D. McKeller, County Auditor.

Ditches—Mankato, Minn.—Surveys completed for Judicial Ditches as follows: No. 6, cost $80,000; 7, $15,000; 8, $35,000, 9, $35,000, and 10, $15,000. Surveys now being made for Judicial Ditch No. 11, cost $125,000. Roy H. Allison, County Engineer, Mankato. George Ernst, Clerk of Court, Mankato.

Ditches—Mankato, Minn.—Surveys have been made for county ditch No. 38, cost $100,000; 42, cost $20,000. Roy H. Allison, County Engineer, Mankato. C. L. Kennedy, County Auditor.

Ditches — Marshall, Minn. — County ditches 11, 12, 20, 21, 22 and 23 are being surveyed. Contract will be let about April. Estimated cost between $300,000 and $400,000. E. Sheppard, County Auditor.

Ditches—New Ulm, Minn.—Resurveying County Ditches 5, 8 and 11 about 72 miles for tile. Surveys being made for Ditches 28, 29, 30, 31 and 33, County Ditch No. 9, 16 miles long, to be retiled. About $300,000 to be spent by the county for this work. F. D. Minium, County Surveyor.

Ditch—Redwood Falls, Minn.—All bids opened Dec. 1 for constructing Ditch No. 27 rejected, new bids to be received; probable cost, $8,490. L. P. Larson, County Auditor.

Ditch Improvements—Windom, Minn.—About $200,000 will be spent in ditch work, most of which is tile construction. S. A. Brown, County Auditor, Windom.

Ditches—Worthington, Minn.—Surveys completed for constructing Judicial Ditch No. 1, cost $39,850, and being made for Judicial Ditch No. 2, cost $25,000, and No. 15. Gustave Swanberg, County Auditor, Worthington.

Ditch—Salina, Kan.—Dayton Township Drainage District No. 1, Salina County, will let contracts soon for approximately 80,000 cu. yd. of open ditch work about three miles from Solomon. P. A. Tobin, 109 N. Santa Fe Street, is interested. Engineer, H. B. Walker, State Drainage Engineer, Manhattan.

Drainage—Strong City, Kan.—Chase County Drainage District No. 1 proposed constructing about two miles of open ditch requiring about 70,000 cu. yd. excavation, four miles from Strong City; suitable for drag line or team work; cost, $10,000. Engineer, H. B. Walker, State Drainage Engineer, Manhattan.

Dam—Billings, Mont.—Plans prepared for power and irrigation project to be constructed by Big Horn Irrigation and Power Company, providing for a dam, a 170,000-hp. hydroelectric power plant, railroad from Custer, Mont., to cost $800,000, ditches, laterals, etc. J. J. Harris, Hardin, Pres. of the company.

Irrigation—Brownsville, Tex.—The La Feria Mutual Canal Company, it is reported, intends making improvements costing about $150,000, including installation of a 48-in. pumping unit on Rio Grande, installation of engines to increase the capacity at least 150 per cent, and rebuilding and remodeling irrigation ditches.

Dam—Santa Fe, N. M. — Application of the Rio Grande Light, Heat & Power Company to build a dam 112 ft. high in White Rock canyon, 18 miles west of Santa Fe has been approved by the State Engineer, James A. French.

Hydro-Electric Plant—Metaline Falls, Wash.—State Board of Land Commissioners has granted Hugh L. Cooper, Consulting Engineer, 101 Park Avenue, New York, water rights on both sides of the Pend d'Oreille River for a distance of 7 miles from McInnis Milles to 1 mile north of Blue Slide. It is proposed to build a hydro-electric power plant in connection with the development of the nitrate fields in that district and to manufacture various chemicals.

Canal Improvements—Wenatchee, Wash.—Citizens Nov. 30 voted in favor of issuing $350,000 bonds for improvements, to include lining canal and tunnels with concrete, larger pipe lines constructed of reinforced concrete, and replacing old structures with permanent structures.

Revetment Wall — Campbell, Cal.—All bids opened Dec. 6 by Board County Supervisors, San Jose (Henry M. Ayer, Chairman), for constructing a reinforced concrete revetment and curtain wall on Los Gatos Creek near Campbell have been rejected as being too high.

Irrigation—Llano, Cal.—Llano del Rio Company of Llano has applied to State Water Commission for permit to appropriate for agricultural purposes 3000 second feet of water from Big Rock Creek. Company intends building a cement core rock-filled dam, 110 ft. high, 900 ft. long at top, and 350 ft. at bottom; main ditch to be about six miles long and reservoir to store 7500 acre feet of water.

Irrigation—Los Angeles, Cal.—Contract soon to be let by Board of Supervisors for distribution system in San Fernando Valley. About 300 miles of pipe to be laid.

Pier—Manhattan Beach, Cal.—Election soon to be held by Board of Trustees for constructing a $70,000 pleasure pier at Center Street and a $20,000 pavilion at Marine Avenue.

Wharf — Santa Monica, Cal.—Santa Monica Land Company intends building a wharf at Santa Monica Canyon to be 560 ft. long and 24 ft. wide.

BIDS DESIRED.

State Canal Work—Albany, N. Y.—See "Paving and Roads."

Dredging—New York, N. Y.—Until Dec. 28, by R. A. C. Smith, Comr. of Docks, for Contract 1487, for furnishing material and dredging slip east side of pier, new 21, East River, foot of Dover Street, Manhattan Borough. Security $4,000.

Pier—New York, N. Y.—Until Dec. 28, by R. A. C. Smith, Comr. of Docks, for Contract 1490, furnishing material and widening pier at foot of West Fifty-seventh Street and constructing shed foundations and laying a concrete surface on the piers at West Fifty-sixth and West Fifty-seventh Streets, North River, Manhattan Borough, and bulkhead adjacent. Security $47,000.

Locks for Dam—Wheeling, W. Va.—Until Jan. 14, by U. S. Engineer Office, Wheeling, for furnishing and erecting steel lock gates for Dam No. 14, Ohio River, advertised in Engineering Record.

Drain—Spirit Lake, Ia.—Reported desired until Dec. 22, for approximately 72,000 cu. yd. cleaning open drain and laying 6 to 44 in. tile in Dist. No. 1; 43,000 cu. yd. cleaning open ditch and laying 6 to 30 in. tile in Dist. No. 5. John S. Blow, Co. Aud.

Ditch—Duluth, Minn.—Until Jan. 7, by County Auditor, for constructing County Ditch No. 5, involving 8 miles of main and lateral ditches and excav. of 33,000 cu. yds. earth.

Ditches—Poplar Bluffs, Mo.—Until Jan. 10 by John H. Greason, Engr. Drainage Dist. No. 11, at the Court House, for constructing four drainage ditches and cleaning out one slough in said district, main ditch approximately 9000 ft. to consist of 21,729 cu. yd., and laterals 1, 2 and 3 approximately 5174 ft. long, to consist of 8256 cu. yd.; also construct a wooden bridge across main ditch.

Canal Extension—Harlingen, Tex.—Reported desired until Dec. 30 by Directors Cameron County Irrigation Dist. No. 1, to extend canals and laterals aggregating 411,900 cu. yd., construct concrete siphon under main canal 80 ft. long.

Shed on Wharf—Houston, Tex.—Until Dec. 20 by City Secretary for constructing sheds and railroad tracks on Municipal Wharf No. 1. E. E. Sands, City Engineer.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Jetties—Stone Harbor, N. J.**—Contract for constructing bulkhead and jetties for ocean front protection awarded to Hill Dredging Company of Atlantic City at $192,414.

★**Dredging, Norfolk, Va.**—Contract for dredging at the Navy Yard (bids opened Nov. 27 by Bureau of Yards and Docks, Washington, D. C., awarded Coastwise Dredging Company, Norfolk, at 14 cts. per cu. yd.; about 703,600 cu. yd. Appropriation $145,000.

Revetment Work—New Orleans, La.—Lowest bid opened Dec. 1 by State Board Engineers, New Orleans, for wooden revetment work in Plaquemine Parish from Joseph Borges to Buras levee, approximately 8000 lin. ft., submitted by A. C. Richaune at $1.10 per lin. ft. for 12-ft. boards, and $1.06 for 10-ft. boards.

Lock Bridge — Louisville, Ky. — See "Bridges."

★**Dredge Work—Plymouth, Ind.**—Contract awarded Yoder & Schwartz, Nappanee, for dredge work on McKesson Ditch in Pike Township, in St. Joseph and Marshall Counties, and for tile and open shovel work, to Walter H. Yzeman of Nappanee, at $3,499.

★**Ditches—Des Moines, Iowa.**—Contract awarded as follows: For Ditch No. 16, to Empire Construction Company, Des Moines, at $12,680, and Ditch No. 17 to J. C. Anderson, Marshalltown, at $30,954.

★**Drainage — Victoria, Tex.**—Contract awarded to J. B. Arpin Drainage Company, Houston, for improvements in Drainage District No. 3 at $126,189.

★**Irrigation — Ysleta, Tex.** — Contracts awarded by U. S. Reclamation Service as follows for the Rio Grande Irrigation Project, New Mexico-Texas: To Toohey & Johnson, Phoenix, Ariz., excavation of approximately 162,000 cu. yd. earth for the Leasburg Canal and the Pucacho Branch Canal in vicinity of Hill, N. M., at $23,008, and to H. R. Williams, El Paso, earthwork of San Elixario Feed Canal near Ysleta, Tex., at about $3,149, and to John Mulligan, El Paso, earthwork on San Elixario Feed Canal, at $2,838.

Irrigation—North Yakima, Wash.—Lowest bid opened recently for clearing 1200 acres of Lake Keechelus reservoir site was submitted by Harrington & Peters, Oriental Building, Seattle.

Irrigation — Emmett, Idaho. — Lowest bid opened recently by Board Directors of Emmett Irrigation District for lining canal with cement was submitted by Manning Bros., Boise, at $44,250. All bids rejected. It is contemplated making an open cut.

ELECTRIC RAILWAYS

PROPOSED WORK.

Sedgwick, Me.—Bar Harbor & Union River Power Co. contemplates constructing an electric railway from Bluehill Falls to Brookline and Sedgwick, 14 miles. C. M. Tolman, Ch. Engr., Bangor.

Buffalo, N. Y.—It is reported the International Ry. Co. will spend about $150,000 for enlarging substation power plants.

Wellsville & Buffalo Railroad Co. incorporated to operate steam, gasoline or electric railroad from Wellsville to Buffalo. Capital $850,000. Among directors are C. A. Finnegan and Abraham Weber.

New York, N. Y.—Public Service Commission approved plans of the Interborough Rapid Transit Company for construction of Webster Avenue extension of the Third Avenue elevated railroad in the Bronx.

Durham, N. C.—The Durham Traction Co. during 1916 will construct about 2.6 miles single track in Durham.

Greenboro, N. C.—It is reported Southern Power Co., Charlotte, plans to construct an electric railway from Greensboro to Reidsville and Spray, about 30 miles. W. S. Lee, Ch. Engr.

Charleston, S. C.—Charleston-Isle of Palms Traction Co. contemplates constructing during 1916 1½ miles of 60 lb. T rail track.

Lula, Ga.—The Lula-Homer R. R. intends during 1916 constructing 110 miles of road as follows: 15 miles Winder to Jefferson; 14 miles Jefferson to Commerce; 18 miles Commerce to Cinesville; 14 miles Cinesville to Bowerswell; 21 miles Homer to Cinesville. D. G. Ziegler, Chief Engineer, Lula.

Meridian, Miss.—Meridian Light & Railway Company expects to construct 1¾ miles of new track during 1916.

Akron, Ohio.—Northern Ohio Traction & Light Company proposes to build 0.7 mile of city extension and construct 9.4 miles of double track between Akron and Cleveland for cut-offs.

Mount Vernon, Ohio.—Mount Vernon Railway Co. contemplates constructing 2 miles of city line during 1916.

Jefferson City, Ill.—The Illinois Traction System plans to construct a line between Jefferson City and Columbia.

Thief River Falls, Minn.—Minnesota-Northwestern Electric Ry. Co. plans to construct 20 miles of new line during 1916.

Manhattan City, Kan.—Manhattan City & Interurban Ry. Co. contemplates constructing one mile line during 1916.

Corpus Christi, Tex.—Corpus Christi Ry. & Light Co. expects to construct one mile of new track during 1916.

Houston, Tex.—Contract will soon be let by Houston, Richmond & Western Traction Co. for grading first 100 miles of line between San Antonio and Houston. A branch line will be constructed from Seguin to New Braunfels. A hydro-electric power plant will also be erected. E. Kennedy, Pres.

Waco, Tex.—Reported Southern Traction Company (J. F. Strickland, Pres., Dallas) contemplates in 1916 building an interurban line from Waco to San Antonio through Temple and Austin; also from Waco to Houston through Marlin.

Bartlesville, Okla.—Reported surveys about to be made for an interurban railway from Bartlesville to Pawhuska, in which the Illuminating Oil Company of Bartlesville is interested.

Los Angeles, Cal.—City Board of Public Utilities has approved the plans of the Pacific Electric Railway Company for elevated track and terminal improvements to include an elevated steel structure about 2000 ft. long, carrying three tracks and to be constructed along Sixth Street. Loading and unloading platforms will parallel these tracks for a distance of about 1100 ft. and will support steel and reinforced concrete umbrella sheds to have reinforced-concrete decks and connected with the elevated tracks by steel and reinforced-concrete bridges. The passenger station will also be altered. Exclusive of signal system and tracks, the cost is estimated at $166,000. Plans are also being prepared for an umbrella shed and rearrangement of the tracks of the Western division station on Hill Street.

Fresno, Cal.—The Fresno Interurban R. R. Co. will during 1914 construct 15½ miles of electric railway from Fresno to Clovis and Fresno to Centerville.

Ogden, Utah.—Ogden, Logan & Idaho Ry. Co. expects to build 30 miles of new line from Logan to Smithfield and from Hot Springs to Brigham City.

Salt Lake City, Utah.—Salt Lake & Utah Electric Ry. and Salt Lake & Ogden Electric Ry. Companies have awarded sale of South and West Temple Streets on which to erect a joint terminal depot costing $200,000.

Pocatello, Idaho.—Pocatello Traction & Interurban Co. incorporated to construct a line in Pocatello. Capital $100,000. Richard Deighan, Pres.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Luna, Ga.**—Contract for first section of the Lula-Homer R. R. from Lula to Homer awarded W. J. Redmond, of Atlanta.

★**Brooklyn, N. Y.**—Contract awarded by New York Municipal Railway Corporation and approved by Public Service Commission to Henry Monheim at $[illegible] for excavation of steel constructing tracks, station buildings, platform, etc., for the additional tracks on the Myrtle Avenue R. R. in Brooklyn between Willoughby Avenue and Palmetto Street and on Palmetto Street between Myrtle and Cypress Avenues.

★**New York, N. Y.**—Contract awarded by Board Public Service for First District, 154 Nassau Street, to Lawrence C. Manson, 11 Park Street, for constructing Sections 1 of Routes Nos. 19 and 22, the Westchester Avenue portion of Southern Boulevard and Westchester Avenue extension of Lexington Avenue Subway (bids opened Nov. 26) at $2,063,877, and for supply of irons and switches to Ramapo Iron Works, 26 Church Street, at $46,195 (bids opened Dec. 7).

Philadelphia, Pa.—Following are two lowest bids opened for constructing concrete caisson foundations for elevated railway on Frankford Avenue from Unity to Dyre Streets: Edwin H. Vare, Betz Building, at $17,700, and Peoples Bros., Inc., 2564 Callowhill Street, $18,489.

★**Henryetta, Okla.** — Contract for grading Henryetta, Oklahoma & Western Ry. awarded to Ally Bros. The road is to be built from Henryetta to Kusa via Dewar, with a branch to Colton and Pleasant Valley, and from Henryetta to Creek mines, a total of about 10 miles. W. T. Croslen, Pres., Oklahoma City.

New York, N. Y.—Following are unit figures of the four bids opened Dec. 7 by Public Service Commission, 1st First District, 154 Nassau Street, for constructing Section 1, Route No. 8 a part of the Fourteenth Street Eastern Rapid Transit R. R.: (a) Smith & Flinn, Ltd., 37 Battery Place, $[illegible] (b) the Holbrook, Cabot & Rollins Corporation, 41 Vanderbilt Avenue, $[illegible] (c) Degnon Contracting Company, 30 E. Forty-second Street, $[illegible] (d) Arthur McMullen & Olaf Hoff, Lexington Avenue and 132nd Street, $[illegible]

Items			(a)	(b)	(c)	(d)
1	1,400	cu. yd. earth excavation, above M. H. W.	$20.00	$16.00	$7.00	$14.00
2	2,000	cu. yd. earth excavated below M. H. W.	20.00	6.40	10.00	14.00
2A	100	cu. yd. earth excavation for sewers	10.00	5.00	6.00	7.00
2B	14,000	cu. yd. earth excavation below M. H. W. for shafts	25.00	15.60	25.00	60.00
2B	100	cu. yd. rock excavation for shafts	16.35	20.00	12.00	10.00
2E	900	cu. yd. tunnel excavation (earth) above M. H. W.	20.00	11.48	20.50	15.00
2F	102,500	cu. yd. tunnel excavation (earth) below M. H. W.	19.40	11.48	20.50	28.00
3	44,500	cu. yd. tunnel excavation (rock)	19.40	14.50	25.00	34.00
3H	4,400	cu. yd. tunnel excavation (earth and rock)	19.40	33.75	30.00	34.00
4	42,500	cu. yd. concrete	2.00	14.00	12.00	10.00
4A	1,200	cu. yd. concrete placed in compressed air	15.00	16.75	18.00	20.00
5	10	cu. yd. rubble stone masonry	3.50	4.00	8.00	4.00
6A	10	cu. yd. dry rubble masonry	2.50	2.50	7.00	4.00
6B	2,000	cu. yd. dry stone packing	2.50	5.00	4.00	3.00
9	15	cu. yd. brick masonry	12.00	15.00	15.00	15.00
10	10	cu. yd. hollow terra cotta brick or tile masonry	12.00	15.00	16.00	15.00
11	12,000	bbl. Portland cement grout	1.50	5.00	2.50	3.50
11B	2,000	bbl. natural cement grout	3.00	4.50	2.00	3.25
12	2,000	fd. ft. timber piles	.50	.50	.50	.40
13	75	M ft. timber foundations	70.00	50.00	60.00	50.00
13A	100	M ft. bonded timbering	100.00	75.00	80.00	70.00
14	150	sq. yd. broken stone or gravel	2.00	1.50	2.00	2.00
15	2,000	sq. yd. (a) waterproofing 1-ply	.50	.35	.40	.50
15	100	sq. yd. (b) waterproofing 2-ply	.80	.50	.50	.75
15	100	sq. yd. (d) waterproofing 3-ply	1.10	.75	.75	1.00
15	100	sq. yd. (d) waterproofing 4-ply	1.40	1.00	1.10	1.25
15	100	sq. yd. (e) waterproofing 5-ply	1.70	1.25	1.50	1.50
15	100	sq. yd. (f) waterproofing 6-ply	2.00	1.50	2.00	1.75
15	100	sq. yd. (g) waterproofing dry ply	.30	.25	.40	.25
15B	400	sq. yd. waterproofing laid in compressed air	4.00	6.50	5.00	5.00
16	275	cu. yd. brick laid in asphalt mastic	30.00	25.00	35.00	25.00
17	500	lin. ft. (a) vitrified pipe, 12-in.	.80	.70	.80	1.00
17	100	lin. ft. (b) vitrified pipe, 10-in.	.60	.65	.55	.80
17	100	lin. ft. (c) vitrified pipe, 8-in.	.50	.55	.40	.55
17	100	lin. ft. (d) vitrified pipe, 6-in.	.40	.50	.25	.50
17	50	lin. ft. (e) vitrified pipe, 4-in.	.30	.45	.20	.40
17	50	lin. ft. (g) cast iron pipe, 6-in.	.60	.70	1.00	1.10
17	100	lin. ft. (h) cast iron pipe, 4-in.	.45	.65	.75	.90
17A	10	lin. ft. (a) cast iron pipe, 8-in. extra heavy	.65	1.00	1.00	1.00
17A	10	lin. ft. (b) cast iron pipe, 6-in. extra heavy	.85	1.25	1.00	1.50
17A	200	lin. ft. (c) cast iron pipe, 4-in. extra heavy	2.00	1.50	1.20	2.00
17A	100	lin. ft. (d) cast iron pipe, 3-in. extra heavy	2.00	2.00	1.40	2.50
18	252,000	short ft. tunnel ducts	.13	.15	.12	.12
19	12	tons riveted steel	100.00	80.00	90.00	80.00
19E	1,400	tons steel for columns	140.00	217.00	125.00	130.00
20	12	tons steel beams and shapes	140.00	140.00	80.00	70.00
21	12	tons rods and bars	80.00	140.00	80.00	80.00
22	40,000	tons cast iron bolted lining	40.00	51.00	49.00	52.00
23	1,400	tons steel beds and brackets in lining	80.00	229.00	80.00	125.00
25	12	tons cast iron segments	55.00	60.00	80.00	70.00
25C	1	ton cast iron furnishings for manholes and baffles	75.00	50.00	80.00	70.00
26	1,000	lb. special wire hangers	.15	.10	.10	.25
27B	20,000	lin. ft. 15-in. hand-rail	.20	.25	.50	.25
28	400	sq. ft. steel gratings	1.40	1.00	1.25	1.50
29	15	sq. yd. watch boxes	1.25	.80	1.50	2.00
30	275	sq. yd. (a) readjustment of sidewalks	2.00	2.00	2.00	1.50
31	150	sq. yd. (f) restoration of granite block pavements	2.00	2.00	1.50	1.50
32	275	sq. yd. (g) restoration of Belgian block pavements	2.25	2.50	2.00	1.50
33A	200	lin. ft. of new granite curb	1.60	1.50	2.00	1.00
33B	150	sq. yd. new concrete sidewalk	1.25	1.50	2.00	1.50
34	50	lin. ft. (a) handrails, 6-in.	.25	.10	.20	.20
34	25	lin. ft. (b) handrails, 4-in.	.25	.15	.30	.25
35	20	cast iron manhole bodies, each	.60	.70	1.00	1.00
37	100	lin. ft. (j) vitrified pipe sewer	1.50	2.50	2.50	1.00
38	100	lin. ft. (k) vitrified pipe sewer	2.00	3.00	3.00	1.25
42	1	type regulating pipe sewer, complete	60.00	45.00	60.00	50.00
43	1	type receiving basin sewer, complete	100.00	80.00	90.00	75.00
44	10	lin. ft. 8"-6" wye sewer	5.00	4.00	8.00	6.00
45	100	lin. ft. 12"-6" diagonal sewer	6.00	5.00	10.00	8.00
47A	40	lin. ft. 8"-6" Y branch sewer	40.00	24.00	25.00	50.00
48	1	[illegible]	1,000.00	1,000.00	500.00	1,500.00
59	50	lin. ft. changing 12" cast-iron water pipe in place	.50	.75	1.50	.50
61	150	lin. ft. changing 8" cast-iron gas pipe in place	1.00	2.25	2.50	.75
62	4	[illegible]	1.00	1.15	1.25	.50
63	4	[illegible]	35.00	45.00	50.00	50.00
63B	845	lin. ft. (b) [illegible]	1.00	1.50	1.50	1.50
64	1	[illegible]	110.00	50.00	80.00	60.00
161A	600	lb. new malleable fittings for new wrought iron gas pipe	.15	.10	.05	.08
167A	[illegible]	[illegible]	.75	1.00	1.00	.50
174	Engineering offices [illegible]		(a) $20,000	(b) $[illegible]	(c) $15,000	(d) $6,000

RAILROADS

PROPOSED WORK.

Bath, Me.—Public Utilities Commission, Augusta, has approved abolition of grade crossing of the Maine Central R. R. in this city at a cost of $18,000. B. T. Wheeler, Portland, Me., Chief Engineer.

Russellville, W. Va.—Mann's Creek and Meadow River Railway Company incorporated by Harrison B. Smith, E. C. Harrison and others of Charleston, W. Va., for purpose of constructing a railroad in Fayette County.

Wichita, Kan.—Atchison, Topeka & Santa Fe R. R. (L. C. Lawton, Division Engineer, Newton, Kan.) intends constructing one mile of industrial track to cost $14,000.

Marshall, Tex.—Marshall & East Texas Ry. Company, Marshall, and New Iberia & Northern R. R. are considering extensions north to Paris, Tex., southeast to New Orleans, La., and an intermediate line to connect the two properties and form a through line from Paris to New Orleans. Nothing very definite has been done about the matter. Bryan Snyder, Vice-Pres. and Gen. Mgr.

Bellingham, Wash.—Reported Bellingham, Mount Baker & Spokane Railway Company, of Bellingham, intends constructing a railroad from Bellingham to the Canadian boundary line, a distance of about 400 miles.

Kamiah, Wash.—Chicago, Milwaukee & St. Paul Ry. Co. (C. F. Loweth, Ch. Engr., Chicago, Ill.) will construct a branch line from Elk River, a distance of 12 miles, to Weippe; also a main line from down North Fork of Clearwater River, from Elk River and on to Lewiston, Idaho.

Leavenworth, Wash.—A. Van Epps of Leavenworth is reported interested in building a standard gauge railroad from Leavenworth 25 miles up Icicle to property of Vaneo Mining Company.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Cleveland, O.**—Contract for grading subway at Hamilton Avenue and Pennsylvania Railroad awarded J. Udelson, 2410 E. Forty-ninth Street.

★**San Francisco, Cal.**—Contract for constructing the Hetch Hetchy R. R. from Rosasco to the Hetch Hetchy dam, a distance of 67 miles, awarded F. Rolandi, San Francisco, at $1,543,080.

Akron, Ohio.—School bonds amounting $400,000 reported sold. Address Board of Education.

Dover, Ohio.—Plans and specifications being prepared by H. O. Wurmser, Lorain, for new school to be erected here. Address Board of Education.

East Youngstown, Ohio.—Citizens voted $60,000 bonds for erecting 12-room school. Address Board of Education.

Tiro, Ohio.—Election to be held Jan. 24 to vote $40,000 bonds for erecting consolidated school for district including Auburn Township, Maple Grove Special, DeKalb Special, north part Vernon Township and Tiro village schools.

PUBLIC BUILDINGS AND SCHOOLS

PROPOSED WORK.

Lowell, Mass.—Tentative plans submitted by architects to Commissioner Newell P. Putnam for proposed high school.

Quincy, Mass.—Cleveland & Godfrey, 15 Beacon Street, Boston, are architects for the two two-story schools which will cost $100,000.

Amsterdam, N. Y.—L. Niles, Amsterdam, is architect for two-story fireproof school to be erected on Vrooman Avenue; cost, $35,000.

Brooklyn, N. Y.—Trustees Polytechnic Institute propose taking steps early in the new year to erect buildings on Dyker Meadows site; cost including erection, equipment and site about $600,000.

East Aurora, N. Y.—School District No. 1 voted to erect new school.

Port Washington, L. I., N. Y.—Election to be held Jan. 7 to vote $110,000 bonds for High School addition. Address John Hutchinson, Clerk Board of Education.

Camden, N. J.—Library Trustees considering offer of Eldredge Johnson, president of the Victor Talking Machine Company, to erect a $30,000 library.

Collingswood, N. J.—Plans being prepared by Clyde S. Adams, 1509 Arch Street, Philadelphia, Pa., for three-story hospital and sanatorium to be erected here; cost about $125,000.

Jersey City, N. J.—Contract will soon be let by Board of Education for erecting a high school in the Bergen Section and also a public school in lower Jersey City.

Plainfield, N. J.—Plans being prepared for new three-story city hall to be erected on Watchung Avenue. Address City Clerk.

Secaucus, N. J. — Board of Education plans erecting $45,000 addition to School No. 1 on Centre Avenue.

Trenton Junction, N. J.—School Board considering erecting $25,000 school to replace building destroyed by fire.

Carbondale, Pa.—Owen McGlynn, of Wilkes-Barre, reported engaged by School Board to prepare new plans for $150,000 high school.

New Brighton, Pa. — School bonds amounting to $150,000 reported sold by Board of Education.

Washington, D. C.—The Freer Museum is to be erected on Smithsonian Institute grounds at an approximate cost of $1,000,000. Details as to materias, receiving bids, etc., will not be decided until about March. Charles A. Pratt, Archt., 101 Park Avenue, New York, N. Y.

Wheeling, W. Va.—Richland District voted $85,000 bonds for erecting new high school.

Mobile, Ala.—School Commissioners passed resolution to petition County Commissioners for an election to vote $150,000 bonds for erecting rural schools.

Toledo, Ohio.—School bonds for $450,000 will be sold Jan. 3 by Lillie I. Donat, Clk. Board Education.

Youngstown, Ohio.—Reported architect selected by Board of Education for proposed two-story, brick and stone fireproof Pine Hollow grade school; approximate cost $73,000.

Brookston, Ind.—Contract will be let about January or February for erecting the two-story 70 x 120 ft. brick high and grade school. Elmer E. Dunlap, Archt., Indianapolis. Edgar M. Ferguson, School Trustee.

Clinton, Ind.—S. N. Sellers, Chairman of Committee in charge of the proposed county hospital, to cost $50,000.

Crawfordsville, Ind.—City Council intends erecting a city building costing $30,000. J. B. Murphy, City Attorney.

Sullivan, Ind.—County Hospital bonds amounting to $30,000 have been sold. Address County Commissioners.

Terre Haute, Ind.—Contract soon to be let by Albert Allen, Business Director Schools, for erecting Eliza J. Warren School, to cost $70,000.

Vincennes, Ind.—Bd. School Trus. has been petitioned to erect a central school costing $138,000. Tentative plans prepared by John W. Gaddis, Vincennes. James W. McCoy, Secretary School Board.

Grand Rapids, Mich. — School bonds amounting to $200,000 will be sold Jan. 3 by Herbert N. Morrill, Secretary Board of Education.

Chicago, Ill.—Trustees of University of Illinois at Urbana approved plans for medical clinic building to be erected here in connection with medical branch of the University; initial cost $100,000.

Woodriver, Ill.—Board of Education said to be contemplating erecting $50,000 school.

Appleton, Wis. — Reported Common Council voted $50,000 bonds for erecting industrial school.

Nevada, Iowa.—School Board engaged G. L. Lockhart of St. Paul, Minn., to prepare plans for the new high school which is to cost $75,000 and supervise the construction of the building; also the remodeling of the old high school.

Wichita, Kan.—Competitive plans being considered for the $75,000 intermediate high school.

David City, Neb.—Architect not selected yet for two-story brick and stone school to cost $50,000. H. O. Schaaf, Secy. School Board.

Lincoln, Neb.—Contract will be let early in January for erecting a social science building at the University of Nebraska. Cost $200,000.

Joplin, Mo.—School bonds amounting to $350,000 will be sold Jan. 4 by J. G. Starr, Treasurer Joplin School District. O. P. M. Wiley, Secretary Board Education.

Corpus Christi, Tex.—Reported committee appointed to consider erection of a municipal auditorium; cost, $80,000.

Orange, Tex.—See "Hydraulic Construction and River Improvements."

Port Arthur, Tex.—Election to be held Jan. 8 to vote on $450,000 school bonds.

Seattle, Wash.—Plans and specifications being prepared by Edgar Blair, 1426 Jackson Street, for school improvements contemplated next year for which citizens recently voted $750,000 bonds.

Port Commission considering erecting seven-story, concrete warehouse near Hanford Street transit sheds. J. R. West, Chief Engr.

Portland, Ore.—Reported School Board will let contract early next year for Trade School, total cost $200,000, and contemplates erecting $120,000 addition to Franklin High School.

Brea, Cal.—Citizens voted $70,000 bonds to erect school, plans being prepared by Elmore R. Jeffery and Frank R. Schaefer, 1202 Van Nuys Building, Los Angeles, for two-story 10-room and auditorium hollow tile building.

Ottawa, Ont.—Police station costing $100,000 contemplated. L. M. Hunter, Roadway Engineer.

BIDS DESIRED.

Belmont, Mass.—Reported desired until Dec. 20, by Brainerd & Leeds, Archts., 89 Franklin Street, Boston, for erecting 3-story 160 x 90 ft. high school, including heating and ventilating. Probable cost $150,000. A. S. Kellogg, Engr., 53 State Street, Boston.

Providence, R. I.—Reported desired until Jan. 15, by Board Education for erecting brick school. Probable cost $200,000.

Smithfield, R. I.—Reported desired until Jan. 17 for erecting school. Wm. R. Walker & Sons, Archts., 17 Custom House Street, Providence.

Buffalo, N. Y.—Reported desired until Dec. 24, by Frank T. Reynolds, Dept. Building Com., Buffalo, for 3-story addition to School No. 54. Probable cost $75,000. Green & Wicks, Archts., 110 Franklin Street.

Waterloo, N. Y.—Until Jan. 21 by Jas. A. Wetmore, Acting Supervising Archt., Washington, D. C., for construction complete, U. S. post office at Waterloo.

Pittsburgh, Pa.—Until Dec. 21, at office of City Controller, and at office of Hyatt M. Cribbs, Co. Controller, for trimble arches, hollow metal doors, and iron elevated doors for construction and completion of new city and county building. Edw. B. Lee and Palmer, Hornbostel & Jones, Archts., 345 Fourth Avenue, Pittsburgh.

Spencer, W. Va.—Reported desired until Dec. 22 by H. C. Ferguson, Secy. Bd. Educ., for erecting 3-story high school. V. T. Ritter, Archt., Huntington, W. Va.

Durham, N. C.—Later official reports state until Jan. 11, by Board County Commissioners (Geo. W. Flowers, Chmn.) for erecting court house and jail. Milburn Heister & Co., Archts., Washington, D. C.

Shelby, N. C.—Until Jan. 26, by James A. Wetmore, Acting Supervising Architect, Washington, D. C., for constructing complete (including mechanical equipment and approaches) U. S. Post Office.

Ashland, Ky.—Until Jan. 24 by Jas. A. Wetmore, Acting Supervising Archt., Washington, D. C., for construction complete (including mechanical equipment and approaches) of U. S. post office at Ashland.

Toledo, Ohio.—Until Jan. 10, at office of Lillie I. Donat, Clk. Bd. Educ., for alterations and additions to Ironville School on Milford and Tiffin Avenues. Edw. M. Gee, Archt., Bd. Educ.

Chicago, Ill.—Until Dec. 20 by Department Public Works (W. R. Moorhouse) for furnishing material and erecting two-story and basement fire engine house on Stave Street.

Reported desired until Jan. 3, by Harry A. Zender, Supt. Public Service, 519 County Building, for county hospital pavilions "B" and "C" addition, including kitchen equipment. Probable cost $1,000,000. E. E. Hall, Archt., 11 La Salle Street, Chicago.

Lincoln, Ill. — Reported desired until Dec. 20, by Board of Administration (Frank D. Whipp, Fiscal Superv.), Springfield, for erecting cottage for girls at the Lincoln State School and Colony Lincoln. Separate bids on heating, plumbing and electric wiring. Jas. B. Dibelka, State Archt., 130 N. Fifth Avenue, Chicago.

Oneida, Iowa.—Reported desired until Feb. 1, by Harry Eames Netcott, Archt., Independence, for erecting 2-story 70 x 50 ft. school.

Austin, Tex.—Reported desired until Dec. 23 by State Inspector of Masonry W. R. Hendrickson for erecting hospital at Confederate Woman's Home. Appropriation $20,000.

George West, Tex.—Until Feb. 1, including plans and specifications, at San Antonio Loan & Trust Co., San Antonio, for reinforced concrete and brick fireproof combination courthouse and jail, 300 x 315 ft. Probable cost, $75,000. For further information address George W. West, San Antonio.

Tulsa, Okla.—Reported desired until Dec. 25 by Board Education (R. S. Fellows, Secy.) for erecting high school. Geo. Winckler, Archt., Tulsa.

Ellensberg, Wash.—Until Jan. 27, by James A. Wetmore, Acting Supervising Architect, Washington, D. C., for constructing (including mechanical equipment and approaches) U. S. Post Office.

Los Angeles, Cal.—Until Dec. 23, by Board of Education for furnishing material and erecting new buildings on Lincoln High school site on North Broadway and Pritchard St.

San Jose, Cal.—Reported desired until Dec. 31, by W. F. McClure, State Engr., Forum Building, Sacramento, for erecting domestic science building and temporary class room building at State Normal School.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Boston, Mass.—Following are four lowest bids opened Dec. 10 by Schoolhouse Commissioners, Boston, for erecting the Oliver Wendell Holmes District School in Dorchester: P. H. Rose Construction Company, 730 Washington Street, Boston, $159,735; John Bowen, 874 Morton Street, Milton, $159,844; Joseph Slotnik, Chelsea, $169,841, and D. R. McKillop, 137 W. Brookline Street, Boston, $169,300.

★**North Adams, Mass.**—Contract awarded by School Committee Dec. 11 for erecting high school to H. C. Wood Company, North Adams, at $144,860; heating and ventilating to Cleghorn Company of Boston at $28,097.

★**Bridgeport, Conn.**—Contracts awarded by Board of Education for erecting eight-room addition to Garfield School as follows: Masonry, Casey & Hurley, 120 Pequonnock Street, $22,796; carpentry, S. W. Hubbell Building Company, 589 Knowlton Street, $10,342; heating, John Scanlon, 1772 Main Street, $3,842; plumbing, J. F. Brady & Bro., 8 N. Washington Avenue, $3,160.

★**Paulsboro, N. J.**—Contract awarded by Board of Education for erecting two-story brick and stone school to E. P. Henry of Woodbury. Clyde S. Adams, Archt., 1509 Arch Street, Philadelphia, Pa.

★**Lebanon, Pa.**—Contracts awarded Dec. 3 by Board Education for erecting high school as follows: General construction, Beard Construction Company, Reading, at about $139,433; plumbing, E. R. Sollenberger, Hamburg, $10,789; electrical work, Electrical Utility Company, Lebanon, $6,650; heating and ventilating to B. S. Carpenter & Co., Wilkesbarre, at $23,641. A. A. Richter, Archt., Reading.

Philadelphia, Pa.—Lowest bids opened Dec. 10 by Board of Education for school improvements, as follows: Three-story brick addition to school at Seventieth Street and Woodland Avenue, Wilbert Beaumont, Stephen Girard Building, at $58,147; four-story brick and stone stone school at Allegheny Avenue and B Street, Melody & Keating, Bailey Building, at $291,698. J. Horace Cook, Archt., City Hall.

★Contract for erecting new building at Westmoreland Recreation Center awarded Frank W. Van Loon, Denckla Biulding, at $23,279; approved by the Mayor.

★**Columbus, Ohio.**—Contracts reported awarded by Rusk & Sheets, architects of Columbus, for erecting grade and high school for Monroe Township, Preble County as follows: General construction, Winters & Wilson, Strasburg, $38,588; heating and ventilating, Columbus Heating & Ventilating Company, Columbus, $4,490; plumbing and sewerage, Stephenson & Mong, Piqua, $2,525.

★**Elyria, Ohio.**—Contract for constructing U. S. Post Office awarded John G. Unkefer & Company, Minerva, at $78,481.

★**Lebanon, Ind.**—Contract for erecting hospital for F. J. Whitman Memorial Hospital (bids opened Dec. 9) awarded H. W. Klausmann, Indianapolis. Cost about $30,000.

★**Owensville, Ind.**—Contract awarded by Township Advisory Board for erecting school to Walter Van Hoy, Loogootee, at $54,800; and heating, ventilating and plumbing (combined) to E. E. Noble, Princeton, at $14,000.

★**Kalamazoo, Mich.**—Contract for erecting a building at the Kalamazoo State Hospital awarded J. J. E. Walffe, Kalamazoo, including heating, plumbing, etc. Sub-contract will be let on heating, plumbing, etc. Wernette-Bradfield-Mead Company, Archts., Grand Rapids.

St. Joseph, Mich.—Following are four lowest bids opened Dec. 7 by Board of Education for erecting the school: F. H. Beaumont & Company, Chicago, Ill., $75,977; T. D. Hobson & Son, Harvey, Ill., $76,256; Dyke & Oosting, Holland, Mich., $78,780, and Covell Construction Company, Ionia, Mich., $79,375. Lowest bid on other parts of work: heating, Adolph Reich, St. Joseph, $10,936; plumbing, City Plumbing Company, St. Joseph, $10,600; electrical work, S. D. Moran, $2,548.

★**Peoria, Ill.**—Contract awarded by Board of Education for erecting Irving School to W. F. Benson, of Peoria, at $23,990.

★**Coffeyville, Kan.**—Contract awarded by School Board for erecting two additions and an eight-room school to Brewster & Brewster, of Coffeyville, at $28,760; Sells-Orr Company, Bartlesville, Okla., secured contract for heating, ventilating and plumbing in these and other schools at $23,897.

★**Houston, Tex.**—Contracts awarded by City Council for erecting Taylor School as follows: General construction, Reinhart & Donovan, Oklahoma City, Okla., $56,000; heating, Warren Company, 609 San Jacinto Street, $4,820; plumbing, Barber Plumbing Company, 810 Fannin Street, $4,283; wiring, F. E. Newberry & Co., 605 La Branch Street, $1,100.

★**Marlin, Tex.**—Contract for constructing U. S. Post Office awarded V. E. Taylor, Huntington, W. Va., at $45,950.

★**Navasota, Tex.**—Contract awarded Algernon Blair, Montgomery, Ala., for constructing U. S. Post Office, at $41,836.

★**Seattle, Wash.**—Following bids opened by Port Commission (C. E. Remsberg, Secy.) for erecting two-story transit shed No. 2, East Terminal Waterway Project: Manhattan Construction Company, Central Building, $34,760 (awarded contract); T. E. Young, Empire Building, $38,715; McRae Bros., American Bank Biulding, $39,400; Jenkins & Jones, Transportation Building, $39,595.

Los Angeles, Cal.—Following are four lowest bids opened recently by Board of Education for erecting four buildings for Jefferson High School: John F. Atkinson, 1118 Story Building, $212,580; Los Angeles Planing Mill Company, $233,726; Nance & Phelps $236,162, and Barber Bradley Company, $238,750.

★**San Francisco, Cal.**—Contract awarded by Board of Library Trustees for granite work in connection with Civic Center Library to McGilvray Raymond Granite Company, 634 Townsend Street, at $350,869.

★Contract for erecting Noe Valley Branch Library, on Jersey Street, awarded by Trustees of Library Board to P. A. Palmer, Monadnock Building; cost about $36,000.

★**Stafford, Ariz.**—Contract for erecting a court house and jail awarded Lescher & Kibby, Phoenix, at $44,000. Benjamin Blake, Clerk Board of Supervisors.

Pearl City, Hawaii.—Following are two bids opened Dec. 4 by Bureau of Yards and Docks, Navy Department, Washington, D. C., for erecting three radio stations at Naval Station, Pearl Harbor: Construction & Engineering Company, 1047 Folsom Street, San Francisco, Cal., $29,322; Spaulding Construction Company, Rialto Building, San Francisco, Cal., $31,685.

PRIVATE BUILDINGS

PROPOSED WORK.

Portland, Me.—Reported Cumberland County Power & Light Company, Portland, will spend about $40,000 in loading tracks and erecting brick station building on Commercial and Pearl Streets.

Providence, R. I.—Rhode Island Hospital Trust Company, 15 Westminster Street, contemplate erecting addition.

New York, N. Y.—Plans filed for erecting following buildings: 12-story apartment house at 568 Park Avenue for Fenlo Realty Co., cost $450,000, Emery Roth, Archt., 119 W. Fortieth Street; 11-story apartment house at 129 E. Eighty-second Street for Fenlo Realty Co., cost $175,000, Emery Roth, Archt., 119 W. Fortieth Street; 6-story brick tenement at 167th Street and Stebbins Avenue for Louis E. Kleban, cost $60,000, Maximilian Zipkes, Archt., 405 Lexington Avenue; 5-story brick tenement at Creston Avenue and 196th Street for Padula Realty Co., cost $60,000, Wm. Koppe, Archt., 830 Westchester Avenue; four 5-story brick tenements at Webster Avenue and 184th Street for Webster Avenue Realty Co., cost $220,000, Geo. Keister, Archt., 56 W. Forty-fifth Street.

Thomas W. Lamb, 644 Eighth Avenue, is architect for a company which plans remodeling car barns on Eighth Avenue between Forty-ninth and Fiftieth Streets, into a coliseum.

Schwartz & Gross, 347 Fifth Avenue, are architects for fourteen-story apartment house to be erected at 302 West End Avenue, for Dr. Charles V. Paterno, 272 West Eighty-fourth Street.

Plans being prepared by Louis Allen Abramson, 220 Fifth Avenue, for five-story, fireproof, brick and limestone building to be erected for Bronx Y. M. H. Association, 1004 Boston Road; estimated cost $150,000. Jacob Shongut, Chairman Executive Committee.

Plans completed by Emery Roth, 119 West Fortieth Street, for twelve-story apartment house to be erected at Park Avenue and Sixty-third Street, for Fenlo Realty Company; cost approximately $450,000.

Hill & Stout, 299 Madison Avenue, reported architects for proposed $150,000 dormitory for women contemplated for Christ Presbyterian Church, Fifth Avenue and Thirty-seventh Street, as a memorial to William D. Barbour. Rev. William P. Merrill, Pastor.

Plans being prepared by N. Serracino, 1170 Broadway, for two five-story tenements to be erected at Webster Avenue and St. Paul Place, Bronx Borough, for Joseph Zibelli, owner and builder.

Rochester, N. Y.—Thomas J. Swanton, 32 State Street, reported interested in company which will erect a fireproof, steel, brick and concrete moving picture theater at 31 Clinton Avenue, North.

Watertown, N. Y.—C. M. Curtis, Vinney Building, Syracuse, is architect for remodeling Franklin Arcade Building into a theater; cost about $50,000.

Atlantic City, N. J.—Jules E. Mastbaum, 2307 N. Broad Street, Philadelphia, Pa., reported interested in erection of $1,000,000 hotel on old Windsor Hotel site.

Bayonne, N. J.—New York Telephone Company intends erecting a telephone exchange building on Broadway, estimated to cost $35,000.

Hoboken, N. J. — Hexamer's Riding Academy and garage on Hudson Street, recently reported destroyed by fire, will be rebuilt.

Allentown, Pa.—All bids opened for erecting addition to Y. M. C. A. Building have been rejected; new bids will be received. Louis Jallade, 37 Liberty Street, New York, and Ruhe & Lange, Allentown, associate architects.

Eddystone, Pa.—George H. Nattress & Son, 1129 Walnut Street, Philadelphia, Pa., are architects for three-story stone edifice to be erected here for St. Luke's Protestant Episcopal Church.

Wilkes-Barre, Pa.—Plans completed for seven-story, limestone, brick and tile apartment house contemplated on South Washington Street for Henry A. and Ferdinand Maier, Archts., Coal Exchange Building; probable cost $100,000.

Norfolk, Va.—Plans prepared for six-story, fireproof, brick, terra cotta and marble store and office building to be erected next spring on City Hall Avenue for M. McKevitt, of Norfolk.

Cleveland, Ohio.—Plans prepared by Hubbell & Benes, 4500 Euclid Avenue, for fourteen-story, terra cotta and steel Exchange Building to be erected at 317 Euclid Avenue.

Painesville, O.—Reported Ohio Mausoleum Company of Galion, contemplates erecting $50,000 mausoleum here.

Toledo, Ohio.—Plans prepared for four-story, 28 x 100-ft. fireproof garage and service building for Willys-Overland Company, to be erected at Adams and Fourteenth Streets; cost about $100,000.

Detroit, Mich.—Oscar Gottesleben, Dime Bank Building, is architect for 14-story, fireproof, steel and cement hotel to be erected at Park Place and Clifford Street.

Grand Rapids, Mich.—Alvah Brown, 501 Paris Avenue, S. E., reported interested in company which will erect seven-story, fireproof Community Hotel at Sheldon Avenue and Oakes Street.

Chicago, Ill.—Mundie & Jensen, 30 S. La Salle Street, reported architects for sixteen-story store and office building to be erected on old Bay State Building site, State and Randolph Streets; cost approximately $500,000.

Freeport, Ill.—Reported plans prepared for eight-story, 70 x 155 ft. hotel to be erected for Freeport Hotel Company; estimated cost $500,000.

Stevens Point, Wis.—Preliminary plans being prepared by E. Brielmaier & Sons Company, 111 Mason Street, for church and parsonage for St. Joseph's German Roman Catholic Church; cost about $30,000.

Minneapolis, Minn.—Swedish-American Club contemplates erecting $50,000 building on Nicollet Avenue and Lake Street.

South St. Paul, Minn.—A $30,000 addition will be erected to Stock Yards Exchange annex.

St. Paul, Minn.—F. G. Leslie Paper Company will rebuild offices and warehouse recently reported destroyed by fire.

Reported St. Paul Southern Electric Railway Company (Adolph Hirschman, Pres., St. Paul), will erect $200,000 terminal building here.

Havre, Mont.—Reported Great Northern Railway Company (A. H. Hogeland, Ch. Engr., St. Paul, Minn.) will erect three-story freight and office building on Main Street and Fifth Avenue.

Pine Bluff, Ark.—Warehouse of Pine Bluff Compress Company recently reported destroyed by fire will be rebuilt. J. P. Daley, Mgr.

Dallas, Tex.—Dallas Terminal Association taking steps to erect $1,500,000 interurban terminal depot here. Charles F. Wallace, President, Rapid Transit Railway Company, Dallas, reported interested.

Ardmore, Okla.—Reported plans submitted to Gulf, Colorado & Santa Fe Railway Company (F. Merritt, Ch. Engr., Galveston, Tex.) for new passenger and freight depots to replace buildings destroyed by explosion here; total cost about $45,000.

Seattle, Wash.—Contract soon to be let by Lawton & Moldenhour, Alaska Building, for erecting five-story, concrete and brick apartment house at Olive and Melrose Avenues, for G. E. Sherwood, 2622 Alki Avenue; cost about $75,000.

Tacoma, Wash.—Oregon-Washington Railroad & Navigation Company will soon be awarded the outstanding floor lengths to the water front property about 500 ft., including a section of the Middle Waterway and erection of buildings for the Company. Chas. H. Howard, Chief Engineer, Portland, Ore.

BIDS DESIRED.

Detroit, Mich.—Reported deposit until Dec. 21 for erection of garage and service station, 100 x 162 ft., cinder, stone and other materials. C. Howard Crane, Archt., 2322 Dime Bank Building, Detroit.

PRICES AND LETTINGS.

★Indicates award of contract.

★Waterbury, Conn.—Contract awarded Turbo Blast Co., 11 Broadway, New York, for erecting the Scovill Manufacturing Co.'s fire-story, 70 x 300-ft. addition, concrete floors, and gable-type building brick exterior walls on East Main Street. Hull L. Thompson, 8 North Main Street, Waterbury, Archt.

★Atlantic City, N. J.—Contract awarded Owens & Company, Lincoln Building, Philadelphia, Pa., for erecting factory building for St. Charles Hotel Company, Stewart & Cleaver, Archts., Bullitt Building, Philadelphia, Pa.

★Marcus Hook, Pa.—Contract awarded by Hood Rubber Company to J. W. Valentine, Lincoln Building, Philadelphia, for erecting two Reception Buildings, total cost about $15,000.

★Pittsburgh, Pa.—Contract awarded by W. C. Sanders, Arch., Empire Building, to Crawford Lumber Company, Thomas and Robinson Streets, for erecting factory, brick store and apartment building for Sargent Piano Company on Federal Street, near Ridge.

Williamsburg, Pa.—Contract for erecting First Christian Church on Bridges Avenue awarded F. D. Osner & Co., Williamsburg Trust Building, Pittsburgh, cost about $20,000.

★Baltimore, Md.—Contract for erecting reinforced stone office for Pratt Presbyterian Church at Broadway and Gay Street, awarded Cranz Building Company, 106 W. Madison street; cost $30,000.

★Sioux City, Iowa.—Contract awarded by E. C. Stevens & Company, 1215 Michigan Avenue, Chicago, Ill., for erecting factory here, cost $50,000. Martin Johnson at 4th and Pierce Streets, cost about $10,000.

NEW INDUSTRIAL PLANTS

PROPOSED WORK.

New Milford, Conn.—Connecticut Lime Company of Lakeville, is reported contemplates erecting limestone here.

New York, N. Y.—Plans filed for erection of factory building on Broadway, Seventeenth Street and Broadway, Montgomery Streets, by Eidlitz & Ross, Inc., Archts., 71 Broadway; estimated cost $1,000,000. Separate bids will be taken for Structural Steel and Steel Sash for Fireproof Storage & Refrigeration Co., Inc., East 26th Street, Horace A. Kent, Archt., 347 Fifth Avenue.

Jersey City, N. J.—Jersey Dairy Products Company will erect a four-story 100 x 150-ft. warehouse to cost $40,000 on Monmouth Street, to cost about $40,000.

Pauloboro, N. J.—Contract soon to be let to Hartmann & Fox, Trenton, 4th Street and Grape Ferry Avenue, Philadelphia, Pa., for erecting brick and concrete manufacturing plant here.

West Hoboken, N. J.—Novo Linoleum Company, Limited, will erect a factory in West Hoboken to cost $40,000.

Allentown, Pa.—Lehigh Yale & Tool Company, of Edward Ferdon, Jr., Vice-Pres. and Gen'l Mgr., plans erecting addition to plant.

Myerstown, Pa.—J. W. Hershey, of Philadelphia, contemplates erecting hosiery mill here.

Philadelphia, Pa.—Plans for Manufacturing & Coal Realty Company, Franklin and Buttonwood Streets, will erect a brick, concrete and steel coal pocket and 2 story brick office, 110 Chestnut Street.

Indiana, Penn.—Chemical Wood Pulp & Paper Company will erect addition to their coal chemical plant here.

Toledo, Ohio.—Toledo Foundry Company is completing plans for erecting 1 story foundry and steel plant here.

Wauwatosa, Wis.—Universal Motor Company, of Milwaukee, contemplates erecting factory here, cost $100,000.

Milwaukee, Wis.—Plans being prepared by A. O. Eisen, 361 Broadway, Milwaukee, for one-story, 50 x 100-ft. factory building for Wisconsin Electric Company, cost $50,000.

St. Paul, Minn.—Chevrolet Motor Car Company intends erecting four-story, fireproof brick and steel factory and assembling plant in the Midway near Overland plant, probable cost $500,000.

Dallas, Tex.—Reported Nelson Morris & Company, Chicago, Ill., contemplate erecting wholesale packing plant here; probable cost $75,000.

Marshall Tex.—Reported plans prepared for new shops for Texas & Pacific Railway Company, H. Chamberlin, Chief Engineer, Dallas, to replace those destroyed by fire.

Paris, Tex.—Plant of Paris Milling Company recently destroyed by fire, will be rebuilt.

Seattle, Wash.—Reported Oregon-Washington Railroad & Navigation Company (O. R. Hudson, Ch. Engr., Portland, Ore.) will soon let contract for erecting freight shed, 200 x 700 ft., concrete and brick addition to plant of American Paper Company, Jansen and Atlantic Streets; cost $100,000.

BIDS DESIRED.

New Orleans, La.—Until Dec. 29, by Board of Port Commissioners for equipment for the public grain elevator, including conveying and elevator belting, electric freight elevator, alternating current motors, 2,000 bushel scales, separators and cast copper, advertised in Engineering Record.

PRICES AND LETTINGS.

★Indicates award of contract.

★New York, N. Y.—Contract awarded D. C. Weeks & Sons, 1123 Broadway, for erecting brick, steel and reinforced-concrete factory at 581 Water Street, for David Dows, 120 Broadway; cost approximately $120,000.

★Milton, Pa.—Contract awarded by Aluminum Car & Foundry Company to Wood Construction Company, Albany, N. Y., for erecting 100 x 200-ft. brick paint shop.

★Philadelphia, Pa.—Contract awarded Turner Concrete Steel Company, 1713 Sansom Street, for concrete work in connection with Collins factory to be erected for Kelly & Glendenning at Twenty-third and Sansom Streets. M. H. Dickinson, Archt., Empire Building.

★Pottstown, Pa.—Contract awarded to James H. Wells Heed Building, Philadelphia, for erecting two-story, 134 x 70-ft., reinforced concrete brick factory, and C x 150-ft. power house for National Rubber Company; cost $150,000. Marshall N. Dana, Engr., Union Building, Newark, N. J.

★Warwood, W. Va.—Contracts awarded by Mountain States Power Company, 517 Arch Street, Philadelphia, Pa., for erecting brick and steel factory in North Warwood, for manufacture of sprinklers, as follows: (Bidders of Wheeling unless otherwise stated)—Foundation, C. H. Seaton & Company; steel, J. E. Moss Iron Works; carpentry, J. H. Murphy Company, Warwood; excavation, brick and concrete, Harry G. Cunningham.

★Terre Haute, Ind.—Contract awarded by Indiana Coke & Gas Company to Gas Machinery Company, of Cleveland, Ohio, for constructing a gas, coke and coal tar products plant. Cost $700,000. All subcontracts awarded.

★St. Paul, Minn.—Contract awarded by Motion Picture Company, 19 West Ninth Street, to W. J. Hoy Company, 700 Metropolitan Building, for erecting plant on Franklin and Chestnut Streets; cost about $75,000.

★Seattle, Wash.—Contract awarded by Port Commission (C. E. Remsberg, Secy), Bell Street Wharf, for erecting fish and ice storage building to Hooper, Kiel & Wheeler, Central Building, at $22,867.

MISCELLANEOUS

PROPOSED WORK.

Coal Bunker—Tacoma, Wash.—St. Paul & Tacoma Lumber Company reported contemplating erecting a large coal bunker on their property on St. Paul Avenue.

BIDS DESIRED.

Lamp Posts—New York, N. Y.—Until Dec. 31 by William Wilkens, Commissioner Gas & Electricity, for furnishing and delivering cast iron lamp posts, exclusive of steel shafts.

Balustrade—New York, N. Y.—Until Dec. 31 by Chief Ward, Pier, Commissioners Parks, New York, for furnishing material and constructing an artificial stone railing on the newly constructed concrete bulkhead wall, Borough Manhattan. Estimate $4,000.

Elevator—Rochester, N. Y.—Until Dec. 28 by C. E. Hill, Supt. Public Works, Contract 4, house for operating elevator, also constructing elevator balcony in city hall. Chandler & Stacey Building, Rochester.

Pumping Engine and Hose Wagon—Farrell, Pa.—Until Dec. 21, by John J. Nolan, Borough Secretary, for one motor-driven pumping engine and hose wagon, approximately 500-gal. capacity and 75 h.p., 1000 ft. hose capacity; advertised in Engineering Record.

Elevator Doors, etc.—Pittsburgh, Pa.—See "Public Buildings and Schools."

Cotton Trolley—Houston, Tex.—Until Dec. 27 by City Secretary for constructing a bar channel cotton trolley for Municipal Cotton Concentration plant. E. E. Sands, City Engineer.

PRICES AND LETTINGS.

★Indicates award of contract.

★Wellsburg, W. Va.—The American Gas & Electric Company, 30 Church Street, New York, N. Y., has secured a site at Beech Bottom, or Windsor, W. Va., on Ohio River, between Wellsburg and Wheeling, on the Pittsburgh Division of the Panhandle Ry., and will erect a power plant; contract for installing intake tunnels, building foundations, and turbine foundations awarded to Foundation Company, 233 Broadway, New York; turbines to General Electric Company, 30 Church Street, New York, and for boilers to Babcock & Wilcox, 85 Liberty Street, New York. Sargent & Lundy, Chicago, Ill., engineers for the plant.

★Cement—Minneapolis, Minn.—Contract awarded Landis Morrison Christiansen Company, Minneapolis, for 30,000 bbl. Portland cement at $1.20 per bbl.

Proposals

For Proposals Advertised, see Pages 50 and 51.

WATERWORKS.

Bids Close.		See Eng. Record.
Dec. 20.	Well, Galesburg, Ill. Adv. Dec. 11.	Dec. 11
Dec. 22.	Borings, Providence, R. I. Adv. Dec. 11.	Dec. 11
Dec. 22.	Pipe, etc., Panama	Dec. 11
Dec. 22	Iron for filtration plant Cleveland, Ohio	Dec. 18
Dec. 23	Sulphuric acid, Columbus, Ohio	Dec. 18
Jan. 1.	Water Works, Beebe, Ark. Adv. Dec. 18.	Dec. 18
Jan. 3.	Extension, Baker, Ore.	Dec. 18
Jan. 4.	Water Works, Wesson, Miss. Adv. Dec. 18.	Dec. 18
Jan. 6.	Reservoir, Manteca, Cal.	Dec. 18
Jan. 10	Filter, Danville, Ill. Adv. Dec. 18.	Dec. 18
Jan. 11.	Filter Plant, St. Hyacinthe, Que.	Dec. 4
Jan. 12.	Pumping Unit, Kansas City, Mo. Adv. Dec. 11, 18.	Dec. 11

SEWERAGE AND SEWAGE DISPOSAL.

Dec. 21.	Strawberry Point, Iowa.	Nov. 20
Dec. 21.	Toronto, Ont.	Dec. 18
Dec. 22.	Lincoln, Neb.	Dec. 18
Dec. 23.	Kenova, W. Va.	Dec. 11
Dec. 27.	Vincennes, Ind.	Dec. 18
Jan. 1.	Wausa, Neb.	Dec. 18
Jan. 4.	Key West, Fla.	Dec. 4
Jan. 4.	Loveland, Colo. Adv. Dec. 18.	Dec. 18
Jan. 6	Mason City, Iowa. Adv. Dec. 4.	Dec. 4

BRIDGES.

Dec. 21.	Atlanta, Ga.	Dec. 4
Dec. 21.	Phoenixville, Pa. Adv. Dec. 4 to 18.	Dec. 4
Dec. 23.	Portland, Ore.	Dec. 18
Dec. 23	Houghton, Mich.	Dec. 18
Dec. 24.	Salem, Ore.	Dec. 18
Dec. 27.	Sacramento, Cal.	Dec. 18
Dec. 28.	Omaha, Neb.	Dec. 11
Dec. 28.	Pittsburgh, Pa.	Dec. 18
Dec. 30.	Defiance, Ohio	Dec. 18
Jan. 3	Lawrence, Kan.	Dec. 18
Jan. 4.	Wadena, Minn.	Dec. 11
Jan. 18.	Knoxville, Iowa.	Dec. 18

PAVING AND ROADS.

Dec. 21.	Seattle, Wash.	Dec. 4
Dec. 21.	Wildwood, N. J.	Dec. 11
Dec. 21	Ocean Grove, N. J.	Dec. 11
Dec. 21	New York, N. Y.	Dec. 18
Dec. 21	Connecticut	Dec. 18
Dec. 21	Massachusetts	Dec. 18
Dec. 22.	Rockford, Ill. Adv. Dec. 11	Dec. 11
Dec. 22	Painesville, Ohio	Dec. 18
Dec. 23	New York, N. Y.	Dec. 18
Dec. 23	Newark, N. J.	Dec. 18
Dec. 27	Opelika, Ala.	Dec. 11
Dec. 27	California	Dec. 11
Dec. 30	Durham, Ala.	Dec. 18
Jan. 1.	Chelsea P. O., Atlantic City, N. J.	Dec. 18
Jan. 3	Maysardsville, Tenn.	Nov. 20
Jan. 3	New Orleans, La.	Dec. 18
Jan. 3	Road Roller, Tucson, Ariz.	Dec. 18
Jan. 4	Huntsville, Ala.	Dec. 18
Jan. 6	The Dalles, Ore.	Dec. 18
Jan. 11.	Florence, S. C.	Dec. 18
Jan. 13.	Sault Ste. Marie, Mich.	Dec. 4
Jan. 14.	Charlestown, W. Va.	Dec. 18

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS.

Dec. 22.	Dock, Miami, Fla. Adv. Dec. 4, 11.	Dec. 4
Dec. 22.	Drainage, Spirit Lake, Ia.	Dec. 18
Dec. 23.	Ditch, Pine City, Minn.	Dec. 11
Dev. 28.	Ditch, Hartford City, Ind.	Dec. 11
Dec. 29.	Grain Elevator, New Orleans, La. Adv. Dec. 4 to 18.	Dec. 4
Dec. 30.	Drain, Morganfield, Ky. Adv. Dec. 11.	Dec. 11
Dec. 30.	Canal Extension, Harlingen, Tex.	Dec. 18
Dec. 31.	Breakwater, Fort Taylor, Fla. Adv. Dec. 4 to 18.	Dec. 4
Jan. 4.	State Canal, Contract 73-A, Albany, N. Y.	Dec. 11
Jan. 5.	Wharf, etc., New Orleans, La. Adv. Dec. 11, 18.	Dec. 11
Jan. 5.	Piling, lumber, etc., for wharf, New Orleans, La. Adv. Dec. 11, 18.	Dec. 11
Jan. 6.	Power house at dam, Wheeling, W. Va. Adv. Dec. 11, 18.	Dec. 11
Jan. 7	Ditch, Duluth, Minn.	Dec. 18
Jan 8.	Dredge, Macaco, China.	Nov. 6
Jan. 10.	Ditches, Poplar Bluffs, Mo.	Dec. 18
Jan. 14.	Gates for Dam, Wheeling, W. Va. Adv. Dec. 18.	Dec. 18

PUBLIC BUILDINGS AND SCHOOLS.

Dec. 21.	Attleboro, Mass.	Nov. 20
Dec. 21.	Alton, Iowa	Dec. 4
Dec. 21.	Fulton, Mo.	Dec. 11
Dec. 21.	Pittsburgh, Pa.	Dec. 18
Dec. 22.	College Station, Tex.	Dec. 11
Dec. 23.	Austin, Tex.	Dec. 18
Dec. 24.	East Youngstown, Ohio.	Dec. 4
Dec. 24.	Buffalo, N. Y.	Dec. 18
Dec. 25.	Tulsa, Okla.	Dec. 18
Dec. 28.	Orient, Ohio	Dec. 11
Dec. 28.	Seymour, Conn.	Nov. 20
Dec. 29.	Missoula, Mont.	Nov. 27
Dec. 30.	St. Petersburg, Fla. Adv. Nov. 20, 27.	Nov. 20
Dec. 30.	Galveston, Tex.	Nov. 27
Dec. 30.	Ridgway, Pa.	Nov. 27
Dec. 30.	Somerville, Ohio	Dec. 11
Dec. 31.	San Jose, Cal.	Dec. 18
Jan. 1.	Arlington, Iowa	Dec. 4
Jan. 1.	Independence, Iowa	Dec. 4
Jan. 1.	Motherwell, Ont.	Dec. 11
Jan. 3.	Chicago, Ill.	Dec. 18
Jan. 4.	Cavite, P. I.	Nov. 13
Jan. 4.	Greenville, S. C.	Nov. 27
Jan. 4.	Gaylord, Minn.	Dec. 4
Jan. 4.	Crookston, Minn.	Dec. 11
Jan. 4.	East Cleveland, Ohio.	Dec. 11
Jan. 5.	Harlan, Iowa	Nov. 27
Jan. 5	Providence, R. I.	Dec. 18
Jan. 6.	Wheeling, W. Va. Adv. Dec. 11.	Dec. 11
Jan. 10.	Titusville, Pa. Adv. Dec. 4, 11.	Dec. 4
Jan. 11.	Durham, N. C.	Dec. 18
Jan. 12.	Durham, N. C.	Dec. 11
Jan. 15.	Duluth, Minn.	Dec. 11
Jan. 16.	Sidney, Neb.	Dec. 11
Jan. 17.	Hackensack, N. J.	Dec. 11
Jan. 17.	Smithfield, R. I.	Dec. 18
Jan. 18.	Anoka, Minn.	Dec. 11
Jan. 19.	Hornell, N. Y.	Dec. 11
Jan. 21.	Waterloo, N. Y.	Dec. 18
Jan. 24.	Ashland, Ky.	Dec. 18
Jan. 26	Shelby, N. C.	Dec. 18
Jan. 27	Ellensburg, Wash.	Dec. 18
Feb. 1.	Oneida, Iowa	Dec. 18

PRIVATE BUILDINGS.

Dec. 23.	Detroit, Mich.	Dec. 18
Dec. 27.	Beaumont, Tex.	Dec. 11

NEW INDUSTRIAL PLANTS.

Dec. 29.	New Orleans, La. Adv. Dec. 4 to 18.	Dec. 4
Dec. 29.	New Orleans, La. Adv. Dec. 18.	Dec. 18

MISCELLANEOUS.

Dec. 20.	Coal, Norfolk, Va. Adv. Nov. 20, Dec. 11.	Nov. 20
Dec. 21.	Cement, Kansas City, Mo Adv. Dec. 4, 11.	Dec. 4
Dec. 21.	Transmission Towers, Los Angeles, Cal.	Dec. 11
Dec. 21.	Pumping Engine and Hose Wagon, Farrell, Pa.	Dec. 18
Dec. 22.	Electric Light Fixtures in Senate Chamber, Albany, N. Y. Adv. Dec. 11, 18.	Dec. 11
Dec. 22.	Elevator, Rochester, N. Y.	Dec. 18
Dec. 22.	Lamp Posts, New York, N. Y.	Dec. 18
Dec. 23.	Elevators, Washington, D. C.	Dec. 4
Dec. 23.	Balustrade, New York, N. Y.	Dec. 18
Dec. 23.	Street Sweeping Machines, Newark, N. J.	Dec. 18
Dec. 27.	Trolley on Wharf, Houston, Tex.	Dec. 18
Jan. 3.	Garbage Incinerator, Fort Wayne, Ind. Adv. Dec. 11.	Dec. 11
Jan. 8.	Steel towers Guam.	Nov. 20
Apr. 1.	Memorial, Fort McHenry (P. O. Baltimore), Md.	Nov. 20

CONTRACTING NEWS

Of Special Interest to Engineers, Contractors, Builders and Manufacturers of Engineering and Building Supplies

THAT Europe is making satisfactory arrangements to pay for the enormous quantity of goods being exported from this country is shown by the relatively strong position of foreign exchange. These arrangements probably include the quiet transfer of large holdings in American securities. Substantial gains in exchange have been made and held since the Anglo-French loan was arranged in the face of a constantly increasing balance of trade in our favor. This balance piled up at almost $40,000,000 a week in October, more than $45,000,000 a week in November, and has increased at the rate of almost $56,000,000 a week for the first three weeks of December.

This situation, the likelihood of the adoption of adequate military measures to insure our industrial development against outside interference, and the work being done to put us in a position to compete successfully for normal foreign trade are factors that have caused the present crisis with a foreign government to be considered with much less alarm than our foreign troubles of last spring and summer, although the crisis itself is the most acute of the past decade. In any event, it seems hardly likely that our difficulties with Austria can have any serious effect on American industry or on construction prospects for next year.

Buildings

A private building contract amounting to $150,000 has been awarded at Cold Spring, L. I. The construction of a $100,000 building has been contracted for at Rochester, N. Y. Contracts totaling $90,000 have been awarded for constructing a school building at Wheeling, W. Va. Many building contractors have been improving their acquaintance with Lincoln, Neb., where three large building contracts have just been let. One of these, a ten-story traction terminal, will cost $500,000. The contracts for the University of Nebraska chemical building total $164,000, and the contracts let for constructing a hospital for the State medical college at Omaha amount to $121,000.

In spite of the lateness of the season, bids are still being taken on much important building work. The projects noted this week include a $100,000 high school to be let Jan. 3 at East Hartford, Conn.; a three-story school and a $200,000 armory on which bids are asked at Chicago; a $138,000 high school at Vincennes, Ind.; a $100,000 parish school to be let Jan. 15 at St. Louis; a court house at Sioux City, Iowa, and the Masonic temple to be let Dec. 27 at Omaha, Neb., which will cost $300,000.

Plans have been completed for another school to cost $150,000 at Jersey City, N. J. In New York City plans were filed last week for two apartment houses to cost $250,000 each. An architect has been selected for the $300,000 chamber of commerce building to be built at Pittsburgh. It is reported that an open-hearth steel plant to cost $1,000,000 will be erected at Ashland, Ky. St. Paul has had a legacy of $1,400,000 left it for constructing and maintaining a public hospital. A warehouse to be built at Minneapolis will cost $300,000. A contract will soon be let at Faribault, Minn., for erecting a $125,000 packing plant. The new city hall to be built at Duluth will cost $400,000. A $200,000 court house is proposed at Prescott, Ariz. A paper company contemplates erecting a $500,000 mill at Oregon City, Ore.

Bridges and Roads

No important paving contracts were reported last week, although a number of small jobs were let ranging from a few thousand dollars to three contracts awarded at Ontario, Cal., totaling $74,000. Bids are desired in New York City for a considerable quantity of paving material. Contracts for constructing about 38 miles of road are to be let Jan. 12 at Dadeville, Ala. Bids are desired Dec. 30 at Washington, Ind., for building a 420-ft. steel and concrete bridge. Contracts for 70,000 sq. yd. of paving will be let Jan. 17 at Evanston, Ill. Rockford, Ill., desires bids for constructing an $83,000 bridge. Considerable paving work is to be let Dec. 30 at Tulsa, Okla. Sherman, Tex., is taking bids for material to be used in the construction of roads for which $900,000 is available.

It is reported from St. John, N. B., that the provincial government has arranged for $1,700,000 to construct bridges and a short railway line. The bond issue authorized to cover paving work to be done by the Toronto Street Railway Company amounts to $453,000. At Columbia, S. C., $1,250,000 has been appropriated for road construction. County road bonds authorized at Greenville, S. C., amount to $750,000. Road improvements contemplated by the county commissioners at Akron, Ohio, will cost $372,000. The repaving of Twelfth Street, Chicago, for the widening of which a condemnation suit is pending, will cost $320,500. Highway improvements contemplated in Milwaukee, Wis., include 35 miles of concrete pavement. A bridge and earth-fill approach, the construction of which has been decided on at Chippewa Falls, Wis., will cost $160,000. Contracts are to be let next year at Chillicothe, Mo., for paving work to cost $100,000. Road work to be let next April at Bemidji, Minn., will cost $105,000. The bridge to be built at Mankato, Minn., will cost $100,000 and a contract will be let toward the end of next month. The sum of $195,000 will be spent for county road improvements next year at Hillsboro, Ore. Plans have been approved at Seattle for paving work to cost $200,000, and estimates have been made for additional work to cost $180,000 more.

Waterworks and Sewers

Waterworks contracts amounting to $79,000 have been awarded at East Youngstown, Ohio. The lowest bid received at Galveston, Tex., for laying new water mains across the bay was $92,000. Columbia, S. C., will sell $500,000 bonds for waterworks and sewer extensions. A franchise to construct a $50,000 waterworks system has been granted at Orleans, Ind. Waterworks contracts amounting to $40,000 will be let next spring at Chardon, Ohio. Waterworks construction bonds amounting to $100,000 have been voted at Fort Dodge, Iowa. An engineer has been selected to superintend the construction of waterworks extensions to cost $500,000 at St. Paul. An expenditure of $678,000 for laying water mains and service connections has been approved at Toronto.

A sewer extension to cost $110,000 has been contracted for at Buffalo. The new sewage disposal system reported on at that city will cost $3,500,000. Two sewer contracts awarded at Philadelphia total $151,000. Houston, Tex., has opened bids on three sewer contracts which will cost $43,000. Bids will be opened this month for sewer construction at Boston and at Cincinnati. The bond issue to be sold by Dayton, Ohio, for its new sewage-disposal plant amounts to $250,000. Plans have been prepared at Greensville, Ohio, for a trunk sewer to cost $60,000. A sewer system which will cost $150,000 is being considered at Fresno, Cal.

Miscellaneous

The lowest bid received at Philadelphia for the steelwork for the extension of the Frankford elevated line was $248,000. Bids have been opened on a drainage contract to cost $133,000 at Marion, Ark., and a similar contract has been awarded at Robstown, Tex., for $141,000. A contract for the Parley's Canyon dam on which bids were opened recently at Salt Lake City has been awarded at $108,000. The re-lining of the Oregon-Washington Railroad & Navigation Company's tunnel at Portland has been contracted for at $400,000. The lowest bid received Dec. 8 by San Francisco for constructing a municipal railway line was $150,000. Bids will be received Jan. 17 at Oakdale, Cal., for irrigation work, including a 1-mile tunnel and estimated to cost $100,000.

Plans for two large New York State Barge Canal contracts have been approved. One, the May's Point lock and dam, is estimated to cost $314,000, and the other, for completing a section of the canal, will cost $1,039,000. The flood-prevention plans of Erie, Pa., approved by the State Water Supply Commission will cost $798,000. Drainage work to cost $100,000 is to be let next month at St. Petersburg, Fla. A report has been submitted on a $300,000 reclamation project near Des Moines, Iowa. Drainage bonds amounting to $205,000 have been sold at Marion, Ark. A $300,000 dredging contract is coming up for letting early in the year at Tacoma, Wash. Plans for jetty work which will cost $150,000 have been submitted at Venice, Cal.

WATERWORKS

PROPOSED WORK.

Liverpool, N. Y.—Construction of water works costing $45,000 under consideration. M. D. Green may be able to give further information.

Lancaster, Pa.—Plans approved by City Council for improvements to the municipal water works system providing for installation of two electrically-driven centrifugal pumps to cost $60,000.

Reading, Pa.—Council has appropriated $31,000 for building part or all of first unit or section of the Hegel-Gehl reservoir.

Windsor, Pa.—Election soon to be held to vote $15,000 bonds to construct water works, including reservoir. Address City Clerk.

Baltimore, Md.—Walter E. Lee, Water Engineer, writes that the installation of water meters in all buildings except two-story dwellings is all newspaper talk.

Charleston, S. C.—At election Dec. 14 citizens voted against issuing bonds for purchase of plant of Charleston Light & Water Company, also against the issue of bonds for improving the same.

Columbia, S. C.—Water and sewer extension bonds amounting to $500,000 will be sold soon by the city. G. F. Cooper, City Clerk.

Tifton, Ga.—Water Works, Sewerage and Fire and School Committees voted to make improvements to the water works costing $21,000, to include a 100,000-gal. tank on a 100-ft. tower, and extensions to the mains; also to erect a high school costing $35,000.

Fort Meade, Fla.—Water works, sewer and electric light bonds amounting to $33,000 have been sold.

Covington, La.—Election to be held Jan. 1 to vote $71,000 bonds for constructing water works and sewer systems. Plans provide for steel tower tank 125 ft. high, capacity 100,000 gal., concrete reservoir, capacity 100,000 gal., for fire protection, two 80-hp. oil burning engines, for pumping.

Pass Christian, Miss.—Board of Aldermen and the Mayor decided to issue $95,000 municipal improvement bonds, including $45,000 for water works and fire protection; $30,000 for improving streets.

Wesson, Miss.—Water and light bonds amounting to $18,000 have been sold by the Mayor. Bids for constructing the system will be opened Jan. 4.

Georgetown, Ky.—City Council reported to be considering construction of electric light plant and water works system.

Chardon, Ohio.—Chardon Water Works Co. (C. H. Tilton, Secy.) will let contracts in spring of 1916 amounting to $40,000.

Bicknell, Ind.—City Council has granted a franchise to George W. Harr, South Bend, to construct and operate water works plant; have daily capacity 2,000,000 gal.; cost about $150,000.

Orleans, Ind.—Ordinance passed granting franchise to J. B. Marvin, Frankford, Ind., to construct water works; cost $50,000.

South Bend, Ind.—Water works bonds amounting to $25,000 will be sold Dec. 29 by City Comptroller.

Monroe, Mich.—Construction of filtration plant in connection with the water works reported under consideration. Address Mayor.

Saginaw, Mich.—Citizens voted against constructing new consolidated pumping station, with filtration and softening plant and necessary connecting mains.

Fort Dodge, Iowa.—Citizens voted to issue $100,000 bonds for constructing water works. Burns & McDonnell, Kansas City, Mo., Engineers.

St. Paul, Minn.—W. N. Jones, of Minneapolis, engaged to superintend construction of the $500,000 improvements to the city's water supply system.

Three Forks, Mont.—Town Council contemplating constructing a water system to cost about $40,000.

Pocahontas, Ark.—City intends having by Jan. 1 city maps of water mains. Indoor Engineering Company, Memphis, Tenn., Engineers.

Mart, Tex.—Improvements are to be made to the water system. Bonds having been sold for same purpose.

Walters, Okla.—Citizens voted in favor of issuing $100 bonds for installing water works.

Colville, Wash.—Several Spokane Engineers, Schmitz, Gaylor have been employed by City Council to prepare a new system of water supply; cost approximately $75,000.

Langley, Wash.—Election soon to be held to vote bonds for purchasing local water works and erecting light plant and improving same. Address Town Clerk.

Olympia, Wash.—Citizens Dec. 14 voted $[illegible] bonds to lease over and improve the local water plant.

Seattle, Wash.—A. H. Dimock, City Engineer, submitted plans and specifications for water mains in Michigan Street to cost $[illegible].

Casa Grande, Ariz.—Water works, electric light plant and ice plant are contemplated by City Trustees. R. R. Stoner, City Clerk.

Downey, Idaho.—Plans for water system to be prepared by W. D. Cotton, Idaho Falls.

Grace Bay, N. S.—A. McKinnon, Town Engineer, is preparing plans for construction of a pumping unit to cost $5,000 to $10,000.

Toronto, Ont.—Board of Control has approved by-law authorizing $[illegible],242 to pay out existing revenue debts and borrow money on certain streets for water supply.

BIDS DESIRED.

Belleville, Ohio.—Through a misunderstanding new bids will be asked for constructing water works to consist of deep well, pumps and engines, 1 million gal. distribution mains and standpipe reservoir. Smith & Bonnell Co., Engrs., Neahy Building, Toledo. Glen L. Shaffer, Village Clerk.

Mansfield, Ohio.—Reported desired until Dec. 28, for two motor-driven centrifugal pumping units and motor-driven reciprocating pumps, for handling 20 cubic feet of water and a head of 50 feet. O. Hursh, Dir. Pub. Service.

St. Paul, Minn.—Until Jan. 17 by August Rosenberg, Purchasing Agent, for furnishing and erecting a steam pumping unit of a capacity of [illegible] gallons per [illegible] hours, advertised in Engineering Record.

Winnipeg, Man.—Until Dec. 28 by S. H. Bronson, Chmn. of Commissioners, 901 Bond Building, Winnipeg, for one steam-operated dual fire extinguisher for Greater Winnipeg Water District.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Philadelphia, Pa.—Following are lowest bids opened recently for furnishing to city pumping station: Coal storage and handling equipment, specially Engineering Company, Franklin and Allegheny Avenue, $[illegible] steam and superheaters, Continental Engineering Corporation, 11 [illegible] Street, N. Y. [illegible] Company, 8 [illegible] pipe and special castings, [illegible] Pipe & Foundry Company, Everett, Mass.; mechanical stoker equipment, Continental Engineering Corporation, [illegible] New York, $[illegible].

★East Youngstown, Ohio.—Contracts in connection with the water works awarded by [illegible] Trustees to Wilbur M. [illegible] Construction Company, Youngstown, engineer, grading and concrete work, $[illegible]; Pittsburgh Equitable Meter Company, meters, at $[illegible] each; cast iron pipe, at $[illegible] per ton; valves and valve connections, at $[illegible]; pumping engines, at $[illegible], to Allis-Chalmers Company, Milwaukee, Wis.; [illegible] to Lord & Miller Company, Pittsburgh, Pa., [illegible] equipment, including [illegible] and [illegible] piping, Byers & Hammond Engineering Company, Pittsburgh, [illegible] pipe and [illegible] to Reading Iron Company, Reading, Pa.; [illegible] to Reading Steel Casting Company, Reading, Pa.; [illegible] to Lord & Miller Company, Pittsburgh, Pa.;

★**Pennsylvania.**—Contract awarded by State Highway Department, Harrisburg, for constructing a concrete and steel bridge on State Highway Route No. 258, at Station 140, near Kearsearge, Erie County (bids opened Dec. 15), to B. W. Blystone, Cambridge Springs, at $5,120.

★**Philadelphia, Pa.**—Following are four lowest bids opened Dec. 14 by Department Public Works for constructing the Diamond Street bridge over Pennsylvania R. R.: Cantrell Construction Company, Philadelphia, $60,715 (awarded contract); Keystone State Construction Company, $62,500; Bran & Stuart, $64,000, and F. J. Boas, $72,500.

★**Pottsville, Pa.**—Contract for constructing bridge over railroad tracks at St. Clair Yards reported awarded by Philadelphia & Reading R. R. Co. to Keystone Structural Co., Philaelphia.

★**Norfolk, Va.**—Contract for constructing bridge over Tanner's Creek on Jamestown Boulevard reported awarded by Norfolk County Road Bond Commissioners to Alsop & Pierce, Newport News, at $28,780.

★**Pembroke, Va.**—Contract for constructing bridge across New River at Pembroke awarded by County Commissioners at Pearisburg to Virginia Bridge & Iron Company, Roanoke, at $17,000. F. E. Snidow, County Clerk.

★**Detroit, Mich.** — Contract awarded Candler Dock & Dredge Company, 305 Moffat Building, Detroit, for wrecking the burned Belle Isle Bridge at $4,250, plus approximately 800 tons of salvaged wrought iron.

★**Wathena, Kan.**—Contract for constructing Peters Creek Bridge over Peters Creek (bids opened Dec. 7) awarded by County Commissioners, Troy, to J. H. Wagenknecht, Wathena, at $5,744.

★**Tekamah, Neb.**—Contract awarded H. J. Cathros Company, Omaha, for concrete culverts at $21.330. Unit figures: Stone concrete, $10.89; gravel concrete, $9.75; steel bars, 2.7 cts. Engineers, Towl Engineering Co., 1122 City National Building, Omaha.

★**Dallas, Tex.**—Contract for constructing 60-ft. girder bridge across Bachman Creek for Dallas County awarded Klein Brothers Company, Dallas, at approximately $4,500.

★**Carson, Wash.**—Contract for constructing bridge over Wind River near Carson awarded by County Comrs. at Stevenson to Coast Bridge Co., Portland, at $12,430 for steel spans.

PAVING AND ROADS

PROPOSED WORK.

Manchester, Conn.—The Bd. Selectmen contemplates spending about $30,000 for constructing sidewalks.

Bayonne, N. J.—City Engineer instructed to prepare plans and specifications for improving 18 streets.

Newton, N. J.—Bd. Freeholders directed Harry Snook, County Engineer, to make survey of road through Loomis Meadows. Construction of a 5-mile road known as the Ross's Corner Sussex Road is contemplated.

Baltimore, Md.—Paving Commission will soon let contracts for paving Bond, Fleet, Bush, Russell, Scott, Wicomico, Calhoun, Ramsey, Mosher, Gilmor, Hollins Streets, Columbia, Wilkens, Frederick Avenues.

Norfolk, Va.—The Virginia Railway & Power Co. will pave Granby Street between Queen and Eighteenth Streets, estimated cost $45,000.

Morgantown, W. Va.—About $304,803 Morgan Dist. Good Road bonds sold by County Court.

Atlanta, Ga.—The surfacing of Ivy Street with asphalt is contemplated by city, cost $13,600.

Tifton, Ga.—About $30,000 is to be spent by city for paving portions of Main, First and Third Streets.

Gainesville, Fla.—Citizens voted to pave with brick University Avenue.

Gainesville, Fla.—See "Sewerage and Sewage Disposal."

Pass Christian, Miss.—See "Water Works."

Columbus, Miss.—About $50,000 bonds for road improvements in Dist. No. 4 sold by Bd. County Supervisors.

Gulfport, Miss.—Road and bridge bonds for $200,000 will be sold Jan. 3 by County Board Supervisors.

Montrose, Miss.—Citizens of northwest section of Jasper County voted bonds for road improvements.

Akron, Ohio.—The expenditure of about $372,000 for road improvements in Summit County is contemplated by County Commissioners.

Defiance, Ohio.—Bd. County Comrs. voted to issue $25,000 bonds for improving county roads.

Wapakoneta, Ohio.—Street improvement bonds for $17,000 will be sold Jan. 3 by Fred. A. Plipfel, City Auditor.

West Salem, Ohio.—Paving bonds for $24,400 will be sold Jan. 10 by G. F. Read, Clk of Council.

Wooster, Ohio.—Street improvement bonds for $8,057 will be sold Dec. 29 by Fred. E. Faber, City Auditor.

South Bend, Ind.—County Commissioners considering constructing 3-mile gravel road in Penn Township, cost about $18,600.

Hastings, Mich.—The City Council voted $17,500 bonds for paving Michigan Avenue with cement.

Pontiac, Mich.—Contract will be let about Feb. 15 for paving as follows: 7712 sq. yd. asphaltic concrete or brick on Franklin Road, cost $19,133; 8700 sq. yd. concrete pavement on Elizabeth L Road, Section A, cost $4,149; Section B, $11,215; asphaltic concrete or brick, 6586 sq. yd., on W. Pike Street, cost $15,468; 4078 sq. yd. on W. Lawrence Street, cost $8,898; 1258 sq. yd. Patterson Street, cost $3,428, and Garland street, 1270 sq. yd., cost $3,521; 3326 sq. yd. brick on William Street, cost $9,209. Wm. J. Fisher, City Engr. Leman A. Cambrey, City Clerk.

Chicago, Ill.—A condemnation suit is now on for the widening of Twelfth Street. If the street is widened as the result of this suit, a portion from Michigan Avenue to Wabash Avenue is to be paved with creosoted wooden blocks at an estimated cost of $13,500, and another portion from Canal Street to Ashland Avenue paved with granite blocks at an estimated cost of $307,000. No action on awarding contracts will be taken until suits are settled. M. J. Faherty, President Board Local Improvements.

Milwaukee, Wis.—Highway improvements in Milwaukee County for 1916 include about 35 miles, mostly concrete, Washington Boulevard, about ¾ mile will be paved with asphalt.

Albert Lea, Minn.—Reported city contemplates laying about five blocks of paving in residence district and building a sanitary sewer; cost $20,000. William Barneck, City Engineer.

About $35,000 will be spent by the county in improving roads, consisting of grading and a small amount of graveling. E. V. H. Brown, Dist. Engineer, Highway Commission, Albert Lea.

Bemidji, Minn.—Contracts will be let about April for road construction costing $105,400. Roy K. Biller, District Engineer, Bemidji.

Duluth, Minn.—Park Point residents have petitioned the Council to pave Minnesota Avenue from Twelfth to Forty-third Street.

Faribault, Minn.—County Commissioners propose spending $65,000 next season in improving county roads. J. A. Prior, of Owatonna, District Engineer Highway Commissioners.

Northfield, Minn.—Paving six blocks in the business district, probably with creosote block, is contemplated by city. F. O. Rice, City Engr.

Owatonna, Minn.—About $40,000 will be spent next season by the county in improving roads. M. J. Parcher, County Auditor.

Wells, Minn.—About six blocks of the business district will be paved next season. Creosoted block is favored. J. A. Culshaw, Superintendent Light and Water.

Lincoln, Neb.—Contract will be let in the spring by County Commissioners for about 6 to 8 miles of fiber brick paving. A. H. Egren, County Surveyor.

Minot, N. D.—Central Avenue, East Third Street, S. E., in all about 15 blocks, are to be paved. E. J. Thomas, Engineer, Minot. A. D. Hagenstein, City Auditor.

Billings, Mont.—City Council considering paving N. Thirtieth Street; cost about $38,520.

Chillicothe, Mo.—Contracts to be let in the new year for about $100,000 worth of paving. Address City Clerk.

Little Rock, Ark.—It is proposed to pave with water bound macadam and oil later on portions of Lee and Fairfax Avenues and Charles, Locust and other Streets, and constructing concrete combined curb and 12 in. or 18 in. gutter, about 48,000 lin. ft. This work is in Little Rock Street Improvement District No. 244 and Pulaski Heights Street Improvement District No. 9, and will cost about $50,000. Contract will be let in about 60 days. Dickinson & Watkins, State Bank Building, Little Rock, Engineers.

Pine Bluff, Ark.—J. H. Thach, Fordyce, reported interested in 45-mile road contemplated between Pine Bluff and Fordyce.

Stuggart, Ark.—City will spend $30,000 on concrete streets. Fred. W. Towl, Engineer.

Pomeroy, Wash.—City Council is about to let contracts for paving two of the principal streets.

Seattle, Wash.—Contract will soon be let by Bd. Public Wks. for constructing concrete sidewalks on W. Fifty-eighth Street and Twenty-ninth Avenue.

Contract about to be let by Bd. County Comrs. for constructing 2 miles highway between Hazelwood and Newport. Byron Phelps, Clerk County Comrs.

Board Public Works approved plans prepared by City Engineer for paving East Marginal Way; cost approximately $100,000.

Plans approved by Board of Public Works for grading Thirty-second Avenue West and other streets at an estimated cost of $100,000. City Engineer A. H. Dimock has submitted to Board of Public Works estimates of cost of filling and planking Ninth Avenue South from Massachusetts Street to Seattle Boulevard; Seattle Boulevard from Eighth to Ninth Avenue South; Seventh Avenue South from Seattle Boulevard to Charlestown Street; Sixth Avenue and Eighth Avenue South from Massachusetts to Stacy Street, and Holgate, Walker and Stacy Streets from Sixth to Ninth Avenue South, at $180,000.

Contract about to be let by Bd. Pub. Wks. for paving Harrison Street with wood block, cost about $16,000; also W. Wheeler Street with asphalt and Second Avenue, West, with sandstone blocks.

Spokane, Wash.—Contracts will soon be let by County Comrs. for constructing following roads: Sunset Highway, 4 miles to Medical Lake, cost $40,000; 2.7 miles paving at Hillyard, through Whitworth College grounds to Inland Empire Highway $25,000; 3 miles Spokane city limits east on Appleway to Dishman, cost $25,000; 6 miles, Meadow Lake to Cheney, on Normal Highway, cost $60,000.

Eugene, Ore.—Election will probably soon be held to vote $14,000 bonds for paving Sixth Street.

Hillsboro, Ore.—About $195,000 will be spent for road improvements in Washington County during 1916.

Pendleton, Ore.—Property owners between Pendleton and Pilot Rock Junction have petitioned county court to hard-surface road connecting the two towns. J. W. Maloney, County Judge.

San Diego, Cal.—See "New Industrial Plants."

San Diego, Cal.—The construction of a paved highway from Torrey Pines Grade to India and Winder Streets is contemplated by City Council. Cost about $30,000.

San Rafael, Cal.—City Council voted to pave 5 miles city streets.

Santa Monica, Cal.—Contract will be let about Feb. 1 by City Engineer for approximately 2900 lin. ft. bitulithic pavt. on Ocean Avenue and 5800 lin. ft. asphalt pavt.; cost about $100,000.

Selma, Cal.—Reported State Highway Department, Sacramento, intends constructing a concrete paved highway through this city in the spring.

Toronto, Ont.—Board of Control passed by-law authorizing issue of $453,650 Toronto Street Railway bonds for new paving, also repairing and renewing pavements on portions of streets occupied by right-of-way of Toronto Street Railway Company.

BIDS DESIRED.

Brooklyn, N. Y.—Until Dec. 30, by L. H. Pounds, Borough Pres., for paving with asphalt on 6-in. concrete foundation portions of Surf Avenue, in all about 13,490 sq. yd., and repairing sidewalks on Adams and Bradford Streets. Total security, $9,150.

New York, N. Y.—Until Dec. 30, by R. A. C. Smith, Comr. of Docks, for Contract No. 1505, furnishing material and paving with wood block pavement gangway and wagon spaces of municipal ferryboats Bay Ridge, Gowanus and Nassau; Contract No. 1504, ferryboats Manhattan, Brooklyn, Queens, Bronx and Richmond; and Contract No. 1506, ferryboat Mayor Gaynor. Total security, $6,000.

Until Jan. 3, by Marcus M. Marks, Borough President, for furnishing and delivering 500 tons Portland cement, 7,000 cu. yd. binder stone, 15,000 cu. yd. asphalt wearing surfacing sand, 2000 tons refined asphalt, etc.

Atlantic City, N. J.—Later official reports state until Jan. 1 by County Board Freeholders, at Mays Landing, for paving Meadow Boulevard between Atlantic City and Pleasantville, four miles long and 60 ft. wide. Alexander Howard Nelson, County Engineer, Atlantic City, N. J.

Jersey City, N. J.—Until Dec. 30, by City Commissioners, for improving Neptune Avenue from Hudson Boulevard to near Romar Avenue. M. I. Fagan, City Clerk.

Ocean Grove, N. J.—Until Dec. 27, by Frank P. Butcher, Clk. Neptune Township, 75 Main Street, Ocean Grove, for reconstructing and resurfacing with Warren Bros. bitulithic composition or reinforced cement concrete pavement, about 9000 sq. yd. on Main Street.

Perth Amboy, N. J.—Reported desired until Dec. 27 for repairing 5.6 miles of road with bituminous concrete. A. B. Fox, County Engr., New Brunswick.

Philadelphia, Pa.—Until Dec. 29, by Commissioners of Fairmont Park (Jesse T. Vodges, Ch. Engr.) for furnishing the following for the year 1916: Paving, cut granite curbing, vitr. blocks, granolithic and asphalt pavement; also bricks, cement, gravel, broken trap rock and screening.

Baltimore, Md.—Until Dec. 29, By Board Awards, care of Richard Gwinn, City Register, for furnishing sand, broken stone, vitr. paving blocks, sidewalk brick, sheet asphalt, bituminous concrete, asphalt filler, creosoted wood block, etc., for general use in the Highway Engineer's Dept. during the year 1916.

Kissimee, Fla.—Reported desired until Jan. 3 by County Commissioners (J. L. Overstreet, Clk.), for constructing one mile sand asphalt road.

Dadeville, Ala.—Reported desired until Jan. 12 by County Commissioners for constructing county roads, in all about 38 miles.

East View (P. O. Warrensville), Ohio.—Reported desired until Jan. 17 by Chas. E. Burger, Town Clerk, for paving portions of East View Avenue. Probable cost, $29,800.

Lisbon, Ohio.—Until Dec. 30, by Board Trustees, Elkrun Township (Horace Martin, Clk.) for paving part of Public Road in said township by macadamizing with waterbound slag, alternate bids for waterbound slag with glutrin binder, in all about 20,132 cu. yd. excav., and 27,991 sq. yd. slag macadam, 14 ft. wide, waterbound, and 27,991 sq. yd. glutrin binder. H. C. Armstrong, Engr., Lisbon.

Anderson, Ind.—Reported desired until Jan. 8 for improving 2.75 miles of road. Address County Commissioners.

Fort Wayne, Ind.—Until Jan. 17 by Board Park Commissioners, for improving Rudisill Boulevard, about 27,200 sq. yd. asphalt macadam pavt., 8175 lin. ft. concrete curb and gutter, and 17,720 cu. yd. excav., advertised in Engineering Record.

Indiana.—By County Commissioners, for constructing roads as follows:

Until Dec. 30.

Bloomfield, macadamized roads in Fairplay Township. Geo. E. Kidd, Co. Aud.

Until Jan. 3.

Vevay, 2 miles of road in York Township. John W. Smith, Co. Aud.

Williamsport, 4 gravel roads, 11,000, 9057.5, 10,686 and 10,711 ft. respectively, in Warren, Steuben and Prairie Townships. D. H. Moffitt, Co. Aud.

Goshen, concrete roads in Concord and Harrison Townships. J. W. Brown, Co. Aud.

Fowler, for constructing roads in Grant, Bolivar and Center Townships. Warren Mankey, Co. Aud.

Until Jan. 4.

Vincennes, constructing 8606 and 15,840 ft. gravel roads in Palmyra and Busserton Townships. J. I. Muentzer, Co. Aud.

Noblesville, for concrete, brick or gravel road in Noblesville Township. W. O. Horton, Co. Aud.

Monticello, crushed stone road in Monon Township. A. G. Fisher, Co. Aud.

Lebanon, gravel road in Marion, Clinkton and Eagle Townships. D. M. Clark, Co. Aud.

Spencer, gravel roads in Marion and Jackson Townships. Geo. T. Stwalley, Co. Aud.

Bedford, macadamizing roads in Bond, Pleasant Run, Shawswick and Guthrie Townships, 4345, 3790 and 5365 ft. in length. Ezra W. Edwards, Co. Aud.

Boonville, for rock roads in Ohio Township. Gaines H. Bass, Co. Aud.

Evanston, Ill.—Until Jan. 17 by Board Local Improvements, for paving with brick on concrete portions of Leon, Simpson, Asbury and other streets, in all approximately 29,900 sq. yd., and also separate bids for paving Bridge, Payne, Grant and other streets, approximately 41,400 sq. yd., both proposals advertised in Engineering Record.

Greenfield, Iowa.—Until Jan. 20 by H. G. Spooner, Town Clerk, for constructing about 25,000 yd. of paving, 16,000 ft. curbing, and a small amount of sewer work. Bids will be considered on Portland cement concrete, asphaltic concrete, asphalt, brick block, bitumenated concrete and sheet asphalt. Theodore S. DeLay, Consulting Engineer, Creston.

Seymour, Mo.—Reported desired until Jan. 5 by Seymour Special Road Dist., for road improvements. Probable cost $30,000.

Santa Barbara, Cal.—Until Jan. 3 by Board of Supervisors, for constructing concrete bridge across Tajiguas Creek, cost approximately $7,000; also concrete bridge across Corral Creek, cost approximately $8,000. Engineers, Mayberry & Parker, Los Angeles.

Sherman, Tex.—Until Jan. 12, by Commissioners Court, Grayson County (Dayton B. Steed, Co. Judge), for furnishing road material, either stone or gravel, for construction of contemplated road improvements. Approximately $900,000 available. Julian C. Field & Co., Consulting Engrs., Dennison. A. S. Noble, Co. Aud.

Tulsa, Okla.—Until Dec. 30, by E. B. Cline, City Auditor, for furnishing material and paving portions of Cameron, Archer, Nineteenth, Twentieth and numerous other streets.

Seattle, Wash.—Reported desired until Jan. 12, by County Commissioners (Bryon Phelps, Clk.), for constructing portion of Permanent Highway No. 13, from Hazelwood Road to Newport Road. Probable cost $25,000.

Bakersfield, Cal.—Until Jan. 6, by County Board Supervisors, for grading, paving and constructing culverts on Div. 6, Sec. 1, McKittrick-Maricopa Road between Taft and Maricopa, 6.7 miles.

San Gabriel, Cal.—Until Jan. 4 by City Clerk, for paving [illegible] Ave., [illegible] ft. cement [illegible] sq. yd. [illegible] etc.

Santa Barbara, Cal.—Until Jan. 3 by County Board of Supervisors, for grading and paving portion of Santa Barbara-Los Angeles road in Pitts Road District, county to furnish rock and screenings.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★Massachusetts.—Following are three lowest bids opened Dec. 14 by Massachusetts Highway Commission, Boston, for constructing [illegible]:

[illegible] ft., T. A. Moynihan, South Hadley, Mass., $20,422, awarded contract; (2) Standard Company, [illegible] Lane, Mass., $23,847; Columbus Construction Company, 16 Foster Street, Boston, $28,000.

[illegible] ft., Columbus Construction Company, 16 Foster Street, Boston, $7,500 (awarded contract); Webster & Dudley Contracting Company, Webster, Mass., $7,800; Alva Contracting Company, 176 North Street, Boston, $8,000.

★Contract awarded by Massachusetts Highway Commission, Boston, for constructing 2 sections of sand and asphalt road in town of Barnstable to Thomas A. Murphy, Middleborough, at $4,400. Bids opened Dec. 14. Next two lowest bidders: A. D. Sargent (no address), $4,600; and Bay State Road, Boston, $4,750; and Alva Contracting Co., Boston, $5,287.

Hackensack, N. J.—Lowest bid opened by Bd. Chosen Freeholders Dec. 5 for constructing 22 miles macadam road on West Shore Route (Hudson River line) to New York, was submitted by George M. Brewster Construction Co., Trenton, at $17,879.

★Jersey City, N. J.—Contract awarded by Board Chosen Freeholders, to William Faber, Inc., Jersey City, for improving and paving portion of Newark Turnpike at 85% of engineer's estimate which was $48,000.

★Philadelphia, Pa.—Contract for surfacing Trinity avenue and repairing Terrace street, awarded to Lucas Paving Co., 112 N. Broad Street, at about $62,300, approved by Mayor Blankenburg.

★Charleston, W. Va.—Contract awarded W. D. Wooten, Weyerhaeuser, Va., for [illegible] miles of brick road in Lincoln District at [illegible]. P. I. Wales, Engineer and General Superintendent, County Road Commission.

Pensacola, Fla.—Following are two lowest bids opened Dec. 6 by Bureau Yards and Docks, Washington, D. C., for constructing concrete walks at Navy Ammunition Station, Pensacola: C. H. Tanner Co., 24 E. Garden Street, $6,749, alternate bid [illegible]; and William A. Harper & Co., Constable Street, Houston, Tex., $9,994.

★Delphi, Ind.—Contract for constructing system of roads in Clay Township awarded by County Council, Cuneo, to William Mueller, Frankfort, at $19,975.

★Des Moines, Iowa.—Contract for paving with asphalt concrete on Lincoln Place, Thirty-third and other streets, in all about 15,000 sq. yd., awarded Lincoln Place Company, 1st Floor, Register Building, Jersey at $1.35 per sq. yd. and curbing at 30c.

★Pine City, Minn.—Contract for constructing Rock Elm [illegible] opened Dec. [illegible], awarded C. F. Haglin & Company, Minneapolis, Minn. W. H. Hamlin, County Auditor.

Houston, Tex.—Lowest bid opened Dec. 12 by City Commissioners for [illegible] Bayou, Montgomery Road and Brunner Avenue, submitted by Hunter & Horton, Houston, at $7,000.

★Gering, Cal.—Contract for [illegible] sq. ft. concrete paving and concrete culverts on Bridge Avenue, awarded James L. Hamer, Long Beach, at $4,[illegible]. Next two lowest bidders: Ford & Ford, $4,[illegible], and J. Cunningham Company, Los Angeles, $4,[illegible].

★Contract for grading on A Street and Jack Rabbit Avenue awarded James L. Hamer, of Long Beach, at $[illegible]. Other bidders: J. C. Cunningham Company, $[illegible], and Ford & Ford, $[illegible].

STREET CLEANING AND GARBAGE DISPOSAL

PROPOSED WORK

Binghamton, N. Y.—City Council considering issuing [illegible] bonds for [illegible].

Glen Ridge, N. J.—Following bonds for $[illegible] will be sold Jan. 2 by Borough Council: [illegible] Sewer, Fleet, Cir. [illegible] Sewer, Fleet, Cir. [illegible] and one issue [illegible].

Wilkes-Barre, Pa.—[illegible] and to be taken to Dist. Atty. Council [illegible] a municipal plant for collection and disposal of garbage.

Madison, Wis.—[illegible] Council [illegible] to [illegible] $[illegible] bonds for [illegible] and [illegible] plant is to be [illegible] operation by June 1, 1918.

BIDS DESIRED.

New York, N. Y.—Until Jan. 28 by Commissioner of Street Cleaning, Room 1247, Municipal Building, New York, for—Form 1, disposal of garbage in Boroughs of Manhattan, Bronx and Brooklyn, for a period of five years from Jan. 2, 1917. Form 2, disposal of garbage from Boroughs of Manhattan, Bronx and Brooklyn on site provided by city for a period of five years, from Jan. 2, 1917, city to acquire plant on termination of contract at a stipulated price, advertised in Engineering Record.

Edgewood, Pa.—Until Jan. 10, by W. H. Garrett, Boro Secy., 238 Elm Street, Edgewood, Sewerside, for collection and disposal of garbage throughout the borough.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★Wilmington, Del.—Contract awarded by Board of Health to Wilmington Sanitary Company, Wilmington, at $81,500, for disposal of garbage for next nine years. Only other bidder: Nicholas J. Hayes, New York, at $94,000.

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS

PROPOSED WORK.

State Canal Work—Albany, N. Y.—The State Canal Board Dec. 14 approved plans submitted by Frank M. Williams, State Engineer, for completion of Contract 63 A in vicinity of Rochester, deepening and widening Barge Canal dimensions of Erie Canal Channel between the west line of Wayne County and King's Bend, a distance of 1.22 miles. The contract also calls for construction of guard gate, new approach to Knapp's Bridge, concrete trough over culvert 20 at Cartersville and concrete corewall for the new canal embankment. Engineer's preliminary estimate, $567,746.

State Canal Work—Albany, N. Y.—State Canal Board has approved plans of Frank M. Williams, State Engineer, for canal improvements as follows, contracts for which will be let after Jan. 1:

Contract 46B—Completing construction of lock and dam at May's Point. Engineer's estimate $314,553.

Contract 47A—Completing canal from southeast corner of town of Galen to N. Y. Central R. R. crossing at Lyons (Erie Canal). Engineer's estimate, $1,-[illegible].

Contract 129—Constructing substructure, superstructure and approaches to Freeman Bridge, over Mohawk River near Schenectady. Engineer's estimate, $80,976.

Flood Protection — Erie, Pa. — State Water Supply Commission, Harrisburg, has approved plans of Farley Gannett, Hydraulic Engineer, Harrisburg, for flood prevention plant for this city. Cost, $[illegible].

Drainage—Monroe, Ga.—Alcovy River Drainage District organized with John J. Sunnally and Joseph Preston as viewers. W. D. Alexander, Civil Engineer, Charlotte, N. C., may be able to give further information.

Drainage—St. Petersburg, Fla.—Contract will be let about January 15 for work in Lake Large Cross Bayou Drainage District, to cost $[illegible]. Isham Randolph, Engineer, Chicago, Ill.; F. R. Eisenbrey of Largo in charge of work.

Sea Wall — Gulfport, Miss. — County Board of Supervisors will issue $20,000 bonds for building a sea wall and boulevard along gulf front.

Drainage—Des Moines, Iowa.—Harmon Engineering Company, Peoria, Ill., has submitted a report on reclamation of 15,-[illegible] acres of [illegible] Riley bottom lands in [illegible] and Story Counties, estimating the cost at $[illegible] for diverting the stream's course, building levees and constructing ditches for a distance of 15¼ miles.

Ditch—Faribault, Minn.—Surveys being made by A. J. Bradshaw, Lesueur Center, for Ditch No. [illegible], cost $16,660. Petitions being circulated for county ditch [illegible], cost $[illegible]. F. M. Kaiserott, County Aud.

Ditch—Blue Earth, Minn.—Ditch improvement costing $[illegible] will be made next year by the county. Carl Hagger, County Surveyor. J. L. Herring, County Auditor.

Ditch—Wheaton, Minn.—Judge of District Court has been petitioned to establish four judicial ditch and drainage systems to cost about $[illegible].

Drainage—Wichita, Kan.—A. E. Munch has been elected as Secretary Board Directors of [illegible] District, to be known as [illegible] No. 3. Plans will be prepared at once and it is expected to reclaim several hundred acres of land, [illegible] Mount Hope and ending at east of Haysville. Canal as contemplated [illegible] miles long, shallow cut.

Drainage—Colman, S. D.—Commissioners of Lake and Moody Counties have had surveys made for a drainage ditch to be constructed in vicinity of Colman, to be 11 miles long and reclaim about 2500 acres. Cost $30,000.

Dock—St. Louis, Mo.—Board of Aldermen considering building municipal dock at North Market Street to cost $285,000.

Drainage—Marion, Ark.—Commissioners of Drainage District No. 7, of Crittenden County, have sold $205,000 bonds. Morgan Engineering Company, Memphis, Tenn., in charge of the work.

Harbor Improvements—Houston, Tex.—City Council appropriated $30,000 for dredging in connection with building the new wharf at the turning basin.

Dock Bonds—Orange, Tex.—Attorney-General has approved the issue of $150,-000 dock bonds, $150,000 school building bonds and $25,000 street bonds.

Hydroelectric Plant—Everett, Wash.—E. C. Money, Everett, it is reported, plans constructing a hydroelectric plant on Snohomish River. H. K. Owens, Consulting Engineer, Empire Building, Seattle.

Dredging — Tacoma, Wash.—Reported contract will be let by Commissioners of Waterway District No. 1 early in the new year for dredging and filling the Hylebos Creek tide flats for a distance of 2 miles and involving about 2,000,000 cu. yd. of material and costing about $300,000. Don B. Roben, Project Engineer, 3019 South Eleventh Street.

Canal — Sacramento, Cal. — Early in spring surveys will be made to obtain data for the proposed tide water canal between Sacramento and San Francisco Bay. As now proposed the canal will be along east side of Sacramento River and cost $1,-000,000.

Jetties—Venice, Cal.—Leeds & Barnard, Central Building, Los Angeles, submitted to Board Trustees plans for four rock jetties for the south beach. Cost, $150,000.

Drainage—Toronto, Ont.—Townships of Kenyon and Charlottenburg have applied to Dept. of Public Works, Toronto, for approval of and assistance in building the inter-township drainage improvement, to cost $27,000.

BIDS DESIRED.

Power House at Dam—Wheeling, W. Va.—See "Public Buildings and Schools."

Milton Lower Mills, Mass.—Until Dec. 27, by Directors of the Port of Boston, 40 Central Street, Boston, for dredging in Neponset River at Milton Lower Mills, advertised in Engineering Record.

Ditch—Crookston, Minn.—Reported desired until Jan. 25, by H. J. Welte, Co. Aud., for repairing and extending County Ditch No. 77. Probable cost, $7,467.

Irrigation—Montrose, Col.—Until Jan. 18, by U. S. Reclamation Service, Montrose, for constructing about 9½ miles of Peach Valley Lateral, Uncompahgre Valley Irrigation Project, Col. Work is in vicinity of Austin, and involves excavation of about 56,200 cu. yd. material in open cut.

Irrigation—Oakdale, Cal.—Until Jan. 17 by Oakdale Irrigation District, for constructing new laterals and a tunnel about 1 mile in length. Cost, $100,000.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Dredging—Brooklyn, N. Y.—Following are bids opened Dec. 11 by Bureau of Yards and Docks, Navy Department, Washington, D. C., for dredging at the Navy Yard, New York: Coastwise Dredging Company, Bank of Commerce, Norfolk, Va., 25¾ cts.; P. Sanford Ross, Inc., 277 Washington Street, Jersey City, N. J., 26 cts.; Morris & Cummings Dredging Company, 17 State Street, New York, 29.5 cts.

Dredging—Washington, D. C.—Following are bids opened Dec. 18 by U. S. Engineer's Office, Southern Building, Washington, for dredging in Anacotia River (a) Section 1, 500,000 cu. yd., (b) Section 2, 300,000 cu. yd.: Bowers Southern Dredging Co., Galveston, Tex., (a) 8 cts., (b) 5 cts.; Sanford & Brooks Co., Baltimore, Md., (a) 6.45 cts., (b) 4.95 cts.; Atlantic, Gulf & Pacific Co., New York, N. Y., (a) and (b) 6.9 cts.; Coastwise Dredging Co., Norfolk, Va., (a) and (b) 6.7 cts.; Maryland Dredging & Contracting Co., Baltimore, Md., (a) and (b) 5.5 cts.

★**Levee Work—New Orleans, La.**—Contracts awarded by State Board of Engineers, New Orleans, for constructing the following levees (bids opened Dec. 8):

Happy Jack to Butler Levee, two sections, about 5600 ft. wooden revetment, to John W. Bick, Triumph, La., at $1.10 per lin. ft. for 12 ft. board, and 97c. for 10 ft. board, and also Butler to Melrose Levee, two sections, 8000 lin. ft., at $1.06 and 95c., respectively.

★**Sea Wall—Bay St. Louis, Miss.**—Contract awarded to Sea Wall Commissioners to Massey & Company, of New Orleans, and C. G. Olinger, of Mobile, Ala., for constructing the sea wall of reinforced-concrete and filling behind.

★**Drainage—Mason City, Iowa.**—Contract for constructing county drainage in District No. 29 awarded Hawkeye Cement Tile Company, Mason City, at $14,475.

★**Ditch—Mankato, Minn.**—Contract for constructing Ditch No. 41, to consist of 19,120 lin. ft. 8 to 24-in. tile, one concrete head wall, etc. (bids opened Dec. 18) awarded by County Commissioners to Minnesota Pipe & Tile Company, at $8,592. C. L. Kennedy, County Auditor.

★**Pier—Philadelphia, Pa.**—Following are unit figures of four lowest bids opened Dec. 6 by Department of Wharves and Docks, for constructing the superstructure of McKean Pier No. 78-80 South: (a) The Snare & Triest Company, 233 Broadway, New York, $554,687 (awarded contract at $494,000, using items Nos. 1 and 5 to 26 inclusive); (b) Pennsylvania Steel Company, Steelton, Pa. $560,990; (c) Irwin & Leighton, 126 N. Twelfth Street, $569,655; (d) Post & McCord, 101 Park Avenue, New York, $582,256.

Lump Sum Prices	(a)	(b)	(c)	(d)
Item No. 1—for the entire work, exclusive of Items 2, 3 and 4	$468,600.00	$495,300.00	$494,500.00	$497,000.00
Item No. 2—for concrete slabs, second and mezzanine decks of pier and second and third decks of bulkhead shed	48,500.00	47,900.00	52,000.00	60,800.00
Item No. 3—for 3-in. siding with glazed steel sash for pier and bulkhead shed	8,300.00	8,560.00	11,000.00	11,200.00
Item No. 4—for all galvanized pipe railings except on stairs	2,600.00	2,440.00	3,500.00	4,500.00
Item No. 5—riveted steel girders (10,000 lbs.)	.03	.029	.0325	.036
Item No. 6—rolled steel beams (10,-000 lb.)	.026	.029	.0305	.036
Item No. 7—steel columns, (10,000 lb.)	.03	.032	.0335	.036
Item No. 8—light structural steel (10,000 lb.)	.03	.032	.035	.036
Item No. 9—steel rods (10,000 lb.)	.027	.028	.035	.0375
Item No. 10—iron castings (2,000 lb.)	.05	.048	.05	.03
Item No. 11—5-in. reinforced concrete deck (1000 sq. ft.)	.25	.26	.32	.375
Item No. 12—4-in. reinforced concrete deck (500 sq. ft.)	.23	.23	.30	.36
Item No. 13—3-in. siding (1000 sq. ft.)	.25	..	..	..
Item No. 14—steel sash, (1000 sq. ft.)	.35	.37	.50	.55
Item No. 15—concrete roof slab (1000 sq. ft.)	.19	.18	.20	.20
Item No. 16—waterproofed concrete gutter (100 lin. ft.)	1.00	.97	1.00	.66
Item No. 17—felt and slag roofing (1000 sq. ft.)	.032	.035	.035	.035
Item No. 18—five large skylights, each	350.00	345.00	330.00	325.00
Item No. 19—five small skylights	200.00	207.00	220.00	230.00
Item No. 20—small skylights (100 lin ft.)	1.00	1.10	12.50	12.00
Item No. 21—6 x 10 chafing stringers (500 lin. ft.)	.30	.32	.25	.26
Item No. 22—8 x 12 chafing stringers (500 lin. ft.)	.50	.49	.40	.42
Item No. 23—I. F. timber 2 x 8 (1000 M ft.)	40.00	42.00	.11	50.00
Item No. 24—16-oz. copper flashing (1000 sq. ft.)	.33	.32	.30	.40
Item No. 25—16-oz. copper cornice (100 lin. ft.)	1.50	1.60	1.60	1.60
Item No. 26—force account ($1,000 expenditure), per cent	10	10	15	10

Drainage—Marion, Ark.—Two lowest bids opened recently for drainage work in Drainage District No. 7 of Crittenden County was submitted by Fred. C. Morgan of Indianapolis, Ind., at 7.415 cts. per cu. yd., and from Northern Construction Company, Elkhart, Ind., at 7.42 cts; about 44 miles drainage ditches, including 1,800,000 cu. yd. earth. Morgan Engineering Company of Memphis, Tenn., Engineers.

★**Drainage—Robstown, Tex.**—Contract awarded Dec. 12 by Drainage Commissioners Neuces County, Drainage District No. 2, to J. B. Arpin Construction Company, Houston, for constructing 45 miles of ditches in said drainage district, at $141,675.

★**Dam—Salt Lake City, Utah.**—Contract for constructing Parley's Canyon dam awarded Parrott Brothers Company, Salt Lake City, at $108,583, partial height multiple arch. Karl A. Scheil, City Recorder.

★**Irrigation — Weiser, Idaho.**—Contract awarded Phelps Construction Company, Weiser, for constructing the irrigation system for the East Weiser Irrigation District. Cost $16,000.

ELECTRIC RAILWAYS

PROPOSED WORK.

New York, N. Y.—It is reported the Interborough Rapid Transit Co., 165 Broadway, will soon ask bids on Webster Avenue elevated extension running from the Bronx Park Terminal to a connection with the White Plains Road and requiring about 20,000 tons of steel work.

Rensselaer, N. Y.—Residents and the Board of Trade are about to petition United Traction Company, of Albany, to extend lines to northern end of the city.

Wind Gap, Pa.—Northampton Traction Co., Easton, contemplates constructing a railway from Wind Gap to Delaware Water Gap.

Charleston, W. Va.—Charleston-Dunbar Traction Co. expects to construct 20 miles of railway during 1916.

Price, W. Va.—Morgantown & Wheeling Ry. Co. contemplates constructing 7.45 miles of interurban line between Price and Blackville during 1916. R. D. Hennen, Ch. Engr., Morgantown.

Benton, Tenn.—East Tennessee Railroad Co. incorporated with capital of $20,000. Among incorporators: F. W. Hoover and Richard Stiles.

Greenwood, Tenn.—Plans being considered to construct a railway from Greenwood to Schlater via Itta Bena. It is also proposed to construct an extension to Black Hawk.

Albion, Mich.—Reported that work on proposed route of Albion-Charlotte Northern Railway Company's electric line from Albion to Lansing will start in spring.

Springfield, Ill.—It is reported the Springfield Consolidated Ry. is considering extending line east to Bergen Park.

Manitowoc, Wis.—Work will begin in the spring on construction of line from Green Bay to Sheboygan via Manitowoc. Wm. M. Willinger, Manitowoc, Pres.

Duluth, Minn.—Duluth Street Railway Co. contemplates constructing 4 miles new track during 1916.

Buena Vista, Tex.—Plans being considered by Pecos Valley Railroad Association for constructing a gasoline electric interurban railway from a connection with the Kansas City, Mexico & Orient Railway northwest via Buena Vista for 35 miles up the Pecos Valley.

Ft. Worth, Tex.—Northern Texas Traction Company expects to double track about two miles of line between Ft. Worth and Dallas during 1916.

Leavenworth, Wash.—It is reported a preliminary survey has been made and part of right of way secured for a railroad from Leavenworth to Icicle, 25 miles. A. Van Eppes, Leavenworth, is interested.

Three Rivers, Que.—Plans being made by Three Rivers Traction Co. to construct 5 mile extension to Cap de la Madeleine in the spring. Thomas McDougall, Pres.

Salt Lake City, Utah.—Salt Lake & Ogden Ry. Co., expects to constructs 4½ miles new track during 1916.

The Salt Lake & Utah R. R. Co. plans to construct 10 miles of line between Provo, Springville and Spanish Fork during 1916.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Boston, Mass.**—Contract awarded by Boston Transit Commission, Boston, to Galassi Mosaic & Tile Company, 127 Federal Street, Boston, for laying 1760 sq. yd. terrazzo finish on walls of "South Station Under," of the Dorchester Tunnel at $8,160. Next two lowest bidders: DePaolo Mosaic Association, Dorchester Avenue, South Boston, $9,025, and L. L. Ranaldi & Company, 263 Atlantic Avenue, Boston, $10,215.

Philadelphia, Pa.—Following are four lowest bids opened recently by Rapid Transit Commission for structural steel for extension of Frankford Elevated Railway: American Bridge Company, $249,000; Pennsylvania Steel Company, $285,000; McClintic-Marshall Company, $263,000; and Phoenix Bridge Company, $269,800.

San Francisco, Cal.—Following are four lowest bids opened Dec. 8 by Board Public Works for grading and track construction of Church Street Municipal Railway: Contra Costa Construction Company, Berkeley, $120,500; J. P. Holland, 550 Third Street, San Francisco, $122,260; Eaton & Smith, San Francisco, $123,485; Grace & Bernier, San Francisco, $124,028.

★Contract for above work awarded Contra Costa Construction Company, Berkeley, at $120,500.

RAILROADS

PROPOSED WORK.

Lyons, N. Y.—An agreement has been reached between the State Canal Board, Albany, and the New York Central R. R. regarding railroad crossing at Lyons. This work is to be done by the forces of the railroad or by a company selected by the railroad, and is to cost $329,656, of which $769.50 is cost of land, the rest for construction entirely. Contract will not be let by State Canal Board.

Savannah, Ga.—The Savannah & Atlanta Ry. incorporated by John H. Hunter, Henry D. Stevens, and others of Savannah, Ga., for purpose of constructing a railroad from St. Clair in a northwesterly direction through counties of Jefferson, Glascock, McDuffie, Warren and Wilkes to Washington, Ga., a distance of 60 miles.

Dardanelle, Ark.—Surveys completed for the Fort Smith, Subiaco & Eastern R. R. Company, a line 23 miles long from Scranton to Dardanelle. Henry Stroup, Paris, Ark., president.

Centerville, Utah.—Salt Lake & Ogden R. R. has authorized the building of a second main track between Centerville and Wilcox, a distance of 3 miles.

St. John, N. B.—See "Bridges."

BIDS DESIRED.

Fredericton, N. B.—Reported desired until Dec. 30, by Irving R. Todd, Pres. St. John & Quebec Ry. Co., for constructing, uncompleted, sections of the line of the St. John & Quebec Ry. Co.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Chilhowee, Tenn.**—Contract awarded by Southern Ry. Company to Oliver & Hill, Knoxville, for constructing 2 1/5 miles of railroad on Bushnell Extension from Chilhowee, Tenn., to a point a mile in North Carolina.

★**Portland, Ore.**—Guthrie McDougall & Company, Pittock Block, secured contract for relining Oregon-Washington R. R. & Navigation Company tunnel in Portland a distance of 5435 ft. from Mock's Bottom under Columbia River and terminating at Columbia Slough Road. Cost, $400,000.

PUBLIC BUILDINGS AND SCHOOLS

PROPOSED WORK.

Brockton, Mass.—Plans prepared by Frank Irving Cooper, Boston, for 30-room brick school have been approved by City Property Committee. J. F. Burbank, Mayor.

Worcester, Mass.—City voted $150,000 bonds for erecting new high school; foundation contract has been awarded. Address Board Education.

Brooklyn, N. Y.—Plans filed for erecting following buildings: 5-story brick hospital at Hicks and Joralemon Streets for St. Christopher's Hospital for Babies, cost $75,000, Donn Barber, Archt., 101 Park Avenue, New York City; 2-story brick school at W. Nineteenth Street and Mermaid Avenue, for Rev. Chas. E. McDonald; cost $80,000. Robt. J. Reilly, Archt., 477 Fifth Avenue, New York City.

Board of Estimate Dec. 17 passed resolution appropriating $600,000 for alterations and improvements to Kings County Courthouse, including architects' fees.

Kenmore, N. Y.—School Board selected Colson & Hudson, 35 Dun Building, Buffalo, architects, for proposed addition to high school.

New York, N. Y.—All bids opened Dec. 1 by Marcus M. Marks, President Manhattan Borough, for erecting county jail and place of detention for women in West Thirtieth Street were rejected Dec. 16.

Syracuse, N. Y.—Reported Joseph Slocum College of Agriculture to be erected here, costing about $250,000. Address F. W. Howe, Dean.

Watertown, N. Y.—Reported steps being taken to erect Tuberculosis Hospital on County Farm on Coffeen Street Hill; total cost about $40,000. Address County Clerk.

Newark, N. J.—All bids opened Nov. 30 by Board of Education for erecting John Catlin School have been rejected. Reported new plans to be prepared by Ernest F. Guilbert, City Hall, providing for 21 class rooms; cost not to exceed $149,500.

Wildwood, N. J.—High School bonds amounting to $100,000 have been sold.

Bethlehem, Pa.—School Board taking preliminary steps to secure plans and estimates for eight-room school.

Butler, Pa.—School Board selected W. G. Eckles of New Castle to prepare plans for new high school; cost about $400,000.

Ebensburg, Pa.—Contract about to be let for improving courthouse; probable cost, $300,000. Address County Clerk.

Harrisburg, Pa. — Paul Monaghan, Drexel Building, Philadelphia, engaged to prepare plans for rebuilding Sylvan Heights Orphanage.

Philadelphia, Pa.—Board of Education contemplates next year issuing $2,000,000 loan, proceeds to be used for erecting elementary schools in congested parts. Edwin Wolf, Chairman Finance Committee.

Philadelphia College of Business Practice intends erecting building at 1109 Locust Street.

Pittsburgh, Pa.—V. B. Lee, 1003 Spruce Street, selected to prepare plans for 16-story Chamber of Commerce Building to be erected at Smithfield Street and Seventh Avenue; cost, $300,000.

Wilkinsburg, Pa.—Election to be held Jan. 15 to vote on $250,000 bonds for purpose of rebuilding Horner School, recently destroyed by fire.

Dobson, N. C.—Bonds for not less than $50,000 nor more than $80,000 will be sold Jan. 3 by Board County Commissioners, Dobson, for erecting courthouse and jail. J. B. Sprague, Chmn. Co. Comrs., at Mount Airy.

Tifton, Ga.—See "Water Works."

Fort Pierce, Fla.—Contract will be let about February by the School Board for erecting a brick school, two-story, to cost $35,000. J. W. Hodge, Secretary.

Jennings, La.—Police Jury selected W. L. Stevens of Baton Rouge architect for $75,000 court house.

Vidalia, La.—School bonds for $20,000 will be sold Jan. 3 by Board of Directors of Public Schools of Concordia Parish (D. C. Strickler, Supt.), Vandalia.

Columbus, Miss.—Election to be held Feb. 1 to vote $50,000 bonds, proceeds to be used for site, erection and equipment of high school.

Gulfport, Miss.—City Commissioners passed resolution providing $125,000 bonds, proceeds to be used to purchase site for Mississippi Centennial Exposition.

Marion, Miss.—Election to be held in Lauderdale County Jan. 4 to vote $100,000 bonds to erect agricultural school at Marion. Address County School Board, Meridian.

Lexington, Ky.—Erection of Junior High School contemplated. Address Board of Education.

School bonds amounting to $100,000 will be sold Dec. 28 by Board Education (J. O. H. Simrall, Bus. Dir.)

Alliance, Ohio.—F. L. Packard, Hayden Building, Columbus, engaged to prepare plans and specifications for two schools to cost $20,000 each. Address Board of Education.

Bellevue, Ohio.—Shriber-Beelman, Second National Bank Building, Toledo, are architects for $25,000 Harkness Memorial Hospital to be erected here.

Cadiz, Ohio.—State Department of Public Instruction (C. H. Teach, Chief Clerk), Columbus, has recommended to the Governor the city of Cadiz as site for new State Normal School.

Cincinnati, Ohio.—Council appropriated $28,000 for erecting and equipping bathhouse at Central and Freeman Avenues.

East Youngstown, Ohio. — Contract about to be let by Board of Education for erecting 12-room school for which citizens recently voted $60,000 bonds.

Woodville, Ohio.—County Commissioners at Pittsburgh authorized $125,000 bond issue for erecting tuberculosis hospital, sewage disposal plant and appurtenances thereto at County Home, Woodville.

Youngstown, Ohio.—E. R. Thompson, Youngstown, is architect for the Pine Hollow School.

Bloomington, Ind.—Trustees Indiana University granted Woman's League permission to erect $50,000 stone dormitory on the campus.

Danville, Ill.—Vermilion County Supervisors considering erecting addition to jail to cost about $25,000.

Quincy, Ill.—The Seymour Memorial School Building is to be one-story, fireproof stone, hollow tile and tile roof, and cost $30,000. Contract will be let in January. Malcolm S. Martin, Architect, Hannibal, Mo.

Tuscola, Ill.—Douglas County Board of Supervisors voted to erect addition to jail, for which J. W. Royer of Urbana, is preparing plans; approximate cost $20,000.

Superior, Wis.—Contract will probably be let in February for erecting $80,000 training school at Superior Normal School. Address State Board Regents, Madison.

Wrightstown, Wis.—School Board taking steps to erect $30,000 combined high and grade school.

Anthon, Iowa.—Contract about to be let by Beuttler & Arnold, Architects, Security Building, Sioux City, for erecting $28,000 school here.

Dow City, Iowa.—Citizens voted to erect consolidated school costing about $75,000. Address School Board.

Waukon, Iowa.—School Board considering plans for improving high school.

St. Paul, Minn.—City Council authorized $1,000,000 school bond issue to be submitted to vote of people next spring.

Sum of $1,400,000 bequeathed to city by Mrs. Martha A. Miller for erection, equipment and maintenance of free hospital.

Emporia, Kan.—Reported Trustees of Emporia College planning to rebuild Stuart Hall, recently destroyed by fire. W. A. White, Chairman Building Committee.

Norton, Kan.—Election to be held Dec. 28 to issue $40,000 bonds for erecting school.

Kansas City, Mo.—Steps being taken to erect art museum and institute, the sum of $300,000 having been bequeathed to the city. Samuel W. Moore, 3700 Baltimore Avenue, President of Kansas City Fine Arts Institute, may be able to give further information.

Lubbock, Tex.—Court house bonds amounting to $100,000 will be sold Dec. 27 by E. R. Haynes, County Judge.

Alva, Okla.—Citizens voted $90,000 bonds for erecting high school.

Bartlesville, Okla.—Board of Education taking steps to erect Junior High School.

Bellingham, Wash.—All bids opened Dec. 13 by F. B. Graves, Clerk of School Board, for erecting high school rejected as being too high. New bids on new specifications will be called for.

Seattle, Wash.—Reported steps being taken for erecting second building at University of Washington. Charles E. Gaches, Chairman Building Committee.

Alameda, Cal.—Preliminary sketches submitted to Board of Education by M. V. Politeo, Alameda, for new unit of Lincoln School.

Bakersfield, Cal.—Citizens Dec. 14 voted $75,000 bonds to erect two grammar schools.

Calexico, Cal.—Plans being prepared by Allison & Allison, Hibernian Building, Los Angeles, for one-story and basement brick and hollow tile Carnegie Library.

Downey, Cal.—Citizens voted $35,000 bonds to erect a high school.

Los Angeles, Cal.—Board of Education having plans prepared for a brick and concrete school to be erected on Temple Street site at a cost of $27,300.

Contract will be let early in new year by Board Education for erecting a one-story and basement, four-room and auditorium school in the Clenega School District. Train & Williams, Archts., 226 Exchange Building.

Modesto, Cal.—Election contemplated to vote $200,000 bonds for erecting a high school and a grammar school. Address School Board.

Riverdale, Cal.—Citizens voted $25,000 bonds for erecting high school.

San Francisco, Cal.—Friend W. Richardson, State Treasurer, Sacramento, will on Jan. 14 sell $1,000,000 bonds, proceeds to be used to erect State building in San Francisco to house State offices.

Turlock, Cal.—Preliminary steps being taken to erect new high school; cost, about $50,000. Address School Board.

Yasco, Cal.—Citizens voted $45,000 bonds for erecting high school.

Prescott, Ariz.—Architect will be selected in February for the $200,000 court house. Address Board Supervisors.

Safford, Ariz.—Plans being prepared by Roy W. Lescher and J. Rinker Kibbey, Bank of Arizona Building, Phoenix, for two-story court house to cost $45,000.

North Toronto, Ont.—At a meeting of Separate School Board it was decided to erect $30,000 school here and a by-law passed authorizing $100,000 bonds for school purposes.

BIDS DESIRED.

Howard, R. I.—Until Jan. 6, by Board Control and Supply (Wm. A. Schofield, Chmn.), Providence, for erecting a 2-story brick ward building and altering two existing ward buildings and other work for the State Hospital for Insane at Howard. Separate bids for plumbing, heating and ventilating and electrical work. Martin & Hall, Archts., 806 Union Trust Building, Providence.

East Hartford, Conn.—Reported desired until [illegible] for erecting [illegible] Archts., 46 Liberty Street, New York City.

Montclair, N. J.—Reported desired until [illegible] Archts., 1 Union Square, New York City.

Lehighton, Pa.—Bids Jan. 25 to L. M. [illegible] Archt., 31 N. Sixth Street, Reading.

Marcus Hook, Pa.—Reported desired until [illegible] Archt., 24 W. Twenty-fourth Street, Wilmington, Del.

Spring City, Pa.—Reported desired until [illegible] Archts., Philadelphia.

Wheeling, W. Va.—Bids Jan. 22 by [illegible] Archt., Land Title Building, Philadelphia.

Quitman, Miss.—Reported desired until [illegible] for erecting high school building at Harmony.

Vincennes, Ind.—Reported desired until [illegible] Supply Department, Washington, D. C., for erecting [illegible] Archts., 4 East Thirty-ninth Street, New York.

Chicago, Ill.—Reported desired until Jan. 2 by Elmer Archt., Jan. E. Dibelka, 120 N. Fifth Street, for erecting a one and six-story and basement, 100 x 100-ft. armory for the First Regiment of Cavalry, I. N. G. Probable cost [illegible] Archts., 1133 S. Wabash Avenue.

Reported desired until Jan. 28 by A. F. [illegible] Archt., 141 Dearborn Street, for erecting factory and [illegible] building to be occupied as Armour Depot.

Bids Jan. 5, by John Dill Robertson, Comptr. of Lands, for furnishing, delivering and erecting structural steel and iron work for the new auditorium building at Montpelier, Indianapolis, Ind. Also separate bids for covering the roof for same.

Sioux City, Iowa.—Bids Feb. 7, by H. F. [illegible] Archt., general contract for erecting and furnishing Carnegie Library and Lecture Building at Sioux City, for United Bank Building, Sioux City, Archts.

Washington, Iowa.—Bids Jan. 28 by Jas. A. Wetmore, Supervising Archt., Washington, D. C., for erecting post office at Washington, Iowa.

Crookston, Minn.—Bids Jan. 20, by [illegible] Archt., Capitol, St. Paul, for erecting [illegible] Archts., Minneapolis, Minn. Also separate bids for covering the roof for same.

St. Louis, Mo.—Reported desired until Jan. [illegible] Archts., Century Building, for erecting [illegible] for Christian Cathedral of St. Louis. Probable cost, $100,000.

Trinidad, Colo.—Reported desired until Jan. 1 by County Commissioners, W. W. Taylor, Chmn., for erecting [illegible] & H. H. Rapp Co., Archts., Masonic Building.

Los Angeles, Cal.—Bids Dec. 30 by [illegible] Archt., for [illegible] 8-room brick school on Fourteenth Street.

PRICES AND LETTINGS.

★Indicates award of contract.

★Belmont, Miss.—Contract for erecting [illegible] Archt., 90 Mill Street, Boston, at $11,000.

Greenwich, Conn.—Following are four [illegible] Archt., 11 E. 24th Street, New York, [illegible] Archt., 1 Madison Avenue, New York, [illegible] Archt., 1 Madison Avenue, New York, [illegible] Archt., 1 Madison Avenue

Atlanta, Ga.—Reported Chevrolet Motor Company, 330 Edgewood Avenue, contemplates erecting assembling plant here.

Jacksonville, Fla.—Eagle Film Manufacturing & Producing Company, 109 N. Dearborn Street, Chicago, Ill., contemplates erecting plant here.

Tampa, Fla.—Wilson & Toomer Fertilizer Company of Jacksonville contemplates erecting fertilizer plant here; cost about $200,000.

Chattanooga, Tenn.—G. H. Miller, 509 Walnut Street, reported interested in company which will erect mill here and install 15,000 spindles and accompanying machinery.

Ashland, Ky.—Reported Ashland Iron & Mining Company will erect open-hearth steel plant here to cost $1,000,000.

Cleveland, Ohio.—Bamberger-Reinthal Knitting Company, 2621 E. Ninth Street, will erect four-story fireproof factory on Twenty-seventh Street and Chester Avenue.

Ironton, Ohio.—Reported Ironton Incandescent Stove Company (Jake Davis, Mgr.) will erect two-story factory on Front Street.

Detroit, Mich.—Reported Ford Motor Company secured additional land and will enlarge Highland Park factory extensively.

Kalamazoo, Mich.—The foundry building which Goodale Company will erect is to be one story, 90 x 250 ft., concrete, steel and brick; they will also erect a three-story shop.

Lansing, Mich.—Novo Engine Company reported considering erecting 125 x 325-ft. addition to foundry.

Faribault, Minn.—Contract soon to be let by Faribault Packing & Provision Company (M. E. Brooks, Supt.) for superstructure of plant to cost $125,000. D. Q. Davis, Engr., Manhattan Building, Chicago.

Minneapolis, Minn.—Kees & Colburn, Donaldson Building, are architects for 12-story warehouse and factory to be erected on Fifth Street for Wyman, Partridge Company; cost $300,000.

Two Harbors, Minn.—Reported Duluth & Iron Range Railroad Company (W. A. Clark, Ch. Engr., Duluth) plans erecting new car and paint shops here.

Jonesboro, Ark.—T. E. Mitchell, Jonesboro, is architect for reinforced concrete, 23 x 107-ft. plant to be erected with equipment for Jonesboro Ice Company.

Seattle, Wash.—F. S. Lang Manufacturing Company, 2758 Second Avenue, contemplates erecting addition to plant.

Oregon City, Ore.—Hawley Pulp & Paper Company, First and Main Streets, contemplates erecting early next year an additional mill of reinforced concrete and steel construction; cost complete, including machinery, about $500,000.

Ontario, Cal.—San Antonio Growers' Assoc. (Judge C. McWhitney, Secy.) will erect a $40,000 packing house.

San Diego, Cal.—Reported National Paving Company, San Diego, intends erecting a paving plant on F Street to cost $65,000.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Philadelphia, Pa.**—Contract awarded Barclay White & Company, 1530 Chestnut Street, for erecting four-story, brick, reinforced concrete, 70 x 120-ft. factory at Manayunk for A. T. Baker.

Contract awarded O'Mera Construction Company, 235 South Turner Street, for erecting boiler house for Pennsylvania Sugar Company; cost about $40,000.

★**Baltimore, Md.**—Dietrich Brothers, Pleasant and Davis Streets, have contract for iron and steel needed in plant of Hess Steel Company, to be erected here.

★**Belmont, N. C.**—Contract awarded J. D. Grandy, Charlotte, for erecting one-story, 127 x 531-ft. brick and wood mill for Climax Spinning Company; cost about $60,000.

★**Manitowoc, Wis.**—Contract awarded Walter Oelein Company of Milwaukee for erecting $100,000 addition to plant of Aluminum Goods Manufacturing Company at Fifteenth and Franklin Streets.

★**Great Bend, Kan.**—Contract for rebuilding mill and elevator of Kansas Flour Mills Company, recently destroyed by a cyclone, awarded McDonald Engineering Company, Chicago, Ill., and for machinery to Allis Chalmers Company, Milwaukee, Wis.

MISCELLANEOUS

PROPOSED WORK.

Transmission Line—Canajoharie, N. Y.—Public Service Commission has authorized Montgomery County Electric Light & Power Company, Canajoharie, to extend the transmission lines into the towns of Sharon and Cherry Valley and village of Cherry Valley; probable cost $15,000. Education.

Fire Escapes—Indianapolis, Ind.—About 95 fire escapes will be placed on 52 schools. Address Business Manager Bd.

Park Bonds—Bartlesville, Okla.—Park improvement bonds amounting to $50,000 have been sold.

Transmission Line—Vancouver, Wash.—J. L. Stannard, Engineer of Portland, Ore., is making a survey for a transmission line between Vancouver and Kalama for the North Coast Power Company.

Conduit—Phoenix, Ariz.—Plans approved as prepared by J. B. Girard, City Engineer, for about 5500 ft. of wood conduit to carry Salt River Canal.

BIDS DESIRED.

Elevator—Rochester, N. Y.—Until Dec. 27, by Board Education (J. S. Mullan, Secy.), for installing an electric elevator in the Washington Junior High School.

Boilers—West Point, N. Y.—Until Jan. 24, by Quarter Master, West Point, for two water tube boilers and stokers, advertised in Engineering Record.

Broken Stone—Mount Holly, N. J.—Until Jan. 1, by Board Chosen Freeholders (A. I. Davis, Dis.), Mount Holly, for furnishing, per ton f.o.b. quarry, broken stone to the county for year 1916; samples of 1½ in., ¾ in., and screening to be furnished. Jas. Logan, County Engr.

Cement Tank—Louisville, Ky.—Until Jan. 18, by Commissioners of Fisheries, Department of Commerce, Washington, D. C., for constructing cement retaining tanks and open shed at Louisville Fisheries Station.

Transmission Line—Tell City, Ind.—Until Dec. 28 by Louis Siebert, City Clerk, for about 5 miles of three-phase transmission line from power house in Tell City to corporation limits of Troy.

Cement—Chicago, Ill.—Until Dec. 28, by Department Public Works, for furnishing and delivering Portland and natural cement to various pipe yards for use of the Bureau of Sewers; also separate bids for furnishing and delivering to city at shafts of Wilson Avenue tunnel 20,000 ft. more or less, of No. C R C D B standard copper cable.

Fire Escapes—Normal, Ill.—Until Dec. 27, by State Board Administration (Frank D. Whipp, Fiscal Supervisor), Springfield, for constructing a three-story spiral fire escape, including proper connections with each floor or stairway leading from the three stories of Administration Building; also fire escape from chapel at the Soldiers Orphan Home, Normal.

Stairway—St. Paul, Minn.—Reported desired until Dec. 27, by Aug. Hohenstein, Purchasing Agent, for constructing steel stairway on Hall Avenue between S. Wabasha Street and Prospect Terrace.

Dump Cars—Winnipeg, Man.—Until Dec. 29, by S. H. Reynolds, Chmn. of Comrs., 901 Boyd Building, Winnipeg, for twenty 20-yd. automatic dump cars.

Steel, Iron, Etc.—Panama.—Until Jan 3, by Maj. F. C. Boggs, Corps Engrs., U. S. A., General Purchasing Officer Panama Canal, Washington, D. C., for Cir. 998, steel, iron, pig iron, steel and iron castings, valves, etc.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Conduit—Boston, Mass.**—Contract for constructing Davenport Brook conduit (bids opened Dec. 15) awarded William J. Barry, 431 Ashland Street, West Roxbury, at $29,871.

★**Reconstructing Coal Yards—Philadelphia, Pa.**—Contract awarded C. P. Bower, Philadelphia, for Contract No. 4, reconstructing coal yards at Emerald Street for Philadelphia & Reading Ry., at $70,-106. Next three lowest bidders: McNichol Paving & Constructing Company, Philadelphia, $77,516; James McGraw Company, Philadelphia, $87,511, and John Goll & Company, $93,551. Saml. T. Wagner, Chief Engineer.

★**Filling — Galveston Ten.** — Contract signed between the city and the Standard American Dredging Company, Merchants Exchange Building, San Francisco, Cal., for sand filling to be used in the protective grade between Sixth and Nineteenth Streets. County is to take about 100,000 cu. yd. of fill and city 171,000 cu. yd., price being 39.75 cts. per cu. yd.

Iron and Steel—Los Angeles, Cal.—Following are bids opened recently by Harbor Commissioners for furnishing (a) 270,000 lbs. structural steel and (b) 27,000 lbs. cast iron; Security Construction Co., Los Angeles, (a) 5.985 cts. per lb.; (b) 4,095 cts. per lb.; Llewellyn Iron Works, Los Angeles, (a) 8.75 cts.; (b) 3½ cts.; Baker Iron Works, Los Angeles, (a) 9.2 cts., (b) 3.5 cts.; Union Iron Works, Los Angeles, (a) $23,955, (b) $1,180.

Sprinkling System in Warehouse—Los Angeles, Cal.—Following are four lowest bids opened recently for installing an automatic sprinkling system in municipal harbor warehouse: Automatic Sprinkler Company of America, $18,810; Thomas Haverty Company, 517-S. Los Angeles, $18 975; Pacific Fire Extinguisher Company, $19,250, and Fire Protection & Equipment Company, $20,470.

Proposals

For Proposals Advertised, See Pages 30 and 31.

WATERWORKS.

Bids Close.		See Eng. Record.
Dec. 28.	Pumps, Pipes, Etc., Mansfield, Ohio	Dec. 25
Dec. 28.	Equipment, Columbus, Ohio	Dec. 25
Dec. 29.	Drag Line, Winnipeg, Man.	Dec. 25
Dec. 29.	Pipes, Valves, Etc., Chicago, Ill.	Dec. 25
Jan. 1.	Water Works, Beebe, Ark.	Dec. 18
Jan. 3.	Extension, Baker, Ore.	Dec. 18
Jan. 4.	Water Works, Wesson, Miss. Adv. Dec. 18.	Dec. 18
Jan. 6.	Reservoir, Manteca, Cal.	Dec. 18
Jan. 10	Filter, Danville, Ill. Adv. Dec. 18.	Dec. 18
Jan. 11.	Filter Plant, St. Hyacinthe, Que.	Dec. 4
Jan. 12.	Pumping Unit, Kansas City, Mo. Adv. Dec. 11 to 25.	Dec. 11
Jan. 17.	Pumping Unit, St. Paul, Minn. Adv. Dec. 24.	Dec. 25

SEWERAGE AND SEWAGE DISPOSAL.

Dec. 28.	South Orange, N. J.	Dec. 25
Dec. 28.	Columbus, Ohio	Dec. 18
Dec. 29.	Chicago, Ill.	Dec. 25
Dec. 30.	Brooklyn, N. Y.	Dec. 25
Jan. 1.	Wausa, Neb.	Dec. 18
Jan. 4.	Key West, Fla.	Dec. 4
Jan. 4.	Loveland, Colo. Adv. Dec. 18, 25.	Dec. 18
Jan. 6.	Mason City, Iowa. Adv. Dec. 4.	Dec. 4
Jan. 4.	Hampton, Iowa	Dec. 25
Jan. 7.	Strawberry Point, Iowa.	Dec. 25

BRIDGES.

Dec. 28.	Omaha, Neb.	Dec. 11
Dec. 28.	Pittsburgh, Pa.	Dec. 18
Dec. 30.	Defiance, Ohio	Dec. 18
Dec. 30.	Washington, Ind.	Dec. 25
Dec. 31.	Omaha, Neb.	Dec. 25
Jan. 3	Lawrence, Kan.	Dec. 18
Jan. 3.	Ft. Worth, Tex.	Dec. 25
Jan. 4.	Wadena, Minn.	Dec. 11
Jan. 15.	Tucson, Ariz.	Dec. 25
Jan. 15.	Sandpoint, Idaho	Dec. 25
Jan. 18.	Knoxville, Iowa.	Dec. 18
Jan. 26.	Rockford, Ill. Adv. Dec. 25.	Dec. 25

PAVING AND ROADS.

Dec. 29.	Wooster, Ohio	Dec. 25
Dec. 29.	Baltimore, Md.	Dec. 25
Dec. 30.	Dothan, Ala.	Dec. 18
Dec. 30.	Brooklyn, N. Y.	Dec. 25
Dec. 30.	Lisbon, Ohio	Dec. 25
Dec. 30.	New York, N. Y.	Dec. 25
Dec. 30.	Jersey City, N. J.	Dec. 25
Jan. 1.	Chelsea P. O., Atlantic City, N. J.	Dec. 18
Jan. 1.	Mandan, N. D.	Dec. 25
Jan. 3.	Maynardsville, Tenn.	Nov. 20
Jan. 3.	New Orleans, La.	Dec. 18
Jan. 3.	Road Roller, Tucson, Ariz.	Dec. 18
Jan. 3.	Kissimee, Fla.	Dec. 25
Jan. 3.	Santa Barbara, Cal.	Dec. 25
Jan. 4.	Oklahoma City, Okla.	Dec. 25
Jan. 3.	Santa Barbara, Cal.	Dec. 25
Jan. 4.	Huntsville, Ala.	Dec. 18
Jan. 5.	Seymour, Mo.	Dec. 25
Jan. 6.	The Dalles, Ore.	Dec. 18
Jan. 8.	Anderson, Ind.	Dec. 25
Jan. 11.	Florence, S. C.	Dec. 18
Jan. 11.	Albany, N. Y. Adv. Dec. 18, 25.	Dec. 18
Jan. 12.	Dadesville, Ala.	Dec. 25
Jan. 12.	Seattle, Wash.	Dec. 25
Jan. 13.	Sault Ste. Marie, Mich.	Dec. 4
Jan. 14.	Charlestown, W. Va.	Dec. 18
Jan. 17.	Evanston, Ill. 2 Props. Adv. Dec. 25.	Dec. 25
Jan. 17.	East View, Ohio	Dec. 25
Jan. 20.	Greenfield, Iowa	Dec. 25
Jan. 20.	Fort Benton, Mont. Adv. Dec. 25.	Dec. 25

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS.

Dec. 27.	Dredging, Milton Lower Mills, Mass. Adv. Dec. 25.	Dec. 25
Dec. 28.	Ditch, Hartford City, Ind	Dec. 11
Dec. 28.	Dredging, New York, N. Y.	Dec. 18
Dec. 28.	Pier, New York, N. Y.	Dec. 25
Dec. 29.	Grain Elevator, New Orleans, La. Adv. Dec. 4 to 25.	Dec. 4
Dec. 29.	Philadelphia, Pa.	Dec. 25
Dec. 30.	Indiana	Dec. 25
Dec. 30.	Tulsa, Okla.	Dec. 25
Dec. 30.	Drain, Morganfield, Ky. Adv. Dec. 11, 18.	Dec. 11
Dec. 30.	Canal Extension, Harlingen, Tex.	Dec. 18
Dec. 31.	Breakwater, Fort Taylor, Fla. Adv. Dec. 4 to 25.	Dec. 4
Jan. 3.	Indiana	Dec. 25
Jan. 3.	Santa Barbara, Cal.	Dec. 25
Jan. 3.	New York, N. Y.	Dec. 25
Jan. 4.	State Canal, Contract 73-A, Albany, N. Y.	Dec. 11
Jan. 4.	Indiana	Dec. 25
Jan. 4.	San Gabriel, Cal.	Dec. 25
Jan. 5.	Wharf, etc., New Orleans, La. Adv. Dec. 11 to 25.	Dec. 11
Jan. 5.	Piling, lumber, etc., for wharf, New Orleans, La. Adv. Dec. 11 to 25.	Dec. 11
Jan. 6.	Power house at dam, Wheeling, W. Va. Adv. Dec. 11 to 25.	Dec. 11
Jan. 6.	Bakersfield, Cal.	Dec. 25
Jan. 7.	Ditch, Duluth, Minn.	Dec. 18
Jan. 8.	Dredge, Macaco, China.	Nov. 6
Jan. 10.	Ditches, Poplar Bluffs, Mo.	Dec. 18
Jan. 11.	State Canal Work, Albany, N. Y. Adv. Dec. 18, 25.	Dec. 18
Jan. 12.	Sherman, Tex.	Dec. 25
Jan. 14.	Gates for dam, Wheeling, W. Va. Adv. Dec. 18, 25.	Dec. 18
Jan. 17.	Ft. Wayne, Ind. Adv. Dec. 25.	Dec. 25
Jan. 17.	Irrigation, Oakdale, Cal.	Dec. 25
Jan. 18.	Irrigation, Montrose, Col.	Dec. 25
Jan. 22.	Power House at Dam, Wheeling, W. Va. Adv. Dec. 25.	Dec. 25
Jan. 25.	Ditch, Crookston, Minn.	Dec. 25

PUBLIC BUILDINGS AND SCHOOLS

Dec. 28.	Orient, Ohio	**Dec. 11**
Dec. 28.	Seymour, Conn.	**Nov. 20**
Dec. 28.	Montclair, N. J.	Dec. 25
Dec. 29.	Missoula, Mont.	**Nov. 27**
Dec. 29.	Chicago, Ill.	Dec. 25
Dec. 30.	St. Petersburg, Fla. Adv. Nov. 20, 27.	**Nov. 20**
Dec. 30.	Galveston, Tex.	**Nov. 27**
Dec. 30.	Ridgway, Pa.	**Nov. 27**
Dec. 30.	Somerville, Ohio	**Dec. 11**
Dec. 29.	Lehighton, Pa.	Dec. 25
Dec. 30.	Spring City, Pa.	Dec. 25
Dec. 30.	Los Angeles, Cal.	Dec. 25
Dec. 31.	San Jose, Cal.	Dec. 18
Dec. 31.	Quitman, Mass.	Dec. 25
Jan. 1.	Arlington, Iowa	Dec. 4
Jan. 1.	Independence, Iowa	Dec. 4
Jan. 1.	Motherwell, Ont.	Dec. 11
Jan. 3.	Chicago, Ill.	Dec. 18
Jan. 3.	East Hartford, Conn.	Dec. 25
Jan. 3.	Chicago, Ill.	Dec. 25
Jan. 3.	Vincennes, Ind.	Dec. 25
Jan. 3.	Chicago, Ill.	Dec. 25
Jan. 4.	Cavite, P. I.	Nov. 18
Jan. 4.	Greenville, S. C.	Nov. 27
Jan. 4.	Gaylord, Minn.	Dec. 4
Jan. 4.	Crookston, Minn.	Dec. 11
Jan. 4.	East Cleveland, Ohio.	Dec. 11
Jan. 4.	Trinidad, Colo.	Dec. 25
Jan. 5.	Harlan, Iowa	Nov. 27
Jan. 5	Providence, R. I.	Dec. 18
Jan. 5.	Marcus Hook, Pa.	Dec. 25
Jan. 6.	Wheeling, W. Va. Adv. Dec. 11.	Dec. 11
Jan. 6.	Howard, R. I.	Dec. 25
Jan. 10.	Titusville, Pa. Adv. Dec. 4, 11.	Dec. 4
Jan. 10.	Toledo, Ohio	Dec. 18
Jan. 11.	Durham, N. C.	Dec. 18
Jan. 15.	Duluth, Minn.	Dec. 11
Jan. 15.	St. Louis, Mo.	Dec. 25
Jan. 16.	Sidney, Neb.	Dec. 11
Jan. 17.	Hackensack, N. J.	Dec. 11
Jan. 17.	Smithfield, R. I.	Dec. 18
Jan. 18.	Anoka, Minn.	Dec. 11
Jan. 19.	Hornell, N. Y.	Dec. 11
Jan. 20.	Crookston, Minn.	Dec. 25
Jan. 21.	Waterloo, N. Y.	Dec. 18
Jan. 22.	Wheeling, W. Va. Adv. Dec. 25.	Dec. 25
Jan. 24.	Ashland, Ky.	Dec. 18
Jan. 26	Shelby, N. C.	Dec. 18
Jan. 27	Ellensburg, Wash.	Dec. 18
Jan. 28.	Washington, Iowa	Dec. 25
Feb. 1.	Oneida, Iowa	Dec. 18
Feb. 1.	George West, Tex.	Dec. 18
Feb. 7.	Sioux City, Iowa.	Dec. 25

PRIVATE BUILDINGS.

Dec. 28.	Gloversville, N. Y.	Dec. 25
Jan. 1.	Gillman, Iowa	Dec. 25
Jan. 1.	Wolfe Island, Ont.	Dec. 25
Jan. 10.	Vicksburg, Miss.	Dec. 25

NEW INDUSTRIAL PLANTS.

Dec. 29.	New Orleans, La. Adv. Dec. 4 to 25.	Dec. 4
Dec. 29.	New Orleans, La. Adv. Dec. 18.	Dec. 18

MISCELLANEOUS.

Dec. 28.	Cement, Chicago, Ill.	Dec. 25
Dec. 28.	Cable, Chicago, Ill.	Dec. 25
Dec. 29.	Dump Cars, Winnipeg, Man.	Dec. 25
Dec. 30.	Railroad, Fredericton, N. B.	Dec. 25
Jan. 1.	Broken Stone, Mt. Holly, N. J.	Dec. 25
Jan. 3.	Garbage Incinerator, Fort Wayne, Ind. Adv. Dec. 11, 18.	Dec. 11
Jan. 8.	Steel towers Guam	Nov. 20
Jan. 8.	Iron, Steel, Etc., Panama wood, Pa. Adv. Dec. 18, 25.	Dec. 25 Dec. 25
Jan. 12.	Cruiser, Chicago, Ill.	Dec. 18
Jan. 18.	Cement tank, Louisville, Ky.	Dec. 25
Jan. 18.	Garbage Disposal, New York, N. Y. Adv. Dec. 25.	Dec. 25
Jan. 19.	Garbage Incinerator, Edg-	
Jan. 24.	Boilers—West Point, N. Y. Adv. Dec. 25.	Dec. 25
Apr. 1.	Memorial, Fort McHenry (P. O. Baltimore, Md.)	Nov. 20

SEARCHLIGHT SECTION

Official Proposal Announcements

Price $2.40 an inch.—Copy can be received until Thursday to a. m. for issue mailed the next morning

Bids open January 17, 1916

NOTICE FOR LETTING PAVING CONTRACT

BOARD OF LOCAL IMPROVEMENTS

CITY OF EVANSTON, ILL.

Notice is hereby given that bids will be received for paving with brick on concrete portions of Bridge Street, Payne Street, Chancery Road, Noyes Street, Dodge Avenue, Grant Street, Bowen Avenue, Green Avenue, Business Avenue and Pioneer Road amounting to approximately 15,000 square yards, by a party in accordance with the following Specifications with the approval of the City Engineer, which will be opened on the 17th day of January, 1916 at the hour of 8:00 p. m., in the Mayor's office in the City Hall of the said City of Evanston.

The specifications for each improvement and bond proposals will be furnished at the office of the Superintendent of Public Works of the City of Evanston.

The contractor will be paid in bonds, which bonds shall draw interest at the rate of five (5) per centum per annum, except payment of which to contractor by warrant against the first installment shall bear no interest.

All proposals or bids must be accompanied by a certified check payable to the order of the President of the Board of Local Improvements of the City of Evanston for a sum not less than ten (10) per centum of the aggregate of the proposal. Such proposals or bids must be delivered to the President of the Board of Local Improvements in open session of said Board at the time and place fixed herein for opening the same. No proposal or bid will be considered unless accompanied by a check as herein provided.

The Board of Local Improvements reserve the right to reject any or all bids should they deem it best for the public good.

The successful bidder will be required to furnish a performance bond equal to the contract and a maintenance bond equal to twenty-five (25) per centum of the contract price, of some approved surety company guaranteeing said improvement against defects arising from poor material or poor workmanship, for a period of five (5) years from the date of the completion and acceptance thereof.

H. F. PEARSONS,
President of the Board of Local Improvements of the City of Evanston.

Dated, Evanston, Ill., December 28, 1915.

Bids open January 24, 1916

BRIDGE BIDS WANTED

ROCKFORD, ILL.

Sealed proposals will be received by the Chairman of the Street and Alley Committee of the City of Rockford, Illinois until 1:00 P. M., Jan. 24, 1916, for the construction of a reinforced concrete bridge over Rock River at Harlem Street, the bridge to be approximately 600 feet long, 40 feet wide. Estimated cost $45,000.00. A 60-ton steel bridge with concrete approaches will also be considered. Bidders to furnish their own plans and specifications. For further information address Elmer Main, City Engineer of the City of Rockford, Illinois.

H. J. GALLAGHER,
Chairman Street and Alley Committee.

Rockford, Ill., Dec. 14, 1915.

PROPOSALS FOR REPAIRING breakwater.—U. S. Engineer Office, Jacksonville, Fla.—Sealed proposals will be received here until 12 noon, Dec. 31, 1915, and then opened, for repairing breakwater, Fort Taylor, Key West, Fla. Further information on application.

POWER-HOUSES.—U. S. ENGINEER Office, Wheeling District, Wheeling, W. Va.—Sealed proposals will be received here until 11 a. m. (Eastern time), January 14, 1916, and then opened, for furnishing and erecting steel lock gates for Dam No. 14, Ohio River. Information on application.

Bids open Jan. 17, 1916

PUMPING UNIT

ST. PAUL, MINN.

Notice is hereby given that sealed proposals bearing the number 667 of the bid and endorsed with the name of the bidder and the date of presentation will be received at the office of the Purchasing Agent at the Court House and City Hall until 10:30 a. m. January 17, 1916, for the designing, construction, delivery and erection complete of a steam pumping unit, of a capacity to pump continuously fifteen (15) million U. S. gallons of water per twenty-four (24) hours, against a total combined head of one hundred and seventy-one (171) feet, with steam pressure of one hundred and fifty (150) pounds per square inch at throttle, together with all auxiliary equipment, tools and appurtenances necessary; all in accordance with the plans and specifications on file in the office of the Purchasing Agent.

Bids are invited on two types of pumping units, namely: (a) The centrifugal type of pump driven by a steam turbine through reduction gears, and (b) the triplex plunger type of pump driven by a vertical triple expansion type of steam engine. The type and make of pumping unit that will be purchased will be that showing the lowest operating cost per year to be determined on a basis given in the specifications plus fixed charges on the total investment.

A bond in the sum of 20 per cent of the amount bid, with two sureties, residents of the City of St. Paul, or a Surety Company bond in the same amount, or a certified check for 10 per cent of the amount bid, must accompany each proposal as surety for the making and execution of a contract.

The City reserves the right to reject any or all bids, or any part thereof.

Bids are to be submitted in duplicate upon the regular proposal blank, furnished by the Purchasing Agent upon request and are subject to the conditions stated thereon. All bids will be opened in public, at the time above stated, by the Purchasing Agent, in the presence of the Purchasing Committee.

AUGUST HOHENSTEIN,
Purchasing Agent.

December 18, 1915.

Bids open January 4, 1916.

SEWER TRUNK LINE

LOVELAND, COL.

Sealed proposals will be received by the City Clerk of Loveland, Col., at her office at the City Hall until 7 o'clock p. m., Tuesday, January 4, 1916, for the construction of a sanitary sewer trunk line for the City of Loveland.

The work will consist of about 3700 ft. of 15-in. and 12-in. sewer, together with the necessary accessories.

All bids must be on forms provided for the same and must be accompanied by a certified check for $200, payable to the City Treasurer of Loveland.

The City Council reserves the right to reject any or all bids.

Plans, specifications and contract may be examined at the office of the City Clerk or City Engineer.

GEORGIA C. RIST,
City Clerk.

POWER-BOOSTER.—U. S. ENGINEER Office, Wheeling District, Wheeling, W. Va.—Sealed proposals will be received here until 11 a. m. (Eastern time), January 22, 1916, and then opened, for building steel power-houses at Dams Nos. 16 and 17, Ohio River. Information on application.

Bids open December 29, 1915.

CHANGE OF DATE

REINFORCED CONCRETE ELEVATOR

NEW ORLEANS, LA.

Sealed proposals will be received by the Board of Commissioners of the Port of New Orleans at their office, suite 200 New Orleans Court Building, until December 29, 1915, at 8 o'clock p. m., and then publicly opened, for the construction of a reinforced concrete elevator of about 1,000,000 bushels capacity with its equipment except as specified and including marine tower and about 1500 ft. of conveyor galleries, located in the city of New Orleans, on the east bank of the Mississippi River, approximately between Soniat and Valmont streets.

A deposit of $25,000 in cash or certified check is required with proposal; bond of $300,000 required with contract. Payment monthly to the extent of 90 per cent of the engineer's estimate of work accomplished, including allowance for a reasonable stock of material on and after December 1, 1915.

Plans and specifications will be on file at the office of Ford, Bacon & Davis, 921 Canal Street, New Orleans, La., by whom full sets will be furnished to prospective bidders on deposit of $100, which will be refunded to depositors who submit proposals and return sets in good condition. To depositors who do not submit proposals $8 will be refunded on return of the sets in good condition.

The right is reserved to reject any and all bids and to waive informalities.

Signed, ERNEST M. LOEB,
President.

Bids open January 5, 1916.

PILING, LUMBER, WOOD BLOCK

NEW ORLEANS, LA.

Sealed proposals will be received by the Board of Commissioners of the Port of New Orleans until January 5, 1916, at 8 p. m., for furnishing creosoted and untreated piling, creosoted lumber, creosoted sheet piling and creosoted wood block, or creosoted piling only, untreated piling only, creosoted lumber only, creosoted sheet piling only and creosoted wood block only, as may be required in the construction of the Dumaine Street Wharf.

Deposit—$3,000.00 cash or certified check.

Payment—Monthly in full for material received, 50 per cent allowed for material treated on requisition and not then ordered.

Bond—50 per cent of the amount of the contract.

On and after December 6, 1915, specifications will be on file at the office of the Engineer, J. Devereaux O'Reilly, by whom full sets will be furnished to prospective bidders on deposit of $10.00, which will be refunded to depositors who submit proposals and return sets in good condition.

To depositors not submitting proposals, $5.00 will be refunded on return of set in good condition.

The right is reserved to reject any and all bids, and to waive any informality in the bids received.

ERNEST M. LOEB,
President.

December 8, 1915.

PROPOSALS FOR MOTOR SURVEY Cruiser.—U. S. Engineer Office, Chicago, Ill. Sealed proposals for constructing and delivering a motor survey cruiser will be received at this office until 10 a. m., Jan. 12, 1916, and then opened. Information on application.

Bids open January 5, 1916.

WHARF AND CAUSEWAY

NEW ORLEANS, LA.

Sealed proposals will be received by the Board of Commissioners of the Port of New Orleans until January 5, 1916, at 8 p. m., for the construction of the Dumaine Street Creosoted Wharf and reinforced concrete causeway with creosoted wood block roadway.

Alternate proposals are requested for bids, to wit:

Board of Commissioners of the Port of New Orleans furnishing all creosoted lumber and piling, or bidders furnishing all material and labor. Bidders will be allowed to submit proposals either way or both ways.

Deposit—$15,000.00 cash or certified check.

Payment—monthly to the extent of 80 per cent of the Engineer's estimate of work accomplished, including allowance for a reasonable stock of material.

Bond—50 per cent of the value of the contract.

On and after December 6, 1915, plans and specifications will be on file at the office of the Engineer, J. Devereaux O'Reilly, by whom full sets will be furnished to prospective bidders on deposit of $20.00, which will be refunded to depositors who submit proposals and return sets in good condition.

To depositors not submitting proposals, $10.00 will be refunded on return of set in good condition.

The right is reserved to reject any and all bids, and to waive any informality in the bids received.

ERNEST M. LOEB,
President.

December 3, 1915.

Bids open January 12, 1916.

TURBO CENTIFUGAL PUMP

KANSAS CITY, MO.

Sealed proposals will be received by the Purchasing Agent of Kansas City, Missouri, at the office of the Purchasing Agent, Second Floor, City Hall, until two o'clock p. m. of January 12, 1916, for the designing, construction, delivery and erection of a steam turbine, reduction gear, centrifugal pumping unit of a capacity to pump continuously twenty (20) million U. S. gallons of water per twenty-four (24) hours against a total combined head of three hundred and sixty (360) feet and a steam pressure of one hundred and sixty-five (165) pounds per square inch at throttle; together with all machinery, tools and appurtenances necessary; all in accordance with the plans and general specifications on file in the office of the Chief Engineer of the Water Department.

Each bidder shall deposit with the City Comptroller a certified check in the amount of Seven Hundred and Fifty Dollars ($750.00), payable to the City Comptroller of Kansas City, Missouri, and accompany his bid with the Comptroller's receipt therefor.

The certified check referred to in the advertisement shall be submitted by each bidder as a guaranty that the bidder will, within ten (10) days after receiving the award of a contract, file with the City a satisfactory bond to the amount of Twenty-five Thousand Dollars ($25,000.00) and will execute the contract.

The Board of Fire and Water Commissioners does not bind itself to accept the lowest or any bid offered, and reserves the right to reject any and all bids and to waive any irregularity or informality in the bids.

(Signed) J. P. LANGAN,
Purchasing Agent.

BURTON LOWTHER,
Chief Engineer.

LOCK GATES.—U. S. ENGINEER Office, Wheeling District, Wheeling, W. Va.—Sealed proposals will be received here until 11 a. m. (Eastern time), January 14, 1916, and then opened, for furnishing and erecting steel lock gates for Dam No. 14, Ohio River. Information on application.



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